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Temporal rainfall disaggregation: from point disaggregation to spatial rainfall

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Rainfall time series with a high temporal resolution are needed in many hydrological and water resources management fields. Observed time series of this kind are very short in most cases, so they cannot be used. Contrary to this, time series with lower temporal resolution (daily measurements) exists for much longer periods. The objective is to derive time series with a long duration and a high resolution by disaggregating time series of the non-recording stations with information of time series of the recording stations.

The multiplicative random cascade model can be used for temporal rainfall disaggregation of daily time series, whereby two versions are used to generate time series with hourly resolution. Time-series of different stations are disaggregated without consideration of other surrounding stations. This yields in unrealistic spatial pattern of rainfall events. With a simulated annealing algorithm relative diurnal cycles of the disaggregated time-series are resampled with the aim to reproduce spatial dependence of rainfall. Investigation areas are two catchments in Northern Germany with up to eight recording rainfall stations.

The results show that the spatial rainfall characteristics can be reproduced by the simulating annealing algorithm, though with increasing number of stations the reproduction performance declines. A comparison of the resulting areal rainfalls for different catchments is another possibility to proof the implementation of spatial consistence. The duration curves of areal rainfall show underestimation if calculated from disaggregated and not annealed time series. After the annealing the duration curves fit better. Also observed extreme values are well represented by the median of the annealed time series.