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Generation of synthetic precipitation in the context of hydraulic engineering

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For many applications in hydraulic engineering tasks long term precipitation time series in a high resolution and with a good quality are necessary. However, measured precipitation time series that fulfill all these requirements are rarely available. Synthetic precipitation time series may be a solution to generate precipitation where measurements are lacking.
A data driven, stochastical approach to simulate synthetic precipitation is applied in this study. The approach uses statistical properties of measured data in order to set up an initial synthetic time series as well as its optimization. In a first step the initial time series is created with the desired marginal distribution, but a random temporal order. In a second step, single values of the initial time series are randomly swapped, until the statistics of the synthetic time series describing the temporal structure fit to the target statistics of measurements. With this approach the optimization of almost any statistic of the time series is possible.
Due to the complexity of precipitation, synthetic precipitation time series cannot reflect all the properties of natural precipitation correctly. However, this is not the major task as synthetic time series only have to represent statistics that are relevant for subsequent applications. Depending on the considered problem the necessary statistics of the precipitation time series might be different. For example, for questions concerning dimensioning sewer networks mostly high precipitation events are important, whereas for planning or optimizing combined sewer systems also small and medium events have to be considered.
In this study it will be shown, that a statistical analysis of some common parameters of synthetic precipitation may not be sufficient to show the applicability for a certain task. In fact, the important statistics of precipitation time series for the given problem have to be identified. It can be further shown, that as soon as these statistics are identified and correctly reproduced in synthetic time series, the results of subsequent applications can be improved.