Geophysical Research Abstracts
Vol. 18, EGU2016-7912, 2016
EGU General Assembly 2016

Tsunamigenic potential of Mediterranean fault systems and active subduction zones

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Since the North East Atlantic and Mediterranean Tsunami Warning System (NEAMTWS) is under development by the European scientific community, it becomes necessary to define guidelines for the characterization of the numerous parameters must be taken into account in a fair assessment of the risk. Definition of possible tectonic sources and evaluation of their potential is one of the principal issues.
In this study we systematically evaluate tsunamigenic potential of up-to-now known real fault systems and active subduction interfaces in the NEAMTWS region. The task is accomplished by means of numerical modeling of tsunami generation and propagation. We have simulated all possible uniform-slip ruptures populating fault and subduction interfaces with magnitudes ranging from 6.5 up to expected Mmax. A total of 15810 individual ruptures were processed. For each rupture, a tsunami propagation scenario was computed in linear shallow-water approximation on 1-arc minute bathymetric grid (Gebco_08) implying normal reflection boundary conditions. Maximum wave heights at coastal positions (totally – 23236 points of interest) were recorded for four hours of simulation and then classified according to currently adopted warning level thresholds. The resulting dataset allowed us to classify the sources in terms of their tsunamigenic potential as well as to estimate their minimum tsunamigenic magnitude. Our analysis shows that almost every source in the Mediterranean Sea is capable to produce local tsunami at the advisory level (i.e. wave height > 20 cm) starting from magnitude values of Mw=6.6. In respect to the watch level (wave height > 50 cm), the picture is less homogeneous: crustal sources in south-west Mediterranean as well as East-Hellenic arc need larger magnitudes (around Mw=7.0) to trigger watch levels even at the nearby coasts. In the context of the regional warning (i.e. source-to-coast distance > 100 km) faults also behave more heterogeneously in respect to the minimum tsunamigenic magnitude. Whereas faults in Adriatic can trigger watch alarm with magnitudes as low as Mw=6.6, crustal sources in south-eastern Mediterranean, Aegean Sea as well as all subduction sources need magnitudes over 7.0 to trigger watch level tsunamis.