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Sensitivity of urban hydrodynamic modelling to high resolution radar rainfall

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Since the early 90's, the need to improve the spatial and temporal resolution of rainfall estimates has been emphasised. Urban hydrological applications require high resolution rainfall inputs matching rapid response times of such catchments. With the advent of new radar technology, urban hydrologists nowadays have access to highly accurate rainfall estimates to drive their models. High resolution rainfall products are provided by dual polarimetric X-band radars, which retrieve rainfall rates at 1 min temporal resolution and 30 m spatial resolution. This study attempts to characterise sensitivity of hydrologic response to high resolution weather radar rainfall input for hydrodynamic models at urban scale. Spatial resolutions of both rainfall input and hydrologic units are of the order of 100 meters. Rainfall rates derived from X-band polarimetric weather radar are used as input into a detailed hydrodynamic sewer model for an urban catchment in Rotterdam, The Netherlands. Rainfall data of two storms, one convective and one stratiform, at different spatial resolutions, are used to analyse the effect of precipitation data resolution on simulated in-sewer water levels as well as runoff peaks. Dimensionless parameters are derived to analyse the effect of rainfall resolution in relation to storm and catchment properties. Simulation results are first analysed in relation to 'storm redistribution' induced by spatial precipitation sampling: storm correlation distance is compared to rainfall resolution and the effect on hydrodynamic model results is discussed. Sensitivity of hydrodynamic model results to storm redistribution will be discussed for varying positions throughout the catchment and dependent on localisation of convective storm cells.