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Estimating extreme Floods using disaggregated Rainfall Time Series and continuous Rainfall Runoff Modelling

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For the dimensioning of hydraulic structures design floods of different frequencies are necessary. Usually, long time series of observed discharge maxima are statistically analysed to obtain those values. If observed flow series do not exist or are too short a “derived flood frequency analysis” can be carried out using continuous rainfall runoff modelling. However, this requires long time series of observed rainfall data with hourly or higher resolution. Often, only daily rainfall data with sufficient spatial and temporal coverage are available. One idea, which is investigated in this paper, is the stochastic disaggregation of daily rainfall to hourly values providing input for the subsequent modelling process.

Some mesoscale subcatchments of the Bode river basin in Germany with drainage areas between 20 km^2 and 200 km^2 were used as study region. First, hourly and daily data of observed rainfall and discharge were utilised to calibrate and validate a conceptual hydrological model over short periods of four and three years, respectively. Then, long term daily rainfall is disaggregated to hourly values using a multiplicative random cascade model. These disaggregated rainfall data were used as input for the rainfall runoff model to simulate continuous discharge. The performance of the approach is assessed by comparison of extreme value statistics from observed and simulated flows.