Modelling of hourly Point Rainfall using an Alternating Renewal Model with 2-Copulas for derived Flood Frequency Analysis

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Sufficiently long-term observed precipitation series with a high temporal resolution are required for continuous long-term hydrological simulations. These data are rarely available, so stochastic precipitation is an alternative. Our purpose is to generate stochastic series of hourly point rainfall which can be used as input for rainfall runoff models to obtain design flows through derived flood frequency analysis.

Starting point for precipitation synthesis is an Alternating Renewal model based on univariate frequency distributions for dry spell duration, wet spell duration and wet spell amount. The dependence of wet spell duration and wet spell amount is described using 2-Copulas. This paper shows the importance of linking these two variables in precipitation synthesis to generate extreme values. Different synthetic precipitation series – (a) with and (b) without consideration of the dependence structure of wet spell duration and wet spell amount are generated.

These different synthetic precipitation data are then used for continuous rainfall runoff modelling for derived flood frequency analysis. The investigations are carried out for a mesoscale subcatchment of the river basin in Central Germany. For rainfall runoff modelling the conceptual hydrological model HEC-HMS is used.

The performance of the precipitation inputs is assessed by comparison of extreme value statistics from observed and simulated precipitation values and flows.