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Performance Benchmarking of tsunami-HySEA for NTHMP Inundation Mapping Activities

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According to the 2006 USA Tsunami Warning and Education Act, the tsunami inundation models used in the National Tsunami Hazard Mitigation Program (NTHMP) projects must be validated against some existing standard problems (see [OAR-PMEL-135], [Proceedings of the 2011 NTHMP Model Benchmarking Workshop]). These Benchmark Problems (BPs) cover different tsunami processes related to the inundation stage that the models must meet to achieve the NTHMP Mapping and Modeling Subcommittee (MMS) approval.

Tsunami-HySEA solves the two-dimensional shallow-water system using a high-order path-conservative finite volume method. Values of h, qx and qy in each grid cell represent cell averages of the water depth and momentum components. The numerical scheme is conservative for both mass and momentum in flat bathymetries, and, in general, is mass preserving for arbitrary bathymetries. Tsunami-HySEA implements a PVM-type method that uses the fastest and the slowest wave speeds, similar to HLL method (see [Castro et al, 2012]). A general overview of the derivation of the high order methods is performed in [Castro et al, 2009]. For very big domains, Tsunami-HySEA also implements a two-step scheme similar to leap-frog for the propagation step and a second-order TVD-WAF flux-limiter scheme described in [de la Asunción et al, 2013] for the inundation step.

Here, we present the results obtained by the model tsunami-HySEA against the proposed BPs. BP1: Solitary wave on a simple beach (non-breaking - analytic experiment). BP4: Solitary wave on a simple beach (breaking - laboratory experiment). BP6: Solitary wave on a conical island (laboratory experiment). BP7 - Runup on Monai Valley beach (laboratory experiment) and BP9: Okushiri Island tsunami (field experiment).

The analysis and results of Tsunami-HySEA model are presented, concluding that the model meets the required objectives for all the BP proposed.

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