Benchmarking The Capabilities of The Latest Hec-Ras Version 6.3 In Simulating Varying Flood Flows

ABSTRACT

This paper assesses the capabilities of the latest version 6.3 of the HEC-RAS flood model using selected benchmark tests developed by the UK Environment Agency. Three 2D model equations in HEC-RAS 6.3 are considered: Diffusion Wave (i.e. Diff Wave), shallow water equations with Eulerian-Lagrangian method (i.e. SWE (ELM)), and shallow water equations with local inertial approximation (i.e. SWE (LIA)). Two benchmark tests - the first involves a slow inflow filling ground depressions whilst the second involves a fast dam-break flow over a slanted building - are used to evaluate each of the models' performance. Water level predictions from the models are extracted from selected sampling points and compared with reference solutions and experimental data. The results from the two tests show that for slow inflow over an uneven topography case, Diff Wave performs the best by providing reliable predictions yet with the fastest computational runtime. Between the two shallow water equations models, SWE (LIA) produces similar outputs as the SWE (ELM) but the former runs at a much faster runtime compared to the later. In the case of fast dam-break flow, SWE (LIA) shows promise in replicating small-scale flow features and predicting receding flow behind the dam, outperforming SWE (ELM) with a 1.3x runtime speedup. This study thus highlights SWE (LIA) as a viable option for both slow-moving and fast dam-break flow conditions whilst offering improved computational efficiency for the HEC-RAS 6.3 software package. These findings provide valuable insights for selecting appropriate 2D flood models.