Geophysical Research Abstracts
Vol. 21, EGU2019-17866, 2019
EGU General Assembly 2019
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Testing performances of decision matrix and inundation zones defined in the frame of the Italian tsunami early warning system

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The Italian Tsunami Warning Centre situated at Istituto Nazionale di Geofisica e Vulcanologia (CAT-INGV) is 24/7 operational since the 1st January 2017 and is governed in the frame of the Italian Tsunami Warning System (SiAM), constituted by the Italian Civil Protection Department (DPC), the Istituto Nazionale di Geofisica e Vulcanologia (INGV) and the Italian Institute for Environmental Protection and Research (ISPRA). The CAT-INGV is committed to deliver tsunami alert messages. At present state, the CAT-INGV operations adopt a Decision Matrix (DM) that considers the available earthquake's parameters (hypocentre and magnitude) and the distance of the epicentre from the nearest coast and from the target forecast points to be alerted. The two defined alert levels (advisory/orange and watch/red) are then associated to each target forecast point and to the corresponding coastal areas in front of them. Moreover, along the coasts are defined evacuation maps which, ideally, need to include all the areas subject to inundation for a given level of acceptable risk.
Numerical modelling is by far the most accredited tool to model tsunami propagation and inundation but a massive use of tsunami inundation simulations on high-resolution numerical grids of coastal areas still represents a challenge in some practical applications. As an alternative, empirical or analytical simplified methods based on amplification factors and/or coastal dissipation models can provide rapid approximated estimates of inundation. In the frame of SiAM, inundation distances associated to the alert levels are defined using a GIS-based approach that convert reference maximum run-up values into inundation lines considering the inundation dissipation obtained with empirical methods. While for the advisory/orange is set by convention based on the definition of the alert level and the uncertainty on DEM model, the reference maximum run-up value for the watch/red is derived from the results of the regional Seismic Probabilistic Tsunami Hazard Analysis (S-PTHA) developed in the TSUMAPS-NEAM project (http://www.tsumaps-neam.eu/), by selecting the tsunami intensity relative to the 2500 yr average return period at the 84th percentile of the epistemic uncertainty distribution. The TSUMAPS-NEAM model evaluated the inshore tsunami intensity from off-shore (50 m depth) maximum waive height through amplification factors and accounting for uncertainty.
The aim of the present work is to evaluate the performances of the adopted simplified procedure by comparing the results of the proposed method with the inundation maps obtained using high resolution tsunami numerical inundation simulations for a set of sources placed offshore in front of the target area and having different magnitudes and focal mechanisms. The selected target area is the coastal segment placed in the South-Eastern Sicily, Italy, between Catania and Siracusa, two touristic and commercial urban areas, comprising harbour infrastructures and a petrochemical complex. This area has experienced destructive tsunamis in the past and the coast presents very different terrain morphological features. Tsunami scenarios are modelled with Tsunami-HySEA, a non-linear hydrostatic shallow-water multi-GPU code.
The work is funded by the TSUMAPS-NEAM (Grant agreement ECHO/SUB/2015/718568/PREV26) project and the Agreement between Istituto Nazionale di Geofisica e Vulcanologia (INGV) and Italian Civil Protection Department (DPC).