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Tsunami hazard and inundation for the northern coast of Crete

Flouri Evangelia[a,b], Vassilios Dougalis[a], and Costas Synolakis[b]
[a]Institute of Applied and Computational Mathematics,
Foundation for Research and Technology Hellas, Heraklion, Crete
[b]Department of Environmental Engineering,
Technical University of Crete, Chania, Crete
flouri@iacm.forth.gr

Abstract

Tsunamis are rare events compared to other natural hazards, but population growth along shorelines has increased their potential impact. Tsunamis are usually generated by an earthquake–induced dislocation of the seabed which displaces a large mass of water. They can be simulated effectively as long waves whose propagation and inundation are modeled by the nonlinear shallow water equations.

In this work, we present a systematic assessment of earthquake-generated tsunami hazards for the northern coastal areas of the island of Crete. Our approach is based on numerical hydrodynamic simulations, including inundation computations, with the model MOST, using accurate bathymetry and topography data of the study area. MOST implements a splitting method in space to reduce the hyperbolic system of shallow water equations in two successive systems, one for each spatial variable, and uses a dispersive, Godunov–type finite difference method to solve the equations in characteristic form.

In the present study we consider hypothetical, but credible, 'worst case' scenarios based on the unit sources methodology of NOAA, and, present inundation results, associated with seismic events of magnitude 8.5 originated in the Hellenic Arc, and 7.5 due to the seismic sources of the central Aegean sea. We also implement a probabilistic scenario in which we assess the influence of the epicenter location on the tsunami hazard, for time windows of 100, 500 and 1000 years. Our results include calculations of the maximum inundation and the maximum wave elevation for the two largest cities of the northern coast of Crete, Chania and Heraklion. We illustrate our findings superimposed on satellite images as maps indicating the estimated maximum values.

Key words: tsunami hazard, inundation, Crete.