

Numerical Modeling of Flood Hazards from Tsunamis and Hurricanes

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Abstract

The low-lying coastal communities of Hawaii are vulnerable to flooding from tsunamis and hurricanes. In particular, Hawaii was hit by six destructive tsunamis generated by subduction earthquakes during the last 100 years. Accurate prediction of tsunami impacts is crucial for mitigation planning and emergency response. We have developed the shock-capturing, dispersive wave model, NEOWAVE (Non-hydrostatic Evolution of Ocean WAVEs), which includes a two-way nesting scheme of telescopic grids to describe tsunami generation, propagation, and inundation in a single computation. The main motivation for the development is to have a model that can handle the complex flow patterns in the shelf and reef environments of Hawaii and other Pacific islands. NEOWAVE has been validated with analytical, laboratory, and field benchmarks at the 2009 NSF and the 2011 and 2015 NOAA benchmarking workshops, and approved by the National Tsunami Hazard Mitigation Program for use in its funded projects. Hawaii is also prone to landslide-generated tsunamis as well as hurricane landfalls, which are less frequent, but can be as destructive as earthquake-generated tsunamis. NEOWAVE has been extended to model landslide-generated tsunamis and storm surges with potential applications to reduce risk in coastal communities from flood hazards.