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Tsunami hazard assessment along the French Mediterranean coast : detailed modeling of tsunami impacts for the ALDES project

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The catastrophic 2004 tsunami drew the international community's attention to tsunami risk in all basins where tsunamis occurred but no warning system exists. Consequently, under the coordination of UNESCO, France decided to create a regional center, called CENALT, for the north-east Atlantic and the western Mediterranean. This warning system, which should be operational by 2012, is set up by the CEA in collaboration with the SHOM and the CNRS. The French authorities are in charge of the top-down alert system including the local alert dissemination. In order to prepare the appropriate means and measures, they initiated the ALDES (Alerte Descendante) project to which the CEA also contributes. It aims at examining along the French Mediterranean coast the tsunami risk related to earthquakes and landslides. In addition to the evaluation at regional scale, it includes the detailed studies of 3 selected sites; the local alert system will be designed for one of them : the French Riviera. In this project, our main task at CEA consists in assessing tsunami hazard related to seismic sources using numerical modeling. Past tsunamis have affected the west Mediterranean coast but are too few and poorly documented to provide a suitable database. Thus, a synthesis of earthquakes representative of the tsunamigenic seismic activity and prone to induce the largest impact to the French coast is performed based on historical data, seismotectonics and first order models. The North Africa Margin, the Ligurian and the South Tyrrhenian Seas are considered as the main tsunamigenic zones. In order to forecast the most important plausible effects, the magnitudes are estimated by enhancing to some extent the largest known values. Our hazard estimation is based on the simulation of the induced tsunamis scenarios performed with the CEA code. The 3 sites have been chosen according to the regional hazard studies, coastal typology elements and the appropriate DTMs (Digital Terrain Models). The ALDES project allows the SHOM and the IGN to conduct high resolution data acquisition in the Litto3D framework for 2 sites, one west of the Gulf of Lion (3 m) and one west of the French Riviera (3 m). DTMs of the third site, centered on the Antibes Cape, are built using pre-existent data sets with lesser resolution (10 m). Then, detailed models for the selected sites are performed based on high resolution bathymetric and topographic data; they provide estimations of water heights and currents, inundation distances and run-up elevations. It points out the most exposed places and morphologic features prone to amplify potential waves and to generate significant coastal effects. Our set of simulations gives an evaluation of the expected maximum impact distribution and highlights places, such as specific beaches or harbors, where mitigation measures must be given priority.