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Tsunami hazard related to tectonic sources in the Augusta-Siracusa coastal area (eastern Sicily, Italy): a "credible worst-case" scenario approach

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Eastern Sicily is one of the areas most exposed to tsunami hazard and risk in Italy and in the entire Mediterranean basin. This area was hit by at least seven tsunamis, originating both in the near-field and in the far-field, in the approximate time interval from 1600 BC to present: the most famous are the 365, 1169, 1693 and 1908 events, whose effects are documented by historical accounts and paleotsunami investigations. Incidentally, a full agreement on the parent sources for those events is still lacking. Nowadays, the Augusta bay hosts one of the most important petrochemical poles in Italy and in Europe, and Siracusa is listed as UNESCO World Heritage Site since 2005. For all the above reasons, the EU Project called ASTARTE – "Assessment, STrategy And Risk Reduction for Tsunamis in Europe" (Grant 603839, 7th FP, ENV.2013.6.4-3) considered the Augusta-Siracusa coastal area as one of the sites for the testing of innovative methods for tsunami hazard, vulnerability and risk assessment and reduction.
This contribution aims at assessing the tsunami hazard for the Augusta and Siracusa areas through a "credible worst-case scenario" approach, involving only earthquake sources. Schematically, we may divide the procedure into the following steps. 1) Based on considerations deriving from the historical earthquake and tsunami activity and from the tectonic framework, we select five main source areas, covering almost entirely the northern Ionian Sea basin (Hyblaean-Malta escarpment, Messina Straits, Ionian subduction zone, Calabria offshore, western Hellenic Trench). 2) We choose potential and credible tsunamigenic faults in each area, with properly assigned magnitude, geometry and focal mechanism. 3) We compute the maximum tsunami wave elevations along the eastern Sicily coast on a coarse grid by means of the in-house shallow-water code UBO-TSUFD, and extract the scenarios that produce the largest effects in the target areas of Augusta and Siracusa. 4) For each of the selected scenarios we run numerical UBO-TSUFD simulations over a set of five nested grids, with grid cells size decreasing from 3 km in the open Ionian Sea to 40 m in the target areas of Augusta and Siracusa. The simulation results consist of fields of maximum water elevation, of maximum water column, of maximum velocity and of maximum momentum flux. 5) We combine the individual scenarios into one aggregate scenario for every tsunami metric. The main findings for the aggregate scenario are presented, discussed, and compared with historical evidences, as well as with other studies' results obtained for almost the same areas through a probabilistic approach.