**MOSART-urban: a semi-distributed regional urban flood modeling framework**

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Modeling urban hydrological processes at regional or larger scales is challenging. On one hand, current urban flood models are highly distributed, data hungry and computationally demanding. On the other hand, urban infrastructure data are rarely available. We try to tackle this dilemma by developing a semi-distributed, physically based model called Model for Scale Adaptive River Transport – urban module, MOSART-Urban. MOSART-urban is designed to capture the dominant urban processes in a computationally efficient framework. It is based on the riverine component of Energy Exascale Earth System Model (E3SM), MOSART, which represents routing processes in hillslope, tributaries, and main channel for non-urban areas. MOSART-urban enhances the hillslope component of MOSART by simulating surface runoff from impervious street areas, based on extensively available street maps. It also adds a surface storage component to account for stormwater retention ponds. The street network conveys the surface runoff from urban areas through the street inlets and grates into below-ground storm drain networks. The storm drain and the street network are coupled through the inlets, i.e., water can flow from the street to the storm drain and vice versa (overflow). The proposed framework is tested at representative synthetic and realistic urban watersheds, achieving satisfactory performance with efficient computing. It is therefore suitable for representing urban hydrological processes in land surface or Earth system models at regional or larger scales.