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Comparing extreme precipitation between data from rain gauges, weather radar and high-resolution climate models

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The representation of extreme precipitation at small spatio-temporal scales is of major importance in urban hydrology. The present study compares observations from tipping bucket gauges and a C-band radar to two sets of re-analysis climate model output data for a historic period of 14 years where there is full spatial and temporal overlap between datasets. The reanalysis data are based on models with different parametrizations and spatio-temporal resolutions, one being a “convective-permitting” model while the other uses a convective parametrization scheme to account for convective rainfall. The study focuses on an area of approximately 100 by 150 km.

The datasets are compared with respect to seasonality of occurrence, intensity levels and spatial structure of the extreme events. All datasets have similar seasonal distributions, and comparable intensity levels. There are, however, clear differences in the spatial correlation structure of the extremes. Seemingly, the radar data is best representation of a “real” spatial structure for extreme precipitation, even though challenges appear in data when moving far from the physical radar. The spatial correlation in point observations is a valid representation of the spatial structure of extreme precipitation. The convective-permitting climate model seem to represent the spatial structure of extreme precipitation much more realistically, compared to the coarser convective parameterized model. However, improvement could be made for the shortest durations and smallest spatial scales.