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Testing of the INGV Prototype Tsunami Early Warning System for the Coasts of Italy

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In the framework of the agreement between Italian Civil Protection and INGV (DPC-S3 project), we are studying the feasibility of a Tsunami Early Warning System (TEWS) for the coasts of Italy. The underlying concept is borrowed, as a starting point, from the Japan Meteorological Agency's TEWS. Some differences arise, however, due to the specificity of the Mediterranean context, as well as due to the reduced possibility of fast direct measurements of the tsunami waves eventually generated.
The prototype system is based on a set of elementary submarine earthquake sources, plus a set of scaling laws of the tsunami height with respect to source parameters. In case of an earthquake, according to information released by the INGV seismic center (epicenter, depth, and magnitude), the pre-calculated wave heights produced by each elementary source must be interpolated to evaluate if a significant tsunami could have been generated, and where it will likely hit the coastlines more severely, in order to launch a proper alert.
We start by considering a grid of nine epicenters on a 20x20 km square in front of the Algeria coast, and potentially threatening the southern Sardinia coast. At the moment, the geometry of the faults (strike, dip, rake) is keep fixed, while we consider for each of the epicenters several different depths and magnitudes. The (empirical) scaling laws that serve as a guidance for the interpolation are instead derived numerically for a wider range of earthquake parameters.
The performances of the prototype have been evaluated both by means of synthetic earthquakes (by simulating hundreds of earthquakes falling in the prototype grid), and by using an ad-hoc database around the epicenter of a real earthquake, which generated a moderate tsunami in the western Mediterranean (the Mw=6.9 May 2003 Boumerdes-Zemmouri earthquake, Algeria). The synthetic tests also serve to assess the uncertainties that will be attached to the forecasts issued, directly descending from uncertainties in earthquake parameters fast evaluation, but also of epistemic nature, mainly due to practical limitations and computational costs.
In the next future, we plan to complete the errors evaluation, with a series of sensitivity tests on parameters not yet investigated, such as fault geometry and earthquake (magnitude to slip) scaling laws. We will also test the performance of the prototype algorithm with several tsunamis outside the Mediterranean, for which more experimental data are available. We will finally extend the database over and around the main potentially tsunamigenic zones in the Mediterranean basin, in order to implement it at the INGV seismic center.