Old Dominion University

ODU Digital Commons

Civil & Environmental Engineering Theses & Dissertations

Civil & Environmental Engineering

Fall 12-2021

Spatiotemporal Variations of Precipitation and Climate-Resilient Structure Design in Virginia

Xiaomin Yang
Old Dominion University, yyjingjing1314@gmail.com

Follow this and additional works at: https://digitalcommons.odu.edu/cee_etds

Part of the Civil Engineering Commons, Climate Commons, and the Water Resource Management Commons

Recommended Citation

Yang, Xiaomin. "Spatiotemporal Variations of Precipitation and Climate-Resilient Structure Design in Virginia" (2021). Doctor of Philosophy (PhD), Dissertation, Civil & Environmental Engineering, Old Dominion University, DOI: 10.25777/aa1p-nd39
https://digitalcommons.odu.edu/cee_etds/117

This Dissertation is brought to you for free and open access by the Civil & Environmental Engineering at ODU Digital Commons. It has been accepted for inclusion in Civil & Environmental Engineering Theses & Dissertations by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.

SPATIOTEMPORAL VARIATIONS OF PRECIPITATION AND CLIMATE-RESILIENT STRUCTURE DESIGN IN VIRGINIA

by

Xiaomin Yang

B.S. June 2008, Inner Mongolia University of Technology, China
M.S. December 2014, Old Dominion University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

CIVIL AND ENVIRONMENTAL ENGINEERING

OLD DOMINION UNIVERSITY

December 2021

Approved by:

Xixi Wang (Director)

Sandeep Kumar (Member)

Guohui Song (Member)

ABSTRACT

SPATIOTEMPORAL VARIATIONS OF PRECIPITATION AND CLIMATE-RESILIENT STRUCTURE DESIGN IN VIRGINIA

Xiaomin Yang
Old Dominion University, 2021
Director: Dr. Xixi Wang

How to consider effects of climate change on the design and management of hydrology-related infrastructure is crucial but remains a challenge for sustaining resilient society. To address this challenge, existing hydrologic design procedures may need to be revised and/or redeveloped to take into account the precipitation nonstationarity resulting from climate change. Using the state of Virginia as a testbed and advanced statistical techniques such as nonparametric test, spatial autocorrelation, linear regression, distribution fitting, and spatial interpolation, this dissertation developed an innovative framework to detect the historical spatiotemporal variations of various precipitation characteristics, namely maximum precipitation intensity, precipitation amount, simple precipitation intensities, dry and wet spells, precipitation maximums, and precipitation exceedances. The results indicated that the state of Virginia has been experiencing more storms with a larger magnitude, a longer duration, and a greater intensity, making it vital to revisit the existing water management policies and engineering design standards. In this regard, next-generation probability-based IDF curves that consider the precipitation nonstationarity were created using both historical and predicted precipitations for Virginia. Such IDF curves can be a handy and useful tool for practical engineers to size hydraulic structures under nonstationary climates.

Copyright, 2021, by Xiaomin Yang, All Rights Reserved.

ACKNOWLEDGMENTS

There are many people who have contributed to the successful completion of this dissertation. I would like to express my deepest appreciation to my academic advisor, Dr. Xixi Wang, for his six years of continuous support and invaluable advice. Without his assistance and dedicated involvement in every step throughout the process, this dissertation would have never been accomplished. In addition, I extend thanks to my committee members, Dr. Sandeep Kumar and Dr. Guohui Song, for their advice and support for my Ph.D. study and dissertation preparation. Further, I want to express my thanks to all others who gave me various kinds of help in my life.

Moreover, I highly appreciate the persistent supports and patience of my lovely husband, Yuan Yang, daughter, Karen Yang and son, Alexander Yang, whose encouragement and understanding made it possible for me to concentrate on the study and dissertation research. Also, my sincere gratitude is extended to my lovely father, Feng Yang and mother, Aiqin Wang, whose unconditional love and exemplification made me a confident, diligent, and dedicated person.

Table of Contents

Chapter Page

Chapter Page

List of Tables

Table Page

List of Figures

Figure Page

Figure Page

CHAPTER 1

GENERAL INTRODUCTION

1.1 Background

The infrastructures for water management, such as storm sewers, dikes, levees, and dams, usually serve rural and urban communities to enable, sustain, and/or enhance societal development. Therefore, any moderate disruption of the infrastructure could have significant impacts on daily life, while any systematic change of the frequencies or intensities of the disruptions could result in profound consequences of economic and human activities.

Besides local regulations, the design of a water related infrastructure also depends on the design peak discharge that is usually estimated using the Rational Equation or a hydrologic mathematical model. Since the rainfall-runoff physical mechanism is driven by the highly interdependent water, energy, and vegetation processes at various spatiotemporal scales (Moradkhani and Sorooshian, 2009), its quantitative description has been an ongoing research. To date, the description methods can be characterized and classified into deterministic and stochastic models, empirical and conceptual models, or lumped and distributed models. Among those models, the Rational Equation, the U.S. Soil Conservation Service (SCS) Curve Number (CN) method, and the regional flood frequency analysis methods (Ghosh, 2014) are most widely applied in practice.

The key input of such rainfall-runoff models is a synthetic design storm that is the stochastic representation of rainfall intensity or depth and its temporal distribution at a given location for a given duration and return period (e.g., 2- or 10-year). The design rainfall intensity can be determined from the National Oceanic and Atmospheric Administration (NCEI) Atlas 14 Point Precipitation Frequency Estimates (PPFEs), the Probable Maximum Precipitation (PMP) maps, or site-specific IDF curves (Moglen and Rios Vidal, 2014). In practice, the design storm is related to five statewide stormwater BMP sizing criteria, namely: 1) groundwater recharge and/or runoff volume reduction, which targets the rainfall events that generate little or no stormwater runoff but result in much annual groundwater recharge at the development site; 2) water quality protection, which targets the rainfall events that transport the majority of stormwater pollutants off the development site; 3) receiving channel protection, which targets the channel-forming storm events that generate bankfull and sub-bankfull flows in downstream channels and may cause erosions of the channel bed and banks; 4) frequent overbank flooding, which targets the large and infrequent storm events that cause water to overtop the banks and spill over into the floodplains, possibly causing damages to infrastructure and streamside properties; 5) flooding from extreme storms, which targets the largest and most infrequent (e.g., 100-year) storm events that cause catastrophic flooding and threaten floodplain structures and public safety (DCR, 2013). The common point of these five criteria is to ensure that the stormwater runoff at a development site of interest be managed in such a way that the post-development flow hydrograph from the site will closely resemble the pre-development flow hydrograph over a variety of storm events. Looser or more stringent criteria may be applied in terms of available resources and acceptable risks.

Additional considerations for the design of water related infrastructure must be made in coastal areas with unique climatic and physiographic features, such as more intense precipitation and higher water table. Based on MDE (2000), a coastal region tends to have a larger rainfall intensity than a piedmont area. In much of the coastal plain, the water table exists within a few feet beneath the ground surface. Since most coastal stormwater management facilities are excavated below the water table, they are strongly influenced by groundwater (CSN, 2009). The rising sea level would result in a rising water table, which can further lessen the percolation capability due to the reduced seepage rate and subsurface storage. Davtalab *et al.* (2020) evaluated the reliability and performance of a retention pond near Tampa Bay of Florida under sea level rise conditions and revealed that sea level rise could increase the seasonal high-water elevation of the retention pond up to 40 cm by mid-21st century. As a result, the pond would fail to deal with the design 72-h stormwater volume.

Since the NOAA Atlas 14 PPFEs, PMP maps, and IDF curves are influenced by how accurate the extreme precipitations are represented. The existing precipitation products were created based on stationary assumption, which may be invalid under the changing climate as proved in many regions, particularly in coastal regions such as the Chesapeake Bay (Melillo *et al.*, 2000b; Karl *et al.*, 2009; NIPCC, 2011; Walsh *et al.*, 2014; Chen *et al.*, 2015). To accurately reflect the relationship among precipitation intensity and its duration and return period, climate models have been utilized to predict future precipitations. GCMs are one type of climate models that imply mathematical models to simulate the general circulation of earth's atmosphere or ocean. Atmosphere-ocean GCMs are a type of atmosphere-ocean coupled general circulation model usually with a spatial resolution of 100 to 300 km and a temporal resolution of 6 h to a month. In order to increase the spatial resolution of the predictions by the atmosphere-ocean GCMs, various downscaling techniques have been applied. One of the most promising techniques is to embed dynamical RCMs within the GCMs to obtain more regional details over a particular domain of interest. NARCCAP investigated uncertainties of the simulated future climates on the high-resolution (i.e., regional) scales over a domain covering the conterminous United States and most of Canada (Mearns *et al.*, 2013). NARCCAP used the A2 scenario of the six possible climate change scenarios formulated by the Intergovernmental Panel on Climate Change (IPCC). The A2 scenario envisages a lower economic growth, less globalization, and high and sustained demographic growth. The NARCCAP outputs, which are based on multiple RCMs nested within multiple AOGCMs (atmosphere-ocean general circulation models), are for current and future periods of 30 years each and recorded at a 50-km spatial grid and a 3-h time interval. Further downscaling is usually needed to obtain local climate estimations with a higher resolution. As with downscaling GCMs to RCMs, both statistical and dynamic techniques have been applied to downscale the NARCCAP outputs.

For rainfall intensity, its fluctuation with time is termed as the temporal variation, whereas its change with location is termed as the spatial variation. The combination of these two types of variations is usually referred to as the spatiotemporal variation or variability. As a result of climate change, such a spatiotemporal variation might exhibit an abrupt change, an increasing or a decreasing trend, and either a regional or localized pattern (Melillo *et al.*, 2000a; Karl *et al.*, 2009; Walsh *et al.*, 2014; Chen *et al.*, 2015). Understanding the natural fluctuations as well as climate change-induced trends and patterns is crucial but incomplete in existing literature for practices of hydrologic engineering design (Smirnov *et al.*, 2018), water resources management (e.g., drought resistance) (Meshram *et al.*, 2017; Asfaw *et al.*, 2018; Abiy *et al.*, 2019; Singh *et al.*, 2019), and flood mitigation (Sayemuzzaman and Jha, 2014).

An increasing number of large weather events (e.g. floods, hurricanes, convective storms, and winter storms) with a greater intensity has contributed to more costs from The Disaster Financial Assistance Arrangements (DFAA) program over the past 20 years (Story *et al.*, 2016). Both the intensity and frequency of heavy storm events have been proved increased in most parts of United States since 1901 with a high confidence (Easterling *et al.*, 2017).

Frequent examples of the severe losses caused by extreme weathers can be found in daily newspapers: Wide areas of Colombia have seen heavy rainfall since the start of July 2020. According to the National Unit for Disaster Risk Management (UNGRD), the rain has caused over 80 incidents of flooding or landslides in 19 departments of the country, with over 5,000 families affected. Around 40 homes have been evacuated in Manitoba, Canada, amid fears that a dam on the Little Saskatchewan River could fail on July 2, 2020. The heavy rain in 2020 caused flash flooding in the Chinese city of Zhaotong and counties of Zhenxiong, Yiliang, Weixin, and Yanjin. A rainfall of over 225 mm in 24 hours was reported in those areas of China. According to local news reported at http://floodlist.com/asia/china-yunnan-floods-june-2020, 33,380 people were affected and 8 homes damaged or destroyed. The damages were also extended to power supply, transportation, telecommunication, and over 3,500 hectares of agricultural lands.

1.2 Literature Review

Zhu (2013) selected the HadCM3- HRM3 projections, which are parts of projected precipitation data by the North American Regional Climate Change Assessment Program (NARCCAP), to calculate annual maximum precipitation in six selected regions of the United States, namely Seattle in Washington, Las Vegas in Nevada, Omaha in Nebraska, Dallas in Texas, Newark in New Jersey, and Miami in Florida. The author used the data from the National Centers for Environmental Prediction (NCEP) North American Regional Reanalysis (NARR) to assess the performance of the projected historical data by the NARCCAP. This study used two types of extreme value probability distributions, namely Gumbel distribution and generalized extreme value (GEV) distribution. The author proposed correction factors to adjust future projections according to the historical match between the climate model results and reanalysis data that were run at similar grid scales. The results revealed that for most of the study regions, future climate projections indicated an increase in the intensity of extreme storms for a given return period and duration with strong regional variations. It revealed that the dependence of the correction factor values on return period and storm duration as related to the characteristics of extreme rainfall, as they varied significantly with regions, storm durations, and return periods. However, the author did not consider the stability of the climate model and just used one projection model (i.e., HadCM3- HRM3) (Solaiman and Simonovic, 2011). Additionally, the future projections were adjusted by the correction factor for only one representative of the NARR observed values. As a result, any biases in the NARR data would be propagated to the adjusted future projections and eventually to the derived IDF curves. Further, this study made a stationary assumption without detecting the possible historical or future abrupt changes and/or trends.

Fadhel *et al*. (2017) used eight reference periods with a fixed length of 30 years and a moving window of 5 years between the cases for the period of 1950 to 2014 to temporally correct the biases of the daily precipitation data simulated by HadCM3-HadRM3, a 1-km regional climate model. The bias-corrected data were further disaggregated into ensembles of 5-min series by using an algorithm that combines the Nonparametric Prediction (NPRED) model and the method of fragments (MoF) framework. The disaggregated data were then aggregated into different durations based on concentration times. Only one Extreme Value (EV) distribution, also known as Gumbel distribution, for the annual maximum series was used in this study to create the IDF curves. The results suggest that uncertainty, defined as the percentage of change in projected rainfall intensity from that of the current climate, varies significantly across the eight reference periods. Such an uncertainty resulted in an increase in rainfall duration as the return period increases. Although the authors noticed the uncertainty of the time series of the rainfall intensity, they did not continue to uncover if the uncertainty was due to a trend and/or an abrupt change. Also, the authors did not create probability-based IDF curves, which is needed to address any uncertainties in climate drivers (e.g., future economy, demography, and technology) and climate models.

Rosenberg, *et al.* (2010) explored the influences of observed and projected extreme precipitation on the stormwater infrastructures in the state of Washington. They applied three different trend analysis methods: regional frequency analysis, precipitation event analysis, and exceedance over-threshold analysis to examine the extent to which trends in precipitation may have occurred in three major urban areas of the state of Washington over the last half century. They chose two General Circulation Models (GCMs) to provide boundary conditions for the RCM (i.e., CCSM3 and ECHAM5) simulations: The

Community Climate System Model version 3.0 (CCSM3) with the IPCC A2 emission scenario, and the Max Planck Institute's ECHAM5 with the IPCC A1B emission scenario. The RCM downscaling was based on the Weather Research and Forecasting (WRF) mesoscale climate model available at http://www.wrf-model.org and developed at the National Center for Atmospheric Research (NCAR). They removed the systematic bias in the RCM precipitation extremes based on the probability mapping described by Rosenberg et al. (2010) and (Wilks, 2011). Hydrologic simulations of streamflow in two Seattle-area watersheds were generated by the Hydrologic Simulation Program-Fortran (HSPF) (Bicknell 2001). The results revealed that few statistically significant changes in extreme precipitation have been observed in the state's three major metropolitan areas. Increasing in extreme rainfall magnitudes has been detected throughout the state over the next half century. The hydrologic modeling of those two watersheds suggested overall increases in annual peak discharge, but only those projections resulting from one of the two RCM simulations are statistically significant. As with the study of (Zhu, 2013), this study did not consider the instability of using few climate models. Also, this study made a stationary assumption though the probability distribution of extreme precipitation may change as trends or abrupt changes might exist in the time series.

Although the above studies presented a few preliminary applications of methodologies for assessing influences of climate change on IDF curves and hydraulic infrastructures, there is a large room for improvement because they: 1) made stationary assumption without detecting whether historical as well as future precipitations exhibit any step change and/or trend; 2) adopted only one type of distribution (e.g., GEV) by solely fitting historical data on precipitation, while the three special cases of the GEV distribution

(Coles 2001, Viessman and Lewis 2003), namely Fréchet (1927), Weibull (1951), and Weibull (1958), may be more tangible and thus have been widely used in practice; 3) assumed that a fitted distribution is independent of climate (i.e., applicable for historical and future precipitations); 4) did not create probability-based IDF curves except for (Solaiman and Simonovic, 2011); and 5) created station-level IDF curves only but not a larger-scale (e.g., watershed-scale) ones.

1.3 Goal and Objectives

The overarching goal of this dissertation is to advance the scientific knowledge of how to incorporate effects of climate change on precipitation into hydrologic engineering design.

The specific objectives are to:

- Detect the climate nonstationarity due to spatiotemporal trends and abrupt changes;
- Develop an innovative approach for creating next-generation IDF curves that consider nonstationary rainfall; and
- Use this approach to create probability-based IDF curves for the state of Virginia, most of which is located within the Chesapeake Bay Watershed.

In this regard, this dissertation detects the spatiotemporal variabilities as well as the spatial associations of rainfall intensities at various time intervals. The state of Virginia includes typical physiographic regions, namely coastal plains, piedmonts, and mountains, and has long-term high-quality records of 15-min precipitation at rain gauges covering the state's entire territory. The detection approach consists of linear regression, nonparametric statistical test, and advanced spatial autocorrelation. In addition, this dissertation detects historical changes in precipitation characteristics, as measured by thirteen indices respectively describing precipitation amount, intensity, spell, maximum, and exceedance. A modified Mann-Kendall technique that can consider the climate-relevant non-stationarity is applied to detect possible step changes and temporal trends of each index on an annual basis. Further, this dissertation uses data on observed 15-min precipitation, predicted precipitation by RCMs, topography, and hydrography to create the probability-based IDF curves.

1.4 Dissertation Structure

This dissertation is organized into five chapters as follows:

Chapter 1 (this chapter) presents the background, reviews literature, and establishes the dissertation goal and objectives.

Chapter 2 detects the spatiotemporal variations of maximum rainfall intensities at various time intervals across Virginia in the past half century.

Chapter 3 scrutinizes the characteristics of historical precipitation across Virginia to make inferences on climate change.

Chapter 4 creates next-generation rainfall IDF curves at the rain gauges and watersheds.

Chapter 5 draws overall conclusions and makes recommendations for future research.

References

Abiy, A. Z., Melesse, A. M., Abtew, W. and Whitman, D. (2019) Rainfall trend and variability in Southeast Florida: Implications for freshwater availability in the

Everglades. *PLOS ONE* 14(2), e0212008. Available at: https://doi.org/10.1371/journal.pone.0212008.

Asfaw, A., Simane, B., Hassen, A. and Bantider, A. (2018) Variability and time series trend analysis of rainfall and temperature in northcentral Ethiopia: A case study in Woleka sub-basin. *Weather and Climate Extremes* 19, 29-41. Available at: http://www.sciencedirect.com/science/article/pii/S2212094717300932.

Auld, H. (2013). "Climate adaptation tools: Extreme rainfall intensity-duration-frequency (IDF) curves." *A PowerPoint Presentation.*

Bicknell, B. R. (2001) Hydrological simulation program--Fortran [electronic resource] HSPF--user's manual. *National Exposure Research*, L. (ed), Athens, Ga.: United States Environmental Protection Agency, Office of Research and Development, National Exposure Research Laboratory, Athens, Ga.].

Chen, D., Walther, A., Moberg, A., Jones, P., Jacobeit, J. and Lister, D. (2015) European trend atlas of extreme temperature and precipitation records, Heidelberg.

Coles, S. (2001), An introduction to statistical modeling of extreme values, Springer-Verlag, London.

CSN, C. C. P. W. G. (2009) Stormwater design in the coastal plain of the Chesapeake Bay watershed. 2, C.T.B.N. (ed)

Davtalab, R., Mirchi, A., Harris, R. J., Troilo, M. X. and Madani, K. (2020) Sea level rise effect on groundwater rise and stormwater retention pond reliability. *Water* 12(4), 1129. Available at: https://www.mdpi.com/2073-4441/12/4/1129.

DCR (2013) Virginia Stormwater Management Handbook (*Chapter 10. Uniford Stormwater BMP Sizng Criteria). Handbook*, S.M. (ed), Department of Conservation and Recreation, Richmond, VA. Available at: https://swbmpvwrrc.wp.prod.es.cloud.vt.edu/wp-content/uploads/2018/07/39_Chap-10_Uniform-SW-BMP-Sizing-Criteria.pdf.

Easterling, D. R., K. E. Kunkel, J. R. Arnold, T. Knutson, A. N. LeGrande, L. R. Leung, R. S. Vose, D. E. Waliser and M. F. Wehner (2017). Precipitation change in the United States. *Climate Science Special Report: Fourth National Climate Assessment.* D. J. Wuebbles, D. W. Fahey, K. A. Hibbard et al. Washington, DC, USA, U.S. *Global Change Research Program*. 1: 207-230.

Fadhel, S., Rico-Ramirez, M. A. and Han, D. (2017) Uncertainty of Intensity-Duration-Frequency (IDF) curves due to varied climate baseline periods. *Journal of Hydrology* 547(C), 600-612.

Fréchet M. 1927. Sur la loi de probability de l'écart maximum. *Ann. Soc. Polon. Math. (Cracovie)* 6: 93-116.

Ghosh, S. N. (2014) Flood control and drainage engineering [e-book], Boca Raton: *CRC Press*, Taylor & Francis Group

Karl, T. R., Melillo, J. M. and Peterson, T. C. e. (2009) Global climate change impacts in the United States., p. 192 Available at: http://aquaticcommons.org/id/eprint/2263.

Liew, S. C., S. V. Raghavan and S.-Y. Liong (2014). "How to construct future IDF curves, under changing climate, for sites with scarce rainfall records?" *Hydrological Processes* 28(8): 3276-3287.

Mearns, L. O., Sain, S., Leung, L. R., Bukovsky, M. S., McGinnis, S., Biner, S., Caya, D., Arritt, R. W., Gutowski, W., Takle, E., Snyder, M., Jones, R. G., Nunes, A. M. B., Tucker, S., Herzmann, D., McDaniel, L. and Sloan, L. (2013) Climate change projections of the North American Regional Climate Change Assessment Program (NARCCAP). *Climatic Change* 120(4), 965-975. Available at: https://doi.org/10.1007/s10584-013-0831-3.

Melillo, J. M., Janetos, A. C., Karl, T. R., Corell, R., Barron, E. J., Burkett, V., Cecich, T. F., Jacobs, K., Joyce, L., Miller, B., Morgan, M. G., Parson, E. A., Richels, R. G. and Schimel, D. S. (2000b) Climate change impacts on the United States: the potential consequences of climate variability and change. Cambridge, UK: *Cambridge University Press*.

Meshram, S. G., Singh, V. P. and Meshram, C. (2017) Long-term trend and variability of precipitation in Chhattisgarh State, India. *Theoretical and Applied Climatology* 129, 729-744. Available at: https://ui.adsabs.harvard.edu/abs/2017ThApC.129.729M.

Moglen, G. E. and Rios Vidal, G. E. (2014) Climate change and storm water infrastructure in the mid-Atlantic region: design mismatch coming? *Journal of Hydrologic Engineering* 19(11).

Moradkhani, H. and Sorooshian, S. (2009) General review of rainfall-runoff modeling: model calibration, data assimilation, and uncertainty analysis.

NCEI, N. N. C. f. E. I. (2021) U.S. Billion-Dollar Weather and Climate Disasters Available at: https://www.ncdc.noaa.gov/billions/.

NIPCC (2011) Climate Change Reconsidered, The Heartland Institute, Chicago, IL.

Rosenberg, E. A., Keys, P. W., Booth, D. B., Hartley, D., Burkey, J., Steinemann, A. C. and Lettenmaier, D. P. (2010) Precipitation extremes and the impacts of climate change on stormwater infrastructure in Washington State. *Climatic Change* 102(1-2), 319-349.Available at: http://proxy.lib.odu.edu/login?url=https://search.proquest.com/docview/753818338?accountid=12967.

Sayemuzzaman, M. and Jha, M. K. (2014) Seasonal and annual precipitation time series trend analysis in North Carolina, United States. *Atmospheric Research* 137, 183-194. Available at: http://www.sciencedirect.com/science/article/pii/S0169809513002858.

Singh, V., Jain, S. K. and Singh, P. K. (2019) Inter-comparisons and applicability of CMIP5 GCMs, RCMs and statistically downscaled NEX-GDDP based precipitation in India. *Science of The Total Environment* 697.

Smirnov, D. S., Brad Workman, P., Batten, B., Rosenberg, S. and McGlone, D. (2018) Analysis of historical and future heavy precipitation. *Final technical report: City of Virginia Beach, Virginia, Department of Public Works*, Virginia Beach, VA.

Solaiman, T. A. and Simonovic, S. P. (2011) Development of probability-based Intensity-Duration-Frequency (IDF) curves under climate change, p. 34, London, Ontario, Canada. Available at: https://ir.lib.uwo.ca/wrrr/34.

Story, R., J. Pomeroy, M. Askari and P. Weltman (2016). Estimate of the average annual cost for disaster financial assistance arrangements due to weather events. Ottawa, Canada, Parliamentary Budget Officer.

Viessman, W. and G. L. Lewis (2003). Introduction to hydrology, *Prentice Hall*.

Walsh, J., D. , Wuebbles, K., Hayhoe, J., Kossin, K., Kunkel, G., Stephens, P., Thorne, R., Vose, M., Wehner, J., Willis, D., Anderson, S., Doney, R., Feely, P., Hennon, V., Kharin, T., Knutson, F., Landerer, T., Lenton, J., Kennedy and Somerville, R. (2014) Ch. 2: Our changing climate. climate change impacts in the United States. Melillo, J.M., Richmond, T.T.C. and Yohe, G.W., Eds. pp. 19-67*, U.S. Global Change Research Program, The Third National Climate Assessment.*

Weibull W. 1951. A statistical distribution function of wide applicability. *Journal of Applied Mechanics* 18 (3): 293-297.

Wilks, D. S. (2011) Statistical methods in the atmospheric sciences, *Oxford.*

Zhu, J. (2013) Impact of climate change on extreme rainfall across the United States. *Journal of Hydrologic Engineering* 18(10), 1301-1309. Available at: https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29HE.1943-5584.0000725.

CHAPTER 2

DETECTING SPATIOTEMPORAL VARIATIONS OF MAXIMUM RAINFALL INTENSITIES AT VARIOUS TIME INTERVALS ACROSS VIRGINIA IN THE PAST HALF CENTURY[1]

Maximum precipitation, which varies among locations and annually at a location of interest, is the base for sizing hydraulic structures. Understanding such spatiotemporal variations is necessary for accurate rainfall prediction but remains incomplete in most regions, including the state of Virginia. The objective of this study was to fill this information gap for Virginia using 15-min precipitation data collected at 57 gauges. In this regard, a linear regression method and a modified Mann-Kendall technique that can consider the climate-relevant non-stationarity were applied to detect possible step changes and temporal trends of maximum annual rainfall intensities at various time intervals, while spatial statistics, namely global Moran's I and local indicator of spatial association, were used to reveal the spatial autocorrelations and clusters. The results indicated that although no step changes were detected, statistically significant trends were detected for almost half of the selected gauges. The coastal plain experienced an increasing trend in rainfall intensity for durations of 24 hr and longer, whereas the other areas of the state had a decreasing trend, with relatively more trends and larger decreasing rates in the west-central ridge-valley areas. The spatial autocorrelations of rainfall intensities in the state of Virginia were dependent on a spatial scale of interest. Given the diversity of the climatic patterns and physiographic features in the testbed, this study demonstrates innovations in understanding how extreme rainfall intensity would be changed from climate change beyond Virginia.

[1] Excerpted with permission from the authored journal paper: "Yang, X., Wang, X., Cai, Z., and Cao, W. 2021. Detecting spatiotemporal variations of maximum rainfall intensities at various time intervals across Virginia in the past half century. *Atmospheric Research* 255 (15): 105534."

2.1 Introduction

As an important hydroclimate variable, rainfall controls how much water is available for a given location during a given time period (i.e., duration) (Viessman and Lewis, 2003). Its intensity, which is the rainfall amount per unit time period, has a positive contribution to both runoff volume and peak discharge. That is, a storm event with a higher rainfall intensity tends to generate a flow hydrograph with a larger peak and a larger volume than a storm event with a lower rainfall intensity, and vice versa. In practice, because any hydrology-related infrastructure (e.g., detention pond and diversion channel) needs to be sized to cope with a specified runoff volume and/or a peak discharge, the maximum rainfall intensity for a duration of interest needs to be determined and used to compute the design discharge when observed flow data are not available (Nunes *et al.*, 2009). Similarly, maximum rainfall intensities are usually needed for practices of soil erosion control (Fiener *et al.*, 2013; Nearing *et al.*, 2015; Vallebona *et al.*, 2015), flood mitigation (Das *et al.*, 2014; Larbi *et al.*, 2018), and water resources management (Brekke *et al.*, 2009; Abiy *et al.*, 2019; Singh *et al.*, 2019; Muthoni, 2020).

Influenced by a variety of weather (e.g., water vapor content and air temperature), geographic (e.g. topographic features), physiographic (e.g., land cover), and/or anthropogenic (e.g. urban heat island) factors, rainfall intensity can fluctuate naturally from time to time at a given location and from location to location at a given time. As a result of climate change, such a spatiotemporal variation might exhibit an abrupt change, an increasing or a decreasing trend, and/or a localized pattern (Melillo *et al.*, 2000; Karl *et al.*, 2009; Walsh *et al.*, 2014; Chen *et al.*, 2015). Understanding the natural fluctuations and climate change-induced trends and patterns is crucial but incomplete in existing literature for practices of hydrologic engineering design (Smirnov *et al.*, 2018), water resources management (e.g., drought resistance) (Meshram *et al.*, 2017; Asfaw *et al.*, 2018; Abiy *et al.*, 2019; Singh *et al.*, 2019), and flood mitigation (Sayemuzzaman and Jha, 2014). Most studies among others analyzed temporal trends of precipitation amounts at a time interval of longer than a day using long-term historical data and/or future projections of various Regional Climate Models (RCMs) and General Circulation Models (GCMs). The commonly-used RCMs and GCMs have been well documented (Chokkavarapu and Mandla, 2019).

Sayemuzzaman and Jha (2014) examined trends of the seasonal and annual precipitations in the state of North Carolina of the United States using historical data on daily precipitation at 249 rain gauges from 1950 to 2009. Those authors found that the winter precipitation exhibited a statewide increasing trend, but the fall precipitation had a statewide decreasing trend. The annual, spring, or summer precipitation exhibited mixed trends across the state: there was an increasing trend in the mountain and coastal regions while a decreasing trend in the piedmont region. The significant (at a significance level of $\alpha = 0.05$) shifts of trends, including those of from increasing to decreasing and from decreasing to increasing, occurred between the 1960s and 1970s in most parts of the state. They attributed the trends to the South Atlantic Oscillation and North Atlantic Oscillation, which are large-scale alternations of atmospheric mass between subtropical high surface pressure centered on the Azores and subpolar low surface pressures centered on Iceland (Hurrell, 1995). On the other hand, using the data on daily precipitation at the Norfolk Airport rain gauge (GHCN USW00013737) observed from 1946 to 2016 and then extended to 1911 using a nearby gauge, Smirnov *et al.* (2018) found that the annual maximum daily precipitation in the city of Virginia Beach, which is a coastal area of the state of Virginia with its southern border with North Carolina, exhibited a significant (α = 0.05) increasing trend. The occurrence of storm events with a maximum daily precipitation of larger than the values (e.g., 50 mm) that have been used for local infrastructure design also had a significant increasing trend. Those authors further found that such increasing trends would continue in the future based on the predictions of the North American Coordinated Regional Modeling Experiment (NA-CORDEX). NA-CORDEX is a set of medium- to high-resolution RCM simulations that use boundary conditions from the Coupled Model Inter-Comparison Project Phase 5 (CMIP5) GCMs. They attributed the increasing trends to a recent active stretch of tropical-related events but could not determine whether the active stretch was just a chance or caused by climate change. Regardless of their distinctly different spatial scales (state versus city) and focused variables (annual and seasonal precipitations versus annual maximum daily precipitation), Sayemuzzaman and Jha (2014) and Smirnov *et al.* (2018) agreed with an increasing trend of precipitation in the coastal environments.

Bartolini *et al.* (2014) detected possible temporal changes in precipitation regimes, namely precipitation amount, intensity, and frequency, using long-term hourly data recorded at two rain gauges in Tuscany, central Italy. One gauge (referred to as coastal gauge) is adjacent to the coastal shoreline and has a record period of 1948 to 2009, whereas another gauge (referred to as inland gauge) is about 100 km far from the shoreline and has a record period of 1930 to 2009. The data at both gauges have a good quality for trend analyses. For each gauge, those authors derived and used eleven precipitation indices, including maximum hourly annual rainfall (or maximum annual rainfall intensity), to characterize the aforementioned precipitation regimes. The results from regressing selected percentiles of the indices over year showed contrasting temporal trends for the two gauges: the inland gauge had more trends than the coastal gauge. Nevertheless, both gauges experienced a significant decreasing trend in total rainfall and heavy rainy days but a non-significant positive trend in maximum rainfall intensity.

On the other hand, Vallebona *et al.* (2015) investigated trends in extreme rainfall intensity frequencies and erosivity using high-temporal resolution rainfall intensity data at 23 rain gauges across a 5000 km^2 area in southern Tuscany, Italy. The data have a record period of 1989 to 2002 at a 1-hr time interval and a successive record period of 2003 to 2010 at a 15-min time interval. Regardless of the time intervals, the data on maximum rainfall intensity, which was assumed to be the maximum 1-min rainfall amount, were recorded and used to derive the 95^{th} percentiles at annual, seasonal, and monthly time scales. A percentile regression analysis of the 95^{th} percentiles showed a significant upward trend in the extreme rainfall intensity frequency, which may be due to the enhanced convective activity that has been identified as a possible result of climate change (Berg *et al.*, 2013). Winter is shown to be the season with the strongest increasing trend in coastal and inland rainfall gauges groups, followed by spring for the costal group and autumn for the inland group.

Although those two studies were conducted in a same geographic area (i.e., Tuscany, Italy), the study conducted by Bartolini *et al.* (2014) could not detect the temporal trends reported by Vallebona *et al.* (2015). One possible reason is that the two gauges of the former study are located in the northern part, whereas the 23 gauges of the latter study are located in the southern part, of Tuscany. These two parts might have very heterogeneous trends in maximum rainfall intensity, which is common in many areas of the Mediterranean region (Costa *et al.*, 2008). Another possible reason is that the former study used hourly data, while the latter study used hourly and 15-min data as well as maximum 1-min rainfall amount within each hourly or 15-min time interval. Some maximum rainfall intensities were likely smoothed out in the former study. The third possible reason is that the two studies have different study periods.

Regardless of what data and methods are used, few of the previous studies have examined trends of rainfall intensity at sub-daily (e.g., 15- and 30-min) time intervals (Bartolini *et al.*, 2014). Given that the drainage areas of many hydraulic structures (e.g., urban stormwater sewers and storage facilities) have a time of concentration (t_c) of much shorter than 24 hr (Rossmiller, 2014), the t_c-duration rainfall intensity corresponding to a mandated return period (e.g., 10-year) is always needed for designing such a structure in practice. Herein, t_c is the gross travel time of a raindrop from the hydraulically remotest location to the outlet of the drainage area upstream of the concerned structure (Viessman and Lewis, 2003). However, the structure is likely to be either over- or under-designed without a good understanding of sub-daily rainfall intensity trend. For a region of interest, while the annual, seasonal, or monthly rainfall might experience a decreasing trend, the corresponding maximum rainfall intensity could have an increasing trend, and vice versa (Easterling *et al.*, 2000; Alpert *et al.*, 2002; Groisman *et al.*, 2005; Alexander *et al.*, 2006; Vallebona *et al.*, 2015).

While some previous studies, including those by Bartolini *et al.* (2014) and Vallebona *et al.* (2015), used hourly and/or minutes-durational rainfall data, few of them considered whether or how the trend of sub-daily rainfall intensity at a given location was associated with those at its spatially-adjacent locations (e.g., Cristiano *et al.*, 2017 and Lu *et al.*, 2019). This limits the capability in extrapolating observed sub-daily rainfall intensity at a gauge to a location where there is no rain gauge but a structure will need to be constructed.

The objective of this study was to detect the spatiotemporal variabilities as well as the spatial associations of rainfall intensities at various time intervals. Virginia was chosen as the testbed for this study because it includes typical physiographic regions, namely coastal plains, piedmonts, and mountains, and has long-term high-quality records of 15-min precipitation at rain gauges covering the state's entire territory. The detection approach consists of linear regression, nonparametric statistical test, and advanced spatial autocorrelation. The following contexts describe the study area and data, followed by the basics of the detection approach that are necessary to understand this while the details are referenced to relevant publications. Afterwards, the results are presented and discussed; and finally, the major findings are concisely summarized.

2.2 Materials and Methods

2.2.1 The State of Virginia

The state of Virginia, most of which is located within the Chesapeake Bay Watershed (Figure 2.1), has a humid subtropical climate. It has an annual average of 35 to 45 days of thunderstorm activity and receives an average annual precipitation of 1080 mm. The statewide-averaged extreme air temperature varies from -3°C in January to 30°C in July.

Virginia has a significant topographic relief (Figure 2.1), with elevations varying from Virginia Beach in the east at sea level to Mount Rogers in the west at 1746 m above sea level (Burnham and Burnham, 2004). The major gradations occur at the edges of the Atlantic Ocean, the end of the Piedmont, and the Blue Ridge and Allegheny chains of the Appalachian Mountains. The moderating influence of the ocean from the east, powered by the Gulf Stream, also creates the potential for hurricanes near the mouth of Chesapeake Bay. Cold air masses arrive over the mountains, especially in winter, which can lead to significant snowfalls when coastal storms known as nor'easters move up the Atlantic coast. The interaction of these elements with the state's topography creates micro-climates in the Shenandoah Valley, the mountainous southwest, and the coastal plains that are slightly but noticeably distinct from each other. To differentiate and characterize the micro-climates, NOAA (National Oceanic and Atmospheric Administration) subdivides Virginia into six climatic divisions (Figure 2.1), namely Tidewater, Eastern Piedmont, Western Piedmont, Northern, Central Mountain, and Southwestern Mountain.

On the other hand, to differentiate and characterize the topographic relief, USGS (U.S. Geological Survey) subdivides Virginia into five physiographic divisions (Figure 2.1), namely Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateaus. The Coastal Plain division is between the Atlantic coast and the fall line. It includes the Eastern Shore and major estuaries of Chesapeake Bay. The Piedmont division is a series of sedimentary and igneous rock-based foothills east of the mountains which were formed in the Mesozoic era. The region, known for its heavy clay soil, includes the Southwest Mountains around City of Charlottesville. The Blue Ridge division is a physiographic province of the Appalachian Mountains with the highest points in the state, the tallest being Mount Rogers. The Valley and Ridge division is west of the mountains and includes the Great Appalachian Valley. The region is carbonate rock based and includes Massanutten Mountain. The Cumberland Plateau and the Cumberland Mountains are in the southwest corner of Virginia, south of the Allegheny Plateau.

This study overlaid the NOAA climatic divisions and the USGS physiographic divisions, resulting in 13 climatic-physiographic zones (CPZs) within which the 57 rain gauges with 15-min rainfall data are located (Figure 2.1). The spatiotemporal analyses were conducted both within and across the CPZs to scrutinize any variabilities and associations at site-specific, regional, and state-wide scales. Herein, the primary reason for using these 13 CPZs is to accommodate the low spatial density of rain gauges, which is a universal issue in detecting spatiotemporal trends of short-term rainfall intensities across any area of the world. Each CPZ is a unique combination of "similar" climates and "uniform" physiographic conditions. In our common knowledge and meteorological principles (Vallebona *et al.*, 2015), by doing this, the rainfall intensity may be reasonably hypothesized to be spatially homogeneous across such a CPZ, which was tested for the CPZs with two or more rain gauges. The number of rain gauges within a CPZ would have a minimal influence on the statistical analyses conducted in this study. In contrast, if the CPZs are dissolved to reduce the number, but increase the sizes, of considered zones, the rainfall intensity across such a larger zone will likely be spatially heterogeneous, increasing the inter-zone variability while diminishing the intra-zone variability. As a result, the intra-zone differences will probably be confounded and could not be detected. Thus, this study used the 13 CPZs, rather than fewer larger zones, to best accommodate the small number of rain gauges.

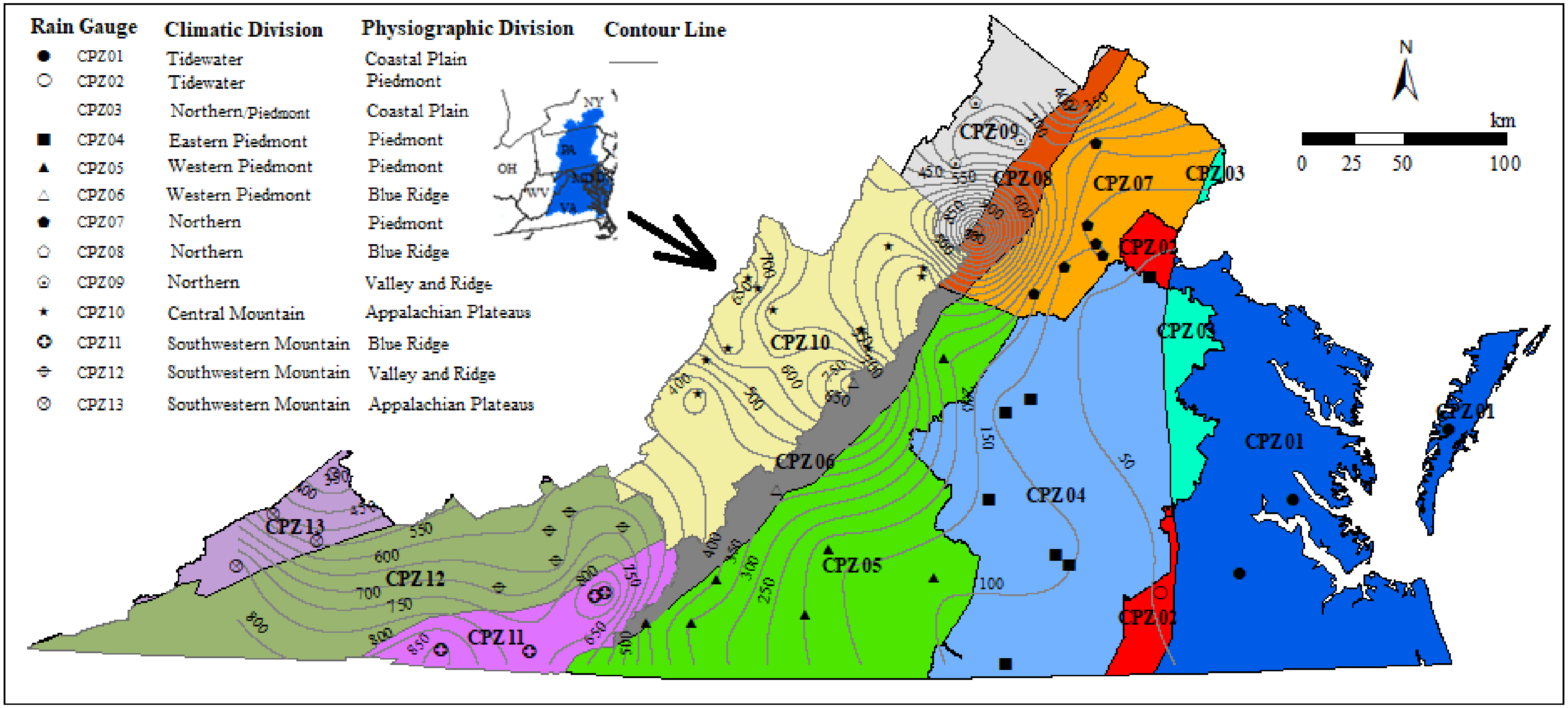


Figure 2.1. The climatic-physiographic zones (CPZs) in the state of Virginia, superimposed by the topographic elevation contours and the 15-min rain gauges. The 25 gauges that had a record period of longer than 30 years were used in this study. The details of the gauges are documented in Wang *et al.* (2019).

2.2.2 Data and preprocessing

The data on 15-min precipitation were obtained from the NOAA National Climatic Data Center (NCDC). Prior to the analyses of spatiotemporal variabilities and associations, the data were preprocessed as shown in the left-top panel of Figure 2.2 and described herein. For a given rain gauge, the missing values were filled using a function (Yozgatligil *et al.*, 2013; Mohanty *et al.*, 2014) of the responding values at its neighboring gauges within a geographic distance of 50 km. As a thumb rule, this study selected the 25 over 57 rain gauges with record period longer than 30 years data for the follow-up analysis. The details of these selected gauges are documented in Wang *et al.* (2019). Based on the data, the summary statistics, namely maximum, mean, and coefficient of variation (C_v), were computed and are presented as contours in Figure 2.3.

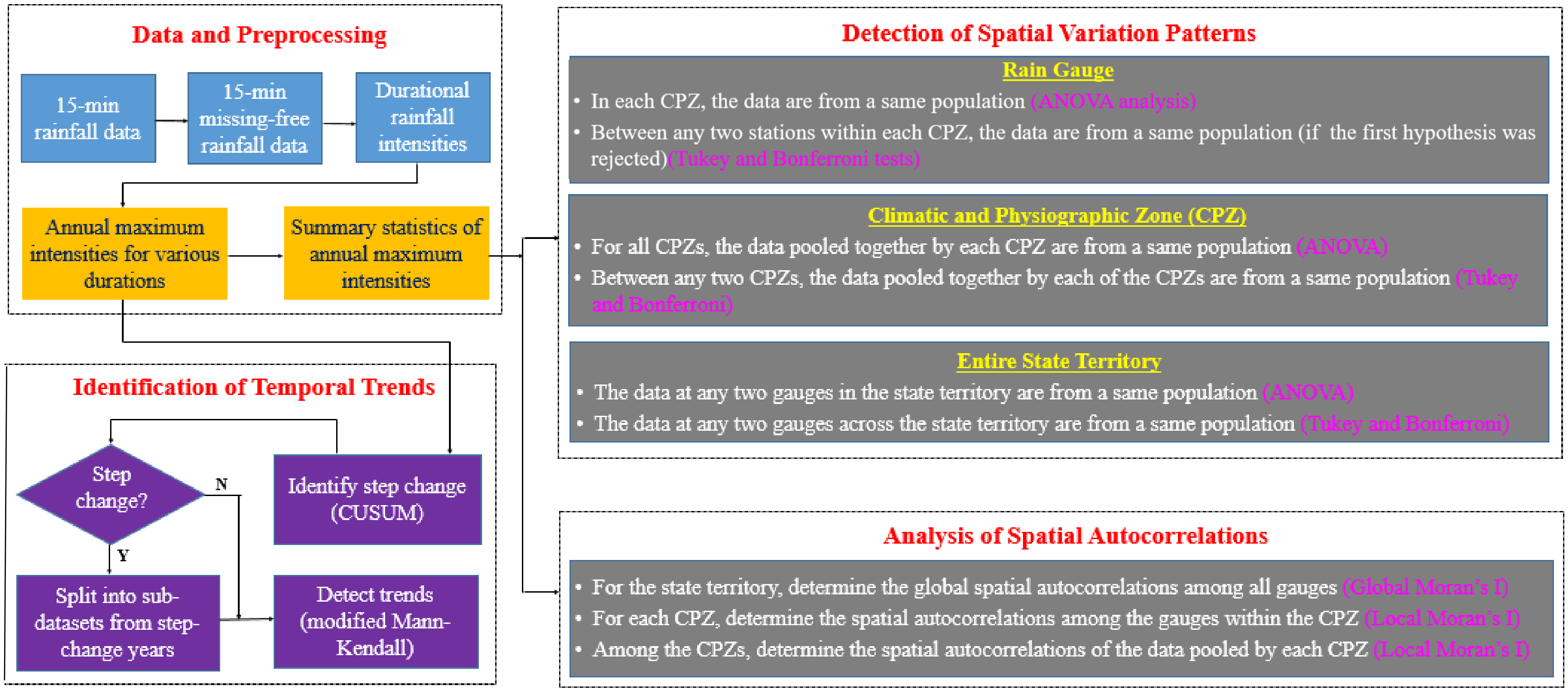
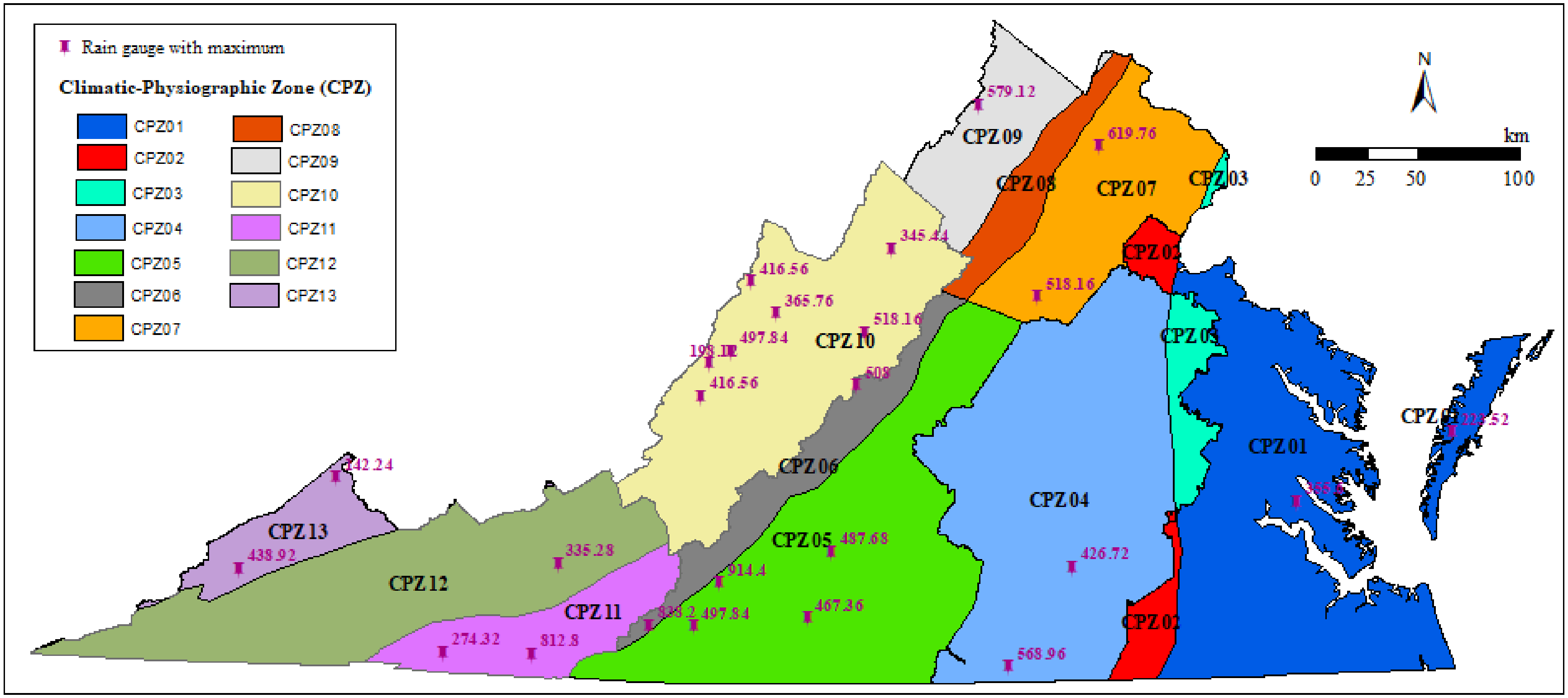
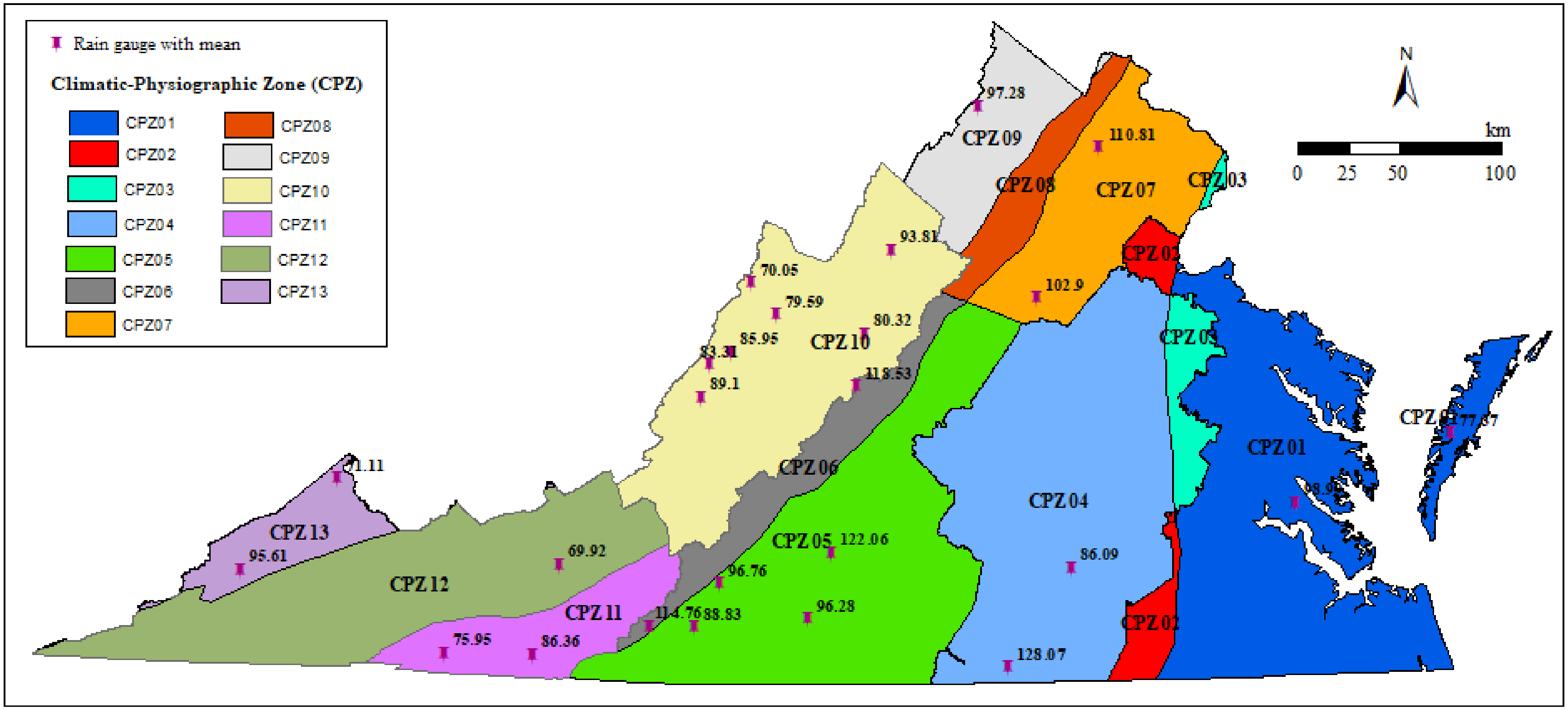


Figure 2.2. The approach proposed and used in this study. The summary statistics include minimum, 1st quantile, mean, median, 3rd quantile, and maximum, while the durations include 15, 30, and 45 min, and 1, 2, 3, 4, 6, 12, 24, 48, and 72 h.


Rain gauge with maximum
Climatic-Physiographic Zone (CPZ)
CPZ01
CPZ02
CPZ03
CPZ04
CPZ05
CPZ06
CPZ07
CPZ08
CPZ09
CPZ10
CPZ11
CPZ12
CPZ13
N
km
0 25 50 100
CPZ 09
579.12
CPZ 08
CPZ 07
619.76
CPZ 03
345.44
416.56
365.76
518.16
518.16
CPZ 02
497.84
CPZ 10
416.56
508
CPZ 06
CPZ 01
CPZ 04
CPZ 13
242.24
438.92
CPZ 12
335.28
CPZ 05
487.68
914.4
426.72
CPZ 11
497.84
467.36
274.32
812.8
568.96
CPZ 02

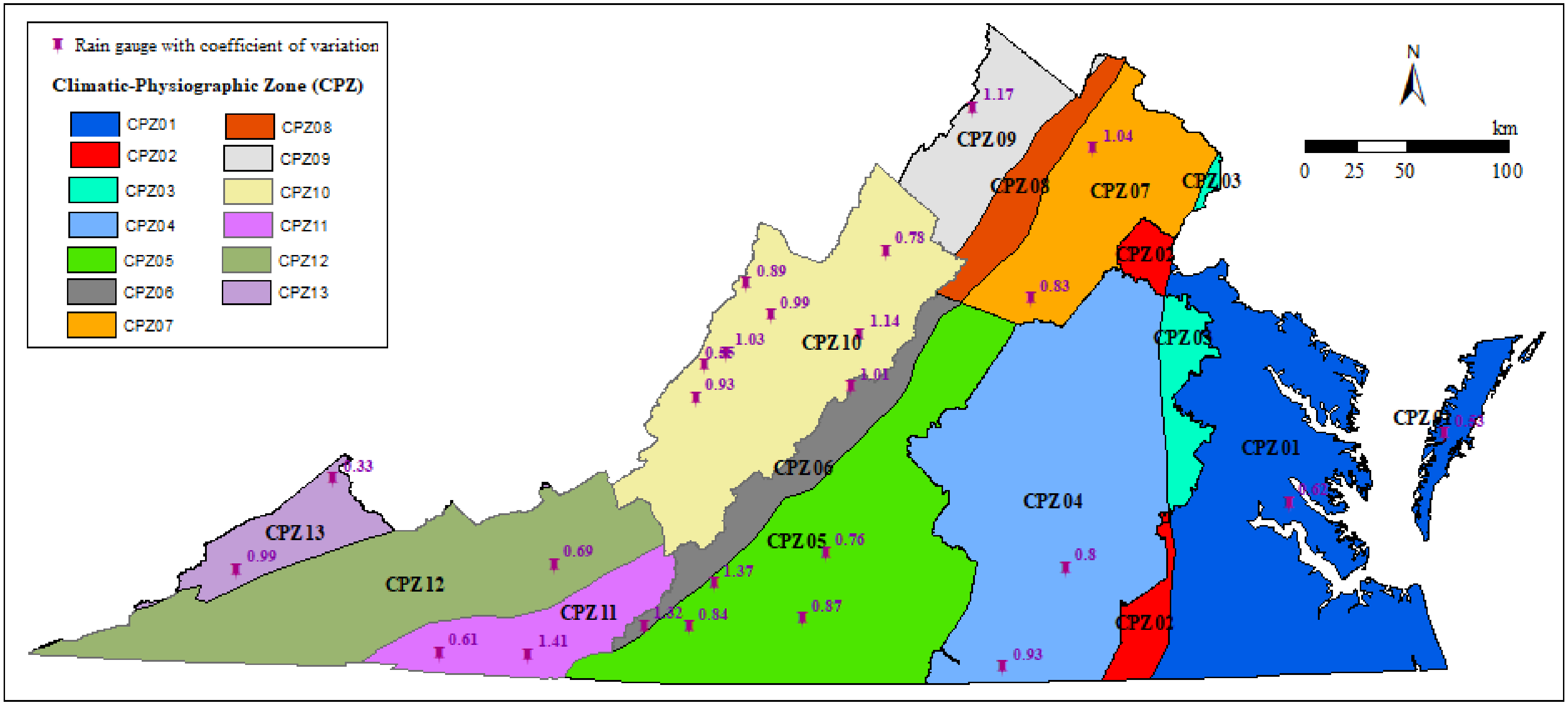
(a)

[Figure 2.3]


Rain gauge with mean
Climatic-Physiographic Zone (CPZ)
CPZ01
CPZ02
CPZ03
CPZ04
CPZ05
CPZ06
CPZ07
CPZ08
CPZ09
CPZ10
CPZ11
CPZ12
CPZ13
N
km
0 25 50 100
CPZ 01
CPZ 02
CPZ 03
CPZ 04
CPZ 05
CPZ 06
CPZ 07
CPZ 08
CPZ 09
CPZ 10
CPZ 11
CPZ 12
CPZ 13
97.28
110.81
93.81
70.05
79.59
80.32
85.95
89.1
118.53
102.9
122.06
96.76
96.28
88.83
114.76
86.09
128.07
69.92
75.95
86.36
95.61
77.87

(b)

[Figure 2.3]



(c)

Figure 2.3. Summary statistics of the historic annual maximum 15-min intensities at the 25 rain gauges a record period of longer than 30 years. The observed: (a) maximums, (b) means, and (c) coefficients of variation (C_v). The maximums and means are in mm hr^{-1}, while the C_v is dimensionless.

For each of the 25 rain gauges, the consecutive missing-filled 15-min precipitation time series was used to generate a dataset of annual maximum 15-min precipitation (designated $\tilde{X}_{15m,i}$ for description purpose, where subscript "15m" signifies the duration of 15 min; and i = 1, 2, …, 25, signifies the gauge). For a given observation year, the element value of $\tilde{X}_{15m,i}$ was computed as the maximum of the observed values at gauge i within this year. For each of the durations of longer than 15 min, the durational precipitation time series was formulated based on the consecutive missing-filled 15-min precipitation time series: the interval values of the durational time series was computed as accumulation (from beginning of the record) of the observed values of 15-min precipitation the duration apart. For instance, for the duration of 30 min, the first value of the 30-min precipitation time series was computed as the summation of first two observed values of the corresponding 15-min precipitation time series, the second value of the 30-min precipitation time series was computed as the summation of second and third observed values of the 15-min precipitation time series, and so on. Similarly, for the duration of 72 hr, the first value of the 72-h precipitation time series was computed as the summation of first 288 ($= 72 \times 60 \div 15$) values of the 15-min precipitation time series, and the successive values were computed as the summation of the 15-min-lagged 288 values of the 15-min precipitation. As a result, eleven more time series, which respectively have durations of 30 and 45 min and 1, 2, 3, 4, 6, 12, 24, 48 and 72 hr, were formulated for the rain gauge.

Further, for each of the eleven formulated time series and for a given observation year, the annual maximum durational precipitation is computed. This generated another eleven datasets of annual maximum durational precipitation for gauge i, namely $\tilde{X}_{30m,i}$, $\tilde{X}_{45m,i}$, $\tilde{X}_{1h,i}$, $\tilde{X}_{2h,i}$, $\tilde{X}_{3h,i}$, $\tilde{X}_{4h,i}$, $\tilde{X}_{6h,i}$, $\tilde{X}_{12h,i}$, $\tilde{X}_{24h,i}$, $\tilde{X}_{48h,i}$, and $\tilde{X}_{72h,i}$. Moreover, the annual maximum durational precipitations were divided by the corresponding duration (e.g., 15 min) to derive the corresponding intensities in mm hr^{-1}. Each time series of maximum durational intensity was used to calculate six summary statistics, including minimum, 25th percentile, mean, median, 75th percentile, and maximum. This calculation resulted in 72 $(= 6 \times 12)$ datasets, which in turn were used to examine spatial variations and autocorrelations.

2.2.3 Detection of temporal trend

As shown in the left-bottom panel of Figure 2.2 and detailed in Wang *et al.* (2014), for a given time series (i.e., dataset), the distribution-free cumulative sum (CUSUM) technique, presented by McGilchrist and Woodyer (1975) and applied by numerous studies (e.g.,Wang *et al.*, 2014; Gao *et al.*, 2017), was used to detect whether, and at which year, a significant step (i.e., upward-to-downward or downward-to-upward) change occurred, at a significance level of α = 0.05. The null hypothesis was that there was no step change (i.e., the mean value of the time series would be statistically independent of the number of computational years). If no significant step change was detected, the modified Mann-Kendall (Mann, 1945; Kendall, 1955; Hirsch *et al.*, 1982; Hamed and Rao, 1998; Wang *et al.*, 2014; Gao *et al.*, 2017) was applied to the entire dataset to determine whether a statistically significant (α = 0.05) temporal (i.e., downward or upward) trend existed. Otherwise, the dataset was split into two, before and after the step-change year, and the modified Mann-Kendall test was applied independently to each subdataset to identify any trends. The sequential Mann-Kendall method (Taubenheim, 1989; Sneyers, 1990; Rahman and Islam, 2019) was used to determine the year when a trend started and the Sen's slope (Sen, 1968; Wu *et al.*, 2020) was computed and used to measure the rate of change of the trend.

Moreover, for each time series, two parametric methods, namely linear regression and moving average (Hubert and Arabie, 1991; Ebrahim Banihabib and Mousavi-Mirkalaei, 2019), were used to either verify or rebut the trends and step changes detected by the above nonparametric methods, namely the modified Mann-Kendall and the CUSUM, as well as to detect possible additional ones. The slope coefficients of the regression equations were tested against the standard student-t distribution at $\alpha = 0.05$. If a slope coefficient was significantly different from zero, the corresponding time series was judged to have either a significant upward or downward trend. A positive coefficient indicates an upward trend, whereas a negative coefficient signifies a downward trend. Also, a one-way analysis of variance (ANOVA) was conducted to compare the five-year moving averages to determine whether the means were dependent on time windows at $\alpha = 0.05$. A significant dependence was judged to be a clue of non-stationarity caused by a significant trend and/or a significant step change.

2.2.4 Detection of spatial trend

As shown in the right-top panel of Figure 2.2, this study tested six interconnected null hypotheses. First, the means at the rain gauges within a CPZ were statistically same. That is, the data at these gauges were from a same population. Second, if the first null hypothesis was not rejected for all CPZs, the zonal means were statistically same. For a CPZ, its zonal mean was computed as the overall average of the data at all gauges within this CPZ. Third, if the first null hypothesis was not rejected and the second hypothesis was rejected, the zonal mean of a CPZ was statistically same as that of another CPZ. That is, the time series averaged across the gauges within a CPZ and that within another CPZ were from a same population. Fourth, if the first null hypothesis was rejected for a CPZ, the data at any paired gauges within this CPZ were from a same population. Fifth, if the first null hypothesis was rejected, the mean at a gauge within a CPZ was statistically same as the mean at a gauge within another CPZ. Finally, the data at any paired gauges across Virginia were from a same population.

The former six hypotheses were tested using the one-way analysis of variance (ANOVA) and the Tukey-Bonferroni pairwise comparison method (Hubert and Arabie, 1991; Crawford and Hawkes, 2020). The ANOVA determines whether there are any statistically significant differences between the means of three or more independent groups. That is, the ANOVA can only tell that at least two groups are different, but it cannot discern which specific groups are statistically different from each other. In contrast, the Tukey-Bonferroni method uses pairwise post-hoc testing to determine whether there is a difference between the means of all possible pairs using a studentized range distribution. It can discern the significantly different groups. Both the ANOVA and the Tukey-Bonferroni method ensure a family significance level (i.e., $\alpha = 0.05$ in this study). On the other hand, the latter three hypotheses were examined using the standard studentized t-test, which compares two groups. The t-test ensures a significance level (e.g., $\alpha = 0.05$) for each comparison but can have a much higher overall significance level for all comparisons.

The test statistic of the Tukey-Bonferroni method is computed as:

$$t_{i,j} = \frac{|\bar{y}_i - \bar{y}_j|}{S_p\sqrt{\frac{1}{n_i}+\frac{1}{n_j}}} \tag{2.1}$$

where $t_{i,j}$ is the test statistic for comparing groups i and j; $\bar{y}_i$ and $\bar{y}_j$ are the means of groups i and j, respectively; n_i and n_j are the sample sizes of groups i and j, respectively; and S_p is the standard deviation of the pooled data of the samples of all comparison groups.

The degree of freedom of $t_{i,j}$ is computed as:

$$df_{i,j} = \left(\sum_{k=1}^{N} n_k\right) - N \tag{2.2}$$

where $df_{i,j}$ is the degree of freedom; n_k is the sample size of group k; and N is the total number of comparison groups.

The test statistic of the ANOVA for groups i and j is computed as:

$$F_{i,j} = \frac{\text{variance between groups}}{\text{variance within groups}} \tag{2.3}$$

where $F_{i,j}$ is the test statistic with degrees of freedom of N – 1 and $df_{i,j}$ in Eq. (2.2).

2.2.5 Analysis of spatial autocorrelations

As shown in the right-bottom panel of Figure 2.2, this study determined the spatial autocorrelations within a CPZ, among the CPZs, and across the state territory in terms of the aforementioned six summary statistics, namely minimum, 25th percentile, mean, median, 75th percentile, and maximum. Herein, the spatial autocorrelation was measured by Moran’s I, which is computed as (Moran, 1950; Sokal and Oden, 1978; Li *et al.*, 2018):

$$I = \frac{m}{\sum_{i=1}^{m}\sum_{j=1}^{m} w_{ij}} \frac{\sum_{i=1}^{m}\sum_{j=1}^{m}[w_{ij}(v_i - \bar{v})(v_j - \bar{v})]}{\sum_{i=1}^{m}(v_i - \bar{v})^2} \tag{2.4}$$

where m is the total number of locations; w_{ij} is the binary weight matrix ($w_{ij} = 1$ if locations i and j are adjacent, whereas $w_{ij} = 0$ if i and j are not adjacent or i = j); v_i is the testing variable at location i; v_j is the testing variable at location j; and $\bar{v}$ is the global mean of the testing variables at all locations.

A value of $I > 0$ indicates a positive spatial autocorrelation among the testing variables, whereas a value of $I < 0$ indicates a negative spatial autocorrelation. If $I = 0$, it can be judged that the testing variables have no autocorrelation. The autocorrelation is significant at a significance level of α if the value of I satisfies:

$$Z = \frac{I - \bar{I}}{\sqrt{\hat{\sigma}_I}} \geq Z_\alpha \tag{2.5}$$

where Z_α is the critical normal Z-score from a standard normal distribution; $\bar{I}$ is the mean of Moran's I; and $\hat{\sigma}_I$is the variance of Moran's I.

$\bar{I}$ is computed as:

$$\bar{I} = \frac{1}{1-m} \tag{2.6}$$

If I is assumed to follow a normal distribution, $\hat{\sigma}_I$ is computed as:

$$\hat{\sigma}_I = \frac{3S_0^2 + m^2S_1 - mS_2}{S_0^2(m^2-1)} - \bar{I}^2 \tag{2.7}$$

$$S_0 = \sum_{i=1}^{m}\sum_{j=1}^{m} w_{ij} \tag{2.8}$$

$$S_1 = \frac{\sum_{i=1}^{m}\sum_{j=1}^{m}\left(w_{ij}+w_{ji}\right)^2}{2} \tag{2.9}$$

$$S_2 = \sum_{i=1}^{m}\left(\bar{w}_{i\bullet} + \bar{w}_{\bullet j}\right)^2 \tag{2.10}$$

where $\bar{w}_{i\bullet}$ is the average of the ith row of the binary weight matrix; and $\bar{w}_{\bullet j}$ is the average of the jth column of the binary weight matrix.

For randomization, $\hat{\sigma}_I$ is computed as:

$$\hat{\sigma}_I = \frac{\left[3S_0^2+m\left(m^2-3m+3\right)S_1-mS_2\right]-\delta\left[6S_0^2+\left(m^2-m\right)S_1-2mS_2\right]}{(m-1)(m-2)(m-3)S_0^2} - \bar{I}^2 \tag{2.11}$$

$$\delta = \frac{m\sum_{i=1}^{m}(v_i-\bar{v})^4}{\sum_{i=1}^{m}(v_i-\bar{v})^2} \tag{2.12}$$

2.3 Results

2.3.1 The temporal trends

The typical inter-annual fluctuations of the maximum precipitation intensities at three selected gauges are shown in Figure 2.4. In terms of the CUSUM results (not shown), such fluctuations did not result in a statistically significant change for any of the gauges and durations, indicating that the trend rate if any in a certain time period preserved throughout the entire record period. In addition, linear regressions revealed that at a duration of 2 hr or shorter, the maximum precipitation intensity exhibited a decreasing trend regardless of the gauges, as indicated by a negative slope, whereas at a duration of longer than 2 hr, the maximum precipitation intensity exhibited an increasing trend at the four gauges located in the coastal, mountainous, and Appalachian regions (i.e., CPZ 01, CPZ 05, CPZ 10, and CPZ 13 as shown in Figure 2.1) and a decreasing trend at any other gauge. At a significance level of $\alpha = 0.05$, some of these trends are significant but the others are insignificant. To be concise, only the gauges with at least one significant (at $\alpha = 0.05$) trend are presented in Table 2.1. Most of these significant trends were further verified by the significant Sen's slopes of the modified Mann-Kendal test. Overall, for a rain gauge (e.g., 444414), linear regressions tended to detect more significant trends than the modified Mann-Kendall test. Further, the one-way ANOVA test revealed significant discrepancies of the five-year moving averages for the gauges with significant trends (Table 2.1), indicating trend-induced non-stationarities. Moreover, the sequential Mann-Kendall test revealed that the significant trends probably started in a 10-years' time window between the late 1970s and early 1980s.

For a given gauge and a given duration, the change rate from the linear regression was numerically faster than that from the Sen's slope (Table 2.1). Given that the Mann-Kendal test does not require, but the linear regression requires, that the data follow a normal probability distribution, the Sen's slope might more reasonably surrogate the change rate and is thus used in the following contexts. For a gauge of interest, the change rate for a shorter duration was faster than that for a longer duration. The fastest decreasing rate of 4.40 mm hr^{-1} yr^{-1} occurred at gauge 440166 for the duration of 15 min, which is located in CPZ05 of the Western Piedmont climate division (Figure 2.1), whereas the fastest increasing rate of 0.03 mm hr^{-1} yr^{-1} occurred at gauge 449151 for the duration of 24 hr, which is located in the CPZ 01 of the Tidewater climatic division. The slowest decreasing rate of 0.01 mm hr^{-1} yr^{-1} occurred at gauge 448046 for the duration of 72 hr, which is located in the CPZ 09 of the Northern climatic division.

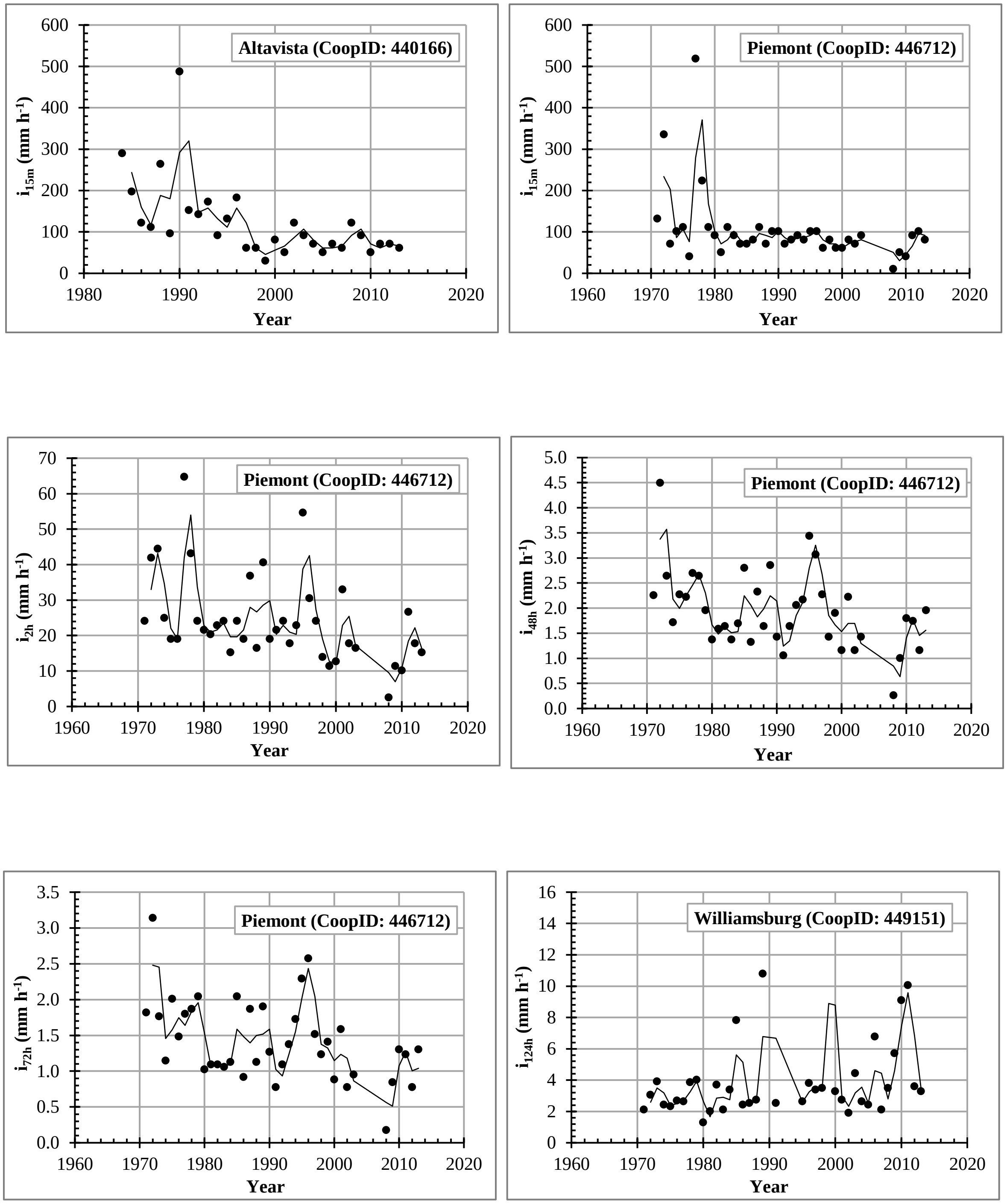


Figure 2.4. Typical significant trends of historic annual maximum durational precipitations. Three gauges (CoopID 440166, 446712, and 449151) were slectedfor illustration purposes. i signifies the intensity for the duration represented by the subscript.

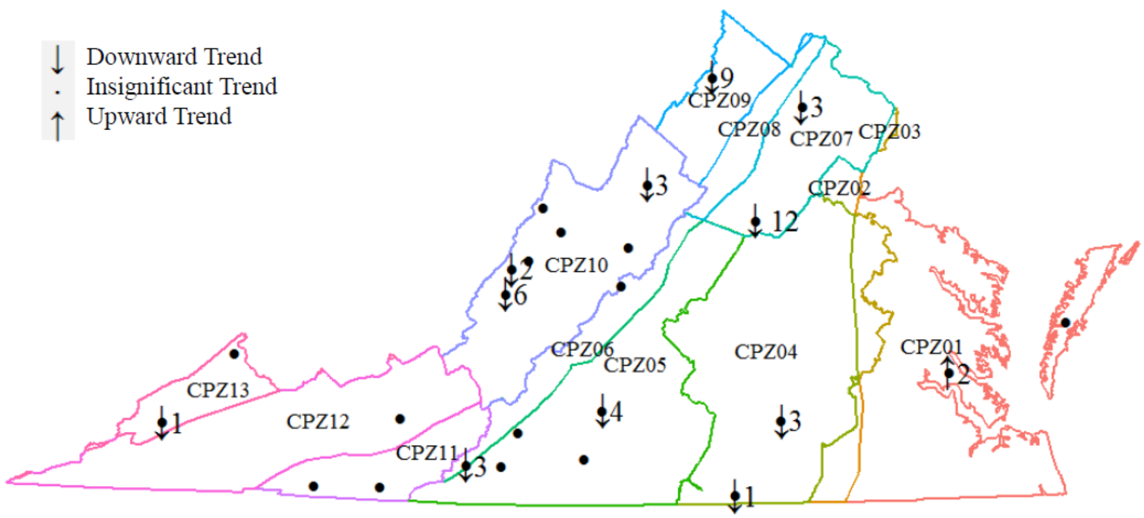
Table 2.1. Detected trends of maximum annual intensities and their five-year moving averages.[1]

CPZ	Gauge (Sample Size)	Parameter	Test Statistcs for Duration of 15min	30min	45min	1hr	2hr	3hr	4hr	6hr	12hr	24hr	48hr	72hr
01	449151	Sen's slope (mm hr^{-1})	0.00	-0.13	0.00	0.00	0.00	0.00	0.03	0.04	0.04	0.03	0.02	0.01
	(N = 39)	Linear slope (mm hr^{-1})	-1.11	-0.31	-0.11	-0.07	-0.04	0.02	0.08	0.08	0.08	0.06	0.04	0.03
		p-value for H_0	0.17	0.49	0.79	0.85	0.85	0.92	0.53	0.33	0.17	0.08	0.04	0.05
04	441322	Sen's slope (mm hr^{-1})	-1.02	-0.78	-0.62	-0.56	-0.27	-0.18	-0.13	-0.09	-0.06	-0.03	-0.01	-0.01
	(N = 36)	Linear slope (mm hr^{-1})	-1.62	-0.97	-0.73	-0.59	-0.31	-0.20	-0.14	-0.10	-0.06	-0.03	-0.01	-0.01
		p-value for H_0	0.18	0.10	0.06	0.06	0.08	0.13	0.25	0.31	0.18	0.22	0.35	0.23
	444414	Sen's slope (mm hr^{-1})	-1.13	-0.51	-0.31	-0.30	-0.18	-0.13	-0.08	-0.07	-0.02	-0.01	0.00	0.00
	(N = 38)	Linear slope (mm hr^{-1})	-4.11	-1.72	-1.01	-0.72	-0.33	-0.20	-0.12	-0.08	-0.02	-0.01	0.00	0.00
		p-value for H_0	0.00	0.01	0.02	0.02	0.03	0.05	0.13	0.16	0.36	0.39	0.60	0.62
05	440166	Sen's slope (mm hr^{-1})	-4.40	-1.85	-1.13	-0.73	-0.25	-0.15	-0.10	-0.04	-0.05	-0.02	-0.01	-0.01
	(N = 30)	Linear slope (mm hr^{-1})	-6.08	-2.62	-1.48	-1.02	-0.38	-0.22	-0.15	-0.09	-0.07	-0.03	-0.02	-0.01
		p-value for H_0	0.00	0.00	0.02	0.03	0.08	0.14	0.16	0.22	0.05	0.16	0.19	0.22
	449272	Sen's slope (mm hr^{-1})	-2.24	-1.13	-0.75	-0.51	-0.32	-0.15	-0.08	-0.03	0.00	0.03	0.02	0.01
	(N = 30)	Linear slope (mm hr^{-1})	-7.39	-3.50	-2.30	-1.66	-0.76	-0.44	-0.27	-0.13	-0.05	0.01	0.01	0.00
		p-value for H_0	0.02	0.03	0.03	0.03	0.06	0.11	0.22	0.42	0.65	0.70	0.44	0.78
07	446712	Sen's slope (mm hr^{-1})	-1.13	-0.85	-0.61	-0.51	-0.33	-0.24	-0.16	-0.09	-0.07	-0.04	-0.02	-0.02
	(N = 39)	Linear slope (mm hr^{1})	-2.79	-1.33	-0.90	-0.70	-0.45	-0.33	-0.26	-0.17	-0.10	-0.05	-0.03	-0.02
		p-value for H_0	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
	448396	Sen's slope (mm hr^{-1})	-0.83	-0.55	-0.47	-0.39	-0.38	-0.27	-0.22	-0.14	-0.08	-0.03	-0.02	-0.02
	(N = 34)	Linear slope (mm hr^{-1})	-2.71	-1.18	-0.77	-0.64	-0.47	-0.39	-0.32	-0.27	-0.14	-0.06	-0.04	-0.03
		p-value for H_0	0.20	0.26	0.27	0.21	0.09	0.06	0.05	0.02	0.04	0.07	0.03	0.02
09	448046	Sen's slope (mm hr^{-1})	-1.07	-0.53	-0.33	-0.23	-0.18	-0.13	-0.13	-0.10	-0.07	-0.03	-0.02	-0.01
	(N = 40)	Linear slope (mm hr^{-1})	-3.31	-1.55	-0.98	-0.72	-0.39	-0.26	-0.22	-0.15	-0.09	-0.04	-0.02	-0.01
		p-value for H_0	0.04	0.05	0.06	0.06	0.03	0.03	0.01	0.01	0.00	0.01	0.01	0.02
10	442044	Sen's slope (mm hr^{-1})	-0.73	-0.49	-0.42	-0.33	-0.17	-0.11	-0.08	-0.06	-0.03	-0.02	-0.01	-0.01
	(N = 39)	Linear slope (mm hr^{-1})	-2.34	-1.22	-0.82	-0.59	-0.30	-0.20	-0.14	-0.10	-0.06	-0.03	-0.02	-0.01
		p-value for H_0	0.05	0.04	0.04	0.04	0.03	0.03	0.06	0.06	0.06	0.08	0.09	0.14
	442208	Sen's slope (mm hr^{-1})	-2.54	-1.15	-0.75	-0.54	-0.20	-0.11	-0.04	0.00	0.02	0.00	0.01	0.01
	(N = 30)	Linear slope (mm hr^{-1})	-3.58	-1.54	-1.00	-0.65	-0.29	-0.14	-0.07	0.00	0.02	0.01	0.01	0.01
		p-value for H_0	0.02	0.04	0.04	0.08	0.11	0.28	0.52	0.91	0.42	0.52	0.54	0.40
	443310	Sen's slope (mm hr^{-1})	-2.26	-0.71	-0.35	-0.15	-0.15	-0.14	-0.08	-0.04	-0.02	0.00	0.00	0.00
	(N = 30)	Linear slope (mm hr^{-1})	-3.12	-1.02	-0.53	-0.31	-0.15	-0.13	-0.12	-0.09	-0.04	-0.02	-0.01	-0.01
		p-value for H_0	0.00	0.05	0.14	0.26	0.31	0.16	0.10	0.12	0.28	0.30	0.68	0.61
11	448547	Sen's slope (mm hr^{-1})	-0.52	-0.28	-0.19	-0.17	-0.13	-0.09	-0.07	-0.02	-0.02	0.00	0.00	0.00
	(N = 40)	Linear slope (mm hr^{-1})	-1.18	-0.52	-0.30	-0.25	-0.12	-0.07	-0.05	-0.01	-0.01	0.00	0.00	0.00
		p-value for H_0	0.04	0.08	0.18	0.17	0.28	0.37	0.43	0.83	0.89	0.90	0.94	0.97
13	449215	Sen's slope (mm hr^{-1})	-2.03	-0.91	-0.78	-0.58	-0.28	-0.12	-0.07	0.00	0.00	0.00	0.00	0.01
	(N = 28)	Linear slope (mm hr^{-1})	-5.07	-2.11	-1.35	-1.02	-0.49	-0.28	-0.16	-0.07	-0.02	0.00	0.00	0.00
		p-value for H_0	0.05	0.11	0.13	0.13	0.15	0.18	0.31	0.59	0.74	0.99	0.75	0.57

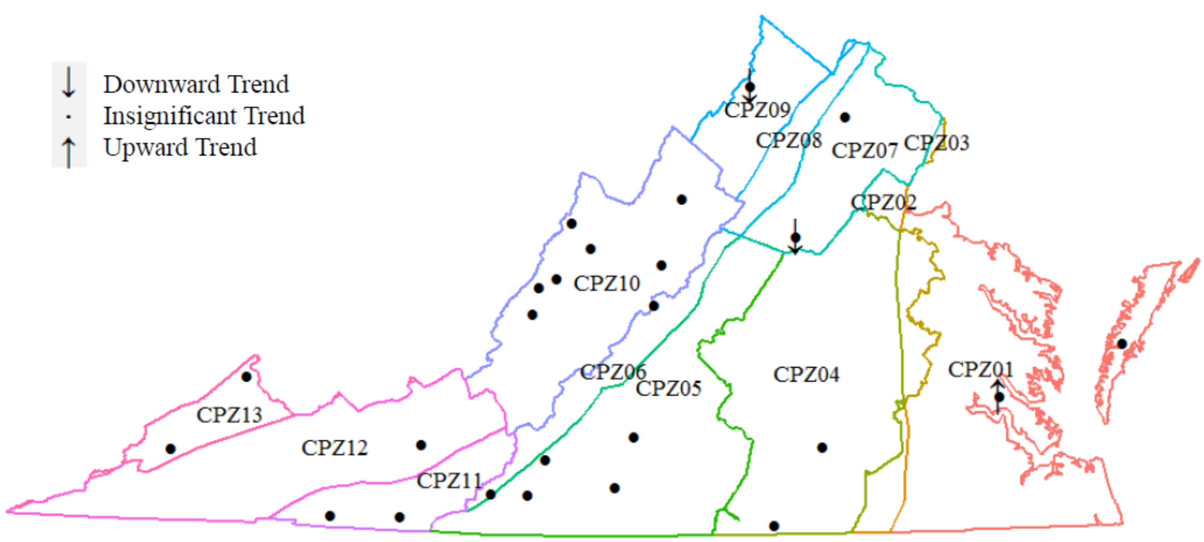
[1] The details of Mann-Kendall test and its statistics (e.g., Sen's slope) can be found from Wang *et al.* (2014). H_0: p-value of one-way analysis of variance (ANOVA) for testing the null hypothesis that the five-year moving averages were same during the record period. The red color signifies that the slope is significant, or the H_0 is rejected, at a significance level of $\alpha = 0.05$.

2.3.2 The spatial trends

The gauges with a significant trend are generally scattered across the state (Figure 2.5), indicating the independence of geographical locations. However, the gauges (e.g., 446712 and 448046) that had decreasing trends for both short and long durations are concentrated in the Northern climate division (Figure 2.1), whereas the gauges that had decreasing trends just in a short duration are geographically dispersed across the state. Gauge 449151, which had an increasing trend at a duration of 24 hr or longer, is located in the Tidewater climate division. Most of the detected significant trends occurred in the northcentral part of the state (i.e., Northern climate division) (Figure 2.6).



(a)



(b)

Figure 2.5. Spatial distribution of the significant temporal trends (signified by an arrow) of maximum precipitation intensities for: (a) all durations; and (b) a duration of 24 hr. The value beside an arrow is the number of durations with a significant trend at a significance level of $\alpha = 0.05$.

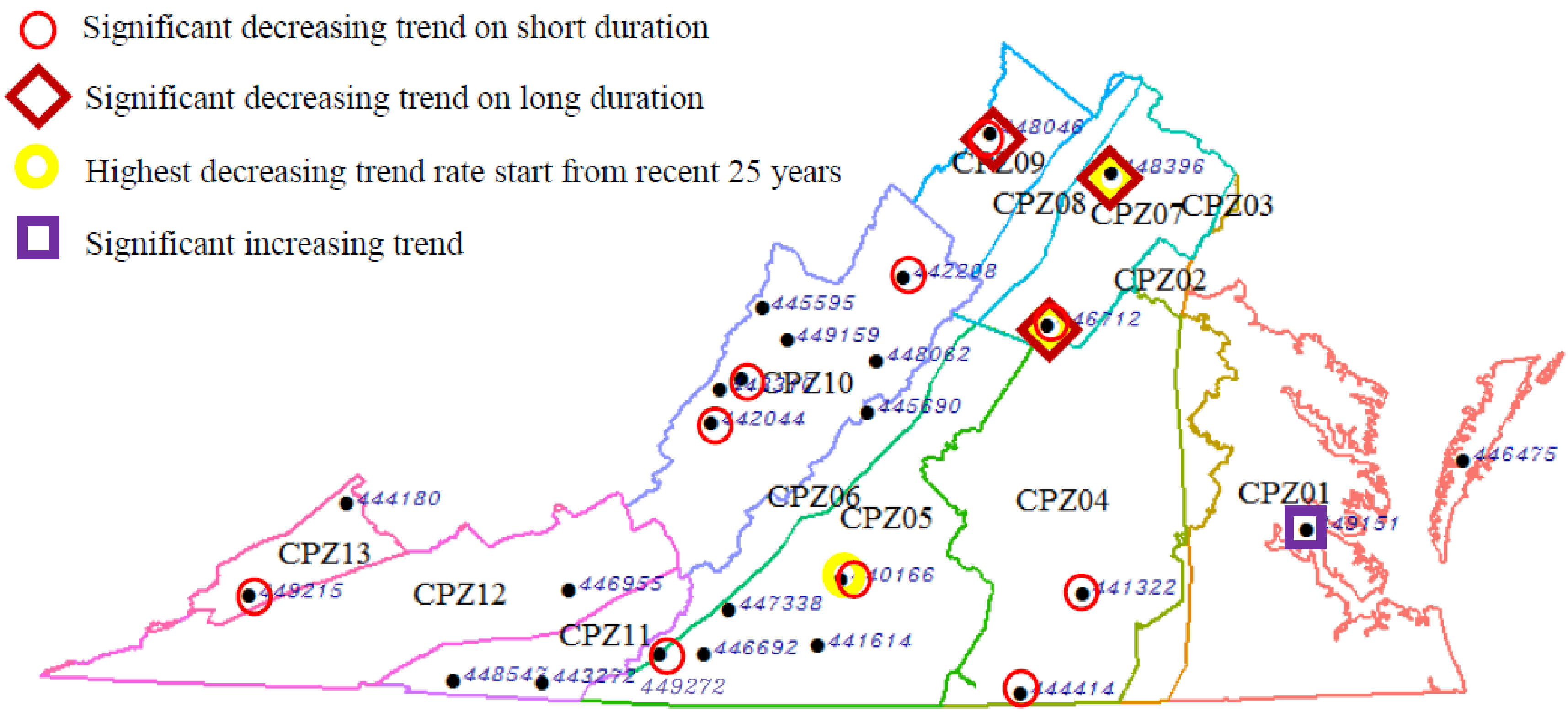


Figure 2.6. Summary of significant (α = 0.05) trends, decreasing rates, and trend start year of maximum precipitation intensities.

For a given duration, the gauges within a CPZ of interest, except for those within CPZ01, had a statistically same mean rainfall intensities. The two gauges (i.e., 446475 and 449151) within CPZ01 had statistically different mean intensities (p-value < 0.02) for a duration of 30 min, 45 min, or 1 hr, but they had a statistically same mean intensity (p-value > 0.07) for each other duration. To make multiple comparisons among the CPZ zones, CPZ01 was split into two subzones, designated CPZ01a and CPZ01b for description purposes. CPZ01a includes gauge 446475, while CPZ01b included gauge 449151. As a result, the rainfall intensities at the gauges within a CPZ were judged to be from a same population and thus pooled together into one dataset. The pooled datasets were in turn used to test whether the mean rainfall intensity of a CPZ was statistically different from those of others. Such a one-way ANOVA test indicated that the CPZs had significantly ($\alpha = 0.05$) different mean rainfall intensities for the durations of 30 min and longer (Table 2.2). The differences among the CPZ mean intensities for a duration of 15 min were marginally significant (p-value = 0.06).

Table 2.2. ANOVA test of whether the CPZ mean intensities were different.[1]

Duration	Degree of Freedom	p-value
15 min	10	0.065
30 min	10	0.006
45 min	10	0.000+
1 hr	10	0.000+
2 hr	10	0.000+
3 hr	10	0.000+
4 hr	10	0.000+
6 hr	10	0.000+
12 hr	10	0.000+
24 hr	10	0.000+
48 hr	10	0.000+
72 hr	10	0.000+

[1] CPZ: climatic-physiographical zone shown in Figure 2.1.

The Tukey-Bonferroni test indicated that all CPZs had a statistically same mean rainfall intensity for a duration of 15 or 30 min and that CPZ06 or CPZ10 tended to have a statistically different mean intensity from other CPZs for durations of 45 min and longer (Table 2.3). The number of CPZs that had significantly different mean intensities was largest for the durations of 24 hr, indicating a most spatial variability of such durational storms. The spatial variability of a shorter durational storm tended to be smaller than that of a longer durational storm, implying that in relative, shorter durational storms occurred uniformly across the state. Overall, the rainfall intensities in the western part of Blue Ridge had a larger spatial variability than those in the eastern part. Such geographical contractions tended to become more obvious with increasing duration length. This is further evidenced by that gauge 445690, which is located in the Blue Ridge physiographical division (Figure 2.1), had a rainfall intensity significantly different from any other gauges for most of the durations, as indicated by a paired family comparison Tukey-Bonferroni test for all 25 gauges (not shown to be concise).

Table 2.3. Paired CPZs with statistically different mean rainfall intensities at α =0.05 by the Tukey-Bonferroni test.[1]

Duration	CPZ	Contrast CPZs
45 min	10	4
		5
		7
1 hr	10	4
		5
		7
2 hr	10	1b
		4
		5
		6
		7
3 hr	1b	12
		13
	7	12
		13
	10	01b
		4
		5
		6
		7
4 hr	1b	11
		12
		13
	6	10
		12
		13
	7	12
		13
	10	1b
		4
		5
		7

Duration	CPZ	Contrast CPZs
6 hr	1b	11
		12
		13
	6	5
		9
		10
		11
		12
		13
	7	12
		13
	10	1b
		4
		5
		7
12 hr	1b	12
		13
	6	1a
		4
		5
		7
		9
		10
		11
		12
		13
	10	1b
		5
		7

Duration	CPZ	Contras CPZs
24 hr	1b	9
		11
		12
		13
	5	12
		13
	6	1a
		4
		5
		7
		9
		10
		11
		12
		13
	10	1b
		5
		7
48 hr	1b	9
		12
		13
	6	1a
		4
		5
		7
		9
		10
		11
		12
		13
	10	1b
		5
		7

Duration	CPZ	Contrast CPZs
72 hr	1b	9
		12
		13
	6	1a
		4
		5
		7
		9
		10
		11
		12
		13
	10	1b
		5
		7

[1] CPZ: climatic-physiographical zone shown in Figure 2.1.

2.3.3 The spatial autocorrelations

Across the state, the rainfall intensity at one location tended to increase or decrease synchronically with that at another location, as indicated by the significant positive global Moran's I values for the summary statistics at most durations (Table 2.4). The minimums for a duration of 2 hr or longer and the maximums for all durations exhibited spatial randomness, indicating localized drizzles and/or heavy storms could occur. The rainfall intensities at the gauges within a CPZ located in the west-central part of the state were found to be positively correlated for most durations, whereas the rainfall intensities at the gauges within a CPZ located in the southwestern part and the coastal plain are spatially random (Figure 2.7). For instance, within CPZ10, the rainfall intensity at a gauge was found to be positively associated with those at its neighboring gauges; so did within CPZ06.

Table 2.4. Global Moran's I for the statistics of the durational maximum rainfall intensities.[1]

Statistics	Diration	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	6 hr	12 hr	24 hr	48 hr	72 hr
	$\bar{I}$	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Minimum	I	-0.53	-0.53	-0.49	-0.50	-0.32	-0.27	-0.31	-0.31	-0.38	-0.32	-0.34	-0.33
	p-value	0.03	0.03	0.04	0.04	0.21	0.31	0.23	0.23	0.13	0.21	0.19	0.19
1st Quantile	I	0.65	0.78	0.77	0.60	0.69	0.71	0.76	0.53	0.35	0.15	0.26	0.46
	p-value	0.00+	0.00+	0.00+	0.00+	0.00+	0.00+	0.00+	0.01	0.03	0.34	0.15	0.02
Mean	I	0.18	0.46	0.65	0.74	0.82	0.78	0.71	0.60	0.47	0.47	0.54	0.57
	p-value	0.30	0.02	0.00+	0.00+	0.00+	0.00+	0.00+	0.00+	0.02	0.02	0.01	0.01
Median	I	0.53	0.80	0.82	0.78	0.86	0.76	0.53	0.60	0.47	0.47	0.52	0.52
	p-value	0.01	0.00+	0.00+	0.00+	0.00+	0.00+	0.01	0.00+	0.01	0.01	0.01	0.01
3rd Quantile	I	0.24	0.35	0.68	0.61	0.57	0.61	0.59	0.39	0.48	0.62	0.54	0.59
	p-value	0.18	0.08	0.00+	0.00+	0.01	0.00+	0.00+	0.04	0.01	0.00+	0.01	0.00+
Maximum	I	0.03	0.02	0.02	0.00	0.02	0.03	0.04	0.10	0.14	0.16	0.21	0.28
	p-value	0.74	0.76	0.79	0.83	0.79	0.76	0.72	0.53	0.41	0.37	0.24	0.14

[1] $\bar{I}$: the mean of Moran's I (Eq. 2.6); I: global Moran's I (Eq. 2.4).

When the gauges within a CPZ were treated as a whole and the corresponding data were pooled together into one dataset, the rainfall intensities of eight CPZs, namely CPZ01a, CPZ01b, CPZ04, CPZ05, CPZ07, CPZ11, CPZ12, and CPZ13, were found to be positively correlated with those of the corresponding neighbor CPZs (Figure 2.8), depending on the summary statistics of interest. For instance, the means of the rainfall intensities of CPZ12 for 11 durations were positively associated with the corresponding means of its neighboring CPZ10, CPZ 11, and CPZ13; so did the medians. Overall, regardless of the statistics, the rainfall intensity of a CPZ located in the southwestern part of the state tended to be more associated with the intensities of its neighboring CPZs than that of a CPZ located in other parts of the state. Moreover, a CPZ (e.g., CPZ05 or CPZ10) within which the gauges had more significant positive autocorrelations was not necessarily to be associated with its neighboring CPZs, and vice versa. This indicated that the spatial autocorrelations of rainfall intensities in the state of Virginia were dependent on a spatial scale of interest (e.g., gauge versus CPZ).

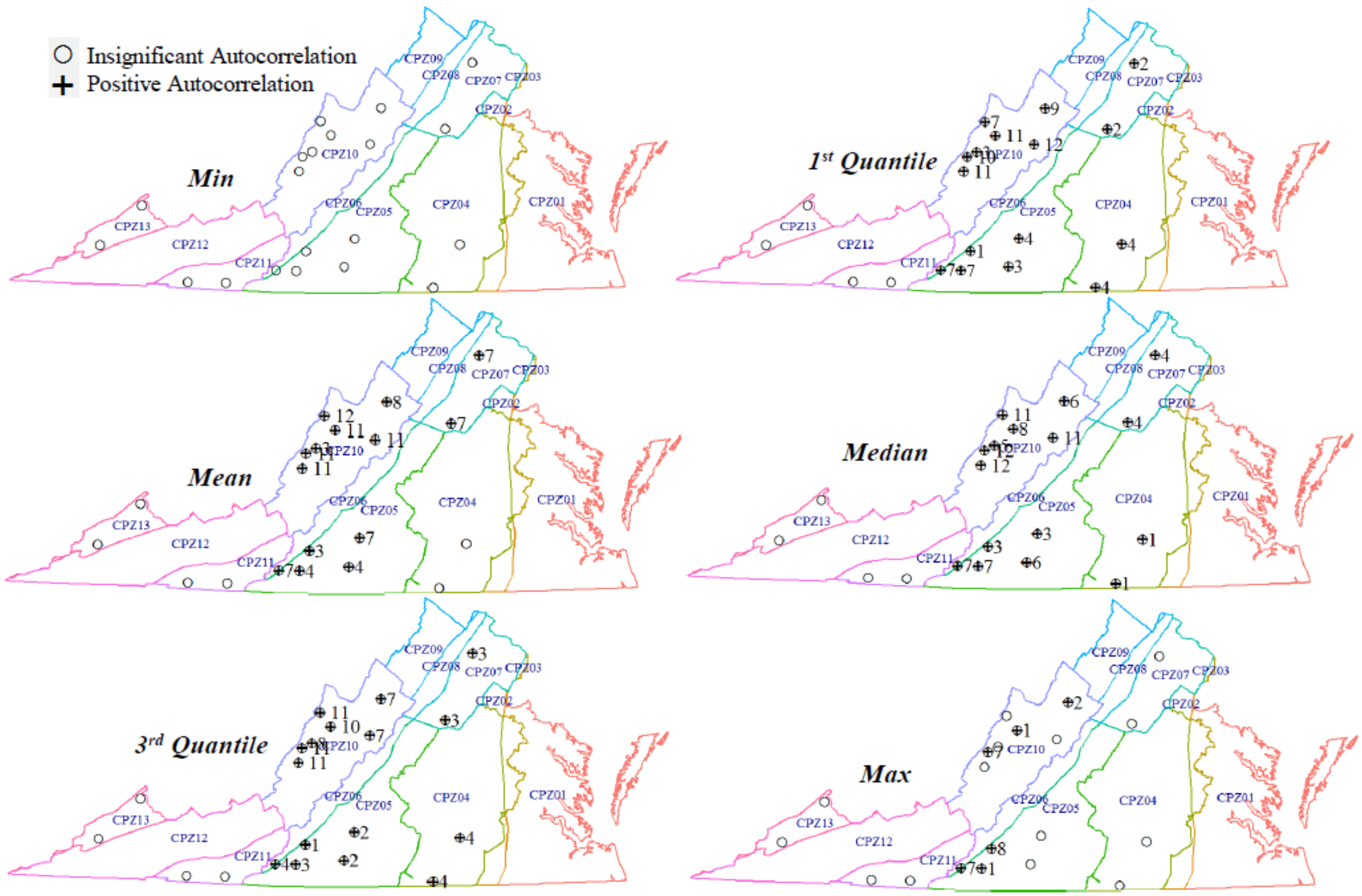


Figure 2.7. Significant spatial autocorrelations among the rain gauges within each climatic-physiographic zone (CPZ) for all 12 durations. Spatial distribution of significant (signified by a circle with cross inside) local Moran's I for six statistics (i.e., minimum, 1st quantile, mean, median, 3rd quantile, and maximum) of the maximum precipitation intensities by CPZ. The value beside the circle is the number of durations with a significant spatial autocorrelation.

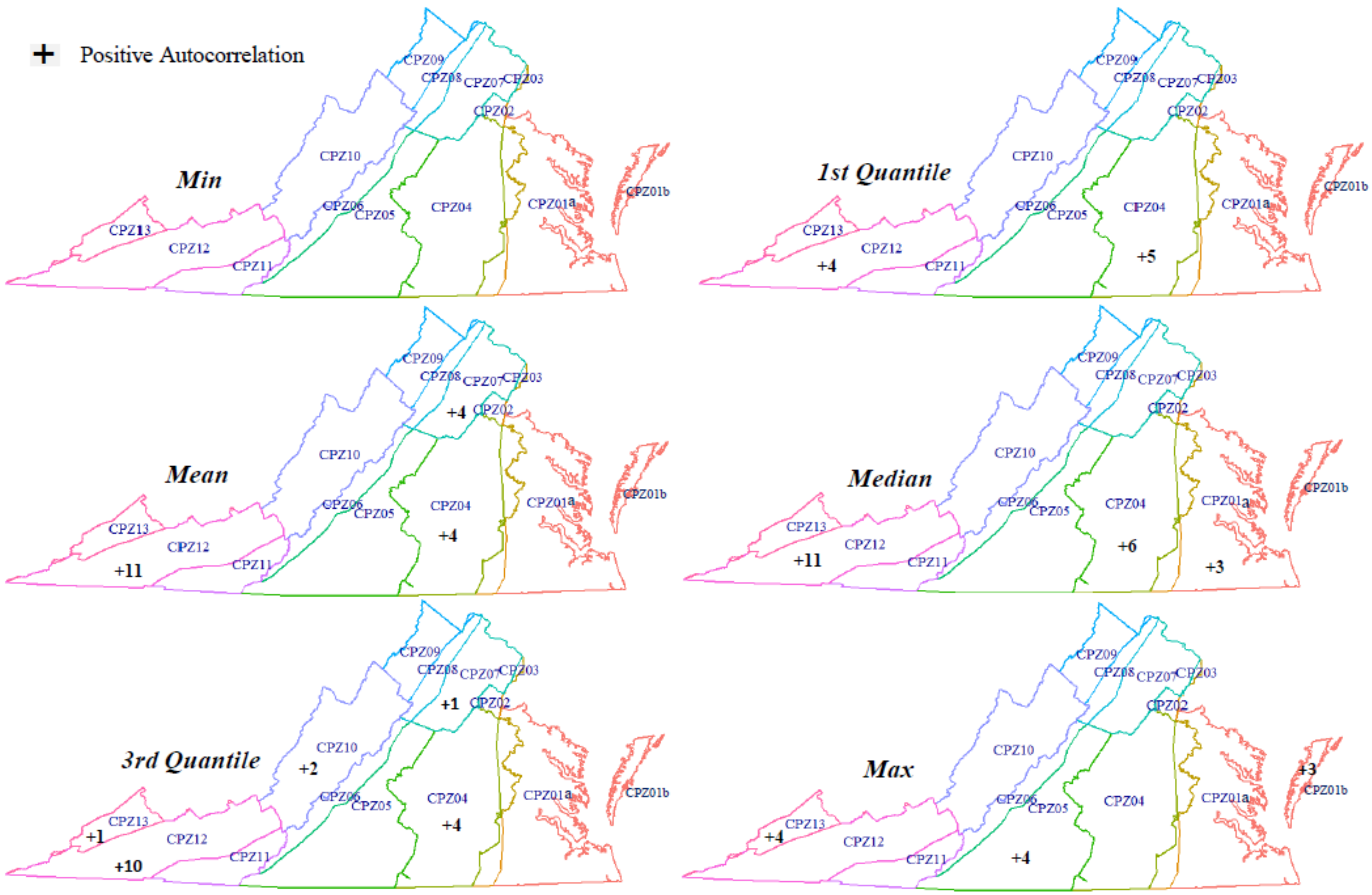


Figure 2.8. Significant spatial autocorrelations among the climatic-physiographic zones (CPZs) for all 12 durations. Spatial distribution of significant (signified by a cross) local Moran's I for six statistics (minimum, 1st quantile, mean, median, 3rd quantile and maximum) of the maximum precipitation intensities when each CPZ was treated as a whole. The value beside the cross in a CPZ is the number of durations with a significant spatial autocorrelation between this CPZ and its neighboring CPZs. For instance, CPZ10, CPZ11, and CPZ13 are the neighbors of CPZ12.

2.3.4 The inter-comparison of the trends and patterns

For a given CPZ within the middle part of the state territory, a rain gauge where the maximum precipitation intensities exhibited a significant decreasing trend tended to be positively autocorrelated with the other gauges in this CPZ (Figure 2.6 versus Figure 2.7), indicating an overall consistent spatiotemporal pattern throughout this geographic region. For instance, in the CPZ10, three gauges had a significant decreasing trend; and the intensities at each of these gauges synchronically fluctuated with those at the other six gauges, which was also true for the CPZ04, 05, and 07. The CPZ09 has only one gauge, making it impossible to do a meaningful autocorrelation analysis. For the minimums or maximums of the maximum precipitation intensities, the number of gauges with significant positive autocorrelations was smaller than that with significant decreasing trends; whereas for each of the other four summary statistics, namely 1st quantile, mean, median, or 3rd quantile, the number of gauges with significant positive autocorrelations was larger. This indicated that the precipitation intensities across this geographic region had more small-scale spatial patterns than temporal trends. In contrast, for the CPZs in the western and eastern fringes of the state territory, two gauges exhibited significant temporal trends, but no significant spatial autocorrelation was detected. The analyses for these two fringing areas might be very limited because of the small number of rain gauges.

The between-CPZ autocorrelations (Figure 2.8) were not as obvious as the within-CPZ autocorrelations (Figure 2.7). For instance, both the CPZ05 and CPZ10 exhibited significant within-CPZ autocorrelations for the six summary statistics except for the minimum, but either had significant between-CPZ autocorrelations for only one statistics:

the CPZ05 for the maximum and the CPZ10 for the 3rd quantile. In contrast, the CPZ04 exhibited significant within-CPZ autocorrelations for three statistics, namely 1st quantile, median, and 3rd quantile, it had significant between-CPZ autocorrelations for all five statistics except for the minimum. Moreover, for a given CPZ, its spatial correlations with its neighboring CPZs were mutually independent of the temporal trends of the rain gauges within this CPZ. For instance, two gauges within the CPZ05 and three gauges within the CPZ10 had a significant decreasing trend, few between-CPZ autocorrelations, however, were detected for these two CPZs. The gauge in the CPZ09 had a significant decreasing trend but was not correlated with its adjacent CPZs, whereas the gauge in the CPZ12 did not have a significant temporal trend but was obviously correlated with its neighboring CPZs. For the CPZ01a, CPZ04, or CPZ07, the temporal trends at the inclusive gauges were compatible with the corresponding between-CPZ autocorrelations, indicating both temporal trends and large-scale spatial patterns were noticeable in the piedmont and coastal regions.

2.4 Discussions

A statistically significant increasing trend of rainfall intensity was detected in the Tidewater climate division at the time interval of 24 hr and longer. This is consistent with the findings reported by Sayemuzzaman and Jha (2014) and Smirnov *et al.* (2018). Smirnov *et al.* (2018) also observed rainfall changes along the entire coastline of northeast United States, which were attributed to the increasing ocean surface water and air temperatures (Ding and Elmore, 2015). Warmer ocean increases the amount of water that evaporates into the air, resulting in that more moisture-laden air moves over land or converges into a storm system to produce more intense precipitation. This may contribute to the significant increase trend in the Tidewater climate division, which is adjacent to Mid-Atlantic Ocean. However, the relations between the increase trend and atmospheric conditions would be probably more complicated by myriad other factors including rising sea levels (Wang *et al.*, 2017; Forget *et al.*, 2020). Such an increasing trend in the coastal area likely leads to flash floods on steep-slope lands and/or urban floods on flat areas when the drainage capacity is insufficient (DHI, 2019).

The gauges with statistically significant decreasing trends in rainfall intensity, particularly those with a relatively larger decreasing rate, were clustered in the climatic divisions of Northern, Central Mountain, and Western Piedmont (Figures 5 and 6). These areas have a relatively higher elevation and steeper topographic gradient (Figure 2.1), which are favorable for cooling and condensing water vapor to form heavy precipitation with great temporal fluctuations (Viessman and Lewis, 2003). This is true for the observations of annual maximum 15-min rainfall intensity in the state of Virginia (Figure 2.3). However, the rainfall intensities of these areas tended to decrease, which is consistent with the findings of Sayemuzzaman and Jha (2014) in North Carolina, which is bordered with Virginia in the south. Such decreasing trends can be attributed to the reducing temporal fluctuations of precipitation both within a year and internally as a result of warming air temperatures in winter and spring and cooling temperatures in summer and fall (Wang *et al.*, 2009; Vose *et al.*, 2017; Smirnov *et al.*, 2018) . This study did not find a similar increasing trend of precipitation in the mountainous area and detected a trend start period of about ten years later than that in North Carolina. These discrepancies are probably because our study focused on durational rainfall intensities whereas Sayemuzzaman and Jha (2014) examined seasonal and annual amounts of precipitation. The opposite trends in precipitation amount versus rainfall intensity imply that for a design storm of interest, the resulting peak discharge would be smaller but the runoff volume will be larger than the corresponding value estimated using a historic intensity-duration-frequency curve that does not account for such temporal trends (McCuen, 1998; Prodanovic and Simonovic, 2007; Wolcott *et al.*, 2009). As a consequence, structures (e.g., culverts) that are controlled by a design peak discharge will likely be oversized, while structures (e.g., detention and retention ponds) that are controlled by a design runoff volume will probably be undersized.

City of Staunton, located in the Shenandoah Valley between the Blue Ridge and Allegheny Mountains of the Appalachian Mountains, is within CPZ06. Our spatial autocorrelation and ANOVA tests showed that this CPZ was noticeably distinct and independent from other areas. Besides the unique topographic features (e.g., intermingled leeward and windward), human activities might have altered the pristine physiography, leading to a changed microclimatic condition. Since 1970, the population of this city has been increasing and the land covers experiencing noticeable alterations, which might regulate evapotranspiration and precipitation of CPZ06. This highlights the importance of urbanization and physiography on local microclimate.

2.5 Conclusions

This study formulated and used a set of methods to detect temporal trends, trending rates, and step changes as well as to examine spatial patterns and autocorrelations of annual maximum rainfall intensities for 12 durations in the state of Virginia. The results indicated that although no step changes were detected, statistically significant trends were detected for almost half of the 25 rain gauges, depending on a duration of interest. The coastal plain experienced an increasing trend in rainfall intensity, whereas the other areas of the state had a decreasing trend, with relatively more trends and larger decreasing rates in the west-central ridge-valley areas. For a CPZ in these latter areas, the gauge-level rainfall intensities were found to be positively correlated across this same CPZ. CPZ-level intensities might or might not be associated with those of the neighboring CPZs, indicating that the autocorrelations likely depended on the spatial scale of interest. Overall, the temporal trends were mutually independent of the spatial autocorrelations. The state territory has been experiencing more storms with a decreasing rainfall intensity but an increasing amount, necessitating the considerations of both peak discharge and runoff volume in hydrologic engineering design practices. Herein, a reasonable recommendation is to update the existing design guidance to consider trend-induced non-stationarities in rainfall intensity.

References

Abiy, A. Z., Melesse, A. M., Abtew, W. and Whitman, D. (2019) Rainfall trend and variability in Southeast Florida: Implications for freshwater availability in the Everglades. *PLOS ONE* 14(2), e0212008. Available at: https://doi.org/10.1371/journal.pone.0212008.

Alexander, L. V., Zhang, X., Peterson, T. C., Caesar, J., Gleason, B., Klein Tank, A. M. G., Haylock, M., Collins, D., Trewin, B., Rahimzadeh, F., Tagipour, A., Rupa Kumar, K., Revadekar, J., Griffiths, G., Vincent, L., Stephenson, D. B., Burn, J., Aguilar, E., Brunet, M., Taylor, M., New, M., Zhai, P., Rusticucci, M. and Vazquez-Aguirre, J. L. (2006) Global observed changes in daily climate extremes of temperature and precipitation. *Journal of Geophysical Research: Atmospheres* 111(D5) Available at: https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2005JD006290.

Alpert, P., Ben-Gai, T., Baharad, A., Benjamini, Y., Yekutieli, D., Colacino, M., Diodato, L., Ramis, C., Homar, V., Romero, R., Michaelides, S. and Manes, A. (2002) The paradoxical increase of Mediterranean extreme daily rainfall in spite of decrease in total values. *Geophysical Research Letters* 29(11), 31-31-31-34. Available at: https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2001GL013554.

Asfaw, A., Simane, B., Hassen, A. and Bantider, A. (2018) Variability and time series trend analysis of rainfall and temperature in northcentral Ethiopia: A case study in Woleka sub-basin. *Weather and Climate Extremes* 19, 29-41. Available at: http://www.sciencedirect.com/science/article/pii/S2212094717300932.

Bartolini, G., Grifoni, D., Torrigiani, T., Vallorani, R., Meneguzzo, F. and Gozzini, B. (2014) Precipitation changes from two long-term hourly datasets in Tuscany, Italy. *International Journal of Climatology* 34(15), 3977-3985. Available at: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.3956.

Berg, P., Moseley, C. and Haerter, J. O. (2013) Strong increase in convective precipitation in response to higher temperatures. *Nature Geoscience* 6(3), 181-185. Available at: http://dx.doi.org/10.1038/ngeo1731.

Brekke, L. D., Kiang, J. E., Olsen, J. R., Pulwarty, R. S., Raff, D. A., Turnipseed, D. P., Webb, R. S. and White, K. D. (2009) Climate change and water resources management: A federal perspective, *Department of the Interior and U.S. Geological Survey*, Washington D.C. U.S..

Burnham, B. and Burnham, M. (2004) Hiking Virginia: A guide to Virginia's greatest hiking adventures, Globe Pequot, Guilford, CT.

Chen, D., Walther, A., Moberg, A., Jones, P., Jacobeit, J. and Lister, D. (2015) European trend atlas of extreme temperature and precipitation records, Heidelberg.

Chokkavarapu, N. and Mandla, V. R. (2019) Comparative study of GCMs, RCMs, downscaling and hydrological models: a review toward future climate change impact estimation. *SN Applied Sciences* 1(12), 1698. Available at: https://doi.org/10.1007/s42452-019-1764-x.

Costa, A., Negreiros, J. and Soares, A. (2008) Identification of inhomogeneities in precipitation time series using stochastic simulation, *Springer, Dordrecht.*

Crawford, K. M. and Hawkes, C. V. (2020) Soil precipitation legacies influence intraspecific plant–soil feedback. *Ecology* 101(10), e03142. Available at: https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/ecy.3142.

Cristiano, E., Veldhuis, M.-c. t. and Giesen, N. v. d. (2017) Spatial and temporal variability of rainfall and their effects on hydrological response in urban areas – a review. *Hydrology and Earth System Sciences* 21, 3859-3878. Available at: https://doi.org/10.5194/hess-21-3859-2017.

Das, P. K., Chakraborty, A. and Seshasai, M. V. R. (2014) Spatial analysis of temporal trend of rainfall and rainy days during the Indian Summer Monsoon season using daily gridded (0.5° × 0.5°) rainfall data for the period of 1971–2005. *Meteorological Applications* 21(3), 481-493. Available at: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/met.1361.

DHI (2019) Best practices for successful coastal flooding adaptation Available at: https://blog.dhigroup.com/2019/07/11/best-practices-for-successful-coastal-flooding-adaptation.

Ding, H. and Elmore, A. J. (2015) Spatio-temporal patterns in water surface temperature from Landsat time series data in the Chesapeake Bay, U.S.A. *Remote Sensing of Environment* 168, 335-348. Available at: http://www.sciencedirect.com/science/article/pii/S0034425715300663.

Easterling, D. R., Evans, J. L., Groisman, P. Y., Karl, T. R., Kunkel, K. E. and Ambenje, P. (2000) Observed variability and trends in extreme climate events: A brief review. *Bulletin of the American Meteorological Society* 81(3), 417-426. Available at: https://doi.org/10.1175/1520 0477(2000)081<0417:OVATIE>2.3.CO;2.

Ebrahim Banihabib, M. and Mousavi-Mirkalaei, P. (2019) Extended linear and non-linear auto-regressive models for forecasting the urban water consumption of a fast-growing city in an arid region. *Sustainable Cities and Society* 48, 101585. Available at: http://www.sciencedirect.com/science/article/pii/S2210670718327161.

Fiener, P., Neuhaus, P. and Botschek, J. (2013) Long-term trends in rainfall erosivity–analysis of high resolution precipitation time series (1937–2007) from Western Germany. *Agricultural and Forest Meteorology* 171-172, 115-123. Available at: http://www.sciencedirect.com/science/article/pii/S0168192312003486.

Forget, K., Stiles, S. and Carter-Lovejoy, S. (2020) Addressing sea level rise and a changing climate, *Virginia Conservation Network*, Richmond, VA. Available at: http://www.vcnva.org/addressing-sea-level-rise-and-a-changing-climate.

Gao, R., Li, F., Wang, X., Liu, T., Du, D. and Bai, Y. (2017) Spatiotemporal variations in precipitation across the Chinese Mongolian plateau over the past half century. *Atmospheric research* 193, 204-215.

Groisman, P., Knight, R., Easterling, D., Karl, T., Hegerl, G. and Razuvaev, V. (2005) Trends in intense precipitation in the climate record. *Journal of Climate* 18, 1326-1350.

Hamed, K. H. and Rao, R. A. (1998) A modified Mann-Kendall trend test for autocorrelated data. *Journal of Hydrology* 204(1), 182-196. Available at: http://www.sciencedirect.com/science/article/pii/S002216949700125X.

Hirsch, R. M., Slack, J. R. and Smith, R. A. (1982) Techniques of trend analysis for monthly water quality data. *Water Resources Research* 18(1), 107-121. Available at: https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/WR018i001p00107.

