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Testing Slip Models for Tsunami Generation

Hafize Başak Bayraktar[1,2], Antonio Scala[1], Stefano Lorito[2], Manuela Volpe[2], Carlos Sánchez Linares[3], Gaetano Festa[1], Gareth Davies[4], Fabrizio Romano[2], Fabrizio Bernardi[2], Jacopo Selva[5], Jorge Macías[3], Marc de la Asunción[3], and Manuel J. Castro[3]

[1]University of Naples Federico II, Department of Physics “Ettore Pancini”, Rome, Italy (hafizebasak.bayraktar@unina.it)
[2]Istituto Nazionale di Geofisica e Vulcanologia (INGV), Rome, Italy
[3]Dpto. Análisis Matemático, Facultad de Ciencias, Universidad de Málaga, Málaga, Spain
[4]Positioning and Community Safety Division, Geoscience Australia, Canberra, Australia
[5]Istituto Nazionale di Geofisica e Vulcanologia (INGV), Bologna, Italy

Tsunami hazard depends strongly on the slip distribution of a causative earthquake. Simplified uniform slip models lead to underestimating the tsunami wave height which would be generated by a more realistic heterogeneous slip distribution, both in the near-field and in the far-field of the tsunami source. Several approaches have been proposed to generate stochastic slip distributions for tsunami hazard calculations, including in some cases shallow slip amplification (Le Veque et al., 2016; Sepulveda et al., 2017; Davies 2019; Scala et al., 2020). However, due to the relative scarcity of tsunami data, the inter-comparison of these models and the calibration of their parameters against observations is a challenging yet very much needed task, also in view of their use for tsunami hazard assessment.

Davies (2019) compared a variety of approaches, which consider both depth-dependent and depth-independent slip models in subduction zones by comparing the simulated tsunami waveforms with DART records of 18 tsunami events in the Pacific Ocean. Model calibration was also proposed by Davies and Griffin (2020).

Here, to further progress along similar lines, we compare synthetic tsunamis produced by kinematic slip models obtained with teleseismic inversions from Ye et al. (2016) and by recent stochastic slip generation techniques (Scala et al., 2020) against tsunami observations at open ocean DART buoys, for the same 18 earthquakes and ensuing tsunamis analyzed by Davies (2019). Given the magnitude and location of the real earthquakes, we consider ensembles of consistent slipping areas and slip distributions, accounting for both constant and depth-dependent rigidity models. Tsunami simulations are performed for about 68.000 scenarios in total, using the Tsunami-HySEA code (Macías et al., 2016). The simulated results are validated and compared to the DART observations in the same framework considered by Davies (2019).