Geophysical Research Abstracts, Vol. 7, 04964, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04964

Tsunamigenic mass failures from the Sciara del Fuoco, Stromboli, Italy, analysed through numerical models

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The recent South-East Asian disaster showed the lethal effects of the generation of waves by a large-size submarine earthquake, but tsunamis with catastrophic consequences can be generated also by mass failures, both submarine and subaerial. A possible mega-tsunami affecting the southern Tyrrhenian sea may have had the source in the volcanic island of Stromboli, in South Italy, where about 5 ka years ago a mass of about 1 km^3 detached from the north-western flank of the volcano, forming the Sciara del Fuoco scar. In addition to large tsunamis, Stromboli can be the source also of small and medium-size events all attributable to mass instability. Indeed, in the course of the ordinary volcanic activity most of the ejecta are channelled to the