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Tsunami early warning in the Mediterranean: role, structure and tricks of pre-computed tsunami simulation databases and matching/forecasting algorithms

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The general idea that pre-computed simulated scenario databases can play a key role in conceiving tsunami early warning systems is commonly accepted by now. But it was only in the last decade that it started to be applied to the Mediterranean region, taking special impulse from initiatives like the GDACS and from recently concluded EU-funded projects such as TRIDEC and NearToWarn. With reference to these two projects and with the possibility of further developing this research line in the frame of the FP7 ASTARTE project, we discuss some results we obtained regarding two major topics, namely the strategies applicable to the tsunami scenario database building and the design and performance assessment of a timely and "reliable" elementary-scenario combination algorithm to be run in real-time.

As for the first theme, we take advantage of the experience gained in the test areas of Western Iberia, Rhodes (Greece) and Cyprus to illustrate the criteria with which a "Matching Scenario Database" (MSDB) can be built. These involve 1) the choice of the main tectonic tsunamigenic sources (or areas), 2) their tessellation with matrices of elementary faults whose dimension heavily depend on the particular studied area and must be a compromise between the needs to represent the tsunamigenic area in sufficient detail and of limiting the number of scenarios to be simulated, 3) the computation of the scenarios themselves, 4) the choice of the relevant simulation outputs and the standardisation of their formats.

Regarding the matching/forecast algorithm, we want it to select and combine the MSDB elements based on the initial earthquake magnitude and location estimate, and to produce a forecast of (at least) the tsunami arrival time, amplitude and period at the closest tide-level sensors and in all needed forecast points. We discuss the performance of the algorithm in terms of the time needed to produce the forecast after the earthquake is detected. In particular, we analyse the different contributions of a number of factors such as the efficient code development and availability of cutting-edge hardware to run the code itself, the wise selection of the MSDB outputs to be combined, the choice of the forecast points where water elevation time series must be taken into account, and few others.