



Temporal synthesis of long continuous precipitation series for unobserved locations

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In order to optimize the design and operation of urban drainage systems, long and continuous rain series in a high temporal resolution are essential. Unfortunately, available observations with such resolutions are usually limited and it is therefore convenient to develop a stochastic precipitation model to generate long time series in locations without observations.

The precipitation model proposed is based on an alternating renewal framework and consists of two structures: external and internal. The components of these structures are described by probability distributions. Different regionalization methods based on descriptors of the locations are presented which are used for estimating the components of the external structure. A multiple linear regression analysis is performed based on the descriptors for this purpose. Alternatively, the descriptors are used for clustering stations and performing regional frequency analysis based on each cluster. Descriptors are as well combined using vine-copulas which result in high flexibility to reproduce different dependence structures.

The state of Lower-Saxony and surrounding areas, located in the north-west of Germany is used to test the different methods. A total of 81 rainfall stations with high temporal resolution records, i.e. rainfall data every 5 minutes, are used for this purpose. The length of the available data ranges from 6 to 20 years. The descriptors include information available for the whole country like: position, topography and hydrometeorologic characteristics which are estimated from long term observations.

The methods are compared by cross validation of different rain statistics. Given that the model is stochastic the evaluation is performed on the basis of ensembles of many long synthetic time series which are compared with observed ones. Uncertainties are as well considered in the analysis. The results show a good representation of the seasonal variability, good performance in reproducing the sample statistics of the rainfall characteristics. Advantages and disadvantages of the different proposed regionalization methods are presented and discussed.

Keywords: regionalization, stochastic precipitation, copulas, continuous simulation, high temporal resolution