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Contribution of large submarine landslide to tsunami potential in the NE Atlantic region: The Gorringe Bank case study

Inês Ramalho (1,2), Rachid Omira (1,2), Maria Ana Baptista (2,3), Miguel Miranda (1,2), Pedro Terrinha (1,2), Luis Batista (1), and Cristina Roque (1)

(1) Instituto Português do Mar e da Atmosfera, IPMA, I. P., Lisbon, Portugal , (2) Instituto Dom Luiz, University of Lisbon , IDL, Lisbon, Portugal , (3) Instituto Superior de Engenharia de Lisboa,Portugal

Tsunami is recognized as a natural hazard, and it is now widely accepted that submarine mass-failures are one of possible tsunami sources. Various studies on tsunami-induced by submarine landslides were carried out based on a spontaneous trigger of the mass-failure. In this study we focus on the deep-water submarine landslide in the Gorringe Bank (GB) area, NE Atlantic. In particular, we investigate the contribution of such mass-failure, as an additional source, to tsunami potential. We assume that an initial tsunami is generated by a large earthquake in the south west Iberia margin area that also initiates the failure of the GB landslide. This mass-failure can play the role of a secondary source of tsunami and contribute to tsunami potential.
We simulate the tsunami generation as combination between the sea free surface perturbation caused instantaneously by the earthquake and the initial wave generated progressively due to the slide motion. Okada's equations are employed to compute the initial tsunami induced by the earthquake. While, a multi-layers viscous shallow water (VSW) model is used to simulate the flow of the submarine mass failure and the resulting tsunami wave. To model the propagation and coastal impact of the tsunami resulted from a combination of earthquake and landslide, we use a non-linear shallow water model and a nested grid system that allow estimating properly near-shore wave heights and inundation.
We consider a 1755-like earthquake of magnitude Mw8.5, and a landslide of an approximate volume of about 60 km3. The characteristics of the landslide come from the analysis of detailed marine geological data including the erosional area (dimensions and scarps) and the seismic profiles.
The results are presents in terms of: i) evidences of submarine mass failures in the area of GB; ii) simulations of the slide motion and the resulting tsunami wave; iii) simulations of the tsunami generated by a combination of two triggers: earthquake and landslide; iv) simulations of tsunami propagation and coastal impact; and v) analysis of the contribution of the submarine landslides to tsunami potential in the NE Atlantic.

Results show that, using the VSW model for landslide motion, we obtain a good agreement between the sediment deposits simulated and observed. We also find that the submarine mass-failures can significantly contribute to the tsunami hazard in the NE Atlantic region, in particular when they are combined with an initial earthquake-induced tsunami.

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