Hubert, L. and Arabie, P. (1991) The assessment of spatial autocorrelation through constrained multiple regression. *Geographical Analysis* 23(2), 95-111. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1538-4632.1991.tb00227.x.

Hurrell, J. W. (1995) Decadal trends in the North Atlantic Oscillation: Regional temperatures and precipitation. *Science* 269(5224), 676-679. Available at: https://science.sciencemag.org/content/sci/269/5224/676.full.pdf.

Karl, T. R., Melillo, J. M. and Peterson, T. C. e. (2009) Global climate change impacts in the United States., p. 192 Available at: http://aquaticcommons.org/id/eprint/2263.

Kendall, M. G. (1955) Rank correlation methods, 2nd ed, Hafner Press, NYC.

Larbi, I., Hountondji, F. C. C., Annor, T., Agyare, W. A., Mwangi Gathenya, J. and Amuzu, J. (2018) Spatio-temporal trend analysis of rainfall and temperature extremes in the Vea Catchment, Ghana. *Climate* 6(4), 87. Available at: https://www.mdpi.com/2225-1154/6/4/87.

Li, C., Liu, M., Hu, Y., Shi, T., Qu, X. and Walter, M. T. (2018) Effects of urbanization on direct runoff characteristics in urban functional zones. *Science of The Total Environment* 643, 301-311. Available at: http://www.sciencedirect.com/science/article/pii/S004896971832285X.

Lu, Y., Jiang, S., Ren, L., Zhang, L., Wang, M., Liu, R. and Wei, L. (2019) Spatial and Temporal Variability in Precipitation Concentration over Mainland China, 1961–

2017. *Water* 11(5), 881. Available at: https://www.mdpi.com/2073-4441/11/5/881.

Mann, H. B. (1945) Nonparametric tests against trend. *Econometrica* 13(3), 245-259.

McCuen, R. H. (1998) Hydrologic analysis and design, 2nd ed, Prentice Hall, New Jersey.

McGilchrist, C. A. and Woodyer, K. D. (1975) Note on a distribution-free CUSUM technique. *Technometrics* 17(3), 321-325. https://www.tandfonline.com/doi/abs/10.1080/00401706.1975.10489335.

Melillo, J. M., Janetos, A. C., Karl, T. R., Corell, R., Barron, E. J., Burkett, V., Cecich, T. F., Jacobs, K., Joyce, L., Miller, B., Morgan, M. G., Parson, E. A., Richels, R. G. and Schimel, D. S. (2000) Climate change impacts on the United States: the potential consequences of climate variability and change. *Cambridge, UK: Cambridge University Press.*

Meshram, S. G., Singh, V. P. and Meshram, C. (2017) Long-term trend and variability of precipitation in Chhattisgarh State, India. *Theoretical and Applied Climatology* 129, 729-744. Available at: https://ui.adsabs.harvard.edu/abs/2017ThApC.129..729M.

Mohanty, P., Panigrahi, D. and Acharya, M. (2014) MissRF: A visual basic application in MS Excel to find out missing rainfall data and related analysis. *Intelligent Information Management* 06, 38-44.

Moran, P. A. P. (1950) Notes on continuous stochastic phenomena. *Biometrika* 37(1/2), 17-23. Available at: www.jstor.org/stable/2332142.

Muthoni, F. (2020) Spatial-temporal trends of rainfall, maximum and minimum temperatures over West Africa. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 13, 2960-2973.

Nearing, M. A., Unkrich, C. L., Goodrich, D. C., Nichols, M. H. and Keefer, T. O. (2015) Temporal and elevation trends in rainfall erosivity on a 149km2 watershed in a semi-arid region of the American Southwest. *International Soil and Water Conservation Research* 3(2), 77-85. Available at: http://www.sciencedirect.com/science/article/pii/S2095633915300848.

Nunes, J. P., Seixas, J., Keizer, J. J. and Ferreira, A. J. D. (2009) Sensitivity of runoff and soil erosion to climate change in two Mediterranean watersheds. Part II: assessing impacts from changes in storm rainfall, soil moisture and vegetation cover.

Hydrological Processes 23(8), 1212-1220. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.7250.

Prodanovic, P. and Simonovic, S. P. (2007) Development of rainfall intensity duration frequency curves for the City of London under the changing climate, *Water Resources Research Report* Available at: https://ir.lib.uwo.ca/wrrr/20.

Rahman, M. S. and Islam, A. R. M. T. (2019) Are precipitation concentration and intensity changing in Bangladesh overtimes? Analysis of the possible causes of changes in precipitation systems. *Science of The Total Environment* 690, 370-387. Available at: http://www.sciencedirect.com/science/article/pii/S0048969719330980.

Rossmiller, R. (2014) Stormwater design for sustainable development, McGraw-Hill Professional, New York, NY. Available at: https://mhebooklibrary.com/doi/book/10.1036/9780071816557.

Sayemuzzaman, M. and Jha, M. K. (2014) Seasonal and annual precipitation time series trend analysis in North Carolina, United States. *Atmospheric research* 137, 183-194. Available at: http://www.sciencedirect.com/science/article/pii/S0169809513002858.

Sen, P. K. (1968) Estimates of the regression coefficient based on Kendall's Tau. *Journal of the American Statistical Association* 63(324), 1379-1389. Available at: https://www.tandfonline.com/doi/abs/10.1080/01621459.1968.10480934.

Singh, V., Jain, S. K. and Singh, P. K. (2019) Inter-comparisons and applicability of CMIP5 GCMs, RCMs and statistically downscaled NEX-GDDP based precipitation in India. *Science of The Total Environment* 697.

Smirnov, D. S., Brad Workman, P., Batten, B., Rosenberg, S. and McGlone, D. (2018) Analysis of historical and future heavy precipitation. Final technical report: City of Virginia Beach, Virginia, Department of Public Works, Virginia Beach, VA.

Sneyers, R. (1990) On the statistical analysis of series of observations, Secretariat of the World Meteorological Organization, Geneva.

Sokal, R. and Oden, N. L. (1978) Spatial autocorrelation in biology: 2. Some biological implications and four applications of evolutionary and ecological interest. *Biological Journal of the Linnean Society* 10(2), 229-249. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1095-8312.1978.tb00014.x.

Taubenheim, J. (1989) An easy procedure for detecting a discontinuity in a digital time series. *Meteorologische Zeitschrift* 39(6), 344-347.

Vallebona, C., Pellegrino, E., Frumento, P. and Bonari, E. (2015) Temporal trends in extreme rainfall intensity and erosivity in the Mediterranean region: a case study in southern Tuscany, Italy. *Climatic Change* 128(1), 139-151. Available at: https://doi.org/10.1007/s10584-014-1287-9.

Viessman, W. and Lewis, G. L. (2003) Introduction to Hydrology, Prentice Hall, Available at: https://books.google.com/books?id=pSOsQgAACAAJ.

Vose, R. S., Easterling, D. R., Kunkel, K. E., LeGrande, A. N. and Wehner, M. F. (2017) Chapter 6: Temperature changes in the United States. In: Climate Science Special Report: Fourth National Climate Assessment, pp. 185-206, *U.S. Global Change Research Program*, Washington, DC, USA.

Walsh, J., D. , Wuebbles, K., Hayhoe, J., Kossin, K., Kunkel, G., Stephens, P., Thorne, R., Vose, M., Wehner, J., Willis, D., Anderson, S., Doney, R., Feely, P., Hennon, V., Kharin, T., Knutson, F., Landerer, T., Lenton, J., Kennedy and Somerville, R. (2014) Ch. 2: Our changing climate. Climate Change Impacts in the United States. Melillo, J.M., Richmond, T.T.C. and Yohe, G.W., Eds. (eds), pp. 19-67, *U.S. Global Change Research Program*, The Third National Climate Assessment.

Wang, H., Schubert, S., Suarez, M., Chen, J., Hoerling, M., Kumar, A. and Pegion, P. (2009) Attribution of the seasonality and regionality in climate trends over the United States during 1950-2000. *Journal of Climate* 22, 2571-2590.

Wang, X., Li, R., Taghadomi, H. J., Pedram, S. and Zhao, X. (2017) Effects of sea level rise on hydrology: case study in a typical mid-Atlantic coastal watershed. *Journal of Water and Climate Change* 8(4), 730-754. Available at: https://doi.org/10.2166/wcc.2017.156.

Wang, X., Yang, X. and Cai, Z. (2019) Next-generation rainfall IDF curves for the Virginian drainage area of Chesapeake Bay, *Department of Defense Strategic Environmental Research and Development Program (SERDP).*

Wang, X., Yang, X., Liu, T., Li, F., Gao, R., Duan, L. and Luo, Y. (2014) Trend and extreme occurrence of precipitation in a mid-latitude Eurasian steppe watershed at various time scales. *Hydrological Processes* 28(22), 5547-5560. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.10054.

Wolcott, S., Mroz, M. and Basile, J. (2009) Application of northeast regional climate center research results for the purpose of evaluating and updating Intensity-Duration-Frequency (IDF) Curves - Case study: Rochester, New York.

Wu, Y., Fang, H., Huang, L. and Ouyang, W. (2020) Changing runoff due to temperature and precipitation variations in the dammed Jinsha River. *Journal of Hydrology* 582, 124500. Available at: http://www.sciencedirect.com/science/article/pii/S0022169419312351.

Yozgatligil, C., Aslan, S., Iyigun, C. and Batmaz, I. (2013) Comparison of missing value imputation methods in time series: the case of Turkish meteorological data. *Theoretical and Applied Climatology* 112(1), 143-167. Available at: https://doi.org/10.1007/s00704-012-0723-x.

CHAPTER 3

SCRUTINIZING CHARACTERISTICS OF HISTORICAL PRECIPITATION ACROSS COMMONWEALTH OF VIRGINIA: IMPLICATIONS OF CLIMATE CHANGE

Since the industrial revolution, the Earth's temperature has been rising at an accelerating pace because more greenhouse gases (e.g., carbon dioxide) have been released into the atmosphere. As a result, the characteristics of precipitation might also be changed, raising eco-environmental concerns, and affecting hydrologic engineering designs. However, the relevant information is incomplete in existing literature. The objective of this study was to detect historical changes in precipitation characteristics using Commonwealth Virginia of the United States as the testbed. In this regard, thirteen indices were selected to characterize precipitation amount, intensity, spell, maximum, and exceedance. A modified Mann-Kendall technique that can consider the climate-relevant non-stationarity was applied to detect possible step changes and temporal trends of each index on an annual basis. The results indicated that most of the rain gauges incurred a statistically significant step change for one index or more between 1948 and 2008, with more step increases than step decreases. Overall, Virginia has been experiencing more storms with a larger magnitude, longer duration, and greater intensity, making it vital to revisit the existing water management policies and engineering design standards.

3.1 Introduction

Cycles of glacial advance and retreat have occurred at least eight times in the last 740,000 years as evidenced by ice cores, coral reefs, and ocean and rock sediments. Most of those cycles were caused by small variations of Earth's orbit that changed the solar energy passing through the extraterrestrial (Maslin, 2016). However, unprecedented changes had begun since the industrial revolution between 1820 and 1840 and become intensified around the mid-twentieth century. This intensifying trend was believed to be caused by human activities because the: 1) warming rate was almost twenty times faster than the average rate during those historical cycles; and 2) current carbon dioxide (CO_2) concentration (~418 ppm) is about twice higher than the average level during 800,000 years before the industrial evolution (Rye *et al.*, 1995; Lüthi *et al.*, 2008; Clark *et al.*, 2016). The solar radiation is trapped by emitted greenhouse gases (e.g., CO_2) in the lower atmosphere, causing an increase in air temperature by 1.2˚C in relative to the pre-industrial value possibly with another 1 to 4˚C increase by 2100 as predicted by climate models under various emission scenarios. As a result of warming climate, the global average precipitation is expected to increase by 3 to 5% by 2100 based on the IPCC Fourth Assessment Report (Meehl, 2007; Pachauri, 2008). This change, which can be abrupt and/or gradual, will not be evenly distributed around the globe and will be reflected in all precipitation characteristics, such as amount, intensity, duration, and frequency (Melillo *et al.*, 2000; Karl *et al.*, 2009; Walsh *et al.*, 2014; Chen *et al.*, 2015).

Precipitation amount represents the available water source in a certain location and is vital to socioeconomics and eco-environment (Felton *et al.*, 2020). However, extreme (e.g., 95 or 99th percentile) precipitations are responsible for many social catastrophes, such as soil erosion, eco-environmental damage, land degradation, and pollution (SWCS, 2003; NCEI, 2021). In addition, precipitation intensity, which is the rainfall amount per unit time period, has a positive contribution to runoff volume and peak discharge (Yang *et al.*, 2021). Dry spell is the sequence of days without precipitation, indicating how vulnerable to drought. It is closely related to agriculture, soil erosion, water quality, soil moisture, and infiltration (Breinl *et al.*, 2020). In contrast, wet spell is the length of consecutive days between two dry spells. It is related to precipitation extremes and subsequent flood risks. The precipitation in multiple days can be used as a flood indicator because regional floods are more likely resulted from long-lasting heavy storms (Sillmann and Roeckner, 2008). Further, precipitation exceedance frequency, which is often reported as a return period that is the reciprocal of the annual exceedance frequency, is widely used as a design standard for hydrologic engineering structures in water management, such as regulating spatiotemporal variations of summer soil moister (Whitworth *et al.*, 2012; Wu *et al.*, 2012). Many important infrastructures are typically designed based on an estimate of the recurrence likelihood of a specific extreme (e.g., 100-year) storm event.

Gao *et al.* (2020) investigated changes of event-based rainfall characteristics from 2041 to 2021 in terms of rainfall depth, rainfall duration, inter-event time, and temporal patterns of daily-scale rainfall events using global circulation model (GCM) predictions in a river basin in east China. Those authors revealed that the total number of rainfall events will decrease, but the proportion of extreme rainfall events, short-duration events, and extreme day-spell events will increase in the future. For the three-day rainfall events, the occurrence frequency of light and heavy rainfall events showed an upward trend. For light rainfall events, the temporal patterns of different rainfall types tend to become more decentralized, whereas for heavy rainfall events, the temporal patterns will become more centralized.

Using daily annual maximum precipitations from 1950 to 2013 at 107 rain gauges in southeast United States, Dhakal and Tharu (2018) employed a linear quantile regression method to detect spatiotemporal trends and examine impacts of North Atlantic tropical cyclones on extreme storms. Those authors revealed that changes in upper quantiles of the distribution of the extreme precipitations occurred at a high rate. The recent increase in heavy precipitation might have been caused by North Atlantic tropical cyclones. Similarly, using eleven previously defined indices, Powell and Keim (2015) investigated spatiotemporal trends in precipitation extremes from 1948 to 2012 across southeast United States. The results showed an overall increase in intensity and magnitude of extreme precipitation events except for some east coastal locations in South Carolina. On average, the fall season has become significantly wetter, whereas the spring and summer seasons have become drier. The precipitation exhibited a great number of spatially coherent patches with a similar mode of variability. On the other hand, Michael and Raymond (2007) selected five extreme precipitation indicators to examine their variations between 1962 and 2000 in northeast United States. Those authors revealed an increase trend, which might be explained by the variations in the Arctic Oscillation (AO), El Niño-Southern Oscillation, and Pacific-North American (PNA) pattern.

However, changes in precipitation have most often been quantified in terms of total precipitation over a long averaging period (e.g., annually, seasonally, or occasionally monthly). Such a statistics is quite useful for many applications (Davenport *et al.*, 2021;

Ma *et al.*, 2021), but it could not reveal changes of other precipitation characteristics. This is particularly true for the mid-latitude areas including Commonwealth Virginia of the United States, where precipitation events can last a few days (Karl and Knight, 1998). Albeit the relevant information on such areas is incomplete or even lacking in existing literature. The objective of this study was to detect step changes and spatiotemporal variations in historical precipitation across Virginia. In this regard, thirteen indices, which describe precipitation amount, intensity, spell, maximum, and exceedance, were calculated and analyzed.

3.2 Materials and Methods

3.2.1 Commonwealth of Virginia

The Virginian territory, most of which is located within the Chesapeake Bay Watershed (Figure 3.1), has a humid subtropical climate. It incurs about 35 to 45 thunderstorms per year with an average annual precipitation of 1080 mm. The average monthly air temperature varies from -3°C in January to 30°C in July. Virginia has a large topographic relief, with altitudes varying from sea level at the oceanfront of Virginia Beach in the east to 1746 m at Mount Rogers in the west (Burnham and Burnham, 2004). The major topographic gradients occur at the edge of the Atlantic Ocean, the end of the Piedmont, and the Blue Ridge and Allegheny chains of the Appalachian Mountains. The moderating effects of the ocean from the east, powered by the Gulf Stream, create the potential for hurricanes near the mouth of Chesapeake Bay. Cold air masses arrive over the mountains, especially in winter, leading to significant snowfalls when coastal storms known as nor’easters move up the Atlantic coast. The interaction of such atmosphere phenomena with the varying topography regulates the micro-climates of the Shenandoah Valley, the mountainous southwest, and the coastal plains, which have noticeably distinct topographies.

In terms of the topographic relief, U.S. Geological Survey (USGS) subdivides Virginia into five physiographic divisions, namely Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateaus (Wang *et al.*, 2019; Yang *et al.*, 2021). The Coastal Plain division is between the Atlantic coast and the fall line. It includes the Eastern Shore and major estuaries of Chesapeake Bay. The Piedmont division is a series of sedimentary and igneous rock-based foothills east of the mountains formed in the Mesozoic era. This division, known for its heavy clay soils, includes the Southwest Mountains around City of Charlottesville. The Blue Ridge division is a physiographic province of the Appalachian Mountains with highest altitudes in the state, the tallest being Mount Rogers. The Valley and Ridge division is west of the mountains and includes the Great Appalachian Valley. This division is carbonate rock-based and includes Massanutten Mountain. The Cumberland Plateau and the Cumberland Mountains are in the southwestern corner of Virginia and south of the Allegheny Plateau. This study grouped these five subdivisions into three geographic subregions shown in Figure 3.1. The eastern subregion is the USGS Coastal Plain division, the middle subregion is the USGS Piedmont division, and the western subregion covers three USGS divisions of Blue Ridge, Valley and Ridge, and Appalachian Plateaus.

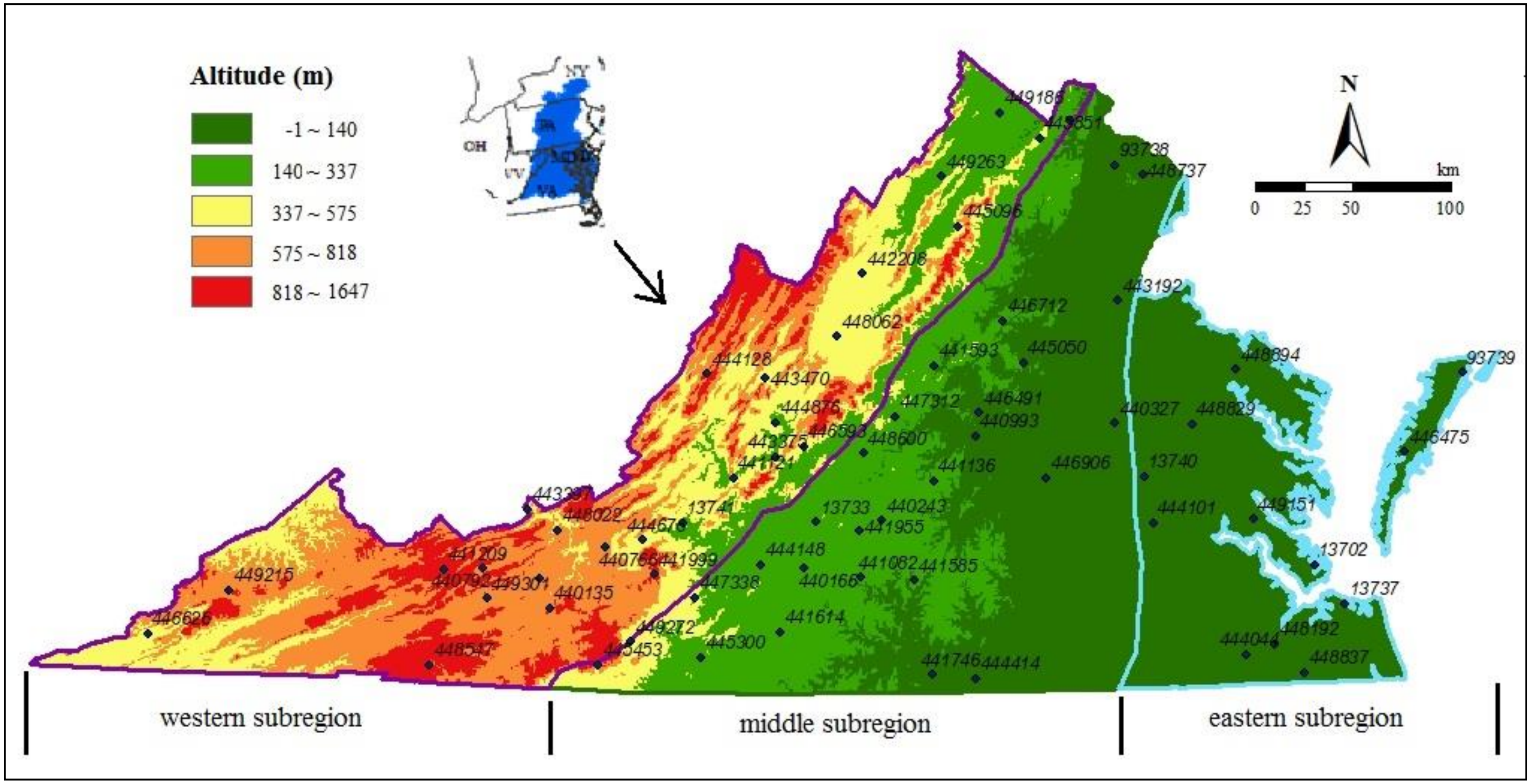


Figure 3.1. The three Virginian subregions of this study, superimposed by the topographic elevations and 66 rain gauges with a record period from 1900 to 2019. The solid diamond signifies the rain gauge indicated by the corresponding cooperative identification number (CoopID).

3.2.2 Data and Uses

The data on daily precipitation were downloaded from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) website for 136 rain gauges with a record period until 2019. First, for each of the gauges, the data were preprocessed in R by using package "climdex.pcic" to calculate the precipitation indices described in the following subsection. The indices for the 66 rain gauges (Figure 3.1) with a record period of longer than 50 years were used to detect any step changes. Second, to avoid any temporal inconsistency and keep the homogeneity of the data (discussed in subsection 3.1), the indices at 50 gauges that share a common record period of 1980 to 2019 were used to scrutinize the precipitation characteristics. These gauges are virtually scattered uniformly across the Virginian territory and thus can be reasonably assumed to represent the spatial distribution of precipitation. The data records with missing values for more than 15 days were excluded from the subsequent trend analysis.

3.3.3 Precipitation indices

This study selected 13 indices (Karl *et al.*, 1999; ICPO, 2001) to characterize precipitation. These indices can be grouped into five categories in terms of precipitation amount, intensity, spell, maximum, and exceedance. For the first category, the precipitation amount at a yearly basis is measured by three indices, namely PRCPTOT, R99pTOT, and R95pTOT. The PRCPTOT, which is computed as the summation of precipitations on all rainy days in a given year, indicates the total water source of this year. The R99pTOT or R95pTOT, which is computed as the summation of precipitations on the rainy days with a daily precipitation exceeding the 99^{th} or 95^{th} percentile. The percentiles were determined using the daily precipitations on rainy days from 1980 to

2019 at the gauge of interest. These two indices measure the annual precipitation from extreme and heavy storm events, respectively. For the second category, the simple precipitation intensity is measured by index SDII, which is computed as the division of PRCPTOT by number of rainy days. The SDII describes the annual average daily precipitation on rainy days. For the third category, the precipitation spell is measured by two indices, namely CDD and CWD. The CDD, which is termed maximum length of dry spell, indicates the possible maximum number of consecutive days with a daily precipitation of ≤ 1.0 mm in a given year, whereas the CWD, which is termed maximum length of wet spell, indicates the possible maximum number of consecutive days with a daily precipitation of > 1.0 mm. For the fourth category, the precipitation maximum is measured by two indices, namely Rx1day and Rx5day, which are annual maximum 1- and 5-d precipitation, respectively. For the fifth category, the precipitation exceedance is measured by five indices, namely R1mm, R10mm, R20mm, Rgmm, and R50thmm, each of which is the number of days with a daily precipitation of not smaller than a threshold value signified by the corresponding subscript. The thresholds of the indices in the above order are 1.0 mm, 10.0 mm, and 20.0 mm, annual average, and 50th percentile (i.e., median) of the gauge of interest, respectively.

3.3.4 Detection of step change and temporal trend

For the time series of an index, the distribution-free cumulative sum (CUSUM) technique presented by McGilchrist and Woodyer (1975) was used to detect whether, and at which year, a significant step (i.e., upward-to-downward or downward-to-upward) change occurred, at a significance level of $\alpha = 0.05$. The null hypothesis was that there was no step change (i.e., the mean value of the time series would be statistically independent of the number of computational years). On the other hand, the modified Mann-Kendall (Mann, 1945; Kendall, 1955; Hirsch *et al.*, 1982; Hamed and Rao, 1998) was applied to determine whether a statistically significant ($\alpha = 0.05$) temporal (i.e., downward or upward) trend existed. The Sen's slopes (Sen, 1968) were computed and used to measure the change rates of the significant trends.

3.3 Results

3.3.1 Step Changes

Most of the 66 gauges incurred a statistically significant step change for one precipitation index or more between 1948 and 2008, with more step increases than step decreases (Table 3.1). Overall, parts of the Virginia territory were shifted to receive more storm events with higher intensities and larger amounts. For instance, the annual precipitation suddenly increased at eleven gauges but suddenly decreased at only three gauges, while the extremes, as measured by R95pTOT, R99pTOT, Rx1day, and Rx5day, and the intensity had sudden increases at eighteen and five gauges, respectively, and no sudden decreases at any of the gauges. The number of consecutive rainy days suddenly increased at three gauges and suddenly decreased at another two gauges, while the number of total rainy days suddenly increased at eighteen gauges.

From the geographic location point of view, the annual precipitation amount suddenly increased at more gauges in the eastern and western subregions than in the middle subregion, and suddenly decreased at three gauges in the middle and western subregions. The sudden increase in extremes, intensity, and total rainy days mainly occurred in the eastern subregion, whereas the sudden increase or decrease in consecutive rainy or dry days occurred at a couple of gauges in the middle and western subregions. This indicates that there were more step changes in the eastern subregion than in other two subregions. The typical step changes of selected indices at representative gauges in the subregions are shown in Figure 3.2. Because the step changes did not alter or reverse the possible trends from 1980 onward, this study used the whole datasets from 1980 to 2019 to detect any trends without being split into sub-datasets as done by (Wang *et al.*, 2019).

3.3.2 Temporal Trends

Across the entire territory, both medians and ranges of the annual precipitations randomly fluctuated from year to year (Figure 3.3), indicating that the long-term average precipitation received by the state was apparently constant. However, significant trends were detected at the rain gauge levels (Figure 3.4). All indices except for SDII, CDD, and R1mm showed a significant increasing trend. The three exceptional indices exhibited a significant increasing trend at some gauges in the eastern subregion but could have a significant decreasing trend at couple of gauges in the middle and western subregions. Trends were also detected for some indices at most of the other gauges (not shown), but they were statistically insignificant at a significance level of $\alpha = 0.05$ and thus excluded from further elaboration.

Table 3.1. Number of rain gauges with a significant step change and median occurrence year.[1]

Precipitation Characteristic	Index[2]	Step increase for the: Entire Territory	Eastern Subregion	Middle Subregion	Western Subregion	Step decrease for the: Entire Territory	Eastern Subregion	Middle Subregion	Western Subregion	Median Occurrence Year
Amount	PRCPTOT	11	4	1	6	3	0	1	2	1981
	R95pTOT	3	3	0	0	0	0	0	0	2003
	R99pTOT	5	2	2	1	0	0	0	0	2002
Intensity	SDII	5	3	1	1	0	0	0	0	1997
Spell	CDD	0	0	0	0	1	0	1	0	2008
	CWD	3	0	2	1	2	1	0	1	2008
Maximum	Rx1day	4	2	1	1	0	0	0	0	2000
	Rx5day	6	2	4	0	0	0	0	0	2002
Exceedance	R1mm	8	0	4	4	0	0	0	0	2008
	R10mm	2	2	0	0	2	1	1	0	2007
	R20mm	3	3	0	0	5	0	2	3	1990
	Rgmm	5	3	0	2	0	0	0	0	1969
	R50thmm	0	0	0	0	3	1	0	2	1948
Total		55	24	15	16	16	3	5	8	1948 ~ 2008

[1] See Figure 3.1 for the territory and subregions.

[2] See subsection 3.2.3 for definitions of the indices.

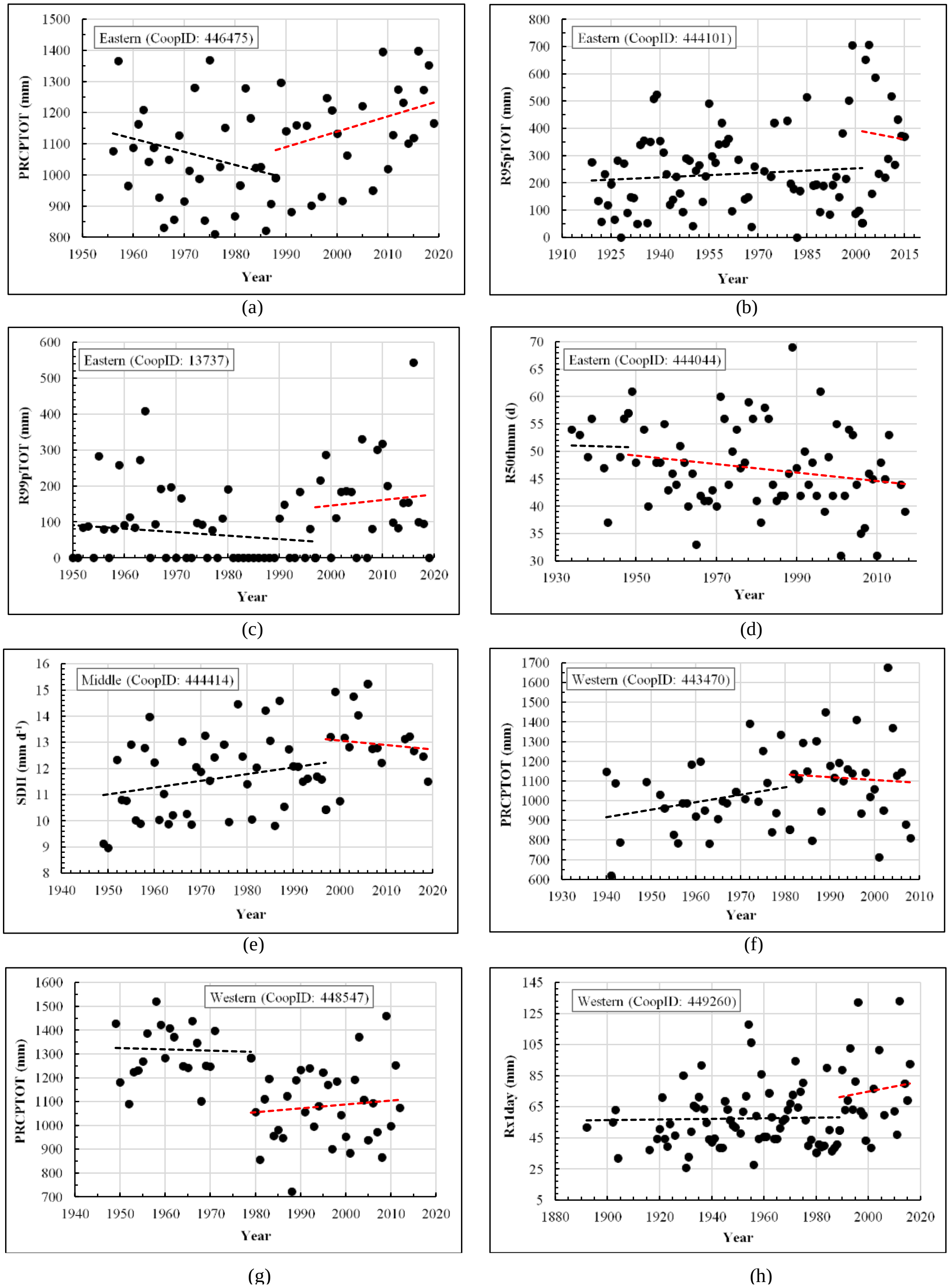


Figure 3.2. Significant step changes and trends of selected indices at representative rain gauges in the eastern subregion (a, b, c, d), middle subregion (e), and western subregion (f, g, h). The locations of the gauges, as signified by the cooperative identification (CoopID) numbers, are shown in Figure 3.1.

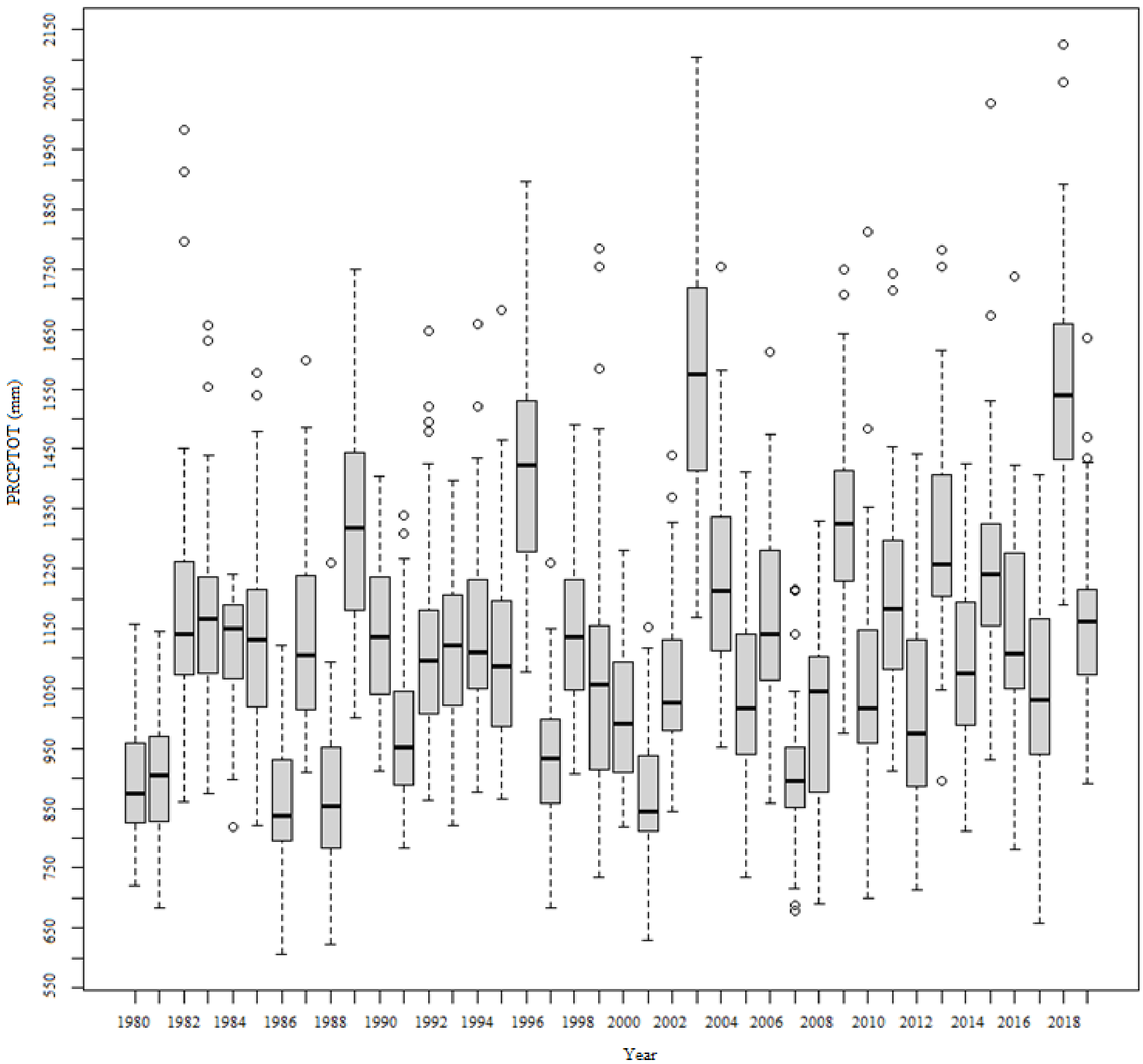


Figure 3.3. Box-Whisker plot of annual precipitations (PRCPTOT) from 1980 to 2019 at the 50 rain gauges across Virginia. For a given year, the bold horizontal line inside the box signifies the median annual precipitation of the gauges, while the lower and upper sides of the box represent the 1st and 3rd quantiles, respectively.

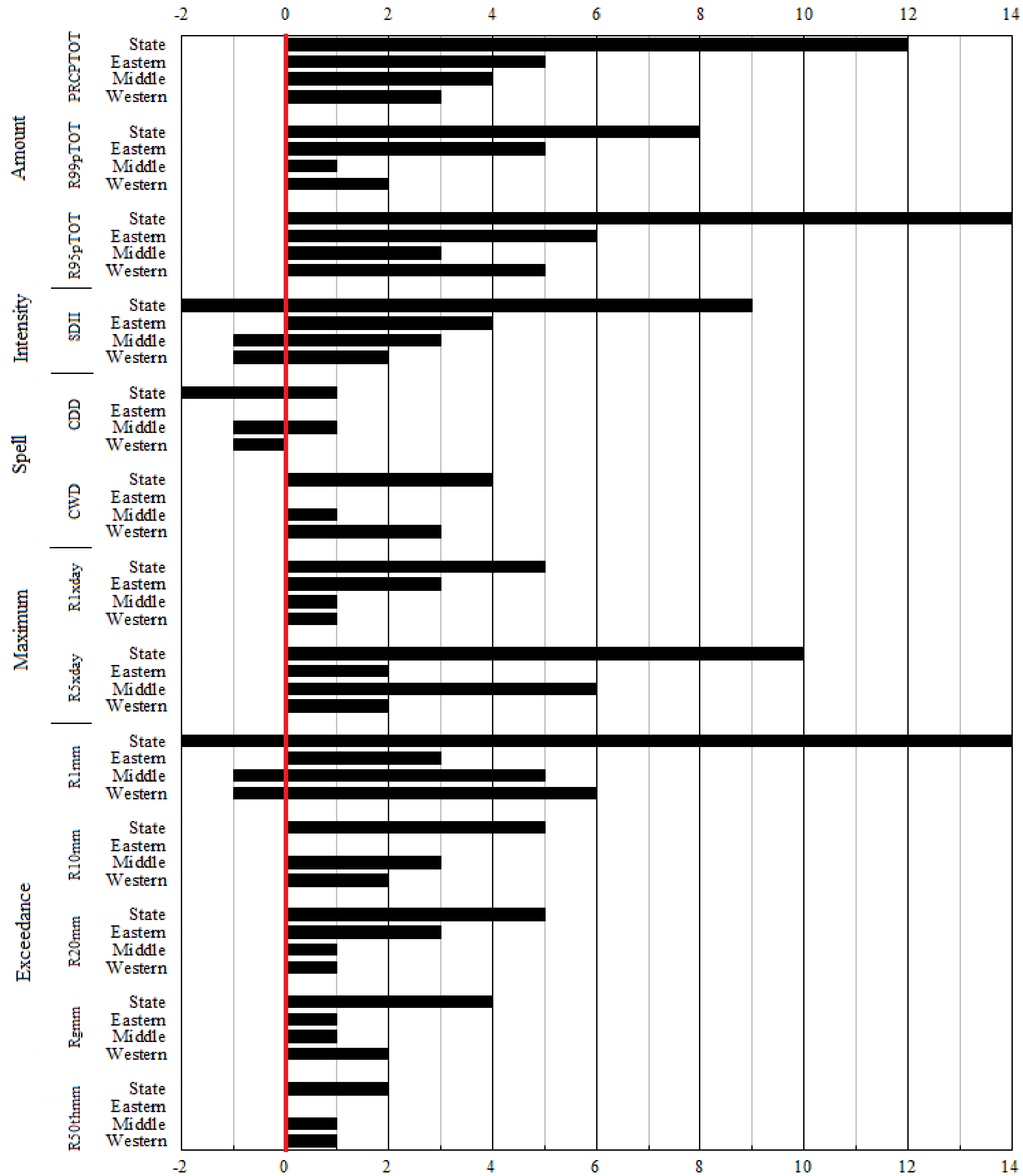


Figure 3.4. Number of rain gauges with significant ($\alpha = 0.05$) trends in the precipitation indices from 1980 to 2019 for the entire Virginia (State), eastern subregion (Eastern), middle subregion (Middle), and western subregion (Western). The indices are described in subsection 2.3 and the subregions are shown in Figure 1. The positive number signifies an increasing trend, whereas the negative number signifies a decreasing trend.

The annual and extreme precipitation amount tended to increase regardless of the subregions (Figure 3.4). For the eastern and western subregions, the gauges with an increasing trend geographically scattered, whereas for the middle subregion, the gauges with an increasing trend clustered at the southern and northern borders (Figure 3.5a). This indicated that Virginia had been becoming wetter except for the central piedmont division. The annual precipitation (i.e., PRCPTOT) had an increasing rate of 5.4 to 13.0 mm yr^{-1}, with a mean of 7.8 mm yr^{-1} (Table 3.2). The PRCPTOT increased about 1.2 times faster in the middle subregion than that in the other two subregions. The total of daily precipitations larger than the 99th (i.e., R99pTOT) or 95th (i.e., R95pTOT) percentile had been increasing at 3.1 or 5.4 mm yr^{-1}, with the highest increasing rate in the middle subregion. Thus, the increase of the PRCPTOT was most probably caused by the increases of the R99pTOT and R95pTOT, which are surrogates of extreme storms.

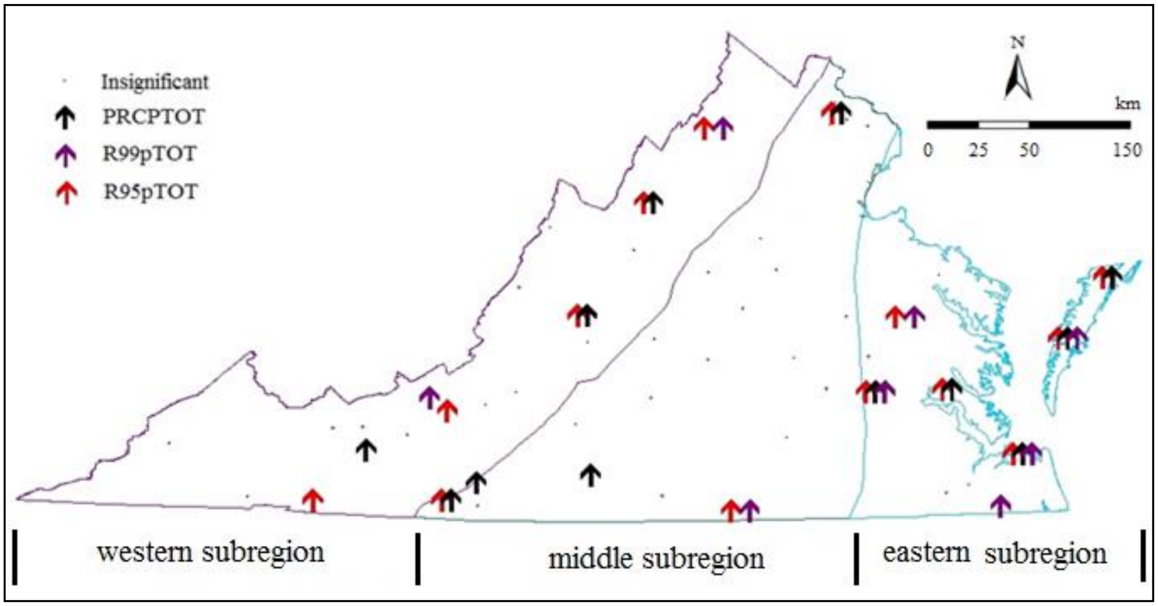
Table 3.2. Significant (α = 0.05) Sen's slopes of the precipitation indices from 1980 to 2019.[1]

Precipitation Characteristic	Index[2]	Entire Territory[3]	Eastern Subregion[3]	Middle Subregion[3]	Western Subregion[3]
Amount	PRCPTOT (mm yr^{-1})	5.40 ~ 12.99 (7.81)	6.00 ~ 9.13 (7.43)	5.60 ~ 12.99 (9.05)	5.40 ~ 8.36 (7.02)
	R99pTOT (mm yr^{-1})	1.22 ~ 4.44 (3.12)	2.90 ~ 3.42 (3.15)	3.58	1.22 ~ 4.44 (2.83)
	R95pTOT (mm yr^{-1})	3.50 ~ 7.83 (5.42)	4.35 ~ 6.78 (5.70)	5.08 ~ 7.83 (6.12)	3.50 ~ 7.35 (4.52)
Intensity	SDII (mm yr^{-1} yr^{-1})	0.04 ~ 0.11 (0.07)	0.06 ~ 0.08 (0.08)	0.05 ~ 0.11 (0.07)	0.04 ~ 0.09 (0.06)
		-0.06 ~ -0.09 (-0.08)		-0.09	-0.06
Spell	CDD (d yr^{-1})	0.25		0.25	
		-0.14 ~ -0.17 (-0.15)		-0.17	-0.14
	CWD (d yr^{-1})	0.03 ~ 0.08 (0.05)		0.06	0.03 ~ 0.08 (0.05)
Maximum	Rx1day (mm yr^{-1})	0.81 ~ 1.37 (1.06)	0.81 ~ 1.22 (0.99)	1.03	1.37
	Rx5day (mm yr^{-1})	0.73 ~ 2.33 (1.42)	1.15 ~ 2.33 (1.63)	0.90 ~ 1.78 (1.36)	0.73 ~ 1.90 (1.31)
Exceedance	R1mm (d yr^{-1})	0.31 ~ 1.18 (0.58)	0.35 ~ 0.45 (0.41)	0.50 ~ 1.18 (0.80)	0.31 ~ 1.00 (0.62)
		-0.50 ~ -0.57 (-0.54)		-0.57	-0.50
	R10mm (d yr^{-1})	0.24 ~ 0.36 (0.38)		0.25 ~ 0.29 (0.27)	0.24 ~ 0.36 (0.34)
	R20mm (d yr^{-1})	0.14 ~ 0.22 (0.17)	0.15 ~ 0.22 (0.18)	0.17	0.14
	Rgmm (d yr^{-1})	0.19 ~ 0.36 (0.26)	0.19	0.26	0.24 ~ 0.36 (0.26)
	R50thmm (d yr^{-1})	0.29 ~ 0.40 (0.34)		0.29	0.40

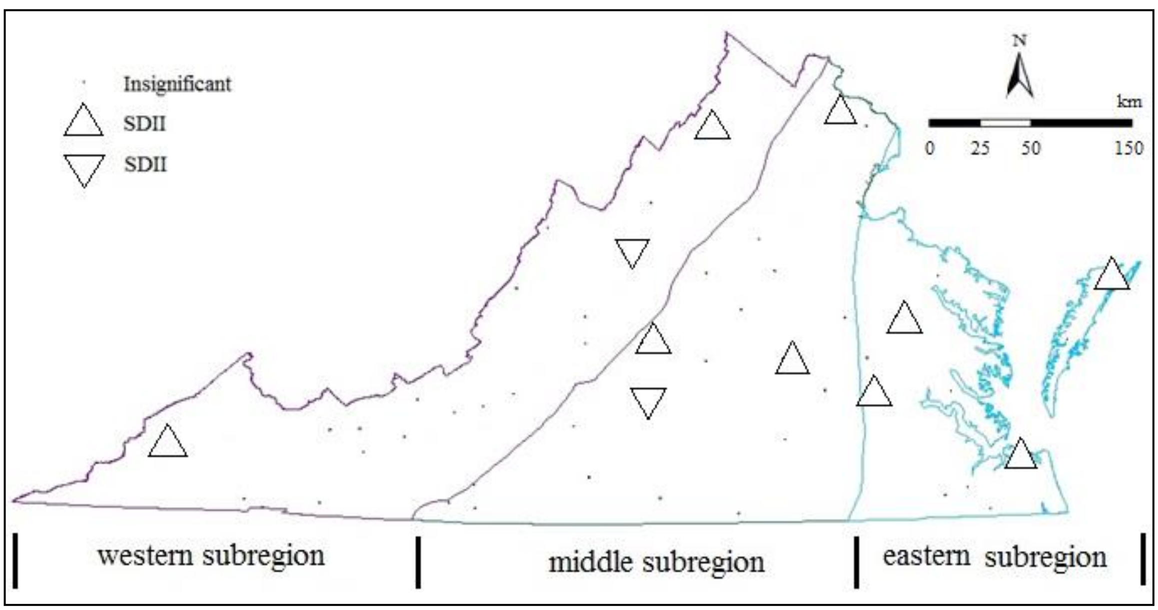
[1] See Figure 3.1 for the territory and subregions.

[2] See subsection 3.2.3 for definitions of the indices.

[3] The range (mean) of the significant increasing (positive) or decreasing (negative) Sen's slopes. The blank cell signifies no significant trend and the single value indicates a significant trend at one gauge only.

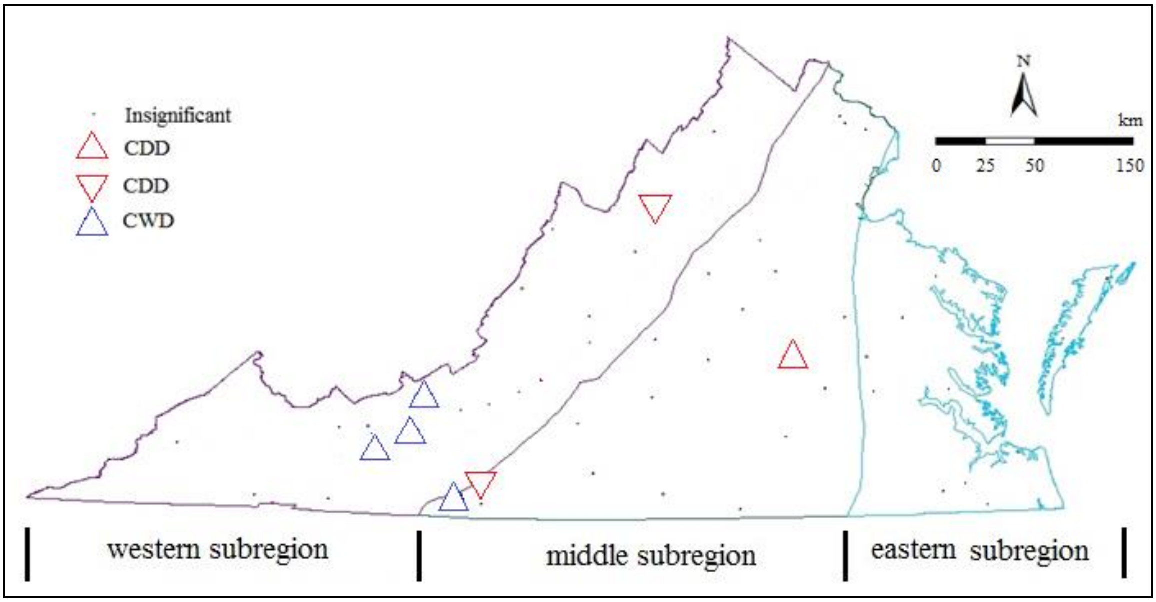

Insignificant
PRCPTOT
R99pTOT
R95pTOT
N
km
0 25 50 150
western subregion
middle subregion
eastern subregion

(a)

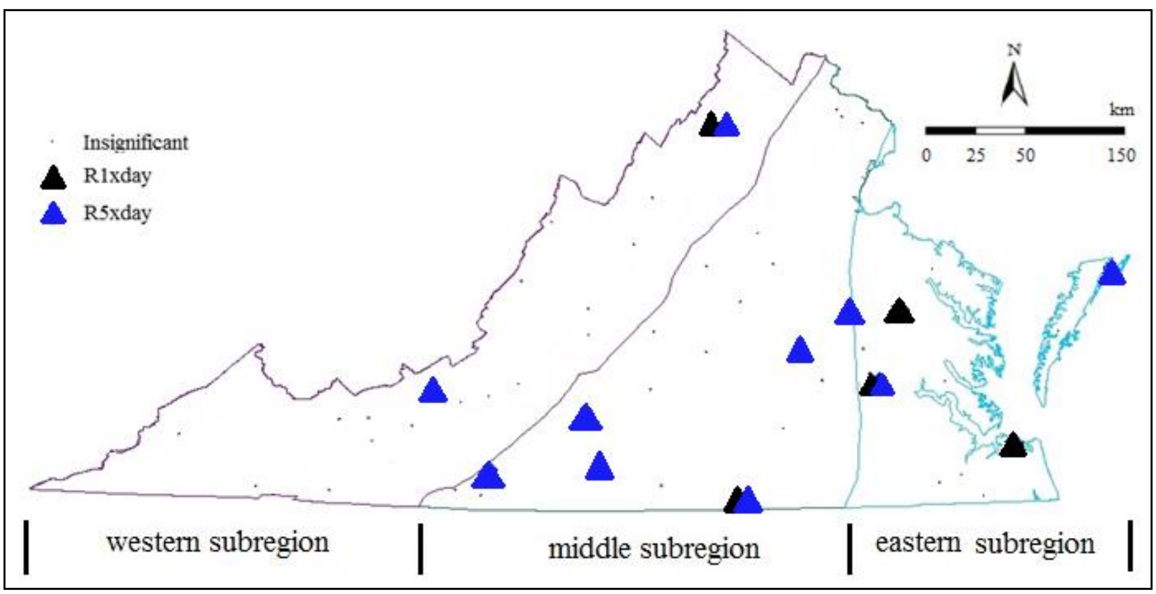

Insignificant
SDII
SDII
N
km
0 25 50 150
western subregion
middle subregion
eastern subregion

(b)

[Figure 3.5]

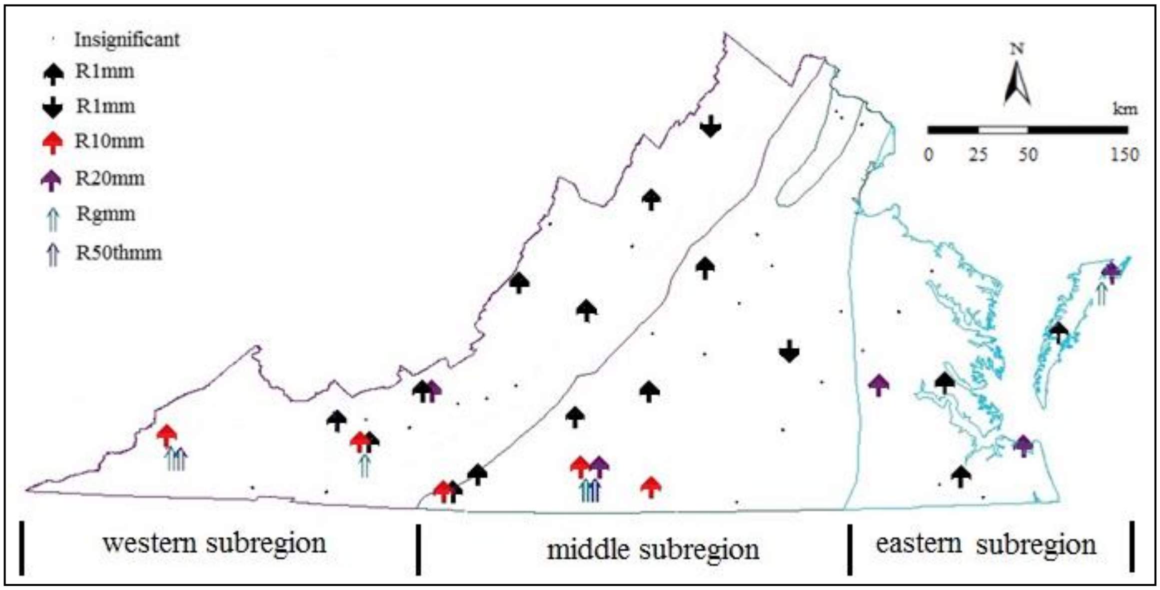

Insignificant
CDD
CDD
CWD
N
km
0 25 50 150
western subregion
middle subregion
eastern subregion

(c)


Insignificant
R1xday
R5xday
N
km
0 25 50 150
western subregion
middle subregion
eastern subregion

(d)

[Figure 3.5]



(e)

Figure 3.5. Rain gauges with significant (α = 0.05) temporal trends in the precipitation indices that describe precipitation: (a) amount; (b) intensity; (c) spell; (d) maximum; and (e) exceedance. The upward arrow signifies a significant increasing trend, whereas the downward arrow signifies a significant decreasing trend.

The precipitation intensity (i.e., SDII) showed an increasing trend in the eastern subregion but either an increasing or a decreasing trend in the middle and western subregions (Figure 3.4). In the middle subregion, three gauges where the SDII had a significant trend did not have a trend in precipitation amount, while in the western subregion, two gauges where the SDII had a significant trend did not have a trend in precipitation amount. The other six gauges where the SDII had a significant increasing trend also incurred an increasing trend in precipitation amount (Figure 3.5b versus Figure 3.5a). This indicated that precipitation amount and precipitation intensity were not interrelated: the increase of the former was not directly caused by the increase of the latter and vice versa. The SDII had a spatially uniform increasing rate of about 0.07 mm yr^{-1} yr^{-1} and decreasing rate of about 0.08 mm yr^{-1} yr^{-1}, with a broad range of -0.09 to 0.11 mm yr^{-1} yr^{-1} (Table 3.2).

The number of consecutive dry days (i.e., CDD) exhibited a decreasing trend at two gauges in the middle and western subregions, whereas the number of consecutive rainy days (i.e., CWD) showed an increasing trend at another four gauges in these two subregions (Figures 4 and 5c). Three gauges with an increasing trend in CWD had an increasing trend in precipitation amount (Figure 3.5c versus Figure 3.5a), indicating that the increased precipitation amount could partially be attributed to the increased CWD. In contrast, the increased precipitation intensity was not related to the increased or decreased CDD and CWD, as indicated by their inconsistent trends (Figure 3.5b versus Figure 3.5c). The CDD had changing rates from -0.17 to 0.25 d yr^{-1}, while the CWD had been increasing at 0.03 to 0.08 d yr^{-1}, with a mean of 0.05 d yr^{-1} (Table 3.2). In comparison to precipitation amount and intensity, the number of dry and wet days experienced a significant change at fewer gauges located in the non-coastal areas.

The maximum one-day (i.e., Rx1day) and five-day (i.e., Rx5day) precipitations exhibited an increasing trend at some gauges located in the three subregions (Figures 4 and 5d). In the eastern and western subregions, the gauges with an increasing trend in the Rx1day and/or Rx5day had an increasing trend in precipitation amount (Figure 3.5d versus Figure 3.5a) but did not fully coincide with those with a significant trend in the SDII, CDD, and CWD (Figure 3.5d versus Figures 5b and 5c), indicating that the increased Rx1day and Rx5day contributed to the increased precipitation amount rather than the increased precipitation intensity. In the middle subregion, the increased Rx1day and Rx5day partially affected the precipitation amount and barely had relation with the changed intensity, CDD and CWD. The Rx1day had an increasing rate from 0.81 to 1.37 mm yr^{-1}, with a mean of about 1.06 mm yr^{-1}, while the Rx5day had been increasing at 0.73 to 2.33

mm yr^{-1}, with a mean of 1.42 mm yr^{-1} (Table 3.2). The increasing rates were basically independent of the subregions.

The number of days with daily precipitations exceeding a smaller threshold (e.g., R1mm) had significant changes at more gauges than that exceeding a larger threshold (e.g., R10mm, R20mm, Rgmm, and R50thmm) (Figure 3.4). For a given subregion, the number of gauges with a significant trend varied from one to six. The R1mm exhibited a significant increasing trend in the eastern subregion and either an increasing or a decreasing trend in the other two subregions. The other four indices, namely R10mm, R20mm, Rgmm, and R50thmm, had a consistent increasing trend in all three subregions. Most of the gauges with a significant trend in these five exceedance indices also exhibited a significant trend in precipitation amount, indicating that the increased exceedance number of days contributed to the increased precipitation amount (Figure 3.5e versus Figure 3.5a). For the gauges located at the eastern subregion and the one at the farthest left-bottom corner of the western subregion, the increased R10mm, Rgmm, and R50thmm likely caused the increased precipitation intensity (Figure 3.5e versus Figure 3.5b). This was not the case for the gauges in other part of the western subregion and middle subregion. The exceedance number of days varied from -0.5 to 1.18 d yr^{-1}, with a largest change in the western subregion (Table 3.2).

3.4 Discussions

Overall increasing annual and extreme precipitations occurred across Virginia, while increasing precipitation intensities were detected in the eastern subregion. This is consistent with previous studies (Sridhar *et al.*, 2019; Yang *et al.*, 2021). Smirnov *et al.* (2018) found that Coastal Virginia experienced increasing trends in annual extreme daily precipitation and precipitation intensity in the past half century. Powell and Keim (2015) and Dhakal and Tharu (2018) revealed higher maximum one-day precipitation and more extreme wet days in southeast United States. Smirnov *et al.* (2018) detected an increasing trend in precipitation along the entire coastline of northeast United States. Since the precipitation characteristics are controlled by various large-scale atmospheric circulations, changes in the occurrence of the patterns or the properties of the circulations may have contributed to recent precipitation trends. Some researcher revealed that the increasing precipitation was partially caused by teleconnections (i.e., climate anomalies being related to each other at thousands of kilometers) (Burt *et al.*, 2018; Dhakal and Tharu, 2018), such as North Atlantic Tropical Cyclone (NATC), Bermuda/Azores High (BH), Nor'easter, and North Atlantic Oscillation (NAO). However, the confidence is low in comparing to the size of the role of human activities in these changes (Perlwitz *et al.*, 2017). Walsh and Pittock (1998) suggest that the potential changes in tropical storms, hurricanes, and extreme rainfall events are a result of warming climate. The warming air temperature that caused by greenhouse gases (e.g., CO_2) had been emitting from the intensifying human activities (e.g., urbanization and industrialization) since the mid-twentieth century. In response, warming oceans increases the amount of water that evaporates into the ambient atmosphere, leading to that more moisture-laden air moves over lands and/or condenses to form more precipitation (Yang *et al.*, 2021). That is, coastal regions will likely become wetter in the future as a result of climate forcing due to increasing concentrations of greenhouse gases, which may lead to flash flooding on steep-sloped landscapes and/or water ponding on low-lying lands with an insufficient drainage capacity (DHI, 2019).

However, decreasing trends of total rainy days (i.e., R1mm) and precipitation intensity (i.e., SDII) emerged in the middle and western subregions, which are also reported by Yang *et al.* (2021), Dhakal and Tharu (2018), Burt *et al.* (2018), and Sayemuzzaman and Jha (2014). Such decreasing trends can be attributed to the reducing temporal fluctuations of precipitation both within a year and inter-annually as a result of warming air temperatures in winter and spring while cooling temperatures in summer and fall (Wang et al., 2009; Vose et al., 2017; Smirnov et al., 2018). Dhakal and Tharu (2018) revealed that precipitations with a decreasing trend were those that had little correlations with tropical cyclones. In our study, the decreasing trends occurred in the middle and western subregions, which have a relatively higher elevation and steeper topographic gradient, can barely be influenced by NATC. The opposite trends in precipitation amount versus intensity imply that a storm event in the future will likely generate a smaller peak discharge but a larger runoff volume (McCuen, 1998; Prodanovic and Simonovic, 2007; Wolcott *et al.*, 2009), making it more important to manage runoff using storage structures (e.g., detention and retention ponds) and infiltration basins and/or trenches.

3.5 Conclusions

This study used 13 indices to investigate step changes and temporal trends of observed daily precipitations across Virginia. The results indicated that most of the state territory incurred significant step changes in precipitation. From 1980 to 2019, the amounts of annual and extreme precipitations tended to increase. The precipitation intensity showed an increasing trend in the eastern subregion but either an increasing or a decreasing trend in the middle and western subregions. In these two latter subregions, the number of consecutive dry days exhibited a decreasing trend, whereas the number of consecutive rainy days showed an increasing trend. The maximum one- and five-day precipitations exhibited an increasing trend at some gauges in the three subregions. The one-day precipitation exhibited a significant increasing trend in the eastern subregion and either an increasing or a decreasing trend in the other two subregions. The four indices, which are exceedance numbers of days with a daily precipitation of not smaller than 10.0 mm, 20.0 mm, annual average, and 50^{th} percentile, respectively, had a consistent increasing trend in all three subregions. The increased precipitation amounts can partially be attributed to the increased extreme storms, wet spell, one- and five-day precipitations, and exceedance numbers of days. The state territory has been experiencing more storms with increasing extreme magnitudes, longer durations, and more intense with a few opposite trends, necessitating the consideration of both peak discharge and runoff volume in hydrologic engineering design.

References

Augustin, L., Barbante, C., Barnes, P. R. F., Marc Barnola, J., Bigler, M., Castellano, E., Cattani, O., Chappellaz, J., Dahl-Jensen, D., Delmonte, B., Dreyfus, G., Durand, G., Falourd, S., Fischer, H., Flückiger, J., Hansson, M. E., Huybrechts, P., Jugie, G., Johnsen, S. J., Jouzel, J., Kaufmann, P., Kipfstuhl, J., Lambert, F., Lipenkov, V. Y., Littot, G. C., Longinelli, A., Lorrain, R., Maggi, V., Masson-Delmotte, V., Miller, H., Mulvaney, R., Oerlemans, J., Oerter, H., Orombelli, G., Parrenin, F., Peel, D. A., Petit, J.-R., Raynaud, D., Ritz, C., Ruth, U., Schwander, J., Siegenthaler, U., Souchez, R., Stauffer, B., Peder Steffensen, J., Stenni, B., Stocker, T. F., Tabacco, I. E., Udisti, R., van de Wal, R. S. W., van den Broeke, M., Weiss, J., Wilhelms, F., Winther, J.-G., Wolff, E. W., Zucchelli, M., members, E. c. and members, E. c. (2004) Eight glacial cycles from an Antarctic ice core. *Nature* 429(6992), 623-628. Available at: https://doi.org/10.1038/nature02599.

Breinl, K., Di Baldassarre, G., Mazzoleni, M., Lun, D. and Vico, G. (2020) Extreme dry and wet spells face changes in their duration and timing. *Environmental Research Letters* 15(7), 074040. Available at: http://dx.doi.org/10.1088/1748-9326/ab7d05.

Burnham, B. and Burnham, M. (2004) Hiking Virginia: A guide to Virginia's greatest hiking adventures, Globe Pequot, Guilford, CT.

Burt, T. P., Ford Miniat, C., Laseter, S. H. and Swank, W. T. (2018) Changing patterns of daily precipitation totals at the Coweeta Hydrologic Laboratory, North Carolina, USA. *International Journal of Climatology* 38, 94. Available at: https://ui.adsabs.harvard.edu/abs/2018IJCli..38...94B.

Chen, D., Walther, A., Moberg, A., Jones, P., Jacobeit, J. and Lister, D. (2015) European trend atlas of extreme temperature and precipitation records, Heidelberg.

Clark, P. U., Shakun, J. D., Marcott, S. A., Mix, A. C., Eby, M., Kulp, S., Levermann, A., Milne, G. A., Pfister, P. L., Santer, B. D., Schrag, D. P., Solomon, S., Stocker, T. F., Strauss, B. H., Weaver, A. J., Winkelmann, R., Archer, D., Bard, E., Goldner, A., Lambeck, K., Pierrehumbert, R. T. and Plattner, G.-K. (2016) Consequences of twenty-first-century policy for multi-millennial climate and sea-level change. *Nature Climate Change* 6(4), 360-369. Available at: https://doi.org/10.1038/nclimate2923.

Davenport, F. V., Burke, M. and Diffenbaugh, N. S. (2021) Contribution of historical precipitation change to US flood damages. *Proceedings of the National Academy of Sciences* 118(4), e2017524118. Available at: https://www.pnas.org/content/pnas/118/4/e2017524118.full.pdf.

Dhakal, N. and Tharu, B. (2018) Spatio-temporal trends in daily precipitation extremes and their connection with North Atlantic tropical cyclones for the southeastern United States. *International Journal of Climatology* 38(10), 3822-3831. Available at: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.5535.

DHI (2019) Best practices for successful coastal flooding adaptation Available at: https://blog.dhigroup.com/2019/07/11/best-practices-for-successful-coastal-flooding-adaptation.

Felton, A. J., Slette, I. J., Smith, M. D. and Knapp, A. K. (2020) Precipitation amount and event size interact to reduce ecosystem functioning during dry years in a mesic grassland. *Global Change Biology* 26(2), 658-668. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14789.

Gao, C., Booij, M. J. and Xu, Y.-P. (2020) Impacts of climate change on characteristics of daily-scale rainfall events based on nine selected GCMs under four CMIP5 RCP scenarios in Qu River basin, east China. *International Journal of Climatology* 40(2), 887-907. Available at: https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.6246.

Hamed, K. H. and Rao, R. A. (1998) A modified Mann-Kendall trend test for autocorrelated data. *Journal of Hydrology* 204(1), 182-196. Available at: http://www.sciencedirect.com/science/article/pii/S002216949700125X.

Hirsch, R. M., Slack, J. R. and Smith, R. A. (1982) Techniques of trend analysis for monthly water quality data. *Water Resources Research* 18(1), 107-121. Available at: https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/WR018i001p00107.

International CLIVAR Project Office (ICPO) (2001) Report on the Activities of the Working Group on Climate Change Detection and Related Rapporteurs 1998-2001, Geneve, Switzerland. Available at: https://eprints.soton.ac.uk/30144/.

Karl, T. R. and Knight, R. W. (1998) Secular Trends of Precipitation Amount, Frequency, and Intensity in the United States. *Bulletin of the American Meteorological Society* 79(2), 231-242. Available at: https://journals.ametsoc.org/view/journals/bams/79/2/1520-0477_1998_079_0231_stopaf_2_0_co_2.xml.

Karl, T. R., Melillo, J. M. and Peterson, T. C. e. (2009) Global climate change impacts in the United States., p. 192 Available at: http://aquaticcommons.org/id/eprint/2263.

Karl, T. R., Nicholls, N. and Ghazi, A. (1999) Clivar/GCOS/WMO Workshop on Indices and Indicators for Climate Extremes Workshop Summary. *Climatic Change* 42(1), 3-7. Available at: https://doi.org/10.1023/A:1005491526870.

Kendall, M. G. (1955) Rank correlation methods, 2nd ed, Hafner Press, NYC.

Lüthi, D., Le Floch, M., Bereiter, B., Blunier, T., Barnola, J.-M., Siegenthaler, U., Raynaud, D., Jouzel, J., Fischer, H., Kawamura, K. and Stocker, T. F. (2008) High-resolution carbon dioxide concentration record 650,000–800,000 years before present. *Nature* 453(7193), 379-382. Available at: https://doi.org/10.1038/nature06949.

Ma, Q., Li, Y., Feng, H., Yu, Q., Zou, Y., Liu, F. and Pulatov, B. (2021) Performance evaluation and correction of precipitation data using the 20-year IMERG and TMPA precipitation products in diverse subregions of China. *Atmospheric research* 249, 105304. Available at: https://www.sciencedirect.com/science/article/pii/S0169809520312412.

Mann, H. B. (1945) Nonparametric tests against trend. *Econometrica* 13(3), 245-259.

Maslin, M. (2016) Forty years of linking orbits to ice ages. *Nature* 540(7632), 208-209. Available at: https://doi.org/10.1038/540208a.

McCuen, R. H. (1998) Hydrologic analysis and design, 2nd ed, Prentice Hall, New Jersey.

McGilchrist, C. A. and Woodyer, K. D. (1975) Note on a distribution-free CUSUM technique. *Technometrics* 17(3), 321-325. Available at: https://www.tandfonline.com/doi/abs/10.1080/00401706.1975.10489335.

Meehl, G. A. S., T F; Collins, W D; Friedlingstein, P; Gaye, A T; Gregory, J M; Kitoh, A; Knutti, R; Murphy, J M; Noda, A; Raper, S C.B.; Watterson, I G; Weaver, A J; Zhao, Z C (2007) Global climate projections. Chapter 10, pp. 748-845, United Kingdom. Available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter10.pdf.

Melillo, J. M., Janetos, A. C., Karl, T. R., Corell, R., Barron, E. J., Burkett, V., Cecich, T. F., Jacobs, K., Joyce, L., Miller, B., Morgan, M. G., Parson, E. A., Richels, R. G. and Schimel, D. S. (2000) Climate change impacts on the United States: the potential consequences of climate variability and change. *Cambridge, UK: Cambridge University Press.*

Michael, L. G. and Raymond, S. B. (2007) Variations of Twentieth-Century Temperature and Precipitation Extreme Indicators in the Northeast United States. *Journal of Climate* 20(21), 5401-5417.

NOAA National Centers for Environmental Information (NCEI) (2021) U.S. Billion-Dollar Weather and Climate Disasters Available at: https://www.ncdc.noaa.gov/billions/.

Pachauri, R. K. R., A (2008) Climate change 2007. Synthesis report. Contribution of Working Groups I, II and III to the fourth assessment report, Switzerland. Available at: http://www.ipcc.ch/ipccreports/ar4-syr.htm.

Perlwitz, J., Knutson, T., Kossin, J. P. and LeGrande, A. N. (2017) Large-scale circulation and climate variability. Wuebbles, D.J., Fahey, D.W., Hibbard, K.A., Dokken, D.J., Stewart, B.C. and Maycock, T.K. (Karl *et al.*), pp. 161-184, *U.S. Global Change Research Program*, Washington, DC, USA.

Powell, E. J. and Keim, B. D. (2015) Trends in Daily Temperature and Precipitation Extremes for the Southeastern United States: 1948–2012. *Journal of Climate* 28(4), 1592-1612. Available at: https://journals.ametsoc.org/view/journals/clim/28/4/jcli-d-14-00410.1.xml.

Prodanovic, P. and Simonovic, S. P. (2007) Development of rainfall intensity duration frequency curves for the City of London under the changing climate, *Water Resources Research Report* Available at: https://ir.lib.uwo.ca/wrrr/20.

Rye, R., Holland, H. D. and Kuo, P. H. (1995) Atmospheric carbon dioxide concentrations before 2.2 billion years ago. *Nature (London)* 378(6557), 603-605.

Sayemuzzaman, M. and Jha, M. K. (2014) Seasonal and annual precipitation time series trend analysis in North Carolina, United States. *Atmospheric research* 137, 183-194. Available at: http://www.sciencedirect.com/science/article/pii/S0169809513002858.

Sen, P. K. (1968) Estimates of the regression coefficient based on Kendall's Tau. *Journal of the American Statistical Association* 63(324), 1379-1389. Available at: https://www.tandfonline.com/doi/abs/10.1080/01621459.1968.10480934.

Sillmann, J. and Roeckner, E. (2008) Indices for extreme events in projections of anthropogenic climate change. *Climatic Change* 86(1), 83-104. Available at: https://doi.org/10.1007/s10584-007-9308-6.

Smirnov, D. S., Brad Workman, P., Batten, B., Rosenberg, S. and McGlone, D. (2018) Analysis of historical and future heavy precipitation. Final technical report: City of Virginia Beach, Virginia, Department of Public Works, Virginia Beach, VA.

Sridhar, V., Modi, P., Billah, M. M., Valayamkunnath, P. and Goodall, J. L. (2019) Precipitation Extremes and Flood Frequency in a Changing Climate in Southeastern Virginia. *JAWRA Journal of the American Water Resources Association* 55(4), 780-799. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/1752-1688.12752.

Soil and Water Conservation Society (SWCS) (2003) Conservation implications of climate change: Soil erosion and runoff from cropland, p. 24, *SWCS Rep.*

Walsh, J., D., Wuebbles, K., Hayhoe, J., Kossin, K., Kunkel, G., Stephens, P., Thorne, R., Vose, M., Wehner, J., Willis, D., Anderson, S., Doney, R., Feely, P., Hennon, V., Kharin, T., Knutson, F., Landerer, T., Lenton, J., Kennedy and Somerville, R. (2014) Ch. 2: Our changing climate. Climate Change Impacts in the United States. Melillo, J.M., Richmond, T.T.C. and Yohe, G.W., Eds. (Karl *et al.*), pp. 19-67, *U.S. Global Change Research Program*, The Third National Climate Assessment.

Walsh, K. and Pittock, A. B. (1998) Potential Changes in Tropical Storms, Hurricanes, and Extreme Rainfall Events as a Result of Climate Change. *Climatic Change* 39(2), 199-213. Available at: https://doi.org/10.1023/A:1005387120972.

Wang, X., Yang, X. and Cai, Z. (2019) Next-generation rainfall IDF curves for the Virginian drainage area of Chesapeake Bay, *Department of Defense Strategic Environmental Research and Development Program (SERDP)*

Whitworth, K. L., Baldwin, D. S. and Kerr, J. L. (2012) Drought, floods and water quality: Drivers of a severe hypoxic blackwater event in a major river system (the southern Murray–Darling Basin, Australia). *Journal of Hydrology* 450-451, 190-198. Available at: https://www.sciencedirect.com/science/article/pii/S0022169412003691.

Wolcott, S., Mroz, M. and Basile, J. (2009) Application of northeast regional climate center research results for the purpose of evaluating and updating Intensity-Duration-Frequency (IDF) Curves - Case study: Rochester, New York,

Wu, C., Chen, J. M., Pumpanen, J., Cescatti, A., Marcolla, B., Blanken, P. D., Ardö, J., Tang, Y., Magliulo, V., Georgiadis, T., Soegaard, H., Cook, D. R. and Harding, R. J. (2012) An underestimated role of precipitation frequency in regulating summer soil moisture. *Environmental Research Letters* 7(2), 024011. Available at: http://dx.doi.org/10.1088/1748-9326/7/2/024011.

Yang, X., Wang, X., Cai, Z. and Cao, W. (2021) Detecting spatiotemporal variations of maximum rainfall intensities at various time intervals across Virginia in the past half century. *Atmospheric research* 255, 105534. Available at: https://www.sciencedirect.com/science/article/pii/S0169809521000867.

CHAPTER 4

NEXT-GENERATION RAINFALL IDF CURVES FOR THE VIRGINIAN DRAINAGE AREA OF CHESAPEAKE BAY[1]

Hydraulic flow infrastructure is conventionally designed under the guidance of historic rainfall intensity-duration-frequency (IDF) curves that assume climate stationarity. However, climate change has altered, and will continue to modify, rainfall characteristics in many regions, particularly in coastal areas such as the Chesapeake Bay Watershed. As a result, the stationarity assumption will likely become invalid, making the existing deterministic IDF curves inadequate in accordance with relevant engineering design standards. To resolve this issue, next-generation probability-based IDF curves that can reflect the non-stationarity at temporal and spatial scales are needed to improve future infrastructure planning processes and prevent over- or under-committing resources. In present, such probability-based IDF curves are lacking. The objectives of this study were to: 1) develop an innovative approach for creating next-generation IDF curves that consider nonstationary rainfall, and 2) use this approach to create probability-based IDF curves for the state of Virginia, most of which is located within the Chesapeake Bay Watershed.

[1] Excerpted from a co-authored technical report with permission from other two authors: "Wang, X., Yang, X., and Cai, Z. 2019. *Next-Generation Rainfall IDF Curves for the Virginian Drainage Area of Chesapeake Bay*. Final Report to the Strategic Environmental Research and Development Program (SERDP). 293pp."

4.1 Introduction

The 166,534 km^2 Chesapeake Bay Watershed (hereinafter referred to as Bay) is an estuary lying land from the Atlantic Ocean. As the largest watershed in the United States, it stretches across six states, covering parts of Virginia, West Virginia, the District of Columbia, Delaware, Maryland, Pennsylvania, and New York (Figure 4.1). Across the watershed, there are numerous populated centers (e.g., cities of Norfolk and Virginia Beach in Virginia) and civic and military infrastructure (e.g., Norfolk Naval Station) (Wray, 2013). This study focused on the state of Virginia.

Figure 4.1. The Chesapeake Bay Watershed. (Source: Smith *et al.*, 2013)

Conventionally, the infrastructure involving hydrologic flows, such as stormwater management facilities, erosion and sediment control structures, and flood protection structures, were designed in terms of historic rainfall intensity-duration-frequency (IDF) curves, which are functional relationships among historic rainfall event statistics of intensity, duration, and frequency or return period (McCuen, 1998; Prodanovic and Simonovic, 2007; Wolcott *et al.*, 2009). Herein, the IDF curves assume that climate is stationary (Auld, 2013), meaning that for a given location, the paired values of rainfall intensity, duration, and frequency are temporally invariant.

However, as climate has shown significant changes in rainfall characteristics in many regions (particularly in coastal regions such as the Bay) (NIPCC, 2011; Yang *et al.*, 2021), such a stationary assumption will likely become invalid and thus the adequacy of the existing IDF curves may be questionable (Liew *et al.*, 2013). Hence, it is necessary to create next-generation IDF curves that consider the changed rainfall characteristics in a foreseeable future (Kutschera *et al.*, 2011; AMEC, 2012; Liew *et al.*, 2013; Mirhosseini, 2013; Mirhosseini *et al.*, 2013; Rodríguez *et al.*, 2013; Wang *et al.*, 2013; Yang *et al.*, 2021).

Liew *et al.* (2013) used a novel three-step (i.e., downscaling-comparison-derivation or DCD) approach to derive IDF curves for both present and future climates at stations (i.e., sites) with a short or no rainfall record in Indonesia. First, the 30-km 6-h-resolution ERA-40 Global Reanalysis Datasets (available at http://www.ecmwf.int/research/era) were downscaled using a Weather Research and Forecasting Model (WRF) (available at http://www.wrf-model.org) for four stations with observed IDF curves and the site of interest where there is no rainfall record but IDF curves need to be created. Second, for the present (i.e., 1961 to 1990) climate and for each of the three of the four stations, the IDF curves based on the downscaled precipitation were compared with the IDF curves based on the observed rainfall to determine a "range of bias correction." Herein, a generalized extreme value (GEV) distribution (McCuen, 1998) was adopted to derive the IDF curves. The GEV parameters were estimated (Hosking *et al.*, 1985; Bhunya *et al.*, 2007) by fitting the distribution to the data at those three stations. Subsequently, for the fourth station, this "range of bias correction" was used to adjust the IDF curves based on the downscaled precipitation and the adjusted IDF curves were compared with the IDF curves based on the observed rainfall to validate the “range of bias correction.” Third, for the site of interest, its IDF curves for the present climate were derived using the downscaled precipitation with adjustments by the “range of bias correction.” In turn, the climate change factors (future or 2011 to 2100 rainfall intensities minus present rainfall intensities) were added to the rainfall intensities of these present IDF curves to derive the future IDF curves for the site of interest. The results indicated that this approach worked well for the study area and could provide the lower and upper limits of an IDF curve. However, this study did not examine uncertainties in climatologic input parameters. That is, it did not adopt an ensemble approach of multiple simulations using perturbed initial and lateral boundary conditions: the future precipitation was simply simulated by a Regional Climate Model (RCM) driven by a Global Climate Model (GCM ECHAM5) for the A2 emission scenario only (NIPCC, 2011; Solaiman and Simonovic, 2011). In addition, this study made a stationary assumption without detecting whether there are any step change and/or trend in the historic and future precipitations. Further, this study used a constant ratio of the future to present intensities regardless of the durations and frequencies, which is inconsistent with the finding of previous studies (e.g., Groisman *et al.*, 1999; Endo *et al.*, 2006; NIPCC, 2011; Wang *et al.*, 2013; Yang *et al.*, 2021) that climate change will likely cause more frequent low- and high-magnitude precipitations with distinctly different amplification factors.

Mirhosseini *et al.* (2013) used six historic (i.e., 1968 to 2000) and future (i.e., 2038 to 2070) projections of 3-h precipitation, downloaded from the North American Regional Climate Change Assessment Program (NARCCAP) website (http://www.narccap.ucar.edu), to assess the impacts of climate change on rainfall IDF curves in the state of Alabama. First, in accordance with the randomly selected events from the 15-min observed precipitation data, downloaded from the National Climate Data Center (NCDC) website (http://www.ncdc.noaa.gov), the 3-h projections were disaggregated into 15-min-resolution time series using a stochastic method that was presented by Socolofsky *et al.* (2001). Second, the 15-min-resolution time series were used to derive future IDF curves by fitting a GEV distribution. Third, the future IDF curves were compared with the present IDF curves to assess the impacts of climate change. The results revealed that for short rainfall durations (i.e., less than 4 h), the precipitation pattern for Alabama will veer toward less intense rainfalls, for long durations (i.e., greater than 4 h); however, a large uncertainty on projected rainfall intensity by these six climate models made it difficult to draw any inclusive conclusions about expected changes of future rainfall intensity. Those authors recommended that methodologies be developed for creating probability-based IDF curves. Although it adopted an ensemble approach of multiple simulations by HRM3-HadCM3, CRCM-CGCM3, HRM3-GFDL, CRCM-CCSM, RCM3-GFDL, and ECP2-GFDL, this study made a stationary assumption without detecting any step change and/or trend in the historic and future precipitations, so the possible violation of stationarity required by the GEV distribution might cause unknown uncertainties in the derived IDF curves. Also, this study derived IDF curves only for individual climatic stations and did not provide IDF curves at watershed levels, which can be a limitation in straightly determining a design storm for a drainage area of interest.

Rodríguez *et al.* (2013) assessed influences of climate change on IDF curves at six thermo-pluviometric stations of the Spanish Meteorology Agency in the metropolitan area of Barcelona in Spain. These stations had more than 20 years of observed daily rainfall data. The study used 114 time series of precipitation predicted by five GCMs (NIPCC, 2011), namely EGMAM, CBCM3, ECHAM5, BCM2, and AR3, for four greenhouse gas emission scenarios (NIPCC, 2011), namely A1B, A2, B1, and B2. The control period was either from 1951 to 1999 or 1961 to 1999, depending on the models and scenarios of interest, while the future period was from 2071 to 2100. First, at daily time scale, each of the time series was downscaled to the stations using an analogue method presented by Ribalaygua *et al.* (2013). Second, the daily rainfall IDF curves for the future period were created using an empirical potential-exponential distribution (Casas *et al.*, 2004). Third, the values for climate change factor (Arnbjerg-Nielsen, 2012), defined as the ratio between the rainfall intensity with a return period for a future climate scenario to the rainfall intensity with the same return period for the control climate, were computed and used to examine influences of climate change on IDF curves. The results indicated an increase of at least 4% on the expected daily rainfall for return periods of longer than 20-year. This study adopted an ensemble approach of multiple simulations from five GCMs for four emission scenarios. However, it did not create probability-based IDF curves, which is needed to address uncertainties in climate drivers (e.g., future economy, demography, and technology) and climate models (Solaiman and Simonovic, 2011). Also, as with the studies of Liew *et al.* (2013) and Mirhosseini *et al.* (2013), this study did not examine stationarity of the historic and future precipitations.

Although the above studies presented a few preliminary applications of methodologies for assessing influences of climate change on IDF curves, there is a large room for improvement because they: 1) made a stationary assumption without detecting any possible step change and/or trend in historic and future precipitations; 2) adopted only one type of distribution, namely GEV, exponential, or Gringorten (Gringorten, 1963; NOAA, 1986; McCuen, 1998), with its parameters determined by solely fitting the distribution to the historic data on precipitation; however, the three special cases of the GEV distribution (Coles, 2001; Viessman and Lewis, 2003), namely Fréchet (1927), Weibull (1951), and Gumbel (1958), which have been widely used in practice, may be more tangible; 3) assumed that a fitted distribution is independent of climate (i.e., applicable for both historic and future precipitations); 4) did not create probability-based IDF curves except for Solaiman and Simonovic (2011); and 5) were not conducted in geographic regions with dense hydraulic and hydrological related facilities.

In contrast, our study studied the entire state of Virginia, which is a very important geographic region with numerous infrastructures involving hydrologic flows. Our study will fill these research gaps and develop an approach that can be used to create next-generation probability-based rainfall IDF curves by considering non-stationarity of historic and future precipitations, and apply this approach to the Virginian drainage area of Chesapeake Bay. Herein, it is hypothesized that the rainfall IDF curves created using such an approach will be least influenced by non-stationarity-related uncertainties and thus they can be used in practice with more confidence.

4.2 Materials and Methods

4.2.1 The Study Sites

This study was conducted for the entire state of Virginia, most of which is located within the Chesapeake Bay Watershed (Figure 4.1). The state has a humid subtropical climate, with an annual average of 35 to 45 days of thunderstorm activity and an average annual precipitation of 1080 mm. The average temperature varies from -3°C in January to 30°C in July.

Virginia has a significant topographic relief (Figure 4.2a), with elevations varying from Virginia Beach in the east at sea level to Mount Rogers in the west at 1746 m above sea level (Wikipedia, 2018). The major gradations occur at the edges of the Atlantic Ocean, the end of the Piedmont, and the Blue Ridge and Allegheny chains of the Appalachian Mountains. The moderating influence of the ocean from the east, powered by the Gulf Stream, also creates the potential for hurricanes near the mouth of Chesapeake Bay. Cold air masses arrive over the mountains, especially in winter, which can lead to significant snowfalls when coastal storms, known as nor’easters, move up the Atlantic coast. The interaction of these elements with the state's topography creates micro-climates in the Shenandoah Valley, the mountainous southwest, and the coastal plains that are slightly but noticeably distinct from each other. To differentiate and characterize the micro-climates, NOAA (National Oceanic and Atmospheric Administration) subdivides Virginia into six climatic divisions (Figure 4.2), namely Tidewater, Eastern Piedmont, Western Piedmont, Northern, Central Mountain, and Southwestern Mountain.

On the other hand, to differentiate and characterize the topographic relief, USGS (U.S. Geological Survey) subdivides Virginia into five physiographic divisions (Figure 4.2), namely Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateaus. The Coastal Plain division is between the Atlantic coast and the fall line. It includes the Eastern Shore and major estuaries of Chesapeake Bay. The Piedmont division is a series of sedimentary and igneous rock-based foothills east of the mountains which were formed in the Mesozoic era. The region, known for its heavy clay soil, includes the Southwest Mountains around City of Charlottesville. The Blue Ridge division is a physiographic province of the Appalachian Mountains with the highest points in the state, the tallest being Mount Rogers. The Valley and Ridge division is west of the mountains and includes the Great Appalachian Valley. The region is carbonate rock based and includes Massanutten Mountain. The Cumberland Plateau and the Cumberland Mountains are in the southwest corner of Virginia, south of the Allegheny Plateau.

Table 4.1. The climatic-physiographic zones with inclusive rain gauges.

Climatic-Physiographic Zone	Climatic Division	Physiographic Division	Rain Gauge ID
CPZ01	CD1 (Tidewater)	PGD1 (Coastal Plain)	446475, 448800, 449151
CPZ02	CD1 (Tidewater)	PGD2 (Piedmont)	448129
CPZ03	CD2 (Eastern Piedmont)	PGD1 (Coastal Plain)	None
CPZ04	CD2 (Eastern Piedmont)	PGD2 (Piedmont)	440778, 440993, 441322, 441929, 442941, 443192, 443200, 444414
CPZ05	CD3 (Western Piedmont)	PGD2 (Piedmont)	440166, 441614, 446178, 446692, 447025, 447338, 449272
CPZ06	CD3 (Western Piedmont)	PGD3 (Blue Ridge)	440561, 445690
CPZ07	CD4 (Northern)	PGD2 (Piedmont)	442159, 442729, 446712, 447130, 447164, 448396
CPZ08	CD4 (Northern)	PGD3 (Blue Ridge)	440720, 445851
CPZ09	CD4 (Northern)	PGD4 (Valley and Ridge)	442663, 443229, 48046, 448149
CPZ10	CD5 (Central Mountain)	PGD4 (Valley and Ridge)	442044, 442208, 443310, 444128, 445142, 445423, 445595, 445880, 448062, 448172, 449159
CPZ11	CD6 (Southwestern Mountain)	PGD3 (Blue Ridge)	443272, 444246, 448547, 449169
CPZ12	CD6 (Southwestern Mountain)	PGD4 (Valley and Ridge)	440766, 446955, 448022 449060, 449301
CPZ13	CD6 (Southwestern Mountain)	PGD5 (Appalachian Plateaus)	442269, 444180, 444410, 449215

This study overlaid the climatic and physiographic divisions, resulting in 13 zones (Table 1 and Figure 4.2b), within which the 57 rain gauges with 15-min rainfall data are located. Note that there is no such rain gauge in one of the zones (i.e., CPZ03). This study did some analyses by pooling together the rainfall data at the rain gauges within each of the climatic-physiographic zones, as detailed in the following contexts.

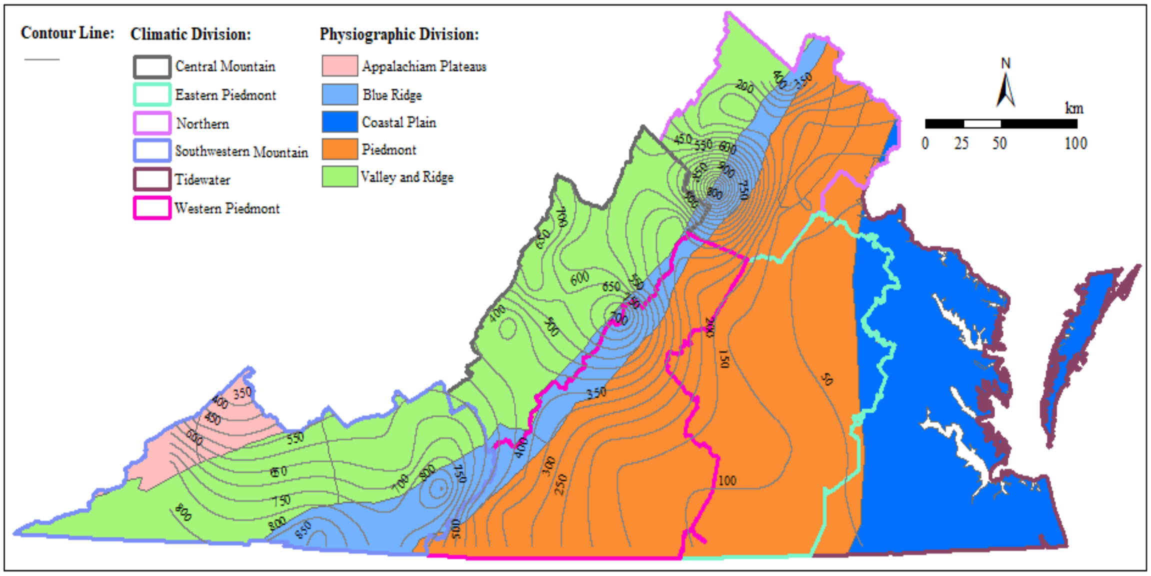
4.2.2 Data and reprocessing

This study used data on observed 15-min precipitation, predicted precipitation by Regional Climate Models (RCMs), topography, and hydrography.

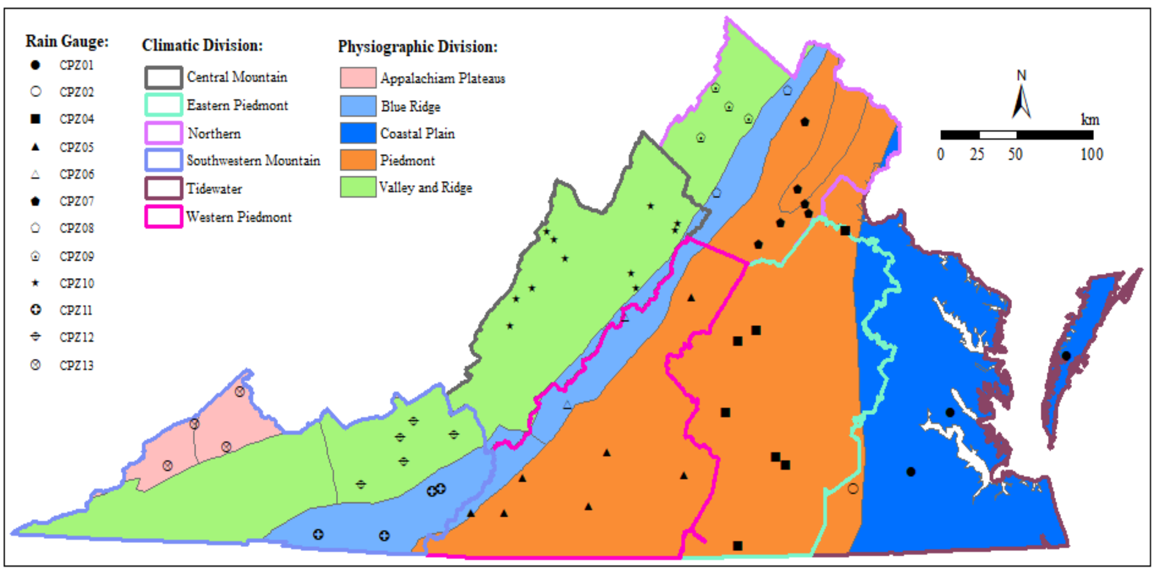
4.2.2.1 The observed 15-min precipitation

The data on 15-min precipitation observed at 57 rain gauges were downloaded from the NOAA National Climatic Data Center (NCDC) website https://www.ncdc.noaa.gov/data-access/land-based-station-data. The gauges were grouped by the climatic-physiographic zones (Figure 4.2b and Table 4.2). Herein, it was hypothesized that the data at the gauges within a same zone are from a same population and can be pooled together into one dataset for statistical analysis. The rationale behind this hypothesis is that the spatial variability of precipitation across the zone might be statistically insignificant because each CPZ has a similar micro-climate and a similar physiology, as stated above. However, given the limited time, this study could not test this hypothesis using a statistical technique. A test will be done once a follow-up research will be awarded.

For a given rain gauge, the record only has times when precipitation was nonzero. To make the record consecutive at a 15-min interval, the times when precipitation was zero were added back by executing a Microsoft® Excel VBA program developed by the study



(a)



(b)

Figure 4.2. The Virginian climatic and physiographic divisions superimposed by the: (a) topographic elevation contours at a 50-m interval, and (b) 57 rain gauges with 15-min rainfall data. For a rain gauge, its neighboring gauges (Table 4.3) were selected as those that are within a geographic distance of 50 km and have relatively fewer missing values. In the table, a rain gauge of interest is highlighted in red, while its neighboring gauges are highlighted in black. At a time when the precipitation at the rain gauge was filled, the neighboring gauges with observations were used in Eq. (4.1) and those without observations were excluded.

team. In addition, the record has missing values for a time interval or more on a record day and/or for one day or more in a record year. The missing values were filled by executing another VBA program, which estimates a missing value as a function of the responding values at the neighboring gauges of this rain gauge. This function is expressed as (Yozgatligil *et al.*, 2012; Mohanty *et al.*, 2014):

$$P_{x,j} = \overline{P}_x \frac{\sum_{i=1}^{m} \frac{P_{i,j}}{\overline{P}_i}}{m} \tag{4.1}$$

where $P_{x,j}$ is the estimated 15-min precipitation of gauge x at time j; $\overline{P}_x$ is the mean annual precipitation of gauge x; $P_{i,j}$ is the observed 15-min precipitation of gauge i at time j; $\overline{P}_i$ is the mean annual precipitation of gauge i; and m is the number of the neighboring gauges of gauge x. The mean annual precipitations of the 57 gauges, obtained from NOAA-NCDC and der Leeden (1994), are given in Table 4.2.

For each of the 57 rain gauges (Table 4.2 and Figure 4.2), the missing-filled 15-min precipitation time series was used to generate a dataset of annual maximum 15-min precipitation (designated $\tilde{X}_{15m,i}$ for description purpose, where subscript "15m" signifies the duration of 15 min; and i = 1, 2, …, 57, signifies the gauge). For a given observation year, the element value of $\tilde{X}_{15m,i}$ was computed as the maximum of the observed values (at gauge i) within this year. In addition, for each of the other eleven durations of longer than 15 min, the durational precipitation time series was formulated based on the missing-filled 15-min precipitation time series: the interval values of the durational time series was computed as accumulation (from beginning of the record) of the observed values of 15-min precipitation the duration apart. For instance, for the duration of 30 min, the first value of the 30-min precipitation time series was computed as the summation of first two observed values of the corresponding 15-min precipitation time series, the second value of the 30-min precipitation time series was computed as the summation of third and fourth observed values of the 15-min precipitation time series, and so on. For the duration of 72 h, the first value of the 72-h precipitation time series was computed as the summation of first 288 (= $72 \times 60 \div 15$) values of the15-min precipitation time series. As a result, eleven more time series, which respectively have durations of 30 and 45 min and 1, 2, 3, 4, 6, 12, 24, 48 and 72 h, were formulated for the rain gauge. Further, for each of the eleven time series and for a given observation year, the annual maximum durational precipitation is computed. This generated another eleven datasets of annual maximum durational precipitation for gauge i, namely $\tilde{X}_{30m,i}$, $\tilde{X}_{45m,i}$, $\tilde{X}_{1h,i}$, $\tilde{X}_{2h,i}$, $\tilde{X}_{3h,i}$, $\tilde{X}_{4h,i}$, $\tilde{X}_{6h,i}$, $\tilde{X}_{12h,i}$, $\tilde{X}_{24h,i}$, $\tilde{X}_{48h,i}$, and $\tilde{X}_{72h,i}$.

Table 4.2. The 57 rain gauges and their climatic-physiographic zones.

Gauge Name	ID	Begin Date	End Date	Elevation (m)	Mean Annual Precipitation (mm)[1]	Divisions	Zone
Painter 2 W	446475	5/2/1971	9/30/2012	9.1	1121.79	CD1-PGD1	CPZ01
CPZ01Wakefield 1 NW	448800	5/31/1985	2/28/2013	34.4	1204.72	CD1-PGD1	
Williamsburg 2 N	449151	5/2/1971	2/28/2013	21.3	1236.35	CD1-PGD1	
Stony Creek 2 N	448129	5/2/1974	4/30/1985	32	1193.04	CD1-PGD2	CPZ02
Blackstone Water Wor	440778	5/3/1971	3/31/1974	128	1133.95	CD2-PGD2	CPZ04
Bremo Bluff	440993	7/31/1986	2/28/2013	68.6	1087.75	CD2-PGD2	
Camp Pickett	441322	3/31/1974	2/28/2013	100.6	1169.42	CD2-PGD2	
Columbia 2 SSE	441929	5/7/1971	5/31/1986	88.4	1000.32	CD2-PGD2	
Farmville 2 N	442941	7/31/2009	12/31/2012	137.2	1126.24	CD2-PGD2	
Fredericksburg 2	443200	8/31/1978	2/28/1993	36.6	1044.51	CD2-PGD2	
Fredericksburg National Park	443192	5/2/1971	8/31/1978	27.4	1044.51	CD2-PGD2	
John H Kerr Dam	444414	5/7/1971	2/28/2013	76.2	1103.5	CD2-PGD2	
Altavista	440166	12/31/1983	2/28/2013	161.2	1118.11	CD3-PGD2	CPZ05
Chatham	441614	5/6/1971	2/28/2013	198.4	1149.6	CD3-PGD2	

Table 4.2. Continuous ……

North Garden	446178	5/31/1971	2/29/1992	209.1	1129.46	CD3-PGD2	
Philpott Dam 2	446692	5/6/1971	5/31/2009	342.3	1278.38	CD3-PGD2	
Randolph 5 NNE	447025	5/12/1971	1/31/1984	107	1077.36	CD3-PGD2	
Rocky Mount	447338	5/6/1971	2/28/2013	400.8	1189.74	CD3-PGD2	
Woolwine 4 S	449272	12/31/1983	2/28/2013	457.2	1293.88	CD3-PGD2	
Bedford	440561	1/31/1996	2/28/2013	374.3	1122.68	CD3-PGD3	CPZ06
Montebello Fish Hatchery	445690	4/30/1971	8/31/2007	812.9	1125.29	CD3-PGD3	
Culpeper Riverside Coast Guard	442159	7/1/1979	12/31/2003	79.2	1046.62	CD4-PGD2	CPZ07
Elkwood 6 SE	442729	6/4/1972	6/2/1984	100	1045.29	CD4-PGD2	
Piemont Research Station	446712	5/7/1971	2/28/2013	158.5	1112.9	CD4-PGD2	
Remington 2	447130	7/7/1979	2/28/1989	85.3	1120.14	CD4-PGD2	
Richardsville	447164	6/30/1984	4/30/1987	105.2	1044.08	CD4-PGD2	
The Plains 2 NNE	448396	5/1/1971	9/30/2004	161.5	1118.87	CD4-PGD2	
Big Meadows	440720	5/2/1971	7/31/1976	1079	1385.19	CD4-PGD3	CPZ08
Mount Weather	445851	5/2/1971	1/31/1987	505.7	1099.57	CD4-PGD3	
Edinburg	442663	6/30/1996	3/31/1999	282.9	896.11	CD4-PGD4	CPZ09
Front Royal	443229	1/1/1979	3/31/1990	283.5	1039.37	CD4-PGD4	
Star Tannery	448046	5/2/1972	1/31/2012	289.6	1023.62	CD4-PGD4	
Strasburg 2 ESE	448149	12/31/1978	4/30/1984	195.1	1068.64	CD4-PGD4	
Cobington Filter Plant	442044	12/31/1972	8/31/2011	374.9	952.75	CD5-PGD4	CPZ10
Dale Enterprise	442208	9/11/1978	1/31/2009	413.9	922.02	CD5-PGD4	
Gathright Dam	443310	12/31/1983	2/28/2013	539.5	986.54	CD5-PGD4	
Hot Springs	444128	9/4/1970	8/31/2011	681.5	1097.41	CD5-PGD4	
Lynnwood	445142	9/30/1983	12/1/1983	309.1	938.17	CD5-PGD4	
Mc Gaheysville 2 S	445423	4/30/1971	11/30/1983	331.9	1149.6	CD5-PGD4	
Millgap 2 NNW	445595	9/1/1976	2/28/2013	737.9	1124.71	CD5-PGD4	
Mustoe 1 SW	445880	6/30/1982	10/28/2007	725.4	1135.89	CD5-PGD4	
Staunton Water Treatment Plant	448062	12/31/1972	8/31/2007	51.5	989.96	CD5-PGD4	
Stuarts Draft	448172	5/1/1979	5/29/1984	442	1058.43	CD5-PGD4	
Williamsburg 2 S	449159	7/1/1978	8/31/2011	499.9	1029.32	CD5-PGD4	
Galax Water Plant	443272	4/1/1972	2/28/2013	719.3	1005.84	CD6-PGD3	CPZ11
Indian Valley	444246	4/30/1973	9/30/1993	823	1063.93	CD6-PGD3	
Trout Dale 3 SSE	448547	3/31/1974	2/28/2013	865.3	1077.98	CD6-PGD3	
Willis	449169	9/30/1993	2/28/2013	856.5	1144.78	CD6-PGD3	
Blacksburg National Weather	440766	3/31/2003	2/28/2013	604.1	1060.7	CD6-PGD4	CPZ12

Table 4.2. Continuous ……

Pulaski	446955	4/1/1972	2/28/2013	563.9	949.2	CD6-PGD4	
Staffordsville 3 ENE	448022	11/30/1993	2/28/2013	594.4	1000.25	CD6-PGD4	
White Gate	449060	12/31/1983	9/30/1993	563.9	965.88	CD6-PGD4	
Wytheville 1 S	449301	12/31/1983	2/28/2013	637.9	968.63	CD6-PGD4	
Davenport 2 NE	442269	12/31/1983	5/31/1986	488	1157.38	CD6-PGD5	CPZ13
Hurley 4 S	444180	3/31/1973	12/31/2009	331.6	1135.39	CD6-PGD5	
John Flannagan Lake	444410	12/31/1983	11/30/1991	445	1144.02	CD6-PGD5	
Wise 3 E	449215	12/31/1983	2/28/2013	776.9	1206.25	CD6-PGD5	

[1] The black number is the average of the values from https://www.ncei.noaa.gov/data/climate-normals-deprecated/access/clim20/va and https://www.ncdc.noaa.gov/cdo-web/datatools/normals and when both present the mean annual precipitations, whereas, it is the value from one of these two websites whichever presents the mean annual precipitation. On the other hand, the red number is from der Leeden (1994).

Table 4.3. Groups of the neighboring rain gauges (signified by their IDs) for filling missing values.[1]

Group 01: 443229, 448149, 448046, 442663, 445851, 442208, 440720, 446712, 442159, 447164, 442729, 447130, 445423	Group 02: 445851, 448149, 448046, 443229	Group 03: 442663, 448149, 448046, 443229, 440720, 442208	Group 04: 445142, 445423, 442208, 440720, 448062	Group 05: 440720, 445142, 445423, 446712
Group 06: 448062, 448172, 445690, 445142, 445423, 446178	Group 07: 446178, 445142, 448172, 448062, 440993, 445423, 445690, 441929	Group 08: 445690, 446178, 448172, 448062, 449159	Group 09: 445595, 445880, 449159, 443310, 444128,	Group 10: 442044, 443310, 444128, 445595, 445880, 445690, 449159
Group 11: 440766, 446955, 448022, 449060, 444246, 449169, 449301, 443272	Group 12: 449301, 449060, 446955, 443272, 448547	Group 13: 444246, 449169, 440766, 446955, 449272	Group 14: 443272, 446955, 444246, 449169, 449301, 448547	Group 15: 446692, 449272, 444246, 449169, 447338
Group 16: 447338, 446692, 449272, 441614	Group 17: 441614, 440166, 447338, 446692	Group 18: 440561, 440166, 447338	Group 19: 440166, 440561, 441614, 447338, 447025	Group 20: 448547, 446955, 449301, 443272
Group 21: 447025, 440778, 444414, 440166, 442941	Group 22: 440778, 441322, 447025, 444414, 442941, 448129	Group 23: 448129, 440778, 441322, 448800, 444414, 449151	Group 24: 448800, 440778, 441322, 448129, 449151, 444414	Group 25: 449151, 446475, 448129, 448800, 440778, 441322
Group 26: 446475, 449151	Group 27: 442159, 442729, 443192, 443200, 447130, 447164, 446712	Group 28: 446712, 442159, 440720, 442729, 447164, 447130, 440993	Group 29: 444414, 440778, 447025, 441322	Group 30: 442941, 447025, 440993, 441322
Group 31: 440993, 441929, 442941, 446178, 446712	Group 32: 442269, 444410, 444180, 449215, 446955, 449301, 448547	Group 33: 448396, 448149, 447130, 443229, 445851, 442729, 448046		

[1] In a given group, a rain gauge highlighted in red was filled by the other rain gauges of this group.

4.2.2.2 The RCMs predicted precipitation

The predicted historic (i.e., pre-2013) and future (i.e., 2038 ~ 2070) data on regional precipitation at a 3-h time interval and a 50-km spatial resolution were downloaded from the North American Regional Climate Change Assessment Program (NARCCAP) website http://www.narccap.ucar.edu. To date, NARCCAP has generated twelve different dynamically downscaled datasets (Table 4.4), and all twelve datasets of precipitation for the grids (Figure 4.3) that cover Virginia were used in this study. The time series of precipitation were extracted from the NARCCAP ".nc" files using a computer program written in r language by the study team. The extracted time series were stored in plain text files, which in turn were uploaded into Excel® spreadsheets for spatial and temporal downscaling.

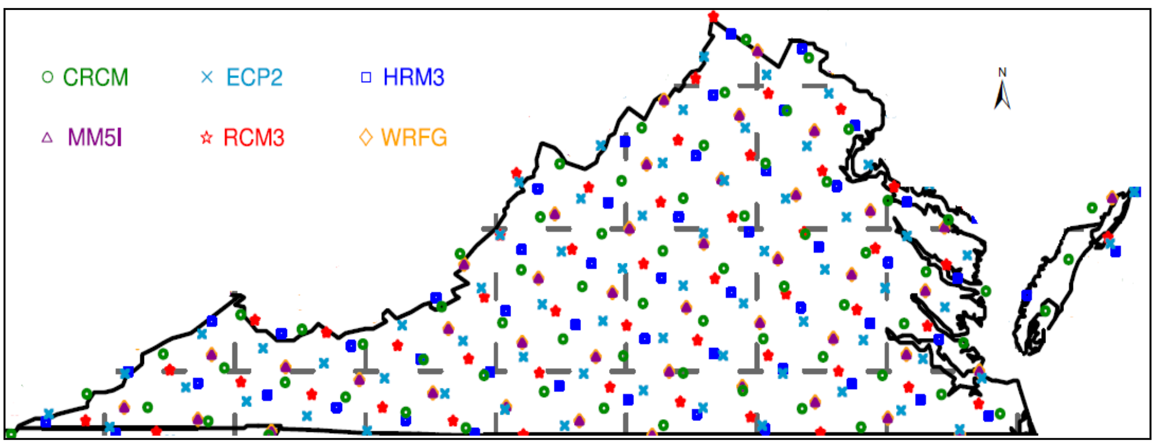


Figure 4.3. The centers of each 50-km grid cell for the six RCMs (not drawn to a scale). (Source: http://www.narccap.ucar.edu/data/gridpoint-maps.html)

Table 4.4. The twelve dynamically downscaled datasets by NARCCAP.

Dataset	Regional Climate Model (RCM)	General Circulation Model (GCM)
1	CRCM	CCSM
2		CGCM3
3	ECP2	GFDL
4		HadCM3
5	HRM3	GFDL
6		HadCM3
7	MM5I	CCSM
8		HadCM3
9	RCM3	CGCM3
10		GFDL
11	WRFG	CCSM
12		CGCM3

4.2.2.3 The watershed-level data

The National Hydrography Dataset (NHD) (i.e., hydrography) was downloaded from the USGS website http://viewer.nationalmap.gov/viewer. NHD is a comprehensive set of digital spatial data about surface water features (e.g., rivers) (USGS, 2001a, b). This study used the 8-digit hydrologic cataloging units (HUCs) or watersheds presented by the NHD. Totally, there are 53 such HUCs in Virginia (Figure 4.4). The 8-digit HUCs were selected because the relevant data are publicly available and because primary water management projects and practices have been implemented at such a spatial scale. The in gauges within and adjacent to a HUC were used to calculate the areal precipitation, which in turn was used to develop the watershed-level IDF curves.

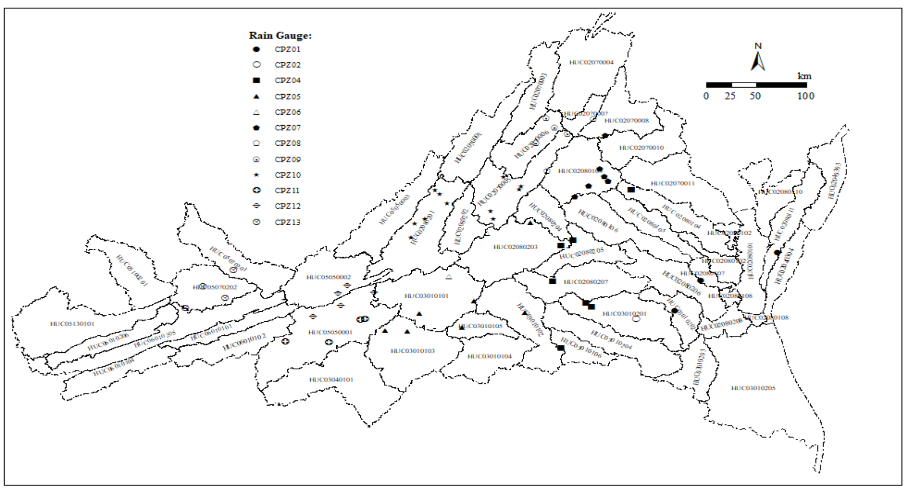


Figure 4.4. The 53 U.S. Geological Survey (USGS) 8-digit hydrologic cataloging units (HUCs) in Virginia, superimposed by the 57 rain gauges with 15-min rainfall data.

4.2.3 Methods

This subsection elaborates the methods for selection of best statistical distributions, development of historic IDF curves of the RCMs' predictions, and development of probability-based IDF curves. In terms of practical applications (Viessman and Lewis, 2003), this study chose twelve durations, including 15 min, 30 min, 45 min, 1, 2, 3, 4, 6, 12, 24, 48, and 72 h, and nine return periods, including 2-, 5-, 10-, 25-, 50-, 100-, 200-, 500-, and 1000-year, for the historic and next-generation IDF curves. Figure 4.5 shows the framework of the methods.

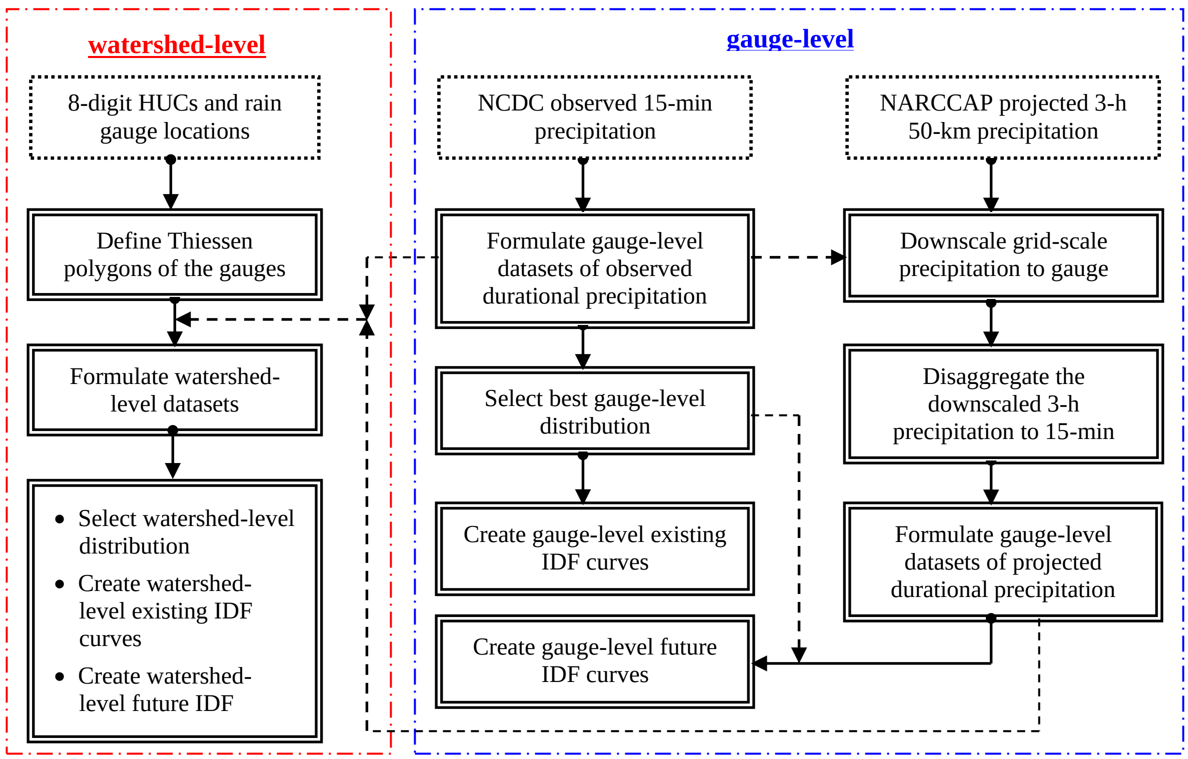


Figure 4.5. The sequential relationships among elements of the methods developed and used in this study. HUC: Hydrologic Cataloging Unit; IDF: intensity-duration-frequency; NCDC: National Climate Data Center; and NARCCAP: North American Regional Climate Change Assessment Program.

4.2.3.1 Selection of best statistical distributions

For each of the 57 rain gauges, when statistically significant (at a significance level of α = 0.05) step changes and/or trends were detected as stated in Chapter 2, each of the twelve datasets might be subdivided into two or more subdatasets at the change and/or trend start years, depending on whether the dataset was non-homogenous in terms of the homogeneity test discussed in section 4.3.1. For each of the twelve datasets, it was sorted in descending order and then assigned consecutive ranks from one to n_i (the number of record years at station i). The empirical frequency at which a given durational precipitation is equaled or exceeded was computed using the Weibull formula (USDA-SCS, 1968; NOAA, 1986) as the ratio of rank to (n_i +1). Subsequently, three commonly used distributions, namely Gumbel (Gumbel, 1958), Fréchet (Fréchet, 1927), and Weibull (Weibull, 1951), were tentatively fitted to the Weibull positioning points for the whole record period as well as the periods of the subdatasets. Based on the goodness of fit as measured by visualization plot and Kolmogorov-Smirnov (i.e., K-S) test (Massey, 1951; Neter et al., 1996), a best distribution was selected. Herein, it was hypothesized that the best distribution is independent of step change, trend, and return period, but the best distribution can be different by gauge. On the other hand, for each of the rain gauges with a record period of shorter than 30 years, its twelve whole datasets were used to compute Weibull points, to which the three distributions were tentatively fitted to select a best distribution for this gauge. If the K-S test rejects all three distributions, in terms of the visualization plot, the distribution that is closest to the empirical Weibull points was judged to be best. Otherwise, the best distribution was the one that was most significant as indicated by the K-S test. The fitting of the distributions and the K-S tests were implemented by creating VBA programs in Microsoft® Excel 2010. As a result, a best distribution and a set of existing IDF curves were determined for each of the rain gauges.

The Gumbel distribution computes the chance for a rainfall (X_p) to be equaled or exceeded as (Gumbel, 1958):

$$P\left(x \geq X_p\right) = 1 - e^{-e^{-b}} \tag{4.2}$$

$$b = \frac{1}{0.7797 \cdot s} \cdot \left(X_p - \overline{x} + 0.45 \cdot s \right) \tag{4.3}$$

where $\overline{x}$ and s, respectively, are the mean and standard deviation of observed rainfall extreme values for a duration of interest.

The Fréchet distribution computes the chance for a rainfall (X_p) to be equaled or exceeded as (Fréchet, 1927):

$$P\left(x \geq X_p \right) = 1 - e^{-\left(\frac{X_p - m}{S_s} \right)^{-\alpha}} \tag{4.4}$$

where m, S_s, and α (> 1) are three parameters, and can be estimated by solving Equations (4.5) to (4.7) simultaneously.

$$\overline{x} = m + S_s \cdot \left[\Gamma\left(1 - \frac{1}{\alpha} \right) \right] \tag{4.5}$$

$$x_m = m + \frac{S_s}{\sqrt[\alpha]{\ln(2)}} \tag{4.6}$$

$$s = \left(S_s \right)^2 \cdot \left\{ \Gamma\left(1 - \frac{2}{\alpha} \right) - \left[\Gamma\left(1 - \frac{1}{\alpha} \right) \right]^2 \right\} \tag{4.7}$$

where $\overline{x}$, x_m, and s, respectively, are the mean, median, and standard deviation of observed rainfall extreme values for a duration of interest; and Γ( ) is gamma function (Neter et al., 1996).

