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A new contribution for the identification of the source that generated the 1693 tsunami in Sicily (earthquake, submarine landslide or both?) and associated tsunami scenarios for the town of Catania, Italy

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The 11 January 1693 tsunami is the most important event that hit the eastern coast of Sicily in historical times. In this area tsunamis are generally associated with medium to large magnitude earthquakes. A sequence of two strong earthquakes hit eastern Sicily between 9 and 11 January 1693, the second was the largest (M=7.4 from CPTI04) and was followed by a violent tsunami. Historical documents and reports tell that the first arrivals seen along all the eastern coast of Sicily was a sea withdrawal. The major damage was experienced at Augusta with a possible 15 m wave run-up and at Catania. Important effects were also documented at Siracusa and Messina (Tinti et al., 2004).

In spite of the earthquake occurrence, the real cause of the tsunami is a question that is still open and different hypotheses have been advanced. They can be divided in four categories: parent fault onshore, parent fault offshore, submarine landslide, or a combination of the previous ones. Here we propose a discussion on these hypotheses, by studying and comparing the corresponding tsunamis by means of numerical simulations. The simulations of tsunamis are calculated through the FE code UBO-TSUFE developed at the University of Bologna (Tinti et al., 1994): as initial condition for seismic origin tsunamis we use the vertical co-seismic displacement of the seabottom, while in case of excitation by a submarine landslide, the forcing term, depending on

the body dynamics, is calculated by a Lagrangian block model, UBO-BLOCK2, also developed at the Bologna University (Tinti et al., 1997). The possibility of a landslide generation of the 1693 tsunami has been recently corroborated after the reinterpretation of the seismic data set acquired by ISMAR-CNR (Argnani and Bonazzi, 2005) that provides evidence of active faults and of mass movements along the Hyblean-Malta escarpment, the most important tectonic structure running almost parallel to the coast a few kilometres off eastern Sicily. The main results of our analysis are: the proposed faults located onshore cannot generate tsunamis compatible with historical data, only offshore faults can produce large scale tsunamis. The mapped submarine landslide has thickness and lateral extent sufficient to set in motion a large tsunami, moreover causing negative first arrivals consistent with observations.

In the course of the study, we have investigated scenarios of inundation for the town of Catania in the frame of the project SCHEMA, by using the finite-difference numerical code UBO-TSUDF written and developed by the researchers of Bologna University.

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