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Probabilistic Tsunami Hazard Analysis for Eastern Sicily (Italy)

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We present preliminary results of a Probabilistic Tsunami Hazard Analysis (PTHA) for the coast of eastern Sicily. We only consider earthquake-generated tsunamis. We focus on important cities such as Messina, Catania, and Augusta. We consider different potentially tsunamigenic Source Zones (SZ) in the Mediterranean basin, basing on geological and seismological evidences.

Considering many synthetic earthquakes for each SZ, we numerically simulate the entire tsunami propagation, from sea-floor displacement to inundation. We evaluate different tsunami damage metrics, as for example maximum runup, current speed, momentum and Froude number. We use a finite difference scheme in the shallow-water approximation for the tsunami propagation at open sea, and a finite volumes scheme for the inundation phase. For the shoaling and inundation stages, we have built a bathy-topo model by merging GEBCO database, multibeam soundings, and topographic data at 10 m of resolution.

Accounting for their relative probability of occurrence, deterministic scenarios are merged together to assess PTHA at the selected target sites, expressed as a probability of exceedance of a given threshold (e.g. 1 m wave height) in a given time (e.g. 100 yr). First order epistemic and aleatory uncertainties are accessed through a logic tree, accounting for changes in the variables judged to have a major impact on PTHA, and for eventual incompleteness of the SZs.

The SZs are located at short, intermediate and large distances with respect to the target coastlines. We thus highlight, for different source-target distances, the relative importance of the different source parameters, and/or the role of the uncertainties in the input parameters estimation. Our results suggest that in terms of inundation extent the Hellenic Arc SZ has the highest impact on the selected target coastlines. In terms of exceedance probability instead, there is a larger variability depending not only on location and recurrence but also on the relative geometry of targets with respect to sources. For example the Messina harbour is most likely inundated by the local SZ in the Messina Strait.