Novel 1D/2D Coupled Hydraulic Solver for Flood Modelling in Urban Watersheds

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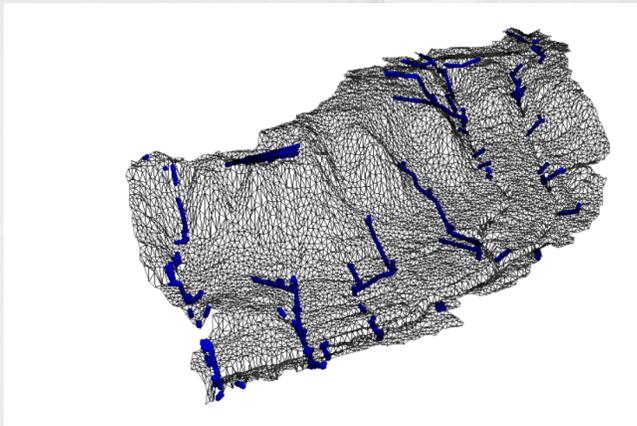
This project proposes a novel, free, and open-source 1D/2D stormwater model tailored for urban watersheds. Unlike existing schemes, the proposed coupling scheme uses a full mass and momentum balance between 1D sewer and 2D hydrologic domains and thus accurately captures rapid storm flows through these structures. This coupled solver thus provides the first fully physically-based open-source model for simulating floods in complex urban environments where the flow of water is influenced by subterranean urban drainage infrastructure.

Investigation of Turbulence-induced Sediment Ripples

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It is well known that the nearshore region often exhibits substantial sediment transport. During the uprush phase in the swash zone, the magnitude of instantaneous localized shear stresses surpasses that imposed by the mean shear. This implies isotropic turbulence, i.e., turbulence generated by wave-breaking, plays a crucial role in sediment transport. Recent laboratory experiments have shown the formation of sediment bedforms under nearly homogeneous isotropic turbulence. Therefore, we hypothesize that the formation of sediment ripples is linked to turbulence-induced instantaneous pressure gradients penetrating and within the porous bed, facilitating the transport of sediment and the development of bedforms. The primary objective of this study is to investigate the formation of such ripples induced by energetic turbulence.