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Impact of Data and Model Choices to Urban Flood Risk Assessments

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Abstract : The availability of high-resolution topography and rainfall information in urban areas has made it necessary to revise modeling approaches used for simulating flood risk assessments. Lidar derived elevation models that have 1m or lower resolutions are becoming widely accessible. The classical approaches of 1D-2D flow models where channel flow is simulated and coupled with a coarse resolution 2D overland flow models may not fully utilize the information provided by high-resolution data. In this context, a study was undertaken to compare three different modeling approaches to simulate flooding in an urban area. The first model used is the base model used is Sobek, which uses 1D model formulation together with hydrologic boundary conditions and couples with an overland flow model in 2D. The second model uses a full 2D model for the entire area with shallow water equations at the resolution of the digital elevation model (DEM). These models are compared against another shallow water equation solver in 2D, which uses a subgrid method for grid refinement. These models are simulated for different horizontal resolutions of DEM varying between 1m to 5m. The results show a significant difference in inundation extents and water levels for different DEMs. They are also sensitive to the different numerical models with the same physical parameters, such as friction. The study shows the importance of having reliable field observations of inundation extents and levels before a choice of model and data can be made for spatial flood risk assessments.

Keywords : flooding, DEM, shallow water equations, subgrid
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