

Modeling of tsunami sources and propagation in the Atlantic Ocean Basin to assess coastal tsunami hazard along the US East Coast

by

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Abstract

Since 2010, under the auspices of the US National Tsunami Hazard Mitigation Program (NTHMP), the authors have conducted modeling work to gradually develop tsunami inundation maps for the most critical or vulnerable areas of the US east coast. These first generation maps are constructed as envelopes of maximum inundation caused by the most extreme near- and far-field tsunami sources, both historical and hypothetical, in the Atlantic Ocean basin, without considering their return period or probability. Probabilistic tsunami hazard analyses will be part of future generations of inundation maps.

Hence, in this work, we first identified and parameterized all the relevant extreme tsunami sources in the Atlantic Ocean basin and then modeled tsunami generation, propagation, and coastal impact from each of those to the considered areas of the US coastline. The extreme sources that have been identified and used for tsunami hazard assessment as part of NTHMP include : (i) near-field submarine mass failures (SMF) on or near the continental shelf break; (ii) an extreme hypothetical M9 seismic event occurring in the Puerto Rico Trench; (iii) a repeat of the historical 1755 M8.9 earthquake occurring in the Azores convergence zone; and (iv) a large scale volcanic flank collapse of the Cumbre Vieja Volcano (CVV) in the Canary Archipelago.

Although a number of earlier papers have dealt in detail with each of these potential tsunami sources, here, we show results of a systematic tsunami hazard study, in which we modeled the propagation to the coast of each of the sources, in a series of nested grids of increasingly fine resolution, using FUNWAVE-TVD, a weakly/fully nonlinear and dispersive long wave Boussinesq model, implemented in spherical or Cartesian coordinates, using a one-way coupling methodology. This leads to an overall assessment of tsunami hazard along the coastline as well as to detailed tsunami inundation maps for a number of the most vulnerable or critical areas. Besides results of the propagation modeling, selected results of coastal tsunami impact will be presented and discussed at the conference.