The Weibull distribution computes the chance for a rainfall (X_p) to be equaled or exceeded as (Weibull, 1951):

$$P\left(x \geq X_p \right) = e^{-\left(\frac{X_p}{\lambda} \right)^{k}} \tag{4.8}$$

where λ and k are two positive parameters and can be estimated by solving Equations

(4.9) and (4.10) simultaneously.

$$\bar{x} = \lambda \cdot \left[\Gamma\left(1 + \frac{1}{k}\right) \right] \tag{4.9}$$

$$s = \lambda^2 \cdot \left\{ \Gamma\left(1 + \frac{2}{k}\right) - \left[\Gamma\left(1 + \frac{1}{k}\right) \right]^2 \right\} \tag{4.10}$$

where $\bar{x}$ and s, respectively, are the mean and standard deviation of observed rainfall extreme values for a duration of interest.

The K-S test is based on an empirical distribution function (ECDF). Given N data points $X_1, X_2, ..., X_N$ that are sorted in ascending order (i.e., from smallest to largest), the ECDF is defined as:

$$F_n\left(x \le X_i\right) = \frac{n_i}{N} \tag{4.11}$$

where n_i is the number of points less than X_i.

The null hypothesis is that the data follow a specified distribution (e.g., Gumbel, Fréchet, or Weibull), while the alternative hypothesis is that the data do not follow the specified distribution. Figure 4.6 is an example plot of the ECDF with a Gumbel cumulative distribution function for 100 normal random numbers. The K-S test is based on the maximum distance between these two curves (Massey, 1951).

The K-S test statistic is defined as:

$$D_n = \max\left|F_n\left(x \le X_i\right) - F\left(x \le X_i\right)\right| \quad (i = 1, 2, ..., N) \tag{4.12}$$

where F( ) is the theoretical cumulative density function of the specified distribution.

The K-S goodness-of-fit is tested by using critical values of the Kolmogorov distribution. The null hypothesis is rejected at a significance level of $\alpha = 0.05$ if:

$$D_n > K_\alpha \tag{4.13}$$

where K_α can either be found from Table 4.5 or determined using the cumulative function of the Kolmogorov distribution expressed as (Wikipedia, 2014):

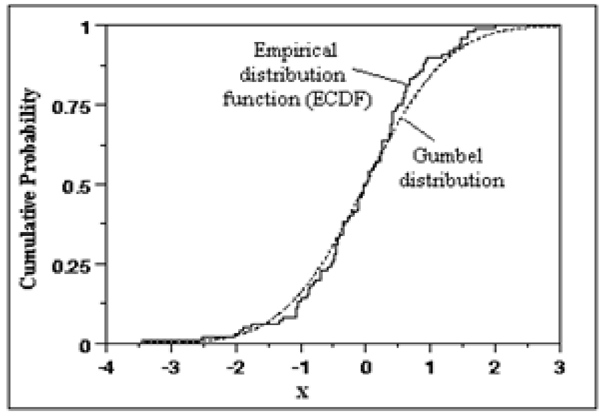


Figure 4.6. An example ECDF and Gumbel

$$\Pr(K \le K_\alpha) = 1 - \alpha = \frac{\sqrt{2\pi}}{K_\alpha} \cdot \sum_{j=1}^{\infty} e^{-\frac{(2j-1)^2 \cdot \pi^2}{8K_\alpha^2}} \tag{4.14}$$

Table 4.5. The critical value, K_α, of the Kolmogorov distribution.

Sample Size N	K_α	Sample Size N	K_α	Sample Size N	K_α	Sample Size N	K_α
1	0.975	11	0.391	21	0.287	31	0.238
2	0.842	12	0.375	22	0.281	32	0.234
3	0.708	13	0.361	23	0.275	33	0.231
4	0.624	14	0.349	24	0.269	34	0.227
5	0.563	15	0.338	25	0.264	35	0.224
6	0.519	16	0.327	26	0.259	36	0.221
7	0.483	17	0.318	27	0.254	37	0.218
8	0.454	18	0.309	28	0.250	38	0.215
9	0.430	19	0.301	29	0.246	39	0.213
10	0.409	20	0.294	30	0.242	40	0.210

4.2.3.2 Development of Gauge-Level historic IDF Curves

For each of the 57 rain gauges, the historic IDF curves were developed using the best statistical distribution. To consider the possible non-stationarity resulting from climate change, based on the trend analysis results, the time series of annual maximum precipitation might be subdivided into several subseries, each of which had invariant statistics of mean, median, and standard deviation. However, if the time series had a sample size of $N < 10$ years, it was not subdivided. The development was implemented using VBA programs in Excel® 2010. Subsequently, the IDF curves were visually compared with the NOAA Atlas 14 Point Precipitation Frequency Estimates downloaded at https://hdsc.nws.noaa.gov/hdsc/pfds.

4.2.3.3 Spatially downscaling of the RCMs' predictions

As shown in Figure 4.3, the centers of the 50-km grids are different for the six RCMs. For each RCM, its grid layer was overlaid with the layer of the rain gauges (Figure 4.2b) in ArcMap® to identify the four grids surrounding each gauge. Subsequently, the geographic distances from the four grid centers to the rain gauge were calculated. At a given time, the RCM's predictions for the four grids were averaged using the inverses of the distances as the weights, resulting in a spatially-averaged 3-h prediction. In addition, for each of the 57 rain gauges, the observed (formulated) 3-h time series $\tilde{X}_{3h,i}$ was regressed on the synchronic spatially-averaged 3-h time series. That is, the regression was done for the record period of the gauge using the synchronically paired values of observed and spatially-averaged 3-h precipitation. Further, taking the spatially-averaged 3-h precipitations from 2038 to 2070, this regression equation was used to generate a 3-h precipitation time series at this gauge for this future period (i.e., downscale the projected precipitation). The regressions and computations were executed in Excel® 2010.

4.2.3.4 Disaggregating spatially-downscaled precipitation

For each of the 57 rain gauges and for each of the six RCMs, the two spatially-downscaled 3-h precipitation time series, one for the record period and another for the future period, were used to generate two datasets of annual maximum 3-h precipitation, namely $\tilde{Y}_{3h,i}$ and $\tilde{Z}_{3h,i}$, respectively.

To generate the annual maximum precipitation time series of 15, 30 and 45 min, and 1, 2 and 4 h (designated $\tilde{Y}_{15m,i}$, $\tilde{Y}_{30m,i}$, $\tilde{Y}_{45m,i}$, $\tilde{Y}_{1h,i}$, $\tilde{Y}_{2h,i}$, and $\tilde{Y}_{4h,i}$ for the record period, and $\tilde{Z}_{15m,i}$, $\tilde{Z}_{30m,i}$, $\tilde{Z}_{45m,i}$, $\tilde{Z}_{1h,i}$, $\tilde{Z}_{2h,i}$, and $\tilde{Z}_{4h,i}$ for the future period), $\tilde{X}_{15m,i}$, $\tilde{X}_{30m,i}$, $\tilde{X}_{45m,i}$, $\tilde{X}_{1h,i}$, $\tilde{X}_{2h,i}$, and $\tilde{X}_{4h,i}$ were separately regressed over $\tilde{X}_{3h,i}$ and then use $\tilde{Y}_{3h,i}$ and $\tilde{Z}_{3h,i}$ in the responding regression equations to get the responding time series. Herein, it was assumed that the regression equations were held regardless of the climatic conditions (Menabde *et al.*, 1999; Socolofsky *et al.*, 2001; Chang and Hiong, 2013; Mirhosseini *et al.*, 2013). The regressions were implemented by each of the climatic-physiographic zones shown in Figure 4.2. For example, to regress $\tilde{X}_{15m,i}$ over $\tilde{X}_{3h,i}$ for CPZ01 (Table 4.1), the time series of $\tilde{X}_{15m,i}$ at the three rain gauges within this zone were pooled together into one 15-min dataset, while the time series of $\tilde{X}_{3h,i}$ at these same three rain gauges were pooled together into one 3-h dataset. To capsulate the datasets, if one value in the 3-h dataset corresponds to two or more values in the 15-min dataset, the arithmetic average, median, 75th percentile, and maximum of the multiple values were calculated, resulting in five capsulated datasets: one for 3-h and four for 15-min. The four capsulated 15-min datasets were separately regressed over the capsulated 3-h dataset. The regression equation with a largest coefficient of determination (R^2) was chosen as the relationship between $\tilde{X}_{15m,i}$ and $\tilde{X}_{3h,i}$, and adopted to generate $\tilde{Y}_{15m,i}$ and $\tilde{Z}_{15m,i}$. Both linear and nonlinear equations as well as piecewise regressions were tried to best fit the data.

On the other hand, to generate the annual maximum precipitation time series of 6, 12, 24, 48, and 72 h (designated $\tilde{Y}_{6h,i}$, $\tilde{Y}_{12h,i}$, $\tilde{Y}_{24h,i}$, $\tilde{Y}_{48h,i}$, and $\tilde{Y}_{72h,i}$ for the record period, and $\tilde{Z}_{6h,i}$, $\tilde{Z}_{12h,i}$, $\tilde{Z}_{24h,i}$, $\tilde{Z}_{48h,i}$, and $\tilde{Z}_{72h,i}$ for the future period), the accumulation procedure discussed in section 4.2.2.1 was applied to $\tilde{Y}_{3h,i}$ and $\tilde{Z}_{3h,i}$, respectively.

As a result, for each rain gauge and each RCM, twelve time series ($\tilde{Y}_{15m,i}$, $\tilde{Y}_{30m,i}$, $\tilde{Y}_{45m,i}$, $\tilde{Y}_{1h,i}$, $\tilde{Y}_{2h,i}$, $\tilde{Y}_{3h,i}$, $\tilde{Y}_{4h,i}$, $\tilde{Y}_{6h,i}$, $\tilde{Y}_{12h,i}$, $\tilde{Y}_{24h,i}$, $\tilde{Y}_{48h,i}$, and $\tilde{Y}_{72h,i}$) were generated for the record period and another twelve time series ($\tilde{Z}_{15m,i}$, $\tilde{Z}_{30m,i}$, $\tilde{Z}_{45m,i}$, $\tilde{Z}_{1h,i}$, $\tilde{Z}_{2h,i}$, $\tilde{Z}_{3h,i}$, $\tilde{Z}_{4h,i}$, $\tilde{Z}_{6h,i}$, $\tilde{Z}_{12h,i}$, $\tilde{Z}_{24h,i}$, $\tilde{Z}_{48h,i}$, and $\tilde{Z}_{72h,i}$) were generated for the future period. Totally, 16,416 (= 57 gauges * 12 RCMs * 24 time series per gauge per RCM) datasets were generated. Again, all regressions and computations were executed in Excel® 2010.

4.2.3.5 Development of gauge-level future IDF Curves

To consider possible non-stationarity, the approach discussed in section 4.2.3.1 was used to detect any step changes and/or trends in $\tilde{Y}$ and $\tilde{Z}$. Again, the null hypothesis was that for a rain gauge, the step changes and/or trends (if any) were independent of duration. If statistically significant step changes and/or trends were detected, each of the twenty-two $\tilde{Y}$ and $\tilde{Z}$ datasets might be subdivided into two or more subdatasets at the change and/or trend start years. Nevertheless, whether the dataset was subdivided was also dependent on the homogeneity test discussed in section 4.2.3.8. For each of the eleven $\tilde{Y}$ datasets, it was sorted in descending order and then assigned consecutive ranks from one to n_i (the number of record years at gauge i). The empirical frequency at which a given durational precipitation is equaled or exceeded was computed using the Weibull formula as the ratio of rank to (n_i +1). Subsequently, the Fréchet, Weibull, and Gumbel distributions were tentatively fitted to the Weibull points for the whole record period as well as the periods of the subdatasets. Based on the goodness of fit, a best distribution was selected. Similarly, analyses of step changes and/or trends in $\tilde{Z}$ were conducted and a best distribution was selected by gauge. Herein, the null hypothesis was that the best distributions selected using $\tilde{Y}$ and $\tilde{Z}$ were same as the one selected using $\tilde{X}$ for a given rain gauge. Further, in terms of the best distribution (determined above) for this rain gauge, the datasets $\tilde{Y}$ were used to create a set of IDF curves (designated $\tilde{Y}$IDF for description purpose), while the datasets $\tilde{Z}$ were used to create another set of IDF curves (designated $\tilde{Z}$IDF for description purpose).

4.2.3.6 Development of gauge-level probability-based IDF Curves

The above sequential analyses, including regression, downscaling, disaggregating, detection of step changes and trends, selection of best distribution, and creation of IDF curves, were repeated for each of the 16,416 datasets. As a result, for a given rain gauge, twelve sets of $\tilde{Y}$IDF curves and another twelve sets of $\tilde{Z}$IDF curves were generated. The twelve sets of $\tilde{Y}$IDF curves were compared with the historic IDF curves (created in section 4.2.3.3 using $\tilde{X}$) to determine the lower and upper bounds of bias correction factor by return period (Liew *et al.*, 2013) (Figure 4.7a). By assuming a same distribution, the future IDF curves were determined as the average of the $\tilde{Z}$ IDF curves (created using the datasets of $\tilde{Z}$) as well as the lower and upper bounds (Figure 4.7b), providing a range of future rainfall intensity for a given duration and a return period. Herein, the null hypothesis was that the correction factors would be same regardless of climatic conditions. In addition, for a given duration (e.g., 1 hr) and a given return period (e.g., 50 year), the twelve values of the $\tilde{Z}$IDF curves were used to create a probability curve of the future IDF curve of this duration and this return period. Figure 4.8 illustrates a hypothetical example result of probability-based IDF curves for a given duration. To determine the future design rainfall intensity for a duration and a return period of interest, its mean, minimum, and maximum values can be found from Figure 4.7b, while the probabilities associated with these three values can be determined from Figure 4.8. Such additional range (from minimum to maximum) and probabilities can well represent uncertainties of future climate projections, allowing the use of future IDF curves with more confidence.

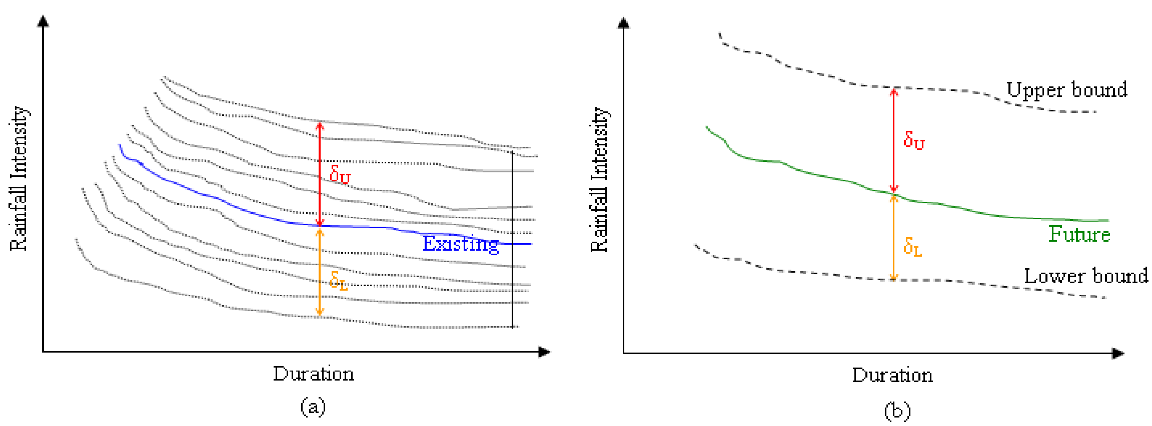


Figure 4.7. Illustration of the: (a) bias correction factors (δ_L and δ_U), and (b) future intensity-duration-frequency (IDF) curve and its range, for a given return period. In (a), the solid-blue line is based on $\tilde{X}$ datasets, while the dot-black lines are based on $\tilde{Y}$ datasets. In (b), the solid-green line (historic IDF curve) is the average of the twelve IDF curves based on $\tilde{Z}$ datasets, and the dash-black lines are upper and lower bounds of the future IDF curve.

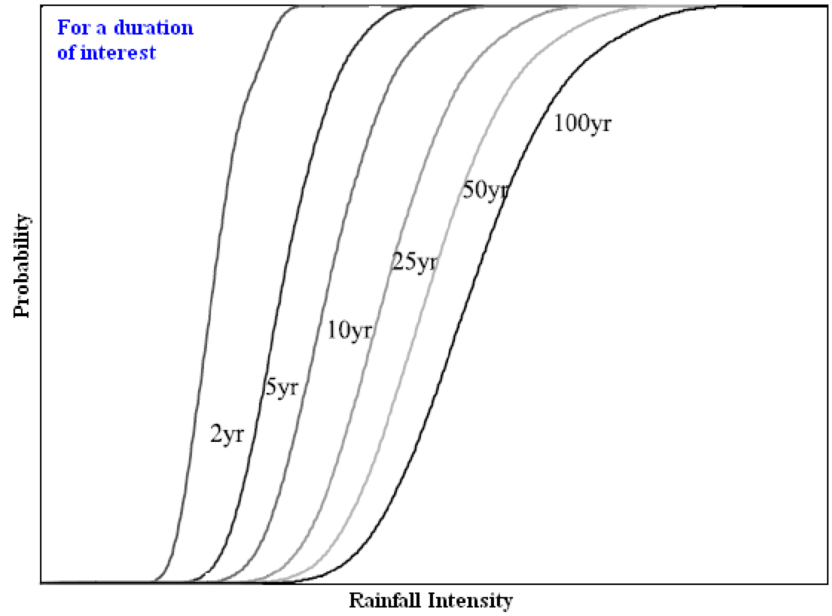


Figure 4.8. Hypothetical probability intensity-duration-frequency (IDF) curves at a rain gauge of interest for a given duration.

The probability curve was developed using the kernel density estimation (KDE) method (Silverman, 1998), a nonparametric way to estimate the probability density function of a random variable based on a finite (i.e., small-size) data sample. The KDE method has been widely used as a viable and flexible alternative to parametric methods in hydrology for estimating probability density function of hydrological variables (e.g., precipitation) (Lall *et al.*, 1996; Sharma *et al.*, 1997). The KDE method estimates the probability for a value x to occur, p(x), as:

$$p(x) = \frac{1}{N \cdot h} \cdot \sum_{i=1}^{n} K\left(\frac{x - x_i}{h}\right) \tag{4.15}$$

where N is the sample size; h is the bandwidth (smoothing parameter); x_i is the i^{th} sample value; and K( ) is the smooth kernel function satisfying $\int_{-\infty}^{\infty} K(y)dy = 1.$

4.2.3.7 Development of watershed-level probability-based IDF Curves

This study used the 8-digit HUCs presented by the NHD in ArcMap® (Wang and Melesse, 2005) to delineate boundaries of the watersheds within the Virginian drainage area of Chesapeake Bay. For each watershed, the rain gauges that are within, or have a Euclidian distance of less than 50 km from, the watershed boundary were used to subdivide the watershed into Thiessen polygons (Viessman and Lewis, 2003). The number of polygons was equal to that of the gauges. Taking polygon-area-weighted averages formulated: 1) twelve observed datasets of annual maximum durational precipitation, designated $W\tilde{X}_{15m,j}$, $W\tilde{X}_{30m,j}$, $W\tilde{X}_{45m,j}$, $W\tilde{X}_{1h,j}$, $W\tilde{X}_{2h,j}$, $W\tilde{X}_{3h,j}$, $W\tilde{X}_{4h,j}$, $W\tilde{X}_{6h,j}$, $W\tilde{X}_{12h,j}$, $W\tilde{X}_{24h,j}$, $W\tilde{X}_{48h,j}$, and $W\tilde{X}_{72h,j}$ for description purpose, where j signifies the watershed; 2) twelve projected datasets of annual maximum durational precipitation for the record period, designated $W\tilde{Y}_{15m,j}$, $W\tilde{Y}_{30m,j}$, $W\tilde{Y}_{45m,j}$, $W\tilde{Y}_{1h,j}$, $W\tilde{Y}_{2h,j}$, $W\tilde{Y}_{3h,j}$, $W\tilde{Y}_{4h,j}$, $W\tilde{Y}_{6h,j}$, $W\tilde{Y}_{12h,j}$, $W\tilde{Y}_{24h,j}$, $W\tilde{Y}_{48h,j}$, and $W\tilde{Y}_{72h,j}$ for description purpose; and 3) twelve projected datasets of annual maximum durational precipitation for the future period, designated $W\tilde{Z}_{15m,j}$, $W\tilde{Z}_{30m,j}$, $W\tilde{Z}_{45m,j}$, $W\tilde{Z}_{1h,j}$, $W\tilde{Z}_{2h,j}$, $W\tilde{Z}_{3h,j}$, $W\tilde{Z}_{4h,j}$, $W\tilde{Z}_{6h,j}$, $W\tilde{Z}_{12h,j}$, $W\tilde{Z}_{24h,j}$, $W\tilde{Z}_{48h,j}$, and $W\tilde{Z}_{72h,j}$ for description purpose. Any missing values for a gauge were filled using the corresponding values at another nearest station. Herein, the basic assumption was that polygon-area-weighted averages can represent areal precipitations of the watershed.

For each watershed, $W\tilde{X}$, $W\tilde{Y}$, and $W\tilde{Z}$ were analyzed using the procedures elaborated in sections 4.2.3.2, 4.2.3.5, and 4.2.3.6 for $\tilde{X}$, $\tilde{Y}$, and $\tilde{Z}$, respectively, resulting in the watershed-level IDF curves with additional ranges and probabilities, as with range-level

IDF curves illustrated in Figures 4.7(b) and 10. The twelve datasets of $W\tilde{X}$ were used to compute Weibull points (NOAA, 1986) for the whole record period. Three distributions (i.e., Fréchet, Weibull, and Gumbel) were tentatively fitted to the Weibull points to select a best distribution for the watershed in terms of goodness of fit and to create a set of historic IDF curves. Herein, the null hypothesis was that the best distribution is independent of return period but can be different by watershed.

Subsequently, in terms of the best distribution for this watershed, the datasets $W\tilde{Y}$ were used to create a set of IDF curves, which in turn were compared with the historic IDF curves to determine lower and upper bounds of bias correction factor. In addition, a similar fitting analysis of $W\tilde{Z}$ was conducted and a best distribution was selected by watershed. Herein, the null hypothesis was that the best distributions selected using $W\tilde{Z}$ is same as the one selected using either $W\tilde{X}$ or $W\tilde{Y}$ for a given watershed. Using this best distribution, the future watershed-level IDF curves were determined as the averages of the IDF curves created using the datasets of $W\tilde{Z}$, plus lower and upper bounds. Moreover, for a given duration and a given return period, the twelve values of the $W\tilde{Z}$-based IDF curves were used in the KED method (discussed in section 4.2.3.6) to create a probability curve of the future IDF curve of this duration and this return period. Again, such an additional range (from minimum to maximum) and probabilities can well represent uncertainties of future climate projections, allowing the use of future IDF curves with more confidence.

4.2.3.8 Homogeneity test of time Series

The development of IDF curves requires that a time series be homogenous and independent. The requirement of independence can be reasonably assumed because the maximum durational precipitation in a year does not depend on the maximum duration precipitation in another year. However, the requirement of homogeneity would become invalid because of climate change. Herein, the homogeneity assures that the values of the time series are from a same population. That is, the mean and standard deviation can be estimated using any subsets of the time series with no difference from a statistical perspective. The homogeneity can be tested based on the cumulative deviations from the mean estimated using the entire time series (Buishand, 1982).

Given the time series of X_1, X_2, ..., X_N, the cumulative deviations, S_k, are computed as:

$$S_k = \sum_{i=1}^{k}\left(X_i - \bar{X}\right) \qquad k = 1, 2, \cdots, N \tag{4.16}$$

where $\bar{X}$ is the mean of the time series.

The test statistics, Q and R, are computed as:

$$Q = \max\left|\frac{S_k}{S_x}\right| \tag{4.17}$$

$$R = \left|\max\left(\frac{S_k}{S_x}\right) - \min\left(\frac{S_k}{S_x}\right)\right| \tag{4.18}$$

where S_x is the standard deviation of the time series.

The homogeneity of a time series is rejected when Q and R are larger than their critical values. Table 4.6 gives the critical values at a significance level of α = 0.05. In this study, if the time series was found to be non-homogenous, it was iteratively subdivided into two or more subsets, each of which is homogenous. However, if the size of a subset is smaller than ten, this subset was pooled together with another subset to assure that the sample size of the pooled subset was larger than ten. In this regard, for the time series, if either Q or R is larger than the responding critical value but not both, it was judged to be homogenous. Subsequently, the IDF curves were developed using the subsets instead of the time series. Moreover, such an approach of homogeneity test and subdivision was applied to both the observed and derived time series.

Table 4.6. The critical values at a significance level of α = 0.05 for test of homogeneity of time series.[1]

Sample Size N	Critical Value of $\frac{Q}{\sqrt{N}}$	Critical Value of $\frac{R}{\sqrt{N}}$
10	1.14	1.28
20	1.22	1.43
30	1.24	1.50
40	1.26	1.53
50	1.27	1.55
100	1.29	1.62
∞	1.36	1.75

[1] Source: Buishand (1982).

4.3 Results and Discussions

4.3.1 Homogeneity Test of Time Series

Among the 300 sets of time series at the 25 rain gauges, only seven time series at gauge 441322, 440166, 448046, and 443310 were found to be non-homogenous (Table 4.7). For gauge 441322, the non-homogenous time series had a duration of 72 h, whereas, for gauge 443310, the non-homogenous time series had a duration of 15 min. Gauge 440166 had three non-homogenous time series with durations of 15, 30, and 45 min, respectively, while gauge 448046 had two non-homogenous time series with durations of 12 and 24 h, respectively. Three non-homogenous time series, including the ones at gauge 441322, 440166 (45 min duration), and 448046 (12 h), were marginally significant because either Q or R was very close to its critical value. For some of the time series, the non-homogeneity was caused by the insignificant trend and/or temporal variation, for the others, however, the non-homogeneity might be attributed to the significant trend. Some significant trends could not switch the time series from being homogenous to non-homogenous (Table 2.1 versus Table 4.7). Through iterations, each of the seven non-homogenous time series was subdivided into two homogenous subsets (Table 4.8), which in turn were used to develop the IDF curves.

4.3.2 The Gauge-Level Best Distributions and Historic IDF Curves

Based on the K-S tests and visualization plots, the best distributions (Table 4.9) for the rain gauges with a record period of more than three years were determined. For each of the seven gauges with a record period of three years or fewer, including gauge 440778, 442269, 442663, 442941, 443200, 445142, and 447164, its best distribution was assumed to be same as that of the geographically closed gauge in a same climatic-physiographic zone (Table 4.2). Herein, a same best distribution was assumed for gauge 440778 and 444414, 442269 and 444410, 442663 and 448149, 442941 and 448149, 443200 and 447164, 445142 and 442208, and 447164 and 442729. Table 4.9 lists the best distributions for the 57 rain gauges.

The K-S test results (see Appendix I of the report) indicated that the time series at most of the rain gauges followed Gumbel and Weibull distributions. The time series at ten gauges, including gauge 440561, 440766, 441929, 442729, 443229, 444246, 448022, 448129, 448172, and 449060, followed all three distributions. For a given rain gauge, the time series of a duration followed either Gumbel and Weibull distributions only or all three distributions. For each of the distributions that were not significant at $\alpha = 0.05$, the summation of the values for D_n (Eq. 4.12) of the twelve durations was computed. The best distribution of this rain gauge was chosen as the one with a smallest value of the summation. As expected, the best distributions based on the K-S test results were consistent with those based on the visualization plots. Figure 4.9 shows the visualization plots for selected two rain gauges and eight durations. The historic IDF curves for each of the gauges were created using its best distribution and are shown in Figure 4.10 and tabulated in Appendix II of the report.

A visual comparison (not shown to be concise) with the NOAA Atlas 14 Point Precipitation Frequency Estimates (https://hdsc.nws.noaa.gov/hdsc/pfds/index.html) indicated that the ID curves (developed in this study and shown in Figure 4.10) and the PPFEs had a similar shape or pattern. In present, the PPFEs are available for 52 out of the 57 rain gauges. However, at each of the 52 rain gauges, for a given duration and a given return period, the intensity from the IDF curve tended to be larger than that from the responding PPFE curve. Overall, for a given return period, the discrepancies were smaller for a longer (> 1 h) than a shorter duration, whereas, for a given duration, the discrepancies were smaller for a lower than a higher return period. For a return period of 100-year or higher and a duration of 1 h or shorter, the intensities from the IDF curves were almost two to five times larger than those from the PPFEs. The largest discrepancy occurred for a return period of 1000-year and a duration of 15 min. One possible reason is that the data and/or distributions used in this study may be different from those used by NOAA. The actual reasons need to be investigated in a future study.

Table 4.7. Homogeneity tests of the historic annual maximum precipitations at various durations.[1]

Rain Gauge ID	Homogeneity Test Statistics	Duration (min)[2]												Critical Value at $\alpha = 0.05$[3]
		15	30	45	60	120	180	240	360	720	1440	2880	4320	
446475	$Q/\sqrt{N}$	0.96	0.55	0.69	0.72	0.61	0.56	0.48	0.47	0.67	0.91	0.96	0.95	1.258
(N = 39)	$R/\sqrt{N}$	0.98	0.91	1.06	1.09	0.96	0.83	0.80	0.93	1.06	1.12	1.20	1.23	1.527
449151	$Q/\sqrt{N}$	1.17	0.69	0.64	0.62	0.47	0.43	0.65	0.76	0.94	1.01	1.06	1.05	1.258
(N = 39)	$R/\sqrt{N}$	1.36	0.96	1.01	0.98	0.72	0.76	0.74	0.83	1.02	1.08	1.13	1.14	1.527
441322	$Q/\sqrt{N}$	0.98	1.07	1.14	1.17	1.18	1.20	1.16	1.14	1.19	1.25	1.27	**1.29**	1.252
(N = 36)	$R/\sqrt{N}$	1.09	1.25	1.35	1.39	1.36	1.36	1.36	1.35	1.39	1.47	1.51	**1.53**	1.518
444414	$Q/\sqrt{N}$	1.51	1.38	1.24	1.15	1.11	1.02	0.86	0.92	0.86	0.81	0.60	0.57	1.256
(N = 38)	$R/\sqrt{N}$	1.51	1.38	1.24	1.18	1.18	1.13	0.96	0.99	0.95	0.94	1.01	0.97	1.524
440166	$Q/\sqrt{N}$	**1.68**	**1.66**	**1.52**	1.42	1.21	1.15	1.10	1.08	1.46	1.23	1.09	1.09	1.240
(N = 30)	$R/\sqrt{N}$	**1.68**	**1.66**	**1.52**	1.42	1.25	1.20	1.15	1.12	1.47	1.43	1.24	1.30	1.500
441614	$Q/\sqrt{N}$	0.88	0.78	0.76	0.78	0.87	0.72	0.72	0.66	0.97	0.83	0.72	0.74	1.262
(N = 42)	$R/\sqrt{N}$	0.91	0.79	0.83	0.88	0.92	0.74	0.72	0.69	0.97	0.89	0.88	0.98	1.534
446692	$Q/\sqrt{N}$	0.77	0.79	0.84	0.77	0.88	1.00	1.00	1.07	1.17	1.13	1.12	1.12	1.258
(N = 39)	$R/\sqrt{N}$	1.08	1.14	1.21	1.25	1.08	1.20	1.19	1.19	1.21	1.20	1.19	1.17	1.527
447338	$Q/\sqrt{N}$	0.68	0.66	0.60	0.60	0.71	0.71	0.72	0.71	0.77	0.74	0.64	0.59	1.262
(N = 42)	$R/\sqrt{N}$	0.99	1.03	1.03	1.07	1.32	1.36	1.42	1.39	1.29	1.25	1.08	1.05	1.534
449272	$Q/\sqrt{N}$	1.25	1.17	1.13	1.11	1.04	0.93	0.83	0.66	0.53	0.56	0.79	0.58	1.240
(N = 30)	$R/\sqrt{N}$	1.25	1.17	1.13	1.11	1.07	0.96	0.86	0.76	0.74	0.89	1.00	1.02	1.500
445690	$Q/\sqrt{N}$	0.97	0.96	0.95	1.02	1.00	0.96	0.94	0.93	0.77	0.80	0.74	0.69	1.252
(N = 36)	$R/\sqrt{N}$	1.78	1.79	1.79	1.77	1.48	1.20	1.09	0.94	0.86	0.90	0.81	0.79	1.518
446712	$Q/\sqrt{N}$	1.35	1.42	1.40	1.46	1.55	1.53	1.45	1.32	1.29	1.19	1.17	1.21	1.258
(N = 39)	$R/\sqrt{N}$	1.35	1.20	1.18	1.21	1.33	1.34	1.28	1.19	1.27	1.24	1.27	1.29	1.527
448396	$Q/\sqrt{N}$	1.02	0.96	0.95	1.00	1.10	1.18	1.20	1.25	1.07	0.88	1.01	1.08	1.248
(N = 34)	$R/\sqrt{N}$	1.24	1.24	1.16	1.14	1.21	1.31	1.31	1.33	1.15	0.97	1.05	1.15	1.512
448046	$Q/\sqrt{N}$	1.20	1.14	1.10	1.07	1.19	1.22	1.38	1.46	**1.66**	**1.57**	1.41	1.32	1.260

Table 4.7. Continuous……

(N = 40)	$R/\sqrt{N}$	1.40	1.35	1.34	1.31	1.33	1.33	1.45	1.46	**1.66**	**1.57**	1.41	1.32	1.530
442044	$Q/\sqrt{N}$	1.11	1.03	1.03	0.97	1.04	1.07	0.99	1.06	1.09	1.07	1.03	0.95	1.258
(N = 39)	$R/\sqrt{N}$	1.27	1.24	1.30	1.24	1.26	1.27	1.23	1.28	1.26	1.27	1.19	1.15	1.527
442208	$Q/\sqrt{N}$	1.45	1.35	1.29	1.22	1.19	1.09	0.95	0.64	0.76	0.59	0.55	0.75	1.240
(N = 30)	$R/\sqrt{N}$	1.45	1.38	1.34	1.29	1.30	1.36	1.35	1.27	1.11	0.91	0.84	0.99	1.500
443310	$Q/\sqrt{N}$	**1.77**	1.21	0.99	0.82	0.77	0.89	0.88	0.86	0.78	0.80	0.64	0.62	1.240
(N = 30)	$R/\sqrt{N}$	**1.77**	1.21	0.99	0.83	0.77	0.89	0.88	0.86	0.87	0.88	0.91	0.90	1.500
444128	$Q/\sqrt{N}$	0.48	0.47	0.45	0.56	0.68	0.72	0.77	0.76	0.68	0.69	0.58	0.48	1.252
(N = 36)	$R/\sqrt{N}$	0.89	0.86	0.89	1.04	1.07	1.02	0.98	0.91	0.92	0.91	0.88	0.80	1.518
445595	$Q/\sqrt{N}$	0.72	0.74	0.79	0.82	0.90	0.87	0.77	0.81	0.80	0.98	1.14	0.92	1.256
(N = 38)	$R/\sqrt{N}$	0.90	0.89	0.92	0.92	1.01	0.97	0.88	0.95	0.89	0.98	1.14	1.15	1.524
448062	$Q/\sqrt{N}$	0.63	0.60	0.63	0.66	0.70	0.73	0.69	0.60	0.85	0.73	0.80	0.87	1.246
(N = 33)	$R/\sqrt{N}$	0.87	0.92	0.98	1.02	1.16	1.21	1.20	1.13	1.35	1.22	1.31	1.37	1.509

[1] N: sample size; Q: homogeneity test statistics by Eq. (4.17); and R: homogeneity test statistics by Eq. (4.18).
[2] The red statistics is larger than the responding critical value listed in the last column of the table. The time series with the bold red statistics are non-homogenous at a significance level of $\alpha = 0.05$.
[3] Lineally interpolated from Table 4.6

Table 4.8. The homogenous subsets of the seven non-homogenous time series.[1]

Rain Gauge ID	Duration	Time Series Subset	Record Year	Sample Size N	Homogeneity Test Statistics $Q/\sqrt{N}$	Homogeneity Test Statistics $R/\sqrt{N}$	Critical Value at α = 0.05 $Q/\sqrt{N}$	Critical Value at α = 0.05 $R/\sqrt{N}$
441322	72 h	Time Series	1974 to 2014	36	**1.29**	**1.53**	1.252	1.518
		Subset 1	1974 to 1983	10	0.64	1.14	1.140	1.280
		Subset 2	1984 to 2014	26	1.44	1.45	1.232	1.472
440166	15 min	Time Series	1984 to 2013	30	**1.68**	**1.68**	1.240	1.500
		Subset 1	1984 to 1999	16	0.97	0.97	1.188	1.360
		Subset 2	2000 to 2013	14	0.58	0.81	1.172	1.340
	30 min	Time Series	1984 to 2013	30	**1.66**	**1.66**	1.240	1.500
		Subset 1	1984 to 1999	16	0.86	0.86	1.188	1.360
		Subset 2	2000 to 2013	14	0.76	0.81	1.172	1.340
	45 min	Time Series	1984 to 2013	30	**1.52**	**1.52**	1.240	1.500
		Subset 1	1984 to 1999	16	0.44	0.76	1.188	1.360
		Subset 2	2000 to 2013	14	0.72	0.94	1.172	1.340
448046	12 h	Time Series	1972 to 2011	40	**1.32**	**1.82**	1.260	1.530
		Subset 1	1972 to 1999	18	1.58	1.33	1.236	1.486
		Subset 2	2000 to 2011	12	0.92	1.11	1.156	1.310
	24 h	Time Series	1972 to 2011	40	**1.27**	**1.75**	1.260	1.530
		Subset 1	1972 to 1999	18	1.52	1.35	1.236	1.486
		Subset 2	2000 to 2011	12	0.87	1.16	1.156	1.310
443310	15 min	Time Series	1984 to 2013	30	**1.77**	**1.77**	1.240	1.500
		Subset 1	1984 to 1999	16	1.02	1.02	1.188	1.370
		Subset 2	2000 to 2013	14	0.66	1.14	1.240	1.500

[1] Q: homogeneity test statistics by Eq. (4.17); and R: homogeneity test statistics by Eq. (4.18). The critical values are linearly interpolated from Table 4.6. The red statistics is larger than the responding critical value listed in the last column of the table. The time series with the bold red statistics are non-homogenous at a significance level of α = 0.05.

Table 4.9. The best distributions for the 57 rain gauges.[1]

Rain Gauge ID	Duration	Time Series Subset	Record Year	Sample Size N	Homogeneity Test Statistics $Q/\sqrt{N}$	Homogeneity Test Statistics $R/\sqrt{N}$	Critical Value at α = 0.05 $Q/\sqrt{N}$	Critical Value at α = 0.05 $R/\sqrt{N}$
441322	72 h	Time Series	1974 to 2014	36	**1.29**	**1.53**	1.252	1.518
		Subset 1	1974 to 1983	10	0.64	1.14	1.140	1.280
		Subset 2	1984 to 2014	26	1.44	1.45	1.232	1.472
440166	15 min	Time Series	1984 to 2013	30	**1.68**	**1.68**	1.240	1.500
		Subset 1	1984 to 1999	16	0.97	0.97	1.188	1.360
		Subset 2	2000 to 2013	14	0.58	0.81	1.172	1.340
	30 min	Time Series	1984 to 2013	30	**1.66**	**1.66**	1.240	1.500
		Subset 1	1984 to 1999	16	0.86	0.86	1.188	1.360
		Subset 2	2000 to 2013	14	0.76	0.81	1.172	1.340
	45 min	Time Series	1984 to 2013	30	**1.52**	**1.52**	1.240	1.500
		Subset 1	1984 to 1999	16	0.44	0.76	1.188	1.360
		Subset 2	2000 to 2013	14	0.72	0.94	1.172	1.340
448046	12 h	Time Series	1972 to 2011	40	**1.32**	**1.82**	1.260	1.530
		Subset 1	1972 to 1999	18	1.58	1.33	1.236	1.486
		Subset 2	2000 to 2011	12	0.92	1.11	1.156	1.310
	24 h	Time Series	1972 to 2011	40	**1.27**	**1.75**	1.260	1.530
		Subset 1	1972 to 1999	18	1.52	1.35	1.236	1.486
		Subset 2	2000 to 2011	12	0.87	1.16	1.156	1.310
443310	15 min	Time Series	1984 to 2013	30	**1.77**	**1.77**	1.240	1.500
		Subset 1	1984 to 1999	16	1.02	1.02	1.188	1.370
		Subset 2	2000 to 2013	14	0.66	1.14	1.240	1.500

[1] The gauges in bold had a record period of three years or fewer. The best distribution for each of these gauges was assumed to be same as that of an adjacent gauge in a same climatic-physiographic zone.

[2] As shown in Table A.3, the time series for the gauge were non-homogenous and subdivided into two subsets, whose best distributions might be either same or different.

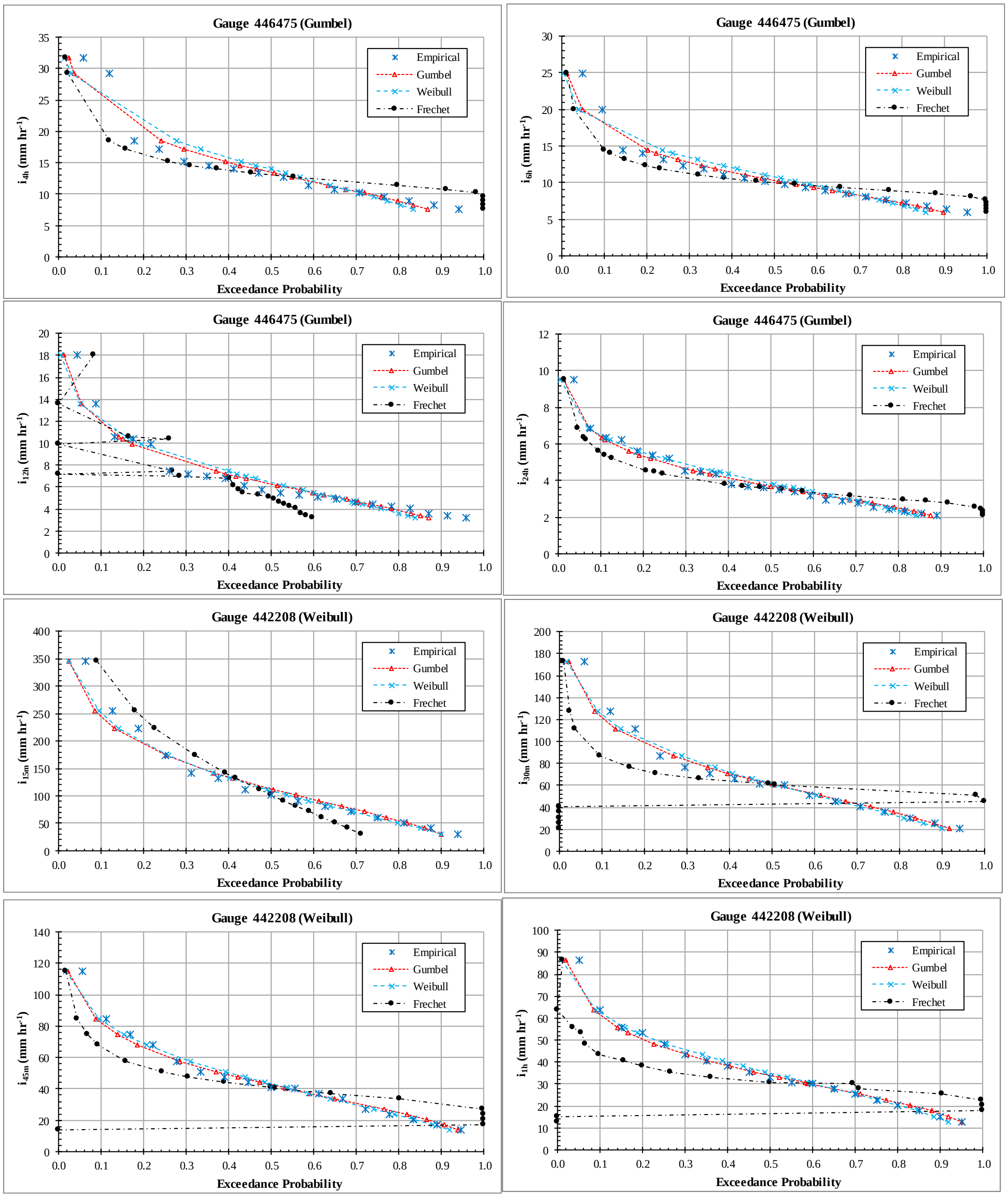


Figure 4.9. The visualization plots for selected two gauges and eight durations. i signifies the intensity for the duration represented by the subscript. The best distribution for gauge 446475 was determined to be Gumbel, whereas, the best distribution for gauge 442208 was determined to be Weibull.

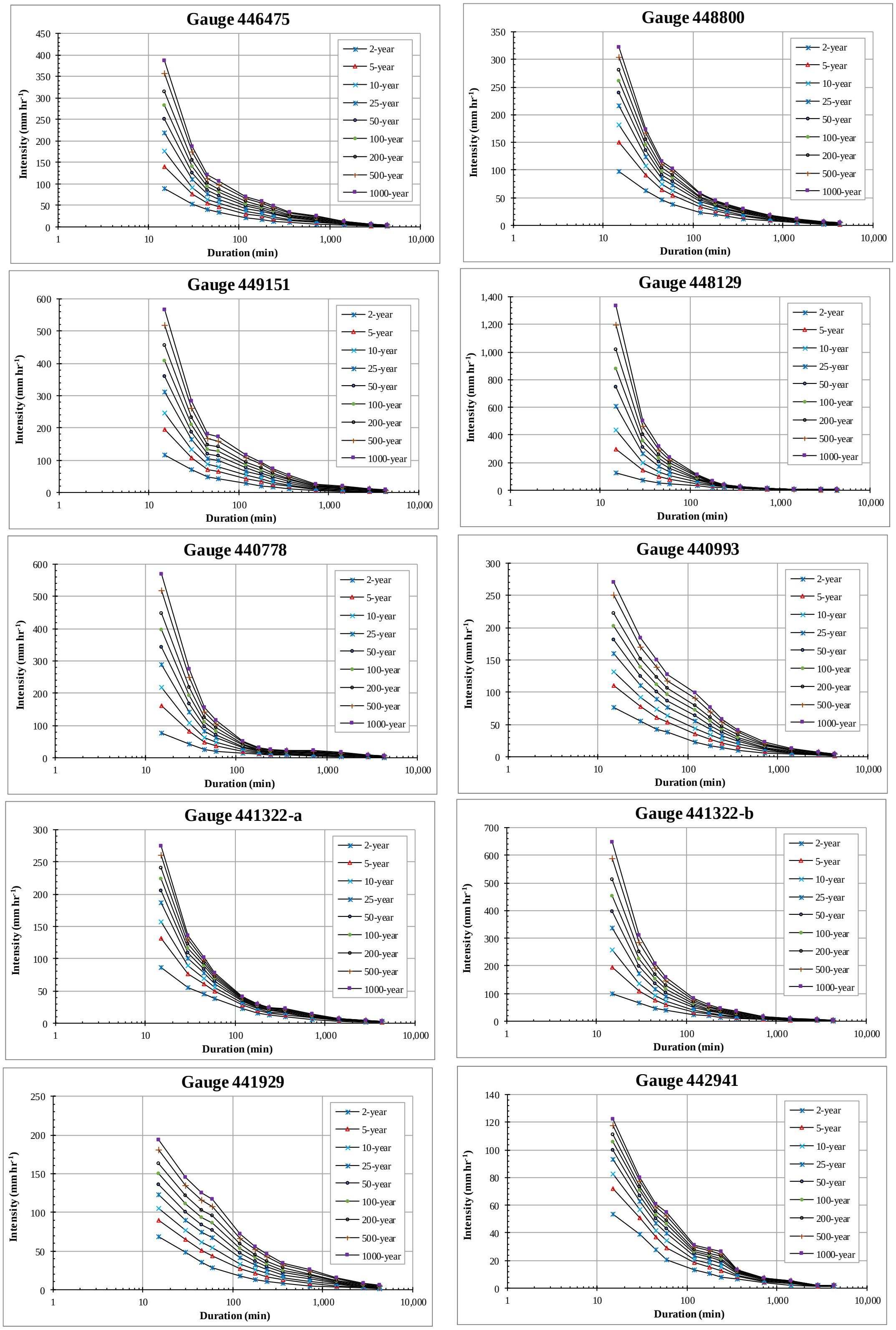


Figure 4.10. The gauge-level historic intensity-duration-frequency (IDF) curves for the 57 rain gauges. Because the time series at gauges 441322, 440166, 448046, and 443310 were non-homogenous, the IDF curves for these four gauges were created for the responding subsets and are signified by -a and -b, respectively.

4.3.3 The Watershed-Level Historic IDF Curves

The Thiessen polygons of the 53 HUCs are shown in Figure 4.11, while the control rain gauge and area of each of the polygons are listed in Table 4.8. The IDF curves are shown in Figure 4.12 and tabulated in Appendix III of the report.

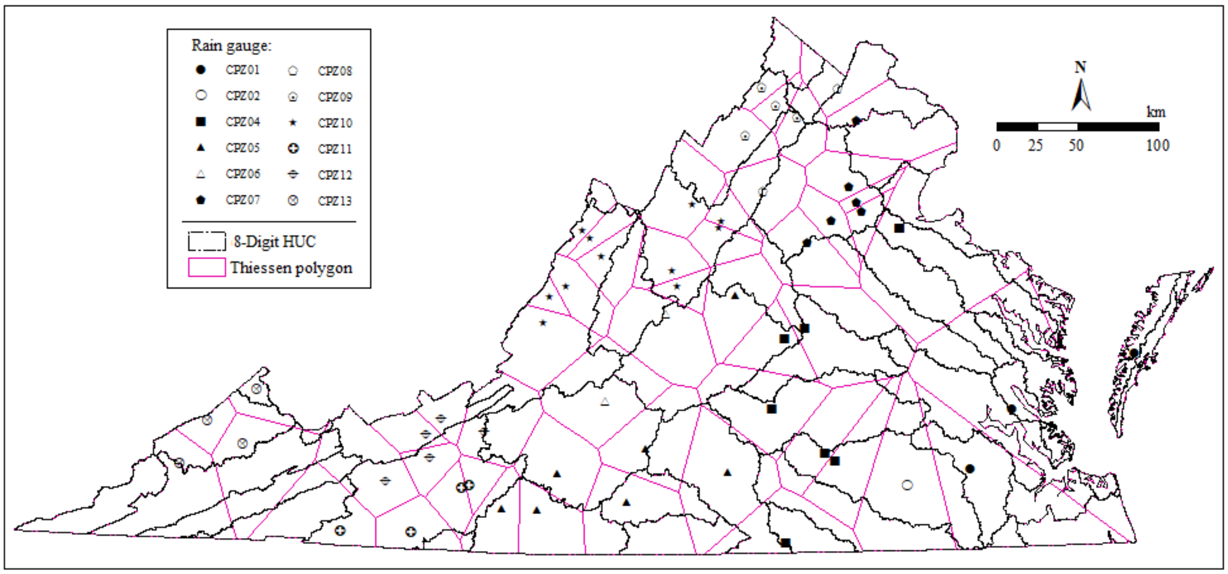


Figure 4.11. The Thiessen polygons of the 53 Virginian 8-digit Hydrologic Cataloging Units (HUCs).

Table 4.10. The control rain gauges, areas, and best statistical distributions of the Thiessen polygons.[1]

HUC Gauge	Area (km^2)	Best Distribution for the Gauge	Best Distribution for the HUC	HUC Gauge	Area (km^2)	Best Distribution for the Gauge	Best Distribution for the HUC	HUC Gauge	Area (km^2)	Best Distribution for the Gauge	Best Distribution for the HUC
2040303	**2716.3**		**Gumbel**	**2080108**	**592.9**		**Gumbel**	**3010201**	**4463.5**		**Weibull**
446475	2716.3	Gumbel		446475	0.0	Gumbel		440778	501.0	Gumbel	
2040304	**1961.3**		**Gumbel**	449151	592.9	Gumbel		441322	933.0	Weibull/Gumbel	
446475	1941.8	Gumbel		**2080110**	**2514.1**		**Gumbel**	442941	23.5	Weibull	
449151	19.6	Gumbel		446475	2514.1	Gumbel		448129	2126.0	Weibull	
2070001	**3831.5**		**Weibull**	**2080111**	**2786.8**		**Gumbel**	448800	880.0	Weibull	
442208	1391.5	Weibull		446475	2786.8	Gumbel		**3010202**	**1916.8**		**Weibull**
442663	803.4	Weibull		**2080201**	**5726.5**		**Gumbel**	448129	129.7	Weibull	
445595	755.5	Gumbel		440561	716.1	Gumbel		448800	1781.7	Weibull	
445880	133.8	Gumbel		440766	614.4	Gumbel		449151	5.3	Gumbel	
448046	747.2	Gumbel/Gumbel		442044	2014.9	Gumbel		**3010203**	**2329.7**		**Weibull**
2070003	**3120.0**		**Gumbel**	443310	287.6	Weibull/Weibull		448129	197.7	Weibull	
442663	421.1	Weibull		444128	805.3	Gumbel		448800	2132.0	Weibull	
448046	2698.9	Gumbel/Gumbel		445595	302.0	Gumbel		**3010204**	**4177.0**		**Weibull**
2070004	**5898.6**		**Weibull**	445880	499.7	Gumbel		440778	284.6	Gumbel	
443229	14.9	Gumbel		448022	12.9	Gumbel		441322	540.7	Weibull/Gumbel	
445851	4397.7	Weibull		449159	473.5	Gumbel		442941	29.2	Weibull	
448046	1429.1	Gumbel/Gumbel		**2080202**	**2169.9**		**Gumbel**	444414	596.8	Gumbel	
448149	57.0	Weibull		440561	124.0	Gumbel		447025	331.7	Weibull	
2070005	**4328.3**		**Weibull**	442044	55.0	Gumbel		448129	2156.0	Weibull	
440720	580.2	Weibull		444128	237.8	Gumbel		448800	238.0	Weibull	
442208	1039.3	Weibull		445690	877.9	Weibull		**3010205**	**11200.4**		**Weibull**
442663	227.5	Weibull		445880	1.6	Gumbel		446475	100.9	Gumbel	
443229	277.7	Gumbel		448062	155.9	Gumbel		448800	10546.4	Weibull	
445142	439.2	Weibull		448172	21.6	Weibull		449151	553.1	Gumbel	
445423	370.6	Gumbel		449159	696.0	Gumbel		**3040101**	**6362.7**		**Gumbel**
445690	10.5	Weibull		**2080203**	**5238.4**		**Gumbel**	443272	3765.5	Gumbel	

Table 4.10. Continuous…

445880	0.4	Gumbel		440166	404.5	Gumbel/Weibull		444246	16.4	Gumbel	
446178	16.8	Gumbel		440561	531.3	Gumbel		446692	78.7	Gumbel	
448062	935.8	Gumbel		440993	822.7	Gumbel		448547	1426.4	Weibull	
448149	36.5	Weibull		441929	29.3	Gumbel		449272	1075.8	Gumbel	
448172	390.5	Weibull		442941	463.1	Weibull		**5050001**	**7622.3**		**Weibull**
449159	3.3	Gumbel		445690	1743.2	Weibull		440766	423.4	Gumbel	
2070006	**2676.7**		**Weibull**	446178	1108.6	Gumbel		443272	1306.9	Gumbel	
440720	39.7	Weibull		448172	135.7	Weibull		444246	706.7	Gumbel	
442208	755.9	Weibull		**2080204**	**1988.5**		**Gumbel**	446692	1.8	Gumbel	
442663	1157.6	Weibull		440720	18.7	Weibull		446955	648.8	Weibull	
443229	10.8	Gumbel		440993	132.0	Gumbel		447338	65.1	Gumbel	
445423	60.7	Gumbel		441929	242.6	Gumbel		448022	104.1	Gumbel	
448046	335.3	Gumbel/Gumbel		445142	343.5	Weibull		448547	2403.8	Weibull	
448149	316.7	Weibull		445423	105.3	Gumbel		449060	58.9	Gumbel	
2070007	**911.0**		**Weibull**	446178	874.0	Gumbel		449169	535.7	Gumbel	
443229	238.2	Gumbel		446712	270.9	Gumbel		449272	316.9	Gumbel	
445851	609.3	Weibull		448172	1.4	Weibull		449301	1050.2	Weibull	
448149	63.5	Weibull		**2080205**	**2446.4**		**Gumbel**	**5050002**	**4349.9**		**Gumbel**
2070008	**3206.1**		**Gumbel**	440993	431.5	Gumbel		440766	199.4	Gumbel	
443229	53.7	Gumbel		441322	0.2	Weibull/Gumbel		446955	35.7	Weibull	
445851	1542.7	Weibull		441929	1651.9	Gumbel		448022	1954.2	Gumbel	
448396	1609.8	Gumbel		442941	362.9	Weibull		449060	1368.2	Gumbel	
2070010	**3373.0**		**Gumbel**	**2080206**	**3732.7**		**Gumbel**	449301	792.3	Weibull	
442729	47.1	Weibull		440778	28.9	Gumbel		**5050003**	**4258.6**		**Gumbel**
443200	576.7	Weibull		441322	76.9	Weibull/Gumbel		440766	50.4	Gumbel	
447130	394.1	Weibull		441929	355.5	Gumbel		442044	1212.2	Gumbel	
448396	2355.2	Gumbel		448129	189.2	Weibull		443310	1179.1	Weibull/Weibull	
2070011	**4675.0**		**Weibull**	448800	737.1	Weibull		444128	102.8	Gumbel	
442729	76.3	Weibull		449151	2345.1	Gumbel		445595	1186.6	Gumbel	

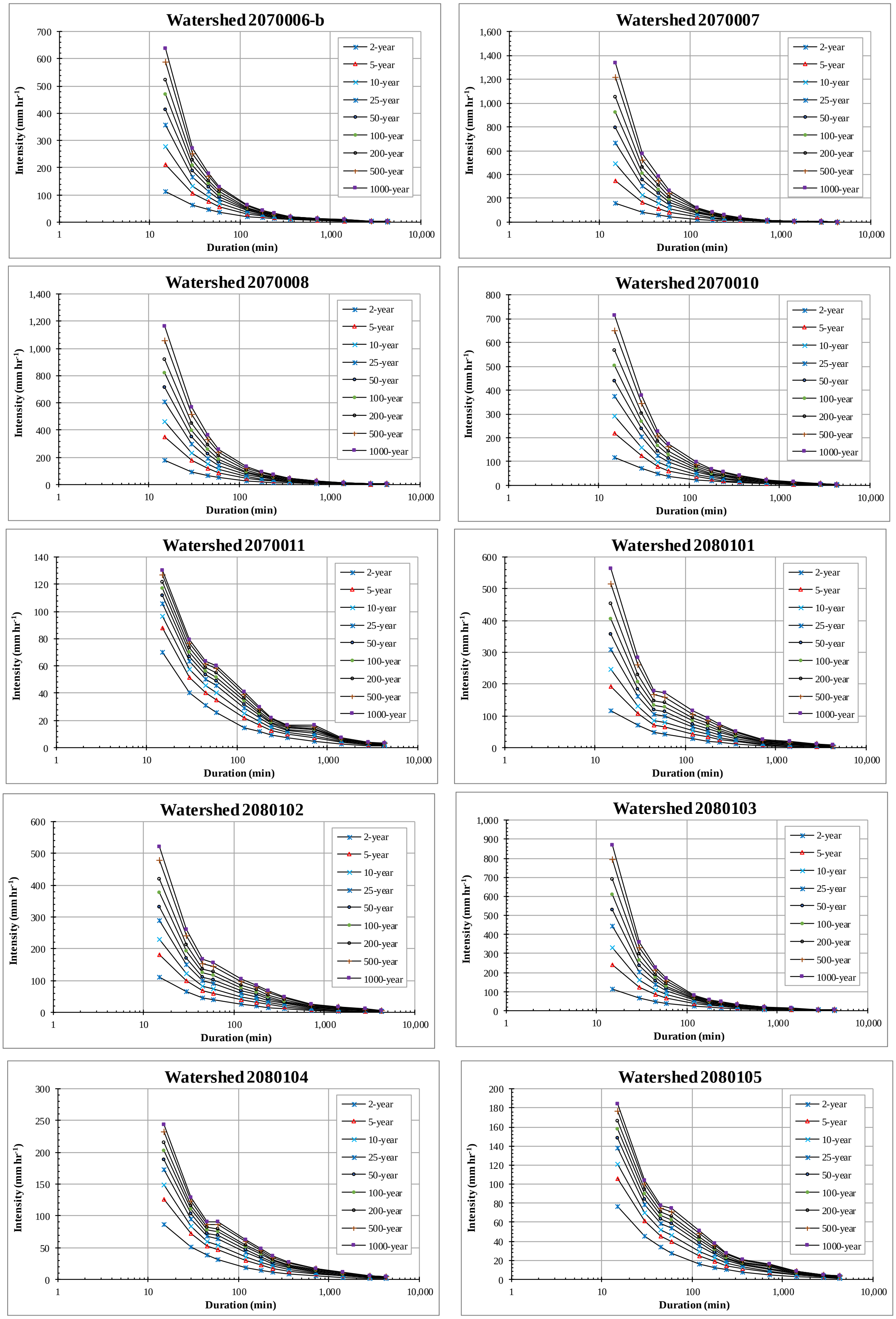
Table 4.10. Continuous…

443200	3817.8	Weibull		**2080207**	**4169.8**		**Weibull**	448022	527.5	Gumbel	
446475	611.1	Gumbel		440778	1133.1	Gumbel		**5070201**	**4029.0**		**Gumbel**
447130	19.9	Weibull		440993	12.3	Gumbel		442269	72.3	Weibull	
447164	47.7	Weibull		441322	488.6	Weibull/Gumbel		444180	3719.1	Gumbel	
449151	102.1	Gumbel		441929	240.0	Gumbel		444410	122.0	Weibull	
2080101	**3047.4**		**Gumbel**	442941	1827.7	Weibull		449060	54.8	Gumbel	
446475	2315.1	Gumbel		447025	61.4	Weibull		449301	60.7	Weibull	
449151	732.3	Gumbel		448129	368.7	Weibull		**5070202**	**3140.9**		**Weibull**
2080102	**1739.5**		**Gumbel**	448800	38.0	Weibull		442269	741.6	Weibull	
446475	435.4	Gumbel		**2080208**	**1309.1**		**Weibull**	444180	444.6	Gumbel	
449151	1304.1	Gumbel		448800	857.4	Weibull		444410	1405.2	Weibull	
2080103	**4030.3**		**Weibull**	449151	451.7	Gumbel		449215	549.5	Weibull	
440720	879.1	Weibull		**3010101**	**5674.0**		**Gumbel**	**5100201**	**3428.1**		**Weibull**
442159	620.5	Gumbel		440166	904.8	Gumbel/Weibull		444410	796.7	Weibull	
442663	5.9	Weibull		440561	1641.4	Gumbel		449215	2631.5	Weibull	
442729	199.5	Weibull		440766	930.3	Gumbel		**5130101**	**6039.5**		**Weibull**
443229	461.7	Gumbel		441614	373.4	Gumbel		449215	6039.5	Weibull	
445423	0.0	Gumbel		446692	23.9	Gumbel		**6010101**	**1882.5**		**Weibull**
446712	565.6	Gumbel		447338	1799.8	Gumbel		442269	651.0	Weibull	
447130	794.1	Weibull		449169	0.3	Gumbel		448547	309.2	Weibull	
447164	312.2	Weibull		**3010102**	**4503.0**		**Weibull**	449215	663.8	Weibull	
448396	191.7	Gumbel		440166	920.4	Gumbel/Weibull		449301	258.5	Weibull	
2080104	**2992.6**		**Weibull**	442941	53.2	Weibull		**6010102**	**3055.4**		**Weibull**
443200	1698.0	Weibull		444414	1364.2	Gumbel		442269	240.8	Weibull	
446475	81.0	Gumbel		447025	2165.2	Weibull		448547	1685.6	Weibull	
447164	19.8	Weibull		**3010103**	**5325.8**		**Gumbel**	449215	1068.1	Weibull	
449151	1193.8	Gumbel		441614	843.7	Gumbel		449301	60.9	Weibull	
2080105	**2358.4**		**Weibull**	446692	2777.0	Gumbel		**6010104**	**2591.8**		**Weibull**
442159	26.4	Gumbel		447338	36.9	Gumbel		449215	2591.8	Weibull	

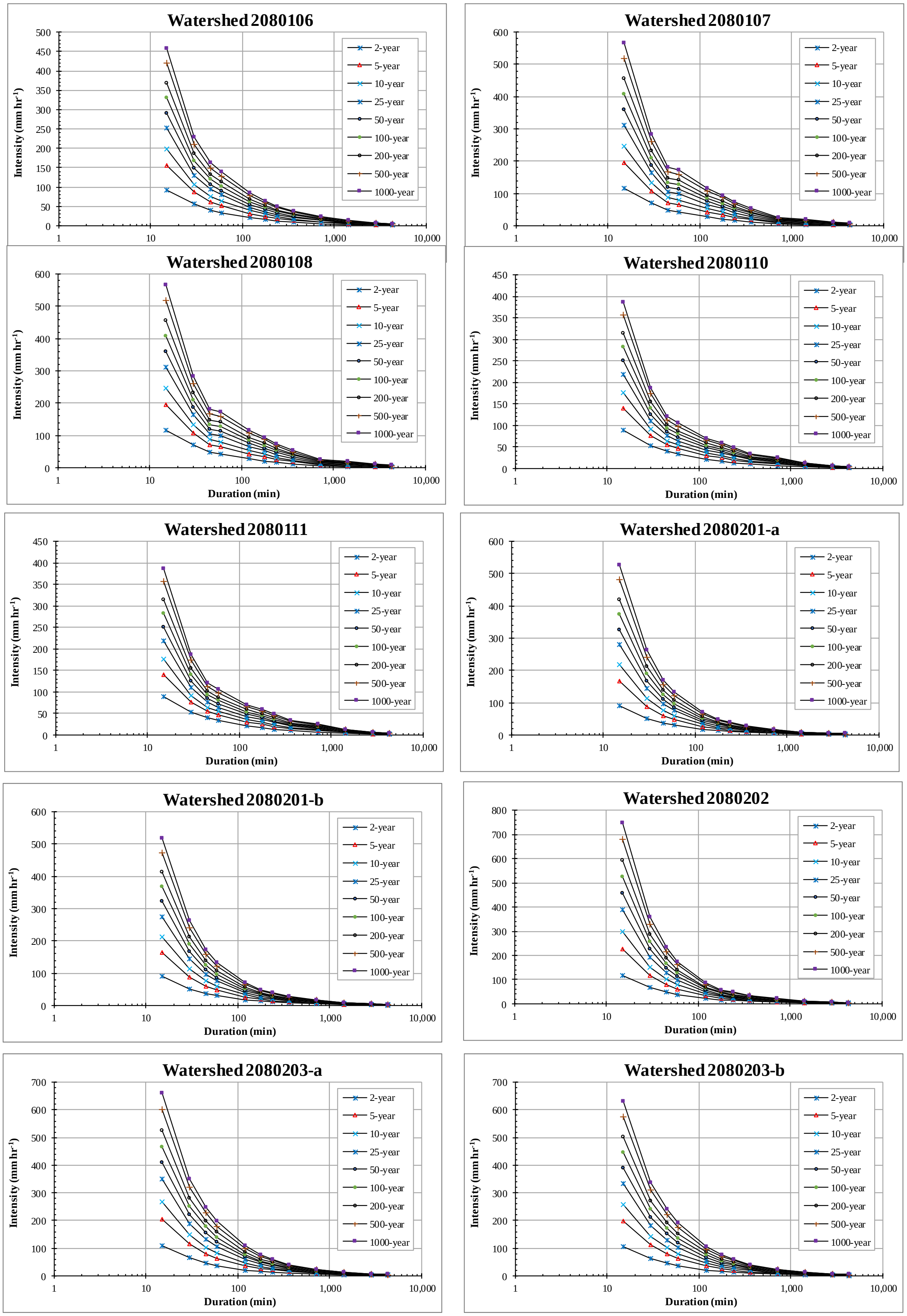
Table 4.10. Continuous…

443200	1667.8	Weibull		449272	1668.2	Gumbel		**6010205**	**5092.5**		**Weibull**
447164	151.7	Weibull		**3010104**	**3327.0**		**Gumbel**	442269	1356.0	Weibull	
449151	512.4	Gumbel		441614	2460.6	Gumbel		444180	15.5	Gumbel	
2080106	**3810.6**		**Gumbel**	444414	445.5	Gumbel		448547	5.8	Weibull	
441929	1125.6	Gumbel		447025	420.9	Weibull		449215	3505.2	Weibull	
442159	222.1	Gumbel		**3010105**	**1545.8**		**Gumbel**	449301	210.0	Weibull	
443200	764.8	Weibull		440166	189.4	Gumbel/Weibull		**6010206**	**2452.7**		**Weibull**
446712	923.5	Gumbel		441614	1039.4	Gumbel		449215	2452.7	Weibull	
447164	13.7	Weibull		447025	317.0	Weibull					
449151	760.9	Gumbel		**3010106**	**1533.4**		**Gumbel**				
2080107	**755.8**		**Gumbel**	444414	1499.3	Gumbel					
449151	755.8	Gumbel		448129	34.1	Weibull					

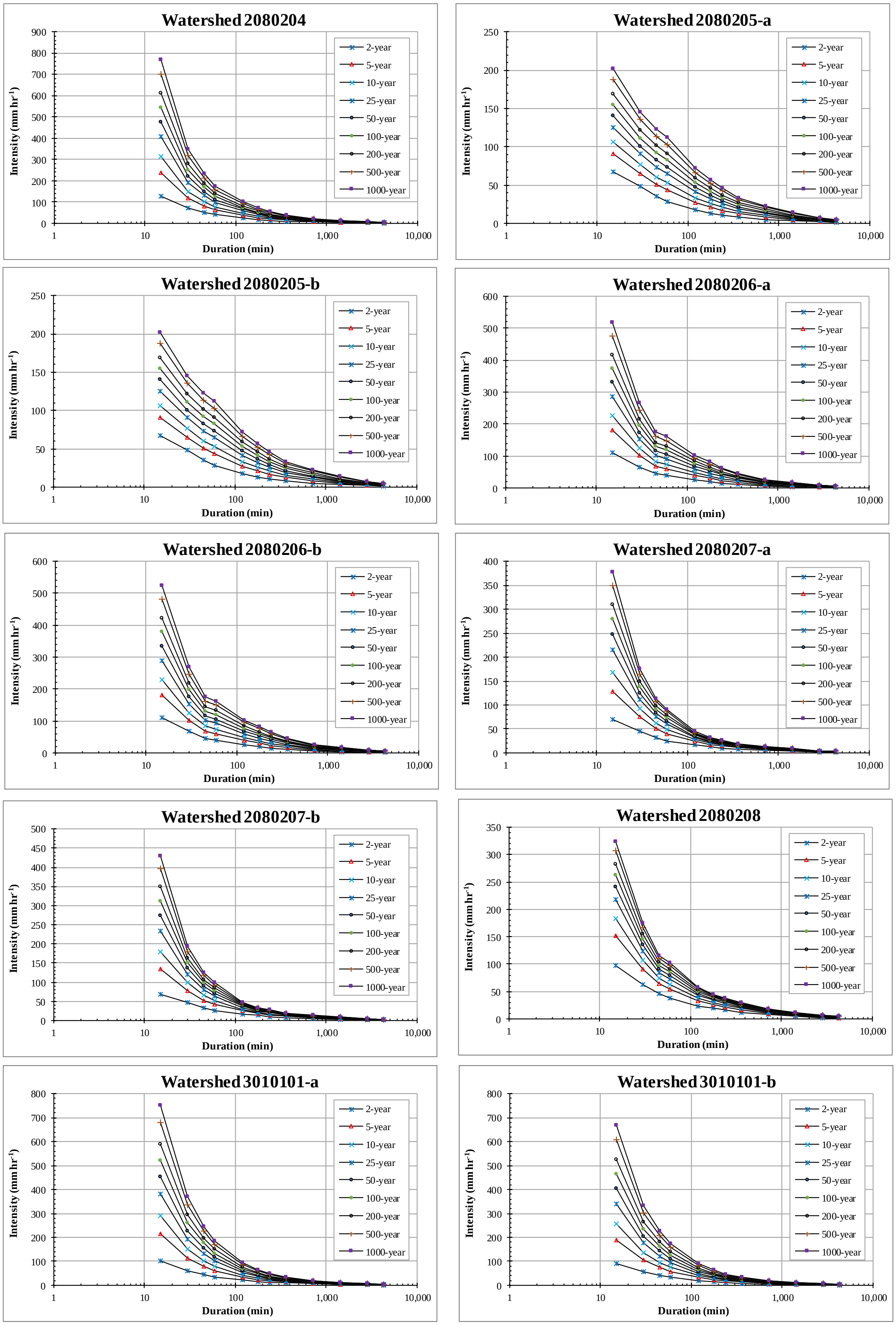
[1] HUC: U.S. Geological Survey 8-digit Hydrologic Cataloging Unit. The best distribution for a HUC was assumed to be same as that of the gauge(s) controlling most of the HUC area.



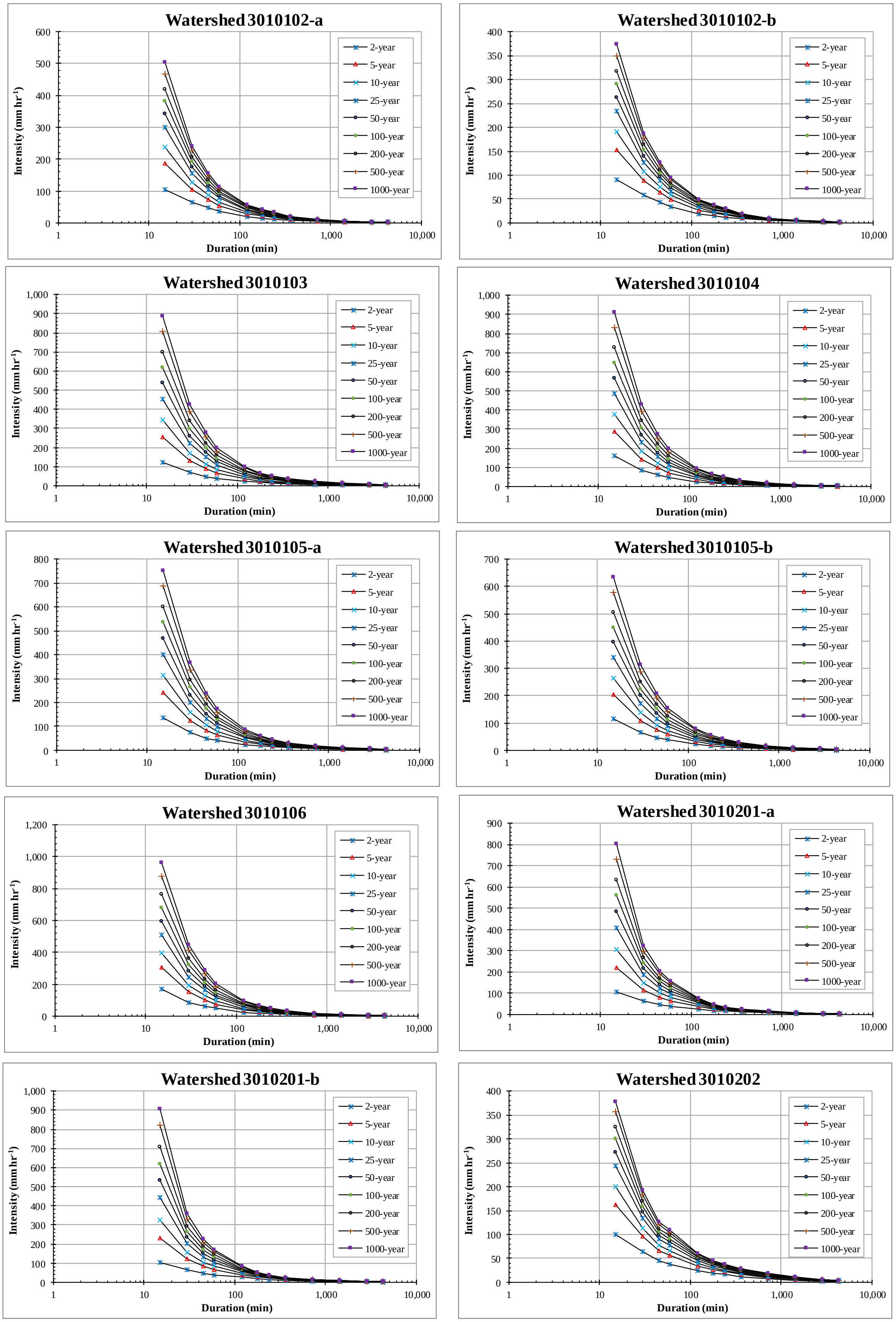
[Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves



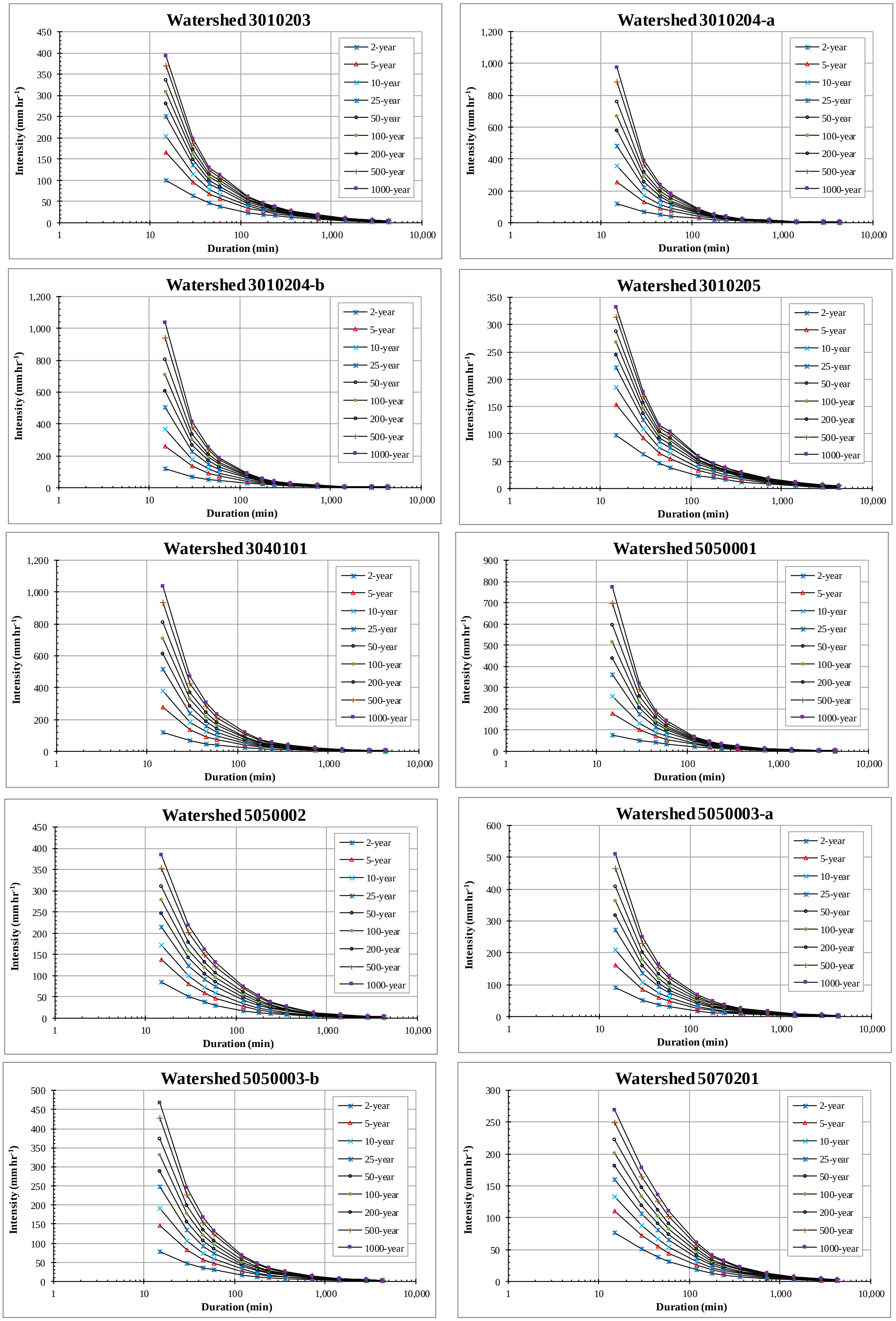
[Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves



[Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves



[Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves



[Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves

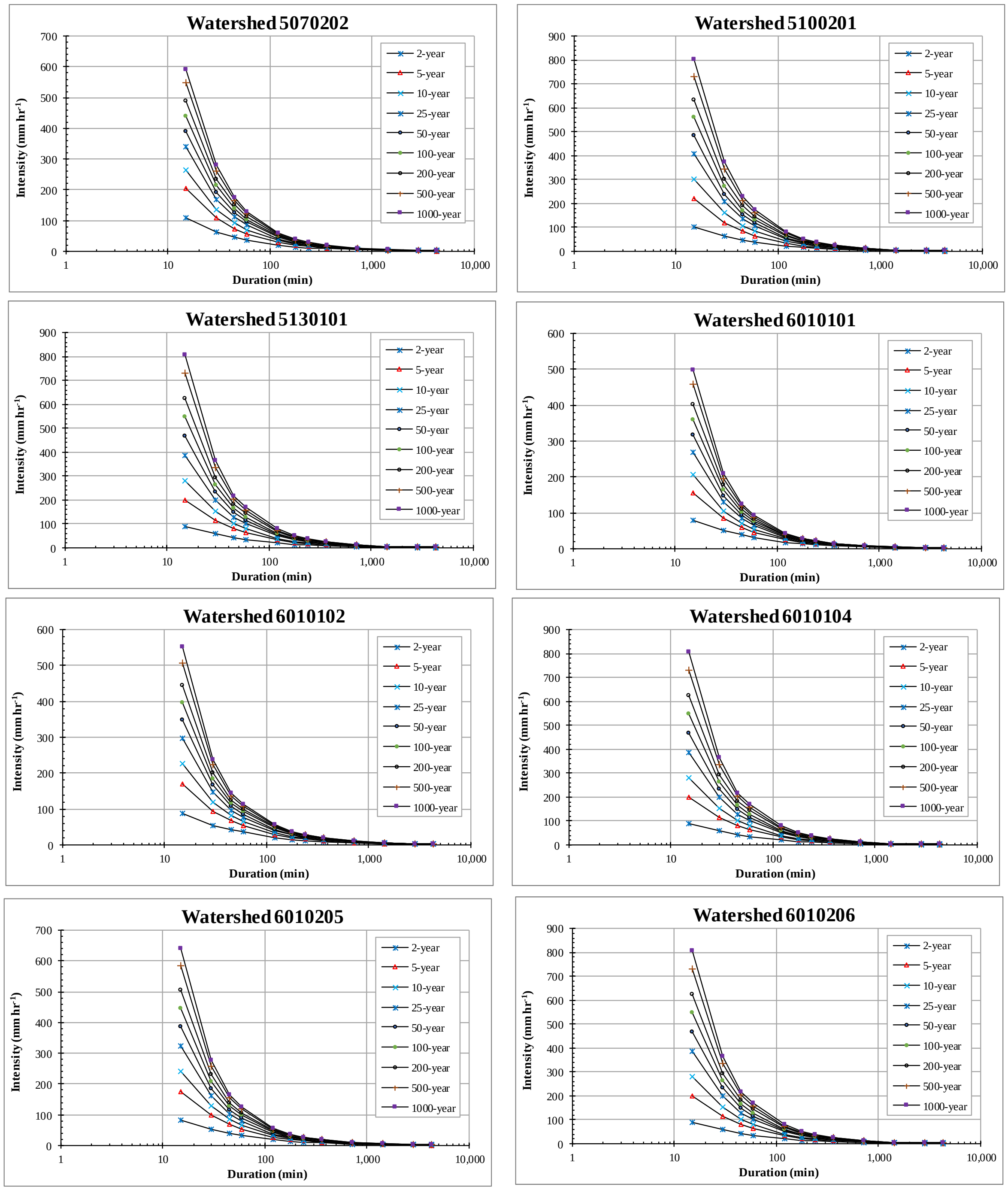


Figure 4.12. The watershed-level historic intensity-duration-frequency (IDF) curves for selected rain gauges of the 53 U.S. Geological Survey 8-digit Hydrologic Cataloging Units. Because the time series at gauges 441322, 440166, 448046, and 443310 were non-homogenous, the IDF curves for the HUCs controlled by these four gauges were created for the responding subsets and are signified by -a and -b, respectively.

4.3.4 Downscaling of the RCMs' Predictions

As discussed in section 4.2.3.3, downscaling of the RCMs' predictions was realized by four steps. First, the predicted 3-h precipitation at a rain gauge by an RCM (hereinafter referred to as RCM-predicted gauge precipitation) was computed as the inverse-distance-weighted average of the RCM's predictions for the four modeling grids surrounding the gauge. Second, the RCM-predicted gauge precipitation was corrected for possible errors in accordance with the observations at this same gauge, deriving the spatially-downscaled gauge precipitation. Third, the spatially-downscaled gauge precipitation was disaggregated to derive the 15-, 30- and 45-min and 1- and 2-h gauge precipitations. Fourth, the spatially-downscaled gauge precipitation for a longer duration of 6, 12, 24, 48, or 72 h was derived from that for the duration of 3 h (i.e., the result of the second step). Herein, to alleviate the burden of data processing, the annual maximum durational precipitations rather than the time series were downscaled. The basic assumption is that the extreme values are independent of the mathematical operations involved in the downscaling procedure.

The equations used in the second step (Table 4.11) were derived by regressing the observed annual maximum 3-h precipitations over the RCM-predicted annual maximum gauge 3-h precipitations for the historic period, whereas the equations used in the third step (Table 4.12) were derived by regressing the observed annual maximum precipitations for a shorter or 4-h duration over those for the duration of 3 h. Both regressions were done by each of the climatic-physiographic zones (Figure 4.2b). In this regard, the data at the rain gauges within a zone of interest (Table 4.2) were pooled together and then capsulated by excluding any abnormal and/or redundant values.

Table 4.11. The regression equations of RCM-predicted over observed annual maximum 3-h rainfall.

RCM	Zone	Regression Equation [1]	Coefficient of Determination (R^2)
CRCM -CCSM	CPZ01	$P_{3h,obs} = 7.44(P_{3h,rcm}) - 44.76$	0.86
	CPZ02	$P_{3h,obs} = 6.82(P_{3h,rcm}) - 34.60$	0.87
	CPZ04	$P_{3h,obs} = 7.57(P_{3h,rcm}) - 45.09$	0.96
	CPZ05	$P_{3h,obs} = 10.01(P_{3h,rcm}) - 64.51$	0.87
	CPZ06	$P_{3h,obs} = 10.29(P_{3h,rcm}) - 61.20$	0.87
	CPZ07	$P_{3h,obs} = 11.59(P_{3h,rcm}) - 96.41$	0.93
	CPZ08	$P_{3h,obs} = 17.64(P_{3h,rcm}) - 153.41$	0.84
	CPZ09	$P_{3h,obs} = 3.74(P_{3h,rcm}) - 7.66 \quad P_{3h,rcm} \leq 15.0\ \mathrm{mm}$	0.95
		$P_{3h,obs} = 64.29(P_{3h,rcm}) - 930.36 \quad P_{3h,rcm} > 15.0\ \mathrm{mm}$	0.92
	CPZ10	$P_{3h,obs} = 7.18(P_{3h,rcm}) - 42.31$	0.88
	CPZ11	$P_{3h,obs} = 7.46(P_{3h,rcm}) - 37.43$	0.80
	CPZ12	$P_{3h,obs} = 6.47(P_{3h,rcm}) - 35.77$	0.90
	CPZ13	$P_{3h,obs} = 6.78(P_{3h,rcm}) - 42.87$	0.95

[1] $p_{3h,obs}$: observed annual maximum 3-h precipitation; $P_{3h,rcm}$: RCM-predicted annual maximum gauge 3-h precipitation.

Table 4.12. The regression equations of observed shorter-duration over 3-h annual maximum rainfall.

Zone	Duration	Regression Equation [1]	Coefficient of Determination (R^2)
CPZ01	15 min	$P_{15m,obs} = 1.76(P_{3h,obs})^{0.82}$	0.67
	30 min	$P_{30m,obs} = 1.54(P_{3h,obs})^{0.73}$	0.83
	45 min	$P_{45m,obs} = 1.45(P_{3h,obs})^{0.78}$	0.89
	1 h	$P_{1h,obs} = 1.22(P_{3h,obs})^{0.88}$	0.95
	2 h	$P_{2h,obs} = 1.04(P_{3h,obs})^{0.98}$	0.99
	4 h	$P_{4h,obs} = 1.07(P_{3h,obs})^{1.01}$	0.99
CPZ02	15 min	$P_{15m,obs} = 0.25(P_{3h,obs})^{1.14}$	0.89
	30 min	$P_{30m,obs} = 0.21(P_{3h,obs})^{1.25}$	0.70
	45 min	$P_{45m,obs} = 0.55(P_{3h,obs})^{1.04}$	0.71
	1 h	$P_{1h,obs} = 0.36(P_{3h,obs})^{1.18}$	0.84
	2 h	$P_{2h,obs} = 0.46(P_{3h,obs})^{1.17}$	0.96
	4 h	$P_{4h,obs} = 1.01(P_{3h,obs})^{1.01}$	0.99
CPZ04	15 min	$P_{15m,obs} = 1.08(P_{3h,obs})^{0.76}$	0.90
	30 min	$P_{30m,obs} = 1.03(P_{3h,obs})^{0.88}$	0.97
	45 min	$P_{45m,obs} = 1.05(P_{3h,obs})^{0.89}$	0.98
	1 h	$P_{1h,obs} = 1.01(P_{3h,obs})^{0.92}$	0.99
	2 h	$P_{2h,obs} = 1.00(P_{3h,obs})^{0.98}$	1.00
	4 h	$P_{4h,obs} = 1.16(P_{3h,obs})^{0.99}$	0.99

Table 4.12. Continuous ……

CPZ05	15 min	$P_{15m,obs} = 1.14(P_{2h,obs})^{0.75}$	0.62
	30 min	$P_{30m,obs} = 1.06(P_{2h,obs})^{0.83}$	0.74
	45 min	$P_{45m,obs} = 0.98(P_{2h,obs})^{0.89}$	0.85
	1 h	$P_{1h,obs} = 1.01(P_{2h,obs})^{0.91}$	0.87
	2 h	$P_{2h,obs} = 0.83(P_{2h,obs})^{1.02}$	0.99
	4 h	$P_{4h,obs} = 1.17(P_{2h,obs})^{0.98}$	0.99
CPZ06	15 min	$P_{15m,obs} = 0.58(P_{2h,obs})^{0.89}$	0.66
	30 min	$P_{30m,obs} = 0.84(P_{2h,obs})^{0.88}$	0.74
	45 min	$P_{45m,obs} = 1.04(P_{2h,obs})^{0.86}$	0.79
	1 h	$P_{1h,obs} = 0.99(P_{2h,obs})^{0.90}$	0.84
	2 h	$P_{2h,obs} = 0.92(P_{2h,obs})^{0.98}$	0.95
	4 h	$P_{4h,obs} = 1.25(P_{2h,obs})^{0.97}$	0.98
CPZ07	15 min	$P_{15m,obs} = 0.56(P_{2h,obs})^{0.93}$	0.64
	30 min	$P_{30m,obs} = 0.72(P_{2h,obs})^{0.94}$	0.78
	45 min	$P_{45m,obs} = 0.68(P_{2h,obs})^{0.99}$	0.88
	1 h	$P_{1h,obs} = 0.69(P_{2h,obs})^{1.01}$	0.91
	2 h	$P_{2h,obs} = 0.40(P_{2h,obs})^{1.18}$	0.94
	4 h	$P_{4h,obs} = 1.49(P_{2h,obs})^{0.93}$	0.98
CPZ08	15 min	$P_{15m,obs} = 1.26(P_{2h,obs})^{0.80}$	0.89
	30 min	$P_{30m,obs} = 1.13(P_{2h,obs})^{0.86}$	0.95
	45 min	$P_{45m,obs} = 1.17(P_{2h,obs})^{0.89}$	0.95
	1 h	$P_{1h,obs} = 1.17(P_{2h,obs})^{0.90}$	0.96
	2 h	$P_{2h,obs} = 1.06(P_{2h,obs})^{0.97}$	0.99
	4 h	$P_{2h,obs} = 1.18(P_{2h,obs})^{0.99}$	0.95
CPZ09	15 min	$P_{15m,obs} = 0.78(P_{2h,obs})^{0.85}$	0.55
	30 min	$P_{30m,obs} = 0.85(P_{2h,obs})^{0.91}$	0.63
	45 min	$P_{45m,obs} = 0.73(P_{2h,obs})^{0.98}$	0.72
	1 h	$P_{1h,obs} = 0.70(P_{2h,obs})^{1.01}$	0.76
	2 h	$P_{2h,obs} = 0.76(P_{2h,obs})^{1.03}$	0.94
	4 h	$P_{4h,obs} = 1.10(P_{2h,obs})^{1.01}$	0.94
CPZ10	15 min	$P_{15m,obs} = 1.14(P_{2h,obs})^{0.77}$	0.67
	30 min	$P_{30m,obs} = 0.79(P_{2h,obs})^{0.93}$	0.81
	45 min	$P_{45m,obs} = 0.81(P_{2h,obs})^{0.95}$	0.88
	1 h	$P_{1h,obs} = 0.77(P_{2h,obs})^{0.98}$	0.88
	2 h	$P_{2h,obs} = 0.63(P_{2h,obs})^{1.09}$	0.96
	4 h	$P_{4h,obs} = 1.18(P_{2h,obs})^{0.98}$	0.98
CPZ11	15 min	$P_{15m,obs} = 0.65(P_{2h,obs})^{0.88}$	0.67
	30 min	$P_{30m,obs} = 1.08(P_{2h,obs})^{0.83}$	0.80
	45 min	$P_{45m,obs} = 1.06(P_{2h,obs})^{0.88}$	0.88
	1 h	$P_{1h,obs} = 1.06(P_{2h,obs})^{0.90}$	0.91

Table 4.12. Continuous ……

CPZ11	2 h	$P_{2h,obs} = 1.17\left(P_{3h,obs}\right)^{0.93}$	0.96
	4 h	$P_{4h,obs} = 1.26\left(P_{3h,obs}\right)^{0.98}$	0.96
CPZ12	15 min	$P_{15m,obs} = 0.56\left(P_{3h,obs}\right)^{0.92}$	0.61
	30 min	$P_{30m,obs} = 0.82\left(P_{3h,obs}\right)^{0.90}$	0.78
	45 min	$P_{45m,obs} = 0.67\left(P_{3h,obs}\right)^{0.99}$	0.84
	1 h	$P_{1h,obs} = 0.69\left(P_{3h,obs}\right)^{1.01}$	0.89
	2 h	$P_{2h,obs} = 0.69\left(P_{3h,obs}\right)^{1.07}$	0.96
	4 h	$P_{4h,obs} = 1.42\left(P_{3h,obs}\right)^{0.93}$	0.98
CPZ13	15 min	$P_{15m,obs} = 0.65\left(P_{3h,obs}\right)^{0.92}$	0.62
	30 min	$P_{30m,obs} = 0.69\left(P_{3h,obs}\right)^{0.98}$	0.82
	45 min	$P_{45m,obs} = 0.59\left(P_{3h,obs}\right)^{1.05}$	0.89
	1 h	$P_{1h,obs} = 0.54\left(P_{3h,obs}\right)^{1.10}$	0.91
	2 h	$P_{2h,obs} = 0.84\left(P_{3h,obs}\right)^{1.02}$	0.94
	4 h	$P_{4h,obs} = 1.51\left(P_{3h,obs}\right)^{0.91}$	0.98

[1] $P_{15m,obs}$, $P_{30m,obs}$, $P_{45m,obs}$, $P_{1h,obs}$, $P_{2h,obs}$, $P_{3h,obs}$, and $P_{4h,obs}$ are the precipitations, in mm, for the durations signified by the subscripts.

The equations used in the fourth step (Table 4.13) were derived by regressing the RCM-predicted annual maximum gauge precipitations for a longer duration (i.e., 6, 12, 24, 48, or 72 h) over the RCM-predicted annual maximum gauge precipitations for one or more shorter durations spanning the entire RCM modeling period.

Table 4.13. The regression equations of RCM-predicted longer- over shorter-duration annual maximum rainfall.

Zone	Duration	Regression Equation [1]	Coefficient of Determination (R^2)
CPZ01	6 h	$P_{6h,obs} = 1.854 + 1.530\left(P_{3h,obs}\right)$	0.84
	12 h	$P_{12h,obs} = 4.084 + 1.266\left(P_{6h,obs}\right)$	0.78
	24 h	$P_{24h,obs} = 3.870 + 1.207\left(P_{12h,obs}\right)$	0.68
	48 h	$P_{48h,obs} = -0.997 + 1.266\left(P_{24h,obs}\right)$	0.77
	72 h	$P_{72h,obs} = 1.922 + 1.073\left(P_{48h,obs}\right)$	0.92
CPZ02	6 h	$P_{6h,obs} = 1.535 + 1.534\left(P_{3h,obs}\right)$	0.85
	12 h	$P_{12h,obs} = 6.953 + 1.144\left(P_{6h,obs}\right)$	0.80
	24 h	$P_{24h,obs} = 7.177 + 1.099\left(P_{12h,obs}\right)$	0.70
	48 h	$P_{48h,obs} = 4.560 + 1.116\left(P_{24h,obs}\right)$	0.69
	72 h	$P_{72h,obs} = 2.907 + 1.051\left(P_{48h,obs}\right)$	0.92
CPZ04	6 h	$P_{6h,obs} = 1.872 + 1.494\left(P_{3h,obs}\right)$	0.73
	12 h	$P_{12h,obs} = 4.803 + 1.241\left(P_{6h,obs}\right)$	0.78
	24 h	$P_{24h,obs} = 7.670 + 1.073\left(P_{12h,obs}\right)$	0.68
	48 h	$P_{48h,obs} = 5.770 + 1.094\left(P_{24h,obs}\right)$	0.68
	72 h	$P_{72h,obs} = 1.671 + 1.081\left(P_{48h,obs}\right)$	0.89

Table 4.13. Continuous……

CPZ05	6 h	$P_{6h,obs} = 0.740 + 1.602(P_{3h,obs})$	0.77
	12 h	$P_{12h,obs} = 2.557 + 1.362(P_{6h,obs})$	0.81
	24 h	$P_{24h,obs} = 8.552 + 1.067(P_{12h,obs})$	0.70
	48 h	$P_{48h,obs} = 8.935 + 1.023(P_{24h,obs})$	0.65
	72 h	$P_{72h,obs} = 5.039 + 1.018(P_{48h,obs})$	0.85
CPZ06	6 h	$P_{6h,obs} = -0.569 + 1.738(P_{3h,obs})$	0.82
	12 h	$P_{12h,obs} = 3.004 + 1.332(P_{6h,obs})$	0.82
	24 h	$P_{24h,obs} = 9.135 + 1.033(P_{12h,obs})$	0.65
	48 h	$P_{48h,obs} = 7.652 + 1.034(P_{24h,obs})$	0.62
	72 h	$P_{72h,obs} = 7.421 + 0.966(P_{48h,obs})$	0.80
CPZ07	6 h	$P_{6h,obs} = 0.867 + 1.554(P_{3h,obs})$	0.74
	12 h	$P_{12h,obs} = 3.896 + 1.295(P_{6h,obs})$	0.78
	24 h	$P_{24h,obs} = 6.300 + 1.140(P_{12h,obs})$	0.67
	48 h	$P_{48h,obs} = -3.961 + 1.340(P_{24h,obs})$	0.76
	72 h	$P_{72h,obs} = 0.945 + 1.115(P_{48h,obs})$	0.91
CPZ08	6 h	$P_{6h,obs} = 4.249 + 1.324(P_{3h,obs})$	0.74
	12 h	$P_{12h,obs} = 4.937 + 1.237(P_{6h,obs})$	0.70
	24 h	$P_{24h,obs} = 6.353 + 1.149(P_{12h,obs})$	0.62
	48 h	$P_{48h,obs} = -0.244 + 1.258(P_{24h,obs})$	0.67
	72 h	$P_{72h,obs} = 2.249 + 1.088(P_{48h,obs})$	0.88
CPZ09	6 h	$P_{6h,obs} = 5.306 + 1.226(P_{3h,obs})$	0.72
	12 h	$P_{12h,obs} = 3.697 + 1.302(P_{6h,obs})$	0.76
	24 h	$P_{24h,obs} = 7.544 + 1.109(P_{12h,obs})$	0.67
	48 h	$P_{48h,obs} = 2.952 + 1.182(P_{24h,obs})$	0.63
	72 h	$P_{72h,obs} = 3.862 + 1.062(P_{48h,obs})$	0.86
CPZ10	6 h	$P_{6h,obs} = 1.555 + 1.551(P_{3h,obs})$	0.83
	12 h	$P_{12h,obs} = 4.470 + 1.264(P_{6h,obs})$	0.80
	24 h	$P_{24h,obs} = 7.913 + 1.065(P_{12h,obs})$	0.68
	48 h	$P_{48h,obs} = 7.181 + 1.047(P_{24h,obs})$	0.61
	72 h	$P_{72h,obs} = 6.315 + 0.982(P_{48h,obs})$	0.82
CPZ11	6 h	$P_{6h,obs} = 0.574 + 1.650(P_{3h,obs})$	0.87
	12 h	$P_{12h,obs} = 1.922 + 1.388(P_{6h,obs})$	0.86
	24 h	$P_{24h,obs} = 2.939 + 1.257(P_{12h,obs})$	0.74
	48 h	$P_{48h,obs} = 3.291 + 1.177(P_{24h,obs})$	0.74
	72 h	$P_{72h,obs} = 1.818 + 1.091(P_{48h,obs})$	0.91
CPZ12	6 h	$P_{6h,obs} = 0.145 + 1.693(P_{3h,obs})$	0.87
	12 h	$P_{12h,obs} = 2.798 + 1.336(P_{6h,obs})$	0.86
	24 h	$P_{24h,obs} = 3.461 + 1.213(P_{12h,obs})$	0.79
	48 h	$P_{48h,obs} = 6.856 + 1.077(P_{24h,obs})$	0.72
	72 h	$P_{72h,obs} = 8.380 + 0.961(P_{48h,obs})$	0.85
CPZ13	6 h	$P_{6h,obs} = 4.140 + 1.381(P_{3h,obs})$	0.70

12 h	$P_{12h,obs} = 6.500 + 1.200\left(P_{6h,obs}\right)$	0.63
24 h	$P_{24h,obs} = 2.287 + 1.263\left(P_{12h,obs}\right)$	0.75
48 h	$P_{48h,obs} = 2.502 + 1.145\left(P_{24h,obs}\right)$	0.74
72 h	$P_{72h,obs} = 3.048 + 1.062\left(P_{48h,obs}\right)$	0.83

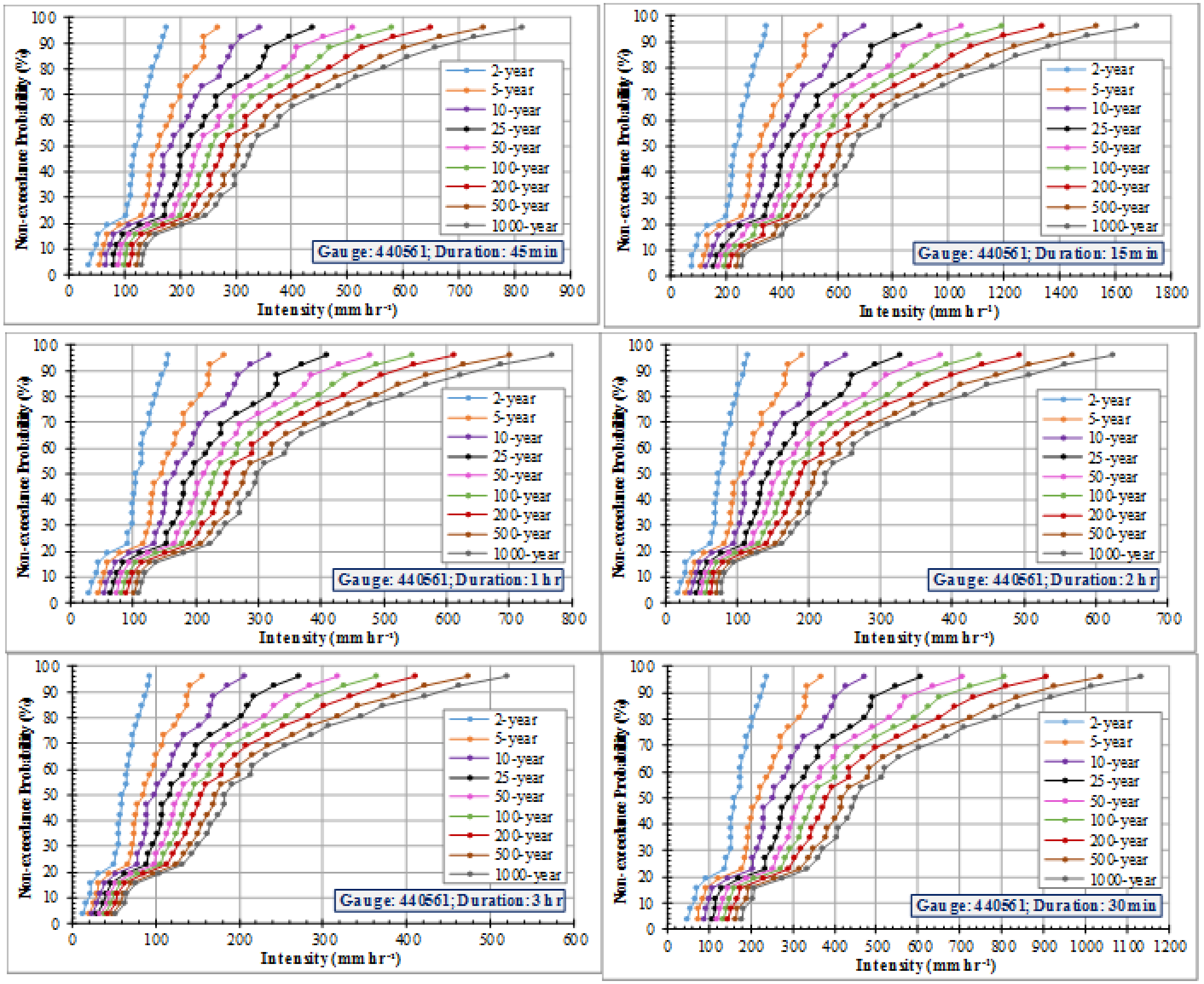
[1] $P_{3h,obs}$, $P_{6h,obs}$, $P_{12h,obs}$, $P_{24h,obs}$, $P_{48h,obs}$, and $P_{72h,obs}$ are the precipitations, in mm, for the durations signified by the subscripts.

4.3.5 The Gauge-Level Probability-Based IDF Curves

Figures 4.13 show the probability-based IDF curves (tabulated in Appendix IV of the report) for gauge 440561, 442044, and 444128, respectively. The curves' coefficients of variation, defined as the ratios of standard deviation to mean and used to measure the dispersion of an IDF curve, range from 0.27 to 0.60 (Table 4.14). Overall, while the dispersions of the IDF curves are not very different, for a given duration, the IDF curve for a higher return period tends to have a relatively greater dispersion than that for a lower return period, whereas, for a given return period, the IDF curve for a longer duration tends to have a relatively greater dispersion than that for a shorter duration, and vice versa.

Table 4.14. The dispersions of the probability-based intensity-duration-frequency (IDF) curves of eight gauges.

Duration	Return Period								
	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year
15 min	0.27~0.37	0.27~0.38	0.28~0.41	0.29~0.44	0.30~0.45	0.31~0.47	0.32~0.48	0.33~0.49	0.34~0.50
30 min	0.32~0.38	0.33~0.40	0.33~0.41	0.32~0.44	0.32~0.46	0.32~0.47	0.32~0.48	0.33~0.49	0.33~0.50
45 min	0.33~0.38	0.33~0.40	0.32~0.42	0.32~0.44	0.32~0.45	0.32~0.46	0.32~0.48	0.32~0.49	0.32~0.50
1 h	0.34~0.39	0.35~0.41	0.34~0.43	0.34~0.45	0.34~0.47	0.34~0.48	0.34~0.50	0.34~0.51	0.34~0.52
2 h	0.37~0.42	0.39~0.45	0.38~0.48	0.38~0.52	0.38~0.54	0.38~0.56	0.38~0.58	0.39~0.59	0.39~0.60
3 h	0.35~0.43	0.37~0.44	0.39~0.47	0.39~0.51	0.39~0.53	0.40~0.54	0.40~0.55	0.40~0.57	0.41~0.58
4 h	0.35~0.43	0.38~0.45	0.40~0.48	0.40~0.51	0.40~0.53	0.40~0.55	0.41~0.56	0.41~0.57	0.42~0.58
6 h	0.35~0.43	0.38~0.45	0.40~0.48	0.40~0.51	0.40~0.53	0.40~0.55	0.41~0.56	0.41~0.57	0.42~0.58
12 h	0.35~0.43	0.38~0.45	0.40~0.48	0.40~0.51	0.40~0.53	0.40~0.55	0.41~0.56	0.41~0.58	0.42~0.58
24 h	0.34~0.42	0.37~0.44	0.39~0.47	0.39~0.51	0.39~0.53	0.40~0.54	0.40~0.56	0.41~0.57	0.41~0.58
48 h	0.33~0.41	0.36~0.43	0.39~0.47	0.39~0.50	0.39~0.52	0.39~0.54	0.40~0.55	0.40~0.57	0.41~0.58
72 h	0.32~0.40	0.36~0.43	0.38~0.46	0.38~0.50	0.39~0.52	0.39~0.53	0.39~0.55	0.40~0.56	0.41~0.57


Non-exceedance Probability (%)
Intensity (mm hr⁻¹)
2-year
5-year
10-year
25-year
50-year
100-year
200-year
500-year
1000-year
Gauge: 440561; Duration: 45 min
Gauge: 440561; Duration: 15 min
Gauge: 440561; Duration: 1 hr
Gauge: 440561; Duration: 2 hr
Gauge: 440561; Duration: 3 hr
Gauge: 440561; Duration: 30 min

[Figure 4.13]

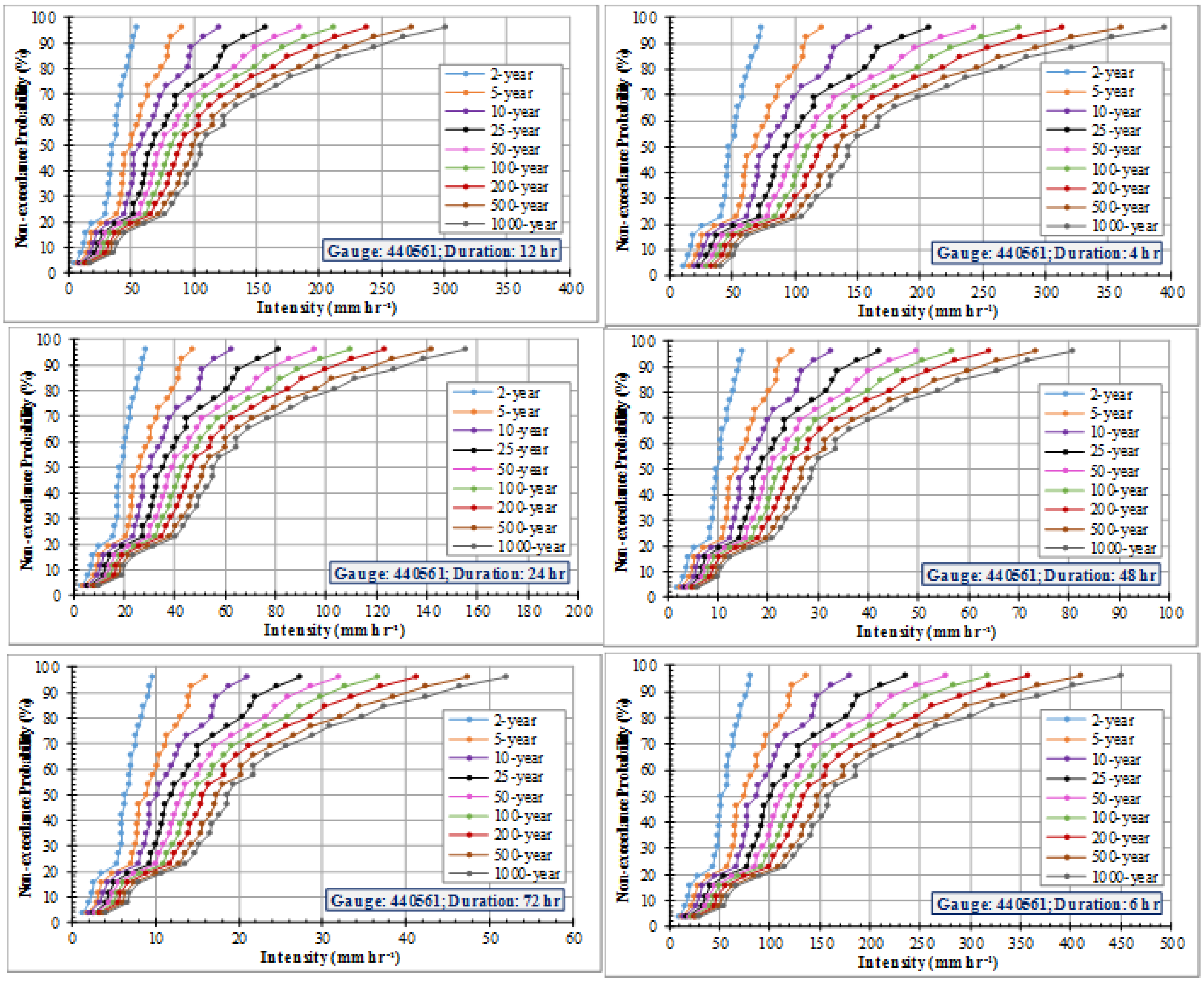


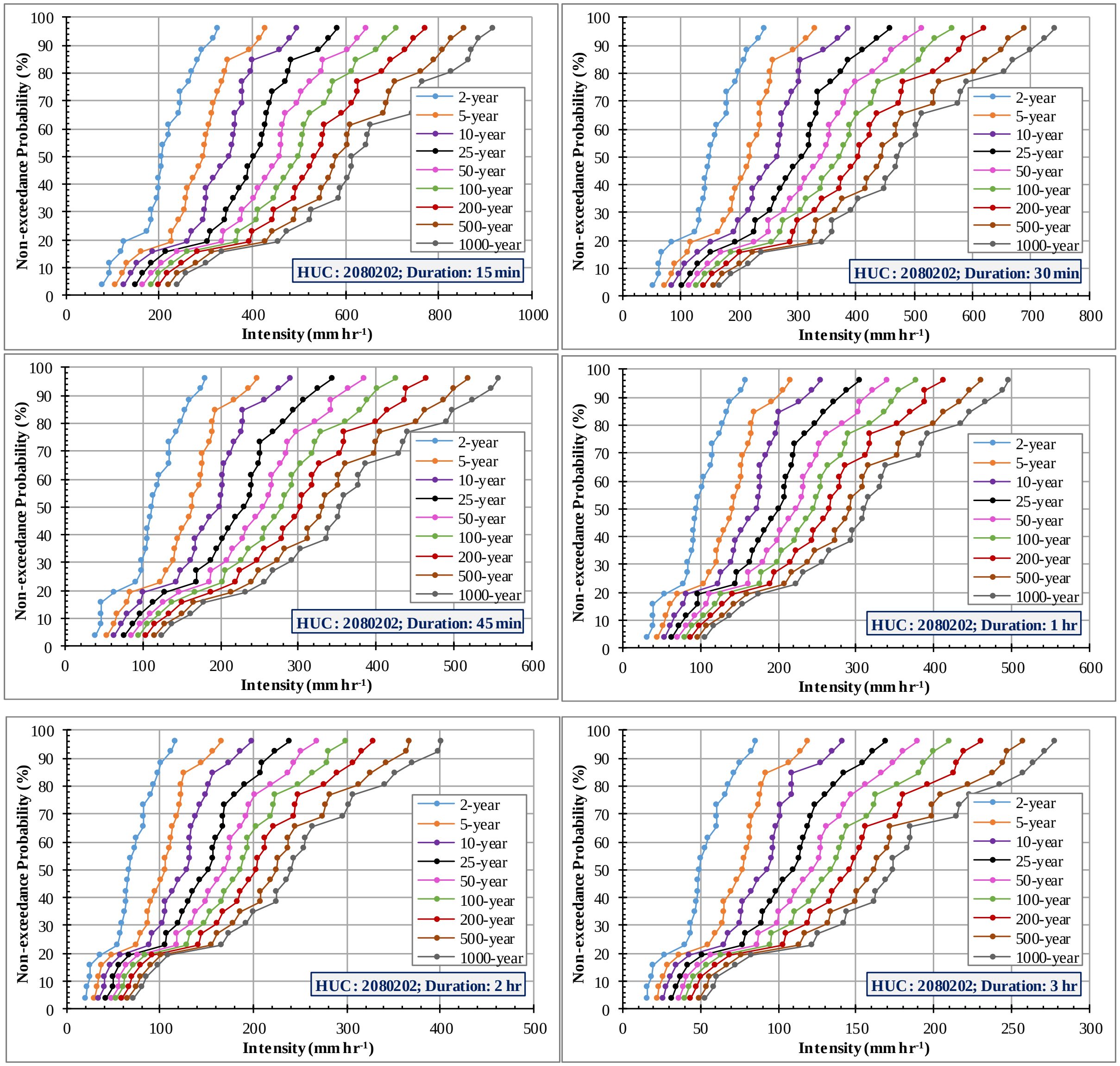
Figure 4.13. The probability-based intensity-duration-frequency (IDF) curves for gauge 440561.

4.3.6 The Watershed-Level Probability-Based IDF Curves

Figure 4.14 shows the probability-based IDF curves (tabulated in Appendix V of the report) for HUC 2080202. This watershed was subdivided into eight polygons that are controlled by the gauges listed in section 4.3.5. The curves' coefficients of variation range from 0.30 to 0.42 (Table 4.15). The dispersions of the IDF curves are not very different. However, as expected, for a given duration and/or a given return period, the dispersion of the watershed-level IDF curve is less than those of the responding gauge-level IDF curves. This is because the watershed-level IDF curve represents the overall average of the rainfall intensities at the gauges, smoothing out the localized peaks and troughs

Table 4.15. Dispersions of the probability-based IDF curves of HUC 2080202.

Duration	Return Period								
	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year
15 min	0.33	0.3	0.3	0.3	0.31	0.31	0.31	0.32	0.32
30 min	0.36	0.34	0.33	0.34	0.34	0.34	0.34	0.35	0.35
45 min	0.36	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.36
1 h	0.37	0.35	0.35	0.36	0.36	0.36	0.37	0.37	0.37
2 h	0.4	0.39	0.39	0.4	0.4	0.41	0.41	0.41	0.42
3 h	0.4	0.38	0.38	0.39	0.39	0.4	0.4	0.4	0.4
4 h	0.4	0.39	0.39	0.4	0.4	0.4	0.41	0.41	0.41
6 h	0.4	0.39	0.39	0.4	0.4	0.4	0.41	0.41	0.41
12 h	0.4	0.39	0.39	0.4	0.4	0.4	0.41	0.41	0.41
24 h	0.39	0.38	0.38	0.39	0.39	0.4	0.4	0.41	0.41
48 h	0.38	0.38	0.38	0.39	0.39	0.39	0.4	0.4	0.4
72 h	0.37	0.37	0.37	0.38	0.38	0.39	0.39	0.4	0.4


Non-exceedance Probability (%)
Intensity (mm hr⁻¹)
2-year
5-year
10-year
25-year
50-year
100-year
200-year
500-year
1000-year
HUC: 2080202; Duration: 15 min
HUC: 2080202; Duration: 30 min
HUC: 2080202; Duration: 45 min
HUC: 2080202; Duration: 1 hr
HUC: 2080202; Duration: 2 hr
HUC: 2080202; Duration: 3 hr

[Figure 4.14]

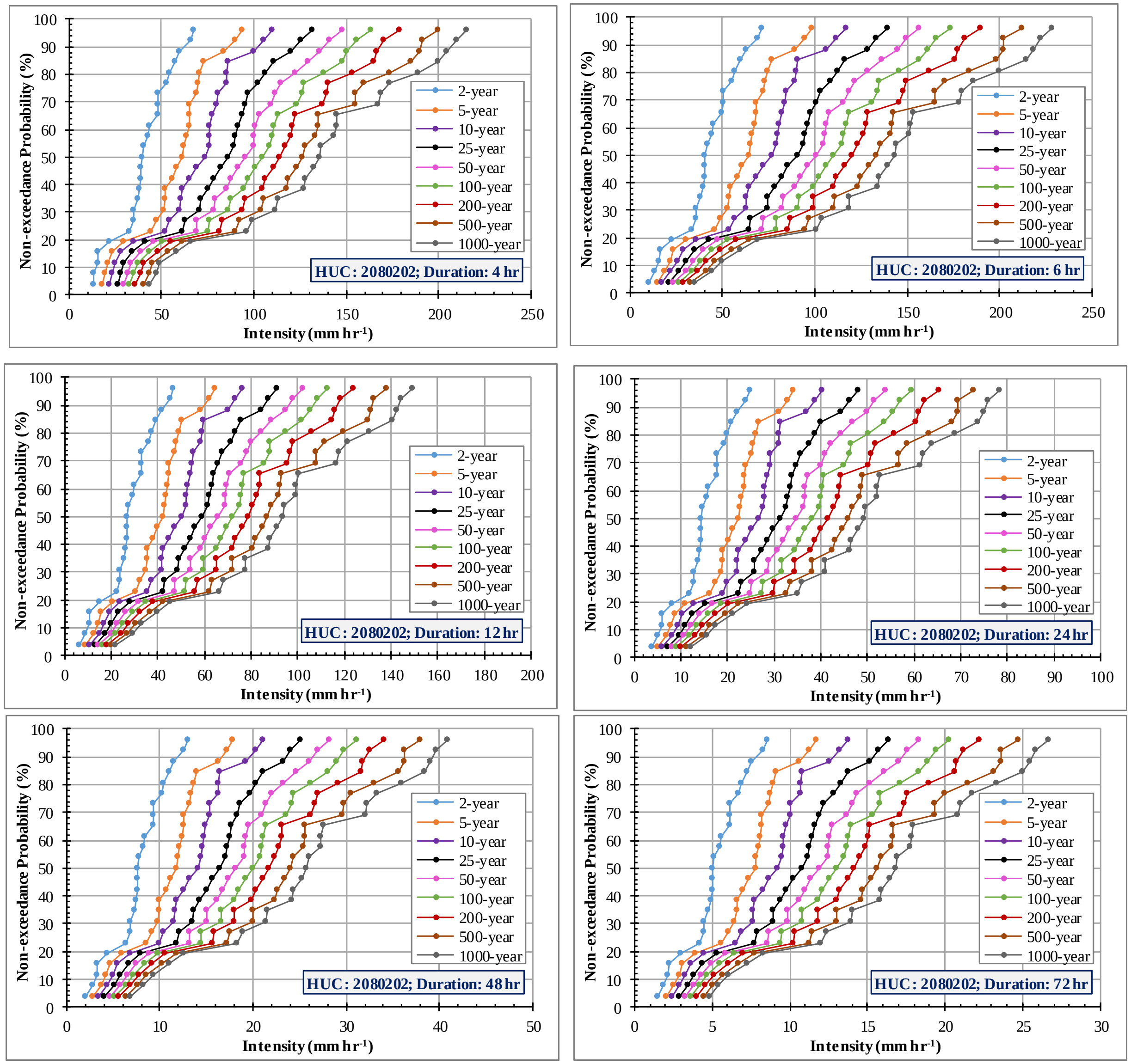


Figure 4.14. The probability-based intensity-duration-frequency (IDF) curves for HUC 2080202

4.4 Conclusions

This study developed an innovative approach for creating gauge- and watershed-level probability-based (i.e., next-generation) intensity-duration-frequency (IDF) curves. This approach consisted of a variety of methods, spreadsheets, and computer scripts for filling missing values of precipitation, detecting temporal trends and non-stationarities, selecting best statistical distributions, downscaling and disaggregating predictions of the RCM-GCM models, and creating probability-based IDF curves. It requires observed historical data on 15-min precipitation at various gauges and predicted historical and future 3-h time series by the RCM-GCM models. Subsequently, this approach was applied to the state of Virginia to create the historical and next-generation IDF curves for 57 gauges and 53 Virginia 8-digit watersheds. Such IDF curves consider the non-stationarity at temporal and spatial scales relevant to improving future infrastructure planning processes and can be a useful tool to construct and/or manage hydrology-influenced infrastructure in changing climate in guarding against over- or under-committing resources.

