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Tsunami vulnerability and damage for buildings analyzed by means of two methods (PTVA-3 and SCHEMA) in the area of Augusta and Siracusa, eastern Sicily, Italy

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The coast of the eastern Sicily is exposed to tsunamis that can be generated by local earthquakes (e.g. the 1169, 1693, 1908 events) and by earthquakes located in distant seismic zones (see the 365 AD tsunamigenic quake in Western Hellenic Arc). Tsunamis can also be generated by landslides possibly triggered by earthquakes. The Hyblean-Malta steep escarpment running offshore at a small angle with the coast is an ideal place for submarine mass failure occurrences with tsunamigenic effects.
The entire eastern coast of Sicily from Messina in the north to Siracusa in the south is under the threat of tsunamis. In the frame of the FP7 European project ASTARTE (Assessment, Strategy And Risk Reduction for
Tsunamis in Europe - FP7-ENV2013 6.4-3, Grant 603839), the segment of coast from Augusta to Siracusa was selected to undertake specific and detailed studies of tsunami hazard, vulnerability and damage to test existing methods and develop innovative approaches. The scope of the present work regards vulnerability and damage analyses.
We chose to adopt two methods, known in the literature and briefly denoted as PTVA-3 and SCHEMA, that are based on two very different approaches, the former more qualitative and the latter more quantitative. The method PTVA-3 determines the vulnerability and damageability of a building by weighting and ranking a number of attributes covering the structural features of the edifice and the relevant characteristics of the surrounding environment such as the position with respect to the coast, the existence of defensive elements (e.g. walls, breakwaters, vegetation) and also the proximity to potential sources of floating objects that can feed damaging debris flows. On the other hand, the SCHEMA method uses a classification of building and a damage matrix that were derived from experimental fragility and damage curves first established after the Sumatra 2004 tsunami and later refined and adapted to the building stock of the Mediterranean region.
The aim of this work is to compare the vulnerability and damage analyses carried out by means of the PTVA-3 and the SCHEMA methods on the same data set, that is the urban and port areas of Siracusa and Augusta in order to highlight similarities and discrepancies. In this preliminary analysis the coastal inundation was not derived from tsunami simulations, but was assumed to be constant along the coast (bathtub hypothesis) and was taken to be 5 m and 10 m respectively for Siracusa and Augusta.
The main outcome of the compared analysis is that the two methods do not provide completely overlapping vulnerability and damage maps, though they use equivalent 5-degree scales. In general the PTVA-3 method tends to overestimate the damage, although there are several counterexamples where PTVA-3 foresees less damage than SCHEMA. The differences we found in the assessment opens the question of how to treat uncertainties in the vulnerability and damage analyses, which is a problem often overlooked, but of crucial importance for the application and for civil authorities.