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A regional approach for subdaily extreme rainfall estimation – a case study in Northern Germany

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Estimates of extreme rainfall are crucial for water resources engineering and risk assessment. A regional analysis enhances estimation for observed locations and enables estimates for unobserved locations. Due to the high temporal variability of extreme rainfall, return periods should be estimated for different durations, including subhourly durations for urban areas. Based on the index-method with L-moments (Hosking & Wallis, 1997), this work uses the generalized extreme value distribution (GEV) and geostatistical interpolation techniques to estimate the design rainfall for any return period and any duration equal or greater than the observation time step at any point within a homogeneous region. To unify the procedure and reduce the working capacity, one index, the mean hourly annual maximum precipitation, is used for all durations up to 24 hours. To guarantee that for the same return level the rainfall depth increases with increasing duration, local L-moments are approximated by simple functions of the duration.

The regional frequency analysis of extreme rainfall was evaluated in Lower Saxony, located in Northern Germany, on a grid with an extent of 338 km x 308 km and 1 km resolution. The grid includes 169 stations with at least 10 years measurements of 1min rainfall. In addition, 19 stations provide 5min summer rainfall from 1950 to 2010, which are used for cross validation. Compared to available design rainfall for this region, the new approach achieves better results.