For the state of Virginia, the annual maximum durational intensities tended to decrease, but they did not experience any significant step change. The decreasing trends have caused the intensities at four gauges, but are expected to cause intensities at more gauges, to become non-stationary. The intensities tended to follow a normal distribution with increase of duration. Overall, the intensity for a longer duration had a smaller interannual variation than that for a shorter duration, implying that using a historic IDF curve, the structures that are controlled by a design peak discharge will likely be oversized, whereas the structures that are controlled by a design runoff volume will probably be undersized. Regardless of the durations, the southwestern portions of the Northern and Western

Piedmont divisions and the middle portion of the Central Mountain division tended to get more and more intense storm events in comparison with the coastal plain. In addition, the intensities at the gauges either follow a Gumbel or Weibull distribution, while the best distribution for a watershed might be assumed to be same as that for the control rain gauges, which account for most of the watershed drainage area. Based on these two types of distributions, the gauge- and watershed-level historic IDF curves were created. Further, the predictions of the 13 RCMs were spatially downscaled to the rain gauges and then temporally disaggregated into 15-min precipitations. However, limited by time, the probability based IDF curves were created for eight gauges and one watershed only.

References

AMEC (AMEC Environment & Infrastructure). 2012. *National Engineering Vulnerability Assessment of Public Infrastructure to Climate Change: Development of Projected Intensity-Duration-Frequency Curbes for Welland, Ontario, Canada*. Final Report. City of Wellland, Canada: Stormwater and Wastewater Infrastructure.

Arnbjerg-Nielsen K. 2012. Quantification of climate change effects on extreme precipitation used for high resolution hydrologic design. *Urban Water Journal* 9(2): 57-65.

Auld H. 2013. Climate adaptation tools: Extreme rainfall intensity-duration-frequency (IDF) curves. *A PowerPoint Presentation*. Available http://www.RiskSciencesInt.com, Accessed December 23, 2013.

Bhunya P, Jain S, Ojha C, and Agarwal A. 2007. Simple parameter estimation technique for three-parameter generalized extreme value distribution. *Journal of Hydrologic Engineering* 12(6): 682-689.

Buishand, TA. 1982. Some methods for testing the homogeneity of rainfall records. *Journal of Hydrology* 58: 11 – 27.

Casas MC, Codina B, Redaño A, and Lorente J. 2004. A methodology to classify extreme rainfall events in the western Mediterranean area. *Theoretical and Applied*

Climatology 77: 139-150.

Chang CW, and Hiong S. 2013. Estimation of sub-daily IDF curves in Singapore using simple scaling. In: *Proceedings of International Conference on Climate Change Effects: Impacts World 2013*. Potsdam, New York, NY, May 27-30.

Coles S. 2001. An Introduction to Statistical Modeling of Extreme Values. London, UK: Springer. 208p.

Conover WJ. 1971. *Practical Nonparametric Statistics*. John Wiley & Sons: New York.

der Leeden V. 1994. *Water Atlas of Virginia* (1st ed.). Tennyson Press. ISBN: 978-0963871107. pp.105.

Endo N, Kadota T, Matsumoto J, Ailikun B. 2006. Climatology and trends in summer precipitation characteristics in Mongolia for the period 1960-98. *Journal of the Meteorological Society of Japan* 84: 543-551.

Fréchet M. 1927. Sur la loi de probability de l'écart maximum. *Ann. Soc. Polon. Math. (Cracovie)* 6: 93-116.

Gringorten II. 1963. A plotting rule for extreme probability paper. *Journal of Geophysics Resources* 68 (3): 813-814.

Groisman PYA, Karl TR, Easterling DR, Supplah R, Page CM, Wibig J, Fortuniak K, Razuvaev VN, Douglas A, Førland E, and Zhai P. 1999. Changes in the probability of heavy precipitation: Important indicators of climate change. *Climatic Change* 42: 243-283.

Gumbel EJ. 1958. *Statistics of Extremes*. New York, NY: Columbia University Press. 375p.

Hamed KH, Rao AR. 1998. A modified Mann-Kendall trend test for autocorrelated data. *Journal of Hydrology* 204: 182-196.

Hirsch RM, Slack JR, Smith RA. 1982. Techniques for trend assessment for monthly water quality data. *Water Resources Research* 18: 107-121.

Hosking JRM, Wallis JR, and Wood EF. 1985. Estimation of the generalized extreme value distribution by method of probability weighted moments. *Technometrics* 27(3): 251-261.

Kendall MG. 1970. *Rank Correlation Methods* (2nd edn). Hafner: New York.

Kutschera P, Bartha M, and Havlik D. 2011. SUDPLAN's experiences with the OGCbased model web services for the climate change usage area. Available at http://www.sudplan.edu, Accessed on February 15, 2014.

Lall U, Rajagopalan B, and Tarboton DG. 1996. A nonparametric wet/dry spell model for daily precipitation. *Water Resources Research* 32(9): 2803-2823.

Liew SC, Srivatsan VR, and Liong SY. 2013. How to construct future IDF curves, under changing climate, for sites with scarce rainfall records? *Hydrological Processes*: online. doi:10.1002/hyp.9839.

Mann HB. 1945. Nonparametric tests against trend. *Econometrica* 13: 245-259.

Massey FJ. 1951. The Kolmogorov-Smirnov test for goodness of fit. *Journal of the American Statistical Association* 46(253): 68-78.

McCuen R. 1998. *Hydrologic Analysis and Design*. Englewood Cliffs, NJ: Prentice-Hall.

McGilchrist CA, Woodyer KD. 1975. Note on a distribution-free CUSUM technique. *Technometrics* 17(3): 321-325.

Menabde M, Seed A, and Pegram G. 1999. A simple scaling model for extreme rainfall. *Water Resources Research* 35(1): 335-339.

Mirhosseini G, Srivastava P, and Stefanova L. 2013. The impact of climate change on rainfall intensity-duration-frequency (IDF) curves in Albama. *Regional Environmental Change* 13(1): S25-S33. doi: 10.1007/s10113-012-0375-5.

Mirhosseini G. 2013. *Evaluating the Impact of Climate Change on Rainfall Intensity-Duration-Frequency (IDF) Curves in Alabama Using Dynamically-Downscaled Precipitation Data*. Dissertation. Auburn, AL: Library at Auburn University.

Neter J, Kutner MH, Nachtsheim CJ, and Wasserman W. 1996. *Applied Linear Statistical Models* (4th ed.). New York, NY: McGraw-Hill Companies, Inc.

NIPCC (Nongovernmental International Panel on Climate Change). 2011. *Climate Change Reconsidered*. Chicago, IL: The Heartland Institute.

NOAA. 1986. Probable Maximum and TVA Precipitation Estimates with Areal Distributions for Tennessee River Drainages Less Than 3000 Square Miles in Area. Hydrometeorological Report No. 56. Washington D.C.: National Oceanic & Atmospheric Administration.

Prodanovic P, and Simonovic SP. 2007. *Development of Rainfall Intensity Duration Frequency Curves for the City of London under the Changing Climate*. Available http://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=1020&context=wrrr, Accessed December 23, 2013.

Ribalaygua J, Torres L, Pórtoles J, Monjo R, Gaitán E, Pino MR. 2013. Description and validation of a two-step analogue/regression downscaling method. *Theoretical and Applied Climatology* 111. doi: 10.1007/s00704-013-0836-x.

Rodríguez R, Navarro X, Casas MC, Ribalaygua J, Russo B, Pougetd L, and Redaño A. 2013. Influence of climate change on IDF curves for the metropolitan area of Barcelona (Spain). *International Journal of Climatology*: online. doi: 10.1002/joc.3712.

Sen PK. 1968. Estimates of the regression coefficient based on Kendall’s tau. *Journal of American Statistical Association* 63: 1379-1389.

Sharma A, Tarbaton DG, and Lall U. 1997. Stremflow simulation: A nonparametric approach. *Water Resources Research* 33(2): 291-308.

Silverman BW. 1998. *Density Estimation for Statistics and Data Analysis*. London, UK: Chapman & Hall/CRC. ISBN: 0-412-24620-1.

Smith, TJS, Rubenstein, LS, and Nachman, KE. 2013. Availability of Information about Airborne Hazardous Releases from Animal Feeding Operations. PLOS ONE 12(8): e85342.

Sneyers R. 1990. *Technical Note No 143 on the Statistical Analysis of series of Observations*. World Meteorological Organization: Geneva.

Socolofsky S, Adams E, and Entekhabi D. 2001. Disaggregation of daily rainfall for continuous watershed modeling. *Journal of Hydrologic Engineering* 6(4): 300-309.

Solaiman TA, and Simonovic SP. 2011. *Development of Probability Based Intensity-Duration-Frequency Curves under Climate Change*. Water Resources Research Report #072 (ISBN: 978-0-7714-2893-7). London, Ontario, Canada: Department of Civil and Environmental Engineering at the University of western Ontario.

Taubenheim J. 1989. An easy procedure for detecting a discontinuity in a digital time series. *Meteorologische Zeitschrift* 39(6): 344-347.

USDA-SCS. 1968. *Hydrology: Supplement A to Section 4 of Engineering Handbook*. Washington D.C.: U.S. Department of Agriculture Soil Conservation Service.

USGS (U.S. Geological Survey). 2001a. National elevation dataset. Available http://gisdata.usgs.net/NED/default.asp, Accessed December 27, 2013.

USGS (U.S. Geological Survey). 2001b. National hydrography dataset. Available http://nhd.usgs.gov, Accessed December 27, 2013.

Viessman W Jr., and Lewis GL. 2003. *Introduction to Hydrology* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Wang X, and Melesse AM. 2005. Evaluation of the SWAT model's snowmelt hydrology in a northwestern Minnesota watershed. *Transactions of the ASAE* 48(4): 1359-1376.

Wang X, Yang X, Liu T, Li F, Gao R, Duan L, and Luo Y. 2013. Trend and extreme occurrence of precipitation in a mid-latitude Eurasian steppe watershed at various time scales. *Hydrological Processes: online*. doi: 10.1002/hyp.10054.

Weibull W. 1951. A statistical distribution function of wide applicability. *Journal of Applied Mechanics* 18 (3): 293-297.

Wikipedia. 2014. Kolmogorov–Smirnov test. Available at http://en.wikipedia.org/wiki/Kolmogorov%E2%80%93Smirnov_test, Accessed on December 20, 2018.

Wikipedia. 2018. Virginia. Available at https://en.wikipedia.org/wiki/Virginia, Accessed on December 20, 2018.

Wolcott SB, Mroz M, and Basile J. 2009. Application of northeast regional climate center research results for the purpose of evaluating and updating intensity-duration-frequency (IDF) curves, case study: Rochester, New York. In: *Proceedings of World Environmental and Water Resources Congress 2009*. Kansas City, Missouri.

Wray D. 2013. *Naval Station Norfolk Siltation Study*. Master Project Report. Norfolk, VA: Civil and Environmental Engineering Department at Old Dominion University.

Yang, X., Wang, X., Cai, Z. and Cao, W. (2021) Detecting spatiotemporal variations of maximum rainfall intensities at various time intervals across Virginia in the past half century. Atmospheric research 255, 105534. Available at: https://www.sciencedirect.com/science/article/pii/S0169809521000867.

Zetterqvist L. 1991. Statistical estimation and interpretation of trends in water quality time series. *Water Resources Research* 27(7): 1637-1648.

CHAPTER 5

OVERALL CONCLUSIONS AND RECOMMENDATIONS

5.1 Overall Conclusions

This dissertation examined different characteristics of observed precipitation, such as maximum precipitation intensities for 12 durations, precipitation amount (e.g., PRCPTOT, R99pTOT, and R95pTOT), simple precipitation intensities (e.g., SDII), both dry and wet spells (e.g., CDD and CWD), precipitation maximums (e.g., Rx1day and Rx5day), and precipitation exceedances (e.g., R1mm, R10mm, R20mm, Rgmm, and R50thmm). By using these characteristics, this dissertation further formulated and used a set of methods, such as nonparametric test and sequential analysis, to fill missing values, detect temporal trends, trending rates, and step changes as well as to examine spatial patterns and even the autocorrelations. Subsequently, this dissertation developed an innovative approach for creating historical and next-generation gauge- and watershed-level probability-based (i.e., next-generation) intensity-duration-frequency (IDF) curves by using observed historical data on 15-min precipitation at various gauges and predicted historical and future 3-h time series from the RCM-GCM models. This approach consists of a variety of methods, spreadsheets, and computer scripts for detecting temporal trends and non-stationarities, selecting best statistical distributions, downscaling and disaggregating predictions of the RCM-GCM models, and creating probability-based IDF curves. Such IDF curves consider the non-stationarity at temporal and spatial scales relevant to improving infrastructure planning processes and can be a useful tool to construct and/or manage hydrology-influenced infrastructure in changing climate in guarding against over- or under-committing resources.

The results indicated that the state of Virginia, especially the coastal area, has been experiencing more storms with a larger magnitude, longer duration, and greater intensity. However, decreasing trends of total rainy days (i.e., R1mm) and precipitation intensity (i.e., maximum precipitation intensity and SDII) emerged in the middle and western subregions. Localized drizzles and/or heavy storms could occur. Most of the gauges incurred a statistically significant step change for one or more of the thirteen precipitation indices between 1948 and 2008, with more step increases than step decreases. However, no significant step changes were detected for the maximum precipitation intensity. The spatial autocorrelations of rainfall in the state of Virginia were dependent on a spatial scale of interest (e.g., gauge versus CPZ). In addition, the intensities at the gauges either follow a Gumbel or Weibull distribution, while the best distribution for a watershed might be assumed to be same as that for the control rain gauge, which accounts for most of the watershed drainage area. Based on these two types of distributions, the gauge- and watershed-level historical IDF curves were created. Further, the predictions of the 13 RCMs were spatially downscaled to the rain gauges and then temporally disaggregated into 15-min precipitations. However, limited by time, the probability-based IDF curves were created for eight gauges and one watershed only.

5.2 Recommendations for Future Research

The state territory has been experiencing more storms with a decreasing rainfall intensity but an increasing amount and longer durations. A follow up study on evaluating the spatiotemporal variations of future precipitation may be valuable. Besides, since there are proofs that the climate has been changing across the state of Virginia, a reasonable recommendation is to update the existing hydrologic engineering design guidance to consider trend-induced non-stationarities in precipitation, and to evaluate how this climate non-stationarities would impact flood control. Moreover, future researches should develop the probability-based IDF curves for the remaining gauges and watersheds.

APENDICES

A. The K-S Test Results for Selecting Best Distributions

Rain Gauge ID	Distribution & Critial Value	15	30	45	60	120	180	240	360	720	1440	2880	4320	Best Distribution	Gross Minimum	Gross Sum	Gross Maximum
		K-S Test Statistics for Duration (min)															
446475	Gumbel	0.07	0.07	0.08	0.11	0.04	0.07	0.10	0.06	0.11	0.06	0.06	0.10	Gumbel	0.93	0.93	0.11
	Weibull	0.06	0.03	0.04	0.06	0.04	0.09	0.14	0.10	0.14	0.10	0.07	0.12			0.99	0.14
	Fréchet	0.30	9999.00	9999.00	9999.00	9999.00	0.21	0.28	0.25	9999.00	0.24	9999.00	0.23			59995.51	9999
	Critial Value	0.38	0.34	0.35	0.33	0.29	0.33	0.33	0.29	0.28	0.26	0.26	0.26			3.7	0.38
448800	Gumbel	0.06	0.12	0.09	0.14	0.09	0.09	0.13	0.09	0.09	0.11	0.09	0.06	Weibull	1.01	1.16	0.14
	Weibull	0.06	0.08	0.06	0.10	0.07	0.06	0.09	0.07	0.12	0.10	0.11	0.09			1.01	0.12
	Fréchet	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	0.23	0.26			99990.49	9999
	Critial Value	0.35	0.31	0.33	0.32	0.33	0.29	0.29	0.31	0.28	0.28	0.27	0.28			3.64	0.35
449151	Gumbel	0.09	0.08	0.04	0.04	0.06	0.09	0.08	0.07	0.13	0.20	0.13	0.16	Gumbel	1.17	1.17	0.2
	Weibull	0.08	0.06	0.06	0.06	0.09	0.10	0.10	0.08	0.17	0.18	0.12	0.15			1.25	0.18
	Fréchet	0.28	0.31	9999.00	0.17	9999.00	9999.00	9999.00	0.26	0.19	9999.00	9999.00	9999.00			69994.21	9999
	Critial Value	0.34	0.31	0.32	0.29	0.28	0.29	0.26	0.26	0.30	0.25	0.25	0.24			3.39	0.34
448129	Gumbel	0.25	0.21	0.21	0.21	0.20	0.18	0.21	0.08	0.09	0.11	0.13	0.08	Weibull	1.89	1.96	0.25
	Weibull	0.21	0.16	0.17	0.18	0.18	0.19	0.24	0.13	0.10	0.11	0.11	0.11			1.89	0.24
	Fréchet	0.34	0.31	0.28	0.34	0.30	0.30	0.31	0.32	0.32	0.29	0.42	0.24			3.77	0.42
	Critial Value	0.52	0.45	0.45	0.48	0.56	0.52	0.48	0.45	0.56	0.45	0.45	0.45			5.82	0.56
440778	Gumbel													Gumbel			
	Weibull																
	Fréchet																
	Critial Value																
440993	Gumbel	0.09	0.12	0.09	0.05	0.06	0.12	0.09	0.08	0.09	0.06	0.08	0.09	Gumbel	1.02	1.02	0.12
	Weibull	0.07	0.09	0.06	0.06	0.08	0.13	0.12	0.10	0.11	0.06	0.10	0.12			1.1	0.13
	Fréchet	0.38	9999.00	9999.00	9999.00	0.20	9999.00	0.25	0.23	9999.00	9999.00	0.27	0.16			59995.49	9999
	Critial Value	0.43	0.35	0.35	0.31	0.32	0.32	0.31	0.32	0.31	0.29	0.28	0.29			3.88	0.43

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
441322	Gumbel	0.13	0.14	0.11	0.05	0.07	0.06	0.06	0.08	0.10	0.10	0.13	0.11	Gumbel	1.14	1.14	0.14
	Weibull	0.12	0.15	0.13	0.08	0.10	0.07	0.09	0.11	0.08	0.07	0.07	0.07			1.14	0.15
	Fréchet	0.25	9999.00	9999.00	0.32	0.30	9999.00	0.19	0.24	9999.00	9999.00	9999.00	9999.00			69994.3	9999
	Critial Value	0.35	0.33	0.33	0.32	0.30	0.29	0.29	0.28	0.26	0.25	0.28	0.26			3.54	0.35
441929	Gumbel	0.08	0.07	0.07	0.14	0.14	0.12	0.09	0.11	0.19	0.19	0.17	0.11	Gumbel	1.48	1.48	0.19
	Weibull	0.07	0.09	0.11	0.13	0.16	0.13	0.11	0.13	0.20	0.22	0.18	0.13			1.66	0.22
	Fréchet	0.34	0.34	0.23	0.34	0.29	0.28	0.28	0.26	0.22	0.32	0.32	0.25			3.47	0.34
	Critial Value	0.48	0.48	0.43	0.48	0.41	0.39	0.39	0.36	0.35	0.36	0.35	0.35			4.83	0.48
442941	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																
443192	Gumbel	0.17	0.09	0.17	0.08	0.10	0.13	0.09	0.10	0.15	0.13	0.12	0.13	Weibull	1.4	1.46	0.17
	Weibull	0.16	0.10	0.14	0.09	0.12	0.17	0.13	0.08	0.11	0.09	0.08	0.13			1.4	0.17
	Fréchet	0.25	0.40	0.29	0.33	0.22	0.22	0.15	0.26	9999.00	9999.00	0.15	0.26			20000.53	9999
	Critial Value	0.62	0.52	0.56	0.45	0.56	0.52	0.52	0.52	0.48	0.45	0.48	0.48			6.16	0.62
443200	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																
444414	Gumbel	0.16	0.14	0.08	0.06	0.05	0.06	0.08	0.08	0.04	0.07	0.07	0.06	Gumbel	0.95	0.95	0.16
	Weibull	0.12	0.12	0.07	0.06	0.07	0.07	0.07	0.09	0.08	0.09	0.09	0.09			1.02	0.12
	Fréchet	9999.00	9999.00	0.24	0.25	0.19	0.23	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			79992.91	9999
	Critial Value	0.32	0.30	0.29	0.27	0.26	0.26	0.28	0.26	0.27	0.26	0.25	0.26			3.28	0.32

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
440166	Gumbel	0.07	0.06	0.05	0.08	0.07	0.07	0.07	0.07	0.09	0.10	0.07	0.10	Gumbel	0.9	0.9	0.1
	Weibull	0.07	0.08	0.06	0.11	0.10	0.12	0.12	0.14	0.12	0.13	0.09	0.10			1.24	0.14
	Fréchet	0.23	0.25	0.26	0.17	9999.00	0.23	9999.00	0.25	9999.00	0.18	0.18	9999.00			39997.75	9999
	Critial Value	0.31	0.30	0.29	0.29	0.31	0.29	0.29	0.29	0.30	0.30	0.28	0.28			3.53	0.31
441614	Gumbel	0.14	0.12	0.09	0.06	0.05	0.05	0.07	0.06	0.07	0.07	0.05	0.07	Gumbel	0.9	0.9	0.14
	Weibull	0.11	0.12	0.10	0.08	0.06	0.06	0.07	0.05	0.06	0.07	0.08	0.06			0.92	0.12
	Fréchet	0.27	0.28	0.23	0.28	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			79993.06	9999
	Critial Value	0.34	0.33	0.31	0.29	0.29	0.29	0.28	0.28	0.26	0.25	0.24	0.25			3.41	0.34
446178	Gumbel	0.15	0.16	0.12	0.11	0.09	0.12	0.08	0.08	0.11	0.14	0.13	0.08	Gumbel	1.37	1.37	0.16
	Weibull	0.16	0.18	0.14	0.13	0.10	0.13	0.10	0.09	0.16	0.18	0.17	0.12			1.66	0.18
	Fréchet	0.36	0.34	0.26	0.27	0.24	0.29	0.29	9999.00	0.30	0.22	0.20	0.26			10002.03	9999
	Critial Value	0.43	0.38	0.36	0.34	0.38	0.35	0.33	0.32	0.31	0.32	0.32	0.33			4.17	0.43
446692	Gumbel	0.17	0.15	0.13	0.09	0.08	0.04	0.05	0.06	0.07	0.06	0.08	0.06	Gumbel	1.04	1.04	0.17
	Weibull	0.18	0.15	0.13	0.11	0.12	0.07	0.10	0.06	0.11	0.10	0.08	0.09			1.3	0.18
	Fréchet	0.32	0.20	0.20	0.21	0.24	0.30	9999.00	9999.00	0.28	0.21	9999.00	0.20			29999.16	9999
	Critial Value	0.39	0.35	0.36	0.33	0.33	0.30	0.30	0.28	0.28	0.26	0.26	0.25			3.69	0.39
447025	Gumbel	0.14	0.14	0.09	0.10	0.08	0.09	0.13	0.16	0.17	0.12	0.21	0.20	Weibull	1.38	1.63	0.21
	Weibull	0.12	0.12	0.06	0.09	0.09	0.06	0.11	0.16	0.14	0.10	0.17	0.16			1.38	0.17
	Fréchet	0.33	0.28	0.27	0.25	0.17	9999.00	0.24	0.31	0.34	0.37	0.39	9999.00			20000.95	9999
	Critial Value	0.41	0.48	0.41	0.43	0.41	0.39	0.43	0.43	0.39	0.41	0.39	0.41			4.99	0.48
447338	Gumbel	0.28	0.25	0.20	0.23	0.14	0.15	0.17	0.15	0.16	0.13	0.07	0.10	Gumbel	2.03	2.03	0.28
	Weibull	0.26	0.24	0.24	0.23	0.17	0.16	0.19	0.17	0.18	0.17	0.10	0.11			2.22	0.26
	Fréchet	0.34	0.13	0.12	0.06	0.06	0.21	0.13	0.28	9999.00	0.26	0.20	9999.00			19999.79	9999
	Critial Value	0.36	0.33	0.34	0.34	0.29	0.31	0.29	0.28	0.29	0.27	0.26	0.26			3.62	0.36

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
449272	Gumbel	0.21	0.21	0.24	0.19	0.14	0.17	0.17	0.17	0.13	0.06	0.12	0.10	Gumbel	1.91	1.91	0.24
	Weibull	0.20	0.21	0.23	0.20	0.17	0.20	0.17	0.20	0.17	0.12	0.12	0.08			2.07	0.23
	Fréchet	9999.00	0.33	0.32	9999.00	0.32	9999.00	0.31	9999.00	0.19	9999.00	9999.00	9999.00			69994.47	9999
	Critial Value	0.34	0.35	0.33	0.30	0.32	0.30	0.31	0.29	0.30	0.27	0.28	0.27			3.66	0.35
440561	Gumbel	0.11	0.06	0.06	0.10	0.06	0.09	0.08	0.09	0.07	0.11	0.10	0.09	Gumbel	1.02	1.02	0.11
	Weibull	0.10	0.08	0.05	0.11	0.09	0.12	0.12	0.11	0.12	0.14	0.15	0.10			1.29	0.15
	Fréchet	0.22	0.23	0.30	0.28	0.22	0.22	0.30	0.39	0.32	0.26	0.33	0.13			3.2	0.39
	Critial Value	0.43	0.39	0.38	0.39	0.38	0.36	0.36	0.39	0.36	0.34	0.36	0.34			4.48	0.43
445690	Gumbel	0.17	0.16	0.15	0.09	0.07	0.05	0.10	0.05	0.05	0.07	0.08	0.07	Weibull	1.08	1.11	0.17
	Weibull	0.13	0.13	0.13	0.08	0.06	0.04	0.07	0.06	0.08	0.10	0.10	0.10			1.08	0.13
	Fréchet	9999.00	0.32	9999.00	0.29	0.24	9999.00	9999.00	0.27	0.23	0.20	9999.00	0.20			49996.75	9999
	Critial Value	0.32	0.32	0.31	0.30	0.29	0.28	0.29	0.28	0.25	0.26	0.27	0.25			3.42	0.32
442159	Gumbel	0.26	0.20	0.16	0.12	0.11	0.11	0.11	0.13	0.06	0.13	0.09	0.08	Gumbel	1.56	1.56	0.26
	Weibull	0.25	0.19	0.15	0.13	0.14	0.14	0.13	0.16	0.08	0.08	0.07	0.09			1.61	0.25
	Fréchet	0.34	0.09	0.17	0.10	0.26	0.27	0.28	0.34	9999.00	9999.00	9999.00	0.30			29999.15	9999
	Critial Value	0.43	0.38	0.35	0.35	0.33	0.33	0.33	0.34	0.31	0.31	0.33	0.31			4.1	0.43
442729	Gumbel	0.12	0.18	0.16	0.13	0.14	0.16	0.13	0.18	0.19	0.22	0.19	0.18	Weibull	1.87	1.98	0.22
	Weibull	0.10	0.15	0.14	0.13	0.13	0.14	0.13	0.16	0.21	0.19	0.18	0.21			1.87	0.21
	Fréchet	0.32	0.35	0.34	0.31	0.33	0.32	0.33	0.37	0.39	0.34	0.32	0.35			4.07	0.39
	Critial Value	0.48	0.45	0.48	0.45	0.43	0.45	0.43	0.41	0.43	0.45	0.41	0.41			5.28	0.48
446712	Gumbel	0.18	0.14	0.11	0.06	0.08	0.07	0.14	0.11	0.07	0.06	0.04	0.08	Gumbel	1.14	1.14	0.18
	Weibull	0.14	0.14	0.13	0.07	0.08	0.08	0.14	0.11	0.08	0.10	0.09	0.06			1.22	0.14
	Fréchet	0.35	0.25	0.21	0.29	0.19	0.24	9999.00	9999.00	0.26	9999.00	9999.00	9999.00			49996.79	9999
	Critial Value	0.38	0.32	0.32	0.30	0.28	0.28	0.29	0.27	0.26	0.26	0.26	0.25			3.47	0.38

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
447130	Gumbel	0.07	0.19	0.19	0.15	0.11	0.07	0.10	0.11	0.08	0.10	0.10	0.12	Weibull	1.32	1.39	0.19
	Weibull	0.08	0.15	0.14	0.13	0.09	0.08	0.11	0.11	0.10	0.10	0.12	0.11			1.32	0.15
	Fréchet	0.40	9999.00	9999.00	9999.00	0.44	0.33	0.33	0.20	0.35	0.22	0.23	0.31			29999.81	9999
	Critial Value	0.45	0.45	0.48	0.48	0.45	0.45	0.45	0.45	0.43	0.45	0.43	0.45			5.42	0.48
447164	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																
448396	Gumbel	0.17	0.13	0.13	0.11	0.06	0.11	0.12	0.14	0.08	0.11	0.10	0.10	Gumbel	1.36	1.36	0.17
	Weibull	0.14	0.14	0.13	0.12	0.09	0.13	0.13	0.15	0.10	0.12	0.12	0.13			1.5	0.15
	Fréchet	0.33	0.33	0.14	0.26	0.26	0.18	0.24	0.28	9999.00	9999.00	0.25	9999.00			29999.27	9999
	Critial Value	0.34	0.36	0.31	0.31	0.29	0.29	0.28	0.28	0.28	0.29	0.28	0.26			3.57	0.36
440720	Gumbel	0.17	0.19	0.20	0.14	0.10	0.13	0.11	0.11	0.09	0.12	0.11	0.11	Weibull	1.44	1.58	0.2
	Weibull	0.14	0.16	0.17	0.12	0.10	0.11	0.09	0.13	0.09	0.11	0.11	0.11			1.44	0.17
	Fréchet	0.15	0.31	0.32	0.30	0.33	9999.00	0.26	0.16	0.37	0.13	0.22	0.22			10001.77	9999
	Critial Value	0.62	0.56	0.56	0.56	0.56	0.56	0.56	0.62	0.56	0.62	0.56	0.56			6.9	0.62
445851	Gumbel	0.19	0.19	0.19	0.15	0.11	0.13	0.14	0.14	0.14	0.11	0.08	0.08	Weibull	1.45	1.65	0.19
	Weibull	0.16	0.14	0.14	0.12	0.10	0.10	0.12	0.12	0.14	0.12	0.10	0.09			1.45	0.16
	Fréchet	0.38	0.36	0.36	0.35	0.30	0.34	0.21	0.26	9999.00	0.28	9999.00	0.33			20001.17	9999
	Critial Value	0.39	0.36	0.38	0.35	0.35	0.35	0.36	0.36	0.35	0.36	0.35	0.35			4.31	0.39
442663	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
443229	Gumbel	0.22	0.18	0.16	0.15	0.17	0.12	0.14	0.12	0.10	0.09	0.12	0.12	Gumbel	1.69	1.69	0.22
	Weibull	0.13	0.16	0.14	0.13	0.17	0.14	0.16	0.16	0.16	0.15	0.12	0.08			1.7	0.17
	Fréchet	0.29	0.27	0.30	0.35	0.32	0.20	0.38	0.38	0.27	0.16	0.29	0.40			3.61	0.4
	Critial Value	0.56	0.43	0.43	0.43	0.43	0.48	0.45	0.45	0.45	0.45	0.45	0.43			5.44	0.56
448046	Gumbel	0.21	0.19	0.17	0.14	0.13	0.15	0.11	0.08	0.06	0.06	0.06	0.04	Gumbel	1.4	1.4	0.21
	Weibull	0.13	0.16	0.16	0.15	0.14	0.15	0.13	0.11	0.10	0.08	0.08	0.08			1.47	0.16
	Fréchet	0.35	0.34	0.32	9999.00	0.29	0.30	0.26	0.28	0.29	0.26	9999.00	9999.00			29999.69	9999
	Critial Value	0.35	0.34	0.33	0.35	0.33	0.32	0.30	0.29	0.29	0.28	0.27	0.26			3.71	0.35
448149	Gumbel	0.19	0.21	0.16	0.23	0.19	0.11	0.13	0.16	0.20	0.14	0.11	0.16	Weibull	1.72	1.99	0.23
	Weibull	0.13	0.14	0.12	0.18	0.14	0.12	0.15	0.18	0.19	0.10	0.11	0.16			1.72	0.19
	Fréchet	0.51	0.62	9999.00	0.29	9999.00	0.16	0.20	0.29	0.20	0.32	0.27	0.36			20001.22	9999
	Critial Value	0.71	0.62	0.62	0.71	0.62	0.62	0.62	0.56	0.56	0.56	0.56	0.62			7.38	0.71
442044	Gumbel	0.12	0.10	0.08	0.07	0.09	0.12	0.10	0.12	0.09	0.12	0.10	0.12	Gumbel	1.23	1.23	0.12
	Weibull	0.11	0.10	0.08	0.08	0.10	0.14	0.11	0.14	0.12	0.15	0.12	0.14			1.39	0.15
	Fréchet	0.24	0.25	0.30	0.11	0.26	0.29	0.28	0.18	0.29	9999.00	9999.00	9999.00			29999.2	9999
	Critial Value	0.36	0.34	0.32	0.32	0.31	0.31	0.29	0.29	0.29	0.26	0.26	0.27			3.62	0.36
442208	Gumbel	0.07	0.05	0.04	0.04	0.06	0.08	0.08	0.08	0.07	0.09	0.10	0.07	Weibull	0.81	0.83	0.1
	Weibull	0.05	0.07	0.06	0.04	0.09	0.07	0.07	0.06	0.08	0.08	0.06	0.08			0.81	0.09
	Fréchet	0.23	9999.00	0.27	0.25	0.20	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	0.27			69994.22	9999
	Critial Value	0.34	0.33	0.32	0.30	0.36	0.33	0.34	0.32	0.31	0.31	0.31	0.30			3.87	0.36
443310	Gumbel	0.11	0.12	0.12	0.13	0.10	0.08	0.04	0.08	0.10	0.14	0.12	0.11	Gumbel	1.25	1.25	0.14
	Weibull	0.09	0.12	0.16	0.17	0.07	0.10	0.11	0.14	0.16	0.18	0.15	0.13			1.58	0.18
	Fréchet	0.22	0.15	0.16	0.29	9999.00	9999.00	9999.00	0.30	9999.00	0.26	9999.00	0.25			49996.63	9999
	Critial Value	0.34	0.33	0.32	0.32	0.32	0.29	0.31	0.30	0.28	0.28	0.26	0.28			3.63	0.34

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
444128	Gumbel	0.15	0.14	0.10	0.09	0.06	0.06	0.08	0.14	0.10	0.11	0.12	0.15	Gumbel	1.3	1.3	0.15
	Weibull	0.10	0.13	0.11	0.10	0.09	0.09	0.12	0.17	0.14	0.14	0.15	0.17			1.51	0.17
	Fréchet	0.31	0.30	0.24	0.14	0.30	0.29	0.20	0.24	9999.00	0.26	9999.00	0.28			20000.56	9999
	Critial Value	0.35	0.35	0.33	0.32	0.31	0.30	0.30	0.31	0.31	0.28	0.27	0.28			3.71	0.35
445142	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																
445423	Gumbel	0.12	0.16	0.12	0.10	0.12	0.10	0.10	0.08	0.12	0.10	0.13	0.09	Gumbel	1.34	1.34	0.16
	Weibull	0.07	0.16	0.14	0.12	0.11	0.09	0.10	0.12	0.08	0.16	0.13	0.11			1.39	0.16
	Fréchet	0.27	0.27	0.22	0.27	9999.00	0.16	0.23	0.33	9999.00	0.25	0.38	0.13			20000.51	9999
	Critial Value	0.45	0.41	0.45	0.43	0.43	0.39	0.41	0.41	0.38	0.39	0.38	0.38			4.91	0.45
445595	Gumbel	0.23	0.18	0.12	0.10	0.07	0.14	0.08	0.07	0.07	0.10	0.10	0.07	Gumbel	1.33	1.33	0.23
	Weibull	0.16	0.16	0.12	0.12	0.09	0.18	0.13	0.07	0.08	0.12	0.07	0.06			1.36	0.18
	Fréchet	0.30	0.18	0.26	0.14	0.24	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			69994.12	9999
	Critial Value	0.41	0.38	0.35	0.34	0.34	0.34	0.32	0.29	0.28	0.31	0.28	0.28			3.92	0.41
445880	Gumbel	0.11	0.11	0.09	0.11	0.09	0.06	0.05	0.09	0.06	0.09	0.12	0.14	Gumbel	1.12	1.12	0.14
	Weibull	0.06	0.06	0.08	0.09	0.08	0.06	0.07	0.10	0.11	0.14	0.16	0.19			1.2	0.19
	Fréchet	9999.00	9999.00	0.35	9999.00	9999.00	9999.00	0.25	9999.00	0.31	0.27	0.26	0.26			59995.7	9999
	Critial Value	0.41	0.39	0.41	0.39	0.38	0.35	0.38	0.33	0.33	0.31	0.32	0.31			4.31	0.41
448062	Gumbel	0.15	0.11	0.13	0.09	0.08	0.07	0.09	0.12	0.14	0.08	0.10	0.07	Gumbel	1.23	1.23	0.15
	Weibull	0.10	0.11	0.12	0.10	0.10	0.10	0.11	0.13	0.16	0.12	0.09	0.08			1.32	0.16
	Fréchet	0.33	0.16	0.31	0.27	9999.00	0.23	9999.00	0.31	9999.00	9999.00	0.24	9999.00			49996.85	9999
	Critial Value	0.36	0.34	0.32	0.31	0.33	0.32	0.32	0.32	0.29	0.28	0.33	0.30			3.82	0.36

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
448172	Gumbel	0.22	0.23	0.23	0.23	0.18	0.15	0.13	0.11	0.16	0.19	0.17	0.19	Weibull	1.72	2.19	0.23
	Weibull	0.14	0.16	0.16	0.16	0.12	0.10	0.11	0.10	0.15	0.18	0.17	0.17			1.72	0.18
	Fréchet	0.25	0.27	0.27	0.30	0.28	0.24	0.17	0.19	0.17	0.30	0.28	0.22			2.94	0.3
	Critial Value	0.56	0.56	0.56	0.56	0.56	0.56	0.62	0.56	0.56	0.56	0.56	0.56			6.78	0.62
449159	Gumbel	0.16	0.11	0.09	0.09	0.07	0.10	0.09	0.08	0.11	0.10	0.08	0.06	Gumbel	1.14	1.14	0.16
	Weibull	0.14	0.12	0.09	0.10	0.10	0.13	0.10	0.12	0.10	0.09	0.10	0.08			1.27	0.14
	Fréchet	0.27	0.25	0.21	0.19	0.36	0.29	0.25	0.19	9999.00	9999.00	9999.00	0.23			29999.24	9999
	Critial Value	0.41	0.39	0.38	0.38	0.36	0.34	0.34	0.35	0.33	0.32	0.33	0.29			4.22	0.41
443272	Gumbel	0.21	0.21	0.21	0.20	0.20	0.14	0.13	0.07	0.08	0.05	0.09	0.08	Gumbel	1.67	1.67	0.21
	Weibull	0.20	0.19	0.20	0.21	0.22	0.16	0.13	0.09	0.11	0.07	0.10	0.07			1.75	0.22
	Fréchet	0.35	0.20	0.18	0.15	0.23	0.26	9999.00	9999.00	0.25	0.23	9999.00	9999.00			39997.85	9999
	Critial Value	0.38	0.33	0.33	0.33	0.33	0.29	0.29	0.30	0.27	0.26	0.25	0.26			3.62	0.38
444246	Gumbel	0.22	0.21	0.17	0.15	0.08	0.10	0.09	0.14	0.09	0.12	0.14	0.09	Gumbel	1.6	1.6	0.22
	Weibull	0.16	0.22	0.16	0.13	0.10	0.13	0.10	0.16	0.14	0.15	0.14	0.12			1.71	0.22
	Fréchet	0.32	0.30	0.19	0.13	0.32	0.25	0.15	0.25	0.30	0.28	0.21	0.23			2.93	0.32
	Critial Value	0.39	0.39	0.34	0.36	0.34	0.33	0.35	0.34	0.32	0.34	0.34	0.32			4.16	0.39
448547	Gumbel	0.09	0.05	0.06	0.11	0.10	0.09	0.10	0.06	0.09	0.11	0.07	0.08	Weibull	0.82	1.01	0.11
	Weibull	0.08	0.08	0.03	0.07	0.07	0.06	0.07	0.06	0.06	0.08	0.08	0.08			0.82	0.08
	Fréchet	0.24	0.28	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			99990.52	9999
	Critial Value	0.39	0.36	0.32	0.30	0.32	0.30	0.30	0.30	0.29	0.31	0.28	0.28			3.75	0.39
449169	Gumbel	0.14	0.10	0.07	0.11	0.10	0.11	0.07	0.16	0.11	0.09	0.11	0.12	Gumbel	1.29	1.29	0.16
	Weibull	0.10	0.11	0.10	0.14	0.12	0.15	0.08	0.09	0.10	0.13	0.06	0.11			1.29	0.15
	Fréchet	0.31	0.23	0.22	0.29	0.24	0.27	0.14	9999.00	9999.00	0.25	9999.00	0.12			29999.07	9999
	Critial Value	0.43	0.39	0.38	0.41	0.39	0.38	0.34	0.36	0.35	0.34	0.32	0.35			4.44	0.43

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
440766	Gumbel	0.11	0.12	0.11	0.09	0.07	0.11	0.08	0.11	0.07	0.14	0.08	0.08	Gumbel	1.17	1.17	0.14
	Weibull	0.13	0.12	0.14	0.12	0.09	0.08	0.08	0.09	0.09	0.14	0.08	0.09			1.25	0.14
	Fréchet	0.19	0.21	0.29	0.25	0.30	0.36	0.33	0.38	0.34	0.23	0.40	0.41			3.69	0.41
	Critial Value	0.52	0.62	0.52	0.52	0.43	0.45	0.45	0.48	0.43	0.45	0.41	0.41			5.69	0.62
446955	Gumbel	0.14	0.10	0.08	0.04	0.08	0.08	0.07	0.09	0.10	0.10	0.06	0.03	Weibull	0.95	0.97	0.14
	Weibull	0.12	0.11	0.10	0.05	0.05	0.06	0.09	0.07	0.10	0.06	0.06	0.08			0.95	0.12
	Fréchet	0.27	0.34	9999.00	0.26	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			89991.87	9999
	Critial Value	0.38	0.35	0.34	0.34	0.31	0.31	0.33	0.31	0.30	0.28	0.28	0.28			3.81	0.38
448022	Gumbel	0.07	0.07	0.09	0.10	0.18	0.19	0.15	0.14	0.11	0.08	0.11	0.10	Gumbel	1.39	1.39	0.19
	Weibull	0.08	0.09	0.12	0.12	0.18	0.19	0.17	0.17	0.16	0.09	0.15	0.14			1.66	0.19
	Fréchet	0.28	0.30	0.28	0.27	0.31	0.14	0.31	0.25	0.25	0.20	0.24	0.15			2.98	0.31
	Critial Value	0.48	0.43	0.39	0.38	0.38	0.39	0.38	0.39	0.36	0.36	0.35	0.32			4.61	0.48
449060	Gumbel	0.09	0.10	0.12	0.13	0.19	0.20	0.11	0.08	0.10	0.12	0.10	0.14	Gumbel	1.48	1.48	0.2
	Weibull	0.07	0.09	0.12	0.13	0.20	0.21	0.15	0.11	0.17	0.08	0.09	0.13			1.55	0.21
	Fréchet	0.16	0.31	0.24	0.30	0.29	0.31	0.23	0.15	0.37	0.37	0.32	0.35			3.4	0.37
	Critial Value	0.43	0.41	0.41	0.41	0.43	0.45	0.45	0.48	0.45	0.45	0.45	0.48			5.3	0.48
449301	Gumbel	0.05	0.06	0.07	0.13	0.11	0.13	0.10	0.10	0.13	0.07	0.10	0.11	Weibull	0.86	1.16	0.13
	Weibull	0.07	0.05	0.06	0.10	0.07	0.07	0.05	0.06	0.08	0.05	0.10	0.10			0.86	0.1
	Fréchet	0.26	0.32	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			99990.58	9999
	Critial Value	0.39	0.32	0.32	0.33	0.36	0.33	0.31	0.30	0.33	0.29	0.28	0.29			3.85	0.39
442269	Gumbel													Weibull			
	Weibull																
	Fréchet																
	Critial Value																

Rain Gauge ID	Distribution & Critial Value	K-S Test Statistics for Duration (min)												Best Distribution	Gross		
		15	30	45	60	120	180	240	360	720	1440	2880	4320		Minimum	Sum	Maximum
444180	Gumbel	0.12	0.07	0.07	0.09	0.09	0.07	0.09	0.05	0.08	0.08	0.07	0.08	Gumbel	0.96	0.96	0.12
	Weibull	0.07	0.07	0.05	0.07	0.09	0.06	0.09	0.09	0.13	0.11	0.08	0.09			1	0.13
	Fréchet	9999.00	0.27	9999.00	0.24	9999.00	9999.00	0.26	9999.00	0.26	9999.00	9999.00	9999.00			79993.03	9999
	Critial Value	0.39	0.35	0.35	0.33	0.33	0.30	0.32	0.29	0.30	0.30	0.30	0.28			3.84	0.39
444410	Gumbel	0.20	0.21	0.22	0.24	0.16	0.18	0.12	0.12	0.18	0.15	0.12	0.11	Weibull	1.66	2.01	0.24
	Weibull	0.16	0.18	0.19	0.21	0.13	0.15	0.10	0.10	0.15	0.10	0.11	0.08			1.66	0.21
	Fréchet	0.33	0.33	0.35	0.36	0.28	0.37	0.30	0.41	9999.00	0.37	0.12	0.35			10002.57	9999
	Critial Value	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.52	0.48	0.48	0.48	0.48			5.8	0.52
449215	Gumbel	0.10	0.10	0.10	0.10	0.07	0.05	0.06	0.06	0.08	0.09	0.10	0.12	Weibull	0.94	1.03	0.12
	Weibull	0.07	0.09	0.10	0.09	0.08	0.07	0.07	0.07	0.06	0.09	0.08	0.07			0.94	0.1
	Fréchet	0.25	0.23	9999.00	0.19	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00	9999.00			89991.67	9999
	Critial Value	0.33	0.34	0.33	0.35	0.32	0.32	0.32	0.31	0.30	0.29	0.30	0.28			3.79	0.35

B. Tabulated Gauge-Level Historical IDF Curves

Gauge 440166-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	168.93	112.16	142.24	15	150.51	249.63	315.26	398.17	459.69	520.75	581.58	661.85	722.51
30	89.44	55.71	76.2	15	80.29	129.52	162.12	203.31	233.86	264.19	294.41	334.27	364.4
45	63.43	37.15	54.19	14	57.33	90.16	111.9	139.36	159.74	179.96	200.11	226.69	246.79
60	48.04	26.39	43.18	15	43.71	67.03	82.47	101.98	116.45	130.82	145.13	164.02	178.29
120	25.16	12.97	22.61	14	23.03	34.49	42.08	51.67	58.78	65.84	72.88	82.16	89.17
180	18.5	8.38	16.68	14	17.12	24.53	29.43	35.63	40.22	44.79	49.33	55.33	59.86
240	14.24	6.1	12.89	15	13.24	18.63	22.2	26.71	30.05	33.37	36.68	41.05	44.35
360	10.55	4.03	10.27	14	9.89	13.45	15.81	18.79	21	23.19	25.38	28.26	30.44
720	6.06	1.95	5.5	15	5.74	7.46	8.6	10.05	11.12	12.18	13.23	14.63	15.68
1440	3.74	1.2	3.27	14	3.54	4.6	5.31	6.19	6.85	7.5	8.15	9.01	9.66
2880	2.18	0.7	1.91	14	2.07	2.68	3.09	3.61	3.99	4.38	4.76	5.26	5.63
4320	1.53	0.62	1.47	15	1.43	1.98	2.34	2.8	3.14	3.47	3.81	4.25	4.59
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 440166-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	79.59	25.23	76.2	6	79.65	101.39	112.34	123.65	130.76	137.01	142.62	149.29	153.88
30	52.07	17.12	55.88	8	51.99	66.85	74.39	82.2	87.13	91.47	95.38	100.03	103.23
45	42.76	16.19	42.33	8	42.22	56.65	64.19	72.16	77.24	81.77	85.87	90.79	94.2
60	33.53	11.66	33.02	10	33.35	43.58	48.82	54.3	57.77	60.84	63.62	66.92	69.21
120	19.69	7.89	17.78	8	19.32	26.43	30.2	34.21	36.78	39.08	41.17	43.69	45.44
180	14.56	4.9	13.55	10	14.52	18.79	20.96	23.23	24.66	25.92	27.06	28.41	29.34
240	11.78	3.73	10.48	11	11.79	15	16.62	18.29	19.34	20.27	21.1	22.08	22.76
360	8.93	2.38	7.83	10	9.01	10.99	11.96	12.95	13.56	14.09	14.56	15.12	15.51

720	4.73	1.16	4.45	9	4.78	5.73	6.19	6.66	6.94	7.19	7.41	7.67	7.85
1440	3.22	0.81	2.8	9	3.25	3.92	4.24	4.57	4.77	4.95	5.11	5.29	5.42
2880	1.72	0.41	1.77	10	1.74	2.07	2.24	2.4	2.5	2.58	2.66	2.75	2.81
4320	1.29	0.38	1.13	11	1.3	1.62	1.78	1.94	2.05	2.14	2.22	2.31	2.38
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Guague 440561					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	88.05	67.2	71.12	9	77.01	136.4	175.72	225.4	262.26	298.84	335.29	383.38	419.72
30	53.11	30.76	45.72	11	48.06	75.24	93.24	115.98	132.85	149.6	166.28	188.29	204.93
45	40.92	19.77	38.95	12	37.67	55.14	66.71	81.33	92.17	102.93	113.66	127.8	138.5
60	33.48	15.44	27.94	11	30.94	44.59	53.62	65.04	73.51	81.91	90.29	101.33	109.69
120	20.32	11.53	17.15	12	18.43	28.62	35.36	43.89	50.21	56.49	62.74	70.99	77.23
180	15.11	7.4	14.39	13	13.89	20.43	24.76	30.23	34.29	38.32	42.34	47.63	51.63
240	12.31	5.72	12.07	13	11.37	16.43	19.77	24	27.14	30.25	33.35	37.45	40.54
360	9.5	4	8.89	11	8.84	12.38	14.72	17.68	19.87	22.05	24.22	27.08	29.24
720	5.68	2.29	5.08	13	5.3	7.33	8.67	10.36	11.62	12.86	14.11	15.74	16.98
1440	3.1	1.34	2.65	15	2.88	4.06	4.85	5.84	6.57	7.3	8.03	8.99	9.71
2880	2.01	0.81	1.85	13	1.88	2.59	3.07	3.67	4.11	4.55	4.99	5.57	6.01
4320	1.45	0.54	1.31	15	1.36	1.84	2.15	2.55	2.85	3.14	3.44	3.82	4.12
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 440720					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	246.38	181.44	198.12	4	206.34	381.1	494.67	631.35	727.7	819.5	907.6	1019.41	1101.02
30	112.24	82.21	65.26	5	94.24	173.43	224.78	286.48	329.93	371.29	410.97	461.29	497.99
45	75.5	54.19	43.51	5	63.97	116.2	149.76	189.88	218.02	244.73	270.29	302.63	326.17

60	57.89	39.8	38.95	5	49.96	88.32	112.53	141.14	161.04	179.83	197.72	220.24	236.57
120	32.62	17.38	28.96	5	30.51	46.92	56.35	66.87	73.88	80.3	86.27	93.6	98.79
180	23.08	10.96	23.41	5	22.1	32.28	37.92	44.08	48.12	51.78	55.15	59.26	62.14
240	18.91	8.07	17.78	5	18.41	25.77	29.73	33.98	36.73	39.2	41.46	44.18	46.09
360	12.6	5.53	11.43	4	12.22	17.29	20.03	23	24.92	26.65	28.23	30.15	31.49
720	8.93	4.33	8.26	5	8.52	12.55	14.8	17.27	18.89	20.36	21.72	23.37	24.54
1440	5.87	3.88	4.82	4	5.14	8.88	11.2	13.92	15.79	17.55	19.22	21.32	22.83
2880	3.29	2.08	2.54	5	2.93	4.93	6.15	7.56	8.53	9.43	10.28	11.35	12.11
4320	2.21	1.42	1.69	5	1.96	3.32	4.16	5.14	5.81	6.43	7.03	7.77	8.3
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 440766					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	77.89	43.9	66.04	6	70.68	109.48	135.16	167.62	191.69	215.59	239.4	270.82	294.56
30	58.42	36.51	45.72	4	52.42	84.69	106.05	133.04	153.07	172.94	192.75	218.87	238.62
45	38.95	18.89	35.56	6	35.85	52.54	63.59	77.56	87.92	98.2	108.45	121.97	132.18
60	30.9	16.1	27.94	6	28.26	42.48	51.9	63.81	72.64	81.4	90.13	101.66	110.36
120	17.78	6.41	16.51	9	16.73	22.39	26.14	30.88	34.4	37.89	41.36	45.95	49.42
180	13.12	5.26	12.7	8	12.26	16.9	19.98	23.87	26.76	29.62	32.47	36.24	39.08
240	9.53	3.58	9.21	8	8.94	12.11	14.2	16.85	18.81	20.76	22.7	25.26	27.2
360	8.04	3.35	8.04	7	7.49	10.45	12.41	14.89	16.72	18.55	20.37	22.76	24.57
720	4.99	1.97	4.45	9	4.67	6.41	7.56	9.02	10.1	11.17	12.24	13.65	14.71
1440	3	1.16	2.65	8	2.81	3.83	4.51	5.37	6.01	6.64	7.27	8.1	8.73
2880	1.85	0.77	1.83	10	1.72	2.4	2.85	3.42	3.85	4.27	4.68	5.23	5.65
4320	1.33	0.61	1.33	10	1.23	1.77	2.13	2.58	2.91	3.24	3.57	4.01	4.34
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 440778					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	91.44	96.92	40.64	3	75.52	161.17	217.88	289.53	342.69	395.45	448.02	517.38	569.8
30	49.11	45.53	25.4	3	41.63	81.87	108.51	142.17	167.14	191.93	216.62	249.2	273.83
45	29.63	25.55	18.63	4	25.43	48.01	62.96	81.85	95.86	109.77	123.63	141.92	155.73
60	22.86	18.89	15.24	4	19.76	36.45	47.5	61.47	71.83	82.11	92.36	105.88	116.09
120	14.29	7.58	11.43	4	13.05	19.74	24.18	29.78	33.94	38.07	42.18	47.6	51.7
180	11.22	3.87	9.74	4	10.58	14	16.27	19.13	21.25	23.36	25.46	28.23	30.32
240	9.31	3.2	8.89	3	8.78	11.61	13.48	15.85	17.61	19.35	21.08	23.37	25.1
360	7.51	3.08	6.77	4	7	9.73	11.53	13.81	15.49	17.17	18.84	21.05	22.71
720	5.14	3.46	4.04	4	4.57	7.63	9.65	12.21	14.11	15.99	17.87	20.35	22.22
1440	3.19	2.73	2.21	4	2.74	5.15	6.75	8.77	10.27	11.75	13.23	15.19	16.66
2880	1.73	1.38	1.32	4	1.5	2.72	3.53	4.55	5.31	6.06	6.81	7.79	8.54
4320	1.2	0.96	0.9	4	1.04	1.89	2.45	3.16	3.69	4.21	4.73	5.42	5.94
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 440993					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	82.41	38.17	81.28	9	76.14	109.87	132.21	160.43	181.36	202.14	222.84	250.16	270.8
30	59.15	25.17	58.42	14	55.02	77.26	91.99	110.59	124.4	138.1	151.75	169.77	183.38
45	45.24	21.28	42.34	14	41.75	60.55	73	88.73	100.41	111.99	123.53	138.76	150.27
60	41.06	17.52	39.37	18	38.18	53.67	63.92	76.87	86.48	96.02	105.52	118.06	127.53
120	24.43	15.02	22.86	17	21.96	35.24	44.03	55.13	63.37	71.54	79.69	90.44	98.56
180	18.38	11.67	16.93	17	16.46	26.78	33.6	42.23	48.63	54.99	61.32	69.67	75.98
240	14.85	8.74	12.39	18	13.41	21.14	26.25	32.71	37.51	42.27	47.01	53.26	57.99
360	11.48	5.94	10.16	17	10.5	15.75	19.23	23.62	26.88	30.11	33.33	37.58	40.8
720	6.46	3.14	5.4	18	5.94	8.72	10.56	12.88	14.6	16.31	18.01	20.26	21.96

1440	3.74	1.82	3.49	21	3.44	5.05	6.11	7.46	8.46	9.45	10.44	11.74	12.72
2880	2.22	1	1.99	22	2.06	2.94	3.52	4.26	4.81	5.36	5.9	6.61	7.16
4320	1.54	0.63	1.38	21	1.44	1.99	2.36	2.83	3.17	3.52	3.86	4.31	4.65
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 441322-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	91.44	48.37	81.28	7	85.66	131.3	157.45	186.6	205.99	223.75	240.24	260.48	274.83
30	56.74	23.81	53.34	8	55.37	77.01	88.6	101.02	109.04	116.23	122.79	130.7	136.23
45	46.3	17.5	48.02	8	45.72	61.32	69.46	78.07	83.56	88.44	92.87	98.18	101.86
60	37.68	13.22	38.55	10	37.45	49.07	55.04	61.28	65.23	68.74	71.9	75.67	78.28
120	22.45	6.47	23.5	8	22.57	28.05	30.76	33.53	35.26	36.78	38.13	39.73	40.83
180	15.7	4.86	15.89	7	15.73	19.9	21.99	24.15	25.5	26.68	27.75	29.01	29.88
240	12.45	3.93	12.39	8	12.46	15.85	17.55	19.31	20.41	21.38	22.26	23.29	24
360	9.63	3.95	8.47	9	9.42	13	14.9	16.94	18.25	19.42	20.49	21.77	22.67
720	5.85	2.42	5.84	10	5.72	7.91	9.08	10.34	11.14	11.87	12.52	13.32	13.87
1440	3.28	1.3	3.28	9	3.22	4.39	5.01	5.67	6.09	6.46	6.8	7.22	7.5
2880	1.72	0.68	1.62	10	1.69	2.3	2.62	2.97	3.19	3.38	3.56	3.78	3.93
4320	1.36	0.6	1.2	9	1.32	1.87	2.17	2.49	2.7	2.89	3.06	3.27	3.42
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 441322-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	116.38	107.46	91.44	11	98.73	193.7	256.57	336.02	394.95	453.45	511.74	588.64	646.76
30	74.51	47.52	63.5	12	66.71	108.7	136.51	171.64	197.7	223.57	249.34	283.35	309.05
45	51.36	31.8	42.34	12	46.14	74.24	92.85	116.36	133.8	151.11	168.36	191.11	208.31
60	42.59	23.35	35.56	13	38.76	59.39	73.05	90.31	103.12	115.83	128.5	145.21	157.84

120	25.48	11.75	22.23	16	23.55	33.93	40.81	49.5	55.94	62.34	68.71	77.12	83.47
180	19.53	7.88	19.05	16	18.24	25.2	29.81	35.64	39.96	44.25	48.52	54.16	58.42
240	15.16	6.31	12.7	15	14.12	19.7	23.39	28.06	31.52	34.95	38.38	42.89	46.3
360	10.95	4.95	9.31	15	10.14	14.51	17.41	21.07	23.78	26.48	29.16	32.7	35.38
720	6.3	2.35	5.93	19	5.91	7.99	9.37	11.1	12.39	13.67	14.95	16.63	17.9
1440	3.5	1.21	3.07	21	3.3	4.37	5.08	5.97	6.64	7.3	7.95	8.82	9.47
2880	2.03	0.67	1.91	17	1.92	2.51	2.9	3.4	3.77	4.13	4.5	4.97	5.34
4320	1.41	0.45	1.31	19	1.34	1.73	2	2.33	2.58	2.82	3.07	3.39	3.63
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 441614					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	149.69	124.05	111.76	15	129.32	238.94	311.53	403.24	471.27	538.8	606.09	694.86	761.95
30	80.96	57.64	68.58	16	71.49	122.43	156.16	198.77	230.38	261.76	293.03	334.27	365.45
45	54.19	36.66	45.72	18	48.17	80.57	102.02	129.12	149.23	169.18	189.07	215.3	235.13
60	44.2	25.93	39.37	20	39.94	62.86	78.03	97.2	111.42	125.54	139.6	158.16	172.18
120	24.73	12.65	22.86	21	22.65	33.83	41.23	50.59	57.52	64.41	71.27	80.32	87.17
180	19.22	8.21	17.78	20	17.87	25.13	29.93	36	40.5	44.97	49.43	55.3	59.74
240	15.18	6.14	14.29	22	14.17	19.6	23.19	27.73	31.1	34.44	37.77	42.16	45.48
360	10.34	4.27	9.74	23	9.64	13.41	15.91	19.07	21.41	23.73	26.05	29.11	31.41
720	6.3	2.21	5.93	27	5.94	7.89	9.18	10.82	12.03	13.23	14.43	16.01	17.21
1440	3.64	1.47	3.39	29	3.4	4.7	5.56	6.64	7.45	8.25	9.05	10.1	10.9
2880	1.97	0.89	1.78	30	1.82	2.61	3.13	3.79	4.28	4.76	5.24	5.88	6.36
4320	1.47	0.6	1.41	29	1.37	1.9	2.25	2.7	3.03	3.35	3.68	4.11	4.43
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 441929					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	72.57	24.49	71.12	7	68.55	90.19	104.52	122.63	136.06	149.39	162.67	180.2	193.44
30	51.53	18.88	50.8	7	48.43	65.11	76.16	90.12	100.47	110.75	120.99	134.5	144.71
45	38.01	17.58	33.87	9	35.12	50.66	60.95	73.94	83.58	93.15	102.69	115.27	124.78
60	31.01	17.43	22.86	7	28.15	43.55	53.75	66.64	76.19	85.68	95.14	107.61	117.04
120	19.62	10.53	15.88	10	17.89	27.2	33.36	41.14	46.92	52.65	58.36	65.9	71.59
180	14.66	8.34	11.85	11	13.29	20.66	25.54	31.71	36.28	40.82	45.34	51.31	55.82
240	12.03	6.78	9.53	11	10.92	16.91	20.88	25.89	29.61	33.3	36.97	41.83	45.49
360	8.89	5.1	7.2	13	8.05	12.56	15.54	19.31	22.11	24.89	27.65	31.3	34.06
720	5.85	3.99	4.98	14	5.19	8.72	11.06	14.01	16.19	18.37	20.53	23.39	25.54
1440	3.41	2.4	2.75	13	3.02	5.14	6.54	8.32	9.63	10.94	12.24	13.96	15.26
2880	1.99	1.24	1.78	14	1.79	2.88	3.61	4.52	5.2	5.88	6.55	7.44	8.11
4320	1.48	0.81	1.26	14	1.35	2.06	2.54	3.14	3.58	4.02	4.46	5.04	5.48
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442044					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	116.45	100.03	91.44	13	100.02	188.42	246.95	320.9	375.76	430.22	484.47	556.06	610.16
30	57.87	46.97	45.72	15	50.16	91.67	119.15	153.87	179.63	205.2	230.68	264.29	289.69
45	40.22	29.95	33.87	17	35.3	61.77	79.29	101.43	117.86	134.17	150.41	171.84	188.04
60	35.97	22.07	30.48	17	32.35	51.85	64.76	81.08	93.18	105.2	117.17	132.96	144.9
120	18.42	11.39	15.88	18	16.55	26.62	33.28	41.7	47.95	54.15	60.33	68.48	74.64
180	13.17	8.16	11.43	18	11.83	19.04	23.82	29.85	34.32	38.77	43.19	49.03	53.44
240	10.64	6.55	9.21	20	9.56	15.35	19.19	24.03	27.62	31.19	34.74	39.43	42.97
360	8.07	4.75	6.99	20	7.29	11.49	14.27	17.78	20.38	22.97	25.55	28.95	31.51
720	4.99	2.81	4.27	21	4.53	7.01	8.66	10.73	12.27	13.8	15.33	17.34	18.86

1440	2.8	1.5	2.6	25	2.55	3.88	4.76	5.87	6.69	7.51	8.32	9.39	10.2
2880	1.53	0.82	1.43	25	1.4	2.12	2.6	3.21	3.66	4.1	4.55	5.13	5.58
4320	1.08	0.58	1.01	24	0.98	1.5	1.84	2.27	2.58	2.9	3.21	3.63	3.94
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442159					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	135.47	172.27	81.28	9	107.18	259.42	360.22	487.57	582.05	675.84	769.28	892.55	985.72
30	70.7	73.15	53.34	12	58.69	123.33	166.13	220.21	260.33	300.15	339.83	392.18	431.74
45	52.49	44.49	42.34	14	45.18	84.5	110.53	143.42	167.82	192.04	216.18	248.01	272.07
60	43.72	33.33	35.56	14	38.25	67.7	87.2	111.84	130.12	148.27	166.35	190.2	208.22
120	25	15.16	20.96	16	22.51	35.91	44.78	55.99	64.3	72.55	80.78	91.62	99.82
180	16.88	10.34	13.97	16	15.18	24.32	30.37	38.01	43.68	49.31	54.92	62.32	67.91
240	13.77	8.2	11.44	16	12.42	19.67	24.47	30.53	35.03	39.49	43.94	49.81	54.24
360	10.89	5.93	9.74	15	9.92	15.16	18.63	23.01	26.26	29.49	32.71	36.95	40.16
720	6.09	2.82	5.61	18	5.63	8.12	9.77	11.85	13.4	14.94	16.47	18.48	20.01
1440	3.68	1.51	3.76	18	3.43	4.77	5.65	6.77	7.59	8.42	9.24	10.32	11.13
2880	2	0.83	1.88	16	1.86	2.6	3.08	3.7	4.15	4.6	5.05	5.65	6.1
4320	1.4	0.61	1.35	18	1.3	1.84	2.2	2.65	2.98	3.31	3.64	4.08	4.41
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442208					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	127.34	88.56	101.6	15	109.37	194.74	248.87	313.04	357.77	400.06	440.37	491.21	528.1
30	67.61	40.8	60.79	16	61.13	100.19	123.61	150.46	168.69	185.63	201.54	221.31	235.47
45	46.8	26.7	40.64	17	43.01	68.44	83.39	100.3	111.69	122.21	132.03	144.17	152.82
60	36.89	18.52	33.02	19	34.95	52.3	62.07	72.86	79.98	86.47	92.47	99.8	104.98

120	20.7	9.55	17.78	13	19.92	28.75	33.6	38.87	42.32	45.43	48.29	51.77	54.21
180	14.97	6.52	13.97	16	14.53	20.5	23.73	27.21	29.46	31.49	33.34	35.59	37.16
240	11.81	5.05	11.43	15	11.5	16.1	18.58	21.25	22.97	24.52	25.93	27.64	28.84
360	8.02	2.7	7.62	17	8	10.35	11.55	12.8	13.58	14.28	14.91	15.65	16.17
720	4.96	1.85	4.56	18	4.9	6.55	7.41	8.31	8.88	9.4	9.86	10.41	10.8
1440	2.82	0.92	2.7	18	2.82	3.61	4.02	4.44	4.7	4.93	5.14	5.39	5.56
2880	1.57	0.48	1.56	18	1.57	1.99	2.19	2.4	2.53	2.65	2.76	2.88	2.96
4320	1.12	0.32	1.09	19	1.13	1.4	1.53	1.67	1.75	1.83	1.89	1.97	2.03
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442269					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	78.24	50.29	78.24	2	69.27	117.64	147.35	181.89	205.62	227.83	248.82	275.07	293.98
30	43.94	18.33	43.94	2	42.91	59.55	68.45	77.98	84.13	89.64	94.67	100.73	104.96
45	31.33	9.34	31.33	2	31.46	39.41	43.37	47.44	49.98	52.21	54.2	56.57	58.19
60	24.64	5.39	24.64	2	24.96	29.3	31.36	33.43	34.69	35.78	36.75	37.88	38.65
120	14.29	0.09	14.29	2	14.3	14.36	14.39	14.41	14.43	14.44	14.45	14.46	14.47
180	9.99	0.6	9.99	2	10.07	10.49	10.68	10.85	10.95	11.04	11.12	11.2	11.26
240	7.78	0.68	7.78	2	7.87	8.35	8.57	8.78	8.9	9.01	9.1	9.2	9.27
360	5.36	0.39	5.36	2	5.41	5.69	5.81	5.93	5.99	6.05	6.1	6.16	6.2
720	3.07	0.12	3.07	2	3.09	3.17	3.21	3.24	3.26	3.28	3.29	3.31	3.32
1440	1.71	0.16	1.71	2	1.73	1.85	1.9	1.95	1.98	2	2.02	2.05	2.06
2880	1.01	0	1.01	2	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
4320	0.8	0.07	0.8	2	0.81	0.86	0.88	0.9	0.92	0.93	0.94	0.95	0.95
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442663					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	54.19	21.15	60.96	3	53.33	72.3	82.29	92.87	99.65	105.7	111.19	117.78	122.37
30	39.37	13.36	43.18	4	39.23	50.89	56.85	63.05	66.97	70.43	73.55	77.26	79.83
45	27.94	10.48	30.48	4	27.61	36.94	41.8	46.93	50.2	53.11	55.75	58.91	61.1
60	21.17	9.62	25.4	3	20.42	29.29	34.14	39.41	42.84	45.93	48.77	52.22	54.64
120	13.65	5.33	14.61	4	13.43	18.21	20.73	23.4	25.11	26.63	28.02	29.68	30.84
180	10.8	5	9.74	4	10.39	15.01	17.55	20.32	22.13	23.77	25.27	27.09	28.38
240	8.74	4.59	7.64	4	8.2	12.53	15	17.75	19.58	21.26	22.81	24.72	26.07
360	6.49	2.27	5.36	5	6.45	8.45	9.47	10.54	11.22	11.82	12.36	13.01	13.45
720	3.77	1.22	3.18	5	3.77	4.82	5.36	5.91	6.26	6.56	6.84	7.17	7.39
1440	2.28	0.89	2.22	5	2.24	3.04	3.46	3.91	4.19	4.45	4.68	4.96	5.15
2880	1.29	0.29	1.22	5	1.31	1.54	1.65	1.76	1.83	1.89	1.95	2.01	2.05
4320	1.1	0.31	1.08	4	1.11	1.37	1.5	1.63	1.71	1.78	1.85	1.92	1.97
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442729					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	165.46	148.36	101.6	7	124.02	263.9	363.81	491.23	585.07	677.2	767.89	885.93	974.01
30	80.01	68.47	48.26	8	61.8	126.87	172.24	229.27	270.81	311.28	350.86	402.05	440.03
45	58.06	47.15	33.87	7	46.24	91.36	122.03	159.98	187.29	213.69	239.33	272.27	296.56
60	43.18	32.75	31.75	8	35.65	67.16	87.92	113.1	130.97	148.06	164.52	185.48	200.83
120	23.12	15.47	16.51	9	20.17	35.07	44.37	55.29	62.85	69.95	76.7	85.17	91.3
180	17.24	11.64	11.86	8	14.99	26.2	33.23	41.49	47.22	52.62	57.75	64.19	68.85
240	13.57	9.09	9.53	9	11.83	20.59	26.06	32.48	36.92	41.1	45.07	50.06	53.66
360	9.59	7.12	6.14	10	8	14.86	19.33	24.73	28.54	32.18	35.67	40.1	43.35
720	6	5.06	3.6	9	4.68	9.49	12.83	17.01	20.04	22.98	25.86	29.57	32.32

1440	3.39	2.59	2.28	8	2.79	5.28	6.93	8.93	10.35	11.71	13.02	14.7	15.92
2880	1.72	1.23	1.3	10	1.46	2.65	3.41	4.31	4.95	5.55	6.13	6.86	7.4
4320	1.25	0.82	0.95	10	1.1	1.89	2.38	2.95	3.34	3.71	4.06	4.5	4.82
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 442941					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	54.19	21.15	60.96	3	53.33	72.3	82.29	92.87	99.65	105.7	111.19	117.78	122.37
30	39.37	13.36	43.18	4	39.23	50.89	56.85	63.05	66.97	70.43	73.55	77.26	79.83
45	27.94	10.48	30.48	4	27.61	36.94	41.8	46.93	50.2	53.11	55.75	58.91	61.1
60	21.17	9.62	25.4	3	20.42	29.29	34.14	39.41	42.84	45.93	48.77	52.22	54.64
120	13.65	5.33	14.61	4	13.43	18.21	20.73	23.4	25.11	26.63	28.02	29.68	30.84
180	10.8	5	9.74	4	10.39	15.01	17.55	20.32	22.13	23.77	25.27	27.09	28.38
240	8.74	4.59	7.64	4	8.2	12.53	15	17.75	19.58	21.26	22.81	24.72	26.07
360	6.49	2.27	5.36	5	6.45	8.45	9.47	10.54	11.22	11.82	12.36	13.01	13.45
720	3.77	1.22	3.18	5	3.77	4.82	5.36	5.91	6.26	6.56	6.84	7.17	7.39
1440	2.28	0.89	2.22	5	2.24	3.04	3.46	3.91	4.19	4.45	4.68	4.96	5.15
2880	1.29	0.29	1.22	5	1.31	1.54	1.65	1.76	1.83	1.89	1.95	2.01	2.05
4320	1.1	0.31	1.08	4	1.11	1.37	1.5	1.63	1.71	1.78	1.85	1.92	1.97
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443192					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	88.9	56.49	66.04	4	79.03	133.31	166.5	204.98	231.35	256	279.28	308.34	329.26
30	54.19	18.36	50.8	6	54	70.03	78.21	86.72	92.1	96.85	101.13	106.23	109.75
45	46.06	13.03	44.03	5	46.35	57.33	62.76	68.3	71.75	74.76	77.46	80.64	82.82
60	35.56	10.52	34.29	8	35.72	44.66	49.11	53.68	56.53	59.02	61.26	63.91	65.73

120	24.89	9.57	21.59	5	24.54	33.09	37.58	42.33	45.36	48.07	50.52	53.47	55.52
180	18.21	7.22	15.67	6	17.89	24.39	27.82	31.46	33.8	35.89	37.79	40.07	41.66
240	16.73	5.47	15.25	6	16.71	21.45	23.86	26.35	27.91	29.3	30.54	32.02	33.04
360	12.35	4.58	11.65	6	12.22	16.28	18.4	20.63	22.05	23.31	24.45	25.82	26.77
720	7.44	2.9	7.41	7	7.32	9.92	11.29	12.74	13.67	14.5	15.25	16.15	16.78
1440	4.22	1.49	4.24	8	4.19	5.5	6.18	6.88	7.33	7.73	8.09	8.51	8.81
2880	2.15	0.88	1.91	7	2.1	2.9	3.32	3.78	4.07	4.33	4.57	4.85	5.05
4320	1.53	0.65	1.27	7	1.49	2.08	2.4	2.74	2.96	3.16	3.34	3.56	3.71
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443200					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	60.96	10.16	60.96	3	61.84	69.68	73.31	76.88	79.03	80.88	82.5	84.39	85.66
30	35.56	8.8	40.64	3	35.93	43.17	46.68	50.21	52.39	54.29	55.97	57.95	59.3
45	28.22	8.52	27.09	3	28.32	35.59	39.22	42.95	45.29	47.34	49.17	51.35	52.84
60	23.71	8.92	22.86	3	23.42	31.37	35.51	39.88	42.67	45.16	47.41	50.1	51.97
120	13.55	6.39	12.7	3	12.99	18.92	22.2	25.77	28.12	30.24	32.19	34.57	36.24
180	10.72	4.26	10.16	3	10.53	14.36	16.39	18.54	19.93	21.16	22.28	23.63	24.57
240	8.26	2.91	7.62	3	8.21	10.77	12.08	13.46	14.33	15.11	15.8	16.64	17.21
360	6.35	2.36	5.93	3	6.28	8.38	9.47	10.62	11.35	12	12.59	13.3	13.79
720	4.37	2.65	3.18	3	3.95	6.48	8.01	9.76	10.95	12.05	13.09	14.38	15.31
1440	2.65	1.06	2.65	3	2.6	3.56	4.06	4.6	4.94	5.25	5.53	5.87	6.11
2880	1.45	0.57	1.69	3	1.43	1.94	2.21	2.49	2.68	2.84	2.99	3.17	3.29
4320	1.2	0.56	1.2	3	1.15	1.67	1.96	2.27	2.47	2.66	2.83	3.03	3.18
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443229					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	138.18	168.42	71.12	5	110.52	259.36	357.9	482.41	574.78	666.47	757.82	878.34	969.43
30	68.3	59.19	50.8	9	58.58	110.89	145.52	189.28	221.74	253.96	286.07	328.43	360.44
45	47.04	39.4	33.87	9	40.57	75.39	98.44	127.57	149.18	170.63	192	220.19	241.5
60	35.84	29.69	25.4	9	30.96	57.2	74.57	96.52	112.81	128.97	145.07	166.32	182.38
120	19.05	14.34	13.97	9	16.69	29.37	37.76	48.36	56.22	64.03	71.81	82.07	89.83
180	16.39	9.41	13.94	7	14.84	23.16	28.67	35.62	40.78	45.91	51.01	57.74	62.83
240	12.14	6.67	10.79	8	11.04	16.94	20.84	25.77	29.43	33.06	36.68	41.45	45.06
360	8.73	4.26	8.05	8	8.03	11.8	14.29	17.44	19.77	22.09	24.4	27.45	29.76
720	5.29	1.93	4.87	8	4.97	6.68	7.81	9.23	10.29	11.34	12.39	13.77	14.82
1440	2.73	0.94	2.49	8	2.58	3.41	3.96	4.65	5.17	5.68	6.19	6.86	7.37
2880	1.55	0.53	1.51	8	1.46	1.93	2.24	2.63	2.92	3.21	3.5	3.88	4.17
4320	1.1	0.37	1.09	9	1.04	1.37	1.58	1.86	2.06	2.26	2.46	2.73	2.93
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443272					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	155.79	215.28	86.36	12	120.43	310.68	436.65	595.8	713.87	831.07	947.84	1101.89	1218.32
30	81.6	90.79	63.5	16	66.69	146.92	200.05	267.17	316.96	366.38	415.63	480.6	529.7
45	58.21	59.59	45.72	16	48.42	101.09	135.95	180.01	212.69	245.13	277.45	320.09	352.32
60	45.56	44.03	36.83	16	38.33	77.24	103	135.55	159.7	183.67	207.55	239.06	262.87
120	25.16	21.42	20.96	16	21.64	40.57	53.1	68.94	80.69	92.35	103.97	119.3	130.88
180	17.75	12.78	15.24	21	15.65	26.95	34.42	43.87	50.88	57.84	64.77	73.91	80.83
240	14.9	9.73	13.02	20	13.3	21.9	27.59	34.79	40.12	45.42	50.7	57.66	62.92
360	11.3	6.91	10.16	19	10.17	16.27	20.31	25.42	29.21	32.97	36.72	41.67	45.4
720	6.18	3.13	5.61	24	5.67	8.43	10.26	12.58	14.29	16	17.7	19.94	21.63

1440	3.34	1.55	2.97	26	3.09	4.46	5.36	6.51	7.36	8.2	9.04	10.15	10.99
2880	2.13	1	1.91	29	1.97	2.85	3.43	4.17	4.72	5.27	5.81	6.52	7.07
4320	1.56	0.71	1.41	26	1.44	2.07	2.49	3.01	3.4	3.79	4.17	4.68	5.06
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443310-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	107.95	53.31	93.98	12	102.61	152.42	180.34	211.07	231.31	249.73	266.73	287.48	302.12
30	54.12	25.02	48.26	13	52.06	75.19	87.92	101.76	110.8	118.97	126.48	135.6	142
45	36.98	15.35	33.87	15	36.14	50.06	57.5	65.45	70.58	75.18	79.37	84.43	87.95
60	29.9	11.21	25.79	14	29.55	39.52	44.73	50.21	53.71	56.82	59.64	63.02	65.36
120	17	5.59	16.77	14	16.98	21.83	24.29	26.84	28.45	29.87	31.14	32.66	33.71
180	12.93	3.88	12.28	14	12.98	16.29	17.94	19.63	20.69	21.62	22.45	23.44	24.12
240	10.9	3.36	10.32	14	10.93	13.8	15.25	16.73	17.67	18.48	19.22	20.09	20.69
360	7.91	2.79	7.29	16	7.86	10.31	11.58	12.9	13.73	14.48	15.15	15.95	16.5
720	4.84	1.99	4.66	13	4.74	6.54	7.5	8.52	9.18	9.78	10.31	10.96	11.42
1440	2.63	1.2	2.38	16	2.54	3.64	4.25	4.91	5.34	5.72	6.08	6.51	6.81
2880	1.48	0.64	1.27	16	1.44	2.02	2.34	2.68	2.9	3.1	3.28	3.5	3.65
4320	1.12	0.51	0.94	14	1.08	1.55	1.81	2.09	2.27	2.43	2.58	2.77	2.9
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 443310-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	64.35	31.26	55.88	6	61.36	90.49	106.74	124.58	136.3	146.95	156.77	168.73	177.16
30	42.09	25.52	35.56	7	38	62.44	77.12	93.97	105.42	116.06	126.06	138.49	147.4
45	31.93	18.22	27.09	7	29.34	46.7	56.9	68.44	76.22	83.39	90.1	98.38	104.29
60	27.52	14.67	24.13	6	25.73	39.59	47.55	56.43	62.35	67.78	72.81	79	83.39

120	16.03	6.26	14.61	8	15.78	21.39	24.35	27.48	29.49	31.28	32.9	34.86	36.22
180	11.38	4.42	10.16	9	11.21	15.17	17.25	19.45	20.87	22.13	23.27	24.64	25.6
240	8.8	2.85	8.26	7	8.8	11.26	12.51	13.8	14.61	15.33	15.97	16.74	17.27
360	6.89	2.21	6.35	7	6.89	8.8	9.76	10.76	11.39	11.94	12.43	13.02	13.43
720	4.3	1.34	4.13	12	4.31	5.46	6.04	6.63	7.01	7.33	7.63	7.98	8.22
1440	2.52	0.67	2.49	10	2.54	3.1	3.37	3.65	3.82	3.97	4.11	4.26	4.37
2880	1.46	0.5	1.46	12	1.45	1.89	2.11	2.35	2.5	2.63	2.74	2.88	2.98
4320	1.05	0.36	1.01	12	1.05	1.36	1.52	1.69	1.8	1.89	1.97	2.08	2.14
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 444128					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	138.61	126.81	96.52	14	117.78	229.85	304.05	397.8	467.34	536.38	605.16	695.91	764.49
30	76.93	59.87	58.42	14	67.1	120.01	155.04	199.3	232.13	264.73	297.2	340.04	372.42
45	51.86	37.24	42.34	16	45.74	78.65	100.44	127.97	148.4	168.67	188.87	215.52	235.66
60	39.59	27.14	33.02	17	35.13	59.12	75	95.06	109.95	124.72	139.44	158.86	173.54
120	23.57	12.41	20.96	18	21.53	32.5	39.76	48.93	55.74	62.5	69.23	78.11	84.82
180	16.22	8.53	14.39	19	14.82	22.36	27.35	33.65	38.33	42.98	47.6	53.71	58.32
240	13.07	6.77	11.43	19	11.96	17.94	21.9	26.91	30.62	34.31	37.98	42.82	46.48
360	9.55	5.06	8.26	18	8.72	13.19	16.15	19.89	22.67	25.42	28.17	31.79	34.52
720	5.85	3.01	4.98	18	5.36	8.02	9.78	12	13.65	15.29	16.92	19.08	20.71
1440	3.56	1.64	3.13	22	3.29	4.74	5.7	6.91	7.81	8.7	9.59	10.77	11.65
2880	1.92	0.98	1.62	24	1.76	2.63	3.2	3.92	4.46	4.99	5.53	6.23	6.76
4320	1.35	0.71	1.16	23	1.23	1.86	2.28	2.8	3.19	3.58	3.96	4.47	4.85
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 444180					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	79.39	33.01	81.28	11	73.97	103.14	122.46	146.86	164.96	182.93	200.84	224.46	242.31
30	53.32	23.56	48.26	14	49.45	70.27	84.06	101.47	114.4	127.22	140	156.86	169.6
45	41.12	18.35	38.95	14	38.11	54.32	65.06	78.63	88.69	98.68	108.63	121.76	131.69
60	32.85	15.14	29.21	16	30.36	43.74	52.6	63.79	72.1	80.34	88.55	99.39	107.57
120	19.63	8.41	18.42	16	18.25	25.68	30.6	36.82	41.43	46.01	50.57	56.59	61.14
180	13.76	5.32	13.55	19	12.89	17.59	20.7	24.63	27.55	30.45	33.33	37.14	40.02
240	10.88	4.49	10.16	17	10.14	14.11	16.74	20.06	22.52	24.96	27.4	30.61	33.04
360	7.94	3.13	7.41	20	7.43	10.19	12.02	14.34	16.05	17.76	19.46	21.7	23.39
720	4.76	1.72	4.45	19	4.48	6	7	8.28	9.22	10.16	11.09	12.32	13.25
1440	2.81	0.89	2.65	19	2.66	3.45	3.97	4.63	5.12	5.6	6.08	6.72	7.2
2880	1.69	0.47	1.66	19	1.61	2.03	2.3	2.65	2.91	3.16	3.42	3.76	4.01
4320	1.24	0.33	1.23	23	1.19	1.48	1.67	1.91	2.1	2.28	2.45	2.69	2.87
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 444246					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	130.23	174.97	81.28	11	101.49	256.12	358.5	487.85	583.81	679.06	773.97	899.18	993.81
30	78.05	82.49	55.88	11	64.5	137.4	185.67	246.65	291.89	336.8	381.54	440.57	485.19
45	53.74	46.91	44.03	15	46.04	87.49	114.94	149.62	175.35	200.88	226.33	259.9	285.27
60	46.7	36.98	38.1	13	40.63	73.31	94.94	122.28	142.56	162.7	182.75	209.22	229.22
120	25.82	17.36	22.86	15	22.97	38.31	48.47	61.3	70.82	80.27	89.69	102.11	111.5
180	17.94	11.06	14.82	16	16.12	25.9	32.37	40.55	46.61	52.63	58.63	66.55	72.53
240	14.52	8.67	12.39	14	13.1	20.76	25.83	32.24	37	41.72	46.42	52.62	57.31
360	10.44	5.79	8.89	15	9.49	14.61	17.99	22.27	25.45	28.6	31.74	35.89	39.02
720	5.97	2.56	5.5	17	5.55	7.81	9.31	11.2	12.61	14	15.39	17.22	18.61

1440	3.37	1.4	2.86	15	3.14	4.38	5.2	6.23	7	7.76	8.52	9.52	10.28
2880	1.91	0.72	1.69	15	1.79	2.43	2.85	3.38	3.78	4.17	4.56	5.07	5.46
4320	1.34	0.42	1.2	17	1.27	1.64	1.89	2.2	2.43	2.66	2.89	3.19	3.41
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 444410					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	180.12	134.37	101.6	7	149.9	279.31	363.91	466.09	538.32	607.27	673.54	757.78	819.34
30	91.01	66.17	50.8	7	76.67	140.43	181.63	231.05	265.79	298.84	330.5	370.63	399.88
45	61.54	43.21	33.87	7	52.64	94.3	120.81	152.33	174.34	195.17	215.05	240.15	258.38
60	46.81	31.78	25.4	7	40.6	71.22	90.45	113.11	128.82	143.64	157.72	175.44	188.26
120	24.44	15.13	17.78	7	21.92	36.43	45.22	55.34	62.25	68.69	74.75	82.3	87.72
180	16.8	9.81	14.65	7	15.34	24.7	30.25	36.57	40.83	44.78	48.48	53.05	56.32
240	13.13	6.98	12.19	7	12.29	18.88	22.66	26.88	29.69	32.26	34.65	37.59	39.67
360	10.06	4.07	9.97	6	9.86	13.54	15.49	17.57	18.9	20.1	21.18	22.49	23.41
720	5.34	2.05	5.42	7	5.26	7.1	8.06	9.07	9.72	10.3	10.83	11.46	11.9
1440	2.88	0.91	2.71	7	2.88	3.67	4.06	4.47	4.72	4.95	5.15	5.39	5.56
2880	1.49	0.45	1.36	7	1.5	1.88	2.07	2.27	2.39	2.5	2.6	2.71	2.79
4320	1.04	0.35	0.98	7	1.04	1.34	1.5	1.66	1.76	1.85	1.93	2.03	2.1
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 444414					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	193.04	155.21	121.92	17	167.55	304.71	395.53	510.27	595.4	679.89	764.08	875.15	959.09
30	99.19	70.71	71.12	19	87.58	150.07	191.44	243.71	282.49	320.99	359.34	409.94	448.19
45	71.97	43.55	59.27	20	64.82	103.3	128.79	160.98	184.87	208.57	232.2	263.36	286.91
60	53.29	30.42	44.45	24	48.29	75.18	92.98	115.47	132.15	148.71	165.21	186.98	203.43

120	27.16	14.36	23.5	26	24.8	37.49	45.89	56.51	64.39	72.2	79.99	90.27	98.04
180	18.83	9.38	16.09	25	17.29	25.58	31.07	38	43.15	48.25	53.34	60.05	65.13
240	16.06	7.04	15.25	22	14.9	21.13	25.24	30.45	34.31	38.14	41.96	47	50.81
360	10.84	4.49	9.95	26	10.1	14.07	16.7	20.02	22.48	24.92	27.36	30.57	33
720	6.12	2.28	5.61	24	5.75	7.76	9.09	10.78	12.03	13.27	14.51	16.14	17.37
1440	3.26	1.13	3.07	25	3.07	4.07	4.73	5.57	6.19	6.8	7.42	8.23	8.84
2880	1.88	0.65	1.75	28	1.77	2.35	2.73	3.21	3.57	3.92	4.27	4.74	5.09
4320	1.42	0.5	1.32	27	1.34	1.78	2.07	2.44	2.72	2.99	3.26	3.62	3.89
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445142					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	127.34	88.56	101.6	15	109.37	194.74	248.87	313.04	357.77	400.06	440.37	491.21	528.1
30	67.61	40.8	60.79	16	61.13	100.19	123.61	150.46	168.69	185.63	201.54	221.31	235.47
45	46.8	26.7	40.64	17	43.01	68.44	83.39	100.3	111.69	122.21	132.03	144.17	152.82
60	36.89	18.52	33.02	19	34.95	52.3	62.07	72.86	79.98	86.47	92.47	99.8	104.98
120	20.7	9.55	17.78	13	19.92	28.75	33.6	38.87	42.32	45.43	48.29	51.77	54.21
180	14.97	6.52	13.97	16	14.53	20.5	23.73	27.21	29.46	31.49	33.34	35.59	37.16
240	11.81	5.05	11.43	15	11.5	16.1	18.58	21.25	22.97	24.52	25.93	27.64	28.84
360	8.02	2.7	7.62	17	8	10.35	11.55	12.8	13.58	14.28	14.91	15.65	16.17
720	4.96	1.85	4.56	18	4.9	6.55	7.41	8.31	8.88	9.4	9.86	10.41	10.8
1440	2.82	0.92	2.7	18	2.82	3.61	4.02	4.44	4.7	4.93	5.14	5.39	5.56
2880	1.57	0.48	1.56	18	1.57	1.99	2.19	2.4	2.53	2.65	2.76	2.88	2.96
4320	1.12	0.32	1.09	19	1.13	1.4	1.53	1.67	1.75	1.83	1.89	1.97	2.03
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445423					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	123.19	105.65	86.36	8	105.84	199.21	261.02	339.13	397.07	454.59	511.89	587.5	644.63
30	66.04	43.5	53.34	10	58.9	97.34	122.79	154.95	178.81	202.49	226.08	257.21	280.74
45	52.49	29.19	45.72	8	47.7	73.49	90.57	112.15	128.16	144.05	159.88	180.77	196.56
60	38.99	20.87	33.02	9	35.56	54.01	66.22	81.65	93.09	104.45	115.77	130.71	142
120	23.23	10.47	24.33	9	21.51	30.76	36.89	44.63	50.37	56.07	61.75	69.24	74.91
180	16.25	7	14.39	11	15.1	21.29	25.38	30.56	34.4	38.21	42	47.01	50.8
240	13.85	5.74	13.07	10	12.91	17.98	21.34	25.58	28.73	31.85	34.97	39.08	42.18
360	10.09	3.91	9.8	10	9.45	12.9	15.19	18.08	20.23	22.35	24.48	27.27	29.39
720	5.48	1.83	5.48	12	5.18	6.8	7.87	9.22	10.22	11.22	12.21	13.52	14.51
1440	3.14	1.05	3.07	11	2.97	3.9	4.51	5.29	5.86	6.43	7	7.75	8.32
2880	1.82	0.59	1.77	12	1.72	2.24	2.59	3.03	3.35	3.67	3.99	4.41	4.73
4320	1.44	0.56	1.29	12	1.35	1.84	2.17	2.58	2.89	3.2	3.5	3.9	4.2
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445595					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	96.52	115.47	66.04	10	77.56	179.6	247.16	332.53	395.86	458.72	521.35	603.98	666.43
30	59.27	49.6	48.26	12	51.12	94.96	123.98	160.65	187.85	214.85	241.76	277.25	304.08
45	41.85	31.06	35.56	14	36.75	64.2	82.37	105.33	122.37	139.28	156.12	178.35	195.15
60	33.37	22.65	27.94	15	29.65	49.67	62.92	79.66	92.09	104.42	116.7	132.91	145.16
120	19.86	10.94	16.51	15	18.06	27.73	34.13	42.22	48.22	54.18	60.11	67.94	73.86
180	13.76	6.9	12.7	15	12.63	18.72	22.76	27.86	31.65	35.4	39.15	44.08	47.82
240	11.14	4.75	10.8	17	10.36	14.56	17.34	20.85	23.45	26.04	28.62	32.02	34.58
360	8.3	3.08	8.28	20	7.79	10.52	12.32	14.6	16.28	17.96	19.63	21.84	23.5
720	5.25	1.53	5.1	23	5	6.35	7.25	8.38	9.22	10.05	10.88	11.97	12.8

1440	3.01	0.73	2.91	18	2.89	3.54	3.96	4.5	4.9	5.3	5.7	6.22	6.61
2880	1.63	0.46	1.62	22	1.55	1.96	2.23	2.57	2.82	3.07	3.32	3.65	3.9
4320	1.14	0.31	1.13	22	1.09	1.36	1.54	1.77	1.94	2.11	2.28	2.5	2.67
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445690					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	178.1	153.17	111.76	17	137.15	282.59	384.27	512.26	605.58	696.58	785.64	900.89	986.47
30	95.78	72.14	68.66	17	79.35	148.79	194.38	249.6	288.7	326.08	362.05	407.83	441.32
45	65.57	45.48	46.59	18	56.38	100.22	127.99	160.88	183.8	205.46	226.1	252.12	271
60	51.33	32.56	40.64	19	45.66	76.94	96.05	118.21	133.39	147.57	160.96	177.68	189.71
120	28.57	15.1	27.31	20	26.77	41.02	49.17	58.27	64.32	69.86	75	81.32	85.79
180	20.57	9.23	19.05	22	19.88	28.37	33	38.01	41.27	44.22	46.91	50.18	52.47
240	17.61	8	15.88	20	16.99	24.36	28.4	32.77	35.63	38.2	40.56	43.43	45.44
360	13.25	6.29	11.85	23	12.69	18.53	21.76	25.3	27.62	29.72	31.65	34.01	35.66
720	8.69	4.02	7.73	28	8.36	12.08	14.12	16.35	17.8	19.11	20.32	21.79	22.82
1440	5.09	2.28	4.45	25	4.92	7.02	8.16	9.4	10.2	10.93	11.59	12.4	12.96
2880	2.78	1.23	2.57	24	2.69	3.82	4.43	5.1	5.53	5.91	6.27	6.7	7
4320	1.99	0.84	1.75	28	1.94	2.7	3.11	3.55	3.84	4.09	4.33	4.61	4.8
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445851					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	267.85	233.47	132.08	11	204.48	425.77	581.56	778.51	922.58	1063.38	1201.44	1380.44	1513.56
30	125.05	108.89	76.2	13	95.52	198.75	271.39	363.19	430.32	495.92	560.24	643.61	705.61
45	88.05	73.65	52.5	12	68.95	139.17	187.6	248.04	291.83	334.34	375.79	429.24	468.8
60	65.13	50.35	44.45	14	53.26	101.65	133.8	173.02	200.95	227.74	253.61	286.63	310.85

120	34.21	24.57	26.04	14	28.98	52.66	67.88	86.08	98.84	110.96	122.56	137.23	147.92
180	23.35	16.24	19.48	14	20.05	35.71	45.64	57.4	65.61	73.36	80.76	90.08	96.84
240	18.96	11.99	15.88	13	16.88	28.4	35.43	43.57	49.15	54.35	59.27	65.4	69.81
360	13.3	7.59	11.01	13	12.22	19.45	23.7	28.51	31.75	34.74	37.53	40.98	43.44
720	6.96	3.48	5.61	14	6.6	9.86	11.69	13.71	15.05	16.26	17.38	18.76	19.72
1440	3.74	1.73	3.07	13	3.6	5.2	6.08	7.03	7.66	8.23	8.74	9.38	9.82
2880	2.01	0.76	1.88	14	1.98	2.66	3.02	3.39	3.63	3.84	4.03	4.26	4.42
4320	1.37	0.5	1.27	14	1.36	1.8	2.03	2.27	2.42	2.56	2.68	2.83	2.93
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 445880					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	75.18	32.55	76.2	10	69.83	98.6	117.65	141.71	159.56	177.28	194.94	218.23	235.83
30	45.72	16.85	45.72	11	42.95	57.84	67.7	80.16	89.4	98.57	107.71	119.77	128.88
45	34.88	14.46	33.87	10	32.51	45.28	53.74	64.43	72.37	80.24	88.08	98.43	106.25
60	30.02	10.52	30.48	11	28.29	37.59	43.74	51.52	57.29	63.02	68.72	76.25	81.94
120	18.52	7.37	18.42	12	17.31	23.82	28.13	33.58	37.63	41.64	45.64	50.91	54.9
180	13.31	5.04	13.13	14	12.48	16.94	19.89	23.61	26.38	29.12	31.85	35.46	38.19
240	11.54	3.85	11.12	12	10.91	14.31	16.56	19.41	21.52	23.62	25.7	28.46	30.54
360	8.41	2.99	7.83	16	7.92	10.56	12.31	14.52	16.16	17.79	19.41	21.55	23.17
720	5.35	2.19	4.87	16	4.99	6.93	8.21	9.83	11.03	12.22	13.41	14.97	16.16
1440	3.16	1.24	2.91	18	2.96	4.05	4.78	5.69	6.37	7.05	7.72	8.61	9.28
2880	1.81	0.8	1.59	17	1.68	2.39	2.85	3.45	3.88	4.32	4.75	5.33	5.76
4320	1.29	0.58	1.18	18	1.19	1.71	2.05	2.48	2.79	3.11	3.42	3.84	4.15
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 446178					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	187.4	178.39	101.6	9	158.1	315.75	420.13	552.01	649.85	746.96	843.72	971.38	1067.86
30	94.83	73.79	68.58	12	82.71	147.92	191.1	245.65	286.12	326.29	366.31	419.12	459.03
45	66.17	46.8	54.19	13	58.48	99.84	127.23	161.82	187.49	212.97	238.35	271.84	297.16
60	51.48	32.12	43.18	15	46.2	74.59	93.38	117.13	134.75	152.23	169.65	192.64	210.01
120	30.8	19.12	25.4	12	27.66	44.56	55.74	69.88	80.37	90.77	101.15	114.83	125.17
180	21.11	12.74	16.94	14	19.02	30.28	37.73	47.15	54.14	61.07	67.98	77.1	83.99
240	17.15	9.01	15.25	16	15.67	23.63	28.9	35.57	40.51	45.41	50.3	56.75	61.62
360	12.18	6	11.01	17	11.19	16.5	20.01	24.44	27.73	31	34.25	38.55	41.79
720	7.39	3.41	6.46	18	6.83	9.84	11.84	14.36	16.23	18.09	19.94	22.38	24.22
1440	4.37	1.99	3.81	17	4.04	5.8	6.97	8.44	9.53	10.61	11.69	13.12	14.19
2880	2.43	1.1	2.17	17	2.25	3.22	3.87	4.68	5.28	5.88	6.48	7.26	7.86
4320	1.84	0.79	1.68	16	1.71	2.41	2.87	3.45	3.89	4.32	4.75	5.31	5.74
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 446475					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	99.06	58.47	86.36	12	89.46	141.13	175.34	218.57	250.63	282.46	314.18	356.02	387.64
30	57.23	26.43	55.88	15	52.89	76.25	91.71	111.25	125.75	140.13	154.47	173.38	187.68
45	42.82	15.97	42.34	14	40.2	54.31	63.65	75.46	84.22	92.91	101.58	113	121.64
60	35.56	14.16	34.29	16	33.23	45.75	54.03	64.5	72.27	79.98	87.66	97.79	105.45
120	23.24	9.65	22.23	20	21.66	30.18	35.83	42.96	48.26	53.51	58.74	65.65	70.87
180	18.31	8.43	16.09	16	16.93	24.38	29.31	35.54	40.16	44.75	49.33	55.36	59.92
240	14.57	6.96	13.02	16	13.43	19.58	23.65	28.8	32.61	36.4	40.18	45.16	48.92
360	11.03	4.69	9.95	20	10.26	14.4	17.15	20.62	23.19	25.74	28.29	31.64	34.18
720	6.86	3.65	5.61	22	6.26	9.49	11.62	14.32	16.32	18.31	20.29	22.9	24.87

1440	3.99	1.83	3.55	26	3.69	5.31	6.38	7.73	8.73	9.73	10.72	12.03	13.02
2880	2.09	0.92	1.91	25	1.94	2.75	3.29	3.97	4.47	4.98	5.47	6.13	6.63
4320	1.52	0.65	1.31	27	1.41	1.99	2.37	2.85	3.21	3.56	3.91	4.38	4.73
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 446692					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	129.31	127.96	91.44	11	108.3	221.38	296.25	390.85	461.03	530.69	600.09	691.66	760.87
30	70.39	55.29	58.42	14	61.31	110.17	142.52	183.4	213.72	243.82	273.81	313.38	343.28
45	52.62	37.4	44.03	13	46.48	79.53	101.41	129.06	149.57	169.93	190.22	216.98	237.21
60	42.23	25.41	36.83	16	38.06	60.51	75.38	94.17	108.1	121.93	135.72	153.9	167.64
120	25	12.42	22.23	16	22.96	33.94	41.2	50.39	57.2	63.96	70.69	79.58	86.3
180	17.78	7.98	16.09	19	16.47	23.52	28.19	34.09	38.47	42.81	47.14	52.85	57.17
240	14.94	6.21	13.97	19	13.92	19.41	23.04	27.63	31.04	34.42	37.79	42.23	45.59
360	10.97	4.03	10.37	22	10.31	13.87	16.23	19.21	21.42	23.61	25.8	28.68	30.86
720	7.12	3.28	6.25	22	6.58	9.48	11.4	13.82	15.62	17.41	19.19	21.53	23.31
1440	4.07	1.88	3.6	26	3.76	5.42	6.52	7.91	8.94	9.97	10.99	12.33	13.35
2880	2.38	1.09	2.17	26	2.2	3.16	3.8	4.61	5.21	5.8	6.39	7.17	7.76
4320	1.66	0.77	1.47	28	1.53	2.21	2.66	3.23	3.66	4.08	4.49	5.04	5.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 446712					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	151.55	142.53	96.52	12	128.14	254.1	337.5	442.87	521.04	598.63	675.94	777.93	855.02
30	81.78	56.4	66.04	17	72.52	122.36	155.36	197.06	227.99	258.69	289.28	329.64	360.15
45	59.3	36.63	50.8	17	53.28	85.66	107.09	134.17	154.26	174.2	194.07	220.28	240.09
60	46.34	27	38.1	19	41.91	65.77	81.56	101.53	116.33	131.03	145.68	165	179.6

120	28.14	14.58	24.13	23	25.75	38.63	47.16	57.94	65.94	73.87	81.78	92.22	100.1
180	20.71	10.83	17.33	23	18.93	28.5	34.84	42.85	48.79	54.68	60.56	68.31	74.16
240	16.47	8.56	13	21	15.06	22.63	27.64	33.97	38.66	43.32	47.96	54.09	58.72
360	12.69	6.25	10.59	24	11.66	17.19	20.84	25.46	28.89	32.29	35.68	40.16	43.54
720	6.87	3.14	6.14	27	6.35	9.13	10.97	13.29	15.01	16.72	18.42	20.67	22.37
1440	3.85	1.48	3.6	25	3.61	4.91	5.78	6.87	7.69	8.49	9.3	10.35	11.15
2880	2.1	0.79	1.96	27	1.97	2.67	3.13	3.71	4.15	4.58	5.01	5.57	6
4320	1.52	0.56	1.41	29	1.43	1.92	2.25	2.66	2.97	3.28	3.58	3.98	4.28
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 446955					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	88.09	83.35	66.04	12	63.61	141.25	198.28	272.3	327.53	382.25	436.52	507.71	561.18
30	54.43	37.72	48.26	14	46.82	83.18	106.2	133.47	152.46	170.4	187.51	209.07	224.71
45	40.64	23.95	37.25	15	37.01	59.89	73.49	89	99.5	109.22	118.33	129.62	137.7
60	36.58	17.77	33.02	15	34.88	51.44	60.68	70.82	77.48	83.53	89.11	95.92	100.71
120	20.88	8.79	19.69	18	20.37	28.36	32.65	37.24	40.21	42.87	45.3	48.24	50.28
180	15.15	5.97	14.82	18	14.9	20.26	23.09	26.09	28.02	29.74	31.3	33.18	34.48
240	12.58	4.87	11.75	16	12.39	16.75	19.04	21.47	23.02	24.4	25.66	27.17	28.21
360	9.24	3.15	8.68	18	9.2	11.96	13.36	14.83	15.75	16.57	17.31	18.19	18.8
720	4.91	1.59	4.66	19	4.91	6.28	6.98	7.7	8.15	8.55	8.91	9.34	9.63
1440	2.89	0.86	2.81	22	2.9	3.63	4	4.37	4.61	4.81	4.99	5.21	5.36
2880	1.76	0.62	1.72	22	1.75	2.29	2.57	2.87	3.05	3.22	3.37	3.54	3.67
4320	1.22	0.45	1.13	23	1.21	1.61	1.81	2.03	2.17	2.29	2.41	2.54	2.63
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 447025					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	138.18	121.18	91.44	10	105.08	219.81	300.84	403.46	478.64	552.18	624.36	718.01	787.7
30	95.07	62.89	66.04	7	83.29	143.85	181.47	225.52	255.94	284.51	311.6	345.57	370.1
45	61.64	35.91	55.88	10	56.32	90.59	110.88	133.96	149.54	163.96	177.46	194.17	206.11
60	53.62	25.03	45.72	9	51.5	74.68	87.46	101.39	110.5	118.74	126.32	135.53	142
120	25.65	12.09	22.23	10	24.59	35.81	42.01	48.78	53.21	57.22	60.91	65.4	68.56
180	21.01	9.64	19.47	11	20.24	29.14	34.02	39.33	42.79	45.93	48.8	52.29	54.73
240	16.09	8.44	12.7	9	15.1	23.06	27.6	32.66	36.02	39.1	41.95	45.45	47.93
360	11.38	5.69	8.47	9	10.79	16.12	19.11	22.42	24.6	26.59	28.42	30.67	32.25
720	7.35	3.23	6.35	11	7.13	10.09	11.69	13.42	14.55	15.56	16.49	17.61	18.39
1440	3.84	1.7	3.71	10	3.72	5.28	6.13	7.04	7.64	8.17	8.66	9.26	9.67
2880	2.2	0.98	2.12	11	2.13	3.03	3.52	4.05	4.39	4.7	4.99	5.33	5.57
4320	1.59	0.69	1.68	10	1.54	2.18	2.52	2.88	3.12	3.34	3.53	3.77	3.93
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 447130					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	88.9	45.36	81.28	8	83.94	126.54	150.66	177.36	195.04	211.17	226.1	244.37	257.29
30	62.23	28.45	68.58	8	59.97	86.22	100.61	116.24	126.43	135.63	144.08	154.33	161.53
45	48.38	19.72	50.8	7	47.38	65.21	74.69	84.81	91.31	97.14	102.44	108.83	113.28
60	35.92	16.94	38.1	7	34.44	50.15	58.84	68.33	74.54	80.17	85.34	91.64	96.07
120	25.08	12.71	24.77	8	23.72	35.64	42.38	49.83	54.75	59.25	63.4	68.49	72.08
180	17.89	9.86	16.51	8	16.59	25.95	31.38	37.48	41.57	45.32	48.82	53.14	56.2
240	14.69	8.74	13.34	8	13.34	21.7	26.68	32.38	36.24	39.82	43.18	47.34	50.32
360	10.74	6.89	9.11	8	9.51	16.14	20.21	24.93	28.18	31.22	34.09	37.68	40.26
720	5.97	3.5	5.08	9	5.44	8.79	10.77	13.03	14.56	15.97	17.29	18.93	20.11

1440	3.36	1.77	2.77	8	3.15	4.82	5.77	6.84	7.55	8.19	8.79	9.53	10.05
2880	1.91	1.06	1.59	9	1.77	2.77	3.36	4.02	4.46	4.87	5.25	5.71	6.05
4320	1.49	0.78	1.31	8	1.4	2.13	2.55	3.02	3.33	3.61	3.88	4.2	4.43
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 447164					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	81.28	57.47	81.28	2	69.32	124.72	160.09	202.21	231.66	259.56	286.21	319.88	344.35
30	45.72	28.74	45.72	2	40.79	68.39	85.2	104.63	117.93	130.34	142.04	156.64	167.14
45	33.87	19.16	33.87	2	31.2	49.43	60.12	72.19	80.3	87.79	94.78	103.41	109.56
60	23.71	12.53	17.78	3	22.22	34.04	40.81	48.35	53.37	57.97	62.24	67.48	71.19
120	15.24	6.35	15.24	3	14.89	20.65	23.73	27.03	29.16	31.07	32.8	34.9	36.37
180	10.72	4.34	11.85	3	10.51	14.43	16.51	18.72	20.15	21.43	22.59	23.98	24.96
240	8.68	3.13	10.16	3	8.61	11.37	12.8	14.3	15.25	16.1	16.86	17.78	18.41
360	5.72	2.69	5.72	2	5.49	7.98	9.36	10.86	11.85	12.74	13.56	14.56	15.26
720	4.37	1.64	4.87	3	4.32	5.78	6.54	7.34	7.85	8.31	8.72	9.22	9.56
1440	2.65	0.74	2.96	3	2.67	3.29	3.6	3.91	4.1	4.27	4.43	4.61	4.73
2880	1.5	0.53	1.69	3	1.49	1.96	2.2	2.45	2.61	2.75	2.88	3.03	3.13
4320	1.14	0.53	1.16	3	1.1	1.59	1.86	2.15	2.34	2.52	2.68	2.87	3.01
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 447338					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	150.06	232.76	91.44	13	111.83	317.53	453.72	625.8	753.45	880.17	1006.42	1172.98	1298.87
30	80.66	103.29	55.97	16	63.7	154.98	215.41	291.77	348.42	404.65	460.68	534.59	590.46
45	61.41	69.97	44.03	15	49.92	111.75	152.69	204.42	242.8	280.89	318.84	368.91	406.75
60	46.57	52.08	35.56	15	38.02	84.04	114.51	153.02	181.58	209.93	238.18	275.45	303.62

120	26.97	21.99	21.59	21	23.36	42.79	55.66	71.92	83.98	95.95	107.87	123.61	135.5
180	19.43	15.59	16.09	18	16.87	30.65	39.77	51.29	59.84	68.33	76.79	87.94	96.38
240	14.89	10.91	12.39	20	13.1	22.74	29.12	37.19	43.17	49.11	55.03	62.84	68.74
360	11.23	6.79	9.53	22	10.11	16.12	20.09	25.11	28.83	32.53	36.21	41.07	44.74
720	6.45	3.77	5.5	21	5.83	9.16	11.37	14.16	16.22	18.28	20.32	23.02	25.06
1440	3.86	1.85	3.44	24	3.56	5.19	6.27	7.64	8.66	9.66	10.67	11.99	12.99
2880	2.21	1.02	1.96	25	2.04	2.94	3.54	4.29	4.85	5.41	5.96	6.69	7.24
4320	1.6	0.72	1.43	26	1.48	2.12	2.54	3.07	3.47	3.86	4.25	4.76	5.15
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448022					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	74.02	27.33	71.12	7	69.53	93.68	109.68	129.88	144.87	159.75	174.57	194.13	208.91
30	55.32	23.06	50.8	9	51.53	71.91	85.4	102.45	115.1	127.65	140.16	156.66	169.13
45	41.87	22.32	37.25	11	38.2	57.93	70.99	87.49	99.73	111.88	123.99	139.96	152.03
60	34.93	21.72	29.21	12	31.36	50.56	63.27	79.32	91.24	103.06	114.84	130.38	142.13
120	20.43	14.12	17.78	12	18.11	30.59	38.85	49.29	57.03	64.72	72.38	82.48	90.12
180	14.16	9.81	11.85	11	12.55	21.22	26.96	34.21	39.59	44.93	50.25	57.27	62.58
240	12.23	6.67	11.12	12	11.13	17.03	20.93	25.86	29.52	33.15	36.77	41.54	45.15
360	8.58	4.57	7.62	11	7.83	11.87	14.54	17.92	20.43	22.91	25.39	28.66	31.14
720	4.9	2.09	4.45	13	4.56	6.4	7.63	9.17	10.32	11.46	12.59	14.09	15.22
1440	2.85	1.14	2.54	13	2.66	3.67	4.34	5.18	5.81	6.43	7.04	7.86	8.48
2880	1.76	0.69	1.51	14	1.65	2.26	2.66	3.17	3.55	3.92	4.3	4.79	5.17
4320	1.21	0.48	1.09	17	1.13	1.56	1.84	2.19	2.45	2.72	2.98	3.32	3.58
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448046-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	183.73	181.31	116.84	12	153.95	314.18	420.27	554.31	653.75	752.45	850.8	980.54	1078.6
30	88.05	81.07	60.96	15	74.74	146.38	193.81	253.75	298.21	342.35	386.32	444.33	488.18
45	61.86	52.8	44.03	15	53.19	99.85	130.74	169.78	198.74	227.48	256.12	293.9	322.46
60	50.26	40.16	34.29	14	43.66	79.16	102.65	132.34	154.37	176.23	198.01	226.75	248.47
120	26.4	19.56	19.69	14	23.19	40.47	51.92	66.38	77.11	87.75	98.36	112.36	122.94
180	17.67	11.96	13.97	16	15.71	26.28	33.27	42.12	48.67	55.19	61.67	70.23	76.7
240	14.49	8.64	12.07	16	13.07	20.71	25.76	32.15	36.89	41.59	46.28	52.46	57.13
360	10.66	5.48	9.1	16	9.76	14.6	17.81	21.86	24.87	27.85	30.82	34.74	37.71
720	5.92	2.49	5.4	20	5.51	7.71	9.17	11.01	12.37	13.73	15.08	16.86	18.21
1440	3.13	1.28	2.75	19	2.92	4.05	4.8	5.75	6.45	7.15	7.84	8.76	9.45
2880	1.79	0.66	1.72	20	1.68	2.26	2.65	3.14	3.5	3.86	4.22	4.69	5.05
4320	1.25	0.5	1.16	21	1.17	1.61	1.9	2.27	2.55	2.82	3.09	3.45	3.72
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448046-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	46.99	27.12	45.72	8	42.54	66.5	82.37	102.42	117.29	132.06	146.77	166.18	180.84
30	38.46	18.28	40.64	7	35.46	51.61	62.31	75.82	85.85	95.8	105.71	118.8	128.68
45	30.48	15.7	33.87	5	27.9	41.78	50.96	62.57	71.18	79.73	88.24	99.48	107.97
60	23.22	12.39	25.4	7	21.19	32.13	39.38	48.54	55.34	62.08	68.8	77.67	84.37
120	12.84	5.1	12.7	9	12	16.51	19.49	23.26	26.06	28.84	31.6	35.25	38.01
180	10.69	3.7	10.59	8	10.08	13.35	15.52	18.25	20.28	22.3	24.3	26.95	28.95
240	8.54	3	8.26	9	8.05	10.7	12.45	14.67	16.32	17.95	19.58	21.72	23.35
360	6.82	2.15	6.14	10	6.47	8.37	9.62	11.21	12.39	13.56	14.73	16.27	17.43
720	4.33	1.36	4.23	9	4.11	5.31	6.1	7.11	7.86	8.6	9.33	10.31	11.04

1440	2.45	0.8	2.43	11	2.32	3.03	3.49	4.09	4.52	4.96	5.39	5.97	6.4
2880	1.33	0.47	1.25	12	1.25	1.67	1.94	2.29	2.55	2.8	3.06	3.4	3.65
4320	1.01	0.41	0.92	11	0.94	1.3	1.54	1.85	2.07	2.3	2.52	2.81	3.03
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448062					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	125.83	132.96	81.28	13	103.99	221.5	299.29	397.59	470.51	542.89	615.01	710.16	782.07
30	69.43	58.83	55.88	15	59.77	111.76	146.18	189.67	221.94	253.96	285.87	327.97	359.79
45	47.41	36.4	40.64	17	41.43	73.6	94.9	121.81	141.77	161.59	181.33	207.38	227.07
60	36.41	26.73	31.75	18	32.02	55.64	71.28	91.04	105.7	120.25	134.75	153.88	168.34
120	21.99	13.47	19.69	16	19.78	31.68	39.56	49.52	56.91	64.24	71.55	81.19	88.47
180	15.94	8.97	13.55	17	14.47	22.39	27.64	34.27	39.19	44.08	48.94	55.36	60.21
240	12.81	6.82	11.43	17	11.69	17.72	21.71	26.75	30.49	34.2	37.9	42.78	46.47
360	9.59	5.38	7.62	17	8.71	13.46	16.61	20.59	23.54	26.47	29.38	33.23	36.14
720	5.9	3.2	5.08	21	5.37	8.2	10.07	12.44	14.2	15.94	17.67	19.96	21.69
1440	3.22	1.54	2.91	22	2.97	4.33	5.23	6.37	7.21	8.05	8.89	9.99	10.82
2880	1.92	0.94	1.64	16	1.77	2.6	3.15	3.84	4.36	4.87	5.38	6.05	6.56
4320	1.39	0.64	1.27	19	1.28	1.85	2.22	2.7	3.05	3.4	3.74	4.2	4.55
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448129					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	186.27	190.47	76.2	6	126.7	300.11	433.01	610.14	744.95	880.33	1016.2	1196.44	1333.21
30	91.44	78.23	60.96	8	70.64	144.99	196.83	261.97	309.42	355.64	400.85	459.32	502.7
45	63.92	50.51	45.72	8	51.68	100.14	132.66	172.58	201.15	228.64	255.25	289.32	314.37
60	51.89	38.99	35.56	7	43.04	80.57	105.19	134.99	156.08	176.23	195.62	220.29	238.33

