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Tsunami hazard along the Alboran Coast triggered by submarine landslides

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Historical earthquake records suggest that the Alboran Sea seismicity is mostly triggered by strike-slip faults with little or no vertical throw preventing significant tsunami formation. Although in the North Alboran Sea the Averroes fault may have a tsunamigenic potential, the main active fault system responsible of the last three major earthquakes ($M_w \geq 6$) in the South Alboran Sea, the Al-Idrissi fault, has no significant vertical component. This points to submarine landslides as the main potential source of tsunamis for the southern sector of the basin. Our study deals with the tsunamigenic potential of submarine landslides in the southern Alboran Sea, where several deposits are stacked within the last million year of sedimentary cover. We have identified up to 67 landslide events with volumes between 0.01 to 15 km³. The probability of landslide occurrence has been analysed with a logistic regression describing the relationship between a binary response variable (existence or absence of landslide) and a set of predictor variables such as high seafloor gradients and presence of active faults. The analysis of the severity of a given landslide has been investigated based on the estimation of the probability that the landslide reaches a certain (high) level (e.g. tsunami run-up or submarine cable breaks) giving that it has occurred through the extreme value analysis. We have used the ShalTOP code simulating landslide run-out on the basis of a depth-averaged model based on the hydrostatic Saint Venant equations and Coulomb-type basal friction considering a Bingham rheology. Our tsunami simulations include ShalTOP output scenarios as a source of the generated tsunami through hydrodynamic simulations using the hydrostatic 3D Navier-Stokes code Freshkiss3d. We found that tsunamis waves triggered by submarine landslides on the South Alboran Sea would be no higher than two meters. However, the tsunami would include wavelengths of tens of kilometres translating into important water volumes flooding several areas of around the Alboran coast.