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Capabilities of stochastic rainfall models as data providers for urban hydrology

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For planning of urban drainage systems using hydrological models, long, continuous precipitation series with high temporal resolution are needed. Since observed time series are often too short or not available everywhere, the use of synthetic precipitation is a common alternative. This contribution compares three precipitation models regarding their suitability to provide 5 minute continuous rainfall time series for a) sizing of drainage networks for urban flood protection and b) dimensioning of combined sewage systems for pollution reduction. The rainfall models are a parametric stochastic model (Haberlandt et al., 2008), a non-parametric probabilistic approach (Bárdossy, 1998) and a stochastic downscaling of dynamically simulated rainfall (Berg et al., 2013); all models are operated both as single site and multi-site generators. The models are applied with regionalised parameters assuming that there is no station at the target location. Rainfall and discharge characteristics are utilised for evaluation of the model performance. The simulation results are compared against results obtained from reference rainfall stations not used for parameter estimation. The rainfall simulations are carried out for the federal states of Baden-Württemberg and Lower Saxony in Germany and the discharge simulations for the drainage networks of the cities of Hamburg, Brunswick and Freiburg. Altogether, the results show comparable simulation performance for the three models, good capabilities for single site simulations but low skills for multi-site simulations. Remarkably, there is no significant difference in simulation performance comparing the tasks flood protection with pollution reduction, so the models are finally able to simulate both the extremes and the long term characteristics of rainfall equally well.

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