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Seismically-induced slope instability and tsunamigenic landslides scenario in the Scilla area (southern Tyrrhenian Calabria, Italy)

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The Scilla area, along the Tyrrhenian coast of Calabria (South Italy), is affected by an intense seismic activity, expression of a complex tectonic setting where the main features are the Calabrian Arc structure and the Messina graben. Furthermore, the area counts several steep slopes, both subaerial and submarine, and the evaluation of their stability conditions under seismic load represents an important step to assess the coastal hazard and risk, because even if not every strong earthquake is a tsunami source, an intense seismic event could generate a catastrophic tsunamigenic landslide: impacting with the sea, the sliding mass transfers its kinematic energy to the water, generating high waves, as occurred on February 6th 1783.

Between 1783 and 1785 several earthquakes hit South Calabria, and following one of the strongest (5th February 1783, Mw = 7.1, CPTI15), a sliding mass of about 6 million m3 detached from Mount Pacì flank, generating a disastrous tsunami. The Scilla inhabitants (over 1500 people), sought safety in the beach from building collapses, but unfortunately found the death from the huge waves that stroke the coast (about 6 – 8 m). Also the Sicilian coasts were inundated by the tsunami waves, as the historical records report: Capo Peloro, the north-eastern point of the Island, was affected by a severe flood of many hundreds of meters.

In this work, we outline the 6th February 1783 landslide-tsunami scenario: using the Minimum Lithostatic Deviation method, we evaluate the equilibrium condition of the coastal cliff under seismic load, with the aim to identify the suitable ground accelerations that have caused slope failures. We simulate the sliding motion by means of in-house code UBO-BLOCK1 and we compute the tsunami generation, propagation and impact with the finite-differences code UBO-TSUFD. Exploring the earthquake-triggered slope failures and its consequences (landslide and tsunami) represents an important step to detect the countermeasures that could be adopted by the authorities in order to minimize the risk for people and structures in case of a catastrophic event as occurred in Scilla.