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*Published in:*
Geophysical Research Abstracts

*Publication date:*
2012

*Document Version*
Publisher's PDF, also known as Version of record

Geophysical Research Abstracts
Vol. 14, EGU2012-7261, 2012
EGU General Assembly 2012


# Extreme and mean rainfall differences in observational data used as reference in climate studies

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The number of climate studies addressing changes in properties of extreme rainfall events has increased in recent years. These studies consider many different indices to characterize extreme rainfall. Indices ranging from the 75th up to 99th percentile of daily rainfall are widely found in the literature, with the lower percentiles sometimes referred to as "moderate extremes". Climate studies often use these indices to compare observations and climate models for evaluating the performance and bias of the models. In this context the characteristics of the observational data is of major importance, but often a single set of data is used for comparison and assumed to be completely correct.

In the present study mean and extreme indices are calculated for different sets of observational data with distinctly different properties with respect to smoothening and averaging. The study is based on five datasets covering Denmark: two datasets based on point measurement station networks; two gridded datasets; and one reanalysis dataset. We study the increase of the dissimilarities between these data sets when going from mean indices to more extreme indices. The extreme indices are highly dependent on the level of averaging in the observations and, thus, show a decreasing trend from pure observations to gridded data to reanalysis data, this smoothening effect is considered in relation to the spatial scale of the observations. Additionally, the study isolates to what level of "moderate extremes" the effect of the type of observational data is significant regarding data properties and methods developed for mean indices which may not be suitable for extremes. The implications of going from point scale to the gridded scale of climate models are highlighted. The study stresses the need for climate impact modellers to consider the indices evaluated and choose appropriate observational data when conclusions are drawn.