Propagation of radar rainfall uncertainty through urban hydraulic models

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This work discusses the implementation of a stochastic generator of radar rainfall fields for the simulation of sewer flows within the drainage system of a small urban area in North-West England. Weather radars provide valuable information to use in hydrology, due to the high spatial and temporal resolution of available radar rainfall records. However, various sources of error affect the accuracy of radar rainfall estimates, despite the application of quality control and correction techniques.

This work addresses the uncertainty affecting radar rainfall estimates through the generation of radar ensembles. The ensembles represent a number of equally likely rainfall fields informed by the spatial and temporal structure of the radar error assessed with reference to rain gauges measurements. The radar ensembles provide a probabilistic estimate of the rainfall field and are implemented to drive a deterministic nowcasting model, in order to propagate the uncertainty into short-term (0-6 hours) forecasts of rainfall. The system has already been calibrated and implemented using radar rainfall records made available by the UK Met Office and raingauges records from a large number of tipping bucket gauges. The chain of models implemented for this work is completed by a hydrodynamic model of the sewer network of the study area, which is used to model the rainfall-runoff process in the urban area and ultimately calculates the flow through the sewer conduits using rainfall as input.

Building on previous results of the implementation of radar ensembles for probabilistic urban flow predictions, this work focuses on expanding the range of applicability of the probabilistic system by implementing the radar ensembles for nowcasting, in order to extend the lead time of the sewer flow predictions and to use the radar uncertainty informing the ensembles to assess the feasibility of a nowcasting method for real-time management applications in small urban areas.