Modelling the compound flood hydrodynamics under mesh convergence and future storm surge events in Brisbane River Estuary, Australia

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Abstract

Floods are the most common and destructive disasters around the globe, which becomes more challenging in coastal areas due to higher population density and catchment area relative to floods in an inland area. For effective coastal flood management to reduce flood adverse impacts it is necessary to investigate the flooding processes and their join interaction in a coastal area. This paper selected the Brisbane River Estuary, Australia as an example and the MIKE 21 model is applied to investigate the effects of mesh resolution on the flood discharge and to explores compound flooding by computing variances in coastal flood assessments resulting from a separation of tidal and riverine processes. The statistical results showed that the Nash-Sutcliffe coefficient, E of water level are varied from 0.84 to 0.95 and the model simulated the 2011 flood extent results agreed with 90% accuracy with the observed flood extent. Five mesh resolutions cases were analyzed and the result found that the finer mesh resolution Case 5 was more appropriate for calculating the peak discharge with 2.7% with estimated discharge. Compound flood event simulation results emphasized that not considering the interaction of various flooding drivers caused 0.62 m and 0.12 m reduction in the flood levels at Jindalee and Brisbane city gauges, and uncertainties in flood extent. Simulated results of flood at Brisbane city gauge, showed that 2011 and 2013 floods with storm surge scenario 4 demonstrate, the increase in flood level to be 12% and 34% respectively. The results recommend flooding assessment by using mesh convergence with joint probability of compound flood under future storm surge for planning and management of coastal projects.

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