120	33.02	19.41	21.59	5	30.09	48.63	59.64	72.19	80.68	88.54	95.9	105.03	111.55
180	22.16	10.99	16.94	6	21.05	31.32	37.09	43.44	47.63	51.44	54.96	59.25	62.28
240	17.06	7	13.97	7	16.69	23.03	26.41	30.01	32.33	34.41	36.3	38.58	40.17
360	12.33	3.97	11.65	8	12.33	15.76	17.49	19.29	20.42	21.41	22.3	23.36	24.1
720	6.86	2.17	6.35	5	6.87	8.73	9.68	10.65	11.26	11.8	12.28	12.85	13.24
1440	3.85	1.01	3.76	8	3.88	4.72	5.13	5.55	5.81	6.03	6.23	6.47	6.63
2880	2.14	0.68	2.04	8	2.14	2.73	3.02	3.33	3.52	3.69	3.84	4.02	4.14
4320	1.52	0.55	1.4	8	1.51	1.99	2.24	2.51	2.68	2.83	2.96	3.12	3.23
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448149					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	54.19	21.15	60.96	3	53.33	72.3	82.29	92.87	99.65	105.7	111.19	117.78	122.37
30	39.37	13.36	43.18	4	39.23	50.89	56.85	63.05	66.97	70.43	73.55	77.26	79.83
45	27.94	10.48	30.48	4	27.61	36.94	41.8	46.93	50.2	53.11	55.75	58.91	61.1
60	21.17	9.62	25.4	3	20.42	29.29	34.14	39.41	42.84	45.93	48.77	52.22	54.64
120	13.65	5.33	14.61	4	13.43	18.21	20.73	23.4	25.11	26.63	28.02	29.68	30.84
180	10.8	5	9.74	4	10.39	15.01	17.55	20.32	22.13	23.77	25.27	27.09	28.38
240	8.74	4.59	7.64	4	8.2	12.53	15	17.75	19.58	21.26	22.81	24.72	26.07
360	6.49	2.27	5.36	5	6.45	8.45	9.47	10.54	11.22	11.82	12.36	13.01	13.45
720	3.77	1.22	3.18	5	3.77	4.82	5.36	5.91	6.26	6.56	6.84	7.17	7.39
1440	2.28	0.89	2.22	5	2.24	3.04	3.46	3.91	4.19	4.45	4.68	4.96	5.15
2880	1.29	0.29	1.22	5	1.31	1.54	1.65	1.76	1.83	1.89	1.95	2.01	2.05
4320	1.1	0.31	1.08	4	1.11	1.37	1.5	1.63	1.71	1.78	1.85	1.92	1.97
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448172					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	197.1	227.71	121.92	5	120.15	317.47	479.85	706.18	884.32	1067.39	1254.75	1508.21	1703.85
30	100.82	112.08	62.15	5	63.74	162.59	242.1	351.33	436.38	523.14	611.38	729.99	821.04
45	67.22	74.72	41.44	5	42.5	108.4	161.41	234.23	290.92	348.76	407.57	486.64	547.33
60	50.41	56.04	31.08	5	31.87	81.29	121.05	175.67	218.19	261.57	305.69	364.99	410.52
120	26.98	27.22	16.81	5	18.55	43.44	62.38	87.5	106.55	125.63	144.74	170.05	189.21
180	19.17	17.68	13.75	5	14.1	30.67	42.67	58.13	69.59	80.89	92.07	106.66	117.59
240	17.66	13.65	13.41	4	14.44	27.56	36.28	46.91	54.48	61.74	68.75	77.7	84.27
360	10.83	8.33	8.57	5	8.88	16.89	22.2	28.66	33.26	37.67	41.93	47.35	51.33
720	6.52	3.73	4.6	5	5.99	9.54	11.63	14	15.59	17.07	18.44	20.14	21.36
1440	3.61	1.71	2.64	5	3.46	5.05	5.92	6.88	7.51	8.08	8.61	9.25	9.7
2880	1.87	0.82	1.44	5	1.81	2.56	2.97	3.41	3.7	3.95	4.19	4.47	4.67
4320	1.42	0.65	1.16	5	1.37	1.97	2.3	2.65	2.89	3.1	3.29	3.53	3.69
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448396					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	162.56	153.99	111.76	15	137.27	273.36	363.46	477.3	561.75	645.59	729.11	839.31	922.59
30	93.78	78.06	66.04	13	80.96	149.94	195.62	253.33	296.14	338.63	380.97	436.83	479.05
45	59.83	44.48	49.11	18	52.53	91.83	117.86	150.74	175.14	199.35	223.48	255.31	279.36
60	48.26	32.86	41.91	18	42.86	71.9	91.13	115.42	133.44	151.33	169.16	192.67	210.44
120	28.53	16.48	24.77	20	25.82	40.39	50.03	62.21	71.25	80.22	89.16	100.96	109.87
180	20.9	11.55	17.78	21	19	29.21	35.97	44.51	50.84	57.13	63.39	71.66	77.91
240	15.86	9.62	13.02	22	14.28	22.78	28.41	35.52	40.8	46.04	51.25	58.14	63.34
360	12.12	7.03	9.6	22	10.97	17.18	21.29	26.49	30.34	34.17	37.98	43.02	46.82
720	7.06	3.8	5.93	23	6.44	9.79	12.02	14.83	16.91	18.98	21.04	23.76	25.82

1440	4.01	2.06	3.28	21	3.67	5.49	6.7	8.22	9.35	10.47	11.59	13.06	14.18
2880	2.09	1.08	1.78	22	1.91	2.87	3.5	4.3	4.89	5.48	6.06	6.84	7.42
4320	1.49	0.7	1.34	27	1.38	1.99	2.4	2.92	3.3	3.69	4.07	4.57	4.94
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448547					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	103.45	74.22	81.28	11	87.67	159.2	205.16	260.1	298.62	335.19	370.18	414.45	446.67
30	58.22	33.29	50.8	13	53.47	85.19	103.84	124.97	139.19	152.33	164.6	179.78	190.6
45	46.22	20.87	44.03	17	44.63	63.85	74.34	85.72	93.13	99.81	105.94	113.37	118.58
60	38.5	17.09	38.1	19	37.28	52.96	61.5	70.72	76.71	82.11	87.05	93.04	97.23
120	22.26	9.04	22.86	17	21.81	29.98	34.32	38.94	41.92	44.58	47.01	49.92	51.96
180	15.51	5.84	15.24	19	15.32	20.52	23.24	26.1	27.93	29.56	31.03	32.79	34.02
240	12.37	4.54	12.7	19	12.25	16.27	18.36	20.56	21.95	23.2	24.32	25.66	26.59
360	9.05	3.18	8.89	19	8.99	11.79	13.23	14.73	15.68	16.52	17.29	18.19	18.82
720	5.44	1.72	5.19	20	5.45	6.93	7.67	8.44	8.93	9.35	9.73	10.19	10.5
1440	3.17	0.92	3.13	18	3.19	3.97	4.35	4.75	4.99	5.21	5.4	5.63	5.79
2880	1.79	0.58	1.69	23	1.79	2.29	2.54	2.81	2.97	3.12	3.25	3.41	3.51
4320	1.29	0.39	1.27	22	1.29	1.63	1.79	1.96	2.07	2.17	2.25	2.35	2.42
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 448800					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	104.5	56.56	96.52	14	97.36	150.89	181.78	216.38	239.48	260.68	280.4	304.66	321.88
30	65.48	30.67	68.58	18	62.85	91.27	106.95	124.06	135.25	145.38	154.69	166.01	173.97
45	46.78	20.14	45.72	16	45.49	63.88	73.8	84.47	91.38	97.59	103.26	110.12	114.91
60	38.7	17.95	38.1	17	37.21	53.81	62.95	72.9	79.4	85.29	90.69	97.25	101.86

120	24.13	10.05	23.5	16	23.57	32.69	37.57	42.79	46.15	49.17	51.92	55.24	57.56
180	19.69	7.73	18.21	20	19.37	26.31	29.97	33.85	36.33	38.55	40.57	42.99	44.68
240	16.39	6.47	15.25	20	16.11	21.93	25	28.25	30.34	32.21	33.9	35.94	37.36
360	12.07	5.05	11.65	18	11.78	16.37	18.83	21.46	23.15	24.67	26.06	27.74	28.9
720	7.55	3.23	6.46	22	7.35	10.29	11.88	13.59	14.69	15.68	16.58	17.68	18.44
1440	4.33	1.88	4.19	22	4.21	5.93	6.85	7.86	8.5	9.09	9.62	10.27	10.72
2880	2.3	1.08	1.94	24	2.21	3.21	3.76	4.36	4.76	5.12	5.44	5.84	6.13
4320	1.66	0.76	1.48	23	1.6	2.3	2.69	3.1	3.38	3.62	3.85	4.12	4.31
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449060					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	137.5	105.9	121.92	9	120.11	213.7	275.66	353.95	412.03	469.68	527.12	602.9	660.18
30	66.95	49.92	55.88	10	58.75	102.87	132.08	168.98	196.36	223.54	250.61	286.34	313.33
45	46.19	31.98	37.26	10	40.94	69.2	87.91	111.55	129.09	146.5	163.85	186.73	204.03
60	35.26	23.45	27.94	10	31.41	52.13	65.85	83.19	96.05	108.82	121.54	138.32	151
120	19.93	11.04	16.51	9	18.12	27.87	34.33	42.49	48.55	54.56	60.55	68.45	74.42
180	14.1	7.45	11.43	8	12.88	19.46	23.82	29.33	33.41	37.47	41.51	46.84	50.87
240	11.55	5.17	10.04	8	10.7	15.27	18.29	22.12	24.95	27.77	30.57	34.27	37.07
360	8.51	3.31	8.04	7	7.97	10.89	12.83	15.28	17.09	18.89	20.69	23.06	24.85
720	4.47	1.44	4.34	8	4.23	5.51	6.35	7.41	8.2	8.99	9.77	10.8	11.58
1440	2.43	0.73	2.38	8	2.31	2.96	3.38	3.92	4.32	4.72	5.12	5.64	6.03
2880	1.32	0.35	1.26	8	1.26	1.57	1.78	2.04	2.23	2.42	2.61	2.86	3.05
4320	0.96	0.23	0.91	7	0.92	1.13	1.26	1.43	1.56	1.68	1.81	1.97	2.1
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449151					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	131.4	88.19	101.6	15	116.92	194.85	246.45	311.65	360.02	408.03	455.86	518.97	566.67
30	77.33	41.87	68.58	18	70.45	107.46	131.95	162.91	185.87	208.67	231.38	261.34	283.98
45	52.59	25.96	47.41	17	48.33	71.27	86.46	105.65	119.89	134.02	148.1	166.68	180.72
60	45.72	25.94	39.37	20	41.46	64.38	79.56	98.74	112.97	127.09	141.16	159.72	173.75
120	29.71	17.54	26.67	23	26.83	42.33	52.59	65.56	75.18	84.73	94.24	106.79	116.28
180	22.34	14.65	19.47	21	19.93	32.88	41.45	52.28	60.32	68.29	76.24	86.72	94.65
240	17.44	11.34	13.97	26	15.58	25.6	32.23	40.62	46.84	53.01	59.16	67.28	73.41
360	13.36	7.89	11.01	25	12.06	19.04	23.65	29.49	33.81	38.11	42.39	48.03	52.3
720	7	3.6	6.14	19	6.41	9.59	11.7	14.36	16.33	18.29	20.24	22.82	24.77
1440	4.51	3.09	3.49	29	4	6.73	8.54	10.83	12.52	14.2	15.88	18.09	19.76
2880	2.54	1.72	1.83	28	2.26	3.78	4.78	6.06	7	7.94	8.87	10.1	11.03
4320	1.73	1.11	1.27	31	1.55	2.53	3.18	4	4.61	5.21	5.81	6.61	7.21
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449159					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	100.58	90.93	76.2	10	85.65	166	219.21	286.43	336.3	385.8	435.12	500.19	549.37
30	59.11	41.29	50.8	11	52.33	88.82	112.98	143.5	166.15	188.63	211.02	240.57	262.9
45	41.77	27.26	35.56	12	37.29	61.38	77.33	97.49	112.44	127.28	142.06	161.57	176.31
60	36.2	20.95	31.75	12	32.76	51.27	63.53	79.02	90.51	101.91	113.28	128.27	139.6
120	17.88	9.03	16.51	13	16.4	24.38	29.66	36.34	41.29	46.2	51.1	57.56	62.45
180	14.17	6.83	12.7	15	13.05	19.08	23.08	28.13	31.88	35.59	39.3	44.19	47.88
240	11.73	4.8	10.16	15	10.94	15.18	17.99	21.54	24.17	26.79	29.39	32.82	35.42
360	9.1	3.07	8.26	14	8.6	11.31	13.11	15.37	17.06	18.73	20.39	22.59	24.25
720	5.21	1.75	4.97	16	4.92	6.47	7.49	8.79	9.75	10.7	11.65	12.9	13.85

1440	2.98	0.89	2.86	17	2.83	3.62	4.14	4.8	5.29	5.77	6.25	6.89	7.37
2880	1.73	0.57	1.61	16	1.64	2.14	2.47	2.9	3.21	3.52	3.83	4.24	4.54
4320	1.2	0.45	1.09	21	1.13	1.52	1.79	2.12	2.37	2.61	2.86	3.18	3.42
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449169					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	103.86	87.37	71.12	9	89.51	166.72	217.84	282.44	330.35	377.92	425.31	487.83	535.08
30	60.96	36.49	50.8	11	54.97	87.21	108.57	135.54	155.55	175.42	195.21	221.32	241.06
45	44.31	22.62	38.95	12	40.6	60.59	73.82	90.54	102.95	115.26	127.53	143.72	155.95
60	35.05	17.91	29.21	10	32.11	47.94	58.42	71.66	81.48	91.23	100.94	113.76	123.45
120	21.13	8.97	17.78	11	19.66	27.58	32.83	39.46	44.38	49.27	54.13	60.55	65.4
180	14.61	6.57	12.28	12	13.53	19.34	23.18	28.04	31.64	35.22	38.78	43.48	47.04
240	12.03	4.72	10.8	15	11.25	15.43	18.19	21.68	24.27	26.84	29.4	32.77	35.33
360	9.41	3.36	10.16	13	8.86	11.83	13.79	16.28	18.12	19.95	21.77	24.18	25.99
720	5.44	2	5.4	14	5.11	6.88	8.05	9.53	10.62	11.71	12.8	14.23	15.31
1440	3.35	1.29	3.07	15	3.14	4.28	5.03	5.99	6.69	7.4	8.1	9.02	9.72
2880	1.9	0.67	1.85	17	1.79	2.38	2.77	3.27	3.64	4	4.37	4.84	5.21
4320	1.37	0.52	1.24	14	1.28	1.74	2.05	2.43	2.72	3	3.28	3.66	3.94
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449215					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	124.14	119.12	86.36	16	88.73	199.28	281.1	387.79	467.69	547.02	625.88	729.51	807.5
30	72.98	58.25	55.88	15	58.68	114.52	152.17	198.52	231.75	263.78	294.83	334.63	363.92
45	51.75	36.41	45.72	16	44.23	79.33	101.69	128.28	146.86	164.45	181.24	202.44	217.84
60	40.91	28.62	34.29	14	35.05	62.64	80.18	101	115.53	129.28	142.39	158.94	170.95

120	21.16	13.47	19.05	17	18.8	31.74	39.66	48.85	55.15	61.04	66.6	73.54	78.54
180	15.45	8.52	14.39	17	14.33	22.41	27.1	32.38	35.91	39.16	42.19	45.92	48.57
240	12.07	6.51	10.99	17	11.26	17.41	20.96	24.94	27.59	30.02	32.28	35.06	37.04
360	9.34	4.38	9.1	18	8.96	13.02	15.26	17.71	19.31	20.76	22.09	23.71	24.84
720	5.26	2.03	5.08	19	5.18	7	7.95	8.96	9.61	10.18	10.71	11.33	11.77
1440	2.92	1.01	2.8	20	2.91	3.79	4.24	4.72	5.02	5.28	5.52	5.81	6
2880	1.72	0.65	1.64	19	1.7	2.28	2.58	2.9	3.1	3.29	3.45	3.65	3.78
4320	1.22	0.41	1.16	23	1.22	1.57	1.76	1.94	2.06	2.17	2.27	2.38	2.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449272					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	172.79	199.6	111.76	15	140.01	316.4	433.19	580.75	690.22	798.88	907.15	1049.98	1157.93
30	97.28	99.34	68.58	14	80.97	168.76	226.88	300.32	354.8	408.88	462.77	533.85	587.58
45	61.62	62.34	45.72	16	51.38	106.47	142.95	189.04	223.23	257.16	290.98	335.59	369.3
60	46.4	43.09	35.56	19	39.32	77.4	102.62	134.47	158.1	181.56	204.93	235.77	259.07
120	26.86	21.28	20.07	18	23.37	42.17	54.62	70.35	82.03	93.61	105.15	120.38	131.89
180	18.94	13.64	15.24	19	16.7	28.75	36.73	46.82	54.3	61.73	69.12	78.88	86.26
240	15.8	10.71	12.64	18	14.04	23.51	29.77	37.69	43.56	49.39	55.2	62.87	68.66
360	11.43	7.12	9.53	20	10.26	16.55	20.72	25.98	29.89	33.76	37.63	42.72	46.57
720	7	3.6	6.14	19	6.41	9.59	11.7	14.36	16.33	18.29	20.24	22.82	24.77
1440	4.45	1.57	4.18	24	4.19	5.58	6.5	7.66	8.52	9.37	10.23	11.35	12.2
2880	2.47	0.88	2.49	23	2.33	3.1	3.62	4.27	4.75	5.23	5.71	6.34	6.81
4320	1.71	0.64	1.57	24	1.6	2.17	2.54	3.02	3.37	3.72	4.06	4.52	4.87
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

Gauge 449301					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	76.01	57.68	71.12	11	62.74	118.24	154.8	199.17	230.65	260.76	289.77	326.72	353.77
30	42.46	26.48	40.64	17	37.99	63.4	78.83	96.64	108.81	120.15	130.85	144.17	153.75
45	31.54	17.92	30.48	17	29.02	46.08	56.09	67.42	75.03	82.06	88.63	96.74	102.52
60	22.75	11.82	21.59	16	21.4	32.52	38.86	45.9	50.58	54.85	58.81	63.66	67.09
120	14.76	6.36	15.24	13	14.35	20.16	23.29	26.66	28.85	30.81	32.6	34.77	36.29
180	11.47	4.53	11.81	16	11.27	15.35	17.5	19.78	21.24	22.55	23.73	25.16	26.15
240	9.11	3.71	8.86	18	8.92	12.28	14.06	15.96	17.19	18.28	19.28	20.48	21.31
360	6.63	2.67	6.35	19	6.5	8.91	10.19	11.55	12.42	13.2	13.91	14.77	15.37
720	3.81	1.51	3.81	16	3.74	5.1	5.82	6.58	7.07	7.51	7.9	8.38	8.71
1440	2.31	0.94	2.22	21	2.26	3.11	3.56	4.05	4.36	4.63	4.89	5.19	5.4
2880	1.4	0.61	1.38	23	1.36	1.92	2.22	2.54	2.76	2.95	3.12	3.33	3.48
4320	1.02	0.49	0.99	21	0.97	1.43	1.68	1.96	2.14	2.31	2.46	2.65	2.78
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

C. Tabulated Watershed-Level Historical IDF Curves

HUC 2040303					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	99.06	58.47	86.36	0	89.46	141.13	175.34	218.57	250.63	282.46	314.18	356.02	387.64
30	57.23	26.43	55.88	0	52.89	76.25	91.71	111.25	125.75	140.13	154.47	173.38	187.68
45	42.82	15.97	42.34	0	40.2	54.31	63.65	75.46	84.22	92.91	101.58	113	121.64
60	35.56	14.16	34.29	0	33.23	45.75	54.03	64.5	72.27	79.98	87.66	97.79	105.45
120	23.24	9.65	22.23	0	21.66	30.18	35.83	42.96	48.26	53.51	58.74	65.65	70.87
180	18.31	8.43	16.09	0	16.93	24.38	29.31	35.54	40.16	44.75	49.33	55.36	59.92
240	14.57	6.96	13.02	0	13.43	19.58	23.65	28.8	32.61	36.4	40.18	45.16	48.92
360	11.03	4.69	9.95	0	10.26	14.4	17.15	20.62	23.19	25.74	28.29	31.64	34.18
720	6.86	3.65	5.61	0	6.26	9.49	11.62	14.32	16.32	18.31	20.29	22.9	24.87
1440	3.99	1.83	3.55	0	3.69	5.31	6.38	7.73	8.73	9.73	10.72	12.03	13.02
2880	2.09	0.92	1.91	0	1.94	2.75	3.29	3.97	4.47	4.98	5.47	6.13	6.63
4320	1.52	0.65	1.31	0	1.41	1.99	2.37	2.85	3.21	3.56	3.91	4.38	4.73
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2040304					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	99.38	58.76	86.51	0	89.73	141.66	176.04	219.48	251.71	283.69	315.57	357.62	389.4
30	57.44	26.58	56.01	0	53.07	76.56	92.12	111.77	126.34	140.81	155.23	174.25	188.63
45	42.91	16.07	42.39	0	40.27	54.47	63.88	75.76	84.57	93.32	102.03	113.53	122.22
60	35.66	14.27	34.34	0	33.32	45.93	54.28	64.83	72.65	80.42	88.16	98.37	106.09
120	23.31	9.73	22.27	0	21.71	30.31	36	43.2	48.53	53.83	59.11	66.07	71.33
180	18.35	8.49	16.12	0	16.96	24.46	29.43	35.7	40.36	44.98	49.59	55.66	60.25
240	14.6	7	13.03	0	13.45	19.64	23.73	28.91	32.75	36.56	40.35	45.36	49.15

360	11.05	4.72	9.96	0	10.27	14.45	17.21	20.7	23.29	25.86	28.42	31.79	34.35
720	6.86	3.65	5.62	0	6.26	9.49	11.62	14.32	16.32	18.31	20.29	22.9	24.87
1440	4	1.85	3.54	0	3.7	5.33	6.41	7.78	8.8	9.8	10.81	12.13	13.13
2880	2.09	0.93	1.91	0	1.94	2.76	3.3	3.99	4.5	5.01	5.51	6.18	6.68
4320	1.53	0.66	1.31	0	1.42	2	2.39	2.88	3.24	3.6	3.96	4.43	4.79
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070001-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	115.1	95.86	88.15	0	90.37	181.81	244.74	323.19	379.96	435.05	488.73	557.91	609.09
30	63.26	43.8	54.13	0	54.43	96.65	123.37	155.02	177.05	197.87	217.72	242.72	260.86
45	44.39	28.82	37.93	0	39.16	66.89	83.99	103.92	117.64	130.49	142.65	157.88	168.85
60	35.26	21.41	30.58	0	31.82	52.33	64.65	78.8	88.41	97.36	105.76	116.21	123.69
120	20.09	10.82	17.26	0	18.74	28.97	34.87	41.47	45.87	49.91	53.66	58.28	61.55
180	14.33	7.29	12.8	0	13.54	20.38	24.25	28.54	31.37	33.96	36.35	39.28	41.35
240	11.55	5.55	10.62	0	11.04	16.2	19.07	22.22	24.28	26.15	27.88	29.98	31.46
360	8.28	3.24	7.57	0	8.15	11.05	12.59	14.21	15.25	16.18	17.02	18.03	18.74
720	4.97	1.79	4.55	0	4.93	6.51	7.33	8.18	8.73	9.21	9.65	10.17	10.53
1440	2.82	0.96	2.66	0	2.81	3.65	4.08	4.52	4.8	5.05	5.28	5.55	5.73
2880	1.58	0.48	1.53	0	1.58	2	2.2	2.41	2.54	2.66	2.76	2.89	2.97
4320	1.15	0.36	1.11	0	1.15	1.46	1.62	1.78	1.88	1.97	2.05	2.14	2.2
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070001-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	88.43	65.79	74.28	0	73.69	137.06	178.43	228.37	263.65	297.32	329.66	370.77	400.8

30	53.59	31.55	50.17	0	48.82	78.96	96.87	117.28	131.1	143.89	155.88	170.74	181.36
45	38.27	21.59	35.95	0	35.28	55.82	67.84	81.42	90.54	98.96	106.81	116.5	123.41
60	29.99	15.99	28.85	0	28.04	43.15	51.82	61.51	67.96	73.87	79.36	86.11	90.9
120	17.45	8	15.9	0	16.81	24.2	28.25	32.65	35.52	38.12	40.5	43.39	45.43
180	12.96	5.68	12.14	0	12.57	17.77	20.59	23.63	25.61	27.38	29.01	30.97	32.35
240	10.39	4.45	9.88	0	10.11	14.17	16.36	18.71	20.23	21.59	22.84	24.35	25.4
360	7.53	2.59	6.99	0	7.5	9.76	10.92	12.13	12.9	13.58	14.19	14.91	15.42
720	4.66	1.57	4.32	0	4.65	6.01	6.71	7.44	7.9	8.3	8.67	9.1	9.4
1440	2.69	0.87	2.6	0	2.69	3.44	3.82	4.22	4.46	4.68	4.88	5.11	5.27
2880	1.48	0.45	1.44	0	1.48	1.87	2.06	2.26	2.38	2.49	2.59	2.7	2.78
4320	1.11	0.34	1.06	0	1.11	1.4	1.55	1.7	1.79	1.88	1.95	2.04	2.1
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070003-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	166.24	159.69	109.3	0	140.01	281.14	374.57	492.63	580.21	667.15	753.76	868.04	954.4
30	81.48	71.93	58.56	0	69.67	133.23	175.32	228.5	267.95	307.11	346.12	397.59	436.5
45	57.28	47.09	42.2	0	49.55	91.16	118.71	153.53	179.35	204.99	230.53	264.23	289.7
60	46.33	36.04	33.09	0	40.41	72.26	93.35	119.99	139.76	159.38	178.93	204.72	224.21
120	24.68	17.64	19	0	21.78	37.37	47.69	60.73	70.41	80.01	89.58	102.2	111.74
180	16.75	11.02	13.4	0	14.94	24.68	31.13	39.27	45.32	51.32	57.29	65.18	71.14
240	13.71	8.09	11.47	0	12.38	19.53	24.26	30.25	34.68	39.09	43.47	49.26	53.64
360	10.1	5.05	8.6	0	9.27	13.73	16.69	20.42	23.19	25.94	28.68	32.29	35.02
720	5.63	2.32	5.1	0	5.25	7.3	8.66	10.37	11.64	12.91	14.17	15.83	17.08
1440	3.02	1.23	2.68	0	2.82	3.9	4.62	5.53	6.21	6.88	7.55	8.43	9.09
2880	1.73	0.61	1.65	0	1.63	2.17	2.53	2.98	3.31	3.64	3.97	4.41	4.74
4320	1.23	0.48	1.15	0	1.15	1.58	1.86	2.21	2.47	2.74	3	3.34	3.6
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070003-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	47.96	26.31	47.78	0	43.64	66.89	82.28	101.73	116.16	130.49	144.76	163.59	177.82
30	38.59	17.62	40.98	0	35.7	51.27	61.58	74.6	84.27	93.86	103.42	116.03	125.56
45	30.14	15	33.41	0	27.68	40.93	49.71	60.8	69.03	77.19	85.33	96.06	104.17
60	22.95	12.02	25.4	0	20.98	31.6	38.63	47.52	54.11	60.65	67.17	75.77	82.28
120	12.95	5.13	12.96	0	12.11	16.64	19.64	23.44	26.25	29.04	31.82	35.5	38.27
180	10.7	3.88	10.47	0	10.06	13.49	15.76	18.63	20.76	22.87	24.98	27.75	29.85
240	8.57	3.21	8.18	0	8.04	10.88	12.76	15.13	16.89	18.64	20.38	22.68	24.41
360	6.77	2.17	6.03	0	6.41	8.33	9.6	11.21	12.4	13.58	14.75	16.31	17.48
720	4.25	1.34	4.09	0	4.03	5.21	6	6.99	7.72	8.45	9.18	10.14	10.86
1440	2.43	0.81	2.4	0	2.3	3.01	3.49	4.09	4.53	4.97	5.41	5.99	6.43
2880	1.32	0.45	1.24	0	1.25	1.64	1.91	2.24	2.49	2.73	2.98	3.3	3.54
4320	1.03	0.4	0.94	0	0.96	1.32	1.55	1.85	2.07	2.28	2.5	2.79	3
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070004-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	245.08	218.62	127.55	0	184.33	390.66	537.64	724.8	862.46	997.49	1130.33	1303.09	1431.94
30	115.11	101.1	72.12	0	87.45	183.15	250.78	336.48	399.29	460.73	521.06	599.34	657.62
45	81.02	67.9	50.18	0	63.38	128.1	172.77	228.56	269	308.27	346.58	395.98	432.54
60	61.03	47.44	41.76	0	49.77	95.34	125.7	162.79	189.23	214.61	239.14	270.47	293.47
120	32.08	23.15	24.36	0	27.12	49.43	63.8	81	93.07	104.55	115.53	129.44	139.57
180	21.84	15.07	18.03	0	18.82	33.34	42.53	53.39	60.95	68.09	74.89	83.45	89.67
240	17.76	11.09	14.86	0	15.88	26.53	32.99	40.46	45.56	50.32	54.8	60.39	64.41
360	12.58	7.02	10.49	0	11.63	18.3	22.19	26.57	29.51	32.21	34.74	37.85	40.06
720	6.67	3.22	5.53	0	6.37	9.37	11.03	12.86	14.07	15.16	16.16	17.39	18.25

1440	3.58	1.61	2.98	0	3.46	4.94	5.75	6.62	7.19	7.71	8.18	8.75	9.15
2880	1.95	0.73	1.83	0	1.93	2.58	2.92	3.27	3.5	3.7	3.89	4.11	4.26
4320	1.34	0.5	1.24	0	1.32	1.77	2	2.24	2.4	2.54	2.66	2.81	2.92
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070004-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	211.95	181.26	110.32	0	163.79	336.05	456.15	607.06	716.95	824.01	928.71	1064.1	1164.56
30	103.1	85.89	67.2	0	80.93	162.86	219.25	289.55	340.44	389.81	437.93	499.93	545.8
45	73.42	58.91	47.72	0	58.87	115.31	153.46	200.5	234.26	266.84	298.43	338.94	368.79
60	54.48	40.71	39.6	0	45.3	84.51	110.16	141.15	163.06	183.99	204.1	229.68	248.38
120	28.79	19.64	22.66	0	24.92	43.85	55.76	69.8	79.56	88.76	97.51	108.52	116.5
180	20.14	13.07	17.21	0	17.77	30.35	38.1	47.14	53.35	59.18	64.69	71.59	76.57
240	16.32	9.72	13.94	0	14.81	24.11	29.66	36	40.29	44.28	48.02	52.66	55.98
360	11.65	6.21	9.77	0	10.89	16.76	20.13	23.89	26.39	28.69	30.82	33.44	35.3
720	6.29	2.94	5.25	0	6.04	8.76	10.26	11.9	12.97	13.94	14.83	15.92	16.68
1440	3.41	1.5	2.91	0	3.31	4.68	5.43	6.23	6.75	7.22	7.65	8.18	8.54
2880	1.83	0.68	1.72	0	1.81	2.41	2.73	3.06	3.27	3.46	3.63	3.83	3.97
4320	1.28	0.48	1.18	0	1.26	1.69	1.91	2.15	2.3	2.43	2.55	2.7	2.8
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070005					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	145.47	126.14	106.24	0	111.45	231.07	315.04	421	498.41	573.98	648.04	743.98	815.28
30	75.33	56.62	58.14	0	62.47	116.98	152.73	196.01	226.64	255.92	284.09	319.92	346.13
45	52.09	36.98	40.54	0	44.35	79.99	102.79	129.97	148.99	167.01	184.24	206.01	221.84

60	40.06	26.99	32.47	0	34.85	60.85	77.13	96.27	109.53	122.02	133.88	148.78	159.57
120	22.88	13.22	19.78	0	20.95	33.56	41	49.45	55.15	60.42	65.34	71.44	75.79
180	16.63	8.82	14.92	0	15.57	23.89	28.67	33.99	37.54	40.78	43.8	47.5	50.12
240	13.55	6.77	12.35	0	12.85	19.19	22.75	26.68	29.28	31.64	33.82	36.49	38.37
360	9.38	4.37	8.32	0	9.01	13.06	15.29	17.72	19.3	20.74	22.06	23.67	24.79
720	5.85	2.62	5.2	0	5.66	8.07	9.38	10.8	11.72	12.56	13.32	14.25	14.9
1440	3.39	1.54	3.02	0	3.27	4.69	5.47	6.31	6.86	7.35	7.81	8.36	8.75
2880	1.91	0.83	1.7	0	1.85	2.61	3.02	3.47	3.75	4.01	4.25	4.53	4.73
4320	1.38	0.59	1.24	0	1.34	1.88	2.17	2.48	2.68	2.86	3.03	3.23	3.37
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070006-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	152.38	123.16	114.1	0	121.69	239.6	319.58	418.39	489.44	558.05	624.66	710.16	773.2
30	76.52	53.94	58.21	0	65.35	117.34	150.5	189.95	217.52	243.62	268.55	300.03	322.91
45	53.7	35.66	40.93	0	46.98	81.32	102.69	127.73	145.04	161.3	176.72	196.07	210.05
60	41.65	26.12	33.01	0	37.19	62.27	77.53	95.16	107.22	118.47	129.08	142.32	151.83
120	23.42	12.6	20.58	0	21.85	33.77	40.63	48.31	53.43	58.13	62.49	67.86	71.67
180	16.9	8.3	15.55	0	16.08	23.83	28.17	32.93	36.07	38.93	41.56	44.77	47.04
240	13.63	6.31	12.64	0	13.11	18.94	22.15	25.65	27.93	29.99	31.89	34.19	35.81
360	9.51	3.9	8.74	0	9.31	12.84	14.72	16.72	18.02	19.17	20.23	21.5	22.38
720	5.88	2.38	5.45	0	5.76	7.91	9.05	10.27	11.05	11.75	12.39	13.15	13.69
1440	3.46	1.57	3.12	0	3.34	4.79	5.58	6.43	6.99	7.5	7.96	8.52	8.92
2880	1.95	0.83	1.77	0	1.9	2.66	3.06	3.5	3.78	4.04	4.27	4.55	4.74
4320	1.39	0.6	1.25	0	1.35	1.9	2.2	2.51	2.72	2.91	3.07	3.28	3.42
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070006-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	135.17	103.76	105.15	0	110.93	210.7	276.77	357.21	414.4	469.22	522.1	589.53	638.97
30	70.28	46.04	55.66	0	61.79	106.11	133.54	165.57	187.65	208.37	227.99	252.57	270.31
45	49.75	30.99	39.65	0	44.53	74.27	92.31	113.14	127.37	140.63	153.13	168.71	179.89
60	38.25	22.63	31.89	0	34.79	56.42	69.3	83.99	93.94	103.16	111.8	122.52	130.18
120	21.71	10.78	19.7	0	20.61	30.69	36.35	42.59	46.7	50.44	53.9	58.12	61.1
180	16.02	7.26	15.12	0	15.46	22.15	25.81	29.77	32.36	34.69	36.83	39.42	41.24
240	12.88	5.6	12.16	0	12.51	17.63	20.4	23.38	25.32	27.06	28.65	30.57	31.92
360	9.02	3.48	8.37	0	8.89	12	13.64	15.37	16.47	17.46	18.35	19.43	20.17
720	5.68	2.23	5.3	0	5.59	7.59	8.64	9.76	10.48	11.12	11.7	12.4	12.89
1440	3.37	1.51	3.08	0	3.26	4.65	5.4	6.22	6.76	7.24	7.68	8.21	8.58
2880	1.89	0.8	1.71	0	1.84	2.57	2.96	3.38	3.65	3.9	4.12	4.39	4.57
4320	1.37	0.59	1.22	0	1.33	1.87	2.16	2.47	2.68	2.86	3.02	3.23	3.37
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070007					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	219.06	201.67	111.18	0	161.29	350.37	487.27	663.37	793.89	922.58	1049.74	1215.86	1340.22
30	104.24	89.24	67.26	0	80.5	165.3	224.45	298.79	352.95	405.71	457.33	524.08	573.61
45	73.14	60.29	46.09	0	57.77	115.36	154.79	203.79	239.18	273.46	306.82	349.75	381.47
60	54.41	42.11	38.14	0	44.47	84.94	111.84	144.66	168.04	190.47	212.14	239.79	260.08
120	28.81	20.56	22.08	0	24.47	44.29	56.99	72.16	82.78	92.85	102.49	114.67	123.53
180	20.65	13.67	17.35	0	18.09	31.25	39.43	49.01	55.63	61.84	67.73	75.12	80.46
240	16.47	10.08	13.97	0	14.83	24.49	30.31	37	41.56	45.8	49.79	54.76	58.32
360	11.63	6.35	9.84	0	10.81	16.83	20.31	24.22	26.83	29.23	31.46	34.21	36.16

720	6.3	2.92	5.25	0	6.06	8.76	10.25	11.86	12.92	13.88	14.75	15.82	16.57
1440	3.37	1.46	2.86	0	3.27	4.61	5.33	6.11	6.61	7.06	7.48	7.98	8.32
2880	1.84	0.66	1.74	0	1.83	2.41	2.71	3.02	3.22	3.4	3.56	3.75	3.89
4320	1.28	0.45	1.21	0	1.27	1.67	1.87	2.08	2.22	2.34	2.45	2.57	2.66
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070008					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	212.82	192.47	120.86	0	181.21	351.3	463.92	606.21	711.77	816.55	920.94	1058.68	1162.77
30	108.4	92.58	70.67	0	93.2	175.01	229.18	297.62	348.4	398.8	449.02	515.27	565.34
45	73.2	58.43	50.48	0	63.6	115.24	149.43	192.62	224.67	256.48	288.17	329.99	361.59
60	56.17	41.23	42.86	0	49.4	85.84	109.96	140.44	163.05	185.5	207.86	237.37	259.66
120	31.1	20.34	25.2	0	27.76	45.73	57.64	72.67	83.83	94.9	105.93	120.49	131.49
180	22	13.77	18.53	0	19.74	31.91	39.96	50.14	57.7	65.19	72.66	82.52	89.96
240	17.29	10.71	14.36	0	15.53	25	31.26	39.18	45.05	50.88	56.69	64.36	70.15
360	12.63	7.25	10.25	0	11.44	17.85	22.09	27.45	31.42	35.37	39.3	44.49	48.41
720	6.98	3.62	5.76	0	6.39	9.58	11.7	14.38	16.36	18.33	20.3	22.89	24.85
1440	3.86	1.89	3.17	0	3.55	5.22	6.33	7.72	8.76	9.79	10.81	12.17	13.19
2880	2.04	0.91	1.82	0	1.89	2.69	3.23	3.9	4.4	4.89	5.39	6.04	6.53
4320	1.43	0.6	1.3	0	1.33	1.86	2.21	2.66	2.99	3.31	3.64	4.07	4.39
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070010					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	136.62	116.63	99.37	0	117.47	220.54	288.78	375	438.96	502.46	565.72	649.18	712.26
30	79.95	60.29	61.75	0	70.05	123.33	158.61	203.18	236.24	269.06	301.77	344.91	377.52

45	53.06	35.47	45.33	0	47.23	78.58	99.33	125.56	145.01	164.32	183.56	208.94	228.13
60	42.55	26.91	38.07	0	38.13	61.91	77.66	97.55	112.31	126.96	141.56	160.81	175.37
120	25.49	14.3	22.59	0	23.14	35.78	44.15	54.72	62.56	70.35	78.1	88.33	96.07
180	18.75	10.11	16.25	0	17.09	26.02	31.94	39.41	44.96	50.46	55.95	63.18	68.65
240	14.39	8.36	12.08	0	13.02	20.41	25.3	31.48	36.06	40.61	45.15	51.13	55.65
360	10.93	6.21	8.86	0	9.91	15.4	19.03	23.62	27.03	30.41	33.78	38.22	41.58
720	6.46	3.58	5.33	0	5.87	9.04	11.13	13.78	15.74	17.69	19.63	22.19	24.13
1440	3.69	1.87	3.1	0	3.38	5.04	6.13	7.51	8.54	9.56	10.57	11.91	12.92
2880	1.95	0.99	1.73	0	1.79	2.66	3.24	3.97	4.52	5.06	5.59	6.3	6.84
4320	1.43	0.69	1.31	0	1.32	1.93	2.33	2.84	3.22	3.59	3.97	4.46	4.84
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2070011					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	69.51	21.07	66.13	0	69.73	87.73	96.73	105.98	111.76	116.84	121.39	126.79	130.5
30	40.25	13.09	43.54	0	40.22	51.55	57.29	63.24	66.98	70.28	73.24	76.77	79.2
45	31.29	10.66	29.81	0	31.17	40.48	45.24	50.2	53.33	56.1	58.6	61.57	63.62
60	26.11	10.44	24.87	0	25.63	35.03	40.01	45.31	48.71	51.75	54.51	57.84	60.15
120	15.39	7.24	14.39	0	14.76	21.47	25.18	29.23	31.88	34.28	36.49	39.17	41.06
180	12.11	5.18	11.21	0	11.79	16.51	19.06	21.79	23.56	25.15	26.6	28.35	29.58
240	9.4	3.75	8.55	0	9.23	12.61	14.39	16.29	17.51	18.6	19.59	20.78	21.61
360	7.18	2.88	6.58	0	7.05	9.64	11.02	12.48	13.42	14.26	15.03	15.94	16.59
720	4.79	2.83	3.59	0	4.36	7.06	8.67	10.51	11.75	12.9	13.98	15.32	16.28
1440	2.88	1.23	2.78	0	2.8	3.93	4.53	5.18	5.6	5.97	6.32	6.73	7.02
2880	1.56	0.65	1.72	0	1.52	2.11	2.43	2.77	2.98	3.18	3.36	3.57	3.72
4320	1.25	0.59	1.21	0	1.2	1.75	2.05	2.38	2.6	2.79	2.97	3.19	3.35
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080101					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	130.77	87.61	101.3	0	116.38	193.81	245.07	309.84	357.89	405.58	453.1	515.79	563.18
30	76.93	41.57	68.33	0	70.1	106.84	131.16	161.89	184.69	207.32	229.87	259.62	282.1
45	52.4	25.77	47.31	0	48.17	70.94	86.02	105.07	119.2	133.23	147.21	165.65	179.59
60	45.52	25.71	39.27	0	41.3	64.02	79.06	98.07	112.17	126.17	140.11	158.51	172.41
120	29.58	17.38	26.58	0	26.73	42.08	52.25	65.1	74.63	84.1	93.52	105.96	115.36
180	22.26	14.53	19.41	0	19.87	32.71	41.22	51.96	59.93	67.84	75.72	86.12	93.97
240	17.38	11.26	13.95	0	15.53	25.48	32.07	40.39	46.57	52.7	58.81	66.86	72.95
360	13.31	7.83	10.99	0	12.02	18.94	23.53	29.31	33.61	37.87	42.12	47.72	51.96
720	7	3.6	6.13	0	6.41	9.59	11.7	14.36	16.33	18.29	20.24	22.82	24.77
1440	4.5	3.07	3.49	0	4	6.71	8.51	10.77	12.46	14.13	15.79	17.99	19.65
2880	2.53	1.71	1.83	0	2.25	3.76	4.76	6.03	6.96	7.89	8.82	10.05	10.97
4320	1.73	1.1	1.27	0	1.55	2.52	3.17	3.98	4.58	5.18	5.78	6.56	7.16
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080102					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	123.31	80.75	97.79	0	110.05	181.41	228.66	288.35	332.64	376.6	420.4	478.19	521.86
30	72.3	38.01	65.4	0	66.06	99.65	121.89	149.99	170.83	191.53	212.14	239.34	259.9
45	50.15	23.46	46.14	0	46.3	67.03	80.76	98.1	110.97	123.74	136.46	153.25	165.94
60	43.18	22.99	38.1	0	39.4	59.72	73.17	90.17	102.78	115.29	127.76	144.22	156.65
120	28.09	15.56	25.56	0	25.53	39.29	48.39	59.89	68.43	76.9	85.34	96.47	104.89
180	21.33	13.09	18.63	0	19.18	30.75	38.41	48.08	55.26	62.39	69.49	78.86	85.94
240	16.72	10.25	13.73	0	15.04	24.09	30.09	37.67	43.29	48.87	54.43	61.77	67.31
360	12.78	7.09	10.74	0	11.62	17.88	22.03	27.27	31.16	35.02	38.87	43.94	47.77
720	6.97	3.61	6.01	0	6.38	9.57	11.68	14.35	16.33	18.29	20.25	22.84	24.79

1440	4.38	2.78	3.5	0	3.92	6.38	8.01	10.06	11.59	13.1	14.61	16.6	18.1
2880	2.43	1.52	1.85	0	2.18	3.52	4.41	5.54	6.37	7.2	8.02	9.11	9.93
4320	1.68	1	1.28	0	1.52	2.4	2.98	3.72	4.27	4.82	5.36	6.07	6.62
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080103					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	151.51	133.48	110.17	0	114.88	241.16	330.54	443.91	527.05	608.44	688.37	792.14	869.42
30	78.95	58.84	60.18	0	65.74	122.4	159.44	204.15	235.75	265.91	294.9	331.75	358.67
45	56.18	38.16	43.71	0	48.72	85.49	108.58	135.79	154.68	172.47	189.4	210.68	226.09
60	43.35	28.51	34.71	0	38.06	65.51	82.52	102.41	116.13	129.01	141.21	156.5	167.54
120	25.74	14.37	22.61	0	23.8	37.45	45.41	54.38	60.39	65.94	71.11	77.48	82.02
180	18.63	9.99	16.9	0	17.4	26.84	32.27	38.35	42.4	46.11	49.56	53.8	56.81
240	14.95	7.87	13.22	0	14.02	21.44	25.69	30.41	33.56	36.44	39.1	42.38	44.7
360	10.83	5.74	9.4	0	10.14	15.56	18.66	22.13	24.43	26.54	28.5	30.91	32.62
720	6.61	3.29	5.93	0	6.27	9.35	11.08	12.99	14.24	15.39	16.44	17.74	18.65
1440	3.93	2.03	3.46	0	3.7	5.61	6.7	7.9	8.7	9.43	10.11	10.93	11.52
2880	2.18	1.12	1.89	0	2.06	3.11	3.71	4.37	4.81	5.21	5.58	6.03	6.35
4320	1.55	0.79	1.36	0	1.46	2.21	2.63	3.09	3.4	3.68	3.94	4.26	4.48
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080104					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	90.23	42.91	77.99	0	86.38	126.23	148.33	172.48	188.32	202.67	215.89	231.97	243.28
30	52.88	22.6	52.23	0	51.48	72.09	83.18	95.1	102.81	109.74	116.07	123.71	129.05
45	38.38	15.75	35.66	0	37.56	51.81	59.41	67.52	72.74	77.42	81.68	86.81	90.39

60	32.81	15.88	29.72	0	31.31	46.1	54.34	63.38	69.32	74.71	79.68	85.74	90
120	20.27	10.93	18.55	0	18.9	29.24	35.2	41.87	46.32	50.41	54.2	58.87	62.18
180	15.56	8.52	14.05	0	14.46	22.53	27.21	32.46	35.97	39.2	42.21	45.91	48.54
240	12.09	6.39	10.32	0	11.33	17.36	20.81	24.66	27.22	29.56	31.74	34.41	36.3
360	9.27	4.63	8.06	0	8.79	13.12	15.56	18.25	20.02	21.64	23.13	24.95	26.24
720	5.49	3.05	4.43	0	5.08	7.98	9.66	11.56	12.83	14	15.1	16.44	17.4
1440	3.43	1.89	3.01	0	3.18	4.97	6.01	7.18	7.97	8.69	9.36	10.19	10.77
2880	1.9	1.04	1.75	0	1.77	2.75	3.32	3.96	4.39	4.79	5.15	5.6	5.92
4320	1.42	0.78	1.23	0	1.32	2.06	2.49	2.97	3.29	3.59	3.86	4.2	4.44
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080105					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	78.41	31.98	71.32	0	76.79	105.7	121.08	137.49	148.05	157.5	166.11	176.47	183.69
30	45.68	17.99	47.18	0	44.91	61.08	69.6	78.65	84.45	89.63	94.33	99.99	103.92
45	34.15	13.4	32.11	0	33.59	45.62	51.96	58.69	63	66.84	70.34	74.54	77.45
60	28.71	13.12	26.26	0	27.67	39.78	46.41	53.61	58.31	62.56	66.45	71.18	74.49
120	17.3	8.91	15.99	0	16.3	24.68	29.44	34.72	38.21	41.41	44.37	47.99	50.56
180	13.32	6.59	12.34	0	12.66	18.82	22.27	26.07	28.58	30.86	32.96	35.53	37.35
240	10.34	4.82	9.21	0	9.93	14.4	16.86	19.54	21.29	22.87	24.33	26.1	27.35
360	7.88	3.62	7.06	0	7.59	10.93	12.77	14.76	16.06	17.24	18.32	19.63	20.55
720	4.96	2.79	3.96	0	4.58	7.23	8.78	10.53	11.71	12.79	13.8	15.05	15.94
1440	3.06	1.48	2.86	0	2.92	4.3	5.07	5.91	6.46	6.96	7.43	7.99	8.39
2880	1.69	0.82	1.72	0	1.61	2.38	2.8	3.27	3.58	3.86	4.11	4.43	4.65
4320	1.31	0.68	1.21	0	1.23	1.87	2.24	2.64	2.91	3.16	3.38	3.66	3.86
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080106					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	104.83	71.67	81.95	0	93.06	156.4	198.33	251.32	290.62	329.64	368.51	419.8	458.56
30	61.9	33.74	56.13	0	56.36	86.18	105.92	130.86	149.37	167.73	186.03	210.18	228.43
45	44.94	23.63	39.81	0	41.06	61.94	75.77	93.24	106.2	119.06	131.88	148.79	161.57
60	36.91	20.65	30.57	0	33.52	51.77	63.85	79.12	90.44	101.68	112.88	127.66	138.83
120	22.78	12.34	19.69	0	20.75	31.66	38.88	48	54.77	61.49	68.18	77.01	83.69
180	16.98	9.49	14.48	0	15.42	23.81	29.36	36.38	41.58	46.75	51.9	58.69	63.82
240	13.52	7.41	10.99	0	12.3	18.85	23.19	28.67	32.73	36.76	40.78	46.09	50.09
360	10.3	5.43	8.67	0	9.41	14.21	17.38	21.4	24.38	27.33	30.28	34.16	37.1
720	6.04	3.36	5.16	0	5.49	8.46	10.42	12.91	14.75	16.58	18.4	20.81	22.62
1440	3.6	1.99	3.14	0	3.27	5.03	6.2	7.67	8.76	9.84	10.92	12.35	13.42
2880	2.02	1.07	1.82	0	1.84	2.79	3.42	4.21	4.79	5.38	5.96	6.72	7.3
4320	1.48	0.75	1.29	0	1.36	2.02	2.46	3.01	3.42	3.83	4.24	4.78	5.18
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080107					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	131.4	88.19	101.6	0	116.92	194.85	246.45	311.65	360.02	408.03	455.86	518.97	566.67
30	77.33	41.87	68.58	0	70.45	107.46	131.95	162.91	185.87	208.67	231.38	261.34	283.98
45	52.59	25.96	47.41	0	48.33	71.27	86.46	105.65	119.89	134.02	148.1	166.68	180.72
60	45.72	25.94	39.37	0	41.46	64.38	79.56	98.74	112.97	127.09	141.16	159.72	173.75
120	29.71	17.54	26.67	0	26.83	42.33	52.59	65.56	75.18	84.73	94.24	106.79	116.28
180	22.34	14.65	19.47	0	19.93	32.88	41.45	52.28	60.32	68.29	76.24	86.72	94.65
240	17.44	11.34	13.97	0	15.58	25.6	32.23	40.62	46.84	53.01	59.16	67.28	73.41
360	13.36	7.89	11.01	0	12.06	19.04	23.65	29.49	33.81	38.11	42.39	48.03	52.3

720	7	3.6	6.14	0	6.41	9.59	11.7	14.36	16.33	18.29	20.24	22.82	24.77
1440	4.51	3.09	3.49	0	4	6.73	8.54	10.83	12.52	14.2	15.88	18.09	19.76
2880	2.54	1.72	1.83	0	2.26	3.78	4.78	6.06	7	7.94	8.87	10.1	11.03
4320	1.73	1.11	1.27	0	1.55	2.53	3.18	4	4.61	5.21	5.81	6.61	7.21
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080108					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	131.4	88.19	101.6	0	116.92	194.85	246.45	311.65	360.02	408.03	455.86	518.97	566.67
30	77.33	41.87	68.58	0	70.45	107.46	131.95	162.91	185.87	208.67	231.38	261.34	283.98
45	52.59	25.96	47.41	0	48.33	71.27	86.46	105.65	119.89	134.02	148.1	166.68	180.72
60	45.72	25.94	39.37	0	41.46	64.38	79.56	98.74	112.97	127.09	141.16	159.72	173.75
120	29.71	17.54	26.67	0	26.83	42.33	52.59	65.56	75.18	84.73	94.24	106.79	116.28
180	22.34	14.65	19.47	0	19.93	32.88	41.45	52.28	60.32	68.29	76.24	86.72	94.65
240	17.44	11.34	13.97	0	15.58	25.6	32.23	40.62	46.84	53.01	59.16	67.28	73.41
360	13.36	7.89	11.01	0	12.06	19.04	23.65	29.49	33.81	38.11	42.39	48.03	52.3
720	7	3.6	6.14	0	6.41	9.59	11.7	14.36	16.33	18.29	20.24	22.82	24.77
1440	4.51	3.09	3.49	0	4	6.73	8.54	10.83	12.52	14.2	15.88	18.09	19.76
2880	2.54	1.72	1.83	0	2.26	3.78	4.78	6.06	7	7.94	8.87	10.1	11.03
4320	1.73	1.11	1.27	0	1.55	2.53	3.18	4	4.61	5.21	5.81	6.61	7.21
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080110					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	99.06	58.47	86.36	0	89.46	141.13	175.34	218.57	250.63	282.46	314.18	356.02	387.64
30	57.23	26.43	55.88	0	52.89	76.25	91.71	111.25	125.75	140.13	154.47	173.38	187.68

45	42.82	15.97	42.34	0	40.2	54.31	63.65	75.46	84.22	92.91	101.58	113	121.64
60	35.56	14.16	34.29	0	33.23	45.75	54.03	64.5	72.27	79.98	87.66	97.79	105.45
120	23.24	9.65	22.23	0	21.66	30.18	35.83	42.96	48.26	53.51	58.74	65.65	70.87
180	18.31	8.43	16.09	0	16.93	24.38	29.31	35.54	40.16	44.75	49.33	55.36	59.92
240	14.57	6.96	13.02	0	13.43	19.58	23.65	28.8	32.61	36.4	40.18	45.16	48.92
360	11.03	4.69	9.95	0	10.26	14.4	17.15	20.62	23.19	25.74	28.29	31.64	34.18
720	6.86	3.65	5.61	0	6.26	9.49	11.62	14.32	16.32	18.31	20.29	22.9	24.87
1440	3.99	1.83	3.55	0	3.69	5.31	6.38	7.73	8.73	9.73	10.72	12.03	13.02
2880	2.09	0.92	1.91	0	1.94	2.75	3.29	3.97	4.47	4.98	5.47	6.13	6.63
4320	1.52	0.65	1.31	0	1.41	1.99	2.37	2.85	3.21	3.56	3.91	4.38	4.73
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080111					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	99.06	58.47	86.36	0	89.46	141.13	175.34	218.57	250.63	282.46	314.18	356.02	387.64
30	57.23	26.43	55.88	0	52.89	76.25	91.71	111.25	125.75	140.13	154.47	173.38	187.68
45	42.82	15.97	42.34	0	40.2	54.31	63.65	75.46	84.22	92.91	101.58	113	121.64
60	35.56	14.16	34.29	0	33.23	45.75	54.03	64.5	72.27	79.98	87.66	97.79	105.45
120	23.24	9.65	22.23	0	21.66	30.18	35.83	42.96	48.26	53.51	58.74	65.65	70.87
180	18.31	8.43	16.09	0	16.93	24.38	29.31	35.54	40.16	44.75	49.33	55.36	59.92
240	14.57	6.96	13.02	0	13.43	19.58	23.65	28.8	32.61	36.4	40.18	45.16	48.92
360	11.03	4.69	9.95	0	10.26	14.4	17.15	20.62	23.19	25.74	28.29	31.64	34.18
720	6.86	3.65	5.61	0	6.26	9.49	11.62	14.32	16.32	18.31	20.29	22.9	24.87
1440	3.99	1.83	3.55	0	3.69	5.31	6.38	7.73	8.73	9.73	10.72	12.03	13.02
2880	2.09	0.92	1.91	0	1.94	2.75	3.29	3.97	4.47	4.98	5.47	6.13	6.63
4320	1.52	0.65	1.31	0	1.41	1.99	2.37	2.85	3.21	3.56	3.91	4.38	4.73
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080201-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	105.39	85.33	83.04	0	91.38	166.79	216.71	279.8	326.59	373.05	419.33	480.39	526.54
30	58.93	41.52	48.2	0	52.11	88.8	113.1	143.79	166.56	189.17	211.69	241.4	263.86
45	41.4	26.25	36.11	0	37.09	60.29	75.65	95.05	109.45	123.74	137.98	156.76	170.96
60	34.68	19.7	29.98	0	31.44	48.85	60.38	74.94	85.75	96.47	107.16	121.26	131.91
120	19.29	10.16	17.17	0	17.62	26.6	32.54	40.06	45.63	51.16	56.67	63.94	69.44
180	13.95	7.15	12.72	0	12.78	19.09	23.28	28.56	32.49	36.38	40.26	45.37	49.24
240	11.28	5.52	10.27	0	10.37	15.25	18.48	22.56	25.59	28.59	31.59	35.54	38.52
360	8.58	4.07	7.78	0	7.91	11.51	13.89	16.9	19.13	21.35	23.55	26.47	28.67
720	5.25	2.43	4.66	0	4.85	7	8.42	10.22	11.55	12.87	14.19	15.93	17.24
1440	3.01	1.34	2.74	0	2.79	3.97	4.76	5.75	6.48	7.21	7.94	8.9	9.62
2880	1.72	0.79	1.58	0	1.59	2.29	2.75	3.33	3.77	4.2	4.63	5.19	5.62
4320	1.22	0.57	1.13	0	1.13	1.63	1.96	2.39	2.7	3.01	3.32	3.73	4.03
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080201-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	103.2	84.23	81.13	0	89.37	163.8	213.09	275.36	321.55	367.41	413.09	473.37	518.92
30	58.33	41.54	47.56	0	51.51	88.22	112.52	143.23	166.02	188.63	211.16	240.89	263.35
45	41.14	26.39	35.77	0	36.81	60.13	75.57	95.08	109.55	123.92	138.23	157.12	171.39
60	34.56	19.87	29.9	0	31.3	48.86	60.48	75.17	86.07	96.89	107.66	121.88	132.63
120	19.24	10.2	17.06	0	17.56	26.58	32.55	40.09	45.68	51.23	56.77	64.07	69.58
180	13.87	7.17	12.61	0	12.69	19.03	23.22	28.52	32.46	36.36	40.25	45.38	49.26
240	11.18	5.5	10.17	0	10.28	15.14	18.36	22.42	25.44	28.43	31.42	35.35	38.33
360	8.52	4.04	7.73	0	7.86	11.43	13.79	16.78	18.99	21.19	23.38	26.27	28.46
720	5.23	2.4	4.64	0	4.84	6.96	8.36	10.14	11.45	12.76	14.06	15.78	17.08

1440	3.01	1.31	2.74	0	2.79	3.95	4.72	5.69	6.41	7.12	7.83	8.77	9.48
2880	1.72	0.78	1.59	0	1.59	2.28	2.74	3.31	3.74	4.17	4.59	5.15	5.57
4320	1.22	0.56	1.13	0	1.13	1.62	1.95	2.36	2.67	2.98	3.28	3.68	3.98
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080202					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	138.55	123.25	93.73	0	118.31	227.23	299.34	390.46	458.06	525.15	592	680.2	746.86
30	76.67	57.3	58.92	0	67.26	117.9	151.42	193.79	225.21	256.4	287.48	328.49	359.48
45	53.07	36.48	41.34	0	47.08	79.32	100.66	127.63	147.64	167.5	187.29	213.39	233.12
60	42.68	26.79	35.23	0	38.28	61.96	77.63	97.44	112.13	126.71	141.24	160.42	174.9
120	23.37	12.56	21.62	0	21.31	32.41	39.76	49.04	55.93	62.77	69.58	78.57	85.36
180	17.19	8.31	15.59	0	15.83	23.17	28.03	34.17	38.73	43.26	47.76	53.71	58.2
240	14.4	6.64	12.82	0	13.31	19.18	23.06	27.97	31.61	35.23	38.83	43.58	47.17
360	10.88	4.91	9.67	0	10.07	14.41	17.29	20.92	23.61	26.28	28.94	32.46	35.11
720	6.77	2.99	6.08	0	6.28	8.92	10.67	12.88	14.52	16.15	17.77	19.91	21.53
1440	3.93	1.63	3.51	0	3.66	5.1	6.06	7.26	8.16	9.04	9.93	11.09	11.98
2880	2.2	0.93	2.01	0	2.05	2.87	3.41	4.1	4.61	5.12	5.62	6.29	6.79
4320	1.56	0.66	1.39	0	1.45	2.03	2.42	2.91	3.27	3.63	3.99	4.46	4.82
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080203-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	128.2	108.04	95.81	0	110.46	205.94	269.15	349.02	408.28	467.09	525.69	603.01	661.44
30	73.98	56.24	58.05	0	64.74	114.44	147.35	188.93	219.77	250.39	280.9	321.14	351.56
45	51.95	39.78	39.63	0	45.42	80.57	103.85	133.26	155.07	176.73	198.31	226.77	248.29

60	41.03	31.51	30.08	0	35.86	63.7	82.14	105.43	122.71	139.87	156.96	179.51	196.55
120	23.59	16.95	18.27	0	20.81	35.79	45.7	58.23	67.53	76.76	85.95	98.08	107.25
180	17.23	11.78	13.92	0	15.3	25.71	32.6	41.31	47.77	54.18	60.57	69	75.37
240	14.73	9.24	11.86	0	13.21	21.38	26.78	33.62	38.68	43.71	48.73	55.34	60.33
360	10.25	6.23	8.55	0	9.23	14.73	18.38	22.98	26.4	29.79	33.17	37.63	41
720	6.36	3.65	5.14	0	5.76	8.99	11.12	13.82	15.82	17.81	19.79	22.4	24.37
1440	3.65	2.01	2.95	0	3.32	5.1	6.27	7.76	8.86	9.95	11.05	12.48	13.57
2880	2.05	1.04	1.76	0	1.88	2.8	3.41	4.18	4.75	5.31	5.88	6.62	7.18
4320	1.51	0.72	1.29	0	1.39	2.03	2.45	2.98	3.38	3.77	4.16	4.67	5.06
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080203-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	123.1	103.07	92.03	0	106.17	197.26	257.57	333.76	390.29	446.4	502.31	576.07	631.81
30	71.84	54.03	56.89	0	62.97	110.71	142.33	182.27	211.9	241.32	270.62	309.29	338.51
45	50.77	38.58	38.95	0	44.43	78.53	101.1	129.62	150.78	171.79	192.71	220.32	241.18
60	40.2	30.67	29.5	0	35.16	62.27	80.21	102.89	119.71	136.4	153.04	174.99	191.57
120	23.28	16.66	18	0	20.54	35.27	45.01	57.33	66.47	75.54	84.57	96.5	105.51
180	17.01	11.59	13.74	0	15.11	25.35	32.13	40.7	47.06	53.36	59.65	67.95	74.21
240	14.59	9.11	11.72	0	13.09	21.14	26.48	33.21	38.21	43.17	48.11	54.63	59.55
360	10.16	6.14	8.41	0	9.15	14.58	18.17	22.71	26.08	29.42	32.75	37.14	40.46
720	6.28	3.6	5.08	0	5.69	8.87	10.98	13.64	15.61	17.57	19.52	22.1	24.05
1440	3.62	1.99	2.93	0	3.29	5.05	6.22	7.69	8.78	9.86	10.94	12.37	13.44
2880	2.02	1.02	1.75	0	1.85	2.75	3.35	4.1	4.66	5.22	5.77	6.5	7.05
4320	1.5	0.71	1.27	0	1.38	2.01	2.43	2.95	3.34	3.73	4.11	4.62	5
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080204					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	148.32	126.1	95.95	0	127.61	239.05	312.83	406.06	475.21	543.86	612.26	702.5	770.7
30	79.34	54.29	63.2	0	70.42	118.4	150.17	190.3	220.08	249.63	279.08	317.93	347.29
45	56.43	35.84	47.56	0	50.54	82.22	103.19	129.68	149.34	168.85	188.29	213.94	233.32
60	44.47	25.8	37.41	0	40.23	63.03	78.13	97.2	111.35	125.4	139.39	157.85	171.81
120	26.52	15.06	22.55	0	24.05	37.36	46.17	57.3	65.56	73.76	81.93	92.7	100.85
180	18.78	10.48	15.78	0	17.06	26.32	32.45	40.2	45.95	51.65	57.34	64.84	70.5
240	15.2	7.79	13.3	0	13.92	20.8	25.36	31.12	35.39	39.64	43.86	49.44	53.65
360	10.97	5.24	9.78	0	10.11	14.74	17.81	21.68	24.55	27.41	30.25	34	36.83
720	6.56	3.08	5.8	0	6.05	8.78	10.58	12.86	14.54	16.22	17.89	20.1	21.76
1440	3.82	1.75	3.41	0	3.53	5.08	6.1	7.4	8.36	9.31	10.26	11.51	12.46
2880	2.15	0.94	1.96	0	2	2.83	3.38	4.07	4.59	5.1	5.61	6.28	6.79
4320	1.59	0.66	1.45	0	1.48	2.06	2.45	2.94	3.3	3.66	4.02	4.49	4.85
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080205-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	71.58	26.41	71.41	0	67.24	90.58	106.03	125.56	140.04	154.42	168.75	187.65	201.93
30	51.07	19.17	51.01	0	47.92	64.86	76.08	90.25	100.77	111.2	121.6	135.32	145.69
45	37.79	17.18	34.86	0	34.97	50.15	60.2	72.9	82.33	91.68	101	113.29	122.58
60	31.32	16.28	26.15	0	28.65	43.03	52.56	64.59	73.52	82.39	91.22	102.87	111.67
120	19.58	10.55	16.92	0	17.85	27.17	33.34	41.14	46.93	52.67	58.39	65.94	71.65
180	14.74	8.43	12.43	0	13.36	20.81	25.74	31.97	36.59	41.18	45.76	51.79	56.35
240	12.04	6.8	9.75	0	10.92	16.93	20.91	25.94	29.67	33.37	37.06	41.92	45.6
360	8.99	4.83	7.45	0	8.2	12.47	15.29	18.86	21.51	24.14	26.76	30.22	32.83

720	5.65	3.43	4.78	0	5.09	8.12	10.12	12.66	14.54	16.41	18.27	20.72	22.58
1440	3.3	2.08	2.8	0	2.96	4.8	6.01	7.55	8.69	9.82	10.95	12.44	13.57
2880	1.93	1.06	1.73	0	1.76	2.69	3.31	4.1	4.68	5.25	5.83	6.59	7.16
4320	1.43	0.7	1.25	0	1.32	1.93	2.34	2.86	3.24	3.63	4.01	4.51	4.88
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080205-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	71.58	26.41	71.41	0	67.24	90.58	106.03	125.56	140.04	154.42	168.75	187.65	201.93
30	51.07	19.17	51.01	0	47.92	64.86	76.08	90.25	100.77	111.2	121.6	135.32	145.69
45	37.79	17.18	34.86	0	34.97	50.15	60.2	72.9	82.33	91.68	101	113.29	122.58
60	31.32	16.28	26.15	0	28.65	43.03	52.56	64.59	73.52	82.39	91.22	102.87	111.67
120	19.58	10.55	16.92	0	17.85	27.17	33.34	41.14	46.93	52.67	58.39	65.94	71.65
180	14.74	8.43	12.43	0	13.36	20.81	25.74	31.97	36.59	41.18	45.76	51.79	56.35
240	12.04	6.8	9.75	0	10.92	16.93	20.91	25.94	29.67	33.37	37.06	41.92	45.6
360	8.99	4.83	7.45	0	8.2	12.47	15.29	18.86	21.51	24.14	26.76	30.22	32.83
720	5.65	3.43	4.78	0	5.09	8.12	10.12	12.66	14.54	16.41	18.27	20.72	22.58
1440	3.3	2.08	2.8	0	2.96	4.8	6.01	7.55	8.69	9.82	10.95	12.44	13.57
2880	1.93	1.06	1.73	0	1.76	2.69	3.31	4.1	4.68	5.25	5.83	6.59	7.16
4320	1.43	0.7	1.25	0	1.32	1.93	2.34	2.86	3.24	3.63	4.01	4.51	4.88
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080206-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	122.14	80.31	95.52	0	108.95	179.92	226.91	286.29	330.33	374.05	417.61	475.08	518.52
30	72.6	38.97	65.85	0	66.2	100.64	123.44	152.25	173.62	194.84	215.98	243.86	264.94

45	50.32	25.08	45.49	0	46.2	68.37	83.04	101.58	115.34	128.99	142.59	160.54	174.1
60	42.9	23.9	37.15	0	38.97	60.1	74.08	91.75	104.86	117.87	130.83	147.93	160.86
120	27.54	15.18	24.57	0	25.05	38.46	47.34	58.57	66.89	75.16	83.39	94.25	102.46
180	20.85	12.21	18.22	0	18.84	29.64	36.78	45.81	52.5	59.15	65.77	74.51	81.11
240	16.53	9.51	13.73	0	14.97	23.37	28.94	35.97	41.18	46.36	51.52	58.32	63.47
360	12.5	6.75	10.72	0	11.39	17.36	21.31	26.3	30	33.67	37.33	42.16	45.82
720	6.96	3.47	6.08	0	6.39	9.46	11.49	14.05	15.96	17.84	19.73	22.21	24.09
1440	4.3	2.64	3.56	0	3.87	6.2	7.74	9.7	11.14	12.58	14.01	15.9	17.33
2880	2.4	1.47	1.84	0	2.16	3.46	4.32	5.4	6.21	7.01	7.81	8.86	9.66
4320	1.67	0.97	1.31	0	1.51	2.37	2.94	3.65	4.18	4.71	5.24	5.93	6.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080206-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	122.65	81.53	95.72	0	109.26	181.31	229.01	289.29	334	378.39	422.61	480.95	525.05
30	72.97	39.46	66.06	0	66.49	101.36	124.45	153.62	175.26	196.75	218.15	246.39	267.73
45	50.43	25.37	45.38	0	46.26	68.68	83.53	102.28	116.2	130.01	143.77	161.92	175.65
60	43	24.11	37.09	0	39.04	60.35	74.45	92.28	105.5	118.63	131.7	148.96	162
120	27.61	15.29	24.55	0	25.1	38.61	47.56	58.86	67.25	75.57	83.86	94.81	103.08
180	20.93	12.28	18.28	0	18.91	29.77	36.95	46.03	52.76	59.45	66.11	74.9	81.54
240	16.59	9.56	13.73	0	15.02	23.47	29.06	36.13	41.37	46.58	51.76	58.6	63.77
360	12.53	6.77	10.73	0	11.42	17.4	21.36	26.37	30.08	33.77	37.44	42.28	45.94
720	6.96	3.46	6.08	0	6.39	9.45	11.47	14.03	15.93	17.81	19.69	22.17	24.04
1440	4.31	2.64	3.55	0	3.88	6.21	7.75	9.71	11.15	12.59	14.02	15.91	17.34
2880	2.41	1.47	1.85	0	2.17	3.47	4.33	5.41	6.22	7.02	7.82	8.87	9.67
4320	1.67	0.97	1.31	0	1.51	2.37	2.94	3.65	4.18	4.71	5.24	5.93	6.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080207-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	83.19	61.94	60.59	0	69.3	128.95	167.92	214.96	248.2	279.92	310.4	349.14	377.45
30	50.47	30.3	42.16	0	45.7	74.7	92.06	111.92	125.4	137.92	149.67	164.27	174.72
45	35.03	19.84	31.4	0	32.26	51.14	62.21	74.72	83.13	90.89	98.14	107.08	113.46
60	27.54	15.93	25.39	0	25.21	40.41	49.38	59.57	66.44	72.79	78.74	86.09	91.34
120	17.22	7.79	15.69	0	16.62	23.8	27.72	31.97	34.74	37.24	39.53	42.31	44.26
180	12.97	5.51	11.46	0	12.64	17.66	20.35	23.25	25.12	26.8	28.34	30.19	31.49
240	10.45	4.56	9.36	0	10.14	14.32	16.58	19.01	20.59	22.01	23.31	24.88	25.98
360	7.93	3.09	6.89	0	7.81	10.58	12.03	13.58	14.57	15.45	16.25	17.21	17.88
720	4.88	2.27	4.19	0	4.69	6.79	7.95	9.21	10.03	10.78	11.46	12.3	12.88
1440	2.9	1.56	2.55	0	2.71	4.18	5.03	5.98	6.62	7.2	7.74	8.4	8.87
2880	1.6	0.74	1.42	0	1.54	2.22	2.6	3.01	3.28	3.52	3.74	4.01	4.2
4320	1.23	0.58	1.09	0	1.18	1.72	2.01	2.34	2.55	2.74	2.92	3.14	3.29
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080207-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	86.11	68.86	61.78	0	69.17	135.17	179.71	234.56	273.92	311.86	348.64	395.8	430.52
30	52.55	33.08	43.35	0	46.87	78.63	97.99	120.38	135.7	150	163.5	180.33	192.43
45	35.63	21.52	30.74	0	32.21	52.81	65.17	79.34	88.96	97.9	106.3	116.74	124.22
60	28.12	17.12	25.04	0	25.35	41.76	51.62	62.95	70.66	77.83	84.57	92.95	98.96
120	17.57	8.41	15.54	0	16.8	24.62	28.96	33.72	36.83	39.66	42.27	45.44	47.67
180	13.41	5.87	11.83	0	13.01	18.39	21.3	24.44	26.48	28.31	29.99	32.02	33.44
240	10.77	4.84	9.4	0	10.41	14.86	17.29	19.92	21.63	23.18	24.59	26.31	27.51
360	8.08	3.2	6.99	0	7.94	10.82	12.34	13.95	14.99	15.91	16.75	17.76	18.47
720	4.93	2.26	4.2	0	4.75	6.84	7.98	9.22	10.04	10.77	11.44	12.26	12.83

1440	2.92	1.55	2.53	0	2.73	4.2	5.04	5.97	6.6	7.17	7.7	8.35	8.81
2880	1.64	0.74	1.46	0	1.58	2.27	2.64	3.04	3.3	3.54	3.76	4.02	4.2
4320	1.24	0.56	1.11	0	1.2	1.71	1.99	2.3	2.5	2.68	2.84	3.04	3.18
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 2080208					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	104.79	56.9	96.57	0	97.56	151.43	182.55	217.43	240.73	262.12	282.02	306.51	323.9
30	65.6	30.79	68.58	0	62.94	91.48	107.24	124.44	135.69	145.87	155.24	166.63	174.64
45	46.84	20.2	45.74	0	45.54	63.99	73.95	84.66	91.6	97.83	103.53	110.42	115.23
60	38.77	18.04	38.11	0	37.25	53.95	63.15	73.17	79.72	85.65	91.09	97.71	102.36
120	24.19	10.13	23.53	0	23.61	32.81	37.74	43.02	46.43	49.48	52.27	55.63	57.97
180	19.71	7.81	18.22	0	19.37	26.39	30.1	34.04	36.57	38.83	40.88	43.35	45.07
240	16.4	6.53	15.23	0	16.11	21.98	25.09	28.4	30.52	32.41	34.14	36.21	37.65
360	12.08	5.08	11.64	0	11.78	16.4	18.88	21.53	23.25	24.79	26.19	27.88	29.06
720	7.55	3.24	6.45	0	7.35	10.3	11.9	13.61	14.72	15.71	16.62	17.72	18.49
1440	4.33	1.89	4.18	0	4.2	5.93	6.87	7.88	8.53	9.12	9.66	10.31	10.77
2880	2.31	1.08	1.93	0	2.22	3.22	3.77	4.37	4.77	5.12	5.45	5.85	6.13
4320	1.66	0.76	1.48	0	1.6	2.3	2.69	3.1	3.38	3.62	3.85	4.12	4.31
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010101-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	123.18	127.06	90.83	0	102.31	214.6	288.94	382.88	452.56	521.73	590.65	681.58	750.3
30	70.42	60.56	55.39	0	60.47	113.99	149.43	194.2	227.41	260.38	293.23	336.57	369.32
45	51.61	39.51	42.9	0	45.12	80.04	103.16	132.36	154.03	175.54	196.97	225.25	246.62

60	40.27	29.65	33.58	0	35.4	61.6	78.95	100.87	117.13	133.27	149.36	170.57	186.61
120	23.1	14.32	19.72	0	20.75	33.4	41.78	52.37	60.22	68.02	75.79	86.03	93.78
180	16.98	9.86	15.25	0	15.36	24.07	29.84	37.13	42.54	47.91	53.26	60.31	65.64
240	13.18	7.11	11.99	0	12.01	18.3	22.46	27.71	31.61	35.48	39.34	44.43	48.27
360	10.04	4.8	9.23	0	9.25	13.49	16.3	19.85	22.48	25.1	27.7	31.13	33.73
720	5.92	2.65	5.24	0	5.48	7.83	9.38	11.34	12.79	14.23	15.67	17.57	19
1440	3.46	1.46	3.05	0	3.22	4.51	5.36	6.44	7.24	8.04	8.83	9.88	10.67
2880	2.07	0.86	1.89	0	1.93	2.69	3.19	3.83	4.3	4.77	5.23	5.85	6.31
4320	1.49	0.63	1.38	0	1.39	1.94	2.31	2.78	3.12	3.47	3.81	4.26	4.6
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010101-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	108.94	113.2	80.3	0	90.35	190.39	256.62	340.31	402.39	464.02	525.42	606.43	667.65
30	64.46	54.41	52.15	0	55.52	103.61	135.44	175.67	205.51	235.13	264.64	303.58	333.01
45	48.31	36.16	41.01	0	42.37	74.33	95.48	122.22	142.05	161.73	181.35	207.22	226.78
60	37.96	27.3	31.96	0	33.48	57.6	73.58	93.76	108.73	123.59	138.4	157.94	172.7
120	22.22	13.51	18.95	0	20	31.94	39.85	49.83	57.24	64.6	71.93	81.59	88.9
180	16.35	9.3	14.75	0	14.82	23.04	28.48	35.36	40.46	45.52	50.57	57.22	62.25
240	12.79	6.73	11.6	0	11.68	17.63	21.57	26.55	30.24	33.9	37.55	42.37	46.01
360	9.78	4.54	8.85	0	9.03	13.05	15.7	19.06	21.55	24.02	26.48	29.73	32.19
720	5.71	2.53	5.07	0	5.29	7.53	9.01	10.88	12.27	13.65	15.02	16.83	18.2
1440	3.38	1.4	2.98	0	3.15	4.39	5.21	6.24	7.01	7.77	8.53	9.53	10.29
2880	2	0.81	1.87	0	1.87	2.58	3.06	3.66	4.1	4.54	4.98	5.56	6
4320	1.45	0.59	1.33	0	1.35	1.87	2.22	2.66	2.98	3.3	3.62	4.04	4.36
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010102-a					Intensity (mm h-1) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	122.85	84.64	97.75	0	105.92	187.5	239.03	299.98	342.38	382.41	420.55	468.58	503.4
30	70.99	41.98	59.91	0	64.58	104.7	128.58	155.83	174.27	191.37	207.4	227.27	241.48
45	50.19	27.21	45.47	0	46.74	72.5	87.37	104.04	115.16	125.38	134.88	146.57	154.87
60	38.39	20.08	36.15	0	36.05	54.97	65.77	77.79	85.77	93.07	99.83	108.14	114.02
120	20.78	9.96	19.37	0	19.86	29.13	34.27	39.91	43.61	46.96	50.05	53.81	56.46
180	15.54	7.3	13.85	0	14.91	21.68	25.41	29.49	32.16	34.58	36.8	39.5	41.4
240	12.52	5.91	11.2	0	12	17.48	20.52	23.83	26	27.96	29.77	31.97	33.51
360	8.97	3.55	7.92	0	8.81	12.01	13.69	15.48	16.63	17.66	18.59	19.71	20.49
720	5.22	1.84	4.62	0	5.19	6.8	7.64	8.51	9.06	9.55	9.99	10.52	10.88
1440	3.01	1.1	2.82	0	2.98	3.96	4.46	4.99	5.33	5.63	5.9	6.23	6.45
2880	1.73	0.54	1.6	0	1.73	2.2	2.43	2.67	2.82	2.95	3.07	3.21	3.31
4320	1.33	0.46	1.29	0	1.32	1.73	1.93	2.15	2.29	2.41	2.51	2.64	2.73
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010102-b					Intensity (mm h-1) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	101.86	64.21	82.23	0	90.8	152.47	190.06	233.56	263.33	291.14	317.37	350.09	373.63
30	62.21	32.91	55.13	0	58.27	89.33	107.12	126.95	140.15	152.24	163.45	177.22	186.99
45	45.33	22.28	42.69	0	43.13	63.93	75.57	88.38	96.81	104.47	111.55	120.18	126.26
60	34.98	16.62	33.77	0	33.49	48.93	57.48	66.83	72.96	78.52	83.63	89.85	94.23
120	19.5	8.77	18.24	0	18.84	26.91	31.31	36.08	39.19	41.99	44.55	47.66	49.85
180	14.61	6.49	13.11	0	14.14	20.1	23.34	26.85	29.12	31.17	33.05	35.33	36.92
240	11.94	5.35	10.63	0	11.54	16.46	19.14	22.05	23.94	25.64	27.2	29.09	30.42
360	8.59	3.16	7.35	0	8.5	11.31	12.76	14.29	15.27	16.13	16.91	17.85	18.5

720	4.91	1.66	4.37	0	4.89	6.34	7.08	7.85	8.34	8.76	9.15	9.61	9.93
1440	2.89	1.01	2.71	0	2.87	3.76	4.22	4.69	4.99	5.26	5.5	5.79	5.99
2880	1.62	0.47	1.56	0	1.63	2.03	2.22	2.43	2.55	2.66	2.76	2.88	2.96
4320	1.27	0.41	1.21	0	1.27	1.62	1.8	1.99	2.11	2.21	2.3	2.41	2.49
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010103					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	146.3	150.51	101.02	0	121.58	254.59	342.66	453.93	536.47	618.41	700.05	807.75	889.16
30	80.56	69.79	63.19	0	69.1	130.77	171.61	223.2	261.48	299.47	337.33	387.27	425.01
45	55.75	45.32	44.83	0	48.31	88.36	114.87	148.38	173.23	197.91	222.49	254.92	279.43
60	43.88	31.22	36.83	0	38.75	66.34	84.61	107.69	124.81	141.81	158.74	181.08	197.97
120	25.56	15.3	21.64	0	23.05	36.57	45.52	56.83	65.22	73.55	81.85	92.8	101.07
180	18.38	9.84	16.09	0	16.76	25.46	31.22	38.49	43.89	49.25	54.58	61.62	66.95
240	15.25	7.64	13.59	0	14	20.75	25.22	30.87	35.06	39.21	43.36	48.83	52.96
360	11.02	5.05	10	0	10.19	14.65	17.61	21.34	24.11	26.86	29.6	33.21	35.94
720	6.95	3.21	6.16	0	6.42	9.26	11.14	13.51	15.27	17.02	18.76	21.06	22.79
1440	4.12	1.72	3.74	0	3.84	5.36	6.36	7.64	8.58	9.52	10.45	11.68	12.61
2880	2.34	0.99	2.21	0	2.18	3.05	3.63	4.36	4.91	5.45	5.98	6.69	7.23
4320	1.65	0.7	1.49	0	1.54	2.15	2.56	3.08	3.46	3.85	4.23	4.73	5.1
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010104					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	182.49	147.68	119.27	0	158.24	288.75	375.16	484.33	565.33	645.72	725.83	831.51	911.38
30	94.94	67.62	70.48	0	83.83	143.59	183.16	233.15	270.23	307.05	343.72	392.11	428.68

45	67.76	41.88	56.11	0	60.88	97.89	122.4	153.36	176.33	199.13	221.84	251.81	274.46
60	51.19	29.33	43.29	0	46.37	72.29	89.45	111.14	127.22	143.19	159.1	180.09	195.95
120	26.58	13.95	23.34	0	24.29	36.62	44.78	55.09	62.74	70.34	77.9	87.89	95.43
180	18.94	9.11	16.51	0	17.44	25.49	30.83	37.56	42.56	47.52	52.46	58.98	63.9
240	15.86	6.85	15	0	14.74	20.79	24.8	29.86	33.62	37.35	41.06	45.96	49.67
360	10.73	4.45	9.89	0	10	13.93	16.54	19.83	22.27	24.69	27.1	30.29	32.69
720	6.17	2.27	5.69	0	5.8	7.8	9.13	10.81	12.05	13.29	14.52	16.15	17.37
1440	3.35	1.21	3.15	0	3.15	4.22	4.93	5.82	6.49	7.15	7.8	8.67	9.32
2880	1.91	0.71	1.76	0	1.79	2.42	2.84	3.36	3.75	4.14	4.52	5.03	5.41
4320	1.43	0.52	1.34	0	1.34	1.8	2.11	2.49	2.78	3.06	3.34	3.72	4
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010105-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	154.01	121.28	118.59	0	134.09	241.27	312.23	401.89	468.41	534.43	600.22	687.01	752.6
30	83.06	57.25	70.31	0	73.66	124.25	157.75	200.07	231.47	262.64	293.69	334.66	365.62
45	56.39	36.77	47.78	0	50.35	82.85	104.36	131.54	151.71	171.73	191.67	217.98	237.87
60	45.18	26.03	40.31	0	40.91	63.91	79.14	98.38	112.66	126.83	140.95	159.58	173.65
120	24.84	12.72	22.79	0	22.75	33.99	41.43	50.84	57.81	64.74	71.64	80.74	87.62
180	19.07	8.27	17.54	0	17.71	25.02	29.86	35.97	40.51	45.01	49.5	55.41	59.89
240	14.98	6.16	13.95	0	13.97	19.41	23.02	27.57	30.95	34.3	37.64	42.05	45.38
360	10.4	4.23	9.85	0	9.71	13.44	15.92	19.05	21.37	23.67	25.96	28.99	31.28
720	6.25	2.16	5.84	0	5.9	7.8	9.07	10.66	11.85	13.03	14.2	15.74	16.91
1440	3.66	1.41	3.36	0	3.43	4.67	5.5	6.54	7.32	8.08	8.85	9.86	10.62
2880	2.02	0.85	1.81	0	1.88	2.63	3.13	3.76	4.22	4.69	5.15	5.76	6.22
4320	1.48	0.6	1.43	0	1.38	1.91	2.26	2.71	3.04	3.36	3.69	4.12	4.44
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010105-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	133.4	101.22	103.35	0	116.78	206.23	265.45	340.28	395.8	450.9	505.8	578.24	632.98
30	74.44	48.34	65.62	0	66.5	109.22	137.5	173.24	199.75	226.07	252.29	286.88	313.03
45	51.63	31.93	45.04	0	46.39	74.6	93.29	116.89	134.4	151.79	169.11	191.95	209.22
60	41.83	22.63	37.97	0	38.11	58.11	71.35	88.08	100.49	112.81	125.09	141.28	153.52
120	23.58	11.55	21.68	0	21.68	31.89	38.65	47.19	53.52	59.81	66.07	74.34	80.59
180	18.16	7.46	16.82	0	16.93	23.53	27.89	33.41	37.5	41.56	45.61	50.94	54.98
240	14.41	5.61	13.39	0	13.49	18.45	21.73	25.88	28.95	32.01	35.05	39.06	42.1
360	10.03	3.85	9.29	0	9.4	12.8	15.05	17.9	20.01	22.11	24.19	26.95	29.03
720	5.95	1.98	5.59	0	5.62	7.37	8.53	10	11.08	12.16	13.23	14.65	15.72
1440	3.54	1.32	3.26	0	3.32	4.49	5.26	6.24	6.96	7.68	8.4	9.34	10.05
2880	1.92	0.78	1.78	0	1.79	2.48	2.94	3.51	3.94	4.37	4.79	5.35	5.77
4320	1.43	0.55	1.35	0	1.34	1.83	2.15	2.55	2.86	3.16	3.45	3.85	4.14
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010106					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	192.89	155.99	120.9	0	167.27	305.13	396.4	511.72	597.27	682.19	766.8	878.43	962.79
30	99.01	70.88	70.89	0	87.37	150.01	191.48	243.88	282.76	321.34	359.79	410.51	448.84
45	71.79	43.7	58.96	0	64.61	103.23	128.8	161.11	185.08	208.87	232.57	263.84	287.48
60	53.26	30.61	44.25	0	48.23	75.28	93.19	115.82	132.61	149.28	165.88	187.78	204.34
120	27.29	14.47	23.45	0	24.91	37.7	46.17	56.87	64.8	72.68	80.53	90.88	98.71
180	18.9	9.42	16.11	0	17.35	25.68	31.19	38.15	43.32	48.45	53.56	60.3	65.39
240	16.09	7.04	15.22	0	14.93	21.16	25.27	30.48	34.34	38.17	41.99	47.03	50.84
360	10.87	4.48	9.99	0	10.13	14.09	16.71	20.03	22.48	24.92	27.35	30.56	32.98
720	6.13	2.28	5.63	0	5.76	7.77	9.1	10.79	12.04	13.28	14.52	16.15	17.38

1440	3.27	1.12	3.09	0	3.09	4.08	4.73	5.56	6.17	6.78	7.39	8.19	8.8
2880	1.89	0.65	1.75	0	1.78	2.36	2.74	3.22	3.58	3.93	4.28	4.75	5.1
4320	1.43	0.5	1.32	0	1.35	1.79	2.08	2.45	2.73	3	3.27	3.63	3.9
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010201-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	138.99	122.98	77.2	0	105.09	221.34	303.81	408.55	485.44	560.76	634.78	730.93	802.57
30	74.04	53.47	56.78	0	62.56	114.09	147.29	187.04	214.96	241.48	266.87	299.03	322.45
45	52.82	34.61	43.08	0	46.44	79.76	100.37	124.46	141.06	156.64	171.39	189.87	203.21
60	42.9	27.04	34.35	0	38.24	64.21	80.04	98.36	110.9	122.6	133.65	147.43	157.34
120	26.85	13.46	21.19	0	25.45	38.05	45.15	52.98	58.15	62.86	67.22	72.54	76.29
180	19.03	8.24	16.12	0	18.49	26.02	30.09	34.47	37.31	39.86	42.19	45.01	46.99
240	15.05	5.81	13.29	0	14.83	20.03	22.76	25.65	27.49	29.14	30.64	32.43	33.68
360	11.14	4.07	10.4	0	11.03	14.64	16.51	18.47	19.72	20.83	21.83	23.03	23.87
720	6.58	2.57	5.99	0	6.48	8.78	9.99	11.28	12.11	12.84	13.51	14.31	14.87
1440	3.74	1.43	3.56	0	3.69	4.97	5.64	6.34	6.79	7.2	7.56	8	8.3
2880	2.03	0.84	1.85	0	1.98	2.75	3.15	3.59	3.87	4.12	4.35	4.62	4.81
4320	1.48	0.64	1.31	0	1.44	2.02	2.34	2.68	2.9	3.1	3.28	3.5	3.65
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010201-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	144.2	135.33	79.32	0	104.74	231.05	323.44	443.02	532.07	620.16	707.44	821.78	907.57
30	77.76	58.42	58.91	0	64.5	120.74	157.62	202.26	233.86	264.05	293.1	330.05	357.08
45	53.88	37.6	41.89	0	46.21	82.45	105.47	132.78	151.83	169.84	187.03	208.7	224.43

60	43.92	29.16	33.73	0	38.42	66.51	83.98	104.46	118.6	131.9	144.51	160.33	171.76
120	27.49	14.56	20.92	0	25.74	39.49	47.36	56.14	61.99	67.34	72.31	78.41	82.73
180	19.83	8.87	16.78	0	19.18	27.33	31.77	36.58	39.71	42.53	45.11	48.24	50.43
240	15.61	6.31	13.35	0	15.3	21	24.02	27.24	29.31	31.17	32.85	34.88	36.29
360	11.42	4.28	10.58	0	11.29	15.09	17.08	19.17	20.51	21.7	22.77	24.06	24.96
720	6.67	2.56	6.01	0	6.58	8.86	10.06	11.33	12.14	12.87	13.52	14.31	14.86
1440	3.79	1.41	3.51	0	3.75	5	5.65	6.34	6.78	7.17	7.52	7.94	8.23
2880	2.1	0.83	1.91	0	2.06	2.81	3.2	3.62	3.89	4.13	4.35	4.61	4.79
4320	1.49	0.61	1.34	0	1.46	2.01	2.3	2.62	2.82	3	3.17	3.36	3.5
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010202					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	110.11	65.71	95.16	0	99.9	162.75	200.28	243.19	272.28	299.27	324.6	356.03	378.53
30	67.27	33.92	68.06	0	63.68	95.47	113.4	133.21	146.3	158.24	169.27	182.76	192.29
45	47.95	22.21	45.72	0	46.11	66.65	77.96	90.26	98.29	105.56	112.24	120.35	126.04
60	39.61	19.4	37.93	0	37.71	55.81	65.94	77.06	84.38	91.04	97.18	104.66	109.94
120	24.75	10.71	23.37	0	24.05	33.84	39.13	44.82	48.5	51.82	54.85	58.51	61.08
180	19.86	7.97	18.12	0	19.49	26.67	30.48	34.53	37.13	39.46	41.57	44.12	45.89
240	16.43	6.52	15.16	0	16.14	22.01	25.11	28.4	30.51	32.4	34.12	36.18	37.61
360	12.09	4.98	11.64	0	11.83	16.34	18.74	21.31	22.97	24.45	25.8	27.43	28.56
720	7.51	3.16	6.45	0	7.33	10.2	11.74	13.39	14.46	15.42	16.29	17.34	18.08
1440	4.3	1.83	4.15	0	4.19	5.86	6.75	7.72	8.34	8.9	9.41	10.02	10.45
2880	2.29	1.05	1.94	0	2.21	3.18	3.71	4.29	4.66	5	5.32	5.7	5.96
4320	1.65	0.74	1.47	0	1.6	2.28	2.65	3.05	3.31	3.55	3.76	4.02	4.21
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010203					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	111.44	67.92	94.8	0	100.45	165.53	204.69	249.67	280.28	308.75	335.51	368.8	392.66
30	67.68	34.71	67.93	0	63.84	96.45	114.95	135.46	149.04	161.44	172.92	186.98	196.92
45	48.23	22.72	45.72	0	46.25	67.32	78.97	91.68	100.01	107.55	114.48	122.92	128.85
60	39.82	19.74	37.88	0	37.82	56.28	66.63	78.04	85.56	92.4	98.72	106.43	111.87
120	24.88	10.85	23.33	0	24.15	34.08	39.46	45.25	49	52.38	55.47	59.21	61.83
180	19.9	8.01	18.1	0	19.52	26.74	30.57	34.65	37.27	39.62	41.75	44.31	46.1
240	16.44	6.52	15.14	0	16.15	22.02	25.12	28.41	30.52	32.41	34.12	36.18	37.62
360	12.09	4.96	11.65	0	11.83	16.32	18.71	21.27	22.91	24.38	25.72	27.34	28.47
720	7.5	3.14	6.45	0	7.32	10.17	11.7	13.34	14.39	15.34	16.2	17.24	17.97
1440	4.29	1.81	4.15	0	4.18	5.83	6.71	7.66	8.27	8.82	9.32	9.93	10.35
2880	2.29	1.04	1.94	0	2.21	3.17	3.69	4.26	4.63	4.97	5.27	5.65	5.91
4320	1.64	0.74	1.47	0	1.58	2.27	2.64	3.04	3.3	3.54	3.76	4.02	4.2
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010204-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	159.1	146.35	83.23	0	117.21	254.45	353.77	481.5	576.15	669.46	761.65	882.07	972.21
30	83.61	63.5	59.72	0	68.98	130.08	170.35	219.22	253.9	287.08	319.05	359.76	389.58
45	59.04	40.37	46.81	0	51.06	89.97	114.47	143.39	163.48	182.43	200.46	223.16	239.61
60	47.44	30.55	36.71	0	41.97	71.36	89.42	110.43	124.87	138.38	151.16	167.15	178.66
120	28.31	14.99	21.53	0	26.51	40.66	48.77	57.81	63.82	69.33	74.44	80.72	85.17
180	19.79	9.15	16.41	0	19.04	27.5	32.15	37.21	40.52	43.51	46.25	49.59	51.93
240	15.62	6.42	13.53	0	15.28	21.09	24.19	27.5	29.63	31.54	33.28	35.37	36.83
360	11.31	4.17	10.36	0	11.19	14.89	16.82	18.84	20.12	21.27	22.3	23.54	24.4

720	6.56	2.44	6	0	6.49	8.66	9.78	10.97	11.73	12.4	13.01	13.74	14.25
1440	3.66	1.28	3.5	0	3.64	4.76	5.34	5.94	6.33	6.66	6.97	7.33	7.59
2880	2.03	0.77	1.89	0	2	2.69	3.05	3.43	3.67	3.89	4.08	4.32	4.48
4320	1.47	0.6	1.35	0	1.44	1.98	2.27	2.58	2.78	2.95	3.12	3.31	3.45
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010204-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	162.32	154	84.54	0	116.98	260.33	365.78	502.77	605.06	706.43	807.03	939.02	1038.2
30	85.91	66.57	61.03	0	70.17	134.14	176.68	228.61	265.62	301.13	335.42	379.2	411.34
45	59.7	42.22	46.07	0	50.91	91.61	117.6	148.54	170.18	190.68	210.27	235.01	252.99
60	48.08	31.86	36.33	0	42.09	72.78	91.85	114.19	129.62	144.12	157.87	175.11	187.57
120	28.7	15.68	21.36	0	26.68	41.53	50.14	59.79	66.24	72.17	77.69	84.48	89.31
180	20.28	9.54	16.82	0	19.45	28.3	33.18	38.52	42.01	45.17	48.08	51.62	54.11
240	15.97	6.72	13.57	0	15.58	21.69	24.97	28.48	30.75	32.78	34.64	36.88	38.44
360	11.48	4.3	10.47	0	11.35	15.17	17.17	19.27	20.61	21.8	22.88	24.18	25.08
720	6.62	2.43	6.02	0	6.55	8.71	9.83	11	11.75	12.41	13.02	13.74	14.23
1440	3.69	1.27	3.47	0	3.67	4.78	5.35	5.95	6.32	6.66	6.95	7.31	7.56
2880	2.07	0.76	1.93	0	2.05	2.72	3.07	3.44	3.67	3.88	4.07	4.3	4.45
4320	1.48	0.58	1.36	0	1.46	1.98	2.25	2.54	2.73	2.89	3.05	3.23	3.35
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3010205					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	105.78	58.14	96.68	0	98.18	153.31	185.29	221.21	245.25	267.36	287.94	313.29	331.32
30	65.99	31.19	68.47	0	63.24	92.18	108.2	125.69	137.15	147.53	157.08	168.69	176.86

45	47.03	20.39	45.77	0	45.69	64.33	74.41	85.25	92.28	98.6	104.38	111.37	116.26
60	39.02	18.31	38.13	0	37.44	54.41	63.78	74.01	80.7	86.75	92.32	99.09	103.85
120	24.4	10.42	23.64	0	23.75	33.26	38.37	43.86	47.42	50.61	53.52	57.05	59.51
180	19.8	8.08	18.25	0	19.39	26.69	30.58	34.73	37.4	39.79	41.96	44.58	46.41
240	16.42	6.72	15.16	0	16.07	22.15	25.39	28.84	31.07	33.06	34.87	37.06	38.58
360	12.12	5.18	11.6	0	11.8	16.52	19.07	21.8	23.57	25.15	26.6	28.35	29.58
720	7.52	3.26	6.43	0	7.31	10.29	11.9	13.63	14.75	15.77	16.69	17.81	18.59
1440	4.34	1.94	4.14	0	4.2	5.98	6.95	8	8.69	9.3	9.87	10.55	11.03
2880	2.31	1.11	1.93	0	2.21	3.24	3.81	4.44	4.86	5.23	5.58	6	6.29
4320	1.66	0.77	1.47	0	1.6	2.31	2.7	3.13	3.41	3.66	3.89	4.17	4.37
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 3040101					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	146.53	179.82	89.57	0	117	275.91	381.13	514.06	612.68	710.58	808.11	936.79	1034.05
30	78.86	78.88	61.43	0	65.91	135.61	181.77	240.08	283.34	326.29	369.07	425.52	468.18
45	56.02	51.07	45.32	0	47.63	92.77	122.65	160.4	188.41	216.21	243.91	280.46	308.08
60	44.08	37.58	36.9	0	37.91	71.12	93.11	120.89	141.5	161.96	182.34	209.23	229.56
120	24.8	18.5	21.25	0	21.76	38.11	48.94	62.61	72.76	82.83	92.86	106.1	116.11
180	17.45	11.3	15.25	0	15.59	25.58	32.19	40.55	46.74	52.9	59.02	67.11	73.22
240	14.49	8.68	12.89	0	13.06	20.74	25.81	32.23	36.99	41.72	46.42	52.64	57.33
360	10.81	6.07	9.77	0	9.81	15.18	18.73	23.22	26.55	29.85	33.14	37.49	40.77
720	6.16	2.89	5.61	0	5.69	8.24	9.93	12.07	13.65	15.23	16.79	18.86	20.42
1440	3.5	1.41	3.21	0	3.27	4.51	5.34	6.38	7.16	7.92	8.69	9.7	10.46
2880	2.12	0.89	1.96	0	1.97	2.76	3.28	3.94	4.43	4.91	5.39	6.03	6.51
4320	1.53	0.63	1.41	0	1.43	1.98	2.35	2.82	3.16	3.51	3.85	4.3	4.64
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5050001					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	111.58	111.67	79.43	0	77.22	179.6	257.13	359.69	437.32	514.97	592.64	695.35	773.07
30	63.62	50.89	52.37	0	51.1	99.87	132.79	173.34	202.43	230.48	257.67	292.53	318.2
45	46.65	32.05	40.97	0	40.27	71.16	90.65	113.68	129.7	144.81	159.21	177.33	190.47
60	37.8	24.38	33.66	0	33.42	56.88	71.3	88.09	99.62	110.43	120.64	133.42	142.63
120	21.8	12.1	20.26	0	20.18	31.67	38.35	45.88	50.92	55.56	59.89	65.22	69.02
180	15.48	7.84	14.27	0	14.64	21.99	26.15	30.74	33.78	36.55	39.11	42.25	44.46
240	12.55	6.03	11.74	0	11.99	17.6	20.72	24.14	26.38	28.41	30.29	32.57	34.18
360	9.32	4.23	8.79	0	8.99	12.89	15.02	17.34	18.84	20.2	21.45	22.97	24.03
720	5.38	2.13	5.05	0	5.29	7.2	8.21	9.29	9.98	10.59	11.15	11.82	12.29
1440	3.13	1.15	2.92	0	3.1	4.12	4.65	5.2	5.56	5.87	6.16	6.5	6.73
2880	1.84	0.71	1.74	0	1.81	2.45	2.78	3.13	3.36	3.56	3.74	3.96	4.12
4320	1.32	0.5	1.25	0	1.3	1.75	1.98	2.23	2.39	2.52	2.65	2.8	2.91
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5050002					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	94.64	58.79	86.82	0	84.98	136.94	171.34	214.8	247.04	279.05	310.94	353.01	384.8
30	56.77	32.87	50.29	0	51.37	80.42	99.65	123.95	141.98	159.87	177.7	201.23	219
45	41.2	24.42	35.94	0	37.19	58.77	73.06	91.11	104.5	117.8	131.04	148.52	161.73
60	32.64	20.17	27.4	0	29.33	47.15	58.95	73.87	84.93	95.91	106.85	121.28	132.19
120	19.12	11.34	16.88	0	17.26	27.28	33.91	42.3	48.52	54.69	60.84	68.96	75.09
180	13.61	7.86	11.77	0	12.32	19.27	23.86	29.68	33.99	38.26	42.53	48.15	52.4
240	11.32	5.5	10.28	0	10.42	15.28	18.5	22.56	25.58	28.57	31.56	35.49	38.47
360	8.18	3.76	7.55	0	7.56	10.89	13.09	15.87	17.93	19.97	22.01	24.7	26.74
720	4.57	1.77	4.3	0	4.28	5.84	6.88	8.19	9.16	10.12	11.08	12.35	13.31

1440	2.63	0.97	2.44	0	2.47	3.33	3.9	4.61	5.14	5.67	6.2	6.89	7.42
2880	1.56	0.57	1.42	0	1.47	1.97	2.3	2.73	3.04	3.35	3.66	4.07	4.37
4320	1.11	0.41	1.03	0	1.04	1.4	1.64	1.95	2.17	2.4	2.62	2.91	3.13
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5050003-a					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	103.37	82.38	82.37	0	89.84	162.64	210.84	271.75	316.93	361.77	406.46	465.41	509.96
30	57.37	38.85	48.07	0	50.99	85.32	108.05	136.78	158.08	179.23	200.3	228.11	249.12
45	40.25	25.32	34.98	0	36.09	58.47	73.28	92	105.89	119.67	133.41	151.53	165.22
60	33.46	19.23	28.35	0	30.3	47.3	58.55	72.76	83.31	93.78	104.21	117.97	128.37
120	18.79	9.96	16.66	0	17.15	25.96	31.78	39.15	44.61	50.03	55.43	62.56	67.95
180	13.46	6.8	12.16	0	12.34	18.35	22.33	27.36	31.09	34.79	38.48	43.34	47.02
240	11.09	5.15	10.25	0	10.24	14.8	17.81	21.62	24.44	27.24	30.04	33.72	36.51
360	8.19	3.71	7.55	0	7.58	10.86	13.03	15.77	17.81	19.83	21.84	24.49	26.5
720	5.03	2.13	4.65	0	4.68	6.56	7.81	9.38	10.55	11.71	12.87	14.39	15.54
1440	2.84	1.16	2.63	0	2.65	3.67	4.35	5.21	5.85	6.48	7.11	7.94	8.57
2880	1.58	0.66	1.46	0	1.47	2.05	2.44	2.93	3.29	3.65	4.01	4.48	4.84
4320	1.14	0.47	1.04	0	1.06	1.48	1.75	2.1	2.36	2.61	2.87	3.21	3.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5050003-b					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	91.29	76.27	71.82	0	78.76	146.17	190.79	247.18	289.01	330.53	371.9	426.48	467.73
30	54.04	38.99	44.55	0	47.64	82.09	104.91	133.73	155.12	176.34	197.49	225.39	246.48
45	38.85	26.11	33.11	0	34.56	57.64	72.91	92.22	106.54	120.75	134.91	153.6	167.72

60	32.8	20.19	27.89	0	29.48	47.33	59.14	74.07	85.14	96.13	107.08	121.53	132.45
120	18.53	10.15	16.07	0	16.86	25.83	31.77	39.28	44.84	50.37	55.87	63.14	68.63
180	13.04	6.95	11.57	0	11.9	18.04	22.11	27.25	31.06	34.84	38.61	43.58	47.34
240	10.51	5.01	9.68	0	9.69	14.11	17.05	20.75	23.5	26.23	28.94	32.53	35.24
360	7.91	3.55	7.29	0	7.33	10.46	12.54	15.17	17.11	19.05	20.97	23.51	25.43
720	4.88	1.95	4.5	0	4.56	6.28	7.42	8.87	9.94	11	12.05	13.45	14.5
1440	2.81	1.01	2.66	0	2.64	3.54	4.13	4.87	5.43	5.98	6.53	7.25	7.79
2880	1.58	0.62	1.51	0	1.48	2.03	2.39	2.85	3.19	3.52	3.86	4.3	4.64
4320	1.11	0.43	1.06	0	1.04	1.42	1.67	1.99	2.22	2.46	2.69	3	3.23
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5070201					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	83.16	37.75	82.24	0	76.96	110.32	132.41	160.32	181.02	201.57	222.05	249.06	269.48
30	54.32	25.16	48.25	0	50.19	72.42	87.14	105.74	119.54	133.24	146.89	164.89	178.5
45	41.49	19.12	38.5	0	38.35	55.25	66.43	80.57	91.06	101.46	111.84	125.52	135.86
60	33.01	15.54	28.88	0	30.46	44.19	53.28	64.77	73.29	81.75	90.18	101.3	109.71
120	19.61	8.47	18.25	0	18.22	25.7	30.66	36.92	41.57	46.18	50.77	56.83	61.41
180	13.75	5.39	13.46	0	12.86	17.63	20.78	24.77	27.72	30.66	33.58	37.44	40.35
240	10.87	4.49	10.16	0	10.13	14.1	16.73	20.05	22.51	24.95	27.39	30.6	33.03
360	7.95	3.1	7.44	0	7.44	10.18	11.99	14.29	15.99	17.67	19.36	21.57	23.25
720	4.73	1.69	4.44	0	4.45	5.95	6.93	8.18	9.11	10.03	10.95	12.16	13.07
1440	2.78	0.87	2.62	0	2.64	3.41	3.92	4.56	5.04	5.51	5.98	6.6	7.07
2880	1.67	0.46	1.63	0	1.59	2	2.27	2.61	2.86	3.11	3.36	3.69	3.94
4320	1.22	0.32	1.21	0	1.17	1.45	1.64	1.87	2.05	2.22	2.4	2.63	2.8
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5070202					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	132.02	97.5	90.54	0	110.4	204.33	265.47	339.11	391.06	440.58	488.12	548.47	592.54
30	71.41	47.46	49.71	0	62.45	108.16	136.61	169.96	193	214.66	235.21	260.99	279.62
45	49.8	30.5	36.06	0	44.82	74.05	91.68	111.94	125.75	138.59	150.67	165.7	176.48
60	38.57	22.64	27.32	0	35.16	56.79	69.62	84.24	94.13	103.29	111.86	122.49	130.09
120	20.79	10.34	17.27	0	19.73	29.41	34.84	40.82	44.77	48.37	51.69	55.74	58.6
180	14.53	6.77	13.35	0	13.96	20.23	23.68	27.44	29.9	32.13	34.18	36.66	38.41
240	11.37	5.05	10.65	0	11.01	15.64	18.17	20.89	22.66	24.26	25.72	27.49	28.73
360	8.52	3.12	8.37	0	8.44	11.2	12.64	14.14	15.1	15.95	16.72	17.65	18.29
720	4.71	1.54	4.67	0	4.7	6.04	6.72	7.42	7.86	8.25	8.6	9.01	9.3
1440	2.6	0.75	2.48	0	2.61	3.25	3.56	3.89	4.09	4.26	4.42	4.6	4.73
2880	1.45	0.38	1.37	0	1.46	1.78	1.93	2.09	2.19	2.27	2.35	2.43	2.49
4320	1.04	0.29	1	0	1.05	1.29	1.41	1.53	1.61	1.68	1.74	1.81	1.85
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5100201					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	137.15	122.66	89.9	0	102.98	218.68	301.22	406.4	483.81	559.77	634.53	731.79	804.35
30	77.17	60.09	54.7	0	62.87	120.59	159.07	206.1	239.64	271.86	302.99	342.76	371.96
45	54.03	37.99	42.97	0	46.19	82.81	106.14	133.88	153.25	171.59	189.1	211.2	227.26
60	42.28	29.35	32.22	0	36.34	64.63	82.56	103.8	118.6	132.59	145.92	162.73	174.93
120	21.92	13.85	18.75	0	19.52	32.83	40.94	50.34	56.78	62.79	68.46	75.54	80.63
180	15.76	8.82	14.45	0	14.56	22.94	27.83	33.35	37.05	40.46	43.64	47.56	50.35
240	12.32	6.61	11.27	0	11.5	17.75	21.35	25.37	28.05	30.51	32.79	35.6	37.59
360	9.51	4.31	9.3	0	9.18	13.15	15.32	17.67	19.21	20.59	21.86	23.4	24.48

720	5.28	2.04	5.16	0	5.2	7.03	7.99	9	9.65	10.23	10.75	11.38	11.82
1440	2.91	0.99	2.78	0	2.9	3.76	4.21	4.67	4.96	5.21	5.44	5.72	5.91
2880	1.66	0.61	1.58	0	1.64	2.18	2.47	2.76	2.95	3.12	3.27	3.45	3.57
4320	1.18	0.4	1.12	0	1.18	1.52	1.7	1.89	2.01	2.11	2.2	2.31	2.39
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 5130101					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	124.14	119.12	86.36	0	88.73	199.28	281.1	387.79	467.69	547.02	625.88	729.51	807.5
30	72.98	58.25	55.88	0	58.68	114.52	152.17	198.52	231.75	263.78	294.83	334.63	363.92
45	51.75	36.41	45.72	0	44.23	79.33	101.69	128.28	146.86	164.45	181.24	202.44	217.84
60	40.91	28.62	34.29	0	35.05	62.64	80.18	101	115.53	129.28	142.39	158.94	170.95
120	21.16	13.47	19.05	0	18.8	31.74	39.66	48.85	55.15	61.04	66.6	73.54	78.54
180	15.45	8.52	14.39	0	14.33	22.41	27.1	32.38	35.91	39.16	42.19	45.92	48.57
240	12.07	6.51	10.99	0	11.26	17.41	20.96	24.94	27.59	30.02	32.28	35.06	37.04
360	9.34	4.38	9.1	0	8.96	13.02	15.26	17.71	19.31	20.76	22.09	23.71	24.84
720	5.26	2.03	5.08	0	5.18	7	7.95	8.96	9.61	10.18	10.71	11.33	11.77
1440	2.92	1.01	2.8	0	2.91	3.79	4.24	4.72	5.02	5.28	5.52	5.81	6
2880	1.72	0.65	1.64	0	1.7	2.28	2.58	2.9	3.1	3.29	3.45	3.65	3.78
4320	1.22	0.41	1.16	0	1.22	1.57	1.76	1.94	2.06	2.17	2.27	2.38	2.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 6010101					Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	($mm\ h^{-1}$)	($mm\ h^{-1}$)	($mm\ h^{-1}$)		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	98.26	79.5	80.62	0	78.43	154.53	206.17	270	315.9	360.24	403.29	458.55	499.3
30	56.32	35.98	48.82	0	49.97	84.56	105.76	130.37	147.26	163.06	177.98	196.62	210.05

45	41	21.96	38.37	0	38.3	59.05	70.99	84.33	93.22	101.38	108.96	118.27	124.87
60	32.39	16.38	29.83	0	30.64	46	54.68	64.27	70.61	76.39	81.73	88.27	92.89
120	18.08	7.14	17.51	0	17.77	24.19	27.58	31.17	33.48	35.54	37.41	39.66	41.22
180	13.02	4.79	12.66	0	12.89	17.14	19.34	21.66	23.14	24.45	25.64	27.06	28.04
240	10.23	3.78	9.87	0	10.12	13.48	15.22	17.06	18.23	19.26	20.2	21.33	22.11
360	7.54	2.57	7.39	0	7.51	9.76	10.9	12.1	12.85	13.52	14.12	14.84	15.34
720	4.33	1.25	4.23	0	4.35	5.41	5.94	6.47	6.81	7.1	7.36	7.67	7.88
1440	2.46	0.69	2.4	0	2.48	3.06	3.34	3.64	3.82	3.98	4.12	4.29	4.4
2880	1.44	0.41	1.39	0	1.45	1.79	1.97	2.14	2.25	2.34	2.43	2.53	2.6
4320	1.06	0.3	1.03	0	1.07	1.32	1.44	1.57	1.65	1.72	1.78	1.86	1.91
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 6010102					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	108.15	87.7	82.61	0	86.21	170.14	227.16	297.68	348.42	397.44	445.05	506.2	551.29
30	61.94	40.7	51.83	0	54.4	93.58	117.86	146.24	165.81	184.17	201.58	223.39	239.13
45	46.69	25.34	43.35	0	43.47	67.46	81.32	96.85	107.22	116.74	125.6	136.5	144.24
60	37.94	20.09	35.38	0	35.53	54.49	65.36	77.47	85.53	92.92	99.77	108.19	114.15
120	21.1	9.83	20.7	0	20.27	29.37	34.39	39.85	43.42	46.66	49.63	53.23	55.77
180	14.97	6.34	14.46	0	14.59	20.36	23.46	26.79	28.94	30.87	32.63	34.76	36.24
240	11.84	4.91	11.64	0	11.57	16.02	18.4	20.95	22.59	24.06	25.39	27.01	28.14
360	8.81	3.37	8.63	0	8.69	11.7	13.28	14.94	16.01	16.96	17.82	18.85	19.57
720	5.16	1.7	4.95	0	5.15	6.63	7.38	8.15	8.64	9.08	9.46	9.93	10.24
1440	2.95	0.89	2.88	0	2.96	3.72	4.1	4.49	4.73	4.95	5.14	5.37	5.52
2880	1.7	0.56	1.61	0	1.7	2.18	2.43	2.69	2.85	2.99	3.12	3.27	3.37
4320	1.22	0.37	1.19	0	1.22	1.54	1.7	1.86	1.96	2.05	2.13	2.23	2.29
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 6010104					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	124.14	119.12	86.36	0	88.73	199.28	281.1	387.79	467.69	547.02	625.88	729.51	807.5
30	72.98	58.25	55.88	0	58.68	114.52	152.17	198.52	231.75	263.78	294.83	334.63	363.92
45	51.75	36.41	45.72	0	44.23	79.33	101.69	128.28	146.86	164.45	181.24	202.44	217.84
60	40.91	28.62	34.29	0	35.05	62.64	80.18	101	115.53	129.28	142.39	158.94	170.95
120	21.16	13.47	19.05	0	18.8	31.74	39.66	48.85	55.15	61.04	66.6	73.54	78.54
180	15.45	8.52	14.39	0	14.33	22.41	27.1	32.38	35.91	39.16	42.19	45.92	48.57
240	12.07	6.51	10.99	0	11.26	17.41	20.96	24.94	27.59	30.02	32.28	35.06	37.04
360	9.34	4.38	9.1	0	8.96	13.02	15.26	17.71	19.31	20.76	22.09	23.71	24.84
720	5.26	2.03	5.08	0	5.18	7	7.95	8.96	9.61	10.18	10.71	11.33	11.77
1440	2.92	1.01	2.8	0	2.91	3.79	4.24	4.72	5.02	5.28	5.52	5.81	6
2880	1.72	0.65	1.64	0	1.7	2.28	2.58	2.9	3.1	3.29	3.45	3.65	3.78
4320	1.22	0.41	1.16	0	1.22	1.57	1.76	1.94	2.06	2.17	2.27	2.38	2.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 6010205					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	109.78	97.94	83.55	0	82.56	174.99	240.84	324.69	386.37	446.87	506.39	583.8	641.53
30	63.91	46.17	52.04	0	54	98.49	127.16	161.49	185.6	208.51	230.45	258.22	278.46
45	45.44	28.36	41.24	0	40.64	67.86	84.39	103.48	116.52	128.68	140.14	154.43	164.69
60	35.8	21.69	31.19	0	32.33	53.1	65.58	79.88	89.61	98.65	107.14	117.7	125.26
120	19.06	9.59	17.63	0	18.05	27.03	32.1	37.69	41.39	44.76	47.87	51.67	54.36
180	13.83	6.23	13.11	0	13.36	19.09	22.22	25.61	27.82	29.81	31.64	33.85	35.41
240	10.8	4.83	10.04	0	10.44	14.88	17.3	19.92	21.62	23.16	24.56	26.27	27.46
360	8.16	3.24	7.99	0	8.02	10.93	12.47	14.11	15.16	16.1	16.95	17.98	18.69
720	4.62	1.5	4.49	0	4.62	5.92	6.57	7.25	7.68	8.06	8.4	8.8	9.08

1440	2.57	0.78	2.49	0	2.58	3.24	3.58	3.92	4.13	4.32	4.49	4.69	4.83
2880	1.51	0.48	1.46	0	1.51	1.92	2.13	2.35	2.48	2.6	2.71	2.84	2.93
4320	1.1	0.32	1.06	0	1.11	1.38	1.51	1.65	1.74	1.81	1.88	1.96	2.01
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

HUC 6010206					Intensity (mm h^{-1}) for the Return Period or Exceedance Probability								
Duration	x_{bar}	s	x_m	N	2	5	10	25	50	100	200	500	1000
(min)	(mm h^{-1})	(mm h^{-1})	(mm h^{-1})		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001
15	124.14	119.12	86.36	0	88.73	199.28	281.1	387.79	467.69	547.02	625.88	729.51	807.5
30	72.98	58.25	55.88	0	58.68	114.52	152.17	198.52	231.75	263.78	294.83	334.63	363.92
45	51.75	36.41	45.72	0	44.23	79.33	101.69	128.28	146.86	164.45	181.24	202.44	217.84
60	40.91	28.62	34.29	0	35.05	62.64	80.18	101	115.53	129.28	142.39	158.94	170.95
120	21.16	13.47	19.05	0	18.8	31.74	39.66	48.85	55.15	61.04	66.6	73.54	78.54
180	15.45	8.52	14.39	0	14.33	22.41	27.1	32.38	35.91	39.16	42.19	45.92	48.57
240	12.07	6.51	10.99	0	11.26	17.41	20.96	24.94	27.59	30.02	32.28	35.06	37.04
360	9.34	4.38	9.1	0	8.96	13.02	15.26	17.71	19.31	20.76	22.09	23.71	24.84
720	5.26	2.03	5.08	0	5.18	7	7.95	8.96	9.61	10.18	10.71	11.33	11.77
1440	2.92	1.01	2.8	0	2.91	3.79	4.24	4.72	5.02	5.28	5.52	5.81	6
2880	1.72	0.65	1.64	0	1.7	2.28	2.58	2.9	3.1	3.29	3.45	3.65	3.78
4320	1.22	0.41	1.16	0	1.22	1.57	1.76	1.94	2.06	2.17	2.27	2.38	2.46
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year

