



## Exploring earthquake source uncertainty in probabilistic tsunami hazard assessment

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Tsunamis are among the most impactful natural hazards, yet their rarity results in incomplete historical and instrumental records. Tsunami hazard assessment is therefore strongly affected by uncertainties, mainly related to the source representation. For earthquake-generated tsunamis, the location of future ruptures and their rupture characteristics (geometry, kinematics, slip distribution) is poorly constrained, leading to some subjective choices regarding the source representation. A probabilistic approach allows us to formally incorporate these uncertainties and to calculate the probability that a given tsunami intensity measure will be exceeded at a target location within a specified time window.

The MULTI-MAREX project established two living-labs in Greece, with the purpose of strengthening preparedness and awareness of natural hazards from marine environments. For these two sites, we estimate the offshore hazard from earthquake-generated tsunamis from different source representations. We adopt the regional probabilistic NEAMTHM18 model to select most representative sources based on de-aggregation analysis. These include interface subduction earthquakes, mainly associated with the Hellenic Arc, and both strike- and dip-slip crustal earthquakes distributed over the region. Source geometries are derived from the mean values of established scaling relationships between fault parameters and earthquake magnitude, and alternative scaling relationships. To explore the sensitivity of tsunami hazard estimates to earthquake source variability, we perturb the selected source geometries by considering further alternative scaling relationships and their associated uncertainties, rather than only the mean values.

In addition, we provide a preliminary assessment of the impact of constraining scenarios to a mapped offshore fault in the EFSM20. This provides the basis to verify the effect of including more mapped faults in NEAMTHM18, which is an improvement in principle, provided that faults are well-mapped. This work complements ongoing research in Sicily (within a Transnational Access provided by the Geo-INQUIRE project), where the influence of source scaling laws on both offshore and onshore probabilistic tsunami hazard is explored using nested high-resolution grids. At the MULTI-MAREX sites, offshore-only analyses are performed, yet using much higher resolutions to simulate the offshore propagation.

This work is contributing to enhancing project tsunami scenario databank by better accounting for source-related uncertainties, that finds applications in high-resolution inundation modelling for onshore tsunami hazard and virtual reality modelling.