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Uncertainty 1D-2D Coupled Models for Flash Flood Simulation with different rainfall boundary conditions (Kulmbach case study)

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Flash floods occurring in urban areas have the potential to cause huge damage. Therefore, accurate simulation on flashfloods can identify areas at higher risk for reducing future losses. Hydrodynamic approaches have been applied for modelling flash floods. In particular, coupled hydraulic models have developed for urbanized areas. While 1D-drainage models are used to model the sewer drainage, 2D models are essential for modelling the overland flow. Coupling the two (i.e. also termed dual-drainage coupled models) offer the ability to simulate the bidirectional water exchange in drainage and surcharge conditions [1]. Despite recent advances, there are still large sources of uncertainties regarding the application of such models [2]. One of those is the definition of the rainfall boundary conditions. 1D-2D coupling model is obviously closer to the reality than pure 2D models. However some interfaces such as street gullies, drainage gutters and downpipes from roofs are often badly documented from the raw-data. On the other hand, street gutters and sidewalks act as conducts or open-channels, transferring and redirecting large amount of water along the streets. The uncertainty of those aspects is closely related to the rainfall boundary conditions.

In this study, four different model variants are simulated and compared for the three events: one pure 2D-surface model and three 1D-2D coupling model with different rainfall boundary conditions. By comparisons in different scales (catchment or streets) over different coupling interfaces, we will quantify its uncertainties for the rainfall boundary conditions. Our study is conducted in the catchment level of the German city of Kulmbach. We use the diffusive wave 2D model PDWave for our surface run-offs and 1D model EPA-SWMM for sewer networks [2].

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2. Leandro, J., Schumann, A., and Pfister, A. (2016). A step towards considering the spatial heterogeneity of urban key features in urban hydrology flood modelling. J. Hydrol., Elsevier, 535 (4), 356-365.