Plinius Conference Abstracts
Vol. 13, Plinius13-61-1, 2011
13th Plinius Conference on Mediterranean Storms

Modelling of a 11,500 cal yr BP old tsunami generated by a submarine landslide in the Western Mediterranean Sea

O. Iglesias (1), M. Canals (1), G. Lastras (1), M. Olabarrieta (2), M. González (2), I. Aniel-Quiroga (2), L. Otero (3), and A. Sanchez (1)

(1) Universitat de Barcelona, Facultat de Geologia, Estratigrafia, Paleontologia i Geociències Marines, Barcelona, Spain (olaiaiglesias@ub.edu), (2) Instituto de Hidráulica Ambiental, Universidad de Cantabria, Av. de los Castros, Santander, Spain, (3) Corporación de Ciencia y Tecnología de la Armada de Colombia, Zona Industrial Mamonal, Colombia

The BIG'95 submarine debris flow occurred on the Ebro margin of the gulf of Valencia, in the Western Mediterranean Sea, at prehistoric times (11,500 cal yr BP). Its resulting deposit covers an area of 2200 km2 of the slope and base of slope, at water depths ranging from 200 to 1800 m, with an estimated volume of 26 km3. The numerical model COMCOT (COrnell Multigrid COupled Tsunami Model) has been used to reveal the size and spreading pattern of the tsunami that such a landslide could have generated though assuming current sea-level conditions. The reconstruction of the pre-failure bathymetry and the shape change of the seafloor during landslide occurrence, both required by the model, have been developed based on multibeam bathymetry and high-resolution seismic reflection profiles of the deposit, and on the conceptual and numerical model of Lastras et al. (2005).

In terms of arrival time to nearby coastlines, the results show the relevance of the asymmetric shape of the basin floor. The model illustrates that the first shoreline impacted by the tsunami would be that of Eivissa Island instead of the closer to the source Iberian coast. Eivissa would be first hit by the out-going wave 18 min after the failure initial triggering and the island of Mallorca 9 min later. The back-going wave would hit the Iberian Peninsula 54 min after the failure. This marked difference is due to the strong shoaling effect produced by the much wider continental shelf of the Ebro margin if compared to the Balearic Islands one.

Serial times and spectral analyses show that the periods of tsunamis generated by seismic sources in the Algerian coast (Alvarez et al., 2010) are larger than those generated by a submarine landslide such as the BIG'95. This implies that resonance effects, that usually account for major damage onshore, would occur in smaller bays, such as Santa Ponça Bay, where the model predicts strong amplification, with waves up to 9 m high, which is 6 m in excess than in Palma Bay, and a peak of energy around 10-15 min. Other peaks in the modelled spectral analyses are found, at larger periods, in the synthetic station in the Iberian coast, which could be explained by resonant excitation of trapped edge waves on the Ebro continental shelf. Both tsunami source mechanism and bottom and shoreline morphology are crucial to assess tsunami impact in a given region, accounting for significant changes in arrival times, wave height and subsequent coastal flooding.