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Northern Caribbean Tsunami Hazard: Earthquake and Gravity Source Contribution of the Tsunami of 2010 in Haïti

Adrien Poupardin (1,2), Hélène Hébert (2), Eric Calais (1), and Audrey Gailler (2)

(1) Ecole Normale Supérieure, Department of Geosciences, UMR CNRS 8538, 24 rue Lhomond, 75231 Paris cedex 05, France, (2) CEA, DAM, DIF, 91297 Arpajon, France

The Mw 7 earthquake of January 12, 2010, in Haïti was followed by a tsunami with wave heights reaching 3 m in some locations (Grand Goâve, Jacmel) on either side of the Presqu'Ile du Sud where the event took place. The tsunami was also recorded at DART buoy 42407 (about 600 km southeast of the earthquake source) and at a tide gauge in Santo Domingo (Dominican Republic). In the hours following the event, the National Earthquake Information Center (NEIC) suggested rupture of a south-dipping segment of the Enriquillo-Plantain Garden fault (EPGF). Fritz et al. (2013) used the NEIC source model to simulate the tsunami height and match coastal run-up measurements and DART data by (1) increasing coseismic slip on the EPGF while keeping a constant Mo by scaling the regional rigidity, and (2) invoking a coastal submarine landslide in addition to ground motion. Since then, several studies have considerably improved our understanding of the 2010 Haiti earthquake source using GPS, InSAR, seismological, geological, and/or teleseismic data (Meng et al., 2012; Hayes et al., 2010, Symithe et al., 2013). All show that rupture occurred on a north-dipping blind fault (Leogâne fault) with 1/3 of its moment expressed by reverse motion and up to 60 cm of coastal uplift.

Here we revisit the January 12, 2010 Haiti tsunami by modeling runup heights, DART, and tide gauge observations using these recent source models as input parameters. We propagate the tsunami using a non linear shallow water tsunami model able to account for the shoaling effect thanks to imbricated bathymetric grids. Simulations indicate run-up heights much lower than observed (1) in the Grand Goâve Bay, consistent with the hypoythesis of a landslide-triggered tsunami at this location, (2) along the southern coast of Hispaniola and at the DART buoy, closest to observations however when using Symithe et al.'s source model. We also find wave heights up to 1 m in Port-au-Prince (harbor and coastal shantytowns) when using Fritz et al.'s scaled NEIC source model, which have not been reported by the population. We conclude that this early model lacks accuracy, but additional work is needed to understand the significant wave heights observed along the southern coast and to the south of the island.