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Integrated Multiscale Urban Flood Modeling with Drainage pipe system

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The integrated multiscale urban flood model (IMUFlood Model) is developed to incorporate the hydrologic influence of rainfall-runoff, and surface and sewer pipe interaction in a grid-size varying scheme for urban flooding. The aim of the research is to solve the calculation of the multiscale integrated relationship between the watershed-scale flood routing to urban domain-scale inundation, and the flow interaction between the surface and drainage pipe system. The integration was performed by applying kinematic equation on the coarser-resolution watershed grid and 2D shallow water equation on the higher-resolution urban inundation domain. Likewise, the surface and subsurface interaction are calculated in the storm drain inlets using weir and orifice equations and the flow within the pipe system was estimated using Priessmann slot model discretized in finite volume and Euler Method. The flood extent and depth are validated for an extreme rainfall event in Marikina basin, Philippines.

Results show the possibility to simulate urban inundation without the need to require observed boundary conditions which opens the possibility of the use of rainfall forecast data for real-time flood prediction. The developed model can provide flood information such as the concentration of flood, estimated peak time, flood source point and flow velocity. The computation of spatial variations of pipe flow, wetted area and water depth inside the pipe can be used to identify the flood susceptible regions. This information can be used as supplementary tools to aid for early warning and flood prevention, as well as to be used for the improvement of sewer construction in decreasing urban flood risk.