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Spatial representation of stochastically generated rainfall for derived flood frequency analysis

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For derived flood frequency analyses, stochastic rainfall models can be linked with rainfall-runoff models to improve the accuracy of design flood estimations when the length of observed rainfall and runoff data is not sufficient. The stochastic rainfall time series, which are used as input for the rainfall-runoff model, can be generated with different spatial resolution: (a) Point rainfall, which is stochastically generated rainfall at a single site. (b) Areal rainfall, which is catchment rainfall averaged over multiple sites before using the single-site stochastic rainfall model. (c) Multiple point rainfall, which is stochastically generated at multiple sites with spatial correlation before averaging to catchment rainfall. To find the most applicable spatial representation of stochastically generated rainfall for derived flood frequency analysis, simulated and observed runoff time series will be compared based on runoff statistics. The simulated runoff time series are generated utilizing the rainfall-runoff model HBV-IWW with an hourly time step. The rainfall-runoff model is driven with point, areal and multiple point stochastic rainfall time series generated by an Alternating Renewal rainfall model (ARM). In order to take into account the influence of catchment size on the results, catchments of different sizes within Germany are considered in this study. While point rainfall may be applicable for small catchments, it is expected that above a certain catchment size a more detailed spatial representation of stochastically generated rainfall is necessary. Here, it would be advantageous if the results based on areal rainfall are comparable to those of the multiple point rainfall. The stochastically generation of areal rainfall is less complex compared to the stochastically generation of multiple point rainfall and extremes at the catchment scale may also be better represented by areal rainfall.