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Evaluation of the tsunami hazard in Naples and in its Gulf (Italy) by means of numerical techniques

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Studying the tsunami hazard for a specific area implies the identification of potential sources and the reconstruction of their effects on the coasts. Moreover, the recognition of the coastal stretches at the highest exposure and vulnerability allows one to estimate the risks connected to such events, providing precious insights for civil protection issues.

In this work, the focus is concentrated on the city of Naples and on its Gulf (south Italy), that is one of the Italian areas with the highest rate of urbanization. The Gulf is delimited on the north by the islands of Ischia and Procida, and on the south by the Sorrento peninsula. Along a total coast length of about 195 km, one can find as many as 328 harbor facilities and 28 ports, involving at least 50 km of shoreline. As far as the population is concerned, this area is characterized by the highest coastal density in Italy (which is also one of the highest in Europe), i.e. 1246 inhabitants/km2.

Regarding specifically the tsunami hazard, in the Gulf of Naples one can count many potential tsunami sources, namely:
- seismic shaking due to the activity of the volcanic complex composed by the Campi Flegrei caldera, the Mount Epomeo ongoing resurgence process (in the Ischia island) and the Vesuvius volcano;
- landslides along the steep flanks of the Ischia main relief (Mount Epomeo), that can reach the sea as testified by the observed submarine deposits;
- eruptions of the Vesuvius and associated phenomena (e.g. pyroclastic flows, collapse of the eruptive column, ...).
Moreover, since the Gulf basin has a peculiar conformation, inhibiting tsunami energy radiation and favoring wave trapping and multiple wave reflections, one can expect the occurrence of resonances, which might amplify tsunami effects considerably.

The combination of such factors makes it crucial to study the hazard in this area, both in terms of tsunami generation from the different sources, and in terms of the evaluation of the tsunami propagation pattern (i.e. energy focusing, edge waves, bathymetric effects, resonances). Such tasks are here dealt with a numerical approach, basing on a set of simulation codes that were developed and are being maintained in-house, and have been tested and applied repeatedly to analyze other scenarios.

The results will provide a portrait of the tsunami propagation inside the Gulf of Naples, identifying the coastal stretches that are most prone to the highest waves and that need the most attention in terms of hazard management and prevention in an area with a very strong urbanization.