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Tsunami hazard assessment in Nice, France, and influence of uncertainties in source parameters

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Although the tsunami hazard on the French Mediterranean coast is still poorly known, potential tsunamigenic sources exist in the Western Mediterranean basin. Even though the water heights are moderate, generated waves and currents could reach busy beaches, harbors and other coastal structures.
The European project ASTARTE aims at reaching a higher level of tsunami resilience in the North-East Atlantic and Mediterranean region (called NEAM by IOC-UNESCO). In this context, ASTARTE proposes to improve the knowledge of tsunami generation, develop methods for hazard, vulnerability and risk assessment, better understand local coastal effects and enhance tools for early warning system. 9 test sites, including Nice for the French coasts, have been selected all over the NEAM area. Nice is the largest city of the French Riviera and welcomes a very large number of tourists every year, notably for seaside activities. Moreover its waterfront hosts the second French airport and many other facilities. Our work focuses on the tsunami hazard assessment related to seismic sources. This study, based on a worst-case scenarios approach, is carried out using multigrid numerical simulations. Seismic sources are computed through the Okada elastic dislocation model and constrained with the seismological parameters of the rupture. The coseismic deformation provides the initial condition to solve the shallow water equations on which the tsunami propagation simulation is based. Nested computational grids allow taking into account the shoaling effect for the Nice area as well as the potential inundation. The French Litto3D project, led by SHOM (Service Hydrographique et Oceanographique de la Marine) and IGN (Institut National de l'Information Geographique et Forestiere) provides high resolution bathymetric and topographic data (1 to 5 meters of resolution) along the coastline. Our modeling thus gives detailed estimation of the wave impacts on Nice with a particular focus on three critical areas; the Harbor, the airport and the beach along the "Promenade des Anglais". For each scenario, instantaneous and maximum wave heights, speeds of horizontal currents and flooding are computed. This numerical study also gives the opportunity to pay special attention on results variability according to source parameters, such as rupture location, orientation, dip, dimension or coseismic slip amount. Sources are indeed often poorly constrained due to the lack of geological and tectonic knowledge or to the limited time imposed by the fast estimation requirement in warning context.

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