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Impact of using moving rain events as input for numerical urban flood simulations

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The simulation of pluvial urban flood events is often based on time series of spatially uniformly distributed rain events. The aim of the present study is to investigate the impact of temporally and spatially variable rain events ('moving' rain events) on the flood volume. Therefore, a method to generate moving rain events from gauge data was developed and tested in a case study on a smaller urban catchment. The moving rain events are generated on a spatial grid with one kilometre resolution, which is the spatial resolution of the radar based rainfall prediction in Germany. In order to ensure the comparability of results to those of a non-moving rain scenario, the rain volume in the whole catchment is maintained and the time series at location of the rain gauge are the same in the moving and in the static event. In the current implementation of the approach, wind directions from north, south, east and west are tested. The generated moving rain events were used as input for the coupled 1D/2D pipe flow and surface flow model HYSTEM-EXTRAN 2D.

The tested rain events had return periods in a range from 10 to 20 years. Generally, results from the moving rain and the static rain scenarios differ. First results have shown a difference in peak of flood volume of more than 40 percent comparing different wind directions. The big difference is due to inhomogeneity in building density and the drainage direction of the pipe network. The difference of the time of the peak of flood volume never exceeded five minutes. The highest flood volumes occurred with moving direction of the rain event equal to the drainage direction of the pipe network. These first results from the case study leading to the conclusion that moving rain events instead of static rain events should be used as input for realistic urban flood simulations.