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Submarine slope earthquake-induced instability and associated tsunami generation potential along the Hyblean-Malta Escarpment (offshore eastern Sicily, Italy)

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The stability analysis of offshore margins is an important step for the assessment of natural hazard: the main challenge is to evaluate the potential slope failures and the consequent occurrence of submarine tsunamigenic landslides to mitigate the potential coastal damage to inhabitants and infrastructures. But the limited geotechnical knowledge of the underwater soil and the controversial scientific interpretation of the tectonic units make it often difficult to carry out this type of analysis reliably.

We select the Hyblean-Malta Escarpment (HME), the main active geological structure offshore eastern Sicily, because the amount of data from historical chronicles, the records about strong earthquakes and tsunami, and the numerous geological offshore surveys carried out in recent years make the region an excellent scenario to evaluate slope failures, mass movements triggered by earthquakes and the consequent tsunamis.

We choose several profiles along the HME and analyse their equilibrium conditions using the Minimun Lithostatic Deviation (MLD) method (Tinti and Manucci, 2006, 2008; Paparo et al. 2013), that is based on the limit-equilibrium theory. Considering the morphological and geotechnical features of the offshore slopes, we prove that large-earthquake shaking may lead some zones of the HME to instability, we evaluate the expected volumes involved in sliding and compute the associated landslide-tsunami through numerical tsunami simulations.

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