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Applying and validating the PTVA-3 Model at the Aeolian Islands, Italy: assessment of the vulnerability of buildings to tsunami

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The volcanic archipelago of the Aeolian Islands (Sicily, Italy) is included in the UNESCO World Heritage list and it is visited by more than 200.000 tourists per year. However, because of its geological characteristics, the risk related to the volcanic and seismic activity is particularly high. Since 1916 the archipelago has been hit by 8 local tsunamis (Maramai et al., 2005). The last and most intense of these events happened on the 30th of December 2002. It was triggered by two subsequent landslides along the north side of the Stromboli volcano (Sciara del Fuoco), which poured into the sea about 2-3 x 107 m3 of rocks and debris (Tinti et al., 2005). The waves reached the whole archipelago, but most of the damage to buildings and infrastructures occurred in the island of Stromboli (maximum run-up 11 metres) and Panarea.
The aim of this study is to assess the vulnerability of those buildings located within the area inundated in 2002. The assessment is carried out using the PTVA-3 model (Papathoma Tsunami Vulnerability Assessment-version 3), recently developed and applied by Dall'Osso et al. (2009) in Sydney. As the original version of the PTVA (Papathoma, 2003), the PTVA-3 calculates a Relative Vulnerability Index (RVI) for every building, based on a set of selected physical and structural attributes. Run up values within the area inundated by the 2002 tsunami were measured and mapped by INGV and University of Bologna during field surveys in January 2003. Results of the assessment show that if the same tsunami occurred today, 54 buildings would be hit in Stromboli, and 5 in Panarea. The overall vulnerability level obtained for Stromboli is "average"/"low", while "very low" for Panarea. Nonetheless, 13 buildings in Stromboli are classified as having a "high" or "average" vulnerability. For 5 buildings, we could validate the RVI values calculated by the PTVA-3 through a qualitative comparison with some pictures taken by INGV during the post-tsunami survey. Apart from one structure, whose seaward side is completely submerged by a coastal dune, we found a good degree of accuracy of the model. Given the high tsunami risk of the archipelago, our results provide a basic support to prioritize investments in prevention measures and address the most critical vulnerabilities of built environment, particularly in the island of Stromboli.

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