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Forecasting database for the tsunami warning center for the western Mediterranean Sea

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Improvements in the availability of sea-level observations and advances in numerical modeling techniques are increasing the potential for tsunami warnings to be based on numerical model forecasts. Numerical tsunami propagation and inundation models are well developed, but they present a challenge to run in real-time, partly due to computational limitations and also to a lack of detailed knowledge on the earthquake rupture parameters.
Through the establishment of the tsunami warning regional center for NE Atlantic and western Mediterranean Sea, the CEA is especially in charge of providing rapidly a map with uncertainties showing zones in the main axis of energy at the Mediterranean scale. The strategy is based initially on a pre-computed tsunami scenarios database, as source parameters available a short time after an earthquake occurs are preliminary and may be somewhat inaccurate. Existing numerical models are good enough to provide a useful guidance for warning structures to be quickly disseminated. When an event will occur, an appropriate variety of offshore tsunami propagation scenarios by combining pre-computed propagation solutions (single or multi sources) may be recalled through an automatic interface. This approach would provide quick estimates of tsunami offshore propagation, and aid hazard assessment and evacuation decision-making.
As numerical model accuracy is inherently limited by errors in bathymetry and topography, and as inundation maps calculation is more complex and expensive in term of computational time, only tsunami offshore propagation modeling will be included in the forecasting database using a single sparse bathymetric computation grid for the numerical modeling.
Because of too much variability in the mechanism of tsunamigenic earthquakes, all possible magnitudes cannot be represented in the scenarios database. In principle, an infinite number of tsunami propagation scenarios can be constructed by linear combinations of a finite number of pre-computed unit scenarios. The whole notion of a pre-computed forecasting database also requires a historical earthquake and tsunami database, as well as an up-to-date seismotectonic database including faults geometry and a zonation based on seismotectonic synthesis of source zones and tsunamigenic faults.
Our forecast strategy is thus based on a unit source function methodology, whereby the model runs are combined and scaled linearly to produce any composite tsunamis propagation solution. Each unit source function is equivalent to a tsunami generated by a Mo 1.75E+19 N.m earthquake with a rectangular fault 25 km by 20 km in size and 1 m in slip. The faults of the unit functions are placed adjacent to each other, following the discretization of the main seismogenic faults bounding the western Mediterranean basin. The number of unit functions involved varies with the magnitude of the wanted composite solution and the combined waveheights are multiplied by a given scaling factor to produce the new arbitrary scenario. Uncertainty on the magnitude of the detected event and inaccuracy on the epicenter location are taken into account in the composite scenarios calculation.
A test-case example using the Boumerdès 2003 earthquake [Algeria, Mw 6.9] is presented.