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Investigation on the November 17, 2015 anomalous signal in the harbor of Crotone, Ionian Sea, by means of numerical techniques

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The 17th November 2015 earthquake occurring offshore west of Lefkada (Ionian Sea, Greece), whose estimated magnitude ranged Mw=6.5, presents some aspects of interest from the scientific point of view and for emergency management issues as well. The seismic shaking was felt also in south Italy, but the earthquake itself had remarkable consequences only at a local scale, with two casualties, diffused damages and coastal landslides triggered in the island of Lekfada.
No relevant perturbations of the sea level were documented by the tide gauges placed in the Ionian coasts of Italy and Greece, with the exception of the signal recorded in Crotone (Calabria, south Italy), more than 250 km west of the source. Here a clear anomaly from the background signal is observed approximately one hour after the earthquake, with oscillations ranging over 20 cm peak-to-peak with a period of 7-8 minutes.
The perturbation affects the small harbor of Crotone, where the tide gauge is placed, for at least 2 hours, raising a series of questions on its nature: is it a tsunami or another kind of excitation of the sea surface? Is the long duration of the perturbation due to resonance effects inside the port basin? Why is such an anomaly observed only in the Crotone tide gauge record?
These issues are investigated by using in-house developed numerical techniques: the perturbation of the sea level provided by the earthquake in Lefkada is reconstructed by hypothesizing a strike-slip sub-vertical fault, compatible with the tectonics of the area, considering different parameter configurations starting from the official available information provided by the seismic agencies. The propagation of the generated tsunami is then computed over the Ionian basin by means of the UBO-TSUFD code, with special focus on the harbor of Crotone, where a nested grid at higher resolution is realized, in order to account properly for local signal amplification and resonance effects.
An additional local source is also considered, i.e. a small submarine landslide, with volume ranging some million m3, detaching from the shelf in front of Crotone at about 100 m sea depth, 10 km offshore. The mass movement is simulated by means of UBO-BLOCK1 code, and the generated tsunami computed and added to the already running sea level oscillations. The combined earthquake- and slide-generated tsunamis are then compared with the Crotone harbor observed signal.
The Lefkada earthquake presents also relevant implications for tsunami early warning procedures, especially as regards 1) the importance of including real-time information on earthquake focal mechanism, and 2) the present inability to deal with possible locally triggered tsunamigenic landslides.
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