D. Tabulated Probability-Based IDF Curves for the Eight Gauges

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	346.82	539.77	697.92	897.74	1045.98	1193.13	1339.74	1533.16	1679.34	RCM3-CGCM3 (future)
2	92.31	337.9	489.89	630.15	807.38	938.86	1069.37	1199.4	1370.95	1500.61	RCM3-GFDL (future)
3	88.46	326.76	487.26	590.27	722.9	841.73	962.23	1082.28	1240.67	1360.38	RCM3-GFDL (historical)
4	84.62	313.03	485.3	580.24	720.34	821.29	918.95	1016.26	1144.64	1241.66	HRM3-HadCM3 (historical)
5	80.77	300.91	460.98	556.7	697.72	784.87	871.38	957.57	1071.29	1157.23	HRM3-HadCM3 (future)
6	76.92	293.86	427.19	542.46	645.42	721.81	797.62	873.16	972.83	1048.15	HRM3-GFDL (future)
7	73.08	278.38	400.52	481.38	583.55	659.34	734.58	809.54	908.43	983.18	HRM3-GFDL (historical)
8	69.23	278.03	399.5	456.74	529.92	597.89	665.36	732.58	821.26	888.29	RCM3-CGCM3 (historical)
9	65.38	261.73	373.28	438.3	529.07	582.73	636	689.07	759.08	812	MM5I-HadCM3 (future)
10	61.54	256.27	365.79	425.87	492.31	541.59	590.52	640.31	710.79	764.07	WRFG-CGCM3 (historical)
11	57.69	253.97	348.78	406.41	479.23	533.26	586.88	639.26	703.58	752.18	WRFG-CGCM3 (future)
12	53.85	253.91	328.18	377.31	439.39	485.44	531.15	576.7	636.79	682.2	WRFG-CCSM (future)
13	50.00	232.86	322.89	368.55	426.26	469.06	511.55	553.89	610.22	658.12	MM5I-CCSM (historical)
14	46.15	231.59	296.19	339.12	402.01	450.58	498.8	546.84	609.74	651.95	MM5I-HadCM3 (historical)
15	42.31	224.43	291.9	338.12	398.78	443.04	486.97	530.75	588.5	632.14	WRFG-CCSM (historical)
16	38.46	223.56	284.91	336.53	391.1	430.4	469.41	508.28	559.56	598.31	ECP2-GFDL (future)
17	34.62	220.59	284.71	328	382.45	422.85	462.94	502.89	555.59	595.43	MM5I-CCSM (future)
18	30.77	219.82	279.43	316.42	363.16	397.83	432.24	466.54	511.78	545.97	ECP2-HadCM3 (historical)
19	26.92	206.43	270.66	301.26	343.59	378.54	413.23	447.8	493.41	527.87	ECP2-GFDL (historical)
20	23.08	202.86	259.18	296.47	339.94	368.63	397.1	425.48	462.91	491.2	ECP2-HadCM3 (future)
21	19.23	133.19	179.43	210.05	248.74	277.44	305.93	335.29	383.38	419.72	Observed
22	15.38	99.8	136.4	175.72	225.4	262.26	298.84	334.31	371.76	400.06	CRCM-CGCM3 (future)
23	11.54	94.56	135.37	158.92	188.68	210.75	232.66	254.5	283.3	305.07	CRCM-CGCM3 (historical)
24	7.69	79.05	123.78	143.13	167.58	185.72	203.72	221.66	245.32	263.21	CRCM-CCSM (future)
25	3.85	77.01	109.81	130.17	155.9	174.98	193.93	212.8	237.71	256.53	CRCM-CCSM (historical)
Gauge: 440561; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	237.23	366.73	473.2	607.74	707.54	806.61	905.32	1035.55	1133.97	RCM3-CGCM3 (future)
2	92.31	231.19	333.14	427.57	546.9	635.41	723.28	810.82	926.32	1013.61	RCM3-GFDL (future)
3	88.46	223.59	331.98	401.42	490.92	569.58	650.65	731.43	838	918.54	RCM3-GFDL (historical)
4	84.62	214.42	330.58	394.71	487.91	557.32	623.23	688.9	775.54	841.02	HRM3-HadCM3 (historical)
5	80.77	205.9	314.4	377.81	473.97	532.76	591.13	649.28	726	783.98	HRM3-HadCM3 (future)
6	76.92	201.44	290.68	369.49	439.1	490.74	542.01	593.08	660.46	711.38	HRM3-GFDL (future)
7	73.08	190.86	273.45	328.14	397.23	448.49	499.37	550.06	616.94	667.49	HRM3-GFDL (historical)
8	69.23	190.5	272.98	311.76	361.17	407.2	452.88	498.4	558.46	603.84	RCM3-CGCM3 (historical)
9	65.38	179.6	255.24	299.13	360.75	397.09	433.17	469.12	516.54	552.38	MM5I-HadCM3 (future)
10	61.54	175.87	250.03	290.85	335.85	369.24	402.37	436.46	484.28	520.43	WRFG-CGCM3 (historical)
11	57.69	174.38	238.66	277.77	327.17	363.83	400.21	435.39	478.95	511.87	WRFG-CGCM3 (future)
12	53.85	174.35	224.71	258.03	300.13	331.36	362.37	393.26	434.01	464.81	WRFG-CCSM (future)
13	50.00	160.05	221.11	252.07	291.18	320.2	349	377.7	416.25	448.79	MM5I-CCSM (historical)
14	46.15	159.07	203.06	232.21	274.85	307.84	340.58	373.21	415.57	444.18	MM5I-HadCM3 (historical)
15	42.31	154.34	200.13	231.54	272.75	302.82	332.67	362.41	401.64	431.3	WRFG-CCSM (historical)
16	38.46	153.74	195.42	230.38	267.52	294.21	320.7	347.1	381.93	408.26	ECP2-GFDL (future)
17	34.62	151.68	195.19	224.73	261.76	289.23	316.5	343.67	379.51	406.6	MM5I-CCSM (future)
18	30.77	151.15	191.66	216.77	248.49	272.03	295.39	318.66	349.37	372.58	ECP2-HadCM3 (historical)
19	26.92	142.03	185.77	206.59	235.37	259.15	282.76	306.28	337.31	360.76	ECP2-GFDL (historical)
20	23.08	139.63	177.95	203.32	232.88	252.39	271.75	291.05	316.5	335.74	ECP2-HadCM3 (future)
21	19.23	92.09	123.68	144.6	171.03	190.64	210.1	229.49	255.07	274.41	CRCM-CGCM3 (future)
22	15.38	69.23	93.6	109.73	130.11	145.23	160.24	175.19	194.92	209.83	CRCM-CGCM3 (historical)
23	11.54	65.65	85.69	98.96	115.98	132.85	149.6	166.28	188.29	204.93	Observed
24	7.69	54.97	76.11	93.24	115.73	128.16	140.51	152.81	169.04	181.31	CRCM-CCSM (future)
25	3.85	48.06	75.24	90.11	107.79	120.91	133.93	146.91	164.02	176.96	CRCM-CCSM (historical)
Gauge: 440561; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	174.73	266.5	342.45	438.43	509.63	580.3	650.72	743.62	813.83	RCM3-CGCM3 (future)
2	92.31	170.36	242.59	309.88	394.98	458.11	520.78	583.22	665.59	727.85	RCM3-GFDL (future)
3	88.46	164.8	242.53	292.24	356.38	410.56	468.3	525.84	601.76	659.13	RCM3-GFDL (historical)
4	84.62	158.35	241.47	287.52	352.38	403.96	451.19	498.25	560.34	607.26	HRM3-HadCM3 (historical)
5	80.77	151.77	230.2	273.95	344.29	386.41	428.21	469.86	524.81	566.34	HRM3-HadCM3 (future)
6	76.92	149.02	211.88	269.83	319.89	357.03	393.9	430.63	479.09	515.72	HRM3-GFDL (future)
7	73.08	141.23	200.67	240.03	289.75	326.64	363.26	399.74	447.87	484.25	HRM3-GFDL (historical)
8	69.23	140.81	200.62	228.61	264.09	297.3	330.26	363.1	406.43	439.18	RCM3-CGCM3 (historical)
9	65.38	133.12	187.84	219.32	263.97	290.2	316.24	342.18	376.41	402.28	MM5I-HadCM3 (future)
10	61.54	130.39	183.9	213.54	246.02	270.11	294.03	319.18	353.82	380	WRFG-CGCM3 (historical)
11	57.69	129.41	175.9	204.23	240.02	266.57	292.92	317.85	349.29	373.05	WRFG-CGCM3 (future)
12	53.85	129.4	165.82	189.93	220.4	243	265.43	287.79	317.28	339.57	WRFG-CCSM (future)
13	50.00	119	163.22	185.6	213.89	234.87	255.7	276.45	304.88	328.5	MM5I-CCSM (historical)
14	46.15	118.14	150.21	171.37	202.25	226.19	249.96	273.64	303.83	324.53	MM5I-HadCM3 (historical)
15	42.31	114.89	148.07	170.88	200.81	222.65	244.32	265.92	294.42	315.96	WRFG-CCSM (historical)
16	38.46	114.45	144.73	169.97	196.99	216.36	235.59	254.75	280.02	299.12	ECP2-GFDL (future)
17	34.62	112.88	144.42	166.07	193.03	213.03	232.89	252.67	278.77	298.49	MM5I-CCSM (future)
18	30.77	112.5	141.94	160.15	183.15	200.21	217.14	234.02	256.28	273.11	ECP2-HadCM3 (historical)
19	26.92	105.84	137.76	152.9	173.9	191.22	208.42	225.55	248.16	265.25	ECP2-GFDL (historical)
20	23.08	104.14	132.06	150.54	172.04	186.23	200.32	214.36	232.88	246.87	ECP2-HadCM3 (future)
21	19.23	69.31	92.51	107.88	127.29	141.69	155.99	170.23	189.03	203.23	CRCM-CGCM3 (future)
22	15.38	52.45	70.44	82.35	97.4	108.57	119.65	130.7	145.27	156.28	CRCM-CGCM3 (historical)
23	11.54	49.8	64.64	74.46	86.88	96.09	105.23	114.33	127.8	138.5	Observed
24	7.69	41.84	57.55	67.96	81.33	92.17	102.93	113.66	126.35	135.43	CRCM-CCSM (future)
25	3.85	37.67	55.14	66.71	81.1	90.85	100.53	110.18	122.9	132.51	CRCM-CCSM (historical)
Gauge: 440561; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	156.68	245.52	318.09	409.8	477.82	545.35	612.63	701.39	768.48	RCM3-CGCM3 (future)
2	92.31	152.61	222.63	287.01	368.35	428.7	488.6	548.28	627.01	686.52	RCM3-GFDL (future)
3	88.46	147.56	220.99	268.21	328.94	384.42	439.76	494.9	567.65	622.63	RCM3-GFDL (historical)
4	84.62	141.22	220.15	263.57	328.66	373.98	418.7	463.25	522.03	566.46	HRM3-HadCM3 (historical)
5	80.77	135.9	208.86	253.51	317.36	357.27	396.89	436.36	488.44	527.79	HRM3-HadCM3 (future)
6	76.92	132.47	194.02	246.1	293.15	328.06	362.71	397.24	442.79	477.21	HRM3-GFDL (future)
7	73.08	125.47	181.27	218.21	264.89	299.52	333.89	368.14	413.32	447.47	HRM3-GFDL (historical)
8	69.23	125.39	180.66	206.77	240.26	271.28	302.06	332.74	373.2	403.79	RCM3-CGCM3 (historical)
9	65.38	117.86	168.7	198.46	239.77	264.25	288.54	312.75	344.69	368.83	MM5I-HadCM3 (future)
10	61.54	115.39	165.37	192.69	223	245.49	267.81	290.28	322.38	346.64	WRFG-CGCM3 (historical)
11	57.69	114.3	157.51	183.75	216.92	241.52	265.94	290.04	319.38	341.56	WRFG-CGCM3 (future)
12	53.85	114.27	148.11	170.49	198.78	219.76	240.59	261.34	288.72	309.42	WRFG-CCSM (future)
13	50.00	104.7	145.71	166.53	192.83	212.35	231.72	251.01	276.48	298.18	MM5I-CCSM (historical)
14	46.15	104.18	133.51	153.04	181.68	203.78	225.71	247.56	276.39	295.72	MM5I-HadCM3 (historical)
15	42.31	100.85	131.57	152.58	180.17	200.3	220.28	240.18	266.45	286.3	WRFG-CCSM (historical)
16	38.46	100.45	128.35	151.89	176.68	194.56	212.31	229.99	253.32	270.95	ECP2-GFDL (future)
17	34.62	99.13	128.32	147.93	172.67	191.02	209.24	227.38	251.33	269.42	MM5I-CCSM (future)
18	30.77	98.78	125.89	142.73	164	179.79	195.46	211.07	231.66	247.23	ECP2-HadCM3 (historical)
19	26.92	92.71	121.85	135.76	154.97	170.84	186.6	202.29	223	238.66	ECP2-GFDL (historical)
20	23.08	91.07	116.64	133.58	153.33	166.37	179.31	192.2	209.21	222.07	ECP2-HadCM3 (future)
21	19.23	59.52	80.43	94.28	111.77	124.74	137.63	150.46	167.39	180.19	CRCM-CGCM3 (future)
22	15.38	44.46	60.5	71.12	84.54	94.49	104.37	114.22	127.2	137.02	CRCM-CGCM3 (historical)
23	11.54	42.09	55.26	63.98	74.99	83.17	91.28	99.36	110.02	118.08	CRCM-CCSM (future)
24	7.69	35.13	48.95	58.1	69.67	78.24	86.76	95.24	106.43	114.89	CRCM-CCSM (historical)
25	3.85	30.94	44.59	53.62	65.04	73.51	81.91	90.29	101.33	109.69	Observed
Gauge: 440561; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	114.93	190.42	250.58	326.58	382.97	438.94	494.7	568.27	623.88	RCM3-CGCM3 (future)
2	92.31	111.72	171.48	224.88	292.36	342.41	392.1	441.61	506.92	556.28	RCM3-GFDL (future)
3	88.46	107.96	167.36	206.1	261.36	307.9	354.09	400.12	460.85	506.74	RCM3-GFDL (historical)
4	84.62	102.43	167.01	202.07	255.5	292.15	328.53	364.77	412.59	448.73	HRM3-HadCM3 (historical)
5	80.77	99.57	156.79	198.62	245.93	278.47	310.77	342.95	385.41	417.5	HRM3-HadCM3 (future)
6	76.92	95.47	148.97	186.64	224.34	252.31	280.07	307.74	344.23	371.81	HRM3-GFDL (future)
7	73.08	90.82	134.98	164.54	201.88	229.58	257.08	284.47	320.62	347.94	HRM3-GFDL (historical)
8	69.23	90.34	133.58	154.21	181.24	205.78	230.13	254.39	286.4	310.59	RCM3-CGCM3 (historical)
9	65.38	84.28	124.09	148.18	180.27	199.6	218.79	237.91	263.13	282.2	MM5I-HadCM3 (future)
10	61.54	82.47	122	143.05	166.99	184.76	202.39	219.96	243.57	262.47	WRFG-CGCM3 (historical)
11	57.69	81.34	115.16	135.6	161.43	180.6	199.62	218.57	243.14	260.65	WRFG-CGCM3 (future)
12	53.85	81.24	107.76	125.26	147.36	163.76	180.04	196.26	217.65	233.82	WRFG-CCSM (future)
13	50.00	73.97	105.89	122.21	142.82	158.12	173.3	188.43	208.39	223.76	MM5I-CCSM (historical)
14	46.15	73.9	96.16	111.3	133.69	150.77	167.73	184.63	206.92	223.47	MM5I-HadCM3 (historical)
15	42.31	70.85	94.74	110.9	132.21	147.73	163.13	178.47	198.72	214.02	WRFG-CCSM (historical)
16	38.46	70.56	92.43	110.66	129.53	143.34	157.05	170.72	188.74	202.37	ECP2-GFDL (future)
17	34.62	69.74	92.05	107	125.89	139.9	153.81	167.67	185.96	199.77	MM5I-CCSM (future)
18	30.77	69.47	90.3	103.38	119.89	132.14	144.3	156.42	172.41	184.49	ECP2-HadCM3 (historical)
19	26.92	64.9	86.92	97.56	112.17	124.25	136.24	148.19	163.96	175.87	ECP2-GFDL (historical)
20	23.08	63.52	82.99	95.88	111	120.97	130.87	140.73	153.74	163.57	ECP2-HadCM3 (future)
21	19.23	40.06	55.47	65.67	78.57	88.13	97.62	107.08	119.56	129	CRCM-CGCM3 (future)
22	15.38	29.14	40.71	48.37	58.04	65.22	72.35	79.45	88.82	95.9	CRCM-CGCM3 (historical)
23	11.54	27.42	36.83	43.05	50.92	56.75	62.54	68.32	75.93	81.68	CRCM-CCSM (future)
24	7.69	22.6	32.31	38.74	46.86	52.89	58.87	64.83	72.7	78.64	CRCM-CCSM (historical)
25	3.85	18.43	28.62	35.36	43.89	50.21	56.49	62.74	70.99	77.23	Observed
Gauge: 440561; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	93.37	156.92	207.26	270.86	318.04	364.87	411.54	473.1	519.63	RCM3-CGCM3 (future)
2	92.31	90.71	141.09	185.79	242.27	284.17	325.77	367.21	421.88	463.2	RCM3-GFDL (future)
3	88.46	87.66	137.06	169.4	216.72	255.75	294.48	333.07	383.99	422.47	RCM3-GFDL (historical)
4	84.62	82.97	136.84	165.99	210.54	241.06	271.36	301.54	341.37	371.47	HRM3-HadCM3 (historical)
5	80.77	80.89	128.11	164.12	202.54	229.66	256.57	283.39	318.77	345.51	HRM3-HadCM3 (future)
6	76.92	77.21	122.49	152.87	184.16	207.37	230.41	253.36	283.65	306.53	HRM3-GFDL (future)
7	73.08	73.57	110.09	134.6	165.58	188.56	211.37	234.1	264.08	286.74	HRM3-GFDL (historical)
8	69.23	73.06	108.73	125.78	148.25	168.54	188.68	208.74	235.21	255.22	RCM3-CGCM3 (historical)
9	65.38	68.03	100.88	120.91	147.32	163.3	179.16	194.97	215.82	231.58	MM5I-HadCM3 (future)
10	61.54	66.58	99.26	116.55	136.35	151.03	165.61	180.14	199.3	214.86	WRFG-CGCM3 (historical)
11	57.69	65.57	93.47	110.32	131.6	147.39	163.07	178.68	199.28	213.79	WRFG-CGCM3 (future)
12	53.85	65.48	87.36	101.78	120	133.52	146.94	160.31	177.95	191.28	WRFG-CCSM (future)
13	50.00	59.62	85.82	99.29	116.31	128.94	141.47	153.95	170.43	182.88	MM5I-HadCM3 (historical)
14	46.15	59.46	77.75	90.2	108.66	122.71	136.65	150.54	168.87	182.72	MM5I-CCSM (historical)
15	42.31	56.94	76.6	89.87	107.38	120.13	132.78	145.38	162.01	174.58	WRFG-CCSM (historical)
16	38.46	56.7	74.75	89.73	105.17	116.52	127.79	139.02	153.83	165.03	ECP2-GFDL (future)
17	34.62	56.06	74.35	86.61	102.1	113.59	124.99	136.36	151.35	162.68	MM5I-CCSM (future)
18	30.77	55.84	72.95	83.71	97.31	107.39	117.4	127.38	140.54	150.49	ECP2-HadCM3 (historical)
19	26.92	52.11	70.12	78.84	90.79	100.69	110.51	120.29	133.2	142.96	ECP2-GFDL (historical)
20	23.08	50.96	66.9	77.46	89.86	98.04	106.16	114.25	124.92	132.98	ECP2-HadCM3 (future)
21	19.23	31.84	44.37	52.66	63.13	70.9	78.62	86.3	96.44	104.11	CRCM-CGCM3 (future)
22	15.38	23.02	32.37	38.56	46.38	52.19	57.95	63.69	71.26	76.98	CRCM-CGCM3 (historical)
23	11.54	21.63	29.21	34.23	40.58	45.28	49.95	54.61	60.75	65.39	CRCM-CCSM (future)
24	7.69	17.76	25.56	30.73	37.26	42.1	46.91	51.7	58.02	62.79	CRCM-CCSM (historical)
25	3.85	13.89	20.43	24.76	30.23	34.29	38.32	42.34	47.63	51.63	Observed
Gauge: 440561; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

	Pr (x ≤ X)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
Rank	Non-exceedance	2	5	10	25	50	100	200	500	1000	Data Source
	Probability (%)	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	for 1000-year
1	96.15	73.74	121.32	159.35	207.39	243.04	278.42	313.67	360.17	395.32	RCM3-CGCM3 (future)
2	92.31	71.7	109.35	143.1	185.75	217.39	248.8	280.09	321.37	352.57	RCM3-GFDL (future)
3	88.46	69.29	106.95	131.48	165.98	195.37	224.55	253.62	291.96	320.95	RCM3-GFDL (historical)
4	84.62	65.82	106.7	128.94	162.78	186	209.05	232.01	262.31	285.21	HRM3-HadCM3 (historical)
5	80.77	63.89	100.32	126.36	156.72	177.33	197.79	218.17	245.06	265.39	HRM3-HadCM3 (future)
6	76.92	61.39	95.01	119.26	143.2	160.96	178.59	196.15	219.32	236.83	HRM3-GFDL (future)
7	73.08	58.37	86.44	105.21	128.92	146.51	163.97	181.36	204.31	221.65	HRM3-GFDL (historical)
8	69.23	58.1	85.63	98.75	115.89	131.49	146.97	162.39	182.75	198.13	RCM3-CGCM3 (historical)
9	65.38	54.24	79.59	94.86	115.32	127.62	139.83	151.99	168.03	180.16	MM5I-HadCM3 (future)
10	61.54	53.09	78.22	91.64	106.87	118.17	129.39	140.56	155.73	167.77	WRFG-CGCM3 (historical)
11	57.69	52.38	73.92	86.94	103.4	115.61	127.72	139.8	155.3	166.44	WRFG-CGCM3 (future)
12	53.85	52.33	69.21	80.35	94.43	104.87	115.23	125.56	139.19	149.48	WRFG-CCSM (future)
13	50.00	47.65	68.03	78.42	91.55	101.29	110.96	120.59	133.3	143.17	MM5I-CCSM (historical)
14	46.15	47.65	61.85	71.5	85.74	96.63	107.45	118.22	132.43	142.91	MM5I-HadCM3 (historical)
15	42.31	45.71	60.94	71.24	84.84	94.74	104.57	114.36	127.28	137.04	WRFG-CCSM (historical)
16	38.46	45.52	59.44	71.06	83.11	91.92	100.67	109.38	120.87	129.56	ECP2-GFDL (future)
17	34.62	44.99	59.23	68.78	80.85	89.8	98.68	107.53	119.21	128.04	MM5I-CCSM (future)
18	30.77	44.81	58.11	66.44	76.97	84.77	92.53	100.25	110.44	118.14	ECP2-HadCM3 (historical)
19	26.92	41.89	55.97	62.77	72.09	79.8	87.46	95.1	105.16	112.77	ECP2-GFDL (historical)
20	23.08	41.02	53.45	61.69	71.35	77.72	84.04	90.33	98.64	104.92	ECP2-HadCM3 (future)
21	19.23	25.97	35.86	42.41	50.68	56.82	62.91	68.98	76.99	83.04	CRCM-CGCM3 (future)
22	15.38	18.97	26.41	31.33	37.56	42.18	46.76	51.33	57.35	61.91	CRCM-CGCM3 (historical)
23	11.54	17.87	23.92	27.93	32.99	36.75	40.48	44.19	49.09	52.8	CRCM-CCSM (future)
24	7.69	14.74	21	25.15	30.39	34.28	38.14	41.99	47.06	50.89	CRCM-CCSM (historical)
25	3.85	11.37	16.43	19.77	24	27.14	30.25	33.35	37.45	40.54	Observed
Gauge: 440561; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	81.04	136.27	180.01	235.28	276.28	316.98	357.53	411.03	451.46	RCM3-CGCM3 (future)
2	92.31	78.74	122.51	161.35	210.43	246.85	282.99	319	366.51	402.41	RCM3-GFDL (future)
3	88.46	76.08	119.01	147.11	188.23	222.14	255.8	289.34	333.59	367.03	RCM3-GFDL (historical)
4	84.62	72.01	118.82	144.15	182.86	209.39	235.71	261.94	296.55	322.7	HRM3-HadCM3 (historical)
5	80.77	70.2	111.24	142.52	175.91	199.47	222.85	246.16	276.9	300.13	HRM3-HadCM3 (future)
6	76.92	67	106.35	132.75	159.93	180.1	200.12	220.06	246.37	266.26	HRM3-GFDL (future)
7	73.08	63.84	95.57	116.87	143.79	163.76	183.58	203.33	229.38	249.07	HRM3-GFDL (historical)
8	69.23	63.39	94.39	109.2	128.75	146.38	163.89	181.32	204.33	221.72	RCM3-CGCM3 (historical)
9	65.38	59.02	87.56	104.98	127.92	141.81	155.59	169.33	187.45	201.14	MM5I-HadCM3 (future)
10	61.54	57.76	86.17	101.18	118.38	131.14	143.81	156.43	173.09	186.62	WRFG-CGCM3 (historical)
11	57.69	56.89	81.13	95.77	114.27	127.99	141.61	155.18	173.09	185.67	WRFG-CGCM3 (future)
12	53.85	56.81	75.82	88.35	104.19	115.94	127.6	139.22	154.55	166.13	WRFG-CCSM (future)
13	50.00	51.71	74.48	86.18	100.97	111.94	122.82	133.67	147.98	158.8	MM5I-HadCM3 (historical)
14	46.15	51.58	67.47	78.29	94.35	106.56	118.67	130.75	146.68	158.72	MM5I-CCSM (historical)
15	42.31	49.38	66.47	78	93.23	104.31	115.3	126.26	140.71	151.64	WRFG-CCSM (historical)
16	38.46	49.18	64.87	77.89	91.3	101.17	110.96	120.72	133.59	143.32	ECP2-GFDL (future)
17	34.62	48.62	64.51	75.16	88.62	98.6	108.51	118.38	131.4	141.25	MM5I-CCSM (future)
18	30.77	48.43	63.3	72.65	84.46	93.23	101.93	110.59	122.03	130.67	ECP2-HadCM3 (historical)
19	26.92	45.19	60.83	68.42	78.81	87.41	95.94	104.45	115.67	124.15	ECP2-GFDL (historical)
20	23.08	44.18	58.04	67.22	78	85.11	92.16	99.19	108.47	115.48	ECP2-HadCM3 (future)
21	19.23	27.58	38.46	45.66	54.76	61.51	68.21	74.89	83.7	90.36	CRCM-CGCM3 (future)
22	15.38	19.91	28.03	33.41	40.2	45.24	50.25	55.23	61.81	66.78	CRCM-CGCM3 (historical)
23	11.54	18.71	25.29	29.65	35.16	39.24	43.3	47.34	52.67	56.7	CRCM-CCSM (future)
24	7.69	15.34	22.12	26.61	32.28	36.48	40.66	44.82	50.31	54.46	CRCM-CCSM (historical)
25	3.85	8.84	12.38	14.72	17.68	19.87	22.05	24.22	27.08	29.24	Observed
Gauge: 440561; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

