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A hybrid hourly Rainfall Model for derived Flood Frequency Analysis

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For derived flood frequency analysis based on hydrological modelling long continuous precipitation time series with high temporal resolution are needed. Often, the observation network with recording rainfall gauges is poor, so stochastic precipitation synthesis is a good alternative. Here, a hybrid two step procedure is proposed to provide suitable space-time precipitation fields as input for hydrological modelling. First, a univariate alternating renewal model is adapted to simulate independent hourly precipitation time series for several locations. In the second step a multi-site resampling procedure is applied on the synthetic point rainfall series to reproduce the spatial dependence structure of rainfall. The model is developed for precipitation synthesis in the 3200 km^2 Bode river basin located in the Harz Mountains in Northern Germany. The alternating renewal model describes wet spell durations, dry spell durations and wet spell amounts using univariate frequency distributions separately for two seasons. The dependence between wet spell amount and duration is accounted for by 2-Copulas. For disaggregation of the wet spells into hourly intensities a predefined profile is used. Posterior resampling is carried out successively on all synthetic point time series using simulated annealing with an objective function considering several bivariate spatial rainfall characteristics. Finally synthetic precipitation is used as input to a hydrological model and applied for derived flood frequency analysis in two mesoscale subcatchments of the Bode river basin. The results show good performance in reproducing average and extreme rainfall characteristics as well as in reproducing observed flood frequencies. However, they show also that it is important to consider explicitly the specific rainfall network used for calibration of the hydrological model

in precipitation modelling.