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Submarine landslide tsunamis in SW Iberia Margin: Sensitivity of tsunamigenic potential and hazard extent to physical properties of marine sediments

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Slope instability is probably the most effective process shaping the seafloor of continental margins. This process often leads to the occurrence of submarine mass failures that, if large enough, can cause potential tsunamis. Yet, the dynamics of the landslide evacuated material and their induced tsunamigenic potential remain largely uncharacterized in most continental margins. This applies to the SW Iberia Margin, where large underwater landslide episodes have been evidenced.

In this work, we investigate the sensitivity of landslide-generated tsunami to the physical properties of marine sediments involved in the slope failures in the SW Iberia Margin. This includes the landslide dynamics, the tsunamigenic potential and the tsunami hazard extent. Based upon the MAGICLAND (Marine Geo-hazards Induced by Underwater Landslides in the SW Iberian Margin) project database, we select promising sizable submarine landslide scenarios. We then use an in-house developed two-layer numerical code (based on a Bingham visco-plastic model for the landslide and a non-linear shallow water model for the tsunami) to simulate both the landslide dynamics and the induced tsunami generation and propagation.

In a first stage, the numerical simulations are done considering uncertain sediments properties deduced from the literature. Next, we perform numerical simulations of the selected landslide scenarios using accurate geotechnical properties (mainly the in-situ shear strength obtained from undisturbed samples) determined by laboratory tests conducted on from the analysis of available marine gravity cores in the SW Iberian Margin. Results show that the geotechnical parameters significatively influence the simulation results of both the landslide dynamics and induced tsunami. Particularly, we noticed major effects on the landslide downslope deformation, failure speed, deposited thickness and run-out, which considerably control the momentum transferred to the generated tsunami wave. This demonstrates that the use of inappropriate material properties leads to a misquantification of landslide tsunamigenesis and hazard extent.

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