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Comparison of different synthetic 5-min rainfall time series regarding their suitability for urban drainage modelling

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For the design and operation of urban drainage systems with numerical simulation models, long, continuous precipitation time series with high temporal resolution are necessary. Suitable observed time series are rare. As a result, intelligent design concepts often use uncertain or unsuitable precipitation data, which renders them uneconomic or unsustainable. An expedient alternative to observed data is the use of long, synthetic rainfall time series as input for the simulation models. Within the project SYNOPSE, several different methods to generate synthetic precipitation data for urban drainage modelling are advanced, tested, and compared.

The presented study compares four different approaches of precipitation models regarding their ability to reproduce rainfall and runoff characteristics. These include one parametric stochastic model (alternating renewal approach), one non-parametric stochastic model (resampling approach), one downscaling approach from a regional climate model, and one disaggregation approach based on daily precipitation measurements. All four models produce long precipitation time series with a temporal resolution of five minutes. The synthetic time series are first compared to observed rainfall reference time series. Comparison criteria include event based statistics like mean dry spell and wet spell duration, wet spell amount and intensity, long term means of precipitation sum and number of events, and extreme value distributions for different durations. Then they are compared regarding simulated discharge characteristics using an urban hydrological model on a fictitious sewage network. First results show a principal suitability of all rainfall models but with different strengths and weaknesses regarding the different rainfall and runoff characteristics considered.