	Pr (x ≤ X)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
Rank	Non-exceedance	2	5	10	25	50	100	200	500	1000	Data Source
	Probability (%)	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	for 1000-year
1	96.15	54.22	91	120.14	156.95	184.25	211.36	238.36	273.99	300.92	RCM3-CGCM3 (future)
2	92.31	52.69	81.85	107.72	140.41	164.66	188.74	212.72	244.37	268.28	RCM3-GFDL (future)
3	88.46	50.92	79.5	98.23	125.62	148.2	170.62	192.96	222.43	244.7	RCM3-GFDL (historical)
4	84.62	48.21	79.39	96.24	122.04	139.71	157.24	174.72	197.76	215.19	HRM3-HadCM3 (historical)
5	80.77	47	74.33	95.17	117.4	133.09	148.66	164.18	184.65	200.13	HRM3-HadCM3 (future)
6	76.92	44.87	71.08	88.66	106.77	120.2	133.53	146.81	164.34	177.58	HRM3-GFDL (future)
7	73.08	42.77	63.9	78.09	96.01	109.31	122.52	135.67	153.02	166.14	HRM3-GFDL (historical)
8	69.23	42.47	63.12	72.99	85.99	97.73	109.39	121	136.32	147.9	RCM3-CGCM3 (historical)
9	65.38	39.56	58.57	70.16	85.46	94.71	103.9	113.05	125.12	134.24	MM5I-HadCM3 (future)
10	61.54	38.71	57.63	67.64	79.1	87.6	96.04	104.45	115.54	124.53	WRFG-CGCM3 (historical)
11	57.69	38.14	54.29	64.03	76.35	85.49	94.56	103.59	115.52	123.92	WRFG-CGCM3 (future)
12	53.85	38.08	50.74	59.08	69.63	77.45	85.21	92.94	103.15	110.86	WRFG-CCSM (future)
13	50.00	34.69	49.85	57.65	67.49	74.8	82.05	89.28	98.81	106.01	MM5I-HadCM3 (historical)
14	46.15	34.6	45.19	52.39	63.07	71.2	79.27	87.3	97.91	105.93	MM5I-CCSM (historical)
15	42.31	33.14	44.52	52.2	62.33	69.71	77.03	84.32	93.95	101.22	WRFG-CCSM (historical)
16	38.46	33	43.44	52.11	61.06	67.63	74.15	80.65	89.22	95.7	ECP2-GFDL (future)
17	34.62	32.63	43.22	50.31	59.27	65.92	72.52	79.09	87.76	94.32	MM5I-CCSM (future)
18	30.77	32.51	42.41	48.63	56.5	62.33	68.12	73.9	81.51	87.26	ECP2-HadCM3 (historical)
19	26.92	30.35	40.77	45.82	52.73	58.45	64.14	69.8	77.27	82.92	ECP2-GFDL (historical)
20	23.08	29.68	38.9	45.01	52.2	56.93	61.63	66.31	72.49	77.15	ECP2-HadCM3 (future)
21	19.23	18.61	25.86	30.66	36.72	41.22	45.68	50.13	56	60.43	CRCM-CGCM3 (future)
22	15.38	13.51	18.92	22.5	27.03	30.39	33.72	37.04	41.42	44.73	CRCM-CGCM3 (historical)
23	11.54	12.71	17.09	19.99	23.66	26.38	29.08	31.77	35.32	38	CRCM-CCSM (future)
24	7.69	10.47	14.99	17.98	21.75	24.56	27.34	30.11	33.77	36.53	CRCM-CCSM (historical)
25	3.85	5.3	7.33	8.67	10.36	11.62	12.86	14.11	15.74	16.98	Observed
Gauge: 440561; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	28.38	47.39	62.43	81.45	95.56	109.56	123.51	141.91	155.82	RCM3-CGCM3 (future)
2	92.31	27.59	42.65	56.02	72.9	85.43	97.86	110.25	126.6	138.95	RCM3-GFDL (future)
3	88.46	26.68	41.44	51.12	65.26	76.93	88.51	100.05	115.27	126.77	RCM3-GFDL (historical)
4	84.62	25.28	41.38	50.09	63.42	72.55	81.61	90.63	102.54	111.54	HRM3-HadCM3 (historical)
5	80.77	24.66	38.77	49.54	61.02	69.12	77.17	85.19	95.76	103.76	HRM3-HadCM3 (future)
6	76.92	23.55	37.09	46.17	55.53	62.46	69.35	76.21	85.26	92.11	HRM3-GFDL (future)
7	73.08	22.47	33.38	40.7	49.96	56.83	63.64	70.43	79.39	86.16	HRM3-GFDL (historical)
8	69.23	22.31	32.98	38.07	44.8	50.86	56.88	62.88	70.8	76.78	RCM3-CGCM3 (historical)
9	65.38	20.82	30.63	36.62	44.51	49.29	54.03	58.76	64.99	69.7	MM5I-HadCM3 (future)
10	61.54	20.37	30.15	35.32	41.24	45.63	50	54.34	60.07	64.73	WRFG-CGCM3 (historical)
11	57.69	20.08	28.42	33.46	39.83	44.55	49.24	53.91	60.07	64.4	WRFG-CGCM3 (future)
12	53.85	20.05	26.59	30.9	36.35	40.4	44.41	48.41	53.68	57.67	WRFG-CCSM (future)
13	50.00	18.3	26.13	30.16	35.24	39.02	42.76	46.49	51.42	55.14	MM5I-HadCM3 (historical)
14	46.15	18.25	23.72	27.45	32.97	37.17	41.34	45.49	50.97	55.12	MM5I-CCSM (historical)
15	42.31	17.5	23.38	27.35	32.59	36.4	40.18	43.95	48.92	52.68	WRFG-CCSM (historical)
16	38.46	17.43	22.82	27.3	31.92	35.32	38.69	42.04	46.47	49.82	ECP2-GFDL (future)
17	34.62	17.24	22.7	26.37	30.99	34.43	37.84	41.23	45.71	49.1	MM5I-CCSM (future)
18	30.77	17.17	22.29	25.51	29.57	32.59	35.58	38.57	42.5	45.48	ECP2-HadCM3 (historical)
19	26.92	16.05	21.44	24.05	27.61	30.56	33.5	36.42	40.28	43.19	ECP2-GFDL (historical)
20	23.08	15.7	20.47	23.62	27.35	29.79	32.22	34.64	37.83	40.24	ECP2-HadCM3 (future)
21	19.23	10	13.73	16.21	19.34	21.66	23.96	26.25	29.28	31.57	CRCM-CGCM3 (future)
22	15.38	7.36	10.15	12	14.34	16.07	17.79	19.51	21.77	23.48	CRCM-CGCM3 (historical)
23	11.54	6.94	9.2	10.7	12.59	14	15.39	16.78	18.61	20	CRCM-CCSM (future)
24	7.69	5.79	8.12	9.66	11.62	13.06	14.5	15.93	17.82	19.25	CRCM-CCSM (historical)
25	3.85	2.88	4.06	4.85	5.84	6.57	7.3	8.03	8.99	9.71	Observed
Gauge: 440561; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	14.84	24.66	32.44	42.27	49.57	56.81	64.02	73.54	80.73	RCM3-CGCM3 (future)
2	92.31	14.43	22.22	29.13	37.86	44.34	50.76	57.17	65.62	72.01	RCM3-GFDL (future)
3	88.46	13.96	21.59	26.59	33.9	39.94	45.92	51.89	59.76	65.71	RCM3-GFDL (historical)
4	84.62	13.23	21.56	26.06	32.95	37.66	42.35	47.01	53.16	57.82	HRM3-HadCM3 (historical)
5	80.77	12.91	20.21	25.77	31.71	35.9	40.05	44.2	49.67	53.8	HRM3-HadCM3 (future)
6	76.92	12.34	19.33	24.03	28.87	32.45	36.01	39.56	44.24	47.78	HRM3-GFDL (future)
7	73.08	11.78	17.42	21.2	25.98	29.53	33.05	36.56	41.19	44.69	HRM3-GFDL (historical)
8	69.23	11.7	17.21	19.84	23.32	26.46	29.57	32.67	36.77	39.86	RCM3-CGCM3 (historical)
9	65.38	10.92	16	19.09	23.17	25.64	28.09	30.53	33.75	36.18	MM5I-HadCM3 (future)
10	61.54	10.69	15.75	18.42	21.48	23.75	26.01	28.25	31.21	33.61	WRFG-CGCM3 (historical)
11	57.69	10.54	14.85	17.46	20.75	23.19	25.61	28.02	31.21	33.45	WRFG-CGCM3 (future)
12	53.85	10.53	13.91	16.14	18.96	21.05	23.12	25.19	27.91	29.97	WRFG-CCSM (future)
13	50.00	9.61	13.67	15.75	18.39	20.34	22.28	24.21	26.76	28.68	MM5I-HadCM3 (historical)
14	46.15	9.59	12.42	14.34	17.2	19.38	21.53	23.68	26.51	28.65	MM5I-CCSM (historical)
15	42.31	9.2	12.24	14.29	17	18.97	20.92	22.87	25.44	27.38	WRFG-CCSM (historical)
16	38.46	9.17	11.96	14.28	16.66	18.42	20.16	21.89	24.18	25.91	ECP2-GFDL (future)
17	34.62	9.07	11.9	13.8	16.19	17.97	19.73	21.49	23.81	25.56	MM5I-CCSM (future)
18	30.77	9.04	11.68	13.35	15.44	17	18.55	20.09	22.12	23.66	ECP2-HadCM3 (historical)
19	26.92	8.46	11.23	12.58	14.44	15.97	17.49	19	21	22.51	ECP2-GFDL (historical)
20	23.08	8.28	10.75	12.38	14.28	15.54	16.79	18.04	19.69	20.93	ECP2-HadCM3 (future)
21	19.23	5.33	7.27	8.55	10.17	11.37	12.56	13.75	15.31	16.5	CRCM-CGCM3 (future)
22	15.38	3.96	5.41	6.37	7.58	8.48	9.37	10.26	11.44	12.32	CRCM-CGCM3 (historical)
23	11.54	3.75	4.93	5.71	6.69	7.42	8.14	8.86	9.82	10.53	CRCM-CCSM (future)
24	7.69	3.16	4.36	5.15	6.16	6.91	7.65	8.38	9.36	10.09	CRCM-CCSM (historical)
25	3.85	1.88	2.59	3.07	3.67	4.11	4.55	4.99	5.57	6.01	Observed
Gauge: 440561; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	9.66	15.98	20.99	27.32	32.01	36.67	41.31	47.44	52.07	RCM3-CGCM3 (future)
2	92.31	9.39	14.41	18.86	24.47	28.64	32.78	36.9	42.34	46.45	RCM3-GFDL (future)
3	88.46	9.09	14.01	17.23	21.93	25.81	29.67	33.51	38.57	42.4	RCM3-GFDL (historical)
4	84.62	8.62	13.99	16.89	21.32	24.36	27.38	30.38	34.35	37.34	HRM3-HadCM3 (historical)
5	80.77	8.41	13.11	16.7	20.53	23.22	25.9	28.57	32.09	34.75	HRM3-HadCM3 (future)
6	76.92	8.05	12.55	15.57	18.68	20.99	23.29	25.57	28.58	30.86	HRM3-GFDL (future)
7	73.08	7.69	11.32	13.76	16.84	19.13	21.4	23.66	26.65	28.9	HRM3-GFDL (historical)
8	69.23	7.64	11.19	12.88	15.11	17.13	19.13	21.13	23.76	25.75	RCM3-CGCM3 (historical)
9	65.38	7.14	10.41	12.39	15.03	16.62	18.2	19.77	21.84	23.41	MM5I-HadCM3 (future)
10	61.54	6.99	10.24	11.97	13.95	15.41	16.87	18.31	20.22	21.78	WRFG-CGCM3 (historical)
11	57.69	6.89	9.67	11.35	13.48	15.05	16.61	18.17	20.22	21.67	WRFG-CGCM3 (future)
12	53.85	6.88	9.05	10.49	12.3	13.64	14.98	16.3	18.06	19.38	WRFG-CCSM (future)
13	50.00	6.3	8.91	10.25	11.94	13.2	14.44	15.69	17.32	18.56	MM5I-CCSM (historical)
14	46.15	6.28	8.1	9.33	11.18	12.58	13.97	15.35	17.18	18.56	MM5I-CCSM (historical)
15	42.31	6.04	7.98	9.31	11.04	12.31	13.57	14.82	16.47	17.72	WRFG-CCSM (historical)
16	38.46	6.01	7.8	9.3	10.83	11.96	13.08	14.2	15.67	16.79	ECP2-GFDL (future)
17	34.62	5.94	7.76	8.97	10.51	11.65	12.78	13.91	15.4	16.53	MM5I-CCSM (future)
18	30.77	5.92	7.63	8.7	10.05	11.05	12.05	13.04	14.35	15.34	ECP2-HadCM3 (historical)
19	26.92	5.55	7.34	8.21	9.41	10.4	11.38	12.35	13.64	14.61	ECP2-GFDL (historical)
20	23.08	5.43	7.03	8.08	9.3	10.12	10.92	11.73	12.78	13.58	ECP2-HadCM3 (future)
21	19.23	3.54	4.78	5.61	6.65	7.43	8.19	8.96	9.97	10.73	CRCM-CGCM3 (future)
22	15.38	2.66	3.59	4.2	4.98	5.55	6.12	6.69	7.44	8.01	CRCM-CGCM3 (historical)
23	11.54	2.52	3.27	3.77	4.4	4.86	5.33	5.79	6.4	6.86	CRCM-CCSM (future)
24	7.69	2.14	2.91	3.43	4.08	4.56	5.04	5.52	6.15	6.62	CRCM-CCSM (historical)
25	3.85	1.36	1.84	2.15	2.55	2.85	3.14	3.44	3.82	4.12	Observed
Gauge: 440561; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	242.72	324.83	397.26	505.44	585.7	665.37	744.75	849.47	928.61	RCM3-GFDL (historical)
2	92.31	238.99	311.63	379.19	459.67	522.32	584.5	646.45	728.19	789.96	RCM3-CGCM3 (future)
3	88.46	227.65	308.4	375.23	447.88	506.98	572.19	637.15	722.86	787.64	RCM3-CGCM3 (historical)
4	84.62	224.8	308.11	368.18	444.09	500.4	556.29	611.98	685.45	740.98	HRM3-HadCM3 (historical)
5	80.77	217.38	307.56	352.97	441.3	498.83	549.41	599.81	666.3	716.55	HRM3-GFDL (future)
6	76.92	207.46	294.11	352.75	410.34	452.9	495.14	537.23	594.98	643.28	RCM3-GFDL (future)
7	73.08	204.24	282.67	338.11	393.7	434.94	482.64	531.08	592.76	634.73	HRM3-HadCM3 (future)
8	69.23	198.94	276.33	319.03	385.05	434.03	475.88	516.67	570.49	611.16	WRFG-CGCM3 (future)
9	65.38	196.93	266.78	310.45	353.56	385.54	417.28	453.17	516.54	564.44	Observed
10	61.54	192.03	254.51	287.8	330.52	364.92	405.13	448.91	490.64	522.17	MM5I-HadCM3 (future)
11	57.69	189.9	247.46	284.16	329.86	361.06	399.07	433.09	477.97	511.89	MM5I-HadCM3 (historical)
12	53.85	188.79	246.92	278.69	318.82	356.92	392.03	422.89	464.62	501.55	MM5I-CCSM (historical)
13	50.00	187.86	241.37	270.79	311.19	348.6	378.71	415.75	463.6	494.37	WRFG-CCSM (future)
14	46.15	182.31	238.44	270.58	308.35	341.53	378.15	407.6	446.45	475.81	ECP2-HadCM3 (future)
15	42.31	180.07	229.33	256.18	307.96	341.32	371.22	401.02	440.32	470.03	WRFG-CGCM3 (historical)
16	38.46	176.83	222.19	255.3	304.08	335.53	362.91	390.18	430.17	460.77	WRFG-CCSM (historical)
17	34.62	173.53	219.32	253.59	297.13	328.17	358.98	389.67	426.16	453.35	HRM3-GFDL (historical)
18	30.77	172.18	215.14	249.64	290.09	316.38	344.59	372.69	409.78	437.8	ECP2-GFDL (historical)
19	26.92	170	213.85	245.03	287.95	315.26	340.23	366.32	402.87	430.5	MM5I-CCSM (future)
20	23.08	153.28	213.63	242.88	282.79	310.81	338.61	365.12	397.95	422.76	ECP2-GFDL (future)
21	19.23	113.21	191.06	236.21	264.47	285.43	306.24	326.97	354.32	374.99	ECP2-HadCM3 (historical)
22	15.38	112.8	146.09	167.85	195.35	215.76	236.01	256.18	282.8	302.92	CRCM-CGCM3 (future)
23	11.54	88.73	118.75	139.67	166.1	185.71	205.17	224.56	250.14	269.48	CRCM-CGCM3 (historical)
24	7.69	87.16	118.17	137.66	162.28	180.55	198.68	216.75	240.59	258.6	CRCM-CCSM (future)
25	3.85	73.44	102.72	122.11	146.61	164.79	182.83	200.81	224.52	242.45	CRCM-CCSM (historical)
Gauge: 442044; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	194.86	276.34	366.94	481.42	566.34	650.64	734.64	845.45	929.2	RCM3-GFDL (historical)
2	92.31	190.74	275.91	332.46	418.24	481.89	549.4	617.82	708.1	776.32	RCM3-CGCM3 (historical)
3	88.46	179.55	264.56	329.57	411.54	480.72	545.06	608	691.04	753.8	RCM3-CGCM3 (future)
4	84.62	176.32	261.14	320.69	397.37	451.76	507.17	562.37	635.21	690.25	HRM3-HadCM3 (historical)
5	80.77	171.19	256.97	318.28	395.94	447.66	497.59	547.33	612.96	662.56	HRM3-GFDL (future)
6	76.92	162.01	244.56	300.82	356.22	397.32	438.12	484.41	548.02	596.08	RCM3-GFDL (future)
7	73.08	157.28	244.47	287.6	341.98	387.82	436.2	478.77	532.39	572.92	HRM3-HadCM3 (future)
8	69.23	152.12	225.73	273.36	339.07	382.32	422.37	462.27	514.91	554.69	WRFG-CGCM3 (future)
9	65.38	150.33	221.36	258.44	299.77	330.44	360.87	391.2	431.21	461.45	MM5I-HadCM3 (future)
10	61.54	146.27	204.25	235.35	275.98	308.19	340.17	372.03	414.07	445.84	MM5I-HadCM3 (historical)
11	57.69	143.94	198.18	232.55	274.64	303.79	332.73	361.56	399.59	431.3	MM5I-CCSM (historical)
12	53.85	142.81	197.41	227.39	265.27	293.37	321.27	352.66	397.45	428.34	WRFG-CCSM (future)
13	50.00	142.7	191.39	219.46	257.48	285.68	318.71	349.06	385.73	413.44	ECP2-HadCM3 (future)
14	46.15	139.49	189.38	218.57	252.92	284.63	313.67	341.56	378.36	406.17	WRFG-CGCM3 (historical)
15	42.31	134.53	180	205.1	250.31	278.4	303.69	329.6	367.12	395.47	WRFG-CCSM (historical)
16	38.46	132.98	174.42	204.7	243.86	272.62	301.16	328.89	362.14	387.27	HRM3-GFDL (historical)
17	34.62	129.14	171.32	204.04	235.9	260.71	286.7	312.59	346.74	372.56	ECP2-GFDL (historical)
18	30.77	128.09	167.68	199.25	234.54	259.05	282.03	307.64	341.48	367.05	MM5I-CCSM (future)
19	26.92	125.88	167.41	195.35	230.31	256.24	281.99	304.93	335.13	357.96	ECP2-GFDL (future)
20	23.08	112.1	165.47	185.95	211.84	231.04	250.1	269.09	294.14	313.07	ECP2-HadCM3 (historical)
21	19.23	77.3	104.8	123.01	151	173.38	195.59	217.72	246.92	268.98	Observed
22	15.38	60.91	96.97	120.84	146.02	163.08	180.03	196.9	219.17	236.01	CRCM-CGCM3 (future)
23	11.54	57.82	82.08	98.94	120.23	136.04	151.72	167.35	187.96	203.54	CRCM-CGCM3 (historical)
24	7.69	56.62	81.18	96.65	116.2	130.7	145.1	159.44	178.36	192.66	CRCM-CCSM (future)
25	3.85	46.34	68.65	83.42	102.08	115.92	129.66	143.35	161.41	175.06	CRCM-CCSM (historical)
Gauge: 442044; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	148	212.75	283.86	373.7	440.36	506.52	572.44	659.4	725.13	RCM3-GFDL (historical)
2	92.31	144.76	211.02	255.72	322.7	373	426.88	480.56	551.39	604.92	RCM3-CGCM3 (historical)
3	88.46	136.06	202.71	252.75	318.72	372.39	421.71	470.85	535.68	584.68	RCM3-CGCM3 (future)
4	84.62	133.5	199.72	246.05	305.48	348.03	391.14	434.09	490.76	533.59	HRM3-HadCM3 (historical)
5	80.77	129.73	196.11	245.56	304.6	344.6	383.42	422.11	473.14	511.72	HRM3-GFDL (future)
6	76.92	122.64	187.65	230.11	273.07	304.94	336.58	373.73	423.26	460.69	RCM3-GFDL (future)
7	73.08	118.82	186.55	219.99	262.23	298.52	336.19	368.1	409.68	441.11	HRM3-HadCM3 (future)
8	69.23	114.82	171.77	209.39	260.56	293.57	324.67	355.67	396.56	427.46	WRFG-CGCM3 (future)
9	65.38	113.44	168.9	197.11	229.13	252.88	276.46	299.95	330.95	354.37	MM5I-HadCM3 (future)
10	61.54	110.36	155.09	179.1	210.54	235.42	260.12	284.73	317.2	341.74	MM5I-HadCM3 (historical)
11	57.69	108.52	150.45	177	209.44	231.95	254.29	276.55	305.92	330.07	MM5I-CCSM (historical)
12	53.85	107.73	149.84	173.02	202.31	224.04	245.61	269.49	303.99	328.12	WRFG-CCSM (future)
13	50.00	107.55	145.09	166.85	196.2	217.98	243.33	267.1	295.45	316.88	ECP2-HadCM3 (future)
14	46.15	105.35	143.61	166.05	192.53	217.08	239.6	261.14	289.56	311.03	WRFG-CGCM3 (historical)
15	42.31	101.24	136.3	155.76	190.64	212.18	231.68	251.81	280.76	302.63	WRFG-CCSM (historical)
16	38.46	100.19	132.09	155.33	185.67	207.85	229.87	251.11	276.74	296.11	HRM3-GFDL (historical)
17	34.62	97.14	129.65	154.99	179.38	198.55	218.58	238.54	264.86	284.76	ECP2-GFDL (historical)
18	30.77	96.35	126.87	151.18	178.37	197.22	215.05	234.84	260.94	280.67	MM5I-CCSM (future)
19	26.92	94.63	126.77	148.21	175.18	195.19	214.93	232.57	255.85	273.44	ECP2-GFDL (future)
20	23.08	84.16	125.07	140.84	160.77	175.56	190.24	204.86	224.15	238.73	ECP2-HadCM3 (historical)
21	19.23	57.53	78.48	92.35	109.88	122.88	135.79	148.65	165.62	178.58	Observed
22	15.38	42.78	66.01	81.63	101.37	116.02	130.55	145.03	164.14	178.44	CRCM-CGCM3 (future)
23	11.54	42.42	61.19	73.98	90.13	102.11	114.01	125.86	141.5	153.31	CRCM-CGCM3 (historical)
24	7.69	41.88	60.47	72.18	86.97	97.94	108.84	119.69	134.01	144.83	CRCM-CCSM (future)
25	3.85	34.16	50.95	62.07	76.11	86.53	96.88	107.18	120.78	131.06	CRCM-CCSM (historical)
Gauge: 442044; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	123.59	181.43	243.78	322.55	380.98	438.99	496.78	573.03	630.66	RCM3-GFDL (historical)
2	92.31	120.75	178.09	217.69	275.95	321.73	368.95	415.99	478.06	524.96	RCM3-CGCM3 (historical)
3	88.46	113.23	171.57	214.18	274.17	319.17	362.08	404.82	461.22	503.84	RCM3-CGCM3 (future)
4	84.62	110.97	168.54	210.05	259.77	296.87	334.17	371.33	420.37	457.43	HRM3-HadCM3 (historical)
5	80.77	107.99	164.95	208.63	259.29	293.59	327.16	360.61	404.74	438.1	HRM3-GFDL (future)
6	76.92	101.93	159.3	194.22	231.2	258.63	286.96	319.47	362.38	394.8	RCM3-GFDL (future)
7	73.08	98.43	156.81	185.66	222.11	254.32	285.86	312.99	348.79	375.84	HRM3-HadCM3 (future)
8	69.23	94.99	143.87	177.12	221.44	249.16	276	302.75	338.04	364.7	WRFG-CGCM3 (future)
9	65.38	93.82	142.04	165.65	193.17	213.59	233.86	254.05	280.7	300.83	MM5I-HadCM3 (future)
10	61.54	91.24	129.46	150	176.98	198.28	219.42	240.48	268.27	289.27	MM5I-HadCM3 (historical)
11	57.69	89.64	125.56	148.28	175.96	195.22	214.33	233.37	258.5	278.78	MM5I-CCSM (historical)
12	53.85	89.06	125	144.87	169.98	188.61	207.09	227.12	256.54	277.49	WRFG-CCSM (future)
13	50.00	88.79	120.84	139.55	164.67	183.31	204.81	225.51	249.82	268.18	ECP2-HadCM3 (future)
14	46.15	87.27	119.67	138.72	161.32	182.43	201.81	220.24	244.55	262.93	WRFG-CGCM3 (historical)
15	42.31	83.39	113.29	130.07	159.88	178.09	194.73	212.13	236.86	255.55	WRFG-CCSM (historical)
16	38.46	82.66	109.85	129.52	155.62	174.57	193.39	211.31	233.19	249.72	HRM3-GFDL (historical)
17	34.62	79.96	107.71	129.48	150.02	166.49	183.58	200.61	223.07	240.05	ECP2-GFDL (historical)
18	30.77	79.3	105.42	126.07	149.28	165.23	180.68	197.58	219.88	236.73	MM5I-CCSM (future)
19	26.92	77.82	105.36	123.59	146.63	163.72	180.32	195.36	215.21	230.2	ECP2-GFDL (future)
20	23.08	69.08	103.69	117.13	134.11	146.71	159.21	171.67	188.11	200.53	ECP2-HadCM3 (historical)
21	19.23	46.61	64.17	75.79	90.48	101.38	112.2	122.97	137.19	147.94	CRCM-CGCM3 (future)
22	15.38	34.35	50.22	61.05	74.74	84.9	94.98	105.03	118.28	128.3	Observed
23	11.54	33.85	49.69	60.33	73.78	83.75	93.66	103.52	116.54	126.38	CRCM-CGCM3 (historical)
24	7.69	33.61	49.02	58.74	71.01	80.11	89.15	98.15	110.03	119.01	CRCM-CCSM (future)
25	3.85	27.28	41.11	50.27	61.84	70.42	78.94	87.43	98.63	107.09	CRCM-CCSM (historical)
Gauge: 442044; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	90.42	144.01	198.24	266.76	317.59	368.04	418.31	484.64	534.76	RCM3-GFDL (historical)
2	92.31	87.93	135.39	171.13	224.23	265.55	306.57	347.44	401.36	442.12	RCM3-CGCM3 (historical)
3	88.46	81.76	132.16	168.52	220.36	256.89	293.15	329.27	376.93	412.95	RCM3-CGCM3 (future)
4	84.62	79.75	128.19	165.16	203.27	234.36	265.22	295.97	336.54	367.2	HRM3-HadCM3 (historical)
5	80.77	78.09	124.43	161.36	202.77	230.68	258.38	285.97	322.38	349.9	HRM3-GFDL (future)
6	76.92	73.3	123.77	147.49	177.47	200.17	227.3	254.34	290	316.96	RCM3-GFDL (future)
7	73.08	69.88	117.46	141.1	172.84	199.71	221.78	243.78	272.8	294.73	HRM3-HadCM3 (future)
8	69.23	67.1	106.83	135.99	170.96	193.12	215.11	237.03	265.94	287.79	WRFG-CGCM3 (future)
9	65.38	66.18	106.27	123.83	146.02	162.48	178.81	195.09	216.57	232.8	MM5I-HadCM3 (future)
10	61.54	64.34	94.47	110.76	132.43	149.35	166.14	182.86	204.93	221.61	MM5I-HadCM3 (historical)
11	57.69	62.95	91.59	109.63	131.33	146.59	161.75	176.84	196.76	211.82	MM5I-CCSM (historical)
12	53.85	62.78	91.06	106.93	126.98	141.85	156.62	171.33	194.39	211.81	WRFG-CCSM (future)
13	50.00	62.2	87.43	102.55	122.48	137.27	153.85	171.33	190.74	205.4	ECP2-HadCM3 (future)
14	46.15	62.11	86.78	101.49	119.27	136.3	151.95	166.57	185.86	200.44	WRFG-CGCM3 (historical)
15	42.31	57.92	81.39	95.1	118.62	132.45	145.54	159.92	179.46	194.22	WRFG-CCSM (historical)
16	38.46	57.85	79.12	94.8	115.28	130.25	145.11	158.58	175.78	188.78	HRM3-GFDL (historical)
17	34.62	55.45	77.23	94.09	110.14	123.38	136.79	150.15	167.79	181.11	ECP2-GFDL (historical)
18	30.77	55	75.94	91.65	109.86	122.05	134.88	148.21	165.79	179.08	MM5I-CCSM (future)
19	26.92	53.77	75.49	89.86	108.03	121.5	133.87	145.64	161.18	172.92	ECP2-GFDL (future)
20	23.08	47.46	73.78	84.27	97.54	107.38	117.14	126.87	139.71	149.41	ECP2-HadCM3 (historical)
21	19.23	30.48	43.4	51.95	62.76	70.78	78.74	86.67	97.13	105.04	CRCM-CGCM3 (future)
22	15.38	21.78	32.81	40.46	50.12	57.29	64.41	71.5	80.85	87.92	CRCM-CGCM3 (historical)
23	11.54	21.26	32.19	39.08	47.79	54.25	60.66	67.05	75.48	81.85	CRCM-CCSM (future)
24	7.69	19.13	27.57	33.16	40.8	46.73	52.62	58.48	66.22	72.06	CRCM-CCSM (historical)
25	3.85	16.93	26.49	32.81	40.22	45.46	50.66	55.84	62.67	67.83	Observed
Gauge: 442044; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	59.46	88.54	119.51	158.64	187.67	216.49	245.2	283.07	311.7	RCM3-GFDL (historical)
2	92.31	58.04	86.28	106.08	134.88	158.17	181.62	204.98	235.8	259.1	RCM3-CGCM3 (historical)
3	88.46	54.34	83.29	104.03	134.55	156.24	177.45	198.57	226.45	247.51	RCM3-CGCM3 (future)
4	84.62	53.21	81.66	102.71	126.47	144.85	163.21	181.51	205.66	223.91	HRM3-HadCM3 (historical)
5	80.77	51.84	79.73	101.4	126.34	143.12	159.64	176.1	197.82	214.24	HRM3-GFDL (future)
6	76.92	48.87	77.51	94.09	112.23	125.69	140.07	156.09	177.23	193.21	RCM3-GFDL (future)
7	73.08	47.1	75.76	89.94	107.86	123.99	139.05	152.36	169.92	183.19	HRM3-HadCM3 (future)
8	69.23	45.41	69.34	85.95	107.79	121.16	134.35	147.5	164.85	177.96	WRFG-CGCM3 (future)
9	65.38	44.84	68.66	80.02	93.51	103.52	113.46	123.35	136.41	146.28	MM5I-HadCM3 (future)
10	61.54	43.6	62.26	72.29	85.51	95.92	106.26	116.55	130.13	140.4	MM5I-HadCM3 (historical)
11	57.69	42.8	60.38	71.48	84.97	94.38	103.72	113.02	125.29	135.11	MM5I-CCSM (historical)
12	53.85	42.56	60.09	69.81	82.09	91.2	100.24	109.92	124.26	134.57	WRFG-CCSM (future)
13	50.00	42.38	58.02	67.2	79.48	88.59	99.04	109.25	121.14	130.12	ECP2-HadCM3 (future)
14	46.15	41.77	57.48	66.75	77.78	88.13	97.63	106.64	118.53	127.51	WRFG-CGCM3 (historical)
15	42.31	39.74	54.33	62.58	77.13	85.97	94.09	102.66	114.74	123.87	WRFG-CCSM (historical)
16	38.46	39.45	52.71	62.31	75.06	84.32	93.51	102.18	112.86	120.93	HRM3-GFDL (historical)
17	34.62	38.1	51.63	62.24	72.23	80.3	88.63	96.94	107.89	116.17	ECP2-GFDL (historical)
18	30.77	37.79	50.58	60.58	71.9	79.65	87.26	95.51	106.39	114.62	MM5I-CCSM (future)
19	26.92	37.05	50.49	59.39	70.64	78.98	87.01	94.34	104.02	111.33	ECP2-GFDL (future)
20	23.08	32.86	49.63	56.18	64.45	70.59	76.68	82.75	90.76	96.81	ECP2-HadCM3 (historical)
21	19.23	21.97	30.43	36.04	43.12	48.37	53.59	58.79	65.64	70.82	CRCM-CGCM3 (future)
22	15.38	16.1	23.46	28.57	35.02	39.81	44.56	49.3	55.55	60.27	CRCM-CGCM3 (historical)
23	11.54	15.75	23.13	27.78	33.66	38.02	42.35	46.66	52.35	56.65	CRCM-CCSM (future)
24	7.69	13.9	19.66	23.69	29.21	33.3	37.36	41.41	46.74	50.78	CRCM-CCSM (historical)
25	3.85	12.73	19.33	23.48	28.3	31.87	35.42	38.96	43.62	47.15	Observed
Gauge: 442044; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	47.35	69.51	93.39	123.57	145.96	168.18	190.32	219.53	241.61	RCM3-GFDL (historical)
2	92.31	46.26	68.23	83.4	105.72	123.26	141.35	159.38	183.16	201.13	RCM3-CGCM3 (historical)
3	88.46	43.38	65.73	82.06	105.04	122.27	138.71	155.08	176.69	193.02	RCM3-CGCM3 (future)
4	84.62	42.52	64.57	80.47	99.53	113.73	128.02	142.26	161.04	175.24	HRM3-HadCM3 (historical)
5	80.77	41.37	63.2	79.93	99.33	112.49	125.35	138.17	155.08	167.86	HRM3-GFDL (future)
6	76.92	39.05	61.03	74.41	88.57	99.08	109.94	122.4	138.84	151.26	RCM3-GFDL (future)
7	73.08	37.71	60.07	71.12	85.09	97.44	109.51	119.9	133.61	143.98	HRM3-HadCM3 (future)
8	69.23	36.39	55.12	67.86	84.84	95.45	105.73	115.98	129.5	139.71	WRFG-CGCM3 (future)
9	65.38	35.95	54.42	63.46	74.01	81.83	89.59	97.32	107.53	115.24	MM5I-HadCM3 (future)
10	61.54	34.96	49.6	57.47	67.81	75.97	84.07	92.15	102.79	110.84	MM5I-HadCM3 (historical)
11	57.69	34.34	48.11	56.81	67.41	74.79	82.11	89.4	99.03	106.79	MM5I-CCSM (historical)
12	53.85	34.12	47.89	55.5	65.12	72.26	79.34	87	98.27	106.3	WRFG-CCSM (future)
13	50.00	34.01	46.3	53.47	63.09	70.23	78.45	86.4	95.71	102.74	ECP2-HadCM3 (future)
14	46.15	33.44	45.85	53.15	61.8	69.88	77.32	84.38	93.7	100.74	WRFG-CGCM3 (historical)
15	42.31	31.94	43.41	49.83	61.24	68.23	74.6	81.27	90.75	97.91	WRFG-CCSM (historical)
16	38.46	31.66	42.09	49.63	59.62	66.88	74.09	80.95	89.33	95.67	HRM3-GFDL (historical)
17	34.62	30.63	41.27	49.6	57.49	63.8	70.34	76.87	85.48	91.99	ECP2-GFDL (historical)
18	30.77	30.39	40.38	48.3	57.2	63.32	69.23	75.71	84.25	90.71	MM5I-CCSM (future)
19	26.92	29.82	40.37	47.36	56.18	62.73	69.1	74.87	82.48	88.23	ECP2-GFDL (future)
20	23.08	26.46	39.72	44.87	51.38	56.2	60.99	65.77	72.06	76.82	ECP2-HadCM3 (historical)
21	19.23	17.85	24.58	29.03	34.65	38.83	42.97	47.1	52.54	56.66	CRCM-CGCM3 (future)
22	15.38	13.17	19.03	23.11	28.27	32.09	35.88	39.66	44.65	48.42	CRCM-CGCM3 (historical)
23	11.54	12.88	18.79	22.51	27.21	30.7	34.16	37.61	42.16	45.6	CRCM-CCSM (future)
24	7.69	10.98	15.75	19.26	23.69	26.98	30.25	33.5	37.8	41.04	CRCM-CCSM (historical)
25	3.85	10.44	15.44	18.4	22.13	24.9	27.65	30.39	34	36.73	Observed
Gauge: 442044; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	46.37	68.93	92.94	123.29	145.81	168.15	190.42	219.79	242	RCM3-GFDL (historical)
2	92.31	45.26	67.16	82.52	104.85	122.91	141.1	159.21	183.11	201.18	RCM3-CGCM3 (historical)
3	88.46	42.4	64.85	80.93	104.6	121.41	137.85	154.23	175.84	192.17	RCM3-CGCM3 (future)
4	84.62	41.53	63.57	79.9	98.32	112.57	126.81	141	159.72	173.86	HRM3-HadCM3 (historical)
5	80.77	40.45	62.08	78.88	98.22	111.23	124.04	136.8	153.64	166.36	HRM3-GFDL (future)
6	76.92	38.16	60.36	73.22	87.29	97.72	108.88	121.31	137.7	150.09	RCM3-GFDL (future)
7	73.08	36.79	59.02	70.02	83.92	96.41	108.08	118.4	132.02	142.31	HRM3-HadCM3 (future)
8	69.23	35.47	54.03	66.91	83.85	94.23	104.46	114.66	128.11	138.28	WRFG-CGCM3 (future)
9	65.38	35.03	53.5	62.31	72.77	80.53	88.23	95.91	106.04	113.69	MM5I-HadCM3 (future)
10	61.54	34.07	48.54	56.32	66.58	74.65	82.66	90.65	101.18	109.14	MM5I-HadCM3 (historical)
11	57.69	33.45	47.08	55.69	66.15	73.45	80.69	87.9	97.42	105.04	MM5I-CCSM (historical)
12	53.85	33.26	46.86	54.39	63.92	70.98	77.99	85.5	96.63	104.61	WRFG-CCSM (future)
13	50.00	33.13	45.25	52.37	61.9	68.96	77.07	84.98	94.19	101.16	ECP2-HadCM3 (future)
14	46.15	32.65	44.84	52.02	60.58	68.6	75.97	82.96	92.17	99.14	WRFG-CGCM3 (historical)
15	42.31	31.07	42.4	48.79	60.07	66.92	73.22	79.87	89.24	96.32	WRFG-CCSM (historical)
16	38.46	30.84	41.13	48.58	58.46	65.64	72.77	79.5	87.78	94.03	HRM3-GFDL (historical)
17	34.62	29.8	40.29	48.54	56.29	62.52	68.98	75.42	83.92	90.34	ECP2-GFDL (historical)
18	30.77	29.56	39.48	47.24	56.01	62.04	67.91	74.31	82.74	89.12	MM5I-CCSM (future)
19	26.92	28.99	39.41	46.31	55.03	61.49	67.75	73.44	80.95	86.62	ECP2-GFDL (future)
20	23.08	25.74	38.75	43.82	50.24	55	59.73	64.43	70.65	75.34	ECP2-HadCM3 (historical)
21	19.23	17.3	23.87	28.21	33.71	37.78	41.83	45.86	51.17	55.19	CRCM-CGCM3 (future)
22	15.38	12.75	18.46	22.42	27.43	31.14	34.83	38.5	43.34	47	CRCM-CGCM3 (historical)
23	11.54	12.48	18.19	21.8	26.35	29.73	33.08	36.42	40.83	44.16	CRCM-CCSM (future)
24	7.69	10.14	15.25	18.63	22.9	26.07	29.22	32.36	36.49	39.62	CRCM-CCSM (historical)
25	3.85	7.58	9.96	11.54	13.54	15.02	16.49	17.95	19.89	21.35	Observed
Gauge: 442044; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	29.68	43.93	59.11	78.29	92.52	106.64	120.71	139.27	153.3	RCM3-GFDL (historical)
2	92.31	28.98	42.82	52.54	66.65	78.05	89.55	101	116.1	127.52	RCM3-CGCM3 (historical)
3	88.46	27.17	41.37	51.52	66.48	77.12	87.51	97.86	111.53	121.85	RCM3-CGCM3 (future)
4	84.62	26.62	40.56	50.87	62.51	71.54	80.54	89.51	101.35	110.29	HRM3-HadCM3 (historical)
5	80.77	25.94	39.62	50.24	62.47	70.67	78.76	86.83	97.47	105.51	HRM3-GFDL (future)
6	76.92	24.49	38.52	46.65	55.55	62.15	69.19	77.04	87.41	95.24	RCM3-GFDL (future)
7	73.08	23.62	37.67	44.62	53.4	61.31	68.69	75.22	83.83	90.34	HRM3-HadCM3 (future)
8	69.23	22.79	34.52	42.66	53.37	59.92	66.38	72.83	81.33	87.75	WRFG-CGCM3 (future)
9	65.38	22.51	34.19	39.75	46.36	51.27	56.13	60.98	67.38	72.21	MM5I-HadCM3 (future)
10	61.54	21.91	31.05	35.97	42.45	47.55	52.61	57.66	64.31	69.34	MM5I-HadCM3 (historical)
11	57.69	21.51	30.13	35.57	42.19	46.8	51.38	55.94	61.96	66.72	MM5I-CCSM (historical)
12	53.85	21.39	29.99	34.75	40.77	45.23	49.66	54.38	61.41	66.51	WRFG-CCSM (future)
13	50.00	21.31	28.97	33.47	39.49	43.95	49.05	54.08	59.9	64.31	ECP2-HadCM3 (future)
14	46.15	21.01	28.71	33.25	38.65	43.71	48.38	52.8	58.62	63.03	WRFG-CGCM3 (historical)
15	42.31	20.02	27.17	31.2	38.32	42.66	46.64	50.84	56.75	61.23	WRFG-CCSM (historical)
16	38.46	19.86	26.36	31.06	37.31	41.85	46.35	50.6	55.84	59.79	HRM3-GFDL (historical)
17	34.62	19.21	25.84	31.05	35.95	39.88	43.97	48.03	53.4	57.46	ECP2-GFDL (historical)
18	30.77	19.05	25.32	30.22	35.77	39.59	43.29	47.33	52.66	56.69	MM5I-CCSM (future)
19	26.92	18.7	25.28	29.64	35.15	39.23	43.2	46.79	51.54	55.12	ECP2-GFDL (future)
20	23.08	16.64	24.87	28.08	32.14	35.15	38.14	41.12	45.05	48.02	ECP2-HadCM3 (historical)
21	19.23	11.3	15.44	18.19	21.66	24.23	26.78	29.33	32.68	35.22	CRCM-CGCM3 (future)
22	15.38	8.43	12.04	14.54	17.71	20.06	22.39	24.71	27.77	30.08	CRCM-CGCM3 (historical)
23	11.54	8.26	11.88	14.16	17.04	19.18	21.3	23.42	26.21	28.32	CRCM-CCSM (future)
24	7.69	6.78	10.01	12.15	14.86	16.87	18.86	20.85	23.46	25.44	CRCM-CCSM (historical)
25	3.85	4.66	6.29	7.37	8.74	9.76	10.76	11.77	13.09	14.09	Observed
Gauge: 442044; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	16.13	23.72	31.8	42.01	49.58	57.1	64.59	74.47	81.94	RCM3-GFDL (historical)
2	92.31	15.76	23.13	28.29	35.81	41.9	48.02	54.11	62.16	68.24	RCM3-CGCM3 (historical)
3	88.46	14.8	22.35	27.76	35.73	41.38	46.91	52.42	59.69	65.19	RCM3-CGCM3 (future)
4	84.62	14.51	21.93	27.42	33.62	38.43	43.22	48	54.31	59.07	HRM3-HadCM3 (historical)
5	80.77	14.14	21.41	27.08	33.6	37.96	42.27	46.57	52.24	56.52	HRM3-GFDL (future)
6	76.92	13.37	20.85	25.16	29.89	33.4	37.17	41.36	46.87	51.04	RCM3-GFDL (future)
7	73.08	12.9	20.39	24.1	28.78	32.98	36.89	40.36	44.94	48.4	HRM3-HadCM3 (future)
8	69.23	12.47	18.71	23.05	28.75	32.25	35.7	39.13	43.66	47.08	WRFG-CGCM3 (future)
9	65.38	12.32	18.54	21.5	25.02	27.63	30.22	32.8	36.21	38.78	MM5I-HadCM3 (future)
10	61.54	12	16.86	19.48	22.93	25.64	28.34	31.02	34.56	37.24	MM5I-HadCM3 (historical)
11	57.69	11.79	16.37	19.27	22.8	25.25	27.69	30.12	33.33	35.86	MM5I-CCSM (historical)
12	53.85	11.72	16.3	18.84	22.05	24.43	26.79	29.29	33.03	35.75	WRFG-CCSM (future)
13	50.00	11.68	15.76	18.15	21.35	23.72	26.46	29.15	32.25	34.6	ECP2-HadCM3 (future)
14	46.15	11.51	15.62	18.03	20.91	23.61	26.08	28.43	31.53	33.87	WRFG-CGCM3 (historical)
15	42.31	10.99	14.8	16.94	20.74	23.04	25.16	27.39	30.54	32.92	WRFG-CCSM (historical)
16	38.46	10.91	14.37	16.87	20.19	22.61	25	27.27	30.06	32.16	HRM3-GFDL (historical)
17	34.62	10.55	14.09	16.87	19.47	21.58	23.76	25.93	28.79	30.95	ECP2-GFDL (historical)
18	30.77	10.48	13.81	16.43	19.39	21.41	23.39	25.55	28.39	30.53	MM5I-CCSM (future)
19	26.92	10.29	13.8	16.12	19.05	21.23	23.33	25.25	27.77	29.68	ECP2-GFDL (future)
20	23.08	9.19	13.57	15.28	17.44	19.04	20.63	22.21	24.3	25.88	ECP2-HadCM3 (historical)
21	19.23	6.35	8.56	10.02	11.87	13.24	14.6	15.96	17.75	19.1	CRCM-CGCM3 (future)
22	15.38	4.82	6.74	8.07	9.76	11.01	12.25	13.49	15.12	16.35	CRCM-CGCM3 (historical)
23	11.54	4.73	6.65	7.86	9.39	10.53	11.65	12.78	14.26	15.38	CRCM-CCSM (future)
24	7.69	3.94	5.66	6.8	8.25	9.32	10.38	11.43	12.83	13.88	CRCM-CCSM (historical)
25	3.85	2.67	3.48	4.02	4.7	5.2	5.71	6.2	6.86	7.36	Observed
Gauge: 442044; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	8.6	12.57	16.8	22.15	26.11	30.05	33.97	39.14	43.05	RCM3-GFDL (historical)
2	92.31	8.4	12.27	14.96	18.89	22.07	25.27	28.46	32.67	35.85	RCM3-CGCM3 (historical)
3	88.46	7.9	11.85	14.69	18.85	21.81	24.71	27.59	31.4	34.28	RCM3-CGCM3 (future)
4	84.62	7.74	11.63	14.5	17.76	20.26	22.77	25.27	28.57	31.06	HRM3-HadCM3 (historical)
5	80.77	7.55	11.36	14.32	17.73	20.04	22.3	24.55	27.52	29.76	HRM3-GFDL (future)
6	76.92	7.15	11.06	13.32	15.8	17.63	19.62	21.81	24.7	26.89	RCM3-GFDL (future)
7	73.08	6.91	10.82	12.76	15.21	17.42	19.46	21.28	23.67	25.48	HRM3-HadCM3 (future)
8	69.23	6.68	9.94	12.22	15.21	17.02	18.82	20.62	22.99	24.78	WRFG-CGCM3 (future)
9	65.38	6.59	9.86	11.4	13.24	14.6	15.96	17.31	19.09	20.44	MM5I-HadCM3 (future)
10	61.54	6.43	8.97	10.34	12.15	13.57	14.98	16.39	18.24	19.64	MM5I-HadCM3 (historical)
11	57.69	6.32	8.72	10.24	12.07	13.36	14.63	15.9	17.57	18.93	MM5I-CCSM (historical)
12	53.85	6.29	8.68	10.01	11.69	12.93	14.17	15.49	17.45	18.84	WRFG-CCSM (future)
13	50.00	6.27	8.4	9.65	11.33	12.57	14	15.4	17.03	18.25	ECP2-HadCM3 (future)
14	46.15	6.18	8.32	9.59	11.1	12.51	13.81	15.04	16.67	17.89	WRFG-CGCM3 (historical)
15	42.31	5.9	7.9	9.02	11.01	12.22	13.33	14.51	16.16	17.41	WRFG-CCSM (historical)
16	38.46	5.86	7.67	8.98	10.73	12	13.26	14.44	15.9	17	HRM3-GFDL (historical)
17	34.62	5.68	7.52	8.98	10.35	11.44	12.58	13.71	15.21	16.34	ECP2-GFDL (historical)
18	30.77	5.63	7.38	8.75	10.29	11.37	12.4	13.53	15.02	16.15	MM5I-CCSM (future)
19	26.92	5.54	7.38	8.59	10.13	11.27	12.37	13.38	14.7	15.7	ECP2-GFDL (future)
20	23.08	4.96	7.25	8.15	9.28	10.12	10.95	11.78	12.87	13.7	ECP2-HadCM3 (historical)
21	19.23	3.47	4.63	5.4	6.37	7.09	7.8	8.51	9.45	10.16	CRCM-CGCM3 (future)
22	15.38	2.67	3.68	4.37	5.25	5.9	6.55	7.2	8.05	8.69	CRCM-CGCM3 (historical)
23	11.54	2.62	3.63	4.27	5.08	5.68	6.27	6.86	7.64	8.23	CRCM-CCSM (future)
24	7.69	2.21	3.11	3.71	4.46	5.02	5.58	6.13	6.86	7.41	CRCM-CCSM (historical)
25	3.85	1.49	1.92	2.2	2.55	2.81	3.08	3.34	3.68	3.94	Observed
Gauge: 442044; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h[-1]) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	5.71	8.31	11.08	14.58	17.17	19.75	22.31	25.7	28.26	RCM3-GFDL (historical)
2	92.31	5.59	8.11	9.88	12.45	14.54	16.64	18.72	21.48	23.56	RCM3-CGCM3 (historical)
3	88.46	5.25	7.84	9.7	12.43	14.36	16.26	18.14	20.63	22.52	RCM3-CGCM3 (future)
4	84.62	5.15	7.7	9.58	11.7	13.36	15	16.64	18.8	20.44	HRM3-HadCM3 (historical)
5	80.77	5.03	7.53	9.47	11.7	13.19	14.66	16.13	18.07	19.54	HRM3-GFDL (future)
6	76.92	4.77	7.33	8.81	10.43	11.63	12.92	14.35	16.24	17.67	RCM3-GFDL (future)
7	73.08	4.61	7.17	8.44	10.05	11.48	12.82	14.01	15.57	16.76	HRM3-HadCM3 (future)
8	69.23	4.46	6.59	8.08	10.04	11.24	12.42	13.59	15.15	16.32	WRFG-CGCM3 (future)
9	65.38	4.41	6.54	7.55	8.75	9.65	10.53	11.42	12.58	13.47	MM5I-HadCM3 (future)
10	61.54	4.3	5.96	6.86	8.05	8.99	9.91	10.83	12.05	12.97	MM5I-HadCM3 (historical)
11	57.69	4.23	5.8	6.8	7.99	8.83	9.66	10.49	11.58	12.46	MM5I-CCSM (historical)
12	53.85	4.21	5.77	6.64	7.75	8.56	9.37	10.22	11.5	12.41	WRFG-CCSM (future)
13	50.00	4.19	5.59	6.41	7.52	8.33	9.24	10.18	11.25	12.05	ECP2-HadCM3 (future)
14	46.15	4.13	5.54	6.37	7.35	8.27	9.14	9.95	11.02	11.82	WRFG-CGCM3 (historical)
15	42.31	3.96	5.26	5.99	7.29	8.08	8.8	9.58	10.66	11.47	WRFG-CCSM (historical)
16	38.46	3.93	5.11	5.97	7.11	7.93	8.76	9.52	10.48	11.19	HRM3-GFDL (historical)
17	34.62	3.81	5.02	5.97	6.86	7.58	8.33	9.07	10.05	10.79	ECP2-GFDL (historical)
18	30.77	3.77	4.92	5.82	6.83	7.53	8.2	8.93	9.91	10.64	MM5I-CCSM (future)
19	26.92	3.71	4.91	5.7	6.71	7.46	8.19	8.84	9.71	10.36	ECP2-GFDL (future)
20	23.08	3.34	4.84	5.42	6.16	6.71	7.26	7.8	8.51	9.06	ECP2-HadCM3 (historical)
21	19.23	2.36	3.12	3.62	4.26	4.73	5.2	5.66	6.28	6.74	CRCM-CGCM3 (future)
22	15.38	1.83	2.49	2.95	3.52	3.95	4.38	4.8	5.36	5.78	CRCM-CGCM3 (historical)
23	11.54	1.8	2.46	2.88	3.4	3.79	4.18	4.56	5.07	5.45	CRCM-CCSM (future)
24	7.69	1.54	2.13	2.52	3.02	3.39	3.75	4.12	4.59	4.96	CRCM-CCSM (historical)
25	3.85	1.07	1.35	1.54	1.77	1.95	2.12	2.3	2.53	2.7	Observed
Gauge: 442044; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	249.47	347.58	448.78	576.64	671.5	765.66	859.47	983.25	1076.79	RCM3-GFDL (historical)
2	92.31	249.29	327.87	379.77	469.56	542.48	614.87	687	782.15	854.06	RCM3-CGCM3 (historical)
3	88.46	221.53	322.86	371.57	446.15	504.05	561.51	618.77	695.91	764.49	Observed
4	84.62	217.45	306.35	371.25	445.35	494.01	542.3	605.16	694.31	751.4	RCM3-CGCM3 (future)
5	80.77	213.06	303.43	368.11	433.11	480.36	538.56	596.54	673.04	730.85	RCM3-GFDL (future)
6	76.92	207.3	293.45	357.65	426.16	478.77	536.38	590.42	653.9	701.88	HRM3-GFDL (future)
7	73.08	201.05	280.15	342.7	421.73	476.98	527.43	577.7	644.01	694.13	HRM3-HadCM3 (historical)
8	69.23	196.36	268.48	313.12	397.8	467.34	524.09	569.25	628.82	673.85	HRM3-HadCM3 (future)
9	65.38	195.47	261.69	304.05	369.53	411.38	452.91	494.3	548.9	590.17	WRFG-CGCM3 (future)
10	61.54	194.77	253.35	290.98	336.88	371.79	406.43	440.95	486.49	520.91	MM5I-HadCM3 (historical)
11	57.69	194.72	252.6	289.84	327.99	355.44	382.7	409.85	445.67	473.05	HRM3-GFDL (historical)
12	53.85	185.68	242.37	283.84	322.37	350.95	379.32	407.58	444.87	472.75	MM5I-HadCM3 (future)
13	50.00	179.65	238.21	273.43	312.66	341.77	370.66	399.44	437.42	468.36	WRFG-CGCM3 (historical)
14	46.15	175.94	229.85	266.97	303.32	330.28	361.9	394	436.35	466.12	ECP2-HadCM3 (future)
15	42.31	174.02	218.85	253.48	297.23	329.68	357.04	385.23	429.05	462.17	MM5I-CCSM (historical)
16	38.46	171.45	217.71	245.7	285.11	318.69	352.02	383.71	418.89	445.47	WRFG-CCSM (future)
17	34.62	166.55	217.14	242.91	281.77	308.54	335.1	362.66	399.27	426.93	WRFG-CCSM (historical)
18	30.77	166.03	211.24	241.17	279	307.05	334.91	361.57	396.49	422.89	MM5I-CCSM (future)
19	26.92	162.75	207.54	239.84	274.75	302.48	330.07	357.57	393.84	421.25	ECP2-GFDL (historical)
20	23.08	149.9	205.51	237.2	274.68	298.37	321.82	345.18	376	399.3	ECP2-GFDL (future)
21	19.23	117.78	204.02	228.06	256.55	277.69	298.67	319.57	347.15	368	ECP2-HadCM3 (historical)
22	15.38	112.83	137.98	154.63	175.67	191.28	209.48	229.59	256.13	276.18	CRCM-CGCM3 (historical)
23	11.54	90.6	119.85	141.54	168.96	189.29	206.77	222.21	242.57	257.97	CRCM-CGCM3 (future)
24	7.69	87.08	118.35	136.71	159.92	177.13	194.22	211.25	233.71	250.69	CRCM-CCSM (future)
25	3.85	73.92	100.19	117.59	139.57	155.87	172.06	188.18	209.46	225.53	CRCM-CCSM (historical)
Gauge: 444128; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	201.06	317.94	428.06	567.19	670.41	772.86	874.95	1009.62	1111.41	RCM3-GFDL (historical)
2	92.31	200.82	278.67	341.35	446.52	524.55	601.99	679.16	780.96	857.9	RCM3-CGCM3 (historical)
3	88.46	174.74	272.65	330.06	397.7	454.88	511.65	568.2	642.82	699.21	RCM3-CGCM3 (future)
4	84.62	169.12	259.6	320.61	395	443.17	496.35	554.63	631.53	689.64	RCM3-GFDL (future)
5	80.77	167.46	258.12	320.21	380.3	437.86	490.98	538.62	601.47	648.97	HRM3-GFDL (future)
6	76.92	159.92	254.97	308.1	378.93	425.01	474.43	523.68	588.65	637.75	HRM3-HadCM3 (historical)
7	73.08	154.88	236.62	299.49	375.22	424.88	469.12	513.21	571.38	615.33	HRM3-HadCM3 (future)
8	69.23	151.62	219.87	262.9	317.27	357.6	397.64	437.52	490.15	529.92	WRFG-CGCM3 (future)
9	65.38	150.1	211.15	238.98	283.56	316.71	349.61	382.4	425.65	458.34	MM5I-HadCM3 (historical)
10	61.54	148.93	203.52	238.88	274.14	300.22	326.11	351.91	385.94	411.67	MM5I-HadCM3 (future)
11	57.69	148.34	202.85	231.26	267.17	293.81	320.25	346.6	381.35	407.62	HRM3-GFDL (historical)
12	53.85	141.66	193	222.18	259.05	286.4	313.55	340.6	376.29	403.26	ECP2-HadCM3 (future)
13	50.00	134.4	188.31	214.76	248.2	273.19	302.8	332.29	371.21	400.62	WRFG-CGCM3 (historical)
14	46.15	132.4	171.35	203.16	243.37	273	297.61	322.41	362.17	392.22	MM5I-CCSM (historical)
15	42.31	129.35	169.44	195.98	231.56	262.03	292.28	322.14	354.5	378.96	WRFG-CCSM (future)
16	38.46	126.84	168.99	191.89	229.51	254.39	279.08	303.69	340.04	372.42	Observed
17	34.62	123.29	163.95	191.43	226.15	251.91	277.48	302.96	336.57	361.97	WRFG-CCSM (historical)
18	30.77	122.44	160.46	190.48	221.78	247.18	272.38	297.49	336.15	360.68	MM5I-CCSM (future)
19	26.92	119.55	157.98	187.55	220.83	242.29	264.73	297.2	330.63	355.67	ECP2-GFDL (historical)
20	23.08	108.88	157.82	178.33	204.24	232.13	263.6	284.83	312.84	334.01	ECP2-GFDL (future)
21	19.23	76.69	120.01	155.04	199.3	223.46	242.54	261.55	286.64	305.59	ECP2-HadCM3 (historical)
22	15.38	67.1	97.44	111.18	128.54	141.42	155.27	171.47	192.86	209.02	CRCM-CGCM3 (historical)
23	11.54	59.11	83.04	100.52	122.61	139	154.2	166.94	183.74	196.44	CRCM-CGCM3 (future)
24	7.69	56.63	81.38	96.13	114.76	128.58	142.3	155.96	174	187.63	CRCM-CCSM (future)
25	3.85	46.49	66.5	79.75	96.48	108.9	121.23	133.51	149.71	161.95	CRCM-CCSM (historical)
Gauge: 444128; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	152.77	245.77	332.5	442.09	523.38	604.08	684.48	790.55	870.72	RCM3-GFDL (historical)
2	92.31	152.58	213.15	264	346.67	408	468.87	529.52	609.54	670.02	RCM3-CGCM3 (historical)
3	88.46	132.43	208.35	253.13	305.94	350.42	394.57	438.56	496.59	540.46	RCM3-CGCM3 (future)
4	84.62	127.92	198.57	245.98	303.65	341.12	383.49	428.93	488.88	534.19	RCM3-GFDL (future)
5	80.77	126.86	198.53	245.27	291.93	337.88	378.32	415.39	464.28	501.24	HRM3-GFDL (future)
6	76.92	120.84	194.76	236.02	291.93	326.85	365.24	403.5	453.97	492.12	HRM3-HadCM3 (historical)
7	73.08	117.03	180.97	229.99	288.17	326.54	360.9	395.13	440.29	474.42	HRM3-HadCM3 (future)
8	69.23	114.78	167.42	200.78	242.93	274.21	305.25	336.17	376.98	407.82	WRFG-CGCM3 (future)
9	65.38	113.3	160.44	182	216.57	242.22	267.69	293.05	326.52	351.82	MM5I-HadCM3 (historical)
10	61.54	112.36	154.63	181.97	209.18	229.36	249.39	269.35	295.69	315.59	MM5I-HadCM3 (future)
11	57.69	111.91	153.97	175.91	203.63	224.19	244.6	264.93	291.76	312.04	HRM3-GFDL (historical)
12	53.85	106.93	146.42	168.97	197.46	218.6	239.58	260.48	288.06	308.91	ECP2-HadCM3 (future)
13	50.00	101.17	142.7	163.1	188.86	208.22	231.03	253.76	283.75	306.42	WRFG-CGCM3 (historical)
14	46.15	99.76	129.72	154.25	185.23	207.97	226.95	245.96	276.56	299.68	MM5I-CCSM (historical)
15	42.31	97.28	128.21	148.69	176.06	199.5	222.78	245.85	270.79	289.64	WRFG-CCSM (future)
16	38.46	95.34	127.77	145.39	174.57	193.76	212.82	231.8	256.99	276.56	WRFG-CCSM (historical)
17	34.62	92.69	123.98	145.15	171.91	191.76	211.46	231.09	256.85	275.78	MM5I-CCSM (future)
18	30.77	92	121.29	144.45	168.5	188.06	207.46	226.8	252.31	271.59	ECP2-GFDL (historical)
19	26.92	89.79	119.44	142.15	167.65	184.17	200.56	216.89	238.44	254.72	ECP2-GFDL (future)
20	23.08	81.66	119.18	134.96	154.89	169.69	184.37	199	218.3	235.66	Observed
21	19.23	57.04	78.65	100.44	127.97	148.4	168.67	188.87	215.52	232.88	ECP2-HadCM3 (historical)
22	15.38	45.74	72.81	83.26	96.45	106.24	116.69	128.98	145.2	157.45	CRCM-CGCM3 (historical)
23	11.54	43.74	61.91	75.17	91.92	104.35	115.96	125.64	138.42	148.07	CRCM-CGCM3 (future)
24	7.69	41.89	60.62	71.8	85.92	96.39	106.79	117.15	130.82	141.15	CRCM-CCSM (future)
25	3.85	34.25	49.32	59.29	71.9	81.25	90.53	99.78	111.98	121.2	CRCM-CCSM (historical)
Gauge: 444128; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h⁻¹) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	127.66	210.89	287.34	383.95	455.61	526.75	597.62	691.13	761.8	RCM3-GFDL (historical)
2	92.31	127.49	179.9	226.69	299.35	353.26	406.77	460.08	530.42	583.58	RCM3-CGCM3 (historical)
3	88.46	110.24	175.6	214.49	260.44	298.91	337.09	375.14	425.33	463.26	RCM3-CGCM3 (future)
4	84.62	106.16	169.18	208.59	258.18	290.6	328.56	368.01	420.06	459.4	RCM3-GFDL (future)
5	80.77	105.56	167.55	207.45	249.08	288.97	322.78	354.84	397.14	429.11	HRM3-GFDL (future)
6	76.92	100.14	164.04	199.66	247.7	278.06	311.2	344.23	387.79	420.72	HRM3-HadCM3 (historical)
7	73.08	96.98	152.76	195.31	244.67	277.56	307.19	336.72	375.68	405.12	HRM3-HadCM3 (future)
8	69.23	95.41	140.36	169.08	205.37	232.3	259.02	285.65	320.78	347.33	WRFG-CGCM3 (future)
9	65.38	93.74	134.05	152.68	182.35	204.36	226.21	247.97	276.69	298.4	MM5I-HadCM3 (historical)
10	61.54	92.89	129.2	152.53	175.87	193.18	210.37	227.49	250.08	267.16	MM5I-HadCM3 (future)
11	57.69	92.51	128.46	147.21	170.91	188.48	205.93	223.32	246.25	263.59	HRM3-GFDL (historical)
12	53.85	88.49	122.06	141.38	165.78	183.88	201.85	219.76	243.38	261.23	ECP2-HadCM3 (future)
13	50.00	83.35	118.78	136.18	158.16	174.8	194.27	213.67	239.26	258.6	WRFG-CGCM3 (historical)
14	46.15	82.32	107.83	128.75	155.19	174.46	190.65	206.77	232.79	252.47	MM5I-CCSM (historical)
15	42.31	80.06	106.5	124	147.27	167.22	187.02	206.76	228.05	244.12	WRFG-CCSM (future)
16	38.46	78.38	105.99	120.98	146.12	162.53	178.82	195.05	216.46	232.98	WRFG-CCSM (historical)
17	34.62	76.23	102.87	120.93	143.74	160.67	177.47	194.21	216.29	232.64	MM5I-CCSM (future)
18	30.77	75.6	100.56	120.37	140.78	157.44	173.97	190.45	212.18	228.6	ECP2-GFDL (historical)
19	26.92	73.72	99.09	118.33	139.92	153.98	167.92	181.82	200.15	214.01	ECP2-GFDL (future)
20	23.08	66.94	98.66	112.09	129.06	141.64	154.14	166.59	183.01	195.42	ECP2-HadCM3 (historical)
21	19.23	46.15	59.33	75	95.06	109.95	124.72	139.44	158.86	173.54	Observed
22	15.38	35.13	59.12	68.05	79.07	87.25	95.92	106.16	119.66	129.86	CRCM-CGCM3 (historical)
23	11.54	35.13	50.31	61.35	75.3	85.65	95.37	103.46	114.13	122.19	CRCM-CGCM3 (future)
24	7.69	33.63	49.17	58.46	70.2	78.91	87.55	96.16	107.53	116.12	CRCM-CCSM (future)
25	3.85	27.32	39.73	47.95	58.33	66.03	73.67	81.29	91.33	98.93	CRCM-CCSM (historical)
Gauge: 444128; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h[-1]) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	93.6	171.3	239.15	324.88	388.48	451.61	514.5	597.49	660.2	RCM3-GFDL (historical)
2	92.31	93.44	136.79	184.5	248.33	295.68	342.69	389.52	451.3	498	RCM3-CGCM3 (historical)
3	88.46	79.74	133.98	165.39	204.24	236.03	267.59	299.02	340.6	373.57	RCM3-GFDL (future)
4	84.62	76.26	132.76	161.4	201.52	230.71	263.9	296.97	340.5	371.85	RCM3-CGCM3 (future)
5	80.77	75.83	127.48	158.79	197.27	228.32	254.92	281.43	316.4	342.83	HRM3-GFDL (future)
6	76.92	71.16	123.84	153.04	191.68	217.3	244.46	271.53	307.24	334.23	HRM3-HadCM3 (historical)
7	73.08	68.95	116.52	152.19	189.93	216.08	240.3	264.44	296.27	320.33	HRM3-HadCM3 (future)
8	69.23	68.83	104.16	127.48	156.94	178.79	200.49	222.1	250.62	272.17	WRFG-CGCM3 (future)
9	65.38	66.25	98.17	113.51	137.3	154.95	172.47	189.92	212.95	230.36	MM5I-HadCM3 (historical)
10	61.54	65.44	94.68	112.96	131.65	145.51	159.28	172.99	191.08	204.75	MM5I-HadCM3 (future)
11	57.69	65.16	93.55	108.37	127.09	140.98	154.77	168.51	186.64	200.34	HRM3-GFDL (historical)
12	53.85	62.64	88.68	104.06	123.49	137.91	152.22	166.48	185.3	199.52	ECP2-HadCM3 (future)
13	50.00	57.99	85.78	99.44	116.69	130.15	145.44	160.68	180.78	195.97	WRFG-CGCM3 (historical)
14	46.15	57.68	77.54	93.98	114.74	129.5	142.2	154.86	174.84	190.16	MM5I-CCSM (historical)
15	42.31	55.45	76.35	90.18	108.26	123.8	139.21	154.57	171.56	184.19	WRFG-CCSM (future)
16	38.46	54.09	75.55	87.62	107.67	120.64	133.51	146.34	163.27	176.06	MM5I-CCSM (future)
17	34.62	52.72	73.47	87.33	105.49	118.75	131.92	145.03	162.34	175.41	WRFG-CCSM (historical)
18	30.77	52.1	71.63	87.19	103.02	116.02	128.92	141.78	158.74	171.55	ECP2-GFDL (historical)
19	26.92	50.69	70.76	85.5	101.88	112.79	123.61	134.39	148.62	159.37	ECP2-GFDL (future)
20	23.08	45.73	69.86	80.29	93.48	103.27	112.98	122.66	135.42	145.07	ECP2-HadCM3 (historical)
21	19.23	30.06	39.65	46	54.02	59.97	66.1	73.46	83.17	90.51	CRCM-CGCM3 (historical)
22	15.38	22.28	33.29	41.23	51.27	58.71	65.87	71.76	79.52	85.39	CRCM-CGCM3 (future)
23	11.54	21.53	32.5	39.76	48.93	55.74	62.5	69.23	78.11	84.82	Observed
24	7.69	21.3	32.31	38.95	47.34	53.56	59.74	65.9	74.02	80.16	CRCM-CCSM (future)
25	3.85	16.92	25.48	31.15	38.32	43.63	48.9	54.16	61.1	66.34	CRCM-CCSM (historical)
Gauge: 444128; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	61.44	103.34	141.45	189.61	225.34	260.8	296.13	342.74	377.97	RCM3-GFDL (historical)
2	92.31	61.36	87.16	111.13	147.29	174.11	200.74	227.27	262.27	288.72	RCM3-CGCM3 (historical)
3	88.46	52.92	84.99	104.18	126.91	145.84	164.64	183.37	208.08	226.76	RCM3-CGCM3 (future)
4	84.62	50.85	82.51	101.38	125.7	141.66	160.78	180.24	205.93	225.34	RCM3-GFDL (future)
5	80.77	50.66	81.17	100.64	121.56	141.24	157.5	173.28	194.11	209.85	HRM3-GFDL (future)
6	76.92	47.92	79.37	96.89	120.4	135.43	151.72	167.96	189.37	205.56	HRM3-HadCM3 (historical)
7	73.08	46.42	74.02	95.02	119.01	135.07	149.63	164.13	183.27	197.73	HRM3-HadCM3 (future)
8	69.23	45.77	67.7	81.79	99.59	112.79	125.9	138.96	156.2	169.22	WRFG-CGCM3 (future)
9	65.38	44.81	64.51	73.68	88.2	98.98	109.68	120.34	134.4	145.02	MM5I-HadCM3 (historical)
10	61.54	44.39	62.18	73.55	84.97	93.44	101.85	110.23	121.29	129.64	MM5I-HadCM3 (future)
11	57.69	44.2	61.75	70.91	82.48	91.06	99.58	108.07	119.27	127.73	HRM3-GFDL (historical)
12	53.85	42.31	58.65	68.1	80.03	88.88	97.67	106.42	117.97	126.7	ECP2-HadCM3 (future)
13	50.00	39.73	57.01	65.5	76.22	84.38	93.87	103.33	115.81	125.25	WRFG-CGCM3 (historical)
14	46.15	39.29	51.72	61.92	74.82	84.17	92.06	99.93	112.58	122.17	MM5I-CCSM (historical)
15	42.31	38.13	51.04	59.59	70.93	80.65	90.29	99.9	110.3	118.15	WRFG-CCSM (future)
16	38.46	37.32	50.75	58.08	70.39	78.4	86.36	94.28	104.74	112.73	WRFG-CCSM (historical)
17	34.62	36.31	49.28	58.05	69.21	77.46	85.66	93.82	104.59	112.64	MM5I-CCSM (future)
18	30.77	35.98	48.15	57.83	67.75	75.87	83.92	91.95	102.54	110.55	ECP2-GFDL (historical)
19	26.92	35.07	47.46	56.81	67.27	74.11	80.9	87.66	96.58	103.33	ECP2-GFDL (future)
20	23.08	31.8	47.19	53.72	61.98	68.11	74.19	80.25	88.24	94.28	ECP2-HadCM3 (historical)
21	19.23	21.74	28.08	32.27	37.57	41.51	45.67	50.58	57.07	61.97	CRCM-CGCM3 (historical)
22	15.38	16.47	23.77	29.07	35.77	40.74	45.41	49.3	54.43	58.32	Observed
23	11.54	15.76	23.2	27.65	33.65	38.33	42.98	47.6	53.71	58.31	CRCM-CGCM3 (future)
24	7.69	14.82	22.36	27.35	33.27	37.45	41.59	45.72	51.16	55.28	CRCM-CCSM (future)
25	3.85	12.75	18.66	22.58	27.52	31.19	34.83	38.46	43.25	46.87	CRCM-CCSM (historical)
Gauge: 444128; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	48.91	80.8	110.09	147.1	174.55	201.81	228.96	264.78	291.86	RCM3-GFDL (historical)
2	92.31	48.84	68.93	86.85	114.69	135.35	155.85	176.28	203.23	223.59	RCM3-CGCM3 (historical)
3	88.46	42.24	67.28	82.18	99.78	114.52	129.14	143.72	162.95	177.48	RCM3-CGCM3 (future)
4	84.62	40.67	64.82	79.91	98.92	111.35	125.86	140.97	160.91	175.98	RCM3-GFDL (future)
5	80.77	40.45	64.19	79.48	95.41	110.69	123.68	135.96	152.17	164.42	HRM3-GFDL (future)
6	76.92	38.36	62.85	76.49	94.91	106.52	119.22	131.87	148.56	161.17	HRM3-HadCM3 (historical)
7	73.08	37.15	58.52	74.82	93.73	106.35	117.7	129.02	143.94	155.23	HRM3-HadCM3 (future)
8	69.23	36.56	53.77	64.78	78.69	89	99.24	109.44	122.91	133.08	WRFG-CGCM3 (future)
9	65.38	35.92	51.37	58.49	69.85	78.28	86.65	94.99	105.99	114.3	MM5I-HadCM3 (historical)
10	61.54	35.58	49.5	58.45	67.39	74.03	80.61	87.18	95.84	102.38	MM5I-HadCM3 (future)
11	57.69	35.44	49.22	56.4	65.48	72.21	78.9	85.56	94.35	100.99	HRM3-GFDL (historical)
12	53.85	33.89	46.76	54.16	63.52	70.45	77.34	84.2	93.25	100.1	ECP2-HadCM3 (future)
13	50.00	31.93	45.51	52.17	60.59	66.98	74.43	81.86	91.67	99.08	WRFG-CGCM3 (historical)
14	46.15	31.54	41.32	49.33	59.46	66.84	73.04	79.22	89.19	96.73	MM5I-CCSM (historical)
15	42.31	30.67	40.8	47.5	56.42	64.07	71.66	79.22	87.37	93.53	WRFG-CCSM (future)
16	38.46	30.03	40.6	46.34	55.97	62.26	68.5	74.71	82.91	89.24	WRFG-CCSM (historical)
17	34.62	29.21	39.4	46.32	55.06	61.54	67.98	74.39	82.85	89.11	MM5I-CCSM (future)
18	30.77	28.96	38.54	46.12	53.95	60.33	66.67	72.99	81.31	87.61	ECP2-GFDL (historical)
19	26.92	28.25	37.96	45.35	53.59	58.97	64.31	69.63	76.65	81.96	ECP2-GFDL (future)
20	23.08	25.64	37.79	42.94	49.44	54.26	59.04	63.81	70.1	74.85	ECP2-HadCM3 (historical)
21	19.23	17.68	22.73	26.07	30.29	33.42	36.75	40.67	45.84	49.75	CRCM-CGCM3 (historical)
22	15.38	13.46	19.27	23.5	28.85	32.81	36.53	39.63	43.71	46.8	CRCM-CGCM3 (future)
23	11.54	12.88	18.83	22.39	26.91	30.62	34.31	37.98	42.82	46.48	Observed
24	7.69	11.96	17.94	21.9	26.89	30.22	33.53	36.83	41.18	44.47	CRCM-CCSM (future)
25	3.85	10.47	15.22	18.37	22.35	25.3	28.23	31.14	34.99	37.9	CRCM-CCSM (historical)
Gauge: 444128; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Pr (x ≤ X)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									
Non-exceedance	2	5	10	25	50	100	200	500	1000	Data Source
Probability (%)	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	for 1000-year
96.15	47.9	80.4	109.96	147.31	175.02	202.52	229.92	266.07	293.4	RCM3-GFDL (historical)
92.31	47.84	67.85	86.44	114.49	135.29	155.94	176.51	203.65	224.17	RCM3-CGCM3 (historical)
88.46	41.3	66.17	81.06	98.67	113.35	127.92	142.44	161.6	176.08	RCM3-CGCM3 (future)
84.62	39.69	64.25	78.87	97.74	110.12	124.94	140.03	159.95	175	RCM3-GFDL (future)
80.77	39.55	63.21	78.31	94.52	109.78	122.41	134.65	150.8	163.01	HRM3-GFDL (future)
76.92	37.43	61.81	75.39	93.64	105.28	117.91	130.5	147.11	159.66	HRM3-HadCM3 (historical)
73.08	36.25	57.66	73.95	92.55	105.02	116.31	127.56	142.4	153.61	HRM3-HadCM3 (future)
69.23	35.75	52.76	63.69	77.5	87.74	97.91	108.05	121.41	131.52	WRFG-CGCM3 (future)
65.38	35.01	50.28	57.39	68.66	77.02	85.31	93.58	104.49	112.73	MM5I-HadCM3 (historical)
61.54	34.68	48.48	57.29	66.15	72.72	79.24	85.74	94.31	100.79	MM5I-HadCM3 (future)
57.69	34.53	48.15	55.26	64.23	70.89	77.5	84.08	92.77	99.34	HRM3-GFDL (historical)
53.85	33.07	45.75	53.07	62.33	69.2	76.01	82.8	91.76	98.53	ECP2-HadCM3 (future)
50.00	31.07	44.47	51.04	59.35	65.68	73.04	80.37	90.05	97.36	WRFG-CGCM3 (historical)
46.15	30.73	40.36	48.27	58.26	65.52	71.64	77.73	87.56	94.99	MM5I-CCSM (historical)
42.31	29.83	39.84	46.47	55.26	62.8	70.28	77.73	85.78	91.86	WRFG-CCSM (future)
38.46	29.2	39.62	45.3	54.85	61.06	67.23	73.37	81.48	87.68	WRFG-CCSM (historical)
34.62	28.41	38.48	45.28	53.93	60.33	66.69	73.02	81.37	87.61	MM5I-CCSM (future)
30.77	28.16	37.6	45.11	52.8	59.1	65.35	71.58	79.79	86	ECP2-GFDL (historical)
26.92	27.45	37.07	44.32	52.42	57.73	62.99	68.24	75.16	80.39	ECP2-GFDL (future)
23.08	24.92	36.86	41.93	48.34	53.1	57.82	62.52	68.72	73.41	ECP2-HadCM3 (historical)
19.23	17.12	22.03	25.28	29.39	32.44	35.66	39.47	44.49	48.29	CRCM-CGCM3 (historical)
15.38	13.03	18.69	22.8	27.99	31.84	35.47	38.49	42.46	45.47	CRCM-CGCM3 (future)
11.54	12.49	18.25	21.7	26.06	29.29	32.51	35.71	39.93	43.12	CRCM-CCSM (future)
7.69	10.15	14.73	17.77	21.61	24.45	27.28	30.09	33.81	36.62	CRCM-CCSM (historical)
3.85	8.72	13.19	16.15	19.89	22.67	25.42	28.17	31.79	34.52	Observed
	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	30.65	51.18	69.87	93.47	110.98	128.37	145.69	168.53	185.8	RCM3-GFDL (historical)
2	92.31	30.61	43.25	55	72.72	85.87	98.92	111.92	129.07	142.04	RCM3-CGCM3 (historical)
3	88.46	26.47	42.19	51.59	62.73	72.01	81.22	90.4	102.51	111.66	RCM3-CGCM3 (future)
4	84.62	25.46	40.98	50.22	62.14	69.96	79.34	88.88	101.46	110.98	RCM3-GFDL (future)
5	80.77	25.37	40.32	49.86	60.11	69.76	77.72	85.45	95.66	103.37	HRM3-GFDL (future)
6	76.92	24.02	39.44	48.02	59.56	66.91	74.9	82.85	93.35	101.29	HRM3-HadCM3 (historical)
7	73.08	23.28	36.82	47.11	58.86	66.75	73.88	80.99	90.38	97.47	HRM3-HadCM3 (future)
8	69.23	22.97	33.71	40.61	49.34	55.81	62.23	68.63	77.08	83.46	WRFG-CGCM3 (future)
9	65.38	22.5	32.15	36.64	43.76	49.04	54.29	59.51	66.4	71.61	MM5I-HadCM3 (historical)
10	61.54	22.29	31.01	36.58	42.17	46.32	50.45	54.55	59.97	64.06	MM5I-HadCM3 (future)
11	57.69	22.2	30.8	35.29	40.96	45.16	49.34	53.5	58.99	63.14	HRM3-GFDL (historical)
12	53.85	21.27	29.28	33.91	39.76	44.1	48.4	52.69	58.35	62.63	ECP2-HadCM3 (future)
13	50.00	20.01	28.49	32.65	37.9	41.89	46.55	51.19	57.31	61.93	WRFG-CGCM3 (historical)
14	46.15	19.79	25.88	30.88	37.21	41.8	45.67	49.53	55.7	60.39	MM5I-CCSM (historical)
15	42.31	19.22	25.55	29.74	35.29	40.05	44.78	49.48	54.62	58.46	WRFG-CCSM (future)
16	38.46	18.82	25.41	28.99	35.03	38.96	42.86	46.74	51.87	55.76	WRFG-CCSM (historical)
17	34.62	18.33	24.68	28.98	34.44	38.49	42.5	46.5	51.77	55.74	MM5I-CCSM (future)
18	30.77	18.17	24.14	28.87	33.74	37.71	41.66	45.59	50.78	54.7	ECP2-GFDL (historical)
19	26.92	17.73	23.8	28.38	33.5	36.85	40.18	43.49	47.86	51.17	ECP2-GFDL (future)
20	23.08	16.12	23.66	26.87	30.92	33.93	36.91	39.88	43.8	46.77	ECP2-HadCM3 (historical)
21	19.23	11.19	14.3	16.36	18.96	20.9	22.92	25.33	28.5	30.9	CRCM-CGCM3 (historical)
22	15.38	8.61	12.18	14.78	18.06	20.5	22.81	24.72	27.24	29.14	CRCM-CGCM3 (future)
23	11.54	8.26	11.9	14.09	16.84	18.89	20.92	22.94	25.61	27.63	CRCM-CCSM (future)
24	7.69	6.79	9.69	11.61	14.03	15.83	17.62	19.4	21.74	23.52	CRCM-CCSM (historical)
25	3.85	5.36	8.02	9.78	12	13.65	15.29	16.92	19.08	20.71	Observed
Gauge: 444128; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	16.65	27.58	37.53	50.1	59.42	68.67	77.9	90.06	99.25	RCM3-GFDL (historical)
2	92.31	16.63	23.36	29.62	39.05	46.05	52.99	59.92	69.05	75.95	RCM3-CGCM3 (historical)
3	88.46	14.43	22.8	27.8	33.74	38.68	43.58	48.47	54.92	59.79	RCM3-CGCM3 (future)
4	84.62	13.89	22.15	27.07	33.41	37.58	42.59	47.67	54.38	59.45	RCM3-GFDL (future)
5	80.77	13.84	21.8	26.89	32.35	37.49	41.71	45.82	51.26	55.36	HRM3-GFDL (future)
6	76.92	13.12	21.33	25.9	32.05	35.96	40.21	44.44	50.03	54.26	HRM3-HadCM3 (historical)
7	73.08	12.73	19.94	25.42	31.67	35.87	39.67	43.46	48.46	52.23	HRM3-HadCM3 (future)
8	69.23	12.56	18.29	21.97	26.62	30.07	33.49	36.9	41.4	44.8	WRFG-CGCM3 (future)
9	65.38	12.31	17.45	19.84	23.64	26.45	29.24	32.02	35.7	38.47	MM5I-HadCM3 (historical)
10	61.54	12.2	16.84	19.81	22.79	25	27.19	29.38	32.26	34.44	MM5I-HadCM3 (future)
11	57.69	12.15	16.73	19.11	22.13	24.37	26.59	28.8	31.72	33.93	HRM3-GFDL (historical)
12	53.85	11.66	15.92	18.38	21.49	23.8	26.1	28.38	31.39	33.67	ECP2-HadCM3 (future)
13	50.00	10.99	15.49	17.7	20.5	22.64	25.11	27.58	30.84	33.3	WRFG-CGCM3 (historical)
14	46.15	10.87	14.11	16.78	20.14	22.57	24.63	26.68	29.97	32.47	MM5I-CCSM (historical)
15	42.31	10.56	13.93	16.16	19.11	21.65	24.16	26.67	29.38	31.43	WRFG-CCSM (future)
16	38.46	10.35	13.86	15.78	18.98	21.07	23.14	25.21	27.93	30.05	WRFG-CCSM (historical)
17	34.62	10.09	13.48	15.76	18.68	20.84	22.98	25.11	27.92	29.99	MM5I-CCSM (future)
18	30.77	10	13.18	15.7	18.29	20.41	22.51	24.6	27.36	29.45	ECP2-GFDL (historical)
19	26.92	9.77	12.99	15.44	18.16	19.95	21.71	23.48	25.8	27.56	ECP2-GFDL (future)
20	23.08	8.91	12.93	14.64	16.8	18.4	19.99	21.57	23.66	25.24	ECP2-HadCM3 (historical)
21	19.23	6.29	7.95	9.04	10.42	11.45	12.52	13.8	15.49	16.77	CRCM-CGCM3 (historical)
22	15.38	4.91	6.82	8.2	9.94	11.24	12.47	13.48	14.82	15.83	CRCM-CGCM3 (future)
23	11.54	4.73	6.67	7.84	9.31	10.4	11.48	12.56	13.99	15.06	CRCM-CCSM (future)
24	7.69	3.94	5.49	6.51	7.81	8.77	9.72	10.67	11.92	12.87	CRCM-CCSM (historical)
25	3.85	3.29	4.74	5.7	6.91	7.81	8.7	9.59	10.77	11.65	Observed
Gauge: 444128; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	8.87	14.59	19.8	26.38	31.26	36.11	40.93	47.3	52.12	RCM3-GFDL (historical)
2	92.31	8.85	12.38	15.65	20.59	24.26	27.89	31.52	36.3	39.91	RCM3-CGCM3 (historical)
3	88.46	7.7	12.08	14.71	17.82	20.41	22.98	25.54	28.91	31.47	RCM3-CGCM3 (future)
4	84.62	7.42	11.75	14.33	17.65	19.84	22.43	25.09	28.59	31.24	RCM3-GFDL (future)
5	80.77	7.39	11.57	14.21	17.08	19.76	22	24.16	27.01	29.16	HRM3-GFDL (future)
6	76.92	7.02	11.31	13.71	16.91	18.97	21.2	23.42	26.34	28.56	HRM3-HadCM3 (historical)
7	73.08	6.81	10.59	13.45	16.73	18.91	20.9	22.88	25.49	27.46	HRM3-HadCM3 (future)
8	69.23	6.73	9.72	11.64	14.07	15.88	17.67	19.45	21.81	23.59	WRFG-CGCM3 (future)
9	65.38	6.6	9.29	10.54	12.52	13.99	15.45	16.9	18.82	20.27	MM5I-HadCM3 (historical)
10	61.54	6.54	8.97	10.52	12.08	13.24	14.39	15.53	17.04	18.18	MM5I-HadCM3 (future)
11	57.69	6.51	8.91	10.16	11.74	12.92	14.08	15.24	16.77	17.93	HRM3-GFDL (historical)
12	53.85	6.26	8.49	9.78	11.42	12.63	13.83	15.03	16.61	17.81	ECP2-HadCM3 (future)
13	50.00	5.9	8.26	9.42	10.89	11.99	13.29	14.58	16.28	17.57	WRFG-CGCM3 (historical)
14	46.15	5.84	7.53	8.92	10.68	11.97	13.05	14.12	15.85	17.15	MM5I-CCSM (historical)
15	42.31	5.68	7.45	8.62	10.16	11.48	12.8	14.11	15.54	16.61	WRFG-CCSM (future)
16	38.46	5.57	7.4	8.41	10.1	11.19	12.28	13.37	14.8	15.89	WRFG-CCSM (historical)
17	34.62	5.43	7.2	8.4	9.93	11.06	12.18	13.3	14.77	15.88	MM5I-CCSM (future)
18	30.77	5.38	7.05	8.37	9.73	10.84	11.94	13.03	14.48	15.57	ECP2-GFDL (historical)
19	26.92	5.27	6.95	8.24	9.65	10.59	11.51	12.43	13.65	14.57	ECP2-GFDL (future)
20	23.08	4.81	6.92	7.82	8.95	9.79	10.62	11.45	12.54	13.37	ECP2-HadCM3 (historical)
21	19.23	3.44	4.31	4.88	5.6	6.14	6.72	7.39	8.28	8.95	CRCM-CGCM3 (historical)
22	15.38	2.72	3.72	4.45	5.36	6.04	6.67	7.21	7.91	8.44	CRCM-CGCM3 (future)
23	11.54	2.63	3.64	4.25	5.02	5.59	6.15	6.72	7.46	8.02	CRCM-CCSM (future)
24	7.69	2.21	3.01	3.55	4.22	4.72	5.21	5.71	6.36	6.85	CRCM-CCSM (historical)
25	3.85	1.76	2.63	3.2	3.92	4.46	4.99	5.53	6.23	6.76	Observed
Gauge: 444128; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	5.89	9.64	13.06	17.37	20.56	23.74	26.9	31.07	34.22	RCM3-GFDL (historical)
2	92.31	5.89	8.19	10.33	13.56	15.96	18.34	20.71	23.84	26.2	RCM3-CGCM3 (historical)
3	88.46	5.13	8	9.71	11.76	13.45	15.13	16.81	19.02	20.69	RCM3-CGCM3 (future)
4	84.62	4.94	7.77	9.47	11.63	13.06	14.78	16.52	18.82	20.55	RCM3-GFDL (future)
5	80.77	4.93	7.66	9.4	11.27	13.03	14.48	15.89	17.75	19.15	HRM3-GFDL (future)
6	76.92	4.68	7.5	9.07	11.16	12.52	13.98	15.43	17.35	18.8	HRM3-HadCM3 (historical)
7	73.08	4.55	7.02	8.9	11.05	12.48	13.78	15.07	16.78	18.08	HRM3-HadCM3 (future)
8	69.23	4.49	6.45	7.7	9.29	10.47	11.64	12.81	14.35	15.51	WRFG-CGCM3 (future)
9	65.38	4.4	6.16	6.99	8.29	9.25	10.21	11.17	12.42	13.38	MM5I-HadCM3 (historical)
10	61.54	4.36	5.96	6.97	7.99	8.75	9.5	10.25	11.23	11.98	MM5I-HadCM3 (future)
11	57.69	4.35	5.92	6.74	7.77	8.54	9.3	10.06	11.06	11.82	HRM3-GFDL (historical)
12	53.85	4.18	5.64	6.48	7.54	8.33	9.12	9.9	10.93	11.71	ECP2-HadCM3 (future)
13	50.00	3.95	5.5	6.26	7.22	7.94	8.79	9.64	10.76	11.6	WRFG-CGCM3 (historical)
14	46.15	3.91	5.02	5.94	7.09	7.93	8.64	9.34	10.44	11.3	MM5I-CCSM (historical)
15	42.31	3.8	4.96	5.73	6.73	7.6	8.46	9.31	10.27	10.98	WRFG-CCSM (future)
16	38.46	3.74	4.94	5.6	6.7	7.42	8.13	8.84	9.78	10.5	WRFG-CCSM (historical)
17	34.62	3.64	4.81	5.59	6.6	7.34	8.07	8.81	9.77	10.49	MM5I-CCSM (future)
18	30.77	3.62	4.7	5.56	6.45	7.17	7.89	8.61	9.55	10.26	ECP2-GFDL (historical)
19	26.92	3.53	4.64	5.47	6.42	7.03	7.64	8.25	9.05	9.66	ECP2-GFDL (future)
20	23.08	3.24	4.62	5.2	5.94	6.49	7.04	7.58	8.29	8.84	ECP2-HadCM3 (historical)
21	19.23	2.34	2.91	3.28	3.76	4.11	4.48	4.92	5.5	5.94	CRCM-CGCM3 (historical)
22	15.38	1.87	2.52	3	3.6	4.04	4.46	4.8	5.26	5.61	CRCM-CGCM3 (future)
23	11.54	1.81	2.47	2.87	3.37	3.74	4.11	4.48	4.97	5.34	CRCM-CCSM (future)
24	7.69	1.54	2.07	2.42	2.87	3.2	3.58	3.96	4.47	4.85	Observed
25	3.85	1.23	1.86	2.28	2.8	3.19	3.52	3.85	4.28	4.6	CRCM-CCSM (historical)
Gauge: 444128; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	421.84	529.5	589.86	666.18	715.08	758.73	798.37	900.89	986.47	Observed
2	92.31	407.49	522.85	583.23	641.88	680.01	713.64	785.64	845.99	879.12	HRM3-HadCM3 (historical)
3	88.46	381.4	517.91	581.3	638.4	672.9	703.18	743.87	779.82	804.61	HRM3-HadCM3 (future)
4	84.62	354.58	431.88	487.32	545.6	605.58	696.58	730.29	762.41	784.48	HRM3-GFDL (future)
5	80.77	325.09	419.08	449.94	527.66	582.68	629.18	674.05	729.01	767.89	RCM3-CGCM3 (historical)
6	76.92	314.95	385.09	447.58	513.78	580.72	616.39	661.93	717.84	757.49	RCM3-GFDL (future)
7	73.08	296.11	377.45	433.33	512.26	567.33	615.63	645.44	694.06	738.53	RCM3-GFDL (historical)
8	69.23	291.64	375.36	430.6	485.43	530.43	582.02	631.98	681.1	705.83	HRM3-GFDL (historical)
9	65.38	274.84	365.06	416.85	480.86	528.84	571.27	608.87	654.66	686.9	RCM3-CGCM3 (future)
10	61.54	256.99	362.77	411.89	478.02	508	534.51	558.4	586.88	606.56	WRFG-CGCM3 (historical)
11	57.69	248.13	361.2	407.64	471.6	499.83	520.26	545.43	575.55	596.43	WRFG-CCSM (future)
12	53.85	244.23	354.21	398.04	461.11	492.43	516.27	530.84	547.91	560.41	MM5I-CCSM (future)
13	50.00	242.03	337.82	387.36	438.07	456.82	484.05	509.2	539.4	559.52	MM5I-HadCM3 (future)
14	46.15	241.51	331.1	384.27	434.13	456.63	476.34	497.38	523.82	542.11	WRFG-CCSM (historical)
15	42.31	235.37	318.14	379.48	425.31	456.35	475.25	493.96	514.8	530.35	MM5I-CCSM (historical)
16	38.46	233.18	313.88	376.83	423.08	450.73	473.12	487.59	508.83	529.1	MM5I-HadCM3 (historical)
17	34.62	229.94	299.66	357.36	398.41	424.45	452.44	477.99	504.6	516.19	WRFG-CGCM3 (future)
18	30.77	215.41	296.21	344.81	393.19	424.42	447.53	468.37	493.26	510.48	ECP2-GFDL (future)
19	26.92	205.14	285.19	329.89	364.84	386.87	406.32	423.81	444.63	458.99	ECP2-HadCM3 (future)
20	23.08	191.37	282.59	310.67	336.57	352.63	366.65	379.43	398.18	411.12	ECP2-GFDL (historical)
21	19.23	145.02	264.65	294.92	326.36	346.18	363.68	379.14	393.88	403.96	ECP2-HadCM3 (historical)
22	15.38	137.15	195.1	221.32	249.03	266.73	282.5	296.8	313.95	325.86	CRCM-CGCM3 (future)
23	11.54	101.92	145.28	168.9	194.47	211.09	226.09	239.83	256.47	268.14	CRCM-CGCM3 (historical)
24	7.69	100.49	130.46	145.77	161.71	171.78	180.69	188.71	198.27	204.87	CRCM-CCSM (future)
25	3.85	87.2	117.22	132.93	149.53	160.13	169.57	178.13	188.4	195.53	CRCM-CCSM (historical)
Gauge: 445690; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h⁻¹) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	288.14	360.68	401.07	452.2	484.91	514.09	540.56	572.35	594.44	HRM3-HadCM3 (historical)
2	92.31	278.45	356.23	396.8	436.27	461.87	484.44	504.71	528.81	545.42	HRM3-HadCM3 (future)
3	88.46	260.9	352.78	395.56	433.86	457.01	477.32	495.49	517.01	531.79	HRM3-GFDL (future)
4	84.62	242.67	294.81	332.13	371.3	396.2	426.93	456.92	493.62	519.55	RCM3-CGCM3 (historical)
5	80.77	222.74	286.19	306.99	358.95	394.5	418.31	448.51	485.8	512.22	RCM3-GFDL (future)
6	76.92	215.83	263.25	305.2	349.47	385.32	418.11	438.29	468.14	497.56	RCM3-GFDL (historical)
7	73.08	203.08	258.12	295.51	330.58	360.77	393.87	427.02	462.18	478.74	HRM3-GFDL (historical)
8	69.23	200.05	256.6	293.96	327.8	358.53	388.13	413.3	443.93	465.47	RCM3-CGCM3 (future)
9	65.38	188.66	249.71	284.49	325.92	346.1	363.94	380.01	407.83	441.32	Observed
10	61.54	176.53	248.14	281.32	320.41	340.57	354.3	371.23	399.15	412.37	WRFG-CGCM3 (historical)
11	57.69	170.65	246.99	278.52	314.5	335.58	351.62	362.05	391.47	405.49	WRFG-CCSM (future)
12	53.85	167.9	242.31	271.93	299.05	311.7	329.67	361.41	372.88	380.91	MM5I-CCSM (future)
13	50.00	166.39	231.28	264.16	296.25	311.4	326.08	346.56	366.83	380.68	MM5I-HadCM3 (future)
14	46.15	166.12	226.68	259.42	290.18	311.06	324.66	338.89	356.67	368.97	WRFG-CCSM (historical)
15	42.31	162	217.91	257.53	288.84	307.48	323.99	336.51	350.52	360.61	MM5I-CCSM (historical)
16	38.46	160.35	214.89	244.4	272.08	289.61	322.68	332.44	346.17	360.13	MM5I-HadCM3 (historical)
17	34.62	158.16	205.37	235.86	268.46	289.48	308.31	325.48	343.89	351.7	WRFG-CGCM3 (future)
18	30.77	148.31	203.07	225.84	249.6	288.7	305.15	319.16	335.89	347.46	ECP2-GFDL (future)
19	26.92	141.27	195.59	212.83	249.44	264.3	277.41	289.19	303.21	312.87	ECP2-HadCM3 (future)
20	23.08	132.24	181.67	202.18	230.32	241.17	250.63	259.3	271.95	280.67	ECP2-GFDL (historical)
21	19.23	100.28	148.79	194.38	223.45	236.85	248.67	259.05	268.98	275.78	ECP2-HadCM3 (historical)
22	15.38	79.35	134.38	152.19	170.98	182.96	193.64	203.3	214.89	222.93	CRCM-CGCM3 (future)
23	11.54	70.8	100.36	116.42	133.75	145	155.14	164.42	175.65	183.52	CRCM-CGCM3 (historical)
24	7.69	69.76	90.27	100.72	111.58	118.44	124.5	129.96	136.45	140.94	CRCM-CCSM (future)
25	3.85	60.61	81.23	91.99	103.35	110.6	117.05	122.89	129.9	134.76	CRCM-CCSM (historical)
Gauge: 445690; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	211.63	263.45	291.92	328.05	351.11	371.64	390.25	412.54	428.02	HRM3-HadCM3 (historical)
2	92.31	204.66	260.27	289.16	317.18	335.33	351.31	365.65	382.67	394.39	HRM3-HadCM3 (future)
3	88.46	192.15	257.68	288.27	315.47	331.88	346.26	359.11	374.32	384.76	HRM3-GFDL (future)
4	84.62	178.91	216.24	242.84	270.67	288.32	309.37	330.45	356.17	374.32	RCM3-CGCM3 (historical)
5	80.77	164.6	210.11	224.98	261.44	286.54	303.96	324.22	350.32	368.77	RCM3-GFDL (future)
6	76.92	159.54	193.65	223.35	254.55	279.83	302.89	318.08	335.36	355.62	RCM3-GFDL (historical)
7	73.08	150.35	189.99	216.34	241.36	262.74	284.01	306.97	334.95	346.62	HRM3-GFDL (historical)
8	69.23	148.16	188.75	215.66	239.83	259.45	282.08	299.84	321.4	336.54	RCM3-CGCM3 (future)
9	65.38	139.93	183.89	208.6	238.49	252.89	265.59	277.02	290.62	300	WRFG-CGCM3 (historical)
10	61.54	131.12	182.73	206.54	232.85	248.92	258.61	270.64	285.01	294.95	WRFG-CCSM (future)
11	57.69	127.04	181.82	204.64	230.25	245.28	256.79	263.76	271.91	277.45	MM5I-HadCM3 (future)
12	53.85	124.89	178.48	199.76	219.37	228.42	240.8	252.8	267.17	277.15	MM5I-CCSM (future)
13	50.00	123.78	170.62	193.38	217.14	227.94	237.38	247.64	260.3	271	Observed
14	46.15	123.69	167.25	190.84	212.68	227.56	237.02	245.81	255.77	269.05	WRFG-CCSM (historical)
15	42.31	120.79	160.93	189.36	211.91	225.23	236.28	243.25	252.27	262.59	MM5I-HadCM3 (historical)
16	38.46	119.35	158.54	179.92	199.72	212.23	225.41	237.6	252.12	262.5	MM5I-CCSM (historical)
17	34.62	117.78	151.86	173.73	197.03	212.01	223.29	233.26	251.43	257.01	WRFG-CGCM3 (future)
18	30.77	110.66	150.23	166.61	183.54	194.18	205.46	226.1	245.15	253.36	ECP2-GFDL (future)
19	26.92	105.46	144.8	157.2	169.77	183.8	203.55	211.97	221.96	228.85	ECP2-HadCM3 (future)
20	23.08	99.38	134.77	149.58	164.9	177.54	184.31	190.64	199.7	205.95	ECP2-GFDL (historical)
21	19.23	75.46	100.34	127.99	160.88	174.53	183.02	190.34	197.43	202.28	ECP2-HadCM3 (historical)
22	15.38	56.38	100.22	113.26	126.84	135.49	143.17	150.13	158.45	164.22	CRCM-CGCM3 (future)
23	11.54	53.75	75.4	87.07	99.61	107.73	115.03	121.69	129.75	135.38	CRCM-CGCM3 (historical)
24	7.69	52.93	68.03	75.69	83.64	88.64	93.06	97.03	101.75	105.01	CRCM-CCSM (future)
25	3.85	46.11	61.4	69.35	77.72	83.05	87.79	92.07	97.21	100.76	CRCM-CCSM (historical)
Gauge: 445690; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	190.83	240.2	268.06	303.25	325.82	345.99	364.33	386.37	401.71	HRM3-HadCM3 (historical)
2	92.31	184.26	237.13	264.88	291.82	309.37	324.85	338.78	355.36	366.79	HRM3-HadCM3 (future)
3	88.46	172.28	234.94	263.97	290.26	306.14	320.08	332.58	347.39	357.56	HRM3-GFDL (future)
4	84.62	160.09	195.5	220.94	247.73	264.8	286.54	307.28	332.71	350.72	RCM3-CGCM3 (historical)
5	80.77	146.6	189.62	203.77	239.69	264.16	280.8	301.88	327.78	346.17	RCM3-GFDL (future)
6	76.92	142.02	174.06	202.83	233.41	258.13	279.98	293.72	318.01	338.79	RCM3-GFDL (historical)
7	73.08	133.42	170.57	196.35	220.24	241.06	265.78	289.05	310.17	321.58	HRM3-GFDL (historical)
8	69.23	131.38	169.66	194.89	217.96	240.96	259.78	277.13	298.28	313.18	RCM3-CGCM3 (future)
9	65.38	123.73	164.93	188.72	216.63	230.38	242.56	253.53	266.62	275.67	WRFG-CGCM3 (historical)
10	61.54	115.6	163.89	186.36	214.5	226.67	236.09	247.65	261.51	271.11	WRFG-CCSM (future)
11	57.69	111.49	163.21	184.38	208.93	223.31	234.22	240.92	248.77	254.72	MM5I-CCSM (future)
12	53.85	109.78	160	180.05	198.32	206.92	219.59	231.15	245.05	254.11	MM5I-HadCM3 (future)
13	50.00	108.79	152.48	175.52	196.59	206.91	215.97	225.55	237.69	246.09	WRFG-CCSM (historical)
14	46.15	108.5	149.44	171.52	192.6	206.86	215.39	224.07	233.65	241.01	MM5I-CCSM (historical)
15	42.31	105.66	143.53	170.37	191.48	204.15	214.38	221.02	231.1	240.22	MM5I-HadCM3 (historical)
16	38.46	104.78	141.65	161.48	180.29	192.28	205.15	216.9	228.82	234.14	WRFG-CGCM3 (future)
17	34.62	103.3	135.11	155.77	177.94	192.24	202.84	212.42	223.86	231.79	ECP2-GFDL (future)
18	30.77	96.68	133.52	148.9	164.9	174.99	183.9	191.93	201.48	208.08	ECP2-HadCM3 (future)
19	26.92	92.04	128.51	140.16	152.01	159.36	165.79	171.55	180.14	189.71	Observed
20	23.08	85.55	119.12	132.92	147.28	156.34	164.34	171.52	178.28	186.06	ECP2-GFDL (historical)
21	19.23	64.81	87.52	99.45	118.21	133.39	147.57	160.96	177.68	182.9	ECP2-HadCM3 (historical)
22	15.38	45.66	76.94	96.05	112.08	120.15	127.35	133.89	141.72	147.17	CRCM-CGCM3 (future)
23	11.54	45.35	64.98	75.72	87.36	94.95	101.8	108.09	115.71	121.05	CRCM-CGCM3 (historical)
24	7.69	44.73	58.27	65.2	72.42	76.99	81.03	84.68	89.02	92.03	CRCM-CCSM (future)
25	3.85	38.76	52.27	59.36	66.85	71.64	75.91	79.79	84.43	87.66	CRCM-CCSM (historical)
Gauge: 445690; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	141.44	182	206.1	236.34	255.94	273.58	289.71	309.23	322.88	HRM3-HadCM3 (historical)
2	92.31	136.15	179.43	202.59	225.19	240.05	253.23	265.13	279.36	289.21	HRM3-HadCM3 (future)
3	88.46	126.19	178.04	201.78	223.96	237.42	249.3	259.98	272.69	282.3	RCM3-GFDL (historical)
4	84.62	116.83	145.67	166.77	189.28	204.77	224.23	242.43	264.93	281.46	HRM3-GFDL (future)
5	80.77	105.96	140.81	152.47	183.71	203.75	220.43	239.09	262.37	280.99	RCM3-CGCM3 (historical)
6	76.92	102.58	128.18	152.44	179.11	200.54	216.7	234.93	262.25	278.83	RCM3-GFDL (future)
7	73.08	95.76	125.3	147.5	167.32	190.42	213.19	228.49	242.69	252.58	HRM3-GFDL (historical)
8	69.23	94.14	124.92	145.1	166.36	184.95	201.12	216.14	234.59	247.69	RCM3-CGCM3 (future)
9	65.38	88.16	120.91	140.87	164.19	174.32	184.45	193.63	204.62	212.25	WRFG-CGCM3 (historical)
10	61.54	81.89	120.2	138.28	162.94	171.44	179.33	189.01	200.66	208.78	WRFG-CCSM (future)
11	57.69	78.17	119.85	136.43	156.79	168.69	177.75	183.36	189.96	196.33	MM5I-CCSM (future)
12	53.85	77.28	117.2	133.36	147.73	155.9	166.57	176.31	188.09	194.46	MM5I-HadCM3 (future)
13	50.00	76.56	111.01	131.91	146.97	155.53	163.06	170.7	180.83	187.87	WRFG-CCSM (historical)
14	46.15	76.03	108.75	126.33	144.05	154.74	162.27	169.83	177.88	185.45	MM5I-CCSM (historical)
15	42.31	73.6	104.1	125.75	142.58	152.99	160.86	166.3	176.99	183.42	MM5I-HadCM3 (historical)
16	38.46	73.55	102.94	118.63	134.05	144.28	155.06	164.96	172.73	177.12	WRFG-CGCM3 (future)
17	34.62	72.42	97.49	114.18	132.38	143.93	152.76	160.77	170.41	177.11	ECP2-GFDL (future)
18	30.77	67.21	96.16	108.48	121.42	129.66	136.97	143.59	151.51	157	ECP2-HadCM3 (future)
19	26.92	63.9	92.27	101.58	111.14	117.11	122.35	127.04	133.74	138.58	ECP2-GFDL (historical)
20	23.08	57.44	84.86	95.73	107.16	114.44	120.9	126.74	132.6	136.42	ECP2-HadCM3 (historical)
21	19.23	43.55	60.73	69.96	79.85	86.24	91.98	97.22	103.54	107.95	CRCM-CGCM3 (future)
22	15.38	29.39	44.01	52.26	61.36	67.37	72.85	77.92	84.11	88.49	CRCM-CGCM3 (historical)
23	11.54	29.12	41.02	49.17	58.27	64.32	69.86	75	81.32	85.79	Observed
24	7.69	26.77	38.97	44.11	49.54	52.99	56.07	58.86	62.2	64.52	CRCM-CCSM (future)
25	3.85	24.96	34.51	39.61	45.06	48.57	51.71	54.57	58.03	60.44	CRCM-CCSM (historical)
Gauge: 445690; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	115.18	149.03	169.38	194.9	211.48	226.43	240.13	256.72	268.34	HRM3-HadCM3 (historical)
2	92.31	110.78	146.87	166.29	185.23	197.73	208.83	218.86	230.87	239.19	HRM3-HadCM3 (future)
3	88.46	102.45	145.79	165.58	184.23	195.55	205.56	214.57	225.29	237.01	RCM3-GFDL (historical)
4	84.62	94.78	118.79	136.45	155.33	168.65	185.11	200.54	219.71	233.34	RCM3-CGCM3 (historical)
5	80.77	85.75	114.74	124.6	150.87	167.51	182.13	197.99	219.67	232.7	HRM3-GFDL (future)
6	76.92	83	104.21	124.45	147.13	165.26	178.42	195.96	217.73	231.89	RCM3-GFDL (future)
7	73.08	77.35	101.83	120.51	137.13	157.65	177.21	188.37	200.36	208.73	HRM3-GFDL (historical)
8	69.23	76.02	101.55	118.29	137.08	151.98	165.62	178.33	193.97	205.09	RCM3-CGCM3 (future)
9	65.38	71.09	98.2	114.93	134.27	142.69	151.17	158.86	168.08	174.49	WRFG-CGCM3 (historical)
10	61.54	65.94	97.63	112.66	133.17	140.34	146.96	155.07	164.85	171.68	WRFG-CCSM (future)
11	57.69	62.77	97.36	111.07	128.1	138.05	145.63	150.34	155.88	161.5	MM5I-CCSM (future)
12	53.85	62.12	95.16	108.59	120.48	127.52	136.46	144.65	154.56	159.66	MM5I-HadCM3 (future)
13	50.00	61.54	90	107.8	119.96	127.11	133.42	139.74	148.22	154.12	WRFG-CCSM (historical)
14	46.15	61.04	88.16	102.72	117.59	126.32	132.69	139.1	145.85	152.49	MM5I-CCSM (historical)
15	42.31	59.12	84.32	102.31	116.25	124.93	131.42	135.96	145.36	150.5	MM5I-HadCM3 (historical)
16	38.46	58.94	83.39	96.4	109.27	117.88	126.92	135.24	141.33	145.38	ECP2-GFDL (future)
17	34.62	58.16	78.85	92.73	107.92	117.53	124.93	131.65	139.74	145	WRFG-CGCM3 (future)
18	30.77	53.85	77.74	87.96	98.72	105.58	111.69	117.22	123.84	128.44	ECP2-HadCM3 (future)
19	26.92	51.19	74.55	82.27	90.22	95.19	99.57	103.48	108.96	113	ECP2-GFDL (historical)
20	23.08	45.58	68.42	77.4	86.87	92.9	98.27	103.13	108.13	111.32	ECP2-HadCM3 (historical)
21	19.23	34.61	48.65	56.23	64.38	69.67	74.42	78.76	84	87.67	CRCM-CGCM3 (future)
22	15.38	23.12	35.04	41.81	49.33	54.31	58.86	63.08	68.24	71.9	CRCM-CGCM3 (historical)
23	11.54	22.95	30.93	35.12	39.54	42.37	44.89	47.18	50.18	52.47	Observed
24	7.69	19.88	28.37	33	38.01	41.27	44.22	46.91	49.92	51.83	CRCM-CCSM (future)
25	3.85	19.63	27.31	31.43	35.84	38.69	41.25	43.58	46.39	48.35	CRCM-CCSM (historical)
Gauge: 445690; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	90.64	116.31	131.47	150.5	162.82	173.9	184.02	196.26	204.81	HRM3-HadCM3 (historical)
2	92.31	87.28	114.68	129.32	143.57	152.93	161.24	168.73	177.69	183.88	HRM3-HadCM3 (future)
3	88.46	80.99	113.78	128.8	142.81	151.3	158.78	165.51	173.52	179.04	HRM3-GFDL (future)
4	84.62	75.01	93.29	106.63	120.83	130.47	142.69	154.11	168.21	178.26	RCM3-CGCM3 (historical)
5	80.77	68.12	90.21	97.57	117.22	129.95	140.22	151.92	166.43	178.25	RCM3-GFDL (historical)
6	76.92	65.94	82.21	97.53	114.27	127.74	138.11	148.81	165.87	176.8	RCM3-GFDL (future)
7	73.08	61.61	80.39	94.35	106.89	121.05	135.26	145.53	154.46	160.67	HRM3-GFDL (historical)
8	69.23	60.59	80.12	92.93	106	118	128.18	137.63	149.22	157.44	RCM3-CGCM3 (future)
9	65.38	56.78	77.59	90.19	105	111.43	117.83	123.62	130.56	135.37	WRFG-CGCM3 (historical)
10	61.54	52.78	77.13	88.61	104.23	109.58	114.58	120.7	128.05	133.17	WRFG-CCSM (future)
11	57.69	50.46	76.89	87.45	100.33	107.86	113.57	117.11	121.27	125.2	MM5I-CCSM (future)
12	53.85	49.85	75.21	85.47	94.61	99.7	106.43	112.58	120.01	124.11	MM5I-HadCM3 (future)
13	50.00	49.38	71.3	84.39	94.08	99.49	104.25	109.09	115.48	119.92	WRFG-CCSM (historical)
14	46.15	49.07	69.85	81.02	92.21	99.05	103.76	108.53	113.61	118.29	MM5I-CCSM (historical)
15	42.31	47.51	66.89	80.63	91.31	97.89	102.92	106.37	112.96	117.1	MM5I-HadCM3 (historical)
16	38.46	47.48	66.14	76.1	85.86	92.32	99.12	105.37	110.44	113.22	WRFG-CGCM3 (future)
17	34.62	46.74	62.69	73.28	84.8	92.11	97.68	102.74	108.82	113.05	ECP2-GFDL (future)
18	30.77	43.42	61.84	69.66	77.86	83.08	87.7	91.89	96.89	100.36	ECP2-HadCM3 (future)
19	26.92	41.29	59.36	65.28	71.34	75.13	78.45	81.42	85.69	88.76	ECP2-GFDL (historical)
20	23.08	37.28	54.66	61.57	68.84	73.45	77.55	81.26	84.94	87.36	ECP2-HadCM3 (historical)
21	19.23	28.25	39.24	45.13	51.42	55.49	59.13	62.46	66.46	69.26	CRCM-CGCM3 (future)
22	15.38	19.15	28.52	33.78	39.58	43.4	46.88	50.1	54.02	56.79	CRCM-CGCM3 (historical)
23	11.54	18.96	25.29	28.59	32.77	35.63	38.2	40.56	43.43	45.44	Observed
24	7.69	16.99	24.36	28.4	32.07	34.28	36.25	38.03	40.16	41.64	CRCM-CCSM (future)
25	3.85	16.28	22.44	25.72	29.22	31.48	33.5	35.33	37.55	39.09	CRCM-CCSM (historical)
Gauge: 445690; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	99.99	129.41	147.1	169.29	183.71	196.72	208.63	223.06	233.17	HRM3-HadCM3 (historical)
2	92.31	96.17	127.54	144.41	160.89	171.76	181.41	190.14	200.58	207.81	HRM3-HadCM3 (future)
3	88.46	88.92	126.59	143.81	160.01	169.85	178.55	186.39	195.72	206.11	RCM3-GFDL (historical)
4	84.62	82.27	103.13	118.49	134.91	146.5	160.82	174.25	191.02	202.8	RCM3-CGCM3 (historical)
5	80.77	74.41	99.62	108.19	131.03	145.5	158.25	172.06	190.9	202.16	HRM3-GFDL (future)
6	76.92	72.02	90.47	108.07	127.79	143.57	155	170.33	189.25	201.58	RCM3-GFDL (future)
7	73.08	67.11	88.39	104.63	119.09	136.97	154	163.65	174.08	181.37	HRM3-GFDL (historical)
8	69.23	65.96	88.15	102.71	119.05	132	143.88	154.93	168.55	178.22	RCM3-CGCM3 (future)
9	65.38	61.67	85.23	99.78	116.61	123.95	131.33	138.02	146.05	151.63	WRFG-CGCM3 (historical)
10	61.54	57.19	84.76	97.81	115.67	121.89	127.64	134.71	143.22	149.16	WRFG-CCSM (future)
11	57.69	54.44	84.5	96.43	111.24	119.89	126.5	130.59	135.41	140.32	MM5I-CCSM (future)
12	53.85	53.88	82.59	94.29	104.61	110.74	118.52	125.65	134.27	138.7	MM5I-HadCM3 (future)
13	50.00	53.37	78.11	93.58	104.17	110.4	115.89	121.38	128.76	133.9	WRFG-CCSM (historical)
14	46.15	52.94	76.51	89.18	102.11	109.69	115.25	120.83	126.7	132.53	MM5I-CCSM (historical)
15	42.31	51.28	73.18	88.82	100.95	108.5	114.13	118.09	126.32	130.75	MM5I-HadCM3 (historical)
16	38.46	51.11	72.34	83.69	94.88	102.39	110.26	117.5	122.76	126.3	ECP2-GFDL (future)
17	34.62	50.44	68.43	80.5	93.72	102.07	108.5	114.35	121.39	125.95	WRFG-CGCM3 (future)
18	30.77	46.69	67.46	76.34	85.7	91.67	96.98	101.79	107.55	111.55	ECP2-HadCM3 (future)
19	26.92	44.38	64.69	71.41	78.32	82.65	86.45	89.86	94.62	98.14	ECP2-GFDL (historical)
20	23.08	39.49	59.36	67.17	75.4	80.65	85.32	89.55	93.9	96.68	ECP2-HadCM3 (historical)
21	19.23	29.96	42.18	48.78	55.88	60.48	64.62	68.4	72.98	76.18	CRCM-CGCM3 (future)
22	15.38	19.99	30.35	36.25	42.79	47.14	51.11	54.79	59.3	62.49	CRCM-CGCM3 (historical)
23	11.54	19.84	26.78	30.42	34.28	36.74	38.94	40.94	43.33	44.99	CRCM-CCSM (future)
24	7.69	16.96	23.64	27.22	31.06	33.55	35.77	37.81	40.26	41.97	CRCM-CCSM (historical)
25	3.85	12.69	18.53	21.76	25.3	27.62	29.72	31.65	34.01	35.66	Observed
Gauge: 445690; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	66.86	86.45	98.21	112.95	122.53	131.17	139.08	148.65	155.36	HRM3-HadCM3 (historical)
2	92.31	64.32	85.2	96.43	107.38	114.6	121.01	126.81	133.74	138.55	HRM3-HadCM3 (future)
3	88.46	59.5	84.57	96.02	106.8	113.35	119.13	124.33	130.53	136.92	RCM3-GFDL (historical)
4	84.62	55.05	68.94	79.14	90.04	97.69	107.18	116.07	127.08	134.95	RCM3-CGCM3 (historical)
5	80.77	49.83	66.59	72.29	87.44	97.07	105.46	114.6	126.98	134.81	HRM3-GFDL (future)
6	76.92	48.23	60.51	72.2	85.29	95.74	103.36	113.34	125.97	134.12	RCM3-GFDL (future)
7	73.08	44.97	59.12	69.93	79.49	91.31	102.56	109.1	116.02	120.84	HRM3-GFDL (historical)
8	69.23	44.2	58.98	68.65	79.46	88.05	95.9	103.22	112.22	118.61	RCM3-CGCM3 (future)
9	65.38	41.35	57.02	66.69	77.88	82.74	87.63	92.07	97.39	101.08	WRFG-CGCM3 (historical)
10	61.54	38.37	56.7	65.37	77.24	81.39	85.16	89.84	95.48	99.41	WRFG-CCSM (future)
11	57.69	36.55	56.56	64.46	74.29	80.02	84.45	87.17	90.36	93.49	MM5I-CCSM (future)
12	53.85	36.16	55.28	63.03	69.9	73.91	79.07	83.78	89.49	92.55	MM5I-HadCM3 (future)
13	50.00	35.82	52.28	62.58	69.6	73.73	77.37	80.98	85.87	89.27	WRFG-CCSM (historical)
14	46.15	35.55	51.21	59.63	68.19	73.27	76.92	80.65	84.54	88.28	MM5I-CCSM (historical)
15	42.31	34.42	48.99	59.38	67.44	72.45	76.22	78.84	84.18	87.22	MM5I-HadCM3 (historical)
16	38.46	34.33	48.49	55.97	63.4	68.35	73.56	78.35	81.94	84.21	ECP2-GFDL (future)
17	34.62	33.86	45.83	53.85	62.61	68.17	72.43	76.3	80.97	84.06	WRFG-CGCM3 (future)
18	30.77	31.38	45.18	51.08	57.28	61.24	64.76	67.94	71.76	74.4	ECP2-HadCM3 (future)
19	26.92	29.83	43.33	47.79	52.37	55.24	57.76	60.02	63.16	65.48	ECP2-GFDL (historical)
20	23.08	26.6	39.79	44.97	50.43	53.91	57	59.8	62.69	64.53	ECP2-HadCM3 (historical)
21	19.23	20.23	28.35	32.73	37.42	40.46	43.2	45.69	48.71	50.81	CRCM-CGCM3 (future)
22	15.38	13.6	20.48	24.38	28.69	31.54	34.14	36.55	39.49	41.57	CRCM-CGCM3 (historical)
23	11.54	13.49	18.1	20.5	23.05	24.67	26.12	27.43	29	30.09	CRCM-CCSM (future)
24	7.69	11.57	16	18.36	20.89	22.52	23.98	25.31	26.92	28.03	CRCM-CCSM (historical)
25	3.85	8.36	12.08	14.12	16.35	17.8	19.11	20.32	21.79	22.82	Observed
Gauge: 445690; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	34.94	45.03	51.08	58.64	63.54	67.95	71.99	76.88	80.3	HRM3-HadCM3 (historical)
2	92.31	33.63	44.39	50.16	55.78	59.48	62.77	65.73	69.28	71.74	HRM3-HadCM3 (future)
3	88.46	31.16	44.08	49.95	55.48	58.84	61.8	64.47	67.64	70.22	RCM3-GFDL (historical)
4	84.62	28.83	36	41.24	46.83	50.65	55.46	59.96	65.53	69.83	HRM3-GFDL (future)
5	80.77	26.16	34.78	37.71	45.44	50.42	54.56	59.18	65.25	69.51	RCM3-CGCM3 (historical)
6	76.92	25.31	31.65	37.67	44.32	49.63	53.64	58.4	64.92	69.03	RCM3-GFDL (future)
7	73.08	23.64	30.92	36.49	41.34	47.3	52.98	56.57	60.1	62.55	HRM3-GFDL (historical)
8	69.23	23.23	30.89	35.82	41.31	45.7	49.69	53.39	57.95	61.18	RCM3-CGCM3 (future)
9	65.38	21.77	29.85	34.81	40.59	43.04	45.53	47.8	50.51	52.39	WRFG-CGCM3 (historical)
10	61.54	20.23	29.67	34.13	40.23	42.39	44.24	46.63	49.5	51.5	WRFG-CCSM (future)
11	57.69	19.33	29.64	33.66	38.69	41.62	43.96	45.35	47	48.37	MM5I-CCSM (future)
12	53.85	19.1	28.97	32.91	36.45	38.44	41.06	43.46	46.35	48.12	MM5I-HadCM3 (future)
13	50.00	18.91	27.39	32.73	36.28	38.39	40.25	42.05	44.53	46.26	WRFG-CCSM (historical)
14	46.15	18.8	26.85	31.16	35.53	38.18	39.98	41.92	43.91	45.62	MM5I-CCSM (historical)
15	42.31	18.18	25.69	31.03	35.15	37.7	39.69	41.03	43.55	45.27	MM5I-HadCM3 (historical)
16	38.46	18.17	25.52	29.27	33.06	35.55	38.19	40.61	42.61	43.7	WRFG-CGCM3 (future)
17	34.62	17.9	24.08	28.17	32.63	35.49	37.65	39.62	41.99	43.64	ECP2-GFDL (future)
18	30.77	16.64	23.73	26.75	29.92	31.93	33.72	35.34	37.27	38.61	ECP2-HadCM3 (future)
19	26.92	15.82	22.76	25.05	27.39	28.86	30.14	31.3	32.83	34.01	ECP2-GFDL (historical)
20	23.08	14.21	20.94	23.59	26.37	28.14	29.71	31.13	32.66	33.59	ECP2-HadCM3 (historical)
21	19.23	10.87	15.03	17.25	19.62	21.15	22.52	23.77	25.27	26.32	CRCM-CGCM3 (future)
22	15.38	7.46	10.99	12.96	15.12	16.54	17.83	19.01	20.46	21.48	CRCM-CGCM3 (historical)
23	11.54	7.37	9.73	10.94	12.22	13.03	13.75	14.4	15.18	15.72	CRCM-CCSM (future)
24	7.69	6.39	8.66	9.85	11.12	11.93	12.65	13.31	14.09	14.64	CRCM-CCSM (historical)
25	3.85	4.92	7.02	8.16	9.4	10.2	10.93	11.59	12.4	12.96	Observed
Gauge: 445690; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	18.23	23.44	26.56	30.44	32.96	35.23	37.3	39.8	41.55	HRM3-HadCM3 (historical)
2	92.31	17.56	23.11	26.08	28.97	30.88	32.56	34.08	35.9	37.16	HRM3-HadCM3 (future)
3	88.46	16.29	22.95	25.98	28.82	30.54	32.07	33.44	35.06	36.19	HRM3-GFDL (future)
4	84.62	15.06	18.78	21.47	24.34	26.27	28.72	31.01	33.84	36.08	RCM3-GFDL (historical)
5	80.77	13.7	18.14	19.65	23.61	26.19	28.24	30.58	33.58	35.86	RCM3-CGCM3 (historical)
6	76.92	13.26	16.52	19.63	23.02	25.73	27.83	30.12	33.49	35.57	RCM3-GFDL (future)
7	73.08	12.39	16.15	19.02	21.49	24.5	27.38	29.33	31.14	32.4	HRM3-GFDL (historical)
8	69.23	12.18	16.14	18.67	21.45	23.71	25.74	27.63	29.94	31.58	RCM3-CGCM3 (future)
9	65.38	11.43	15.6	18.15	21.13	22.38	23.66	24.82	26.21	27.17	WRFG-CGCM3 (historical)
10	61.54	10.63	15.51	17.8	20.94	22.06	22.99	24.21	25.68	26.7	WRFG-CCSM (future)
11	57.69	10.18	15.5	17.55	20.14	21.65	22.87	23.59	24.43	25.08	MM5I-CCSM (future)
12	53.85	10.05	15.15	17.17	18.99	20.01	21.35	22.57	24.05	25.01	MM5I-HadCM3 (future)
13	50.00	9.95	14.32	17.08	18.89	19.97	20.93	21.83	23.09	23.97	WRFG-CCSM (historical)
14	46.15	9.9	14.05	16.25	18.51	19.87	20.77	21.78	22.8	23.62	MM5I-CCSM (historical)
15	42.31	9.6	13.44	16.2	18.3	19.61	20.65	21.33	22.57	23.5	MM5I-HadCM3 (historical)
16	38.46	9.57	13.38	15.27	17.21	18.49	19.84	21.07	22.14	22.7	WRFG-CGCM3 (future)
17	34.62	9.43	12.62	14.72	17	18.45	19.56	20.56	21.77	22.61	ECP2-GFDL (future)
18	30.77	8.78	12.43	13.97	15.6	16.63	17.54	18.36	19.35	20.03	ECP2-HadCM3 (future)
19	26.92	8.35	11.93	13.11	14.32	15.07	15.73	16.32	17.05	17.65	ECP2-GFDL (historical)
20	23.08	7.54	10.98	12.34	13.76	14.66	15.46	16.19	17.01	17.49	ECP2-HadCM3 (historical)
21	19.23	5.8	7.94	9.08	10.29	11.07	11.77	12.4	13.17	13.7	CRCM-CGCM3 (future)
22	15.38	4.03	5.85	6.85	7.94	8.65	9.3	9.89	10.61	11.12	CRCM-CGCM3 (historical)
23	11.54	3.98	5.19	5.81	6.45	6.86	7.22	7.55	7.94	8.21	CRCM-CCSM (future)
24	7.69	3.48	4.65	5.25	5.89	6.3	6.66	6.99	7.38	7.65	CRCM-CCSM (historical)
25	3.85	2.69	3.82	4.43	5.1	5.53	5.91	6.27	6.7	7	Observed
Gauge: 445690; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h[-1]) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	11.85	15.2	17.21	19.7	21.31	22.76	24.09	25.69	26.81	HRM3-HadCM3 (historical)
2	92.31	11.41	14.99	16.9	18.75	19.97	21.05	22.03	23.19	24	HRM3-HadCM3 (future)
3	88.46	10.6	14.89	16.82	18.66	19.77	20.75	21.62	22.67	23.39	HRM3-GFDL (future)
4	84.62	9.81	12.2	13.93	15.77	16.97	18.53	19.99	21.78	23.18	RCM3-GFDL (historical)
5	80.77	8.93	11.79	12.75	15.28	16.95	18.23	19.72	21.6	23.06	RCM3-CGCM3 (historical)
6	76.92	8.64	10.74	12.74	14.91	16.63	18.01	19.41	21.57	22.89	RCM3-GFDL (future)
7	73.08	8.09	10.51	12.35	13.91	15.84	17.67	18.97	20.12	20.92	HRM3-GFDL (historical)
8	69.23	7.95	10.5	12.11	13.9	15.32	16.62	17.81	19.28	20.32	RCM3-CGCM3 (future)
9	65.38	7.48	10.15	11.78	13.7	14.48	15.29	16.03	16.91	17.53	WRFG-CGCM3 (historical)
10	61.54	6.96	10.1	11.56	13.56	14.3	14.87	15.65	16.58	17.23	WRFG-CCSM (future)
11	57.69	6.67	10.08	11.41	13.06	14.01	14.82	15.27	15.81	16.18	MM5I-HadCM3 (future)
12	53.85	6.59	9.86	11.15	12.33	12.95	13.78	14.56	15.49	16.14	MM5I-CCSM (future)
13	50.00	6.52	9.33	11.11	12.26	12.94	13.56	14.12	14.93	15.49	WRFG-CCSM (historical)
14	46.15	6.49	9.15	10.57	11.99	12.9	13.45	14.11	14.75	15.23	MM5I-CCSM (historical)
15	42.31	6.29	8.76	10.52	11.88	12.71	13.39	13.84	14.57	15.2	MM5I-HadCM3 (historical)
16	38.46	6.27	8.74	9.93	11.17	11.98	12.84	13.62	14.36	14.71	WRFG-CGCM3 (future)
17	34.62	6.18	8.24	9.58	11.04	11.96	12.66	13.3	14.07	14.6	ECP2-GFDL (future)
18	30.77	5.77	8.11	9.1	10.13	10.79	11.37	11.9	12.52	12.96	ECP2-HadCM3 (future)
19	26.92	5.49	7.78	8.53	9.29	9.77	10.19	10.56	11.06	11.44	ECP2-GFDL (historical)
20	23.08	4.97	7.18	8.05	8.96	9.54	10.05	10.51	11.01	11.31	ECP2-HadCM3 (historical)
21	19.23	3.85	5.22	5.94	6.71	7.2	7.64	8.04	8.52	8.85	CRCM-CGCM3 (future)
22	15.38	2.72	3.88	4.51	5.19	5.64	6.04	6.4	6.85	7.16	CRCM-CGCM3 (historical)
23	11.54	2.67	3.45	3.84	4.25	4.51	4.73	4.94	5.18	5.35	CRCM-CCSM (future)
24	7.69	2.35	3.09	3.47	3.87	4.13	4.35	4.55	4.79	4.96	CRCM-CCSM (historical)
25	3.85	1.94	2.7	3.11	3.55	3.84	4.09	4.33	4.61	4.8	Observed
Gauge: 445690; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2 (0.5)	5 (0.2)	10 (0.1)	25 (0.04)	50 (0.02)	100 (0.01)	200 (0.005)	500 (0.002)	1000 (0.001)	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
1	96.15	280.97	389.02	466.9	581.2	665.99	750.15	834.01	944.64	1028.25	RCM3-CGCM3 (future)
2	92.31	272.98	376.45	460.56	550.96	618.02	684.58	750.9	838.4	904.52	HRM3-GFDL (future)
3	88.46	248.47	360.52	418.47	491.7	546.02	599.94	653.67	724.55	778.12	HRM3-HadCM3 (future)
4	84.62	244.17	318.53	367.76	433.84	497.7	561.08	624.23	707.55	770.52	RCM3-GFDL (historical)
5	80.77	239.82	311.11	352.58	429.96	476.11	521.91	567.55	627.76	673.27	HRM3-GFDL (historical)
6	76.92	234.28	293.11	347.77	404.98	443.86	493.47	546.92	617.44	670.74	RCM3-GFDL (future)
7	73.08	226.74	279.64	332.07	385.77	439.82	482.44	520.89	571.61	609.94	HRM3-HadCM3 (historical)
8	69.23	216.83	270.4	312.91	381.29	417.81	454.05	490.17	537.81	573.82	WRFG-CGCM3 (future)
9	65.38	212.57	265.8	303.08	350.19	385.13	419.82	454.39	499.98	534.45	MM5I-HadCM3 (historical)
10	61.54	209.58	261.98	299.31	336.04	366.71	398.47	430.63	473.05	505.12	WRFG-CGCM3 (historical)
11	57.69	209.49	258.49	294.7	335.84	366.19	397.16	427.49	467.5	497.75	WRFG-CCSM (future)
12	53.85	202.75	255.25	289.84	333.67	362.94	389.84	418.32	460.71	492.75	ECP2-HadCM3 (future)
13	50.00	190.64	255.15	286.07	321.45	353.94	386.19	416.64	458.24	490.25	WRFG-CCSM (historical)
14	46.15	188.39	250.33	277.66	320.92	351.55	383.77	415.88	451.99	480.1	MM5I-CCSM (historical)
15	42.31	187.21	242.99	277.32	319.09	346.77	372.44	401	446.05	478.72	MM5I-HadCM3 (future)
16	38.46	183.17	240.7	275.33	311.41	339.76	369.89	399.9	439.51	469.44	ECP2-GFDL (historical)
17	34.62	176.75	236.12	268.5	309.41	336.71	366.86	398	431.74	457.23	ECP2-GFDL (future)
18	30.77	168.16	230.25	261.42	300.8	332.59	361.82	387.91	426.03	454.84	MM5I-CCSM (future)
19	26.92	159.06	214.69	251.53	298.06	330.01	359.01	386.83	419.84	444.78	ECP2-HadCM3 (historical)
20	23.08	156.17	205.09	237.48	278.41	308.77	338.91	368.94	408.55	438.49	RCM3-CGCM3 (historical)
21	19.23	108.37	130.63	145.36	164.49	183.36	202.08	220.74	245.36	263.96	CRCM-CGCM3 (historical)
22	15.38	89.69	118.93	139.06	163.98	177.79	191.56	208.3	230.38	247.07	CRCM-CCSM (future)
23	11.54	88.53	116.96	135.02	157.83	174.76	191.49	205.15	223.17	236.79	CRCM-CGCM3 (future)
24	7.69	71.14	98.6	117.65	141.71	159.56	177.28	194.94	218.23	235.83	Observed
25	3.85	69.83	96.36	113.05	134.14	149.79	165.32	180.8	201.21	216.64	CRCM-CCSM (historical)
Gauge: 445880; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	232.94	345.09	429.35	547.03	634.33	720.99	807.33	921.24	1007.33	RCM3-CGCM3 (future)
2	92.31	224.16	336.21	419.35	513.17	582.77	651.86	720.7	811.52	880.16	HRM3-GFDL (future)
3	88.46	199.32	312.83	371.54	445.72	500.76	555.38	609.81	681.61	735.88	HRM3-HadCM3 (future)
4	84.62	195.77	268.94	317.39	391.3	455.11	518.45	581.56	664.82	727.75	RCM3-GFDL (historical)
5	80.77	195.54	260.51	305.28	378.6	424.02	469.09	514	573.26	625.77	RCM3-GFDL (future)
6	76.92	185.28	243.45	301.02	352.21	395.9	449.3	502.51	572.71	618.04	HRM3-GFDL (historical)
7	73.08	177.79	237.2	281.96	342.1	390.18	427.88	465.43	514.98	552.43	HRM3-HadCM3 (historical)
8	69.23	168.45	219.59	269.57	330.62	366.72	402.55	438.25	485.35	520.95	WRFG-CGCM3 (future)
9	65.38	164.9	216.07	251.75	296.83	330.27	363.47	396.54	440.18	473.16	MM5I-HadCM3 (historical)
10	61.54	162.18	212.17	247.27	282.24	310.58	341.14	371.58	411.75	442.1	WRFG-CGCM3 (historical)
11	57.69	161.76	211.45	242.26	281.2	310.09	338.76	367.33	405.02	433.51	WRFG-CCSM (future)
12	53.85	155.85	207.94	238.3	279.79	308.18	333.93	359.58	398.71	428.83	ECP2-HadCM3 (future)
13	50.00	144.77	205.46	234.09	267.77	298.31	328.64	358.85	398.4	428.75	WRFG-CCSM (historical)
14	46.15	142.6	199.86	226.59	267.13	297.27	327.81	358.25	393.43	419.01	MM5I-HadCM3 (future)
15	42.31	141.49	194	225.08	266.49	291.64	315.97	340.58	380.23	411.48	MM5I-CCSM (historical)
16	38.46	137.91	192.18	225.01	256.95	284.28	312.48	340.21	377.65	405.66	ECP2-GFDL (historical)
17	34.62	134.38	187.27	217.58	255.87	280.6	307.56	338.89	372.19	396.36	ECP2-GFDL (future)
18	30.77	125.48	181.27	209.97	246.24	276.11	304.06	327.45	361.58	388.11	MM5I-CCSM (future)
19	26.92	116.86	167.92	201.72	244.43	273.15	299.86	326.47	358.3	381.61	ECP2-HadCM3 (historical)
20	23.08	114.16	158.17	187.31	224.13	251.44	278.55	305.56	341.2	368.13	RCM3-CGCM3 (historical)
21	19.23	72.97	91.18	103.24	118.75	133.93	148.99	164.01	183.82	198.79	CRCM-CGCM3 (historical)
22	15.38	58.34	82.09	98.28	118.47	129.78	141	154.04	171.86	185.33	CRCM-CCSM (future)
23	11.54	57.62	80.35	94.91	113.32	126.98	140.53	152.18	166.93	178.07	CRCM-CGCM3 (future)
24	7.69	44.46	63.31	75.79	91.56	103.25	114.87	126.44	141.7	153.24	CRCM-CCSM (historical)
25	3.85	42.95	57.84	67.7	80.16	89.4	98.57	107.71	119.77	128.88	Observed
Gauge: 445880; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	177.64	265.42	331.71	423.73	492	559.77	627.29	716.37	783.69	RCM3-CGCM3 (future)
2	92.31	170.73	258.87	323.54	396.97	451.45	505.52	559.4	630.48	684.2	HRM3-GFDL (future)
3	88.46	151.34	239.9	285.69	343.56	386.48	429.09	471.55	527.56	569.89	HRM3-HadCM3 (future)
4	84.62	148.87	205.54	243.19	301.57	351.29	400.64	449.8	514.67	563.7	RCM3-GFDL (historical)
5	80.77	148.66	198.86	234.55	290.78	326.07	361.11	396.02	442.67	483.98	RCM3-GFDL (future)
6	76.92	140.43	185.66	230.32	270.07	305	346.58	388.01	442.08	476.88	HRM3-GFDL (historical)
7	73.08	134.6	181.51	215.61	263.11	299.56	328.83	358	396.48	425.56	HRM3-HadCM3 (historical)
8	69.23	127.39	166.98	206.65	253.45	281.52	309.38	337.14	373.76	401.44	WRFG-CGCM3 (future)
9	65.38	124.68	164.34	191.98	226.89	252.8	278.51	304.13	337.92	363.47	MM5I-HadCM3 (historical)
10	61.54	122.6	161.96	188.41	215.49	237.4	261.04	284.59	315.66	339.14	WRFG-CGCM3 (historical)
11	57.69	122.22	160.66	184.48	214.58	236.9	259.07	281.15	310.28	332.3	WRFG-CCSM (future)
12	53.85	117.71	157.94	181.49	213.59	235.58	255.52	275.39	305.44	328.87	WRFG-CCSM (historical)
13	50.00	109.18	156.08	178.17	204.24	227.85	251.29	274.64	305.4	328.73	ECP2-HadCM3 (future)
14	46.15	107.49	151.64	172.41	203.73	227.15	250.79	274.33	301.6	321.41	MM5I-HadCM3 (future)
15	42.31	106.65	147.22	171.25	203.35	222.69	241.51	260.39	290.74	314.82	MM5I-CCSM (historical)
16	38.46	103.9	145.85	171.12	195.73	216.91	238.69	260.26	289.01	310.64	ECP2-GFDL (historical)
17	34.62	101.4	142	165.4	194.98	213.99	234.74	258.89	285	303.69	ECP2-GFDL (future)
18	30.77	94.46	137.32	159.45	187.41	210.5	232.11	250.17	276.32	296.77	MM5I-CCSM (future)
19	26.92	87.78	127.12	153.17	186.08	208.15	228.74	249.26	273.99	292	ECP2-HadCM3 (historical)
20	23.08	85.69	119.52	141.92	170.22	191.21	212.05	232.82	260.21	280.91	RCM3-CGCM3 (historical)
21	19.23	54.2	68.03	77.19	88.96	100.47	111.89	123.27	138.28	149.63	CRCM-CGCM3 (historical)
22	15.38	43.16	61.18	73.45	88.76	97.34	105.86	115.72	129.23	139.44	CRCM-CCSM (future)
23	11.54	42.63	59.84	70.89	84.85	95.2	105.48	114.35	125.55	134.01	CRCM-CGCM3 (future)
24	7.69	32.73	46.89	56.27	68.12	76.92	85.64	94.34	105.81	114.48	CRCM-CCSM (historical)
25	3.85	32.51	45.28	53.74	64.43	72.37	80.24	88.08	98.43	106.25	Observed
Gauge: 445880; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	149.27	225.9	284.22	364.46	423.99	483.08	541.95	619.63	678.33	RCM3-CGCM3 (future)
2	92.31	143.18	220.71	276.63	340.74	388.29	435.5	482.53	544.58	591.47	HRM3-GFDL (future)
3	88.46	126.34	203.27	243.05	293.31	330.6	367.62	404.5	453.15	489.92	HRM3-HadCM3 (future)
4	84.62	124.79	173.25	205.79	257.49	300.61	343.41	386.05	442.32	484.84	RCM3-GFDL (historical)
5	80.77	124.11	167.33	199.37	246.9	277.4	307.67	337.84	379.5	415.29	RCM3-GFDL (future)
6	76.92	116.91	156.02	194.47	228.76	260.24	296.26	332.15	377.63	407.71	HRM3-GFDL (historical)
7	73.08	111.87	153.37	181.91	223.94	254.19	279.44	304.6	337.79	362.87	HRM3-HadCM3 (historical)
8	69.23	105.69	139.68	175.03	214.62	238.89	262.98	286.98	318.65	342.58	WRFG-CGCM3 (future)
9	65.38	103.43	137.54	161.28	191.28	213.54	235.63	257.64	286.68	308.63	MM5I-HadCM3 (historical)
10	61.54	101.68	136.31	158.1	181.36	200.14	220.41	240.61	267.26	287.4	WRFG-CGCM3 (historical)
11	57.69	101.29	134.26	154.66	180.45	199.58	218.57	237.49	262.45	281.31	WRFG-CCSM (future)
12	53.85	97.48	131.89	152.18	179.71	198.62	215.75	232.82	258.54	278.68	WRFG-CCSM (historical)
13	50.00	90.21	130.39	149.23	171.65	191.88	211.95	231.96	258.35	278.29	ECP2-HadCM3 (future)
14	46.15	88.76	126.45	144.38	171.14	191.42	211.69	231.89	255.34	272.36	MM5I-HadCM3 (future)
15	42.31	88.04	122.81	143.46	170.99	187.4	203.53	219.61	245.2	265.73	MM5I-CCSM (historical)
16	38.46	85.71	121.67	143.11	164.16	182.4	201.03	219.6	244.09	262.61	ECP2-GFDL (historical)
17	34.62	83.89	118.29	138.32	163.62	179.77	197.43	218.03	240.82	256.85	ECP2-GFDL (future)
18	30.77	77.83	114.23	133.11	156.97	176.76	195.27	210.72	232.83	250.28	MM5I-CCSM (future)
19	26.92	72.09	105.65	127.87	155.94	174.66	192.23	209.74	231.09	246.49	ECP2-HadCM3 (historical)
20	23.08	70.31	99.06	118.09	142.14	159.98	177.69	195.33	218.61	236.2	RCM3-CGCM3 (historical)
21	19.23	43.79	55.33	62.97	72.79	82.36	91.87	101.34	113.83	123.28	CRCM-CGCM3 (historical)
22	15.38	34.65	49.66	59.88	72.62	79.79	86.9	95.03	106.27	114.77	CRCM-CCSM (future)
23	11.54	34.23	48.53	57.73	69.34	77.96	86.51	93.98	103.33	110.39	CRCM-CGCM3 (future)
24	7.69	28.29	37.71	45.41	55.14	62.36	69.52	76.66	86.07	93.19	CRCM-CCSM (historical)
25	3.85	26.08	37.59	43.74	51.52	57.29	63.02	68.72	76.25	81.94	Observed
Gauge: 445880; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	111.72	177.22	228.59	296.96	347.68	398.03	448.19	514.37	564.38	RCM3-CGCM3 (future)
2	92.31	106.37	174.48	220.59	275.38	316.03	356.38	396.59	449.63	489.72	HRM3-GFDL (future)
3	88.46	92.75	156.73	190.08	232.21	263.47	294.49	325.4	366.19	397.01	HRM3-HadCM3 (future)
4	84.62	92.25	131.1	157.87	204.41	240.44	276.2	311.83	358.84	394.37	RCM3-GFDL (historical)
5	80.77	90.67	125.76	155.85	191.69	216.78	241.69	266.5	305.15	334.92	RCM3-GFDL (future)
6	76.92	84.51	117.41	147.94	175.96	205.97	235.92	265.77	299.24	323.98	HRM3-GFDL (historical)
7	73.08	80.35	116.73	138.07	175.79	196.76	217.39	237.96	265.08	285.59	HRM3-HadCM3 (historical)
8	69.23	75.43	102.9	135.1	165.02	185.02	204.87	224.64	250.73	270.45	WRFG-CGCM3 (future)
9	65.38	73.79	102.74	120.48	144.64	162.57	180.37	198.1	221.49	239.17	MM5I-HadCM3 (historical)
10	61.54	72.46	101.35	117.56	136.28	151.35	167.59	183.77	205.12	221.25	WRFG-CGCM3 (historical)
11	57.69	71.97	98.34	114.61	135.15	150.39	165.52	180.59	200.48	215.51	WRFG-CCSM (future)
12	53.85	69.12	96.37	112.94	134.99	150.17	163.96	177.7	198.32	214.46	WRFG-CCSM (historical)
13	50.00	63.44	95.48	110.24	128.34	144.54	160.78	176.97	197.43	213.33	ECP2-HadCM3 (future)
14	46.15	62.28	91.89	106.61	128.17	144.46	160.46	176.4	195.83	209.53	MM5I-HadCM3 (future)
15	42.31	61.71	89.42	106.11	127.76	140.76	153.66	166.52	185.53	201.5	MM5I-CCSM (historical)
16	38.46	59.92	88.65	105.08	121.74	136.58	151.36	166.1	185.4	200.22	ECP2-GFDL (historical)
17	34.62	59.36	85.71	101.6	121.68	134.1	147.93	164.08	183.48	196.29	ECP2-GFDL (future)
18	30.77	54.27	82.31	97.13	115.85	131.72	146.37	158.6	175.4	189.1	MM5I-CCSM (future)
19	26.92	49.63	75.95	93.37	115.39	129.74	143.53	157.27	174.73	186.92	ECP2-HadCM3 (historical)
20	23.08	48.21	70.44	85.16	103.76	117.56	131.26	144.91	162.91	176.52	RCM3-CGCM3 (historical)
21	19.23	28.32	36.66	42.19	49.33	56.2	63.01	69.8	78.76	85.53	CRCM-CGCM3 (historical)
22	15.38	21.92	32.75	40.07	49.16	54.34	59.48	65.23	73.3	79.39	CRCM-CCSM (future)
23	11.54	21.68	31.88	38.47	46.8	52.99	59.12	64.6	71.36	76.46	CRCM-CGCM3 (future)
24	7.69	17.31	24	29.26	35.89	40.82	45.71	50.58	57	61.86	CRCM-CCSM (historical)
25	3.85	16.07	23.82	28.13	33.58	37.63	41.64	45.64	50.91	54.9	Observed
Gauge: 445880; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	72.11	110.06	139.1	178.82	208.28	237.53	266.66	305.11	334.16	RCM3-CGCM3 (future)
2	92.31	69.08	107.67	135.18	166.92	190.48	213.85	237.14	267.87	291.09	HRM3-GFDL (future)
3	88.46	60.77	98.74	118.37	143.18	161.59	179.86	198.06	222.08	240.23	HRM3-HadCM3 (future)
4	84.62	60.2	83.86	99.86	125.71	146.98	168.08	189.11	216.85	237.82	RCM3-GFDL (historical)
5	80.77	59.69	80.91	97.05	120.08	135.08	149.97	164.8	185.78	203.42	RCM3-GFDL (future)
6	76.92	56.12	75.36	94.24	111.09	127.01	144.76	162.45	184.38	199.17	HRM3-GFDL (historical)
7	73.08	53.65	74.37	88.1	109.12	123.59	136	148.36	164.67	176.99	HRM3-HadCM3 (historical)
8	69.23	50.63	67.27	85.01	104.2	116.14	127.99	139.79	155.37	167.15	WRFG-CGCM3 (future)
9	65.38	49.54	66.26	77.9	92.6	103.51	114.34	125.13	139.36	150.12	MM5I-HadCM3 (historical)
10	61.54	48.68	65.93	76.3	87.7	96.89	106.81	116.7	129.75	139.61	WRFG-CGCM3 (historical)
11	57.69	48.48	64.61	74.6	87.21	96.57	105.85	115.11	127.31	136.54	WRFG-CCSM (future)
12	53.85	46.64	63.45	73.41	86.89	96.15	104.55	112.91	125.5	135.36	WRFG-CCSM (historical)
13	50.00	43.1	62.75	71.94	82.91	92.8	102.62	112.45	125.3	135.05	ECP2-HadCM3 (future)
14	46.15	42.39	60.77	69.58	82.67	92.64	102.56	112.39	123.95	132.29	MM5I-HadCM3 (future)
15	42.31	42.03	59.03	69.16	82.64	90.62	98.52	106.39	118.69	128.7	MM5I-CCSM (historical)
16	38.46	40.9	58.5	68.91	79.19	88.15	97.26	106.33	118.3	127.35	ECP2-GFDL (historical)
17	34.62	40.1	56.82	66.61	78.97	86.82	95.4	105.44	116.78	124.63	ECP2-GFDL (future)
18	30.77	37.11	54.8	64.01	75.65	85.32	94.39	101.94	112.65	121.17	MM5I-CCSM (future)
19	26.92	34.3	50.66	61.49	75.17	84.28	92.85	101.39	111.89	119.41	ECP2-HadCM3 (historical)
20	23.08	33.43	47.41	56.67	68.36	77.04	85.65	94.23	105.55	114.11	RCM3-CGCM3 (historical)
21	19.23	20.6	26.15	29.82	34.55	39.14	43.71	48.25	54.25	58.78	CRCM-CGCM3 (historical)
22	15.38	16.23	23.45	28.35	34.47	37.91	41.33	45.21	50.61	54.68	CRCM-CCSM (future)
23	11.54	16.04	22.9	27.31	32.88	37.02	41.12	44.74	49.23	52.63	CRCM-CGCM3 (future)
24	7.69	12.48	17.69	21.34	25.96	29.39	32.79	36.18	40.66	44.04	CRCM-CCSM (historical)
25	3.85	12.16	16.94	19.89	23.61	26.38	29.12	31.85	35.46	38.19	Observed
Gauge: 445880; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	57.18	86.54	108.89	139.63	162.43	185.07	207.62	237.37	259.86	RCM3-CGCM3 (future)
2	92.31	54.85	84.56	105.98	130.54	148.76	166.84	184.86	208.63	226.6	HRM3-GFDL (future)
3	88.46	48.4	77.87	93.12	112.37	126.66	140.84	154.97	173.61	187.7	HRM3-HadCM3 (future)
4	84.62	47.81	66.38	78.84	98.64	115.16	131.56	147.9	169.45	185.74	RCM3-GFDL (historical)
5	80.77	47.55	64.11	76.37	94.59	106.27	117.86	129.42	145.39	159.1	RCM3-GFDL (future)
6	76.92	44.8	59.78	74.5	87.64	99.7	113.5	127.25	144.66	156.18	HRM3-GFDL (historical)
7	73.08	42.86	58.75	69.69	85.79	97.39	107.06	116.7	129.41	139.03	HRM3-HadCM3 (historical)
8	69.23	40.49	53.52	67.05	82.22	91.52	100.75	109.94	122.07	131.24	WRFG-CGCM3 (future)
9	65.38	39.63	52.7	61.8	73.29	81.82	90.29	98.72	109.85	118.26	MM5I-HadCM3 (historical)
10	61.54	38.96	52.22	60.57	69.49	76.68	84.45	92.19	102.4	110.12	WRFG-CGCM3 (historical)
11	57.69	38.81	51.43	59.25	69.13	76.45	83.73	90.97	100.53	107.76	WRFG-CCSM (future)
12	53.85	37.35	50.53	58.31	68.86	76.1	82.67	89.21	99.06	106.78	WRFG-CCSM (historical)
13	50.00	34.56	49.96	57.18	65.76	73.51	81.2	88.87	98.98	106.62	ECP2-HadCM3 (future)
14	46.15	34.01	48.45	55.31	65.58	73.34	81.11	88.85	97.84	104.36	MM5I-HadCM3 (future)
15	42.31	33.73	47.05	54.97	65.52	71.81	77.99	84.16	93.95	101.82	MM5I-CCSM (historical)
16	38.46	32.84	46.62	54.83	62.9	69.87	77	84.11	93.5	100.59	ECP2-GFDL (historical)
17	34.62	32.13	45.31	52.98	62.68	68.88	75.65	83.54	92.28	98.43	ECP2-GFDL (future)
18	30.77	29.82	43.76	50.99	60.13	67.73	74.82	80.74	89.19	95.87	MM5I-CCSM (future)
19	26.92	27.62	40.48	48.99	59.75	66.91	73.64	80.34	88.55	94.45	ECP2-HadCM3 (historical)
20	23.08	26.93	37.95	45.24	54.45	61.28	68.06	74.82	83.74	90.48	RCM3-CGCM3 (historical)
21	19.23	16.77	21.19	24.11	27.88	31.55	35.19	38.82	43.61	47.23	CRCM-CGCM3 (historical)
22	15.38	13.27	19.02	22.94	27.81	30.55	33.27	36.41	40.72	43.97	CRCM-CCSM (future)
23	11.54	13.11	18.59	22.11	26.56	29.87	33.14	35.99	39.56	42.27	CRCM-CGCM3 (future)
24	7.69	10.91	14.45	17.4	21.12	23.89	26.63	29.36	32.97	35.7	CRCM-CCSM (historical)
25	3.85	9.99	14.31	16.56	19.41	21.52	23.62	25.7	28.46	30.54	Observed
Gauge: 445880; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	56.18	85.61	108.13	138.93	161.78	184.46	207.05	236.87	259.4	RCM3-CGCM3 (future)
2	92.31	53.83	83.75	105.09	129.71	147.97	166.1	184.17	208	226.01	HRM3-GFDL (future)
3	88.46	47.38	76.82	92.05	111.28	125.55	139.72	153.83	172.45	186.52	HRM3-HadCM3 (future)
4	84.62	46.94	65.29	77.7	97.76	114.25	130.62	146.93	168.45	184.71	RCM3-GFDL (historical)
5	80.77	46.55	62.99	75.53	93.38	105.01	116.56	128.06	144.33	158.01	RCM3-GFDL (future)
6	76.92	43.79	58.71	73.33	86.4	98.75	112.52	126.24	143.24	154.71	HRM3-GFDL (historical)
7	73.08	41.87	57.94	68.58	84.88	96.09	105.71	115.29	127.94	137.49	HRM3-HadCM3 (historical)
8	69.23	39.52	52.44	66.18	81.06	90.32	99.51	108.66	120.74	129.87	WRFG-CGCM3 (future)
9	65.38	38.68	51.63	60.66	72.06	80.51	88.91	97.27	108.31	116.65	MM5I-HadCM3 (historical)
10	61.54	38.01	51.39	59.43	68.28	75.41	83.1	90.77	100.89	108.54	WRFG-CGCM3 (historical)
11	57.69	37.85	50.37	58.11	67.89	75.15	82.35	89.53	98.99	106.15	WRFG-CCSM (future)
12	53.85	36.43	49.46	57.2	67.65	74.83	81.35	87.83	97.59	105.24	WRFG-CCSM (historical)
13	50.00	33.68	48.92	56.05	64.57	72.25	79.86	87.47	97.46	105.03	ECP2-HadCM3 (future)
14	46.15	33.13	47.38	54.23	64.36	72.11	79.8	87.45	96.39	102.86	MM5I-HadCM3 (future)
15	42.31	32.85	46.05	53.9	64.35	70.53	76.66	82.76	92.33	100.1	MM5I-CCSM (historical)
16	38.46	31.98	45.62	53.7	61.67	68.6	75.66	82.7	91.98	98.99	ECP2-GFDL (historical)
17	34.62	31.36	44.31	51.9	61.49	67.59	74.26	82.05	90.81	96.9	ECP2-GFDL (future)
18	30.77	29.04	42.76	49.9	58.92	66.45	73.47	79.32	87.6	94.19	MM5I-CCSM (future)
19	26.92	26.86	39.55	47.95	58.57	65.61	72.25	78.87	87.04	92.87	ECP2-HadCM3 (historical)
20	23.08	26.18	37.03	44.21	53.28	60.01	66.69	73.34	82.12	88.76	RCM3-CGCM3 (historical)
21	19.23	16.23	20.53	23.38	27.06	30.62	34.16	37.68	42.34	45.85	CRCM-CGCM3 (historical)
22	15.38	12.85	18.45	22.25	26.98	29.65	32.31	35.33	39.52	42.68	CRCM-CCSM (future)
23	11.54	12.7	18.02	21.44	25.77	28.98	32.16	34.95	38.43	41.07	CRCM-CGCM3 (future)
24	7.69	9.69	13.98	16.82	20.4	23.06	25.7	28.33	31.8	34.43	CRCM-CCSM (historical)
25	3.85	7.92	10.56	12.31	14.52	16.16	17.79	19.41	21.55	23.17	Observed
Gauge: 445880; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h[-1]) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	35.87	54.48	68.71	88.18	102.62	116.95	131.23	150.07	164.31	RCM3-CGCM3 (future)
2	92.31	34.39	53.3	66.79	82.35	93.9	105.36	116.78	131.84	143.22	HRM3-GFDL (future)
3	88.46	30.32	48.93	58.55	70.71	79.73	88.69	97.61	109.38	118.28	HRM3-HadCM3 (future)
4	84.62	30.04	41.64	49.48	62.14	72.56	82.91	93.21	106.81	117.09	RCM3-GFDL (historical)
5	80.77	29.79	40.19	48.1	59.4	66.75	74.05	81.33	91.58	100.22	RCM3-GFDL (future)
6	76.92	28.05	37.48	46.72	54.98	62.78	71.48	80.14	90.92	98.18	HRM3-GFDL (historical)
7	73.08	26.83	36.98	43.72	54.01	61.11	67.19	73.25	81.24	87.28	HRM3-HadCM3 (historical)
8	69.23	25.35	33.51	42.2	51.61	57.46	63.27	69.06	76.69	82.46	WRFG-CGCM3 (future)
9	65.38	24.82	33.02	38.72	45.93	51.28	56.58	61.87	68.85	74.12	MM5I-HadCM3 (historical)
10	61.54	24.4	32.85	37.93	43.52	48.01	52.87	57.71	64.11	68.93	WRFG-CGCM3 (historical)
11	57.69	24.29	32.21	37.1	43.28	47.86	52.41	56.95	62.93	67.45	WRFG-CCSM (future)
12	53.85	23.39	31.64	36.51	43.11	47.67	51.78	55.88	62.03	66.85	WRFG-CCSM (historical)
13	50.00	21.66	31.29	35.8	41.18	46.03	50.84	55.63	61.96	66.74	ECP2-HadCM3 (future)
14	46.15	21.31	30.32	34.64	41.05	45.93	50.79	55.63	61.29	65.38	MM5I-HadCM3 (future)
15	42.31	21.13	29.47	34.43	41.03	44.95	48.82	52.68	58.7	63.61	MM5I-CCSM (historical)
16	38.46	20.58	29.21	34.31	39.35	43.74	48.2	52.65	58.52	62.95	ECP2-GFDL (historical)
17	34.62	20.19	28.38	33.18	39.24	43.09	47.29	52.21	57.77	61.61	ECP2-GFDL (future)
18	30.77	18.73	27.4	31.91	37.61	42.35	46.8	50.5	55.73	59.9	MM5I-CCSM (future)
19	26.92	17.35	25.37	30.67	37.38	41.84	46.03	50.22	55.38	59.07	ECP2-HadCM3 (historical)
20	23.08	16.92	23.77	28.3	34.03	38.28	42.5	46.7	52.25	56.44	RCM3-CGCM3 (historical)
21	19.23	10.63	13.36	15.16	17.47	19.72	21.96	24.19	27.13	29.36	CRCM-CGCM3 (historical)
22	15.38	8.49	12.03	14.43	17.44	19.12	20.8	22.68	25.32	27.31	CRCM-CCSM (future)
23	11.54	8.4	11.75	13.91	16.64	18.67	20.67	22.47	24.68	26.34	CRCM-CGCM3 (future)
24	7.69	6.5	9.21	11.01	13.27	14.96	16.63	18.29	20.49	22.15	CRCM-CCSM (historical)
25	3.85	4.99	6.93	8.21	9.83	11.03	12.22	13.41	14.97	16.16	Observed
Gauge: 445880; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	19.43	29.34	36.92	47.29	54.97	62.61	70.21	80.24	87.83	RCM3-CGCM3 (future)
2	92.31	18.64	28.72	35.89	44.18	50.33	56.43	62.51	70.54	76.6	HRM3-GFDL (future)
3	88.46	16.47	26.38	31.51	37.98	42.79	47.56	52.31	58.58	63.32	HRM3-HadCM3 (future)
4	84.62	16.33	22.51	26.68	33.42	38.97	44.48	49.97	57.21	62.69	RCM3-GFDL (historical)
5	80.77	16.2	21.73	25.94	31.96	35.88	39.77	43.64	49.1	53.7	RCM3-GFDL (future)
6	76.92	15.27	20.29	25.21	29.61	33.76	38.39	43.01	48.75	52.61	HRM3-GFDL (historical)
7	73.08	14.62	20.02	23.61	29.09	32.87	36.11	39.34	43.6	46.82	HRM3-HadCM3 (historical)
8	69.23	13.83	18.17	22.8	27.81	30.92	34.02	37.1	41.16	44.23	WRFG-CGCM3 (future)
9	65.38	13.54	17.9	20.94	24.78	27.62	30.45	33.26	36.98	39.79	MM5I-HadCM3 (historical)
10	61.54	13.32	17.82	20.52	23.5	25.91	28.5	31.08	34.49	37.06	WRFG-CGCM3 (historical)
11	57.69	13.26	17.47	20.08	23.37	25.81	28.23	30.64	33.83	36.23	WRFG-CCSM (future)
12	53.85	12.79	17.18	19.78	23.3	25.7	27.89	30.07	33.38	35.95	WRFG-CCSM (historical)
13	50.00	11.87	16.99	19.39	22.27	24.85	27.41	29.97	33.34	35.89	ECP2-HadCM3 (future)
14	46.15	11.68	16.47	18.78	22.2	24.8	27.39	29.97	32.95	35.12	MM5I-HadCM3 (future)
15	42.31	11.58	16.03	18.67	22.19	24.27	26.34	28.39	31.59	34.2	MM5I-CCSM (historical)
16	38.46	11.29	15.88	18.6	21.28	23.63	26.01	28.38	31.51	33.87	ECP2-GFDL (historical)
17	34.62	11.08	15.44	18	21.23	23.27	25.51	28.13	31.11	33.16	ECP2-GFDL (future)
18	30.77	10.3	14.92	17.32	20.36	22.88	25.25	27.22	30.02	32.25	MM5I-CCSM (future)
19	26.92	9.57	13.84	16.66	20.23	22.61	24.85	27.08	29.81	31.78	ECP2-HadCM3 (historical)
20	23.08	9.34	12.99	15.41	18.46	20.73	22.97	25.21	28.17	30.4	RCM3-CGCM3 (historical)
21	19.23	5.99	7.44	8.4	9.64	10.84	12.03	13.22	14.78	15.97	CRCM-CGCM3 (historical)
22	15.38	4.86	6.74	8.02	9.61	10.51	11.4	12.43	13.84	14.9	CRCM-CCSM (future)
23	11.54	4.8	6.6	7.75	9.21	10.29	11.36	12.29	13.47	14.35	CRCM-CGCM3 (future)
24	7.69	3.79	5.23	6.19	7.39	8.29	9.17	10.06	11.22	12.11	CRCM-CCSM (historical)
25	3.85	2.96	4.05	4.78	5.69	6.37	7.05	7.72	8.61	9.28	Observed
Gauge: 445880; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	10.33	15.51	19.48	24.9	28.93	32.92	36.9	42.16	46.13	RCM3-CGCM3 (future)
2	92.31	9.91	15.18	18.95	23.29	26.51	29.7	32.89	37.09	40.26	HRM3-GFDL (future)
3	88.46	8.78	13.96	16.64	20.02	22.53	25.03	27.51	30.79	33.26	HRM3-HadCM3 (future)
4	84.62	8.69	11.93	14.12	17.65	20.56	23.44	26.32	30.11	32.98	RCM3-GFDL (historical)
5	80.77	8.63	11.53	13.73	16.88	18.94	20.97	23	25.87	28.28	RCM3-GFDL (future)
6	76.92	8.14	10.77	13.35	15.65	17.83	20.26	22.68	25.68	27.7	HRM3-GFDL (historical)
7	73.08	7.8	10.63	12.5	15.39	17.35	19.05	20.73	22.96	24.64	HRM3-HadCM3 (historical)
8	69.23	7.38	9.67	12.09	14.7	16.33	17.95	19.56	21.68	23.29	WRFG-CGCM3 (future)
9	65.38	7.24	9.53	11.12	13.13	14.62	16.1	17.58	19.52	20.99	MM5I-HadCM3 (historical)
10	61.54	7.12	9.48	10.9	12.46	13.7	15.06	16.41	18.19	19.54	WRFG-CGCM3 (historical)
11	57.69	7.1	9.3	10.66	12.38	13.66	14.93	16.19	17.86	19.12	WRFG-CCSM (future)
12	53.85	6.84	9.13	10.5	12.34	13.62	14.77	15.91	17.61	18.96	WRFG-CCSM (historical)
13	50.00	6.36	9.04	10.29	11.79	13.14	14.48	15.83	17.57	18.9	ECP2-HadCM3 (future)
14	46.15	6.26	8.78	9.97	11.76	13.12	14.48	15.81	17.42	18.56	MM5I-HadCM3 (future)
15	42.31	6.21	8.53	9.92	11.76	12.84	13.92	15.02	16.69	18.06	MM5I-CCSM (historical)
16	38.46	6.06	8.46	9.89	11.29	12.53	13.77	14.99	16.65	17.89	ECP2-GFDL (historical)
17	34.62	5.95	8.24	9.58	11.27	12.34	13.51	14.88	16.41	17.48	ECP2-GFDL (future)
18	30.77	5.54	7.96	9.21	10.8	12.13	13.37	14.4	15.86	17.02	MM5I-CCSM (future)
19	26.92	5.15	7.39	8.87	10.74	11.98	13.15	14.32	15.76	16.79	ECP2-HadCM3 (historical)
20	23.08	5.04	6.94	8.21	9.8	10.99	12.17	13.34	14.88	16.05	RCM3-CGCM3 (historical)
21	19.23	3.29	4.05	4.55	5.19	5.81	6.43	7.04	7.86	8.48	CRCM-CGCM3 (historical)
22	15.38	2.69	3.67	4.34	5.18	5.66	6.13	6.65	7.39	7.94	CRCM-CCSM (future)
23	11.54	2.66	3.6	4.2	4.97	5.53	6.09	6.59	7.21	7.67	CRCM-CGCM3 (future)
24	7.69	2.13	2.88	3.38	4.01	4.47	4.94	5.4	6.01	6.47	CRCM-CCSM (historical)
25	3.85	1.68	2.39	2.85	3.45	3.88	4.32	4.75	5.33	5.76	Observed
Gauge: 445880; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	6.85	10.24	12.83	16.38	19.01	21.63	24.23	27.66	30.26	RCM3-CGCM3 (future)
2	92.31	6.58	10.02	12.49	15.33	17.43	19.53	21.61	24.36	26.43	HRM3-GFDL (future)
3	88.46	5.83	9.23	10.98	13.2	14.85	16.48	18.11	20.25	21.88	HRM3-HadCM3 (future)
4	84.62	5.78	7.9	9.34	11.64	13.55	15.43	17.32	19.8	21.68	RCM3-GFDL (historical)
5	80.77	5.74	7.64	9.08	11.15	12.49	13.83	15.15	17.03	18.61	RCM3-GFDL (future)
6	76.92	5.42	7.14	8.83	10.34	11.77	13.36	14.94	16.91	18.23	HRM3-GFDL (historical)
7	73.08	5.19	7.05	8.28	10.17	11.46	12.57	13.68	15.14	16.24	HRM3-HadCM3 (historical)
8	69.23	4.93	6.41	8.01	9.73	10.8	11.86	12.91	14.31	15.36	WRFG-CGCM3 (future)
9	65.38	4.83	6.32	7.36	8.68	9.65	10.62	11.59	12.86	13.83	MM5I-HadCM3 (historical)
10	61.54	4.75	6.3	7.22	8.24	9.07	9.95	10.84	12	12.89	WRFG-CGCM3 (historical)
11	57.69	4.74	6.18	7.08	8.21	9.05	9.88	10.71	11.8	12.63	WRFG-CCSM (future)
12	53.85	4.57	6.08	6.97	8.17	9	9.75	10.5	11.62	12.51	WRFG-CCSM (historical)
13	50.00	4.26	6.01	6.84	7.81	8.69	9.57	10.46	11.6	12.47	ECP2-HadCM3 (future)
14	46.15	4.19	5.83	6.62	7.8	8.69	9.57	10.44	11.48	12.23	MM5I-HadCM3 (future)
15	42.31	4.15	5.68	6.59	7.79	8.51	9.22	9.92	11.04	11.93	MM5I-CCSM (historical)
16	38.46	4.06	5.63	6.56	7.47	8.29	9.11	9.92	10.99	11.8	ECP2-GFDL (historical)
17	34.62	3.98	5.48	6.36	7.47	8.15	8.95	9.85	10.85	11.56	ECP2-GFDL (future)
18	30.77	3.72	5.3	6.13	7.17	8.04	8.83	9.5	10.49	11.25	MM5I-CCSM (future)
19	26.92	3.47	4.93	5.91	7.13	7.95	8.71	9.48	10.39	11.06	ECP2-HadCM3 (historical)
20	23.08	3.39	4.64	5.47	6.52	7.3	8.07	8.84	9.86	10.63	RCM3-CGCM3 (historical)
21	19.23	2.24	2.73	3.06	3.48	3.89	4.3	4.71	5.25	5.65	CRCM-CGCM3 (historical)
22	15.38	1.85	2.49	2.93	3.47	3.78	4.09	4.43	4.9	5.27	CRCM-CCSM (future)
23	11.54	1.83	2.44	2.83	3.33	3.7	4.06	4.39	4.79	5.09	CRCM-CGCM3 (future)
24	7.69	1.49	1.98	2.31	2.72	3.03	3.34	3.64	4.04	4.34	CRCM-CCSM (historical)
25	3.85	1.19	1.71	2.05	2.48	2.79	3.11	3.42	3.84	4.15	Observed
Gauge: 445880; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	287.53	385.53	450.41	532.39	593.2	653.57	713.72	793.07	853.04	HRM3-GFDL (future)
2	92.31	271.28	352.75	406.7	474.85	525.42	575.61	625.61	710.16	782.07	Observed
3	88.46	262.36	324.09	371.86	432.21	476.99	542.89	615.01	691.59	741.45	HRM3-HadCM3 (future)
4	84.62	251.94	304.29	348.21	405	470.51	521.43	565.72	624.14	668.29	HRM3-HadCM3 (historical)
5	80.77	246.28	303.28	347.1	404.99	447.95	490.59	533.07	589.12	637.03	RCM3-GFDL (future)
6	76.92	246.28	301.27	332.05	397.59	447.11	488.92	530.58	588.04	631.48	HRM3-GFDL (historical)
7	73.08	235.41	295.83	328.64	383.04	428.36	474.11	523.23	585.54	627.07	WRFG-CGCM3 (historical)
8	69.23	232.06	295.83	328.64	375.14	424.81	473.34	518.16	577.29	621.99	RCM3-CGCM3 (future)
9	65.38	224.19	280.7	321.95	371.75	409.46	446.89	484.19	533.39	570.57	WRFG-CCSM (future)
10	61.54	219.94	276.54	320.92	370.1	400.85	434.42	471.93	521.4	558.8	WRFG-CCSM (historical)
11	57.69	206.2	273.6	311.19	370.1	400.85	431.38	461.79	509.96	551.06	RCM3-GFDL (historical)
12	53.85	200.57	267.3	308.18	367.13	396.78	431.38	461.79	504.34	541.38	MM5I-CCSM (future)
13	50.00	192.09	255.19	307.75	358.87	393.16	419.71	455.58	501.92	532.24	ECP2-HadCM3 (future)
14	46.15	183.45	252.62	299.29	354.98	387.46	418.99	455.32	501.92	532.24	ECP2-HadCM3 (future)
15	42.31	175.15	232.41	292.69	343.33	380.89	418.18	451.84	494.22	526.25	MM5I-HadCM3 (historical)
16	38.46	172.29	230.68	275.14	331.32	372.99	414.36	444.73	485.78	523.39	MM5I-CCSM (historical)
17	34.62	171.15	230.2	270.89	322.3	360.44	398.3	436.02	478.68	504.34	MM5I-HadCM3 (future)
18	30.77	168.75	227.72	265.17	312.49	347.6	382.44	417.16	462.97	497.59	RCM3-CGCM3 (historical)
19	26.92	163.52	221.5	264.83	305.78	336.17	366.33	396.37	436.02	465.98	ECP2-GFDL (future)
20	23.08	156.26	212.16	238.56	271.92	296.67	321.23	345.7	377.99	402.39	ECP2-HadCM3 (historical)
21	19.23	113.72	196.14	222.55	255.91	280.66	305.23	329.71	362.01	386.41	ECP2-GFDL (historical)
22	15.38	103.99	144.99	165.69	191.84	211.25	230.51	249.7	275.02	294.15	CRCM-CGCM3 (future)
23	11.54	86.97	117.49	137.7	163.24	182.18	200.98	219.72	244.43	263.12	CRCM-CGCM3 (historical)
24	7.69	85.1	110.19	126.8	147.79	163.36	178.81	194.21	214.53	229.88	CRCM-CCSM (future)
25	3.85	73.65	99.96	117.38	139.39	155.71	171.92	188.07	209.37	225.47	CRCM-CCSM (historical)
Gauge: 448062; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	238.93	339.86	406.69	491.12	553.76	615.93	677.88	759.61	821.38	HRM3-GFDL (future)
2	92.31	222.26	304.12	358.32	426.8	477.6	528.03	578.27	644.56	694.66	HRM3-HadCM3 (future)
3	88.46	211.79	274.45	321.75	381.52	425.85	469.86	513.71	571.56	615.28	HRM3-HadCM3 (historical)
4	84.62	203.01	253.19	299.43	357.86	401.2	444.23	487.09	543.65	586.87	RCM3-GFDL (future)
5	80.77	196.63	252.83	296.13	350.92	391.57	431.91	474.69	538.58	586.39	HRM3-GFDL (historical)
6	76.92	196.63	252.77	279.99	328.69	377.66	426.26	472.11	525.14	565.23	WRFG-CGCM3 (historical)
7	73.08	187.28	244.6	276.37	328.32	371.34	414.04	456.58	512.71	555.13	RCM3-CGCM3 (future)
8	69.23	183.35	244.6	276.37	318.04	354.26	390.22	426.04	473.31	509.03	WRFG-CCSM (future)
9	65.38	175.66	230.56	270.33	316.5	346.27	375.82	410.03	458.53	498.62	RCM3-GFDL (historical)
10	61.54	172.2	226.3	269.21	316.5	346.27	375.82	405.47	456.65	491.88	WRFG-CCSM (historical)
11	57.69	159.63	224.44	262.69	314.32	339.78	374.69	405.27	444.12	475.99	MM5I-CCSM (future)
12	53.85	155.12	217.21	259.82	303.49	339.22	365.26	405.27	444.12	473.47	ECP2-HadCM3 (future)
13	50.00	146.54	210.45	255.33	302.19	333.61	365.06	395.88	441.05	473.47	ECP2-HadCM3 (future)
14	46.15	138.06	203.63	241.43	289.19	324.9	364.8	394.82	436.89	467.88	MM5I-HadCM3 (historical)
15	42.31	131.55	186.04	229.42	284.23	324.62	359.78	390.24	423.47	455.62	MM5I-CCSM (historical)
16	38.46	127.85	183.98	220.7	268.53	304.01	339.24	374.33	420.63	448.58	MM5I-HadCM3 (future)
17	34.62	127.7	182.84	214.38	257.32	289.51	321.47	353.31	395.31	427.06	RCM3-CGCM3 (historical)
18	30.77	125.66	179.57	213.92	252.79	281.29	309.57	337.76	374.94	403.04	ECP2-GFDL (future)
19	26.92	120.52	164.14	188.17	218.53	241.06	263.42	285.87	327.97	359.79	Observed
20	23.08	113.83	149.3	172.79	202.46	224.48	253.96	285.69	315.08	337.29	ECP2-HadCM3 (historical)
21	19.23	77.62	111.76	146.18	189.67	221.94	246.33	268.1	296.83	318.53	ECP2-GFDL (historical)
22	15.38	59.77	103.84	121.2	143.13	159.4	175.56	191.65	212.88	228.93	CRCM-CGCM3 (future)
23	11.54	56.2	81.53	98.3	119.49	135.21	150.81	166.35	186.86	202.36	CRCM-CGCM3 (historical)
24	7.69	54.77	74.57	87.67	104.23	116.52	128.71	140.86	156.89	169.01	CRCM-CCSM (future)
25	3.85	46.39	66.16	79.24	95.78	108.05	120.23	132.36	148.37	160.47	CRCM-CCSM (historical)
Gauge: 448062; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	182.25	261.15	313.39	379.39	428.35	476.96	525.38	589.27	637.56	HRM3-GFDL (future)
2	92.31	169.22	233.01	275.25	328.61	368.2	407.5	446.65	498.3	537.34	HRM3-HadCM3 (future)
3	88.46	160.93	209.82	246.61	293.1	327.59	361.82	395.92	440.92	474.93	HRM3-HadCM3 (historical)
4	84.62	154.25	193.42	229.48	275.05	308.85	342.4	375.83	419.93	453.26	HRM3-GFDL (historical)
5	80.77	149.21	192.84	226.46	268.94	300.46	331.74	365.95	415.64	453.19	RCM3-GFDL (future)
6	76.92	149.21	192.8	213.89	252.41	290.49	328.29	362.9	404.02	435.1	WRFG-CGCM3 (historical)
7	73.08	142.06	186.42	211.05	251.29	284.58	317.62	350.54	393.97	426.79	RCM3-CGCM3 (future)
8	69.23	138.96	186.42	211.05	243.37	271.44	299.3	327.06	363.68	391.36	WRFG-CCSM (future)
9	65.38	132.98	175.59	206.42	242.18	265.27	288.19	314.28	353.07	384.21	RCM3-GFDL (historical)
10	61.54	130.36	172.25	205.53	242.18	265.27	288.19	311.87	350.32	377.57	WRFG-CCSM (historical)
11	57.69	120.69	170.91	201.08	240.55	260.33	286.96	311.02	341.15	365.26	MM5I-CCSM (future)
12	53.85	117.27	165.2	198.26	231.91	259.54	280.63	311.02	341.15	363.92	ECP2-HadCM3 (future)
13	50.00	110.58	160.45	194.67	231.11	255.48	279.96	303.78	338.25	363.92	ECP2-HadCM3 (future)
14	46.15	104	154.71	183.93	220.85	249.29	279.68	302.52	335.58	359.62	MM5I-HadCM3 (historical)
15	42.31	99.09	141.45	175.14	217.71	248.24	275.43	299.52	325.32	349.33	MM5I-CCSM (historical)
16	38.46	96.14	139.48	167.93	204.86	232.26	259.46	286.56	322.31	344.83	MM5I-HadCM3 (future)
17	34.62	96.1	138.7	162.97	195.98	220.78	245.4	269.94	302.3	326.77	RCM3-CGCM3 (historical)
18	30.77	94.55	136.07	162.54	192.65	214.67	236.53	258.31	287.04	308.75	ECP2-GFDL (future)
19	26.92	90.56	124.07	142.57	165.94	183.27	200.48	217.63	240.25	257.34	ECP2-HadCM3 (historical)
20	23.08	85.4	112.63	130.66	153.43	170.33	187.1	203.81	225.86	242.53	ECP2-GFDL (historical)
21	19.23	57.77	77.75	94.9	121.81	141.77	161.59	181.33	207.38	227.07	Observed
22	15.38	41.54	73.6	90.98	107.69	120.09	132.4	144.67	160.85	173.07	CRCM-CGCM3 (future)
23	11.54	41.43	60.81	73.57	89.7	101.66	113.53	125.36	140.97	152.77	CRCM-CGCM3 (historical)
24	7.69	40.46	55.42	65.33	77.84	87.13	96.34	105.53	117.64	126.8	CRCM-CCSM (future)
25	3.85	34.18	49.04	58.88	71.32	80.54	89.7	98.82	110.86	119.96	CRCM-CCSM (historical)
Gauge: 448062; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	153.19	221.94	267.46	324.97	367.63	409.98	452.18	507.85	549.92	HRM3-GFDL (future)
2	92.31	141.85	197.17	233.8	280.07	314.4	348.48	382.44	427.23	461.09	HRM3-HadCM3 (future)
3	88.46	134.47	176.95	208.76	248.97	278.79	308.4	337.89	376.81	406.22	HRM3-HadCM3 (historical)
4	84.62	128.89	162.97	194.28	233.85	263.2	292.34	321.37	359.67	388.61	HRM3-GFDL (historical)
5	80.77	124.44	162.13	191.06	227.62	254.74	281.66	312.51	355.48	387.96	RCM3-GFDL (future)
6	76.92	124.44	161.96	180.17	214.33	247.26	279.95	308.48	343.87	370.61	WRFG-CGCM3 (historical)
7	73.08	118.43	156.47	177.69	212.27	240.83	269.19	297.44	334.71	362.88	RCM3-CGCM3 (future)
8	69.23	115.67	156.47	177.69	205.52	229.65	253.61	277.48	308.97	332.78	WRFG-CCSM (future)
9	65.38	110.52	147.23	173.77	204.49	224.37	244.11	265.97	300.96	327.83	RCM3-GFDL (historical)
10	61.54	108.34	144.33	172.98	204.49	224.37	244.11	265.4	296.86	320.2	WRFG-CCSM (historical)
11	57.69	100.09	143.29	169.93	203.17	220.23	242.56	263.77	289.71	309.78	MM5I-CCSM (future)
12	53.85	97.27	138.23	166.71	195.39	219.07	238.44	263.77	289.71	309.32	ECP2-HadCM3 (future)
13	50.00	91.46	134.8	163.49	195	215.98	237.16	257.56	286.63	309.32	ECP2-HadCM3 (future)
14	46.15	85.78	129.29	154.34	185.99	211.39	236.81	255.99	284.94	305.64	MM5I-HadCM3 (historical)
15	42.31	81.74	118.33	147.41	184.14	209.47	232.77	254.04	276.3	295.78	MM5I-CCSM (historical)
16	38.46	79.17	116.17	140.63	172.22	195.65	218.91	242.09	272.67	293.13	MM5I-HadCM3 (future)
17	34.62	79.08	115.62	136.28	164.33	185.49	206.48	227.4	255.01	275.87	RCM3-CGCM3 (historical)
18	30.77	77.86	113.25	135.82	161.7	180.55	199.27	217.92	242.52	261.12	ECP2-GFDL (future)
19	26.92	74.42	102.86	118.61	138.5	153.26	167.91	182.51	201.76	216.32	ECP2-HadCM3 (historical)
20	23.08	70.01	93.09	108.36	127.67	141.99	156.2	170.36	189.05	203.17	ECP2-GFDL (historical)
21	19.23	46.79	63.53	74.62	91.04	105.7	120.25	134.75	153.88	168.34	Observed
22	15.38	33.3	55.64	71.28	88.63	99.02	109.34	119.62	133.18	143.43	CRCM-CGCM3 (future)
23	11.54	32.41	49.43	60.11	73.6	83.61	93.55	103.44	116.5	126.37	CRCM-CGCM3 (historical)
24	7.69	32.02	44.82	53.04	63.42	71.12	78.76	86.38	96.42	104.02	CRCM-CCSM (future)
25	3.85	27.27	39.48	47.57	57.79	65.37	72.89	80.39	90.28	97.75	CRCM-CCSM (historical)
Gauge: 448062; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	114.78	173.1	211.72	260.51	296.7	332.63	368.42	415.65	451.34	HRM3-GFDL (future)
2	92.31	105.18	151.29	181.82	220.39	249	277.41	305.71	343.04	371.26	HRM3-HadCM3 (future)
3	88.46	98.5	134.11	160.37	193.54	218.15	242.58	266.91	299.02	323.29	HRM3-HadCM3 (historical)
4	84.62	94.46	123.23	149.47	182.64	207.24	231.66	256	288.1	312.36	HRM3-GFDL (historical)
5	80.77	90.5	121.47	144.92	174.55	196.53	220.95	247.86	283.36	310.19	RCM3-GFDL (future)
6	76.92	90.5	120.96	135.83	166.73	193.94	218.35	240.09	268.77	290.45	WRFG-CGCM3 (historical)
7	73.08	86.05	116.51	133.73	161.66	184.57	207.31	229.97	259.87	282.46	RCM3-CGCM3 (future)
8	69.23	83.58	116.51	133.73	156.34	175.85	195.2	214.49	239.93	259.17	WRFG-CCSM (future)
9	65.38	79.37	109.25	130.77	155.49	171.63	187.65	207.91	237.06	259.1	RCM3-GFDL (historical)
10	61.54	77.83	106.81	130.06	155.49	171.63	187.65	203.75	228.4	247.02	WRFG-CCSM (historical)
11	57.69	71.38	106.33	130.05	154.63	168.57	185.81	203.61	224.67	240.59	ECP2-HadCM3 (future)
12	53.85	69.41	101.82	124.98	147.93	166.32	185.07	203.61	224.67	240.59	ECP2-HadCM3 (future)
13	50.00	64.58	101.03	121.97	147.43	164.96	182.41	198.71	220.93	239	MM5I-CCSM (future)
14	46.15	59.95	94.81	114.82	141.29	163.63	181.87	196.19	220.5	237.72	MM5I-HadCM3 (historical)
15	42.31	57.18	87.33	111.17	140.1	158.86	177.48	196.03	214.38	228.13	MM5I-HadCM3 (future)
16	38.46	55.06	84.12	103.9	128.96	147.55	166.01	184.39	208.65	226.99	MM5I-CCSM (historical)
17	34.62	54.71	84.06	100.12	121.88	138.47	154.95	171.36	193.02	209.38	RCM3-CGCM3 (historical)
18	30.77	54.1	81.8	99.51	120.34	135.34	150.23	165.06	184.64	199.43	ECP2-GFDL (future)
19	26.92	51.33	73.23	85.49	100.99	112.49	123.9	135.26	150.26	161.6	ECP2-HadCM3 (historical)
20	23.08	47.86	65.53	77.23	92.02	102.99	113.87	124.72	139.03	149.85	ECP2-GFDL (historical)
21	19.23	30.58	42.91	51.08	61.4	69.06	76.66	84.23	94.22	101.77	CRCM-CGCM3 (future)
22	15.38	20.98	32.78	40.6	50.48	57.8	65.08	72.32	81.88	89.11	CRCM-CGCM3 (historical)
23	11.54	20.36	31.68	39.56	49.52	56.91	64.24	71.55	81.19	88.47	Observed
24	7.69	19.78	29.12	34.92	42.25	47.68	53.08	58.45	65.54	70.9	CRCM-CCSM (future)
25	3.85	16.89	25.26	30.8	37.81	43	48.15	53.29	60.07	65.19	CRCM-CCSM (historical)
Gauge: 448062; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	74.02	108.02	130.54	158.98	180.09	201.03	221.91	249.44	270.25	HRM3-GFDL (future)
2	92.31	68.41	95.69	113.74	136.56	153.49	170.29	187.03	209.12	225.81	HRM3-HadCM3 (future)
3	88.46	64.71	85.69	101.35	121.15	135.83	150.4	164.92	184.08	198.56	HRM3-HadCM3 (historical)
4	84.62	62.03	78.86	94.31	113.84	128.32	142.7	157.03	175.93	190.21	HRM3-GFDL (historical)
5	80.77	59.81	78.35	92.54	110.47	123.78	136.99	152.59	173.74	189.72	RCM3-GFDL (future)
6	76.92	59.81	78.21	87.15	104.26	120.47	136.56	150.15	167.51	180.63	WRFG-CGCM3 (historical)
7	73.08	56.91	75.53	85.94	102.89	116.87	130.76	144.59	162.84	176.63	RCM3-CGCM3 (future)
8	69.23	55.52	75.53	85.94	99.59	111.43	123.17	134.88	150.32	161.99	WRFG-CCSM (future)
9	65.38	53	71.02	84.04	99.09	108.84	118.53	129.27	146.75	159.96	RCM3-GFDL (historical)
10	61.54	51.95	69.59	83.64	99.09	108.84	118.53	129.07	144.17	155.59	WRFG-CCSM (historical)
11	57.69	47.93	69.12	82.41	98.45	106.83	117.62	128.18	140.91	150.53	ECP2-HadCM3 (future)
12	53.85	46.58	66.59	80.57	94.55	106.12	116.03	128.18	140.91	150.53	ECP2-HadCM3 (future)
13	50.00	43.72	65.12	78.94	94.44	104.74	115.15	125.14	139.19	150.51	MM5I-CCSM (future)
14	46.15	40.93	62.23	74.48	89.96	102.73	114.96	124.2	138.57	148.72	MM5I-HadCM3 (historical)
15	42.31	39	57	71.29	89.34	101.44	112.84	123.44	134.37	143.6	MM5I-CCSM (historical)
16	38.46	37.73	55.78	67.78	83.22	94.67	106.04	117.36	132.3	142.64	MM5I-HadCM3 (future)
17	34.62	37.67	55.56	65.62	79.27	89.58	99.82	110.02	123.49	133.66	RCM3-CGCM3 (historical)
18	30.77	37.11	54.35	65.36	78.05	87.27	96.42	105.54	117.57	126.66	ECP2-GFDL (future)
19	26.92	35.42	49.25	56.92	66.62	73.81	80.94	88.05	97.44	104.53	ECP2-HadCM3 (historical)
20	23.08	33.27	44.47	51.89	61.27	68.22	75.12	82	91.08	97.93	ECP2-GFDL (historical)
21	19.23	22.05	30.13	35.47	42.23	47.24	52.22	57.18	63.72	68.66	CRCM-CGCM3 (future)
22	15.38	15.6	23.36	28.51	35.01	39.83	44.61	49.38	55.67	60.42	CRCM-CGCM3 (historical)
23	11.54	15.17	22.39	27.64	34.27	39.19	44.08	48.94	55.36	60.21	Observed
24	7.69	14.47	21.1	25.02	29.98	33.66	37.32	40.96	45.76	49.39	CRCM-CCSM (future)
25	3.85	12.73	18.54	22.39	27.26	30.87	34.45	38.02	42.73	46.29	CRCM-CCSM (historical)
Gauge: 448062; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	58.69	85.03	102.47	124.5	140.85	157.07	173.24	194.57	210.68	HRM3-GFDL (future)
2	92.31	54.35	75.54	89.57	107.3	120.45	133.51	146.52	163.68	176.65	HRM3-HadCM3 (future)
3	88.46	51.52	67.79	79.99	95.39	106.82	118.17	129.47	144.39	155.66	HRM3-HadCM3 (historical)
4	84.62	49.38	62.43	74.42	89.58	100.82	111.98	123.1	137.77	148.86	HRM3-GFDL (historical)
5	80.77	47.67	62.11	73.19	87.19	97.58	107.89	119.73	136.19	148.63	RCM3-GFDL (future)
6	76.92	47.67	62.06	69.03	82.11	94.73	107.25	118.16	131.72	141.96	WRFG-CGCM3 (historical)
7	73.08	45.37	59.95	68.07	81.32	92.27	103.13	113.95	128.23	139.02	RCM3-CGCM3 (future)
8	69.23	44.31	59.95	68.07	78.74	87.98	97.16	106.31	118.37	127.49	WRFG-CCSM (future)
9	65.38	42.34	56.41	66.57	78.34	85.96	93.52	101.91	115.32	125.61	RCM3-GFDL (historical)
10	61.54	41.51	55.3	66.27	78.34	85.96	93.52	101.69	113.75	122.69	WRFG-CCSM (historical)
11	57.69	38.34	54.9	65.1	77.84	84.38	92.94	101.05	110.99	118.67	MM5I-CCSM (future)
12	53.85	37.26	52.96	63.88	74.87	83.94	91.36	101.05	110.99	118.51	ECP2-HadCM3 (future)
13	50.00	35.04	51.64	62.64	74.71	82.75	90.87	98.69	109.8	118.51	ECP2-HadCM3 (future)
14	46.15	32.87	49.53	59.13	71.25	81	90.73	98.07	109.18	117.11	MM5I-HadCM3 (historical)
15	42.31	31.31	45.34	56.48	70.56	80.24	89.17	97.34	105.87	113.32	MM5I-CCSM (historical)
16	38.46	30.33	44.51	53.88	65.98	74.96	83.87	92.75	104.46	112.31	MM5I-HadCM3 (future)
17	34.62	30.3	44.3	52.21	62.97	71.07	79.12	87.14	97.71	105.71	RCM3-CGCM3 (historical)
18	30.77	29.83	43.39	52.04	61.95	69.17	76.34	83.48	92.91	100.03	ECP2-GFDL (future)
19	26.92	28.51	39.41	45.44	53.06	58.72	64.33	69.92	77.3	82.88	ECP2-HadCM3 (historical)
20	23.08	26.83	35.67	41.52	48.91	54.39	59.84	65.26	72.42	77.83	ECP2-GFDL (historical)
21	19.23	17.93	24.34	28.59	33.96	37.94	41.89	45.83	51.03	54.95	CRCM-CGCM3 (future)
22	15.38	12.76	18.94	23.03	28.2	32.03	35.84	39.63	44.63	48.41	CRCM-CGCM3 (historical)
23	11.54	12.42	17.72	21.71	26.75	30.49	34.2	37.9	42.78	46.47	Observed
24	7.69	11.69	17.17	20.32	24.3	27.25	30.18	33.09	36.94	39.85	CRCM-CCSM (future)
25	3.85	10.45	15.13	18.22	22.13	25.03	27.91	30.78	34.57	37.43	CRCM-CCSM (historical)
Gauge: 448062; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	57.66	84.03	101.49	123.55	139.92	156.16	172.35	193.7	209.84	HRM3-GFDL (future)
2	92.31	53.31	74.46	88.47	106.16	119.29	132.32	145.3	162.43	175.38	HRM3-HadCM3 (future)
3	88.46	50.44	66.71	78.85	94.2	105.59	116.89	128.15	143.01	154.23	HRM3-HadCM3 (historical)
4	84.62	48.36	61.42	73.4	88.54	99.77	110.92	122.03	136.68	147.76	HRM3-GFDL (historical)
5	80.77	46.64	61.01	72.02	85.93	96.24	106.48	118.59	134.99	147.39	RCM3-GFDL (future)
6	76.92	46.64	60.92	67.85	81.11	93.68	106.16	116.68	130.15	140.32	WRFG-CGCM3 (historical)
7	73.08	44.39	58.83	66.9	80.05	90.89	101.66	112.39	126.54	137.23	RCM3-CGCM3 (future)
8	69.23	43.32	58.83	66.9	77.49	86.67	95.78	104.86	116.83	125.88	WRFG-CCSM (future)
9	65.38	41.36	55.33	65.43	77.1	84.67	92.18	100.52	114.08	124.32	RCM3-GFDL (historical)
10	61.54	40.55	54.23	65.12	77.1	84.67	92.18	100.35	112.06	120.92	WRFG-CCSM (historical)
11	57.69	37.43	53.86	64.17	76.61	83.11	91.47	99.66	109.53	117	ECP2-HadCM3 (future)
12	53.85	36.38	51.9	62.75	73.58	82.56	90.25	99.66	109.53	117	ECP2-HadCM3 (future)
13	50.00	34.16	50.76	61.48	73.51	81.49	89.56	97.32	108.2	116.98	MM5I-CCSM (future)
14	46.15	32	48.51	58.02	70.02	79.94	89.42	96.58	107.74	115.61	MM5I-HadCM3 (historical)
15	42.31	30.5	44.47	55.55	69.55	78.93	87.77	95.99	104.47	111.6	MM5I-CCSM (historical)
16	38.46	29.52	43.52	52.81	64.78	73.66	82.47	91.26	102.84	110.88	MM5I-HadCM3 (future)
17	34.62	29.47	43.34	51.14	61.74	69.74	77.68	85.6	96.04	103.93	RCM3-CGCM3 (historical)
18	30.77	29.03	42.42	50.95	60.77	67.92	75.01	82.08	91.4	98.45	ECP2-GFDL (future)
19	26.92	27.73	38.45	44.39	51.91	57.48	63.01	68.52	75.79	81.29	ECP2-HadCM3 (historical)
20	23.08	26.07	34.75	40.5	47.77	53.16	58.51	63.85	70.88	76.2	ECP2-GFDL (historical)
21	19.23	17.36	23.62	27.77	33.01	36.9	40.76	44.61	49.68	53.51	CRCM-CGCM3 (future)
22	15.38	12.35	18.37	22.35	27.39	31.12	34.83	38.52	43.4	47.08	CRCM-CGCM3 (historical)
23	11.54	12.02	16.63	19.68	23.53	26.39	29.22	32.05	35.78	38.59	CRCM-CCSM (future)
24	7.69	10.13	14.64	17.62	21.39	24.19	26.97	29.73	33.38	36.14	Observed
25	3.85	8.71	13.46	16.61	20.59	23.54	26.47	29.38	33.23	36.14	Observed
Gauge: 448062; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h⁻¹) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	36.81	53.48	64.51	78.46	88.8	99.07	109.3	122.79	132.99	HRM3-GFDL (future)
2	92.31	34.07	47.43	56.28	67.47	75.76	84	92.2	103.03	111.21	HRM3-HadCM3 (future)
3	88.46	32.25	42.53	50.21	59.91	67.1	74.24	81.36	90.75	97.84	HRM3-HadCM3 (historical)
4	84.62	30.94	39.19	46.76	56.33	63.42	70.47	77.49	86.75	93.75	HRM3-GFDL (historical)
5	80.77	29.85	38.93	45.89	54.68	61.2	67.68	75.32	85.69	93.52	RCM3-GFDL (future)
6	76.92	29.85	38.87	43.25	51.64	59.58	67.46	74.13	82.63	89.06	WRFG-CGCM3 (historical)
7	73.08	28.43	37.55	42.65	50.96	57.82	64.62	71.4	80.34	87.1	RCM3-CGCM3 (future)
8	69.23	27.75	37.55	42.65	49.35	55.15	60.91	66.64	74.21	79.93	WRFG-CCSM (future)
9	65.38	26.51	35.34	41.72	49.1	53.88	58.63	63.9	72.47	78.94	RCM3-GFDL (historical)
10	61.54	26	34.64	41.53	49.1	53.88	58.63	63.81	71.22	76.81	WRFG-CCSM (historical)
11	57.69	24.03	34.41	40.93	48.79	52.9	58.2	63.36	69.6	74.31	ECP2-HadCM3 (future)
12	53.85	23.37	33.18	40.02	46.88	52.56	57.41	63.36	69.6	74.31	ECP2-HadCM3 (future)
13	50.00	21.97	32.45	39.23	46.82	51.87	56.97	61.87	68.74	74.29	MM5I-CCSM (future)
14	46.15	20.6	31.03	37.04	44.62	50.89	56.88	61.4	68.45	73.43	MM5I-HadCM3 (historical)
15	42.31	19.65	28.47	35.48	44.33	50.25	55.83	61.04	66.4	70.89	MM5I-CCSM (historical)
16	38.46	19.04	27.88	33.75	41.31	46.92	52.49	58.04	65.36	70.45	MM5I-HadCM3 (future)
17	34.62	19	27.76	32.7	39.39	44.45	49.47	54.47	61.07	66.06	RCM3-CGCM3 (historical)
18	30.77	18.72	27.18	32.58	38.79	43.31	47.8	52.27	58.16	62.62	ECP2-GFDL (future)
19	26.92	17.89	24.67	28.43	33.17	36.69	40.19	43.67	48.26	51.74	ECP2-HadCM3 (historical)
20	23.08	16.84	22.33	25.96	30.55	33.96	37.34	40.71	45.15	48.51	ECP2-GFDL (historical)
21	19.23	11.34	15.3	17.92	21.24	23.69	26.13	28.56	31.77	34.19	CRCM-CGCM3 (future)
22	15.38	8.18	11.99	14.51	17.7	20.06	22.41	24.75	27.83	30.16	CRCM-CGCM3 (historical)
23	11.54	7.97	10.88	12.8	15.23	17.04	18.83	20.61	22.97	24.75	CRCM-CCSM (future)
24	7.69	6.77	9.62	11.5	13.88	15.65	17.4	19.15	21.45	23.19	CRCM-CCSM (historical)
25	3.85	5.37	8.2	10.07	12.44	14.2	15.94	17.67	19.96	21.69	Observed
Gauge: 448062; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h⁻¹) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	19.93	28.81	34.68	42.11	47.62	53.08	58.53	65.72	71.15	HRM3-GFDL (future)
2	92.31	18.47	25.59	30.3	36.26	40.67	45.06	49.43	55.19	59.55	HRM3-HadCM3 (future)
3	88.46	17.5	22.98	27.07	32.24	36.07	39.88	43.67	48.67	52.45	HRM3-HadCM3 (historical)
4	84.62	16.8	21.2	25.23	30.32	34.1	37.85	41.59	46.52	50.25	HRM3-GFDL (historical)
5	80.77	16.22	21.06	24.77	29.45	32.92	36.37	40.44	45.96	50.13	RCM3-GFDL (future)
6	76.92	16.22	21.03	23.37	27.83	32.06	36.25	39.8	44.33	47.75	WRFG-CGCM3 (historical)
7	73.08	15.47	20.33	23.04	27.47	31.12	34.74	38.35	43.11	46.71	RCM3-CGCM3 (future)
8	69.23	15.11	20.33	23.04	26.61	29.7	32.76	35.82	39.85	42.89	WRFG-CCSM (future)
9	65.38	14.45	19.15	22.55	26.48	29.02	31.55	34.35	38.9	42.35	RCM3-GFDL (historical)
10	61.54	14.17	18.78	22.44	26.48	29.02	31.55	34.3	38.25	41.23	WRFG-CCSM (historical)
11	57.69	13.13	18.65	22.12	26.32	28.5	31.31	34.07	37.39	39.92	MM5I-CCSM (future)
12	53.85	12.77	17.99	21.64	25.29	28.31	30.89	34.07	37.39	39.9	ECP2-HadCM3 (future)
13	50.00	12.02	17.61	21.22	25.27	27.95	30.68	33.28	36.96	39.9	ECP2-HadCM3 (future)
14	46.15	11.3	16.86	20.06	24.1	27.42	30.62	33.04	36.78	39.43	MM5I-HadCM3 (historical)
15	42.31	10.79	15.49	19.22	23.93	27.1	30.08	32.84	35.7	38.09	MM5I-CCSM (historical)
16	38.46	10.46	15.18	18.3	22.33	25.32	28.29	31.24	35.14	37.85	MM5I-HadCM3 (future)
17	34.62	10.45	15.11	17.75	21.31	24	26.67	29.33	32.85	35.5	RCM3-CGCM3 (historical)
18	30.77	10.29	14.8	17.68	20.99	23.4	25.79	28.17	31.31	33.69	ECP2-GFDL (future)
19	26.92	9.86	13.47	15.47	18	19.88	21.74	23.59	26.04	27.89	ECP2-HadCM3 (historical)
20	23.08	9.3	12.22	14.16	16.61	18.42	20.22	22.02	24.39	26.18	ECP2-GFDL (historical)
21	19.23	6.37	8.47	9.86	11.62	12.93	14.23	15.52	17.22	18.51	CRCM-CGCM3 (future)
22	15.38	4.68	6.71	8.05	9.74	11	12.24	13.49	15.12	16.36	CRCM-CGCM3 (historical)
23	11.54	4.57	6.12	7.14	8.44	9.4	10.35	11.3	12.55	13.5	CRCM-CCSM (future)
24	7.69	3.94	5.46	6.46	7.74	8.68	9.62	10.55	11.78	12.71	CRCM-CCSM (historical)
25	3.85	2.97	4.33	5.23	6.37	7.21	8.05	8.89	9.99	10.82	Observed
Gauge: 448062; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	10.58	15.23	18.31	22.19	25.08	27.94	30.79	34.55	37.4	HRM3-GFDL (future)
2	92.31	9.82	13.54	16.01	19.13	21.44	23.74	26.03	29.04	31.32	HRM3-HadCM3 (future)
3	88.46	9.32	12.18	14.32	17.03	19.04	21.03	23.02	25.63	27.61	HRM3-HadCM3 (historical)
4	84.62	8.95	11.25	13.36	16.03	18.01	19.97	21.93	24.52	26.47	HRM3-GFDL (historical)
5	80.77	8.64	11.17	13.11	15.56	17.37	19.17	21.32	24.21	26.39	RCM3-GFDL (future)
6	76.92	8.64	11.16	12.39	14.72	16.93	19.13	20.97	23.34	25.13	WRFG-CGCM3 (historical)
7	73.08	8.25	10.79	12.21	14.53	16.44	18.34	20.23	22.72	24.6	RCM3-CGCM3 (future)
8	69.23	8.06	10.79	12.21	14.08	15.7	17.3	18.9	21.01	22.6	WRFG-CCSM (future)
9	65.38	7.71	10.17	11.95	14.01	15.34	16.67	18.15	20.54	22.34	RCM3-GFDL (historical)
10	61.54	7.57	9.97	11.9	14.01	15.34	16.67	18.09	20.15	21.7	WRFG-CCSM (historical)
11	57.69	7.02	9.91	11.73	13.93	15.08	16.52	17.98	19.72	21.04	ECP2-HadCM3 (future)
12	53.85	6.84	9.56	11.47	13.38	14.96	16.34	17.98	19.72	21.04	ECP2-HadCM3 (future)
13	50.00	6.44	9.37	11.25	13.36	14.77	16.22	17.55	19.48	21.03	MM5I-CCSM (future)
14	46.15	6.06	8.97	10.64	12.76	14.52	16.16	17.43	19.38	20.77	MM5I-HadCM3 (historical)
15	42.31	5.8	8.26	10.22	12.69	14.32	15.88	17.35	18.85	20.08	MM5I-CCSM (historical)
16	38.46	5.63	8.09	9.73	11.84	13.4	14.95	16.5	18.54	19.98	MM5I-HadCM3 (future)
17	34.62	5.62	8.06	9.44	11.3	12.71	14.11	15.51	17.34	18.73	RCM3-CGCM3 (historical)
18	30.77	5.54	7.9	9.4	11.14	12.4	13.65	14.9	16.55	17.79	ECP2-GFDL (future)
19	26.92	5.31	7.2	8.25	9.57	10.55	11.52	12.5	13.78	14.74	ECP2-HadCM3 (historical)
20	23.08	5.02	6.54	7.56	8.84	9.78	10.73	11.66	12.9	13.84	ECP2-GFDL (historical)
21	19.23	3.48	4.59	5.32	6.24	6.93	7.61	8.29	9.18	9.86	CRCM-CGCM3 (future)
22	15.38	2.6	3.66	4.37	5.25	5.91	6.56	7.21	8.07	8.72	CRCM-CGCM3 (historical)
23	11.54	2.54	3.35	3.89	4.57	5.07	5.58	6.07	6.73	7.23	CRCM-CCSM (future)
24	7.69	2.21	3.01	3.53	4.2	4.69	5.18	5.67	6.32	6.8	CRCM-CCSM (historical)
25	3.85	1.77	2.6	3.15	3.84	4.36	4.87	5.38	6.05	6.56	Observed
Gauge: 448062; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
1	96.15	7.02	10.06	12.07	14.62	16.5	18.38	20.24	22.71	24.57	HRM3-GFDL (future)
2	92.31	6.52	8.96	10.57	12.61	14.13	15.63	17.13	19.1	20.59	HRM3-HadCM3 (future)
3	88.46	6.19	8.06	9.46	11.22	12.54	13.84	15.13	16.84	18.14	HRM3-HadCM3 (historical)
4	84.62	5.95	7.45	8.83	10.57	11.87	13.15	14.43	16.12	17.4	HRM3-GFDL (historical)
5	80.77	5.75	7.4	8.67	10.28	11.47	12.65	14.04	15.94	17.37	RCM3-GFDL (future)
6	76.92	5.75	7.4	8.2	9.72	11.17	12.61	13.82	15.38	16.55	WRFG-CGCM3 (historical)
7	73.08	5.48	7.15	8.08	9.6	10.85	12.09	13.33	14.96	16.19	RCM3-CGCM3 (future)
8	69.23	5.36	7.15	8.08	9.3	10.36	11.41	12.46	13.84	14.89	WRFG-CCSM (future)
9	65.38	5.13	6.75	7.91	9.26	10.13	11	11.94	13.5	14.68	RCM3-GFDL (historical)
10	61.54	5.04	6.62	7.88	9.26	10.13	11	11.94	13.3	14.32	WRFG-CCSM (historical)
11	57.69	4.68	6.58	7.77	9.21	9.96	10.92	11.86	13	13.86	ECP2-HadCM3 (future)
12	53.85	4.56	6.35	7.6	8.85	9.89	10.76	11.86	13	13.86	ECP2-HadCM3 (future)
13	50.00	4.3	6.22	7.46	8.84	9.77	10.71	11.59	12.83	13.84	MM5I-CCSM (future)
14	46.15	4.05	5.96	7.05	8.43	9.57	10.68	11.49	12.79	13.7	MM5I-HadCM3 (historical)
15	42.31	3.89	5.49	6.76	8.38	9.46	10.48	11.45	12.43	13.25	MM5I-CCSM (historical)
16	38.46	3.77	5.38	6.46	7.84	8.87	9.89	10.9	12.24	13.17	MM5I-HadCM3 (future)
17	34.62	3.77	5.37	6.26	7.48	8.41	9.32	10.23	11.43	12.34	RCM3-CGCM3 (historical)
18	30.77	3.71	5.26	6.24	7.37	8.19	9.01	9.82	10.89	11.7	ECP2-GFDL (future)
19	26.92	3.56	4.8	5.49	6.35	6.99	7.63	8.26	9.1	9.73	ECP2-HadCM3 (historical)
20	23.08	3.37	4.37	5.03	5.87	6.49	7.1	7.72	8.53	9.14	ECP2-GFDL (historical)
21	19.23	2.37	3.09	3.57	4.18	4.63	5.07	5.52	6.1	6.55	CRCM-CGCM3 (future)
22	15.38	1.79	2.49	2.95	3.53	3.97	4.4	4.83	5.39	5.82	CRCM-CGCM3 (historical)
23	11.54	1.75	2.28	2.63	3.08	3.41	3.73	4.06	4.49	4.81	CRCM-CCSM (future)
24	7.69	1.53	2.05	2.4	2.84	3.16	3.48	3.8	4.22	4.55	Observed
25	3.85	1.28	1.85	2.22	2.7	3.05	3.4	3.74	4.2	4.54	CRCM-CCSM (historical)
Gauge: 448062; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	298.63	388.1	433.84	481.49	511.61	538.24	562.23	590.84	610.59	HRM3-GFDL (future)
2	92.31	281.6	358.11	400.17	443.97	471.64	496.11	518.15	544.42	562.57	HRM3-HadCM3 (future)
3	88.46	275.79	335.68	372.07	409.67	433.29	454.09	472.76	494.93	510.2	HRM3-HadCM3 (historical)
4	84.62	269.19	330.46	365.2	400.99	423.42	443.15	460.84	481.82	496.25	WRFG-CGCM3 (historical)
5	80.77	263.5	321.28	342.84	376.6	397.77	416.38	433.08	452.89	466.52	WRFG-CCSM (future)
6	76.92	261.22	317.55	340.66	365.25	386.51	405.24	422.06	442.05	459.82	RCM3-GFDL (future)
7	73.08	244.85	310.08	339.8	363.8	377.99	391.1	413.59	440.8	455.82	HRM3-GFDL (historical)
8	69.23	241.37	298.72	331.43	358.09	373.42	391.06	406.96	425.79	440.16	Observed
9	65.38	233.96	291.52	321.32	353.33	369.19	390.28	401.16	423.91	438.75	WRFG-CCSM (historical)
10	61.54	228.61	290.29	315.88	340.51	366.39	381.04	400.53	413.91	422.58	WRFG-CGCM3 (future)
11	57.69	207.22	267.35	297.94	338.93	359.55	378.73	387.14	402.29	415.36	MM5I-CCSM (future)
12	53.85	194.26	262.14	297.77	335.45	355.72	368.96	383.34	396.92	410.8	MM5I-CCSM (historical)
13	50.00	193.58	256.95	296.48	329.7	349.74	367.42	380.74	395.72	404.06	MM5I-HadCM3 (historical)
14	46.15	191.7	248.81	278.57	313.6	335.99	355.94	374.02	394.59	403.55	MM5I-HadCM3 (future)
15	42.31	187.19	245.44	277.99	308.36	327.55	344.52	359.8	378.02	390.6	RCM3-CGCM3 (future)
16	38.46	183.53	241.89	265.92	290.55	305.93	319.41	331.99	350.38	363.13	RCM3-GFDL (historical)
17	34.62	182.53	229.9	250.9	280.51	299.63	316.62	331.48	345.76	355.57	ECP2-GFDL (future)
18	30.77	182.22	221.92	250.48	272.27	285.53	297.13	307.47	319.67	328.03	ECP2-HadCM3 (future)
19	26.92	177.84	220.28	241.27	262.7	276.05	287.73	298.17	310.5	318.95	RCM3-CGCM3 (historical)
20	23.08	166.93	218.8	236.33	253.99	264.88	274.34	282.74	292.61	299.35	ECP2-HadCM3 (historical)
21	19.23	164.7	203.07	221.97	241.25	253.23	263.71	273.06	284.11	291.68	ECP2-GFDL (historical)
22	15.38	121.23	152.58	168.25	184.37	194.45	203.31	211.24	220.65	227.11	CRCM-CGCM3 (future)
23	11.54	93.95	124.22	139.88	156.32	166.76	176.02	184.4	194.41	201.35	CRCM-CGCM3 (historical)
24	7.69	91.46	114.74	126.36	138.28	145.73	152.27	158.13	165.07	169.83	CRCM-CCSM (future)
25	3.85	80.33	104.59	117	129.95	138.14	145.38	151.91	159.69	165.07	CRCM-CCSM (historical)
Gauge: 448172; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h[-1]) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	245.59	340.15	390.67	444.69	479.52	510.73	539.19	573.49	597.42	HRM3-GFDL (future)
2	92.31	229.73	308.65	354.32	403.14	434.6	462.79	488.47	519.44	541.04	HRM3-HadCM3 (future)
3	88.46	223.11	285.95	325.35	367.1	393.83	417.68	439.33	465.33	483.4	HRM3-HadCM3 (historical)
4	84.62	217.51	279.36	315.73	354.02	378.42	400.11	419.75	443.26	459.57	WRFG-CGCM3 (historical)
5	80.77	211.07	269.94	293.69	329.97	353.13	373.74	392.41	419.97	443.68	RCM3-GFDL (future)
6	76.92	209.49	266.11	289.93	323.59	348.08	369.98	389.91	414.79	430.58	HRM3-GFDL (historical)
7	73.08	193.46	259.3	289.1	314.13	330.25	359.44	386.59	413.88	430.32	WRFG-CCSM (future)
8	69.23	190.33	249.68	285.47	308.25	329.15	344.88	362.16	382.86	397.24	WRFG-CCSM (historical)
9	65.38	182.18	240.96	270.86	304.41	325.82	342.25	353.93	367.71	377.13	WRFG-CGCM3 (future)
10	61.54	178.24	239.07	266.38	298.44	319.98	330.13	339.69	360.71	375.36	MM5I-CCSM (future)
11	57.69	157.98	216.92	250.79	292.57	308.99	323.43	339.11	357.35	374.55	MM5I-CCSM (historical)
12	53.85	145.44	208.23	248.23	281.59	303.04	322.23	336.38	351.75	362.32	MM5I-HadCM3 (historical)
13	50.00	143.73	198.93	229.82	266.73	290.89	312.77	332.89	349.63	356.78	MM5I-HadCM3 (future)
14	46.15	139.93	195.99	228.41	259.93	280.24	298.45	315.04	335.04	348.99	RCM3-CGCM3 (future)
15	42.31	135.89	192.82	217.38	243.17	261.08	280.89	299.13	321.31	336.92	RCM3-GFDL (historical)
16	38.46	134.76	180.88	205.84	239.21	259.58	274.14	287.32	303.07	313.99	ECP2-GFDL (future)
17	34.62	134.45	175.29	201.74	223.43	237.11	249.19	260.07	273.03	281.97	ECP2-HadCM3 (future)
18	30.77	131.69	171.27	191.52	212.61	225.95	237.74	248.37	261.04	269.8	RCM3-CGCM3 (historical)
19	26.92	120.13	170.23	187.34	204.91	215.88	225.51	234.13	244.33	251.34	ECP2-HadCM3 (historical)
20	23.08	120	155.35	173.37	192.11	203.94	214.4	223.81	235.02	242.76	ECP2-GFDL (historical)
21	19.23	99.74	132.91	150.17	168.34	179.91	190.19	199.5	210.65	218.38	Observed
22	15.38	82.78	110.14	124.36	139.31	148.83	157.29	164.95	174.11	180.47	CRCM-CGCM3 (future)
23	11.54	60.33	86.53	100.86	116.41	126.55	135.7	144.09	154.27	161.42	CRCM-CGCM3 (historical)
24	7.69	58.93	77.98	87.85	98.21	104.79	110.63	115.91	122.23	126.6	CRCM-CCSM (future)
25	3.85	50.5	69.45	79.52	90.27	97.18	103.36	108.99	115.77	120.5	CRCM-CCSM (historical)
Gauge: 448172; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	187	261.11	300.93	343.66	371.28	396.07	418.7	446.03	465.12	HRM3-GFDL (future)
2	92.31	174.77	236.45	272.37	310.91	335.8	358.15	378.54	403.16	420.35	HRM3-HadCM3 (future)
3	88.46	169.53	218.72	249.69	282.62	303.75	322.63	339.8	360.45	374.82	HRM3-HadCM3 (historical)
4	84.62	165.27	213.47	241.94	272	291.18	308.27	323.76	342.32	355.21	WRFG-CGCM3 (historical)
5	80.77	160.18	206.13	224.81	253.31	271.54	287.78	302.52	326.07	345.05	RCM3-GFDL (future)
6	76.92	159.02	203.12	221.73	248.87	268.29	285.69	301.54	320.65	333.98	HRM3-GFDL (historical)
7	73.08	146.58	197.88	221.11	240.68	254.54	277.76	299.4	320.21	332.51	WRFG-CCSM (future)
8	69.23	144.16	190.55	218.74	236.11	252.44	264.97	278.57	294.88	306.22	WRFG-CCSM (historical)
9	65.38	137.74	183.64	206.92	233.19	249.99	262.73	271.9	282.73	290.14	WRFG-CGCM3 (future)
10	61.54	134.82	182.09	203.54	229.32	245.3	253.27	261.18	277.76	289.33	MM5I-CCSM (future)
11	57.69	119.15	164.92	191.69	224.1	237.02	248.39	260.32	275.46	289.07	MM5I-CCSM (historical)
12	53.85	109.48	158.26	189.36	215.49	232.33	247.42	258.6	270.73	279.08	MM5I-HadCM3 (historical)
13	50.00	108.18	150.96	175.1	204.02	223.01	240.24	256.12	268.59	274.21	MM5I-HadCM3 (future)
14	46.15	105.28	148.69	173.94	198.59	214.51	228.81	241.86	257.61	268.62	RCM3-CGCM3 (future)
15	42.31	102.19	146.27	165.44	185.65	200.48	216.22	230.74	248.44	260.92	RCM3-GFDL (historical)
16	38.46	101.24	137	156.81	183.15	198.52	209.98	220.35	232.78	241.4	ECP2-GFDL (future)
17	34.62	100.84	132.83	153.23	170.15	180.85	190.31	198.84	209	216.03	ECP2-HadCM3 (future)
18	30.77	98.98	129.52	145.21	161.6	171.98	181.18	189.47	199.37	206.22	RCM3-CGCM3 (historical)
19	26.92	90	128.75	142.04	155.71	164.26	171.78	178.51	186.49	191.98	ECP2-HadCM3 (historical)
20	23.08	89.89	117.24	131.2	145.74	154.94	163.08	170.42	179.17	185.22	ECP2-GFDL (historical)
21	19.23	66.5	88.62	100.13	112.24	119.95	126.81	133.02	140.45	145.61	Observed
22	15.38	61.58	82.52	93.45	104.98	112.34	118.89	124.82	131.93	136.87	CRCM-CGCM3 (future)
23	11.54	44.52	64.55	75.59	87.62	95.49	102.62	109.16	117.12	122.71	CRCM-CGCM3 (historical)
24	7.69	43.53	57.99	65.52	73.43	78.47	82.96	87.01	91.87	95.24	CRCM-CCSM (future)
25	3.85	37.19	51.49	59.13	67.29	72.56	77.28	81.58	86.76	90.38	CRCM-CCSM (historical)
Gauge: 448172; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	156.73	221.53	256.64	294.5	319.06	341.17	361.4	385.87	403	HRM3-GFDL (future)
2	92.31	146.3	199.98	231.56	265.59	287.67	307.53	325.7	347.68	363.06	HRM3-HadCM3 (future)
3	88.46	141.65	184.6	211.81	240.88	259.61	276.39	291.67	310.09	322.94	HRM3-HadCM3 (historical)
4	84.62	138.11	179.91	204.76	231.11	247.98	263.04	276.71	293.13	304.55	WRFG-CGCM3 (historical)
5	80.77	133.59	173.52	189.97	214.98	231.03	245.38	258.91	281.66	298.81	RCM3-GFDL (future)
6	76.92	132.69	170.91	187.13	211.86	229.16	244.7	258.42	276.07	288.07	HRM3-GFDL (historical)
7	73.08	121.94	166.44	186.58	203.68	217.42	238.19	257.62	274.09	285.01	WRFG-CCSM (future)
8	69.23	119.89	160.29	185.14	199.68	213.98	225.13	237.09	251.47	261.49	WRFG-CCSM (historical)
9	65.38	114.21	154.12	174.3	197.24	211.97	223	231.05	240.57	247.39	MM5I-CCSM (historical)
10	61.54	111.89	152.71	171.49	194.96	207.73	214.71	222.18	236.83	247.09	WRFG-CGCM3 (future)
11	57.69	98.46	137.93	161.65	189.51	200.86	210.87	220.9	235.29	247.06	MM5I-CCSM (future)
12	53.85	90.21	132.31	159.18	182.02	196.79	210.06	219.87	230.58	237.97	MM5I-HadCM3 (historical)
13	50.00	89.11	125.9	146.94	172.24	188.93	204.12	218.15	228.15	233.09	MM5I-HadCM3 (future)
14	46.15	86.68	123.99	145.83	167.32	181.26	193.81	205.28	219.17	228.89	RCM3-CGCM3 (future)
15	42.31	84.08	121.95	138.62	156.28	170.29	184.35	197.37	213.3	224.56	RCM3-GFDL (historical)
16	38.46	83.16	113.92	131.58	154.87	167.57	177.64	186.78	197.76	205.38	ECP2-GFDL (future)
17	34.62	82.61	110.53	127.95	142.64	151.95	160.21	167.66	176.57	182.73	ECP2-HadCM3 (future)
18	30.77	81.35	107.46	120.95	135.11	144.1	152.08	159.29	167.91	173.87	RCM3-CGCM3 (historical)
19	26.92	73.76	106.84	118.3	130.13	137.56	144.09	149.96	156.92	161.71	ECP2-HadCM3 (historical)
20	23.08	73.37	96.98	108.95	121.47	129.42	136.47	142.83	150.42	155.68	ECP2-GFDL (historical)
21	19.23	49.87	67.52	76.82	86.67	92.97	98.6	103.7	109.83	114.1	CRCM-CGCM3 (future)
22	15.38	49.85	66.46	75.09	84.17	89.95	95.1	99.75	105.33	109.19	Observed
23	11.54	35.6	52.46	61.86	72.18	78.96	85.12	90.79	97.71	102.58	CRCM-CGCM3 (historical)
24	7.69	34.86	46.92	53.23	59.9	64.17	67.97	71.41	75.54	78.41	CRCM-CCSM (future)
25	3.85	29.64	41.47	47.84	54.68	59.1	63.07	66.7	71.08	74.14	CRCM-CCSM (historical)
Gauge: 448172; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	115.98	171.48	202.49	236.56	258.98	279.35	298.13	321.05	337.2	HRM3-GFDL (future)
2	92.31	107.81	153.04	180.64	210.94	230.86	248.97	265.66	286.02	300.37	HRM3-HadCM3 (future)
3	88.46	103.63	140.2	163.96	189.82	206.71	221.98	236.02	253.06	265.03	HRM3-HadCM3 (historical)
4	84.62	101.09	135.85	157.04	179.84	194.61	207.89	220.03	234.7	250.13	RCM3-GFDL (future)
5	80.77	97.01	130.56	144.91	166.65	182.24	196.69	210.46	233.49	244.96	WRFG-CGCM3 (historical)
6	76.92	96.6	128.33	142.2	166.34	180.79	193.52	210.03	226.31	237.79	HRM3-GFDL (historical)
7	73.08	87.79	124.79	142.03	156.16	172.75	192.1	205.19	219.31	229.21	WRFG-CCSM (future)
8	69.23	86.2	120.26	141.64	152.85	165.03	175.24	185.73	198.44	207.34	WRFG-CCSM (historical)
9	65.38	81.08	114.71	131.44	152.16	163.77	172.84	179.84	188.15	198.11	MM5I-CCSM (historical)
10	61.54	79.87	113.29	129.52	151.04	159.77	165.81	173.86	187.08	196.08	MM5I-CCSM (future)
11	57.69	69.13	101.28	122.35	145.11	155.03	163.85	171.82	186.9	193.87	WRFG-CGCM3 (future)
12	53.85	62.64	96.9	119.15	138.69	151.52	163.15	171.61	181.38	188	MM5I-HadCM3 (historical)
13	50.00	61.85	91.49	109.3	131.03	145.62	159.06	171.18	177.5	184.41	RCM3-GFDL (historical)
14	46.15	60.06	90.03	108.06	126.26	138.24	149.13	159.17	173.51	181.82	MM5I-HadCM3 (future)
15	42.31	58.12	88.54	102.58	118.79	132.91	146	158.28	171.41	180.05	RCM3-CGCM3 (future)
16	38.46	57.06	81.95	97.94	117.71	127.53	136.37	144.45	154.24	161.08	ECP2-GFDL (future)
17	34.62	56.05	79.69	93.52	105.82	113.71	120.77	127.18	134.88	140.25	ECP2-HadCM3 (future)
18	30.77	56	76.64	87.54	99.14	106.58	113.24	119.29	126.57	131.64	RCM3-CGCM3 (historical)
19	26.92	50.25	76.3	85.65	95.44	101.65	107.15	112.11	118.04	122.14	ECP2-HadCM3 (historical)
20	23.08	49.05	68.39	77.97	88.15	94.67	100.49	105.78	112.14	116.57	ECP2-GFDL (historical)
21	19.23	32.46	45.76	52.96	60.71	65.73	70.25	74.38	79.38	82.87	CRCM-CGCM3 (future)
22	15.38	26.9	34.8	42.02	50.27	55.8	60.89	65.63	71.48	75.64	CRCM-CGCM3 (historical)
23	11.54	22.11	34.69	38.83	43.02	45.66	48	50.1	52.6	54.45	CRCM-CCSM (future)
24	7.69	21.82	30.5	35.17	40.19	43.43	46.34	49	52.2	54.33	Observed
25	3.85	18.26	26.53	31.09	36.07	39.33	42.27	44.98	48.28	50.6	CRCM-CCSM (historical)
Gauge: 448172; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	75.58	107.7	125.19	144.12	156.44	167.54	177.71	190.04	198.67	HRM3-GFDL (future)
2	92.31	70.49	97.02	112.73	129.72	140.77	150.73	159.85	170.9	178.64	HRM3-HadCM3 (future)
3	88.46	68.16	89.43	102.96	117.48	126.85	135.26	142.93	152.2	158.66	HRM3-HadCM3 (historical)
4	84.62	66.46	87.06	99.37	112.46	120.86	128.37	135.19	143.39	149.1	WRFG-CGCM3 (historical)
5	80.77	64.19	83.91	92.11	104.54	112.54	119.71	126.86	138.57	147.27	RCM3-GFDL (future)
6	76.92	63.78	82.63	90.64	103.21	111.89	119.7	126.42	135.51	141.58	HRM3-GFDL (historical)
7	73.08	58.51	80.45	90.37	98.84	106.17	116.62	126.22	134.06	139.53	WRFG-CCSM (future)
8	69.23	57.5	77.48	89.85	96.86	103.95	109.54	115.49	122.66	127.66	WRFG-CCSM (historical)
9	65.38	54.67	74.38	84.32	95.69	103	108.43	112.43	117.16	120.98	MM5I-CCSM (historical)
10	61.54	53.6	73.66	82.98	94.9	100.85	104.32	108.19	115.5	120.61	MM5I-CCSM (future)
11	57.69	47.03	66.41	78.26	91.92	97.56	102.54	107.39	114.92	120.41	WRFG-CGCM3 (future)
12	53.85	43	63.69	76.9	88.22	95.55	102.16	107.03	112.37	116.06	MM5I-HadCM3 (historical)
13	50.00	42.47	60.5	70.92	83.46	91.76	99.34	106.34	110.99	113.45	MM5I-HadCM3 (future)
14	46.15	41.3	59.58	70.33	80.95	87.86	94.09	99.8	106.72	111.57	RCM3-CGCM3 (future)
15	42.31	40.05	58.59	66.83	75.58	82.85	89.92	96.48	104.53	110.23	RCM3-GFDL (historical)
16	38.46	39.56	54.64	63.49	75.12	81.2	86.21	90.77	96.25	100.06	ECP2-GFDL (future)
17	34.62	39.22	53.04	61.55	68.79	73.4	77.49	81.18	85.6	88.67	ECP2-HadCM3 (future)
18	30.77	38.72	51.46	58.08	65.03	69.46	73.39	76.95	81.2	84.16	RCM3-CGCM3 (historical)
19	26.92	35.03	51.18	56.81	62.64	66.3	69.53	72.42	75.87	78.24	ECP2-HadCM3 (historical)
20	23.08	34.75	46.35	52.21	58.36	62.26	65.73	68.87	72.61	75.21	ECP2-GFDL (historical)
21	19.23	23.49	32.03	36.55	41.36	44.44	47.19	49.69	52.7	54.79	CRCM-CGCM3 (future)
22	15.38	19.22	24.78	29.37	34.42	37.75	40.78	43.59	47.01	49.42	CRCM-CGCM3 (historical)
23	11.54	16.63	24.26	26.79	29.39	31.02	32.45	33.97	35.98	37.38	CRCM-CCSM (future)
24	7.69	16.3	22.09	25.14	28.37	30.44	32.29	33.74	35.26	36.31	Observed
25	3.85	13.82	19.47	22.53	25.82	27.95	29.87	31.62	33.75	35.23	CRCM-CCSM (historical)
Gauge: 448172; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	60.05	84.88	98.33	112.84	122.25	130.73	138.48	147.85	154.42	HRM3-GFDL (future)
2	92.31	56.05	76.62	88.71	101.75	110.21	117.82	124.77	133.19	139.08	HRM3-HadCM3 (future)
3	88.46	54.27	70.72	81.14	92.28	99.45	105.88	111.73	118.79	123.71	HRM3-HadCM3 (historical)
4	84.62	52.91	68.92	78.45	88.54	95.01	100.78	106.02	112.31	116.69	WRFG-CGCM3 (historical)
5	80.77	51.18	66.48	72.78	82.37	88.52	94.02	99.19	107.92	114.49	RCM3-GFDL (future)
6	76.92	50.83	65.47	71.68	81.16	87.79	93.75	99.01	105.77	110.36	HRM3-GFDL (historical)
7	73.08	46.72	63.76	71.48	78.02	83.31	91.26	98.71	105.02	109.2	WRFG-CCSM (future)
8	69.23	45.93	61.41	70.93	76.5	81.96	86.27	90.86	96.37	100.21	WRFG-CCSM (historical)
9	65.38	43.75	59.05	66.79	75.58	81.23	85.42	88.5	92.14	94.76	MM5I-CCSM (historical)
10	61.54	42.87	58.51	65.71	74.7	79.59	82.26	85.13	90.74	94.66	MM5I-CCSM (future)
11	57.69	37.71	52.84	61.94	72.61	76.96	80.8	84.63	90.13	94.64	WRFG-CGCM3 (future)
12	53.85	34.56	50.7	60.98	69.73	75.4	80.48	84.25	88.35	91.18	MM5I-HadCM3 (historical)
13	50.00	34.15	48.24	56.29	65.98	72.37	78.19	83.56	87.41	89.3	MM5I-HadCM3 (future)
14	46.15	33.21	47.5	55.87	64.1	69.44	74.24	78.64	83.95	87.67	RCM3-CGCM3 (future)
15	42.31	32.21	46.71	53.1	59.86	65.25	70.64	75.63	81.73	86.05	RCM3-GFDL (historical)
16	38.46	31.86	43.64	50.41	59.34	64.19	68.05	71.55	75.75	78.68	ECP2-GFDL (future)
17	34.62	31.65	42.35	49.02	54.64	58.21	61.37	64.22	67.63	69.99	ECP2-HadCM3 (future)
18	30.77	31.17	41.17	46.33	51.75	55.2	58.25	61.01	64.31	66.59	RCM3-CGCM3 (historical)
19	26.92	28.26	40.93	45.32	49.86	52.7	55.21	57.46	60.12	61.96	ECP2-HadCM3 (historical)
20	23.08	28.11	37.15	41.74	46.53	49.58	52.27	54.71	57.62	59.63	ECP2-GFDL (historical)
21	19.23	19.1	25.87	29.43	33.2	35.61	37.77	39.72	42.07	43.71	CRCM-CGCM3 (future)
22	15.38	17.83	21.6	23.71	27.67	30.27	32.63	34.81	37.46	39.33	CRCM-CGCM3 (historical)
23	11.54	13.64	20.1	23.43	25.29	26.44	27.44	28.33	29.38	30.09	Observed
24	7.69	13.36	17.97	20.39	22.95	24.58	26.03	27.35	28.93	30.03	CRCM-CCSM (future)
25	3.85	11.35	15.88	18.32	20.94	22.63	24.15	25.54	27.22	28.39	CRCM-CCSM (historical)
Gauge: 448172; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	58.9	83.79	97.33	111.98	121.5	130.09	137.95	147.47	154.14	HRM3-GFDL (future)
2	92.31	54.93	75.51	87.67	100.81	109.35	117.04	124.09	132.62	138.59	HRM3-HadCM3 (future)
3	88.46	53.15	69.62	80.09	91.3	98.54	105.03	110.96	118.1	123.09	HRM3-HadCM3 (historical)
4	84.62	51.81	67.78	77.3	87.42	93.91	99.71	104.97	111.3	115.71	WRFG-CGCM3 (historical)
5	80.77	50.08	65.34	71.67	81.29	87.47	93	98.51	107.42	114.1	RCM3-GFDL (future)
6	76.92	49.75	64.34	70.54	80.26	86.96	92.99	98.07	105.19	109.87	HRM3-GFDL (historical)
7	73.08	45.65	62.65	70.35	76.88	82.48	90.53	98.03	104.08	108.3	WRFG-CCSM (future)
8	69.23	44.88	60.35	69.93	75.37	80.83	85.1	89.7	95.22	99.07	WRFG-CCSM (historical)
9	65.38	42.68	57.95	65.63	74.41	80.06	84.29	87.38	91.04	93.79	MM5I-CCSM (historical)
10	61.54	41.85	57.39	64.6	73.79	78.46	81.14	84.04	89.67	93.61	MM5I-CCSM (future)
11	57.69	36.76	51.77	60.95	71.51	75.87	79.72	83.52	89.13	93.55	WRFG-CGCM3 (future)
12	53.85	33.63	49.68	59.89	68.63	74.29	79.38	83.19	87.31	90.16	MM5I-HadCM3 (historical)
13	50.00	33.22	47.19	55.23	64.91	71.31	77.14	82.54	86.31	88.21	MM5I-HadCM3 (future)
14	46.15	32.31	46.48	54.79	63	68.33	73.13	77.53	82.86	86.6	RCM3-CGCM3 (future)
15	42.31	31.33	45.71	52.08	58.84	64.43	69.87	74.92	81.11	85.49	RCM3-GFDL (historical)
16	38.46	30.97	42.64	49.5	58.47	63.17	67.04	70.55	74.78	77.71	ECP2-GFDL (future)
17	34.62	30.72	41.42	47.99	53.59	57.14	60.3	63.15	66.56	68.92	ECP2-HadCM3 (future)
18	30.77	30.31	40.18	45.29	50.67	54.08	57.12	59.86	63.14	65.42	RCM3-CGCM3 (historical)
19	26.92	27.45	39.96	44.31	48.81	51.64	54.13	56.37	59.03	60.86	ECP2-HadCM3 (historical)
20	23.08	27.24	36.21	40.74	45.48	48.5	51.17	53.58	56.47	58.47	ECP2-GFDL (historical)
21	19.23	18.49	25.11	28.6	32.29	34.66	36.78	38.7	41	42.61	CRCM-CGCM3 (future)
22	15.38	13.2	19.5	23.02	26.89	29.43	31.75	33.88	36.48	38.31	CRCM-CGCM3 (historical)
23	11.54	12.92	17.4	19.74	22.22	23.8	25.21	26.49	28.03	29.09	CRCM-CCSM (future)
24	7.69	11.01	15.37	17.72	20.23	21.86	23.32	24.65	26.25	27.38	CRCM-CCSM (historical)
25	3.85	10.93	13.24	14.36	15.49	16.19	16.8	17.34	17.98	18.42	Observed
Gauge: 448172; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	37.64	53.35	61.88	71.08	77.06	82.44	87.37	93.33	97.51	HRM3-GFDL (future)
2	92.31	35.1	48.1	55.75	63.99	69.35	74.16	78.57	83.91	87.64	HRM3-HadCM3 (future)
3	88.46	34	44.39	50.98	58.02	62.56	66.63	70.34	74.81	77.93	HRM3-HadCM3 (historical)
4	84.62	33.13	43.22	49.21	55.56	59.63	63.26	66.55	70.51	73.27	WRFG-CGCM3 (historical)
5	80.77	32.06	41.67	45.65	51.69	55.56	59.02	62.43	67.77	71.9	RCM3-GFDL (future)
6	76.92	31.85	41.03	44.93	51.02	55.21	58.99	62.16	66.6	69.52	HRM3-GFDL (historical)
7	73.08	29.27	39.98	44.82	48.92	52.3	57.3	61.98	65.95	68.58	WRFG-CCSM (future)
8	69.23	28.75	38.53	44.54	47.98	51.41	54.06	56.93	60.38	62.79	WRFG-CCSM (historical)
9	65.38	27.39	37	41.85	47.36	50.89	53.58	55.52	57.81	59.39	WRFG-CGCM3 (future)
10	61.54	26.86	36.66	41.19	46.89	49.92	51.61	53.31	56.82	59.27	MM5I-CCSM (future)
11	57.69	23.65	33.11	38.87	45.53	48.27	50.69	53.1	56.34	59.22	MM5I-CCSM (historical)
12	53.85	21.65	31.81	38.21	43.68	47.22	50.41	52.86	55.44	57.23	MM5I-HadCM3 (historical)
13	50.00	21.41	30.22	35.26	41.3	45.28	48.91	52.25	54.85	56.05	MM5I-HadCM3 (future)
14	46.15	20.82	29.77	34.98	40.12	43.45	46.44	49.18	52.5	54.82	RCM3-CGCM3 (future)
15	42.31	20.19	29.26	33.26	37.49	40.92	44.29	47.42	51.24	53.94	RCM3-GFDL (historical)
16	38.46	20	27.33	31.63	37.22	40.2	42.61	44.8	47.43	49.25	ECP2-GFDL (future)
17	34.62	19.85	26.57	30.68	34.19	36.41	38.38	40.16	42.28	43.75	ECP2-HadCM3 (future)
18	30.77	19.56	25.78	28.99	32.35	34.48	36.38	38.09	40.13	41.54	RCM3-CGCM3 (historical)
19	26.92	17.75	25.62	28.35	31.17	32.94	34.5	35.89	37.55	38.69	ECP2-HadCM3 (historical)
20	23.08	17.65	23.27	26.11	29.08	30.96	32.62	34.13	35.92	37.17	ECP2-GFDL (historical)
21	19.23	12.1	16.26	18.43	20.73	22.2	23.5	24.69	26.11	27.09	CRCM-CGCM3 (future)
22	15.38	8.75	12.71	14.89	17.27	18.83	20.24	21.54	23.11	24.22	CRCM-CGCM3 (historical)
23	11.54	8.57	11.37	12.83	14.36	15.34	16.21	16.99	17.93	18.58	CRCM-CCSM (future)
24	7.69	7.36	10.1	11.55	13.09	14.09	14.97	15.78	16.76	17.43	CRCM-CCSM (historical)
25	3.85	6.61	7.59	8.05	8.5	8.77	9.01	9.22	9.46	9.63	Observed
Gauge: 448172; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	20.41	28.75	33.26	38.11	41.26	44.09	46.67	49.8	51.99	HRM3-GFDL (future)
2	92.31	19.03	25.96	30	34.35	37.17	39.71	42.02	44.82	46.77	HRM3-HadCM3 (future)
3	88.46	18.47	23.97	27.45	31.16	33.55	35.68	37.63	39.97	41.6	HRM3-HadCM3 (historical)
4	84.62	17.99	23.36	26.52	29.87	32.01	33.91	35.64	37.72	39.16	WRFG-CGCM3 (historical)
5	80.77	17.43	22.52	24.62	27.8	29.84	31.65	33.41	36.03	38.16	RCM3-GFDL (future)
6	76.92	17.32	22.18	24.24	27.44	29.63	31.61	33.3	35.58	37.1	HRM3-GFDL (historical)
7	73.08	15.94	21.63	24.19	26.35	28.03	30.62	33.04	35.29	36.66	WRFG-CCSM (future)
8	69.23	15.67	20.86	24.03	25.86	27.65	29.01	30.51	32.31	33.57	WRFG-CCSM (historical)
9	65.38	14.95	20.04	22.59	25.49	27.35	28.8	29.82	31.02	31.85	WRFG-CGCM3 (future)
10	61.54	14.66	19.86	22.25	25.21	26.89	27.78	28.57	30.39	31.67	MM5I-CCSM (future)
11	57.69	12.95	17.97	21.02	24.54	25.98	27.25	28.56	30.08	31.57	MM5I-CCSM (historical)
12	53.85	11.9	17.31	20.66	23.53	25.38	27.05	28.39	29.75	30.68	MM5I-HadCM3 (historical)
13	50.00	11.77	16.43	19.09	22.25	24.33	26.22	27.96	29.49	30.12	MM5I-HadCM3 (future)
14	46.15	11.44	16.2	18.94	21.63	23.36	24.92	26.35	28.06	29.26	RCM3-CGCM3 (future)
15	42.31	11.1	15.92	18.02	20.23	22.01	23.76	25.37	27.34	28.73	RCM3-GFDL (historical)
16	38.46	11.02	14.89	17.16	20.08	21.64	22.9	24.04	25.4	26.35	ECP2-GFDL (future)
17	34.62	10.96	14.51	16.65	18.49	19.65	20.68	21.61	22.71	23.47	ECP2-HadCM3 (future)
18	30.77	10.76	14.05	15.74	17.5	18.61	19.6	20.48	21.54	22.28	RCM3-CGCM3 (historical)
19	26.92	9.8	13.98	15.41	16.89	17.81	18.62	19.35	20.21	20.8	ECP2-HadCM3 (historical)
20	23.08	9.77	12.72	14.21	15.76	16.74	17.6	18.38	19.31	19.96	ECP2-GFDL (historical)
21	19.23	6.8	8.99	10.13	11.32	12.07	12.74	13.35	14.08	14.58	CRCM-CGCM3 (future)
22	15.38	5.03	7.12	8.25	9.48	10.27	10.98	11.64	12.43	12.98	CRCM-CGCM3 (historical)
23	11.54	4.92	6.4	7.15	7.94	8.44	8.88	9.28	9.75	10.08	CRCM-CCSM (future)
24	7.69	4.28	5.71	6.46	7.24	7.74	8.19	8.59	9.07	9.4	CRCM-CCSM (historical)
25	3.85	3.66	4.1	4.3	4.5	4.62	4.72	4.81	4.91	4.98	Observed
Gauge: 448172; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	10.85	15.2	17.55	20.06	21.69	23.16	24.49	26.11	27.24	HRM3-GFDL (future)
2	92.31	10.11	13.75	15.85	18.1	19.56	20.87	22.06	23.51	24.51	HRM3-HadCM3 (future)
3	88.46	9.84	12.71	14.52	16.44	17.68	18.78	19.78	20.99	21.83	HRM3-HadCM3 (historical)
4	84.62	9.57	12.38	14.02	15.76	16.86	17.85	18.74	19.81	20.55	WRFG-CGCM3 (historical)
5	80.77	9.29	11.93	13.03	14.68	15.73	16.67	17.58	18.86	19.94	RCM3-GFDL (future)
6	76.92	9.23	11.76	12.83	14.49	15.63	16.65	17.52	18.7	19.48	HRM3-GFDL (historical)
7	73.08	8.51	11.48	12.8	13.93	14.77	16.1	17.33	18.55	19.26	WRFG-CCSM (future)
8	69.23	8.36	11.08	12.73	13.68	14.61	15.27	16.04	16.96	17.61	WRFG-CCSM (historical)
9	65.38	7.99	10.64	11.96	13.46	14.42	15.2	15.73	16.36	16.79	WRFG-CGCM3 (future)
10	61.54	7.84	10.55	11.79	13.32	14.21	14.67	15.08	15.95	16.6	MM5I-CCSM (future)
11	57.69	6.94	9.56	11.16	12.98	13.73	14.38	15.01	15.75	16.5	MM5I-CCSM (historical)
12	53.85	6.39	9.23	10.95	12.43	13.38	14.24	14.97	15.68	16.16	MM5I-HadCM3 (historical)
13	50.00	6.32	8.75	10.13	11.75	12.82	13.78	14.67	15.56	15.89	MM5I-HadCM3 (future)
14	46.15	6.14	8.64	10.05	11.44	12.33	13.13	13.87	14.75	15.36	RCM3-CGCM3 (future)
15	42.31	5.97	8.49	9.58	10.72	11.6	12.49	13.32	14.32	15.02	RCM3-GFDL (historical)
16	38.46	5.94	7.94	9.12	10.62	11.45	12.1	12.69	13.39	13.88	ECP2-GFDL (future)
17	34.62	5.91	7.75	8.85	9.8	10.4	10.93	11.4	11.97	12.36	ECP2-HadCM3 (future)
18	30.77	5.8	7.51	8.38	9.29	9.86	10.36	10.82	11.36	11.74	RCM3-CGCM3 (historical)
19	26.92	5.29	7.46	8.21	8.97	9.45	9.87	10.24	10.69	10.99	ECP2-HadCM3 (historical)
20	23.08	5.29	6.81	7.58	8.38	8.89	9.33	9.73	10.21	10.54	ECP2-GFDL (historical)
21	19.23	3.72	4.86	5.45	6.06	6.44	6.78	7.09	7.46	7.72	CRCM-CGCM3 (future)
22	15.38	2.8	3.88	4.46	5.08	5.47	5.83	6.16	6.55	6.82	CRCM-CGCM3 (historical)
23	11.54	2.73	3.49	3.87	4.27	4.52	4.74	4.94	5.18	5.34	CRCM-CCSM (future)
24	7.69	2.41	3.14	3.52	3.92	4.17	4.39	4.59	4.82	4.99	CRCM-CCSM (historical)
25	3.85	1.9	2.1	2.19	2.29	2.34	2.39	2.43	2.48	2.51	Observed
Gauge: 448172; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	7.2	10.05	11.58	13.23	14.29	15.24	16.11	17.16	17.89	HRM3-GFDL (future)
2	92.31	6.71	9.09	10.46	11.93	12.87	13.72	14.49	15.43	16.08	HRM3-HadCM3 (future)
3	88.46	6.54	8.4	9.58	10.83	11.63	12.34	12.99	13.78	14.32	HRM3-HadCM3 (historical)
4	84.62	6.36	8.19	9.26	10.39	11.11	11.74	12.32	13.01	13.49	WRFG-CGCM3 (historical)
5	80.77	6.17	7.9	8.61	9.68	10.36	10.97	11.53	12.33	13.03	RCM3-GFDL (future)
6	76.92	6.14	7.79	8.49	9.54	10.28	10.93	11.52	12.25	12.75	HRM3-GFDL (historical)
7	73.08	5.67	7.6	8.47	9.2	9.71	10.57	11.36	12.17	12.63	WRFG-CCSM (future)
8	69.23	5.57	7.33	8.4	9.03	9.65	10.07	10.58	11.18	11.59	WRFG-CCSM (historical)
9	65.38	5.33	7.06	7.92	8.9	9.52	10.03	10.38	10.78	11.06	WRFG-CGCM3 (future)
10	61.54	5.23	7	7.8	8.78	9.38	9.68	9.94	10.47	10.89	MM5I-CCSM (future)
11	57.69	4.64	6.35	7.39	8.57	9.05	9.48	9.87	10.35	10.84	MM5I-CCSM (historical)
12	53.85	4.28	6.14	7.25	8.21	8.82	9.37	9.86	10.31	10.62	MM5I-HadCM3 (historical)
13	50.00	4.23	5.81	6.72	7.77	8.46	9.09	9.66	10.26	10.47	MM5I-HadCM3 (future)
14	46.15	4.11	5.75	6.65	7.55	8.12	8.64	9.11	9.67	10.06	RCM3-CGCM3 (future)
15	42.31	4	5.64	6.35	7.09	7.67	8.25	8.77	9.42	9.87	RCM3-GFDL (historical)
16	38.46	3.98	5.29	6.06	7.03	7.56	7.98	8.36	8.81	9.12	ECP2-GFDL (future)
17	34.62	3.98	5.17	5.88	6.49	6.88	7.22	7.53	7.9	8.15	ECP2-HadCM3 (future)
18	30.77	3.88	5	5.57	6.16	6.54	6.87	7.16	7.52	7.76	RCM3-CGCM3 (historical)
19	26.92	3.56	4.98	5.46	5.95	6.26	6.53	6.77	7.05	7.25	ECP2-HadCM3 (historical)
20	23.08	3.56	4.55	5.06	5.58	5.9	6.19	6.45	6.76	6.97	ECP2-GFDL (historical)
21	19.23	2.53	3.27	3.65	4.04	4.29	4.51	4.7	4.94	5.1	CRCM-CGCM3 (future)
22	15.38	1.92	2.63	3	3.39	3.65	3.87	4.08	4.33	4.5	CRCM-CGCM3 (historical)
23	11.54	1.88	2.38	2.63	2.89	3.05	3.19	3.32	3.47	3.57	CRCM-CCSM (future)
24	7.69	1.67	2.14	2.39	2.64	2.8	2.94	3.06	3.21	3.31	CRCM-CCSM (historical)
25	3.85	1.44	1.61	1.69	1.76	1.81	1.85	1.88	1.92	1.95	Observed
Gauge: 448172; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	272.1	371	436.48	519.21	580.59	641.51	702.21	782.3	842.82	HRM3-GFDL (future)
2	92.31	263.59	346.6	401.56	471	522.52	579.11	647.04	736.67	804.41	RCM3-GFDL (historical)
3	88.46	259.69	321.34	362.16	442.23	510.92	573.65	624.6	691.82	742.62	HRM3-HadCM3 (future)
4	84.62	243.82	301.46	353.79	429.81	486.22	542.2	597.98	671.58	727.2	RCM3-CGCM3 (future)
5	80.77	241.15	301.27	349.63	413.73	451.99	489.97	527.81	578.61	619.39	HRM3-GFDL (historical)
6	76.92	237.56	298.82	345.58	401.33	442.69	483.74	524.64	577.73	615.46	WRFG-CGCM3 (future)
7	73.08	234.82	293.61	339.38	390.62	428.64	466.38	503.98	553.58	591.07	HRM3-HadCM3 (historical)
8	69.23	226.51	286.03	339.31	387.37	423.03	458.42	493.68	540.2	575.36	WRFG-CCSM (future)
9	65.38	226.19	282.79	320.26	367.6	402.72	437.59	472.32	518.15	552.78	MM5I-HadCM3 (historical)
10	61.54	213.69	280.21	315.76	360.68	394.16	429.8	465.31	512.16	549.37	Observed
11	57.69	202.73	276.35	315.74	358.25	394	427.08	460.03	503.51	549.37	Observed
12	53.85	196.12	271.55	309.85	353.28	381.13	408.77	440.51	500.19	547.57	WRFG-CCSM (historical)
13	50.00	182.18	247.1	280.85	325.13	363.83	402.24	436.32	500.19	536.38	WRFG-CGCM3 (historical)
14	46.15	172.56	231.68	272.96	323.5	355.14	388.68	435.12	491	529.17	MM5I-CCSM (historical)
15	42.31	169.32	228.45	259.21	311.45	350.21	386.55	435.12	477.59	515.81	RCM3-CGCM3 (historical)
16	38.46	165.66	218.48	259.09	309.8	347.61	385.8	427.02	472.66	509.18	RCM3-GFDL (future)
17	34.62	157.55	217.86	258.82	297.8	336.3	385.8	422.55	471.89	500.12	MM5I-HadCM3 (future)
18	30.77	155.4	209.97	234.73	286.43	336.3	385.15	417.84	459.12	490.32	MM5I-CCSM (future)
19	26.92	151.05	197.32	227.96	286.43	326.52	355.02	383.42	420.89	449.21	ECP2-HadCM3 (future)
20	23.08	114.45	166	219.21	266.67	295.39	323.89	352.29	389.76	418.08	ECP2-GFDL (historical)
21	19.23	93.35	166	219.21	266.03	289.24	312.29	335.25	365.54	388.43	ECP2-HadCM3 (historical)
22	15.38	91.53	137.37	152.55	171.73	189.11	208.38	227.58	252.91	272.06	CRCM-CGCM3 (historical)
23	11.54	85.65	122.81	143.52	169.69	185.96	200.08	214.15	232.71	248.74	CRCM-CCSM (future)
24	7.69	85.65	120.27	138.1	160.63	177.34	193.93	210.45	232.26	246.74	CRCM-CGCM3 (future)
25	3.85	77.01	102.12	118.74	139.75	155.33	170.79	186.2	206.53	221.9	CRCM-CCSM (historical)
Gauge: 449159; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^-1^) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	223.81	325.22	392.36	477.2	540.13	602.6	664.84	746.96	809.02	HRM3-GFDL (future)
2	92.31	214.86	298.05	353.12	422.71	483.56	554.65	625.47	718.92	789.54	RCM3-GFDL (historical)
3	88.46	209.75	271.6	315.41	411.94	474.34	525.58	576.64	644	694.91	HRM3-HadCM3 (future)
4	84.62	194.57	251.13	312.55	378.08	432.72	486.95	540.99	612.27	666.15	RCM3-CGCM3 (future)
5	80.77	191.52	250.57	304.44	364.29	402.68	440.78	478.74	528.83	566.68	WRFG-CGCM3 (future)
6	76.92	188.79	248.36	293.87	347.88	387.94	427.71	467.33	519.61	559.11	HRM3-GFDL (historical)
7	73.08	186.57	246.15	287.8	337.64	374.61	411.31	447.87	496.11	532.57	HRM3-HadCM3 (historical)
8	69.23	177.95	239	287.65	334.5	369.26	403.75	438.13	483.48	517.75	WRFG-CCSM (future)
9	65.38	177.74	234.77	268.97	314.89	348.95	382.76	416.45	460.9	494.49	MM5I-HadCM3 (historical)
10	61.54	165.96	232.63	264.13	307.51	341.64	376.33	410.9	456.51	490.97	WRFG-CCSM (historical)
11	57.69	158.11	229.8	263.39	306.69	339.68	371.62	403.45	445.43	477.16	WRFG-CGCM3 (historical)
12	53.85	149.72	222.28	259.57	299.57	326.4	353.04	379.58	424.48	459.86	MM5I-CCSM (historical)
13	50.00	136.93	197.68	229.44	270.71	306.59	342.19	377.67	414.6	446.4	RCM3-GFDL (future)
14	46.15	128.05	184.08	222.35	269.57	299.34	329.67	364.87	411.31	441.74	RCM3-CGCM3 (historical)
15	42.31	126.28	179.69	210.79	258.76	294.35	328.89	361.07	407.02	441.06	MM5I-HadCM3 (future)
16	38.46	123.6	172.82	208.6	256.07	291.28	326.24	358.33	397.18	426.53	MM5I-CCSM (future)
17	34.62	115.47	171.03	208	243.76	270.3	296.64	322.88	357.5	383.66	ECP2-HadCM3 (future)
18	30.77	114.28	161.81	184.16	214.11	240.11	265.92	291.64	325.57	351.21	ECP2-GFDL (historical)
19	26.92	109.42	151.32	179.06	212.4	233.35	254.14	274.86	302.2	322.86	ECP2-HadCM3 (historical)
20	23.08	77.97	96.68	112.98	143.5	166.15	188.63	211.02	240.57	262.9	Observed
21	19.23	61.19	88.82	112.98	143.5	166.15	188.63	211.02	240.57	262.9	Observed
22	15.38	59.97	88.82	109.07	124.72	139.19	154.84	170.43	191	206.54	CRCM-CGCM3 (historical)
23	11.54	52.33	85.37	102.18	123.43	136.33	147.85	159.34	174.49	186.65	CRCM-CCSM (future)
24	7.69	52.33	82.93	97.32	115.51	129	142.39	155.74	173.34	185.94	CRCM-CGCM3 (future)
25	3.85	48.81	67.79	80.36	96.24	108.02	119.72	131.37	146.74	158.36	CRCM-CCSM (historical)
Gauge: 449159; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	170.5	249.75	302.21	368.51	417.69	466.5	515.14	579.31	627.8	HRM3-GFDL (future)
2	92.31	163.49	228.29	271.2	325.41	375.09	430.79	486.29	559.51	614.85	RCM3-GFDL (historical)
3	88.46	159.39	207.58	243.33	318.97	365.63	405.55	445.32	497.8	537.46	HRM3-HadCM3 (future)
4	84.62	147.64	191.59	239.49	290.34	332.73	374.81	416.73	472.04	513.84	RCM3-CGCM3 (future)
5	80.77	145.24	191.11	233.2	279.8	309.71	339.4	368.97	408	437.49	WRFG-CGCM3 (future)
6	76.92	143.19	189.42	224.75	266.65	297.73	328.58	359.32	399.87	430.52	HRM3-GFDL (historical)
7	73.08	141.51	187.98	220.02	258.7	287.39	315.86	344.24	381.67	409.96	HRM3-HadCM3 (historical)
8	69.23	134.77	183.46	219.89	256.26	283.24	310.02	336.7	371.9	398.5	WRFG-CCSM (future)
9	65.38	134.61	178.75	205.38	240.99	267.42	293.65	319.78	354.26	380.32	MM5I-HadCM3 (historical)
10	61.54	125.51	177.19	201.59	235.22	261.85	288.77	315.6	350.99	377.74	WRFG-CCSM (historical)
11	57.69	119.68	174.97	200.94	234.72	260.17	284.93	309.6	342.16	366.76	WRFG-CGCM3 (historical)
12	53.85	112.98	169.22	198.16	228.97	249.77	270.42	290.98	325.08	352.37	MM5I-CCSM (historical)
13	50.00	103.13	150.05	174.6	206.46	234.13	261.6	288.97	318.12	342.57	RCM3-GFDL (future)
14	46.15	96.28	139.63	169.15	205.61	228.62	252.32	279.53	315.43	338.63	MM5I-HadCM3 (future)
15	42.31	95.03	136.1	160.4	197.49	225.01	251.46	275.84	311.21	337.95	RCM3-CGCM3 (historical)
16	38.46	93.04	131.05	158.47	195.01	222.12	249.03	274.21	304.23	326.92	MM5I-CCSM (future)
17	34.62	86.71	129.55	157.92	185.5	205.95	226.26	246.49	273.18	293.36	ECP2-HadCM3 (future)
18	30.77	85.86	122.23	139.42	162.57	182.57	202.43	222.21	248.31	268.03	ECP2-GFDL (historical)
19	26.92	82.04	114.27	135.61	161.13	177.24	193.23	209.16	230.17	246.06	ECP2-HadCM3 (historical)
20	23.08	58.01	72.21	81.62	97.49	112.44	127.28	142.06	161.57	176.31	Observed
21	19.23	45.31	63.68	77.33	97.49	112.44	127.28	142.06	161.57	176.31	Observed
22	15.38	44.4	61.79	77.33	93.5	104.54	116.42	128.26	143.87	155.67	CRCM-CGCM3 (historical)
23	11.54	37.29	61.38	76.45	92.58	102.31	111.06	119.77	131.27	140.42	CRCM-CCSM (future)
24	7.69	37.29	61.38	72.7	86.49	96.72	106.87	116.99	130.33	139.96	CRCM-CGCM3 (future)
25	3.85	35.99	50.27	59.72	71.67	80.53	89.33	98.09	109.66	118.4	CRCM-CCSM (historical)
Gauge: 449159; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h-1) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	143.06	212.07	257.76	315.49	358.32	400.83	443.18	499.07	541.3	HRM3-GFDL (future)
2	92.31	136.92	193.09	230.28	277.27	323.38	372.11	420.65	484.7	533.11	RCM3-GFDL (historical)
3	88.46	133.23	175	208.13	274.3	312.13	346.73	381.21	426.69	461.07	HRM3-HadCM3 (future)
4	84.62	123.14	161.08	202.66	246.51	283.04	319.3	355.42	403.08	439.1	RCM3-CGCM3 (future)
5	80.77	121	160.61	197.28	237.61	263.53	289.26	314.9	348.73	374.3	WRFG-CGCM3 (future)
6	76.92	119.33	159.17	189.64	225.73	252.51	279.09	305.57	340.5	366.91	HRM3-GFDL (historical)
7	73.08	117.93	158.31	185.54	218.87	243.59	268.13	292.59	324.85	349.23	HRM3-HadCM3 (historical)
8	69.23	112.06	155.77	185.43	216.78	240.04	263.13	286.13	316.48	339.42	WRFG-CCSM (future)
9	65.38	111.93	149.83	172.89	203.57	226.33	248.92	271.43	301.13	323.58	MM5I-HadCM3 (historical)
10	61.54	104.14	148.61	169.58	198.53	221.7	244.92	268.06	298.58	321.64	WRFG-CCSM (historical)
11	57.69	99.45	146.67	168.92	198.31	220.01	241.32	262.57	290.59	311.77	WRFG-CGCM3 (historical)
12	53.85	93.45	141.83	166.78	193.03	210.92	228.68	246.37	274.87	298.19	MM5I-CCSM (historical)
13	50.00	85.05	125.21	146.24	173.5	197.15	220.63	244.01	269.72	290.48	RCM3-GFDL (future)
14	46.15	79.2	116.39	141.62	172.81	192.52	213.13	236.45	267.22	287.36	MM5I-HadCM3 (future)
15	42.31	78.29	113.2	134.35	166.14	189.72	212.08	232.33	262.45	285.21	RCM3-CGCM3 (historical)
16	38.46	76.67	109.19	132.38	163.5	186.58	209.5	231.58	257.3	276.73	MM5I-CCSM (future)
17	34.62	71.19	107.75	131.83	155.38	172.85	190.19	207.46	230.25	247.48	ECP2-HadCM3 (future)
18	30.77	70.56	101.26	115.86	135.7	152.71	169.6	186.43	208.63	225.4	ECP2-GFDL (historical)
19	26.92	67.21	94.62	112.77	134.32	148	161.59	175.13	192.99	206.49	ECP2-HadCM3 (historical)
20	23.08	46.96	58.8	66.64	79.02	90.51	101.91	113.28	128.27	139.6	Observed
21	19.23	36.42	51.77	63.53	79.02	90.51	101.91	113.28	128.27	139.6	Observed
22	15.38	35.69	51.27	63.53	76.55	85.83	95.74	105.6	118.62	128.46	CRCM-CGCM3 (historical)
23	11.54	32.76	51.27	62.41	75.86	83.9	91.19	98.46	108.05	115.62	CRCM-CCSM (future)
24	7.69	32.76	50.14	59.23	70.71	79.23	87.68	96.11	107.22	115.3	CRCM-CGCM3 (future)
25	3.85	28.76	40.51	48.29	58.12	65.42	72.66	79.87	89.39	96.58	CRCM-CCSM (historical)
Gauge: 449159; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	106.45	164.93	203.65	252.56	288.86	324.88	360.77	408.12	447.43	RCM3-GFDL (historical)
2	92.31	101.2	147.93	178.87	224.05	266.42	308.47	350.37	405.65	443.91	HRM3-GFDL (future)
3	88.46	97.69	132.45	166.94	217.96	246.96	275.75	304.43	342.27	370.87	HRM3-HadCM3 (future)
4	84.62	89.57	121.74	155.46	191.34	221.11	250.65	280.09	318.92	348.27	RCM3-CGCM3 (future)
5	80.77	87.67	120.69	151.22	184.54	206.11	227.52	248.85	277	298.27	WRFG-CGCM3 (future)
6	76.92	86.59	120.13	143.93	173.29	195.08	216.7	238.25	266.67	288.15	HRM3-GFDL (historical)
7	73.08	85.59	119.47	140.54	167.69	187.84	207.83	227.75	254.04	273.9	HRM3-HadCM3 (historical)
8	69.23	80.64	119.05	140.36	165.93	184.89	203.72	222.47	247.22	265.92	WRFG-CCSM (future)
9	65.38	80.58	110.97	130.12	155.06	173.56	191.92	210.22	234.35	252.6	MM5I-HadCM3 (historical)
10	61.54	74.36	110.39	127.27	151.21	170.29	189.24	208.11	233.02	251.84	WRFG-CCSM (historical)
11	57.69	71.51	108.69	126.4	150.74	168.16	185.44	202.66	225.38	242.55	WRFG-CGCM3 (historical)
12	53.85	65.94	105.12	125.48	145.9	160.36	174.72	189.02	209.67	228.08	MM5I-CCSM (historical)
13	50.00	59.38	91.27	108.04	129.64	148.31	166.84	185.31	207.89	224.17	RCM3-GFDL (future)
14	46.15	54.79	84.56	104.48	129.23	144.95	162.36	181	205.58	222.15	MM5I-HadCM3 (future)
15	42.31	54.48	81.53	99.41	124.81	143.65	160.55	176.09	198.51	216.28	RCM3-CGCM3 (historical)
16	38.46	53.47	79.3	96.93	121.23	139.26	157.15	174.98	196.6	212.1	MM5I-CCSM (future)
17	34.62	48.94	77.7	96.19	114.72	128.46	142.11	155.7	173.63	187.19	ECP2-HadCM3 (future)
18	30.77	48.65	71.85	83.14	98.94	112.14	125.24	138.3	155.52	168.54	ECP2-GFDL (historical)
19	26.92	45.79	67.06	81.14	97.41	107.99	118.5	128.97	142.78	153.22	ECP2-HadCM3 (historical)
20	23.08	30.63	39.18	44.85	52	58.9	66.05	73.17	82.56	89.66	CRCM-CGCM3 (historical)
21	19.23	23.16	34.31	41.99	51.7	57.31	62.58	67.83	74.76	80	CRCM-CGCM3 (future)
22	15.38	22.7	33.01	39.52	47.76	53.87	59.93	65.98	73.95	79.97	CRCM-CCSM (future)
23	11.54	17.88	25.96	31.32	38.08	43.1	48.08	53.04	59.59	64.54	CRCM-CCSM (historical)
24	7.69	16.4	24.38	29.66	36.34	41.29	46.2	51.1	57.56	62.45	Observed
25	3.85	16.4	24.38	29.66	36.34	41.29	46.2	51.1	57.56	62.45	Observed
Gauge: 449159; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	2	5	10	25	50	100	200	500	1000	Data Source for 1000-year
		Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	69.04	103.17	125.76	154.32	175.5	196.52	217.47	245.11	265.99	HRM3-GFDL (future)
2	92.31	65.99	93.68	112.01	135.18	158.92	183.09	207.17	238.93	262.94	RCM3-GFDL (historical)
3	88.46	64.12	84.71	101.76	134.58	152.36	169.41	186.41	208.83	225.77	HRM3-HadCM3 (future)
4	84.62	59.18	77.84	98.35	119.9	137.83	155.63	173.37	196.77	214.45	RCM3-CGCM3 (future)
5	80.77	58.11	77.59	95.72	115.57	128.35	141.04	153.67	170.35	182.95	WRFG-CGCM3 (future)
6	76.92	57.32	76.89	91.86	109.58	122.73	135.78	148.78	165.93	178.9	HRM3-GFDL (historical)
7	73.08	56.65	76.59	89.84	106.21	118.35	130.41	142.42	158.26	170.23	HRM3-HadCM3 (historical)
8	69.23	53.76	75.79	89.78	105.17	116.6	127.94	139.24	154.14	165.41	WRFG-CCSM (future)
9	65.38	53.69	72.24	83.61	98.67	109.85	120.94	131.98	146.56	157.58	MM5I-HadCM3 (historical)
10	61.54	49.88	71.7	81.97	96.17	107.63	119.03	130.4	145.39	156.72	WRFG-CCSM (historical)
11	57.69	47.69	70.73	81.6	96.14	106.71	117.17	127.59	141.33	151.72	WRFG-CGCM3 (historical)
12	53.85	44.66	68.39	80.65	93.42	102.19	110.9	119.57	133.29	144.67	MM5I-CCSM (historical)
13	50.00	40.58	60.2	70.49	83.8	95.35	106.81	118.23	131.01	141.16	RCM3-GFDL (future)
14	46.15	37.72	55.93	68.24	83.48	93.12	103.32	114.73	129.79	139.66	MM5I-HadCM3 (future)
15	42.31	37.32	54.31	64.77	80.32	91.86	102.69	112.41	127.09	138.18	RCM3-CGCM3 (historical)
16	38.46	36.56	52.46	63.71	78.87	90.12	101.28	112.23	124.81	134.32	MM5I-CCSM (future)
17	34.62	33.86	51.71	63.4	74.89	83.41	91.87	100.3	111.42	119.83	ECP2-HadCM3 (future)
18	30.77	33.58	48.44	55.55	65.25	73.53	81.75	89.95	100.75	108.92	ECP2-GFDL (historical)
19	26.92	31.91	45.25	54.09	64.52	71.18	77.79	84.37	93.06	99.63	ECP2-HadCM3 (historical)
20	23.08	22.12	27.81	31.58	36.34	40.81	45.56	50.3	56.55	61.27	CRCM-CGCM3 (historical)
21	19.23	17.09	24.46	29.57	36.02	39.87	43.38	46.87	51.48	55.08	CRCM-CCSM (future)
22	15.38	16.75	23.67	28.03	33.54	37.62	41.68	45.72	51.05	54.97	CRCM-CGCM3 (future)
23	11.54	13.43	19.08	23.08	28.13	31.88	35.59	39.3	44.19	47.88	Observed
24	7.69	13.05	19.08	23.08	28.13	31.88	35.59	39.3	44.19	47.88	Observed
25	3.85	13.05	19.02	22.73	27.41	30.88	34.33	37.76	42.29	45.71	CRCM-CCSM (historical)
Gauge: 449159; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	54.81	81.25	98.75	120.87	137.28	153.57	169.8	191.21	207.39	HRM3-GFDL (future)
2	92.31	52.46	73.98	88.23	106.23	123.9	142.57	161.17	185.71	204.25	RCM3-GFDL (historical)
3	88.46	51.04	67.04	79.75	105.1	119.58	132.84	146.05	163.47	176.64	HRM3-HadCM3 (future)
4	84.62	47.17	61.7	77.64	94.43	108.42	122.31	136.14	154.4	168.2	RCM3-CGCM3 (future)
5	80.77	46.36	61.53	75.57	91.02	100.96	110.82	120.64	133.6	143.39	WRFG-CGCM3 (future)
6	76.92	45.71	60.98	72.65	86.47	96.73	106.91	117.05	130.43	140.55	HRM3-GFDL (historical)
7	73.08	45.18	60.64	71.08	83.85	93.32	102.72	112.09	124.45	133.79	HRM3-HadCM3 (historical)
8	69.23	42.94	59.68	71.04	83.05	91.97	100.81	109.63	121.25	130.04	WRFG-CCSM (future)
9	65.38	42.89	57.4	66.24	78	86.72	95.37	104	115.38	123.98	MM5I-HadCM3 (historical)
10	61.54	39.9	56.94	64.97	76.06	84.94	93.83	102.7	114.39	123.23	WRFG-CCSM (historical)
11	57.69	38.1	56.19	64.72	75.98	84.29	92.45	100.59	111.32	119.43	WRFG-CGCM3 (historical)
12	53.85	35.8	54.34	63.9	73.96	80.81	87.62	94.4	105.3	114.24	MM5I-CCSM (historical)
13	50.00	32.59	47.97	56.02	66.47	75.53	84.52	93.48	103.34	111.27	RCM3-GFDL (future)
14	46.15	30.34	44.59	54.25	66.2	73.76	81.64	90.58	102.36	110.1	MM5I-HadCM3 (future)
15	42.31	29.99	43.37	51.47	63.64	72.68	81.25	89.02	100.57	109.29	RCM3-CGCM3 (historical)
16	38.46	29.38	41.83	50.72	62.65	71.49	80.28	88.72	98.58	106.02	MM5I-CCSM (future)
17	34.62	27.28	41.29	50.51	59.53	66.22	72.86	79.48	88.21	94.8	ECP2-HadCM3 (future)
18	30.77	27.03	38.79	44.38	51.98	58.5	64.96	71.41	79.91	86.33	ECP2-GFDL (historical)
19	26.92	25.75	36.25	43.2	51.45	56.69	61.9	67.08	73.92	79.09	ECP2-HadCM3 (historical)
20	23.08	17.99	22.53	25.54	29.34	32.89	36.68	40.46	45.45	49.22	CRCM-CGCM3 (historical)
21	19.23	13.95	19.83	23.91	29.07	32.15	34.95	37.74	41.42	44.3	CRCM-CCSM (future)
22	15.38	13.68	19.21	22.69	27.09	30.35	33.59	36.82	41.08	44.2	CRCM-CGCM3 (future)
23	11.54	11.01	15.51	18.49	22.25	25.05	27.82	30.58	34.22	36.97	CRCM-CCSM (historical)
24	7.69	10.94	15.18	17.99	21.54	24.17	26.79	29.39	32.82	35.42	Observed
25	3.85	10.94	15.18	17.99	21.54	24.17	26.79	29.39	32.82	35.42	Observed
Gauge: 449159; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	53.79	80.26	97.78	119.92	136.35	152.66	168.9	190.33	206.53	HRM3-GFDL (future)
2	92.31	51.44	72.91	87.12	105.08	123.52	142.27	160.94	185.58	204.2	RCM3-GFDL (historical)
3	88.46	49.98	65.95	79.19	104.64	118.4	131.62	144.8	162.18	175.32	HRM3-HadCM3 (future)
4	84.62	46.15	60.63	76.52	93.24	107.15	120.96	134.71	152.86	166.58	RCM3-CGCM3 (future)
5	80.77	45.33	60.42	74.49	89.88	99.79	109.63	119.43	132.36	142.14	WRFG-CGCM3 (future)
6	76.92	44.71	59.88	71.5	85.25	95.44	105.56	115.65	128.95	139	HRM3-GFDL (historical)
7	73.08	44.2	59.66	69.93	82.62	92.04	101.39	110.7	122.99	132.27	HRM3-HadCM3 (historical)
8	69.23	41.94	59.04	69.87	81.81	90.67	99.46	108.22	119.78	128.51	WRFG-CCSM (future)
9	65.38	41.91	56.29	65.11	76.79	85.46	94.06	102.63	113.94	122.48	MM5I-HadCM3 (historical)
10	61.54	38.94	55.87	63.83	74.84	83.71	92.55	101.36	112.98	121.76	WRFG-CCSM (historical)
11	57.69	37.25	55.11	63.55	74.8	83.02	91.13	99.21	109.87	117.93	WRFG-CGCM3 (historical)
12	53.85	34.9	53.29	62.8	72.71	79.52	86.27	92.99	103.6	112.43	MM5I-CCSM (historical)
13	50.00	31.72	46.95	54.92	65.24	74.19	83.07	91.92	101.86	109.7	RCM3-GFDL (future)
14	46.15	29.51	43.62	53.17	65	72.47	80.36	89.21	100.88	108.57	MM5I-HadCM3 (future)
15	42.31	29.2	42.37	50.48	62.54	71.48	79.89	87.41	98.79	107.39	RCM3-CGCM3 (historical)
16	38.46	28.62	40.94	49.65	61.41	70.13	78.78	87.29	97.04	104.41	MM5I-CCSM (future)
17	34.62	26.52	40.35	49.42	58.33	64.94	71.5	78.03	86.66	93.17	ECP2-HadCM3 (future)
18	30.77	26.3	37.83	43.34	50.86	57.29	63.66	70.01	78.39	84.73	ECP2-GFDL (historical)
19	26.92	25.01	35.36	42.21	50.29	55.45	60.58	65.68	72.41	77.5	ECP2-HadCM3 (historical)
20	23.08	17.42	21.83	24.75	28.44	31.9	35.59	39.26	44.1	47.76	CRCM-CGCM3 (historical)
21	19.23	13.51	19.22	23.18	28.19	31.18	33.89	36.6	40.17	42.99	CRCM-CCSM (future)
22	15.38	13.24	18.62	22	26.27	29.44	32.59	35.73	39.86	42.87	CRCM-CGCM3 (future)
23	11.54	10.67	15.01	17.89	21.52	24.21	26.88	29.54	33.06	35.71	CRCM-CCSM (historical)
24	7.69	8.6	11.31	13.11	15.37	17.06	18.73	20.39	22.59	24.25	Observed
25	3.85	8.6	11.31	13.11	15.37	17.06	18.73	20.39	22.59	24.25	Observed
Gauge: 449159; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source
Rank	Non-exceedance	2	5	10	25	50	100	200	500	1000	Data Source
	Probability (%)	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	for 1000-year
1	96.15	34.37	51.1	62.18	76.17	86.55	96.86	107.13	120.67	130.91	HRM3-GFDL (future)
2	92.31	32.88	46.44	55.43	66.77	78.44	90.29	102.09	117.66	129.43	RCM3-GFDL (historical)
3	88.46	31.96	42.06	50.42	66.51	75.19	83.55	91.87	102.86	111.16	HRM3-HadCM3 (future)
4	84.62	29.54	38.68	48.74	59.3	68.1	76.82	85.52	96.99	105.66	RCM3-CGCM3 (future)
5	80.77	29.02	38.57	47.45	57.18	63.44	69.66	75.86	84.03	90.2	WRFG-CGCM3 (future)
6	76.92	28.63	38.22	45.56	54.25	60.69	67.09	73.46	81.87	88.22	HRM3-GFDL (historical)
7	73.08	28.3	38.07	44.57	52.59	58.54	64.44	70.33	78.09	83.96	HRM3-HadCM3 (historical)
8	69.23	26.88	37.69	44.54	52.09	57.69	63.25	68.78	76.09	81.61	WRFG-CCSM (future)
9	65.38	26.85	35.95	41.51	48.89	54.36	59.79	65.21	72.35	77.75	MM5I-HadCM3 (historical)
10	61.54	24.98	35.67	40.71	47.66	53.29	58.88	64.45	71.8	77.36	WRFG-CCSM (historical)
11	57.69	23.91	35.2	40.54	47.66	52.82	57.95	63.05	69.78	74.87	WRFG-CGCM3 (historical)
12	53.85	22.42	34.06	40.07	46.33	50.63	54.9	59.15	65.87	71.46	MM5I-CCSM (historical)
13	50.00	20.42	30.04	35.09	41.61	47.27	52.89	58.49	64.76	69.72	RCM3-GFDL (future)
14	46.15	19.02	27.95	33.98	41.46	46.19	51.17	56.76	64.14	69.01	MM5I-HadCM3 (future)
15	42.31	18.83	27.15	32.28	39.9	45.56	50.88	55.62	62.81	68.24	RCM3-CGCM3 (historical)
16	38.46	18.46	26.25	31.75	39.18	44.69	50.16	55.55	61.72	66.38	MM5I-CCSM (future)
17	34.62	17.14	25.87	31.61	37.24	41.42	45.57	49.71	55.16	59.28	ECP2-HadCM3 (future)
18	30.77	16.99	24.28	27.76	32.51	36.57	40.6	44.62	49.91	53.91	ECP2-GFDL (historical)
19	26.92	16.17	22.71	27.04	32.16	35.42	38.66	41.89	46.15	49.37	ECP2-HadCM3 (historical)
20	23.08	11.38	14.17	16.02	18.36	20.54	22.87	25.19	28.25	30.56	CRCM-CGCM3 (historical)
21	19.23	8.91	12.52	15.02	18.19	20.09	21.81	23.53	25.79	27.52	CRCM-CCSM (future)
22	15.38	8.74	12.14	14.27	16.97	18.97	20.96	22.94	25.55	27.5	CRCM-CGCM3 (future)
23	11.54	7.12	9.86	11.67	13.97	15.67	17.35	19.04	21.25	22.93	CRCM-CCSM (historical)
24	7.69	4.92	6.47	7.49	8.79	9.75	10.7	11.65	12.9	13.85	Observed
25	3.85	4.92	6.47	7.49	8.79	9.75	10.7	11.65	12.9	13.85	Observed
Gauge: 449159; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	18.63	27.54	33.44	40.89	46.42	51.91	57.38	64.59	70.04	HRM3-GFDL (future)
2	92.31	17.84	25.07	29.85	35.9	42.11	48.41	54.7	63	69.26	RCM3-GFDL (historical)
3	88.46	17.35	22.72	27.18	35.75	40.39	44.84	49.28	55.13	59.55	HRM3-HadCM3 (future)
4	84.62	16.06	20.93	26.28	31.89	36.57	41.22	45.84	51.95	56.56	RCM3-CGCM3 (future)
5	80.77	15.79	20.86	25.59	30.78	34.11	37.42	40.72	45.07	48.36	WRFG-CGCM3 (future)
6	76.92	15.58	20.69	24.58	29.2	32.63	36.03	39.42	43.9	47.28	HRM3-GFDL (historical)
7	73.08	15.4	20.6	24.07	28.34	31.51	34.66	37.8	41.93	45.06	HRM3-HadCM3 (historical)
8	69.23	14.65	20.4	24.05	28.07	31.05	34.01	36.96	40.86	43.8	WRFG-CCSM (future)
9	65.38	14.63	19.47	22.44	26.37	29.29	32.19	35.07	38.88	41.76	MM5I-HadCM3 (historical)
10	61.54	13.63	19.33	22.01	25.71	28.71	31.69	34.65	38.57	41.53	WRFG-CCSM (historical)
11	57.69	13.06	19.07	21.91	25.71	28.46	31.19	33.9	37.49	40.2	WRFG-CGCM3 (historical)
12	53.85	12.28	18.47	21.67	24.99	27.28	29.55	31.81	35.39	38.36	MM5I-CCSM (historical)
13	50.00	11.2	16.33	19.02	22.48	25.49	28.48	31.46	34.8	37.45	RCM3-GFDL (future)
14	46.15	10.46	15.21	18.42	22.41	24.93	27.57	30.55	34.48	37.05	MM5I-HadCM3 (future)
15	42.31	10.36	14.79	17.51	21.57	24.58	27.43	29.94	33.77	36.67	RCM3-CGCM3 (historical)
16	38.46	10.16	14.3	17.24	21.19	24.13	27.04	29.92	33.2	35.68	MM5I-CCSM (future)
17	34.62	9.45	14.11	17.17	20.17	22.39	24.61	26.81	29.71	31.91	ECP2-HadCM3 (future)
18	30.77	9.38	13.26	15.12	17.64	19.8	21.95	24.09	26.91	29.04	ECP2-GFDL (historical)
19	26.92	8.94	12.42	14.73	17.46	19.2	20.92	22.64	24.91	26.63	ECP2-HadCM3 (historical)
20	23.08	6.39	7.88	8.86	10.1	11.27	12.51	13.75	15.38	16.61	CRCM-CGCM3 (historical)
21	19.23	5.07	7	8.33	10.02	11.03	11.94	12.85	14.05	14.97	CRCM-CCSM (future)
22	15.38	4.99	6.79	7.92	9.36	10.42	11.48	12.53	13.92	14.96	CRCM-CGCM3 (future)
23	11.54	4.12	5.58	6.54	7.76	8.67	9.57	10.46	11.64	12.53	CRCM-CCSM (historical)
24	7.69	2.83	3.62	4.14	4.8	5.29	5.77	6.25	6.89	7.37	Observed
25	3.85	2.83	3.62	4.14	4.8	5.29	5.77	6.25	6.89	7.37	Observed
Gauge: 449159; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	9.9	14.57	17.66	21.56	24.46	27.33	30.2	33.97	36.83	HRM3-GFDL (future)
2	92.31	9.49	13.27	15.77	18.94	22.2	25.5	28.79	33.14	36.42	RCM3-GFDL (historical)
3	88.46	9.24	12.05	14.38	18.87	21.29	23.62	25.94	29	31.31	HRM3-HadCM3 (future)
4	84.62	8.55	11.1	13.91	16.86	19.31	21.74	24.17	27.36	29.78	RCM3-CGCM3 (future)
5	80.77	8.41	11.07	13.55	16.26	18	19.73	21.46	23.74	25.46	WRFG-CGCM3 (future)
6	76.92	8.3	10.97	13.02	15.43	17.23	19.01	20.78	23.12	24.89	HRM3-GFDL (historical)
7	73.08	8.21	10.94	12.74	14.97	16.63	18.27	19.91	22.07	23.71	HRM3-HadCM3 (historical)
8	69.23	7.82	10.83	12.74	14.85	16.41	17.96	19.51	21.55	23.09	WRFG-CCSM (future)
9	65.38	7.81	10.35	11.9	13.95	15.48	16.99	18.5	20.49	21.99	MM5I-HadCM3 (historical)
10	61.54	7.29	10.27	11.67	13.61	15.17	16.73	18.28	20.33	21.88	WRFG-CCSM (historical)
11	57.69	6.99	10.14	11.63	13.61	15.04	16.47	17.89	19.76	21.18	WRFG-CGCM3 (historical)
12	53.85	6.58	9.82	11.49	13.25	14.45	15.64	16.83	18.7	20.25	MM5I-CCSM (historical)
13	50.00	6.01	8.7	10.1	11.93	13.51	15.07	16.64	18.39	19.74	RCM3-GFDL (future)
14	46.15	5.63	8.11	9.8	11.88	13.19	14.57	16.13	18.18	19.58	MM5I-HadCM3 (future)
15	42.31	5.57	7.89	9.31	11.44	13.01	14.5	15.82	17.83	19.34	RCM3-CGCM3 (historical)
16	38.46	5.46	7.63	9.17	11.24	12.78	14.3	15.8	17.52	18.82	MM5I-CCSM (future)
17	34.62	5.1	7.53	9.13	10.69	11.86	13.01	14.16	15.68	16.82	ECP2-HadCM3 (future)
18	30.77	5.06	7.09	8.07	9.38	10.51	11.63	12.75	14.22	15.34	ECP2-GFDL (historical)
19	26.92	4.83	6.65	7.86	9.29	10.2	11.11	12.01	13.2	14.09	ECP2-HadCM3 (historical)
20	23.08	3.5	4.27	4.79	5.44	6.03	6.68	7.33	8.18	8.82	CRCM-CGCM3 (historical)
21	19.23	2.8	3.81	4.5	5.38	5.92	6.4	6.88	7.51	8	CRCM-CCSM (future)
22	15.38	2.75	3.7	4.3	5.05	5.61	6.17	6.72	7.45	7.98	CRCM-CGCM3 (future)
23	11.54	2.31	3.07	3.57	4.21	4.68	5.15	5.61	6.23	6.69	CRCM-CCSM (historical)
24	7.69	1.64	2.14	2.47	2.9	3.21	3.52	3.83	4.24	4.54	Observed
25	3.85	1.64	2.14	2.47	2.9	3.21	3.52	3.83	4.24	4.54	Observed
Gauge: 449159; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	6.57	9.62	11.64	14.19	16.08	17.96	19.83	22.3	24.17	HRM3-GFDL (future)
2	92.31	6.3	8.77	10.41	12.48	14.61	16.77	18.93	21.77	23.91	RCM3-GFDL (historical)
3	88.46	6.13	7.97	9.5	12.43	14.02	15.54	17.06	19.07	20.58	HRM3-HadCM3 (future)
4	84.62	5.69	7.36	9.18	11.11	12.71	14.3	15.88	17.97	19.55	RCM3-CGCM3 (future)
5	80.77	5.6	7.34	8.95	10.72	11.86	12.99	14.12	15.61	16.74	WRFG-CGCM3 (future)
6	76.92	5.52	7.27	8.61	10.19	11.37	12.53	13.69	15.22	16.38	HRM3-GFDL (historical)
7	73.08	5.47	7.24	8.43	9.9	10.98	12.06	13.13	14.55	15.62	HRM3-HadCM3 (historical)
8	69.23	5.21	7.18	8.43	9.8	10.82	11.83	12.84	14.17	15.18	WRFG-CCSM (future)
9	65.38	5.2	6.86	7.87	9.22	10.22	11.21	12.2	13.5	14.48	MM5I-HadCM3 (historical)
10	61.54	4.86	6.81	7.73	9.01	10.02	11.04	12.05	13.39	14.4	WRFG-CCSM (historical)
11	57.69	4.66	6.73	7.7	8.99	9.95	10.89	11.82	13.05	13.98	WRFG-CGCM3 (historical)
12	53.85	4.39	6.52	7.61	8.75	9.54	10.32	11.09	12.3	13.32	MM5I-CCSM (historical)
13	50.00	4.02	5.78	6.7	7.88	8.91	9.94	10.96	12.11	13.01	RCM3-GFDL (future)
14	46.15	3.77	5.39	6.49	7.86	8.72	9.63	10.65	11.99	12.89	MM5I-HadCM3 (future)
15	42.31	3.73	5.25	6.18	7.57	8.6	9.57	10.43	11.74	12.73	RCM3-CGCM3 (historical)
16	38.46	3.67	5.08	6.09	7.44	8.44	9.44	10.43	11.55	12.4	MM5I-CCSM (future)
17	34.62	3.42	5.02	6.06	7.09	7.85	8.61	9.36	10.36	11.11	ECP2-HadCM3 (future)
18	30.77	3.4	4.73	5.37	6.23	6.97	7.7	8.44	9.4	10.13	ECP2-GFDL (historical)
19	26.92	3.25	4.44	5.23	6.18	6.78	7.37	7.96	8.74	9.33	ECP2-HadCM3 (historical)
20	23.08	2.37	2.89	3.23	3.66	4.04	4.47	4.89	5.45	5.87	CRCM-CGCM3 (historical)
21	19.23	1.92	2.58	3.04	3.61	3.97	4.29	4.6	5.02	5.34	CRCM-CCSM (future)
22	15.38	1.89	2.51	2.9	3.4	3.77	4.13	4.5	4.97	5.33	CRCM-CGCM3 (future)
23	11.54	1.6	2.1	2.43	2.86	3.17	3.48	3.79	4.2	4.5	CRCM-CCSM (historical)
24	7.69	1.13	1.52	1.79	2.12	2.37	2.61	2.86	3.18	3.42	Observed
25	3.85	1.13	1.52	1.79	2.12	2.37	2.61	2.86	3.18	3.42	Observed
Gauge: 449159; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

