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Rain Gauge and Radar Rainfall Information for Urban Flash Flood Analysis

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ABSTRACT

Convective storms often lead to intense rainfall concentrated in local areas that overwhelms the drainage capacity and causes flash flooding. Such events are difficult to capture by scattered rain gauges, while the rainfall radar could provide a viable alternative to get the required precipitation information. However, the observations from rain gauges and radar often disagree with each other and efforts have been made to get a better estimation via blending the radar and rain gauge information.

In general, the radar rainfall measurements are calibrated with rain gauge observations such that the records of the both datasets are consistent. Nonetheless, the spatiotemporal variations of convective rainfall events are rapid and difficult to capture by sparse rain gauges. In that case, the calibration using the rain gauge data that are outside the track of the rain storm may underestimate the radar rainfall.

The paper presents such a convective event for which the radar observations offered good representation of spatiotemporal pattern of rainfall distributions, but not for the magnitude. The rainfall concentrated in a local area that official rain gauges did not record the event. Fortunately, two additional rain gauges provided extra information such that the rain gauge observations were used to calibrate the radar rainfall estimation.

The rainfall data were then applied to simulate a flash flooding event in Exeter, UK. The spatiotemporal varied rainfall was used as the input to the hydraulic model to reconstruct the flood event via numerical modelling. The constant infiltration rate was used to reflect the capacity of the storm drainage network. The flood modelling results using the non-uniform rainfall showed better agreement to the flood records. Furthermore, the function of drainage network was also found to play a critical role during the event.