



Evaluation of tsunami risk in Heraklion city, Crete, Greece, by using GIS methods

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The Hellenic Arc is the most active seismotectonic structure in the Mediterranean region. The island of Crete occupies the central segment of the arc which is characterized by high seismic and tsunami activity. Several tsunamis generated by large earthquakes, volcanic eruptions and landslides were reported that hit the capital city of Heraklion in the historical past. We focus our tsunami risk study in the northern coastal area of Crete (ca. 6 km in length and 1 km in maximum width) which includes the western part of the city of Heraklion and a large part of the neighboring municipality of Gazi. The evaluation of tsunami risk included calculations and mapping with QGIS of (1) cost for repairing buildings after tsunami damage, (2) population exposed to tsunami attack, (3) optimum routes and times for evacuation. To calculate the cost for building reparation after a tsunami attack we have determined the tsunami inundation zone in the study area after numerical simulations for extreme tsunami scenarios. The geographical distribution of buildings per building block, obtained from the 2011 census data of the Hellenic Statistical Authority (EL.STAT) and satellite data, was mapped. By applying the SCHEMA Damage Tool we assessed the building vulnerability to tsunamis according to the types of buildings and their expected damage from the hydrodynamic impact. A set of official cost rates varying with the building types and the damage levels, following standards set by the state after the strong damaging earthquakes in Greece in 2014, was applied to calculate the cost of rebuilding or repairing buildings damaged by the tsunami. In the investigation of the population exposed to tsunami inundation we have used the interpolation method to smooth out the population geographical distribution per building block within the inundation zone. Then, the population distribution was correlated with tsunami hydrodynamic parameters in the inundation zone. The last approach of tsunami risk assessment refers to the selection of optimal routes and times needed for evacuation from certain points within the inundation zone to a number of shelters outside the zone. The three different approaches were evaluated as for their overall contribution in the development of a plan for the tsunami risk mitigation. This research is a contribution to the EU-FP7 tsunami research project ASTARTE (Assessment, Strategy And Risk Reduction for Tsunamis in Europe), grant agreement no: 603839, 2013-10-30.