Application of adaptive mesh refinement technique on digital surface model-based urban flood simulation

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Abstract

Urban flood simulation plays a vital role in national flood early warning, prevention and mitigation. In recent studies on 2-dimensional flood modeling, the integrated run-off inundation model is gaining grounds due to its ability to perform in greater computational efficiency. The adaptive quadtree shallow water numerical technique used in this model implements the adaptive mesh refinement (AMR) in this simulation, a procedure in which the grid resolution is refined automatically following the flood flow. The method discounts the necessity to create a whole domain mesh over a complex catchment area, which is one of the most time-consuming steps in flood simulation. This research applies the dynamic grid refinement method in simulating the recent extreme flood events in Metro Manila, Philippines. The rainfall events utilized were during Typhoon Ketsana 2009, and Southwest monsoon surges in 2012 and 2013. In order to much more visualize the urban flooding that incorporates the flow within buildings and high-elevation areas, Digital Surface Model (DSM) resolution of 5m was used in representing the ground elevation. Results were calibrated through the flood point validation data and compared to the present flood hazard maps used for policy making by the national government agency. The accuracy and efficiency of the method provides a strong front in making it commendable to use for early warning and flood inundation analysis for future similar flood events.

Keywords : Urban flooding, Adaptive mesh refinement, Rainfall events

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