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Benefit of merging precipitation from rain gauges and radar for event based and continuous simulations of floods

A. Verworn and U. Haberlandt

Leibniz University of Hannover, Institute of Water Resources Management, Hydrology and Agricultural Hydraulic Engineering, Hannover, Germany (a.verworn@iww.uni-hannover.de)

Several merging methods combining radar or satellite data with gauge data have been developed in order to make available better input data for distributed hydrological modelling. However, in many studies the performance of the merging methods is only validated using precipitation data, while the benefit of using improved precipitation estimation for hydrological modelling is not evaluated.

In this study the objective was to test the hypothesis that better rainfall data according to precipitation cross-validation should enable a better simulation of floods. For interpolation different methods of varying complexity were chosen: the nearest neighbour method as the simplest one, ordinary kriging as standard geostatistical approach and kriging with external drift (KED) as a more sophisticated geostatistical method merging point observations with weather radar data. The investigations were conducted on the basis of 12 flood events caused by precipitation with different characteristics as well as continuous simulations over a period of four years. For hydrological modelling the raster-based runoff and water balance simulation model WaSiM-ETH with the topmodel approach was chosen. Hydrological modelling was conducted on an hourly time step for three mesoscale catchments with diverse physiographic characteristics and rainfall network configurations located on the foothills of the Harz Mountains.

According to precipitation cross-validation the most complex interpolation method KED using radar rainfall intensities as additional information was the best interpolation method by far. Regarding the simulation of floods though, a general improvement for all cases could not be detected. Only for specific events and time periods, always additionally dependent on the catchment, advantages could be achieved.