4.8 INVESTIGATING THE SENSITIVITY OF HYDROLOGICAL RESPONSE MODELLING TO CRITICAL RAINFALL AND CATCHMENT SCALES IN THE (SEMI-)URBANISED CHARLOTTE AREA

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Hydrological response is mainly influenced by the interactions between rainfall variability in space and time and catchment characteristics. These aspects are relevant especially in urban areas, where runoff generation is fast, due to the high degree of imperviousness. For this reason, it is necessary to use high resolution rainfall data to investigate and predict the hydrological response of an urban system. In the last decades, new technologies and instruments have been developed and improved to capture the rainfall variability in space and time at a high resolution. This has led to an increased use of rainfall data derived from weather radars for urban hydrological applications. At the same time, many studies focused on the development of distributed models, that can represent the system with high resolution. However, the interactions between rainfall and catchment scale and their influence on the sensitivity of hydrological response to small-scale variability remain poorly understood. In this study, we aim to identify critical scales of rainfall variability in time and space and catchment characteristics that determine the sensitivity of hydrological response for the Charlotte metropolitan area (North Carolina, USA). The watershed of Little Sugar Creek (111km2) was chosen as study case and a physically-based distributed model was used to predict the hydrological response of the system. Twenty-five storm events were selected from a 15-year (2001 2015) high-resolution (15 min, 1 km^2) radar data set, measured from the National Weather Service (NWS) Next Generation Radar network (NEXRAD). To investigate hydrological response sensitivity to different combinations of spatial and temporal rainfall resolutions, rainfall events were aggregated in space (3 km^2 and 6 km^2) and time (30 min and 60 min). The selected rainfall events were used as input for the hydrological model and the simulated flow at the output of the catchment was compared with local measurements. To classify the rainfall events, we analysed the variability in space and time of the storm core. A cluster classification was applied, identifying the main storm core dimension above selected thresholds at each time step and evaluating the variability of the main cluster during the rainfall event. In a previous synthetic study, three dimensionless parameters were introduced to define the interaction between rainfall and basin scale and their effects on the urban hydrological response sensitivity. The applicability of these parameters to different catchment scale was investigated and validated with the use of local flow measurements. Preliminary results suggest that cluster classification can be a valid instrument to characterize rainfall variability.