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On the use of faults and background seismicity in Seismic Probabilistic Tsunami Hazard Analysis (SPTHA)

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Most of the SPTHA studies and applications rely on several working assumptions: i) the – mostly offshore – tsunamigenic faults are sufficiently well known; ii) the subduction zone earthquakes dominate the hazard; iii) and their location and geometry is sufficiently well constrained. Hence, a probabilistic model is constructed as regards the magnitude-frequency distribution and sometimes the slip distribution of earthquakes occurring on assumed known faults. Then, tsunami scenarios are usually constructed for all earthquakes location, sizes, and slip distributions included in the probabilistic model, through deterministic numerical modelling of tsunami generation, propagation and impact on realistic bathymetries.

Here, we adopt a different approach (Selva et al., GJI, 2016) that releases some of the above assumptions, considering that i) also non-subduction earthquakes may contribute significantly to SPTHA, depending on the local tectonic context; ii) that not all the offshore faults are known or sufficiently well constrained; iii) and that the faulting mechanism of future earthquakes cannot be considered strictly predictable. This approach uses as much as possible information from known faults which, depending on the amount of available information and on the local tectonic complexity, among other things, are either modelled as Predominant Seismicity (PS) or as Background Seismicity (BS). PS is used when it is possible to assume sufficiently known geometry and mechanism (e.g. for the main subduction zones). Conversely, within the BS approach information on faults is merged with that on past seismicity, dominant stress regime, and tectonic characterisation, to determine a probability density function for the faulting mechanism.

To illustrate the methodology and its impact on the hazard estimates, we present an application in the NEAM region (Northeast Atlantic, Mediterranean and connected seas), initially designed during the ASTARTE project and now applied for the regional-scale SPTHA in the TSUMAPS-NEAM project funded by DG-ECHO.