E. Tabulated Probability-Based IDF Curves for HUC 2080202

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	325.43	428.03	495.95	581.78	645.44	708.64	771.61	854.69	917.47	HRM3-GFDL (future)
2	92.31	316.23	415.04	480.46	563.12	624.44	685.31	745.96	825.97	886.44	HRM3-HadCM3 (future)
3	88.46	292.19	392.53	458.95	542.88	605.15	666.95	728.53	809.78	871.18	HRM3-HadCM3 (historical)
4	84.62	282.91	346.13	401.28	483.36	550.74	623.37	695.74	791.22	863.38	RCM3-GFDL (historical)
5	80.77	269.32	340.35	395.66	477.57	548.42	613	677.35	762.24	826.4	RCM3-CGCM3 (future)
6	76.92	262.83	334.07	378.93	470.97	522.66	573.98	625.89	705.4	765.49	RCM3-GFDL (future)
7	73.08	243.79	326.24	378.38	444.2	505.14	565.62	625.11	692.56	746.86	Observed
8	69.23	243.75	314.92	376.94	436.7	495.52	553.92	612.1	688.85	746.86	Observed
9	65.38	243.05	313.23	362.06	431.11	471.29	525.15	592	680.2	743.54	HRM3-GFDL (historical)
10	61.54	221.41	307.83	362.04	426.43	465.74	511.18	553.26	610.89	654.44	WRFG-CGCM3 (historical)
11	57.69	219.43	300.87	359.69	421.58	462.08	509.58	550.92	605.08	648.02	WRFG-CCSM (future)
12	53.85	208.71	297.04	357.4	418.4	461.95	505.18	548.25	603.35	642.98	WRFG-CGCM3 (future)
13	50.00	204.27	294.64	350.22	403.79	458.06	497.47	532.72	579.24	614.39	MM5I-HadCM3 (future)
14	46.15	203.14	286.17	330.35	390.46	443.53	482.98	522.28	574.13	613.32	MM5I-HadCM3 (historical)
15	42.31	199.85	274.27	317.68	386.19	427.6	468.72	509.68	563.72	604.57	WRFG-CCSM (historical)
16	38.46	198.85	260.06	300.15	372.53	413.22	453.6	493.85	546.94	588.38	MM5I-CCSM (historical)
17	34.62	195.19	258.67	299.34	358.83	402.37	445.58	488.64	545.45	587.06	MM5I-CCSM (future)
18	30.77	183.55	253.7	296.99	343.65	378.27	412.63	446.87	492.04	526.17	ECP2-HadCM3 (future)
19	26.92	182.96	240.52	295.44	341.9	376.36	410.57	444.66	489.63	523.61	ECP2-GFDL (future)
20	23.08	173.83	227.23	270.54	308.46	336.6	367.7	399.56	441.58	473.35	ECP2-GFDL (historical)
21	19.23	124.7	225.74	260.1	303.52	335.73	364.52	392.35	429.06	456.81	ECP2-HadCM3 (historical)
22	15.38	118.31	160.92	184.91	215.21	237.69	260	282.24	311.57	333.74	CRCM-CGCM3 (future)
23	11.54	93.53	129.37	153.09	183.07	205.31	227.38	249.38	278.4	300.33	CRCM-CGCM3 (historical)
24	7.69	93.1	121.53	140.35	164.13	181.78	199.29	216.74	239.76	257.16	CRCM-CCSM (future)
25	3.85	78.8	106.41	124.69	147.78	164.91	181.92	198.87	221.22	238.12	CRCM-CCSM (historical)
HUC: 2080202; Duration: 15 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	242.08	328.66	385.98	458.41	512.14	565.48	618.62	688.72	741.71	HRM3-GFDL (future)
2	92.31	234.29	314.88	368.24	435.65	485.67	535.31	584.77	660.47	723.17	RCM3-GFDL (historical)
3	88.46	213.91	292.81	345.05	411.05	460.01	514.63	577.51	650.03	699.35	HRM3-HadCM3 (future)
4	84.62	207.62	258.69	303.74	387.94	451.52	508.62	557.04	620.93	669.22	HRM3-HadCM3 (historical)
5	80.77	199.57	253.71	302.41	374.94	427.75	480.18	532.41	601.32	653.41	RCM3-CGCM3 (future)
6	76.92	192.65	253.36	302.23	357.66	398.65	439.33	479.86	542.14	589.64	RCM3-GFDL (future)
7	73.08	179.37	247.4	289.56	335.67	383.84	431.65	479.29	533.89	580.37	RCM3-CGCM3 (historical)
8	69.23	178.36	235.34	283.65	334.86	378.97	425.76	472.38	533.34	573.76	HRM3-GFDL (historical)
9	65.38	177.93	234.44	272.39	331.83	368.46	401.82	435.05	478.9	512.03	WRFG-CGCM3 (future)
10	61.54	162.29	234.4	271.86	321.91	354.21	389.02	423.71	469.47	504.06	WRFG-CGCM3 (historical)
11	57.69	159.55	230.35	270.73	319.21	353.94	388.42	422.77	468.09	502.34	WRFG-CCSM (future)
12	53.85	150.73	219.34	268.29	319.14	350.3	378.48	406.55	446.56	478.38	MM5I-HadCM3 (historical)
13	50.00	147.98	218	264.77	308.26	340.53	372.55	404.46	443.59	471.59	MM5I-HadCM3 (future)
14	46.15	145.57	213.16	248.65	293.49	326.76	359.78	392.69	436.1	468.9	WRFG-CCSM (historical)
15	42.31	142.04	202.29	236.43	279.57	311.57	343.34	374.99	417.78	451.8	MM5I-CCSM (historical)
16	38.46	141.73	192.5	223.41	269.91	304.41	338.65	372.77	416.74	448.3	MM5I-CCSM (future)
17	34.62	139.27	188.18	221.98	259.22	286.85	314.28	341.61	377.66	404.9	ECP2-HadCM3 (future)
18	30.77	131.95	186.61	216.4	252.05	278.49	304.74	330.9	365.4	391.48	ECP2-GFDL (future)
19	26.92	131.02	174.56	197.92	227.44	250.21	275.33	300.36	333.37	359.48	Observed
20	23.08	123.02	163.8	190.79	224.91	249.34	271.08	292.74	328.49	358.33	ECP2-GFDL (historical)
21	19.23	85.58	117.9	151.42	193.79	225.21	256.4	287.48	321.31	342.91	ECP2-HadCM3 (historical)
22	15.38	67.26	112.22	129.85	152.13	168.66	185.07	201.42	222.99	239.29	CRCM-CGCM3 (future)
23	11.54	62.91	89.61	107.28	129.62	146.18	162.63	179.02	200.64	216.97	CRCM-CGCM3 (historical)
24	7.69	62.6	83.79	97.82	115.55	128.7	141.76	154.77	171.93	184.9	CRCM-CCSM (future)
25	3.85	52.2	72.15	85.36	102.04	114.42	126.71	138.95	155.1	167.31	CRCM-CCSM (historical)
HUC: 2080202; Duration: 30 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	181.04	246.41	289.69	344.38	384.95	425.21	465.34	518.27	558.28	HRM3-GFDL (future)
2	92.31	175.15	235.6	275.63	326.2	363.72	400.96	438.07	500.12	547.71	RCM3-GFDL (historical)
3	88.46	159.71	218.42	257.29	306.4	342.83	389.43	437.16	487.02	524.02	HRM3-HadCM3 (future)
4	84.62	155.25	193.48	228.22	293.27	341.53	378.99	415.03	462.56	498.49	HRM3-HadCM3 (historical)
5	80.77	149.63	190.56	227.92	281.37	321.03	360.4	399.62	451.36	490.47	RCM3-CGCM3 (future)
6	76.92	144.14	189.46	226.15	267.42	298.04	328.43	358.72	404.78	440.24	RCM3-GFDL (future)
7	73.08	134.56	185.61	217.66	251.89	286.61	322.3	357.86	399.79	434.64	RCM3-CGCM3 (historical)
8	69.23	133.61	176.74	212.11	250.66	283.66	318.74	353.69	398.67	428.86	HRM3-GFDL (historical)
9	65.38	133.18	176.52	204.3	248.33	277.29	302.5	327.62	360.76	385.81	WRFG-CGCM3 (future)
10	61.54	121.7	175.5	203.52	240.73	265.44	291.29	317.23	351.5	377.41	WRFG-CGCM3 (historical)
11	57.69	119.54	172.69	202.19	239.4	265.19	291.26	317.05	351.02	376.7	WRFG-CCSM (future)
12	53.85	112.88	163.83	200.7	238.92	261.96	283.03	304.03	335.25	359.17	MM5I-HadCM3 (historical)
13	50.00	110.93	163	198.57	231.27	255.53	279.61	303.6	331.73	352.67	MM5I-HadCM3 (future)
14	46.15	108.91	159.82	186.49	220.19	245.19	270	294.73	327.34	351.99	WRFG-CCSM (historical)
15	42.31	106.06	151.47	177.02	209.31	233.26	257.03	280.72	313.22	338.74	MM5I-CCSM (historical)
16	38.46	105.89	144.38	167.39	202.28	228.16	253.85	279.45	311.97	335.59	MM5I-CCSM (future)
17	34.62	104.21	140.65	166.53	194.51	215.27	235.88	256.41	283.49	303.96	ECP2-HadCM3 (future)
18	30.77	98.98	139.78	161.67	188.23	207.93	227.48	246.96	272.67	292.1	ECP2-GFDL (future)
19	26.92	98.08	130.59	148.07	170.14	187.49	206.33	225.11	249.89	268.61	ECP2-GFDL (historical)
20	23.08	92.05	122.65	142.91	168.5	186.52	202.77	218.97	240.34	256.49	ECP2-HadCM3 (historical)
21	19.23	64.03	83.85	100.66	127.63	147.64	167.5	187.29	213.39	233.12	Observed
22	15.38	47.11	79.32	96.97	113.55	125.86	138.07	150.23	166.28	178.42	CRCM-CGCM3 (future)
23	11.54	47.08	67.07	80.29	96.99	109.38	121.68	133.93	150.1	162.31	CRCM-CGCM3 (historical)
24	7.69	46.9	62.79	73.31	86.6	96.46	106.25	116	128.87	138.59	CRCM-CCSM (future)
25	3.85	39.09	54.03	63.92	76.41	85.68	94.88	104.05	116.14	125.28	CRCM-CCSM (historical)
HUC: 2080202; Duration: 45 min		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	157.48	216.21	255.09	304.23	340.68	376.86	412.91	460.47	496.41	HRM3-GFDL (future)
2	92.31	152.18	206.62	242.66	288.2	321.99	355.52	388.94	445.17	488.02	RCM3-GFDL (historical)
3	88.46	138.49	191.72	226.97	271.5	304.54	345.49	388.47	433.02	466.33	HRM3-HadCM3 (future)
4	84.62	134.05	168.53	200.33	258.91	302.36	337.34	370.01	413.12	445.7	HRM3-HadCM3 (historical)
5	80.77	128.68	165.09	199.17	247.02	282.52	317.75	352.85	399.17	434.17	RCM3-CGCM3 (future)
6	76.92	124.15	164.73	197.9	235.02	262.56	289.9	317.5	359.77	391.72	RCM3-GFDL (future)
7	73.08	115.2	161.31	189.2	220.9	253.3	285.46	317.13	354.19	385.45	RCM3-CGCM3 (historical)
8	69.23	114.52	153.98	185.05	219.66	250.03	281.49	312.84	353.06	380.22	HRM3-GFDL (historical)
9	65.38	114.32	152.66	177.46	218.34	242.25	264.68	287.03	316.51	338.8	WRFG-CGCM3 (future)
10	61.54	104.11	152.11	177.23	210.71	232.21	255.5	278.7	309.3	332.44	WRFG-CGCM3 (historical)
11	57.69	102.04	149.34	177.14	208.8	232.05	255.13	278.12	308.45	331.38	WRFG-CCSM (future)
12	53.85	96.19	142.67	175.61	208.76	229.76	248.66	267.49	294.14	315.45	MM5I-HadCM3 (historical)
13	50.00	94.32	141.8	172.39	201.52	223.13	244.58	265.95	292.34	311.11	MM5I-HadCM3 (future)
14	46.15	92.76	137.86	161.58	191.54	213.77	235.83	257.82	286.82	308.74	WRFG-CCSM (historical)
15	42.31	90.73	130.56	153.32	182.07	203.4	224.57	245.66	273.67	296.26	MM5I-CCSM (historical)
16	38.46	90.47	123.92	144.63	175.5	198.41	221.14	243.79	273.49	294.52	MM5I-CCSM (future)
17	34.62	88.59	121.07	143.52	168.29	186.66	204.9	223.07	247.04	265.16	ECP2-HadCM3 (future)
18	30.77	83.96	120.2	139.81	163.49	181.05	198.49	215.86	238.78	256.11	ECP2-GFDL (future)
19	26.92	83.29	111.95	127.41	146.95	161.91	178.49	195.02	216.81	233.29	ECP2-GFDL (historical)
20	23.08	77.95	104.87	122.69	145.21	161.45	175.83	190.17	209.08	223.38	ECP2-HadCM3 (historical)
21	19.23	53.5	70.84	82.33	97.44	112.13	126.71	141.24	160.42	174.9	Observed
22	15.38	38.88	61.96	77.63	96.84	107.61	118.29	128.94	142.99	153.61	CRCM-CGCM3 (future)
23	11.54	38.65	56.14	67.57	82.01	92.72	103.35	113.94	127.92	138.48	CRCM-CGCM3 (historical)
24	7.69	38.28	52.26	61.27	72.66	81.1	89.49	97.84	108.86	117.19	CRCM-CCSM (future)
25	3.85	32.08	44.76	53.15	63.75	71.61	79.42	87.2	97.46	105.22	CRCM-CCSM (historical)
HUC: 2080202; Duration: 1 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	116.74	165.42	197.65	238.37	268.58	298.56	328.44	367.85	400.85	RCM3-GFDL (historical)
2	92.31	112.38	156.94	186.45	223.73	251.39	280.18	316.57	364.57	397.64	HRM3-GFDL (future)
3	88.46	101.28	144.71	173.47	209.81	243.66	278.85	306.2	342.29	369.56	HRM3-HadCM3 (future)
4	84.62	97.33	125.55	157.28	206.87	236.76	263.52	290.18	325.35	351.93	HRM3-HadCM3 (historical)
5	80.77	93.28	122.75	151.4	190.1	218.8	247.3	275.69	313.14	341.45	RCM3-CGCM3 (future)
6	76.92	89.78	121.97	149.23	179.15	201.34	223.37	247.33	281.53	307.37	RCM3-GFDL (future)
7	73.08	82.74	120.78	142.26	169.18	195.39	221.4	245.32	276.91	302.18	RCM3-CGCM3 (historical)
8	69.23	82.04	118.03	138.28	167.05	192.68	218.12	243.47	274.29	296.17	HRM3-GFDL (historical)
9	65.38	82	112.55	133.85	166.9	185.19	203.34	221.42	245.28	263.31	WRFG-CGCM3 (future)
10	61.54	74.52	112.06	132.5	158.89	175.76	194.27	212.72	237.06	255.45	WRFG-CGCM3 (historical)
11	57.69	72.38	109.88	132.28	157.22	175.72	194.08	212.38	236.51	254.76	WRFG-CCSM (future)
12	53.85	67.8	105.89	131.96	157.1	174.18	189.36	204.48	225.69	242.73	MM5I-HadCM3 (historical)
13	50.00	66.31	105.16	128.32	151.61	168.89	186.05	203.14	224.44	239.51	MM5I-HadCM3 (future)
14	46.15	65.03	100.77	119.56	143.31	160.93	178.41	195.83	218.82	236.19	WRFG-CCSM (historical)
15	42.31	63.87	94.86	112.78	135.41	152.21	168.88	185.49	207.4	224.54	MM5I-CCSM (historical)
16	38.46	63.65	89.51	105.99	130.12	148.03	165.8	183.51	206.88	223.96	MM5I-CCSM (future)
17	34.62	61.74	87.07	104.87	124.27	138.67	152.96	167.2	185.98	200.18	ECP2-HadCM3 (future)
18	30.77	58.75	86.88	101.67	120.1	133.78	147.36	160.89	178.74	192.22	ECP2-GFDL (future)
19	26.92	58.03	79.84	91.82	106.96	118.36	131.11	143.82	160.59	173.26	ECP2-GFDL (historical)
20	23.08	53.77	74.48	88.19	105.51	118.19	129.34	140.45	155.1	166.18	ECP2-HadCM3 (historical)
21	19.23	35.53	48.3	56.75	67.43	75.36	83.23	91.06	101.4	109.22	CRCM-CGCM3 (future)
22	15.38	25.08	37.63	45.94	56.43	64.22	71.95	79.65	89.82	97.5	CRCM-CGCM3 (historical)
23	11.54	24.86	34.6	41.05	49.19	55.93	62.77	69.58	78.57	85.36	Observed
24	7.69	21.31	32.41	39.76	49.04	55.24	61.24	67.21	75.1	81.06	CRCM-CCSM (future)
25	3.85	20.34	29.12	34.94	42.29	47.74	53.15	58.54	65.65	71.03	CRCM-CCSM (historical)
HUC: 2080202; Duration: 2 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	85.82	119.07	141.09	168.91	189.55	210.04	230.45	257.37	277.73	HRM3-GFDL (future)
2	92.31	82.85	114.21	134.97	161.2	180.66	199.97	219.22	246.9	271.04	RCM3-GFDL (historical)
3	88.46	75.32	106.89	127.79	154.2	173.79	193.23	214.96	244.61	263.79	HRM3-HadCM3 (future)
4	84.62	72.04	92.07	109.09	141.96	166.44	190.74	212.61	238.17	257.49	HRM3-HadCM3 (historical)
5	80.77	68.24	89.7	108.96	135.99	156.17	176.21	196.18	222.52	242.43	RCM3-CGCM3 (future)
6	76.92	66.37	88.42	108.77	130.59	146.54	162.37	180.08	204.7	223.31	RCM3-GFDL (future)
7	73.08	60.67	87.23	101.79	123.81	142.68	161.42	178.14	198.95	216.82	RCM3-CGCM3 (historical)
8	69.23	60.51	82.84	101.39	121.19	139.33	157.33	175.27	198.93	214.68	HRM3-GFDL (historical)
9	65.38	60.5	82.16	98.37	118.67	131.2	143.63	156.02	172.37	184.72	WRFG-CGCM3 (future)
10	61.54	54.7	81.74	96.74	116.16	127.71	140.95	154.14	171.54	184.69	WRFG-CGCM3 (historical)
11	57.69	53.47	80.06	96.39	114.37	127.11	139.83	152.86	170.06	183.05	WRFG-CCSM (future)
12	53.85	50.32	78.24	95.8	113.56	126.74	137.99	148.83	163.13	173.93	MM5I-HadCM3 (future)
13	50.00	48.98	77.39	93.01	109.37	121.51	133.56	145.56	161.4	173.36	MM5I-HadCM3 (historical)
14	46.15	48.58	73.53	86.8	103.58	116.02	128.37	140.68	156.92	169.19	WRFG-CCSM (historical)
15	42.31	48.17	69.79	82.68	98.97	111.05	123.04	134.99	150.76	162.67	MM5I-CCSM (future)
16	38.46	47.83	65.43	77.53	94.74	107.51	120.18	132.81	149.47	162.06	MM5I-CCSM (historical)
17	34.62	46.21	64.79	76.32	90.08	100.28	110.41	120.51	133.83	143.89	ECP2-HadCM3 (future)
18	30.77	43.39	63.91	75.52	89.08	99.13	109.12	119.07	132.19	142.11	ECP2-GFDL (future)
19	26.92	43.34	59.32	68	78.96	87.09	95.73	104.83	116.83	125.9	ECP2-GFDL (historical)
20	23.08	40.38	55.2	65.01	77.41	86.6	95.17	103.21	113.82	121.84	ECP2-HadCM3 (historical)
21	19.23	27.06	36.68	43.04	51.09	57.05	62.98	68.88	76.66	82.55	CRCM-CGCM3 (future)
22	15.38	19.2	28.45	34.58	42.32	48.06	53.76	59.44	66.93	72.6	CRCM-CGCM3 (historical)
23	11.54	19.01	26.15	30.88	36.85	41.29	45.68	50.07	55.85	60.22	CRCM-CCSM (future)
24	7.69	15.83	23.17	28.03	34.17	38.73	43.26	47.76	53.71	58.2	Observed
25	3.85	15.67	22.22	26.56	32.04	36.1	40.13	44.15	49.46	53.46	CRCM-CCSM (historical)
HUC: 2080202; Duration: 3 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	67.81	93.39	110.33	131.73	147.61	163.37	179.07	199.79	215.45	HRM3-GFDL (future)
2	92.31	65.51	89.65	105.63	125.82	140.8	155.66	170.48	190.98	209.49	RCM3-GFDL (historical)
3	88.46	59.69	83.93	99.98	120.25	135.3	150.23	166.47	190.02	204.79	HRM3-HadCM3 (future)
4	84.62	57.24	72.64	85.78	110.48	129.26	147.9	165.11	184.74	199.57	HRM3-HadCM3 (historical)
5	80.77	54.31	70.89	85.46	106.49	122.09	137.57	152.99	173.35	188.73	RCM3-CGCM3 (future)
6	76.92	52.8	69.96	85.17	102.38	114.69	126.91	140.28	159.26	173.61	RCM3-GFDL (future)
7	73.08	48.38	68.82	80.31	96.89	111.44	125.89	139.09	155.15	168.92	RCM3-CGCM3 (historical)
8	69.23	48.29	65.14	79.92	95.01	109.03	122.94	136.81	155.1	167.29	HRM3-GFDL (historical)
9	65.38	48.29	65.06	77.28	93.4	103.1	112.74	122.34	135.01	144.61	WRFG-CGCM3 (historical)
10	61.54	43.69	64.77	76.12	91.34	100.4	110.67	120.91	134.41	144.58	WRFG-CGCM3 (future)
11	57.69	42.8	63.46	76.1	90.05	99.81	109.85	119.97	133.31	143.4	WRFG-CCSM (future)
12	53.85	40.33	61.76	75.68	89.47	99.7	108.21	116.59	127.63	135.99	MM5I-HadCM3 (future)
13	50.00	39.31	61.16	73.5	86.18	95.59	104.94	114.24	126.52	135.8	MM5I-HadCM3 (historical)
14	46.15	38.98	58.4	68.73	81.77	91.45	101.06	110.64	123.27	132.81	WRFG-CCSM (historical)
15	42.31	38.57	55.47	65.49	78.15	87.55	96.87	106.16	118.42	127.69	MM5I-CCSM (future)
16	38.46	38.31	52.13	61.5	74.92	84.87	94.75	104.6	117.58	127.4	MM5I-CCSM (historical)
17	34.62	37.14	51.59	60.62	71.35	79.3	87.2	95.07	105.46	113.31	ECP2-HadCM3 (future)
18	30.77	34.88	50.88	59.94	70.49	78.31	86.08	93.82	104.03	111.75	ECP2-GFDL (future)
19	26.92	34.84	47.36	54.13	62.69	69.03	75.92	83.04	92.45	99.55	ECP2-GFDL (historical)
20	23.08	32.54	44.15	51.84	61.56	68.76	75.33	81.61	89.89	96.14	ECP2-HadCM3 (historical)
21	19.23	22.03	29.63	34.66	41.02	45.73	50.42	55.08	61.23	65.89	CRCM-CGCM3 (future)
22	15.38	15.76	23.12	27.98	34.14	38.7	43.23	47.74	53.69	58.19	CRCM-CGCM3 (historical)
23	11.54	15.62	21.32	25.09	29.86	33.4	36.91	40.41	45.03	48.51	CRCM-CCSM (future)
24	7.69	13.31	19.18	23.06	27.97	31.61	35.23	38.83	43.58	47.17	Observed
25	3.85	12.93	18.21	21.7	26.11	29.39	32.64	35.87	40.15	43.38	CRCM-CCSM (historical)
HUC: 2080202; Duration: 4 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	71.26	98.55	116.62	139.45	156.38	173.19	189.94	212.04	228.74	HRM3-GFDL (future)
2	92.31	68.82	94.74	111.89	133.57	149.65	165.61	181.51	202.49	221.9	RCM3-GFDL (historical)
3	88.46	62.69	89.01	106.44	128.47	144.81	161.02	177.18	202.17	218.35	HRM3-HadCM3 (future)
4	84.62	59.81	76.4	90.53	116.41	136.42	156.28	176.07	198.5	214.61	HRM3-HadCM3 (historical)
5	80.77	56.41	74.44	89.82	112.27	128.93	145.46	161.94	183.67	200.09	RCM3-CGCM3 (future)
6	76.92	55.05	72.93	89.44	108.38	121.63	134.77	149.77	170.24	185.72	RCM3-GFDL (future)
7	73.08	50.28	72.05	84.13	102.99	118.68	134.25	147.87	165.15	179.8	RCM3-CGCM3 (historical)
8	69.23	50.1	68.1	83.88	100.62	115.64	130.54	145.39	164.99	178.21	HRM3-GFDL (historical)
9	65.38	49.93	68.09	81.83	97.7	107.96	118.14	128.28	142.14	153.04	WRFG-CGCM3 (historical)
10	61.54	45.21	67.52	80.38	96.38	105.83	116.8	127.72	141.66	151.78	WRFG-CGCM3 (future)
11	57.69	44.24	66.21	79.88	94.77	105.46	115.62	126.41	140.66	151.42	WRFG-CCSM (future)
12	53.85	41.67	65.09	79.16	93.87	104.79	114.47	123.46	135.31	144.26	MM5I-HadCM3 (future)
13	50.00	40.48	64.36	76.87	90.35	100.35	110.27	120.16	133.21	143.07	MM5I-HadCM3 (historical)
14	46.15	40.3	60.8	71.76	85.6	95.87	106.07	116.23	129.63	139.76	WRFG-CCSM (historical)
15	42.31	40.16	57.82	68.51	82.01	92.03	101.98	111.89	124.96	134.84	MM5I-CCSM (future)
16	38.46	39.81	54.04	64.15	78.34	88.87	99.33	109.74	123.48	133.86	MM5I-CCSM (historical)
17	34.62	38.35	53.81	63.01	74.35	82.77	91.12	99.44	110.42	118.71	ECP2-HadCM3 (future)
18	30.77	35.95	52.91	62.76	74.06	82.45	90.77	99.06	110.01	118.28	ECP2-GFDL (future)
19	26.92	35.86	49.21	56.39	65.47	72.2	79.17	86.67	96.57	104.05	ECP2-GFDL (historical)
20	23.08	33.52	45.74	53.83	64.06	71.64	78.89	85.55	94.34	100.98	ECP2-HadCM3 (historical)
21	19.23	22.51	30.54	35.86	42.58	47.56	52.51	57.44	63.95	68.86	CRCM-CGCM3 (future)
22	15.38	15.96	23.6	28.66	35.06	39.8	44.51	49.2	55.39	60.07	CRCM-CGCM3 (historical)
23	11.54	15.78	21.65	25.55	30.46	34.11	37.73	41.34	46.1	49.69	CRCM-CCSM (future)
24	7.69	13.05	18.46	22.04	26.57	29.93	33.26	36.58	40.96	44.27	CRCM-CCSM (historical)
25	3.85	10.07	14.41	17.29	20.92	23.61	26.28	28.94	32.46	35.11	Observed
HUC: 2080202; Duration: 6 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	46.81	64.53	76.26	91.08	102.08	112.99	123.87	138.21	149.06	HRM3-GFDL (future)
2	92.31	45.22	62.1	73.28	87.4	97.87	108.27	118.63	132.3	144.26	RCM3-GFDL (historical)
3	88.46	41.26	58.48	69.87	84.28	94.96	105.56	116.13	131.47	142.63	HRM3-HadCM3 (future)
4	84.62	39.33	50.15	59.37	75.87	88.84	101.71	114.54	130.07	140.61	HRM3-HadCM3 (historical)
5	80.77	37.04	48.87	58.78	73.4	84.24	95	105.73	119.87	130.57	RCM3-CGCM3 (future)
6	76.92	36.21	47.76	58.38	71.03	79.68	88.27	98.13	111.51	121.62	RCM3-GFDL (future)
7	73.08	33.09	47.21	55.19	67.57	77.82	88	96.82	108.11	117.59	RCM3-CGCM3 (historical)
8	69.23	32.94	44.7	54.85	65.97	75.76	85.48	95.16	107.94	116.63	HRM3-GFDL (historical)
9	65.38	32.79	44.55	53.75	63.82	70.48	77.08	83.66	93	100.1	WRFG-CGCM3 (historical)
10	61.54	29.74	44.26	52.78	63.17	69.31	76.47	83.59	92.34	98.98	WRFG-CCSM (future)
11	57.69	29.12	43.42	52.39	62.11	69.1	75.63	82.68	91.96	98.9	WRFG-CGCM3 (future)
12	53.85	27.45	42.82	51.85	61.45	68.57	74.98	80.83	88.56	94.4	MM5I-HadCM3 (future)
13	50.00	26.65	42.33	50.36	59.13	65.64	72.09	78.52	87.01	93.43	MM5I-HadCM3 (historical)
14	46.15	26.59	39.9	47.04	56.06	62.75	69.39	76.01	84.74	91.33	WRFG-CCSM (historical)
15	42.31	26.56	37.99	44.96	53.77	60.31	66.8	73.27	81.8	88.24	MM5I-CCSM (future)
16	38.46	26.3	35.47	42.1	51.34	58.19	65	71.78	80.72	87.48	MM5I-CCSM (historical)
17	34.62	25.32	35.43	41.31	48.69	54.16	59.6	65.02	72.18	77.59	ECP2-GFDL (future)
18	30.77	23.74	34.78	41.28	48.67	54.15	59.59	65.01	72.15	77.55	ECP2-HadCM3 (future)
19	26.92	23.65	32.4	37.09	43.01	47.4	51.91	56.8	63.25	68.12	ECP2-GFDL (historical)
20	23.08	22.17	30.13	35.4	42.07	47.01	51.77	56.11	61.84	66.17	ECP2-HadCM3 (historical)
21	19.23	14.98	20.24	23.72	28.12	31.38	34.62	37.85	42.11	45.33	CRCM-CGCM3 (future)
22	15.38	10.7	15.69	18.99	23.16	26.25	29.32	32.38	36.42	39.47	CRCM-CGCM3 (historical)
23	11.54	10.58	14.4	16.93	20.12	22.49	24.84	27.18	30.28	32.61	CRCM-CCSM (future)
24	7.69	8.82	12.33	14.66	17.6	19.79	21.95	24.11	26.96	29.11	CRCM-CCSM (historical)
25	3.85	6.28	8.92	10.67	12.88	14.52	16.15	17.77	19.91	21.53	Observed
HUC: 2080202; Duration: 12 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity ($mm\ h^{-1}$) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	24.82	34.11	40.26	48.03	53.8	59.52	65.22	72.74	78.42	HRM3-GFDL (future)
2	92.31	23.99	32.82	38.66	46.05	51.53	56.97	62.38	69.53	76.02	RCM3-GFDL (historical)
3	88.46	21.91	30.9	36.85	44.37	49.94	55.48	61	69.31	74.94	HRM3-HadCM3 (future)
4	84.62	20.91	26.57	31.39	40.13	46.94	53.7	60.43	68.27	73.77	HRM3-HadCM3 (historical)
5	80.77	19.74	25.91	31.12	38.77	44.45	50.09	55.7	63.11	68.7	RCM3-CGCM3 (future)
6	76.92	19.29	25.36	30.96	37.48	42	46.49	51.61	58.59	63.87	RCM3-GFDL (future)
7	73.08	17.66	25.07	29.21	35.65	41	46.31	50.96	56.85	61.81	RCM3-CGCM3 (historical)
8	69.23	17.59	23.73	29.08	34.83	39.95	45.03	50.09	56.76	61.31	HRM3-GFDL (historical)
9	65.38	17.53	23.7	28.43	33.78	37.27	40.73	44.18	48.98	52.7	WRFG-CGCM3 (historical)
10	61.54	15.92	23.52	27.93	33.39	36.6	40.34	44.07	48.73	52.17	WRFG-CGCM3 (future)
11	57.69	15.59	23.08	27.75	32.83	36.49	39.91	43.58	48.44	52.1	WRFG-CCSM (future)
12	53.85	14.72	22.72	27.49	32.5	36.22	39.56	42.63	46.67	49.73	MM5I-HadCM3 (future)
13	50.00	14.31	22.47	26.71	31.3	34.71	38.09	41.46	45.9	49.26	MM5I-HadCM3 (historical)
14	46.15	14.25	21.23	24.96	29.68	33.18	36.65	40.11	44.68	48.13	WRFG-CCSM (historical)
15	42.31	14.23	20.22	23.87	28.47	31.89	35.28	38.66	43.12	46.49	MM5I-CCSM (future)
16	38.46	14.1	18.93	22.38	27.22	30.8	34.36	37.91	42.59	46.13	MM5I-CCSM (historical)
17	34.62	13.59	18.87	21.99	25.86	28.73	31.58	34.41	38.15	40.98	ECP2-HadCM3 (future)
18	30.77	12.78	18.56	21.92	25.78	28.64	31.48	34.32	38.05	40.87	ECP2-GFDL (future)
19	26.92	12.73	17.29	19.75	22.84	25.14	27.49	30.05	33.42	35.97	ECP2-GFDL (historical)
20	23.08	11.95	16.11	18.86	22.35	24.93	27.42	29.7	32.69	34.96	ECP2-HadCM3 (historical)
21	19.23	8.19	10.94	12.76	15.06	16.76	18.46	20.14	22.37	24.05	CRCM-CGCM3 (future)
22	15.38	5.96	8.56	10.29	12.47	14.09	15.69	17.29	19.4	21	CRCM-CGCM3 (historical)
23	11.54	5.9	7.9	9.22	10.89	12.13	13.36	14.58	16.2	17.42	CRCM-CCSM (future)
24	7.69	4.97	6.81	8.02	9.56	10.7	11.83	12.96	14.45	15.58	CRCM-CCSM (historical)
25	3.85	3.66	5.1	6.06	7.26	8.16	9.04	9.93	11.09	11.98	Observed
HUC: 2080202; Duration: 24 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability									Data Source for 1000-year
		2	5	10	25	50	100	200	500	1000	
		0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002	0.001	
1	96.15	13.05	17.89	21.09	25.13	28.13	31.11	34.07	37.99	40.95	HRM3-GFDL (future)
2	92.31	12.62	17.2	20.24	24.08	26.92	29.75	32.56	36.28	39.72	RCM3-GFDL (historical)
3	88.46	11.53	16.2	19.29	23.19	26.09	28.96	31.83	36.23	39.09	HRM3-HadCM3 (future)
4	84.62	11.02	13.96	16.46	21.04	24.59	28.1	31.61	35.6	38.46	HRM3-HadCM3 (historical)
5	80.77	10.42	13.61	16.33	20.31	23.26	26.19	29.1	32.95	35.86	RCM3-CGCM3 (future)
6	76.92	10.18	13.34	16.27	19.63	21.98	24.31	26.96	30.59	33.33	RCM3-GFDL (future)
7	73.08	9.33	13.18	15.32	18.67	21.45	24.21	26.63	29.69	32.28	RCM3-CGCM3 (historical)
8	69.23	9.3	12.49	15.28	18.25	20.91	23.55	26.18	29.65	32	HRM3-GFDL (historical)
9	65.38	9.27	12.49	14.92	17.73	19.54	21.34	23.14	25.61	27.54	WRFG-CGCM3 (historical)
10	61.54	8.43	12.39	14.67	17.49	19.17	21.12	23.05	25.51	27.3	WRFG-CGCM3 (future)
11	57.69	8.26	12.15	14.58	17.22	19.1	20.92	22.84	25.36	27.27	WRFG-CCSM (future)
12	53.85	7.81	11.96	14.46	17.06	19	20.69	22.28	24.38	25.96	MM5I-HadCM3 (future)
13	50.00	7.59	11.83	14.04	16.43	18.2	19.96	21.71	24.03	25.77	MM5I-HadCM3 (historical)
14	46.15	7.56	11.2	13.14	15.6	17.42	19.22	21.02	23.4	25.2	WRFG-CCSM (historical)
15	42.31	7.54	10.67	12.57	14.96	16.74	18.5	20.26	22.58	24.33	MM5I-CCSM (future)
16	38.46	7.48	10	11.79	14.3	16.16	18.01	19.86	22.29	24.13	MM5I-CCSM (historical)
17	34.62	7.22	9.96	11.59	13.6	15.09	16.57	18.05	19.99	21.46	ECP2-HadCM3 (future)
18	30.77	6.79	9.8	11.55	13.55	15.04	16.51	17.98	19.92	21.39	ECP2-GFDL (future)
19	26.92	6.78	9.15	10.42	12.04	13.23	14.46	15.78	17.54	18.86	ECP2-GFDL (historical)
20	23.08	6.37	8.53	9.97	11.78	13.12	14.42	15.6	17.16	18.34	ECP2-HadCM3 (historical)
21	19.23	4.42	5.84	6.78	7.97	8.85	9.73	10.6	11.76	12.63	CRCM-CGCM3 (future)
22	15.38	3.25	4.6	5.5	6.63	7.47	8.3	9.13	10.22	11.05	CRCM-CGCM3 (historical)
23	11.54	3.22	4.26	4.95	5.82	6.47	7.11	7.75	8.6	9.23	CRCM-CCSM (future)
24	7.69	2.74	3.7	4.33	5.13	5.72	6.31	6.89	7.67	8.25	CRCM-CCSM (historical)
25	3.85	2.05	2.87	3.41	4.1	4.61	5.12	5.62	6.29	6.79	Observed
HUC: 2080202; Duration: 48 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Rank	Pr (x ≤ X) Non-exceedance Probability (%)	Intensity (mm h^{-1}) for the Return Period or Exceedance Probability 2 / 0.5	5 / 0.2	10 / 0.1	25 / 0.04	50 / 0.02	100 / 0.01	200 / 0.005	500 / 0.002	1000 / 0.001	Data Source for 1000-year
1	96.15	8.56	11.69	13.77	16.4	18.34	20.28	22.2	24.74	26.66	HRM3-GFDL (future)
2	92.31	8.28	11.25	13.23	15.72	17.57	19.4	21.23	23.64	25.86	RCM3-GFDL (historical)
3	88.46	7.57	10.59	12.59	15.12	17	18.86	20.71	23.59	25.46	HRM3-HadCM3 (future)
4	84.62	7.24	9.14	10.76	13.74	16.04	18.32	20.6	23.16	25.01	HRM3-HadCM3 (historical)
5	80.77	6.85	8.92	10.69	13.27	15.19	17.09	18.98	21.48	23.37	RCM3-CGCM3 (future)
6	76.92	6.7	8.75	10.65	12.81	14.33	15.84	17.58	19.94	21.72	RCM3-GFDL (future)
7	73.08	6.15	8.65	10.03	12.2	14.01	15.8	17.34	19.34	21.05	RCM3-CGCM3 (historical)
8	69.23	6.13	8.19	10	11.94	13.67	15.38	17.09	19.32	20.82	HRM3-GFDL (historical)
9	65.38	6.1	8.19	9.77	11.59	12.77	13.94	15.11	16.68	17.93	WRFG-CGCM3 (historical)
10	61.54	5.57	8.13	9.61	11.43	12.52	13.78	15.03	16.65	17.81	WRFG-CGCM3 (future)
11	57.69	5.46	7.97	9.54	11.25	12.48	13.66	14.91	16.54	17.78	WRFG-CCSM (future)
12	53.85	5.16	7.85	9.47	11.16	12.42	13.51	14.54	15.9	16.93	MM5I-HadCM3 (future)
13	50.00	5.02	7.77	9.2	10.74	11.89	13.03	14.16	15.66	16.79	MM5I-HadCM3 (historical)
14	46.15	5	7.36	8.61	10.2	11.38	12.55	13.72	15.26	16.42	WRFG-CCSM (historical)
15	42.31	4.98	7.01	8.24	9.79	10.94	12.09	13.23	14.73	15.86	MM5I-CCSM (future)
16	38.46	4.94	6.58	7.74	9.38	10.59	11.79	12.99	14.57	15.77	MM5I-CCSM (historical)
17	34.62	4.78	6.56	7.61	8.91	9.87	10.83	11.79	13.04	14	ECP2-HadCM3 (future)
18	30.77	4.5	6.45	7.59	8.89	9.85	10.81	11.77	13.02	13.98	ECP2-GFDL (future)
19	26.92	4.49	6.02	6.85	7.89	8.67	9.47	10.33	11.47	12.33	ECP2-GFDL (historical)
20	23.08	4.22	5.62	6.55	7.73	8.6	9.43	10.2	11.21	11.97	ECP2-HadCM3 (historical)
21	19.23	2.96	3.88	4.49	5.26	5.83	6.39	6.96	7.7	8.26	CRCM-CGCM3 (future)
22	15.38	2.21	3.08	3.66	4.39	4.94	5.48	6.01	6.72	7.26	CRCM-CGCM3 (historical)
23	11.54	2.19	2.86	3.3	3.86	4.28	4.69	5.11	5.65	6.06	CRCM-CCSM (future)
24	7.69	1.88	2.49	2.9	3.42	3.8	4.19	4.57	5.07	5.44	CRCM-CCSM (historical)
25	3.85	1.45	2.03	2.42	2.91	3.27	3.63	3.99	4.46	4.82	Observed
HUC: 2080202; Duration: 72 hr		2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1000-year	

Xiaomin Yang

74401 Hovley Ln E, Palm Desert, CA 92260 | (804)528-8659 | xyang003@odu.edu

Education

Ph.D. | expected 2021 | Old Dominion University [Civil and Environmental Engineering]

Dissertation: Spatiotemporal Variations of Precipitation and Climate-Resilient Structure Design in Virginia

M.S. | 12/2014 | Old Dominion University [Civil and Environmental Engineering]

Thesis: Hydro-Climate Temporal Variations and Their Influences on Net Primary Production (NPP) in a Eurasian Steppe Watershed

B.S. | 05/2008 | Inner Mongolia University of Technology [Water Supply & Drainage Engineering]

Thesis: Analysis and Design of Urban Drainage System and Wastewater Treatment Plant: Orbal Oxidation Ditch Simultaneous Nitrification and Denitrification and Biological Phosphorus Removal Mechanism

Professional Experience

Jan 2018 – Present | Old Dominion University, Norfolk, VA

Graduate Research Assistant

- Analyzing the spatiotemporal trends of observed meteorological and hydrological variables / indices and downscaled GCM/RCM projections
- Assessing the availability of future streamflow using HEC-HMS model
- Assessing the impact of climate change on sustainability and resilience of hydraulic structures and communities
- Investigating geostatistical models and predicting spatial distributed Hydrological and meteorological data

Jan 2015 – Dec 2017 | Draper Aden Associates, Richmond, VA

Civil Engineer

- Applying ArcGIS and CAD on subsurface powerline
- Analyzing various geotechnical and physiographical data

Aug 2012 – Dec 2014 | Old Dominion University, Norfolk, VA

Graduate Research Assistant

- Statistically modeling /assessing for Hydrological and meteorological data
- Utilizing ArcGIS to manage, analysis, and present soil, NPP, and so on
- Used SWAT (ArcSWAT) to predict the impact of land management practices on water, sediment, and agricultural yields in an arid-semiarid watershed over 50 years

Computer Skills and Models

R; SAS; ArcGIS; AutoCAD; Visual Basic; SWAT; MODFLOW-2005; HEC-HMS; HEC-RAS

Licenses and Certifications

- Engineer in Training (E.I.T.) (since 2016); Notary Public in Virginia (since 2016); OSHA 10 Hour Outreach Training Program: Construction (since 2015)

Publications

- **Yang, X.**, Wang, X., Cai, Z. and Cao, W. (2021) Detecting spatiotemporal variations of maximum rainfall intensities at various time intervals across Virginia in the past half century. *Atmospheric research* 255, 105534. Available at: https://www.sciencedirect.com/science/article/pii/S0169809521000867.
- Wang, X., R. Gao, and **X. Yang**. (2021) Responses of soil moisture to climate variability and livestock grazing in a semiarid Eurasian steppe. *Science of The Total Environment* 781, 146705 Available at: https://www.sciencedirect.com/science/article/pii/S0048969721017733.
- Wang, X., **X. Yang**, and Z. Cai. 2019. *Next-Generation Rainfall IDF Curves for the Virginian Drainage Area of Chesapeake Bay*. Final Report to the Strategic Environmental Research and Development Program (SERDP). 293pp.
- Wang, X., **X. Yang**, T. Liu, F. Li, R. Gao, L. Duan, and Y. Luo. 2014. Trend and extreme occurrence of precipitation in a mid-latitude Eurasian steppe watershed at various time scales. *Hydrological Processes* 28(22): 5547-5560. doi: 10.1002/hyp.10054.
- Wang, X., T. Liu, F. Li, R. Gao, **X. Yang**, L. Duan, Y. Luo, and R. Li. 2014. Simulated soil erosion from a semiarid typical steppe watershed using an integrated aeolian and fluvial prediction model. *Hydrological Processes* 28(2): 325-340. doi: 10.1002/hyp.9579.
- Wang, X., and **X. Yang**. 2018. Development of next-generation rainfall IDF curves. Abstract #: H232R-2210. Presented (in poster) at *AGU Fall Meeting 2018*, Washington D.C., USA, December 10-14, 2018.
- **Yang, X.**, and X. Wang. 2018. Estimation of station mean annual precipitation using geostatistical techniques. Abstract #: H221-06. Presented (in oral and poster) at *SERDP & ESTCP Symposium 2018: Enhancing DoD's Mission Effectiveness*, Washington D.C., USA, November 27-29, 2018.
- Wang, X., **X. Yang**, and Z. Cai. 2019. Next-generation rainfall IDF curves for the Virginian drainage area of Chesapeake Bay. Presented (in oral) on the *Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) Webinar Series*, March 14, 2019. https://www.serdp-estcp.org/Tools-and-Training/Webinar-Series/03-14-2019.

Ongoing Manuscripts

- **Yang, X.**, and X. Wang. In review. Scrutinizing characteristics of historical precipitation across commonwealth of Virginia: implications of climate change. *Climate Change.*
- **Yang, X.**, X. Wang, and Z. Cai. in review. Performances of four geostatistical techniques in estimating mean annual precipitation. *Journal of Hydrologic Engineering*.
- **Yang, X.**, H.J. Taghadomi, and X. Wang. in preparation. Development of next-generation IDF curves for resilience engineering design in changing clime. *Journal of Hydrology*.

Honors

- Excellent GTA/GRA Awards ($100) | 2021
- First Class of CEE Graduate Enhancement Award ($2000) | Fall 2019
- ODU Graduate Student Travel Award ($500) | 2013