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Downscaling from daily to subdaily rainfall through regression based on large-scale atmospheric variables

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Urban hydrology studies usually require observed rainfall information of high temporal resolution (1 h or less) (Smith et al., 2007) for derived flood frequency analysis, infrastructure design or risk assessments (Arnbjerg-Nielsen et al., 2013). However, rainfall stations with hourly resolution are more sparse than daily rainfall stations, and in most studies, no rainfall information is available at subdaily resolution.

There are different solutions to address the problem of rainfall temporal downscaling such as the point process theory (Rodriguez-Iturbe et al., 1987) or assuming some temporal scaling behavior of the rainfall statistics (Marani and Zanetti, 2007). However, while in the first approach it is advisable to include the subdaily rainfall properties in the calibration process to improve the quality of the simulated synthetic subdaily rainfall series (Cowpertwait et al 1996), the second one is only appropriate for specific rainfall regimes or climates.

The goal of the present work is to provide subdaily rainfall series at locations where only daily rainfall series are available. Our work extends the methodology carried out by Beuchat et al., 2011 to other climatic regimes. The methodology is based on seeking relationships between target subdaily rainfall statistics and available predictors, including daily rainfall statistics and large-scale atmospheric variables. Then the predicted subdaily statistics are included in the calibration process to improve the skill of the point process models to simulate synthetic subdaily series.

As a result, we validate the skill of the methodology in other climatic regimes and also, in order to improve the results, we tests different regression methods and reanalysis databases. The results show the power of the methodology to simulate synthetic subdaily rainfall series.

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References

1. Arnbjerg-Nielsen, K., Willems, P., Olsson, J., Beecham, S., Pathirana, A., Bülow Gregersen, I., Madsen, H., Nguyen, V.-T.V. Impacts of climate change on rainfall extremes and urban drainage systems: A review (2013) Water Science and Technology, 68 (1), pp. 16-28.
2. Beuchat, X., Schaefli, B., Soutter, M., Mermoud, A. Toward a robust method for subdaily rainfall downscaling from daily data (2011) Water Resources Research, 47 (9), art. no. W09524.
3. Cowpertwait, P.S.P., O’Connell, P.E., Metcalfe, A.V., Mawdsley, J.A. Stochastic point process modelling of rainfall. II. Regionalisation and disaggregation (1996) Journal of Hydrology, 175 (1-4), pp. 47-65.
4. Marani, M., Zanetti, S. Downscaling rainfall temporal variability (2007) Water Resources Research, 43 (9), art. no. W09415.
5. Rodriguez-Iturbe, I., Cox, D.R., Isham, Valerie. Some models for rainfall based on stochastic point processes. (1987) Proceedings of The Royal Society of London, Series A: Mathematical and Physical Sciences, 410 (1839), pp. 269-288.
6. Smith, J.A., Baeck, M.L., Meierdiercks, K.L., Miller, A.J., Krajewski, W.F. Radar rainfall estimation for flash flood forecasting in small urban watersheds (2007) Advances in Water Resources, 30 (10), pp. 2087-2097.