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Effect of different temporal rainfall disaggregation methods on derived flood frequency analysis

Hannes Müller and Uwe Haberlandt
Germany (mueller@iww.uni-hannover.de)

Flood statistics can be determined by continuous rainfall runoff modelling and analyzing the simulated discharge results. To use these hydrological models rainfall data in high temporal resolution is required. Observed time series of this kind are very short in most cases, so they cannot be used for flood statistics. Contrary to this, time series with lower temporal resolution (daily measurements) exists for much longer periods. Different information from high resolution time series e.g. the average duration of rainy periods, typical diurnal courses or more complex statistical features can be utilized for disaggregating the lower resolution time series. Using these disaggregated time series in rainfall runoff modelling can provide results comparable with observed time series.

In this work different methods for disaggregating daily precipitation values are evaluated. These methods are a) a disaggregation in 24 uniform one-hour-values, b) a mean diurnal course of the daily precipitation considering four seasons, c) a mean rainfall duration per day considering four seasons (implementation in three different ways) and d) a disaggregation using a random cascade-model (implementation in two different ways). Three mesoscale catchments located in northern Germany are used as study areas. Continuous rainfall runoff modelling over a period of 50 years is carried out using the conceptual model HEC-HMS. Flood statistics for all catchments resulting from the different methods of precipitation disaggregation, are analyzed and compared.

The comparison of the flood statistics shows that the choice of the disaggregation method is essentially for the quality of a design flood. The design floods of every catchment vary strongly depending on the chosen disaggregation method. By comparing simulated and observed flood statistics conclusions about the best disaggregation method can be drawn.