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A review of the 11th January 1693 eastern Sicily tsunami: what can numerical modelling tell us about the source?

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The tsunami that hit the entire eastern Sicily coastline on 11th January 1693 shares some rather outstanding peculiarities with several other historical events occurred in the Italian seas and more generally in the Mediterranean. It followed a large magnitude earthquake (estimated in 7.4) that produced extremely severe damages in a large area inland; the tsunami impacted a quite long portion of coastlines; its effects are described in coeval chronicles, from which we can deduce the most important impacting features; despite the large number of studies devoted to the definition of the source, a commonly agreed solution does not exist: macroseismic and onshore geomorphological investigations favour earthquake sources located inland while the tsunami observations can be reproduced satisfactorily only by offshore faults. In the last few years, and again similarly to other historical Italian tsunamis (see the 1908 Messina Straits event), the hypothesis of a submarine landslide triggered by the earthquake has been proposed as a possible source for the tsunami and consequently as a possible way of reconciling macroseismic and tsunami observations and simulations. In this contribution we first focus our attention on possible sources (faults and landslide bodies) located offshore eastern Sicily and recognised during recent marine geophysical surveys performed by ISMAR-CNR. After careful quantitative characterisation of the sources, we assess their tsunamigenic potential through numerical modelling and at the same time we check their ability to reproduce the historically observed impacting features of the 1693 event. Secondly, we take into consideration at least the most recent alternative hypotheses for both offshore and inland faults and we perform similar numerical experiments. We will finally try to draw some conclusions on the relative weight of earthquake and landslide sources in the 1693 tsunami generation and impact. All numerical simulations (tsunami generation by faults and landslides, tsunami propagation and impact) are performed by means of numerical codes developed and maintained by the Tsunami Research Team of the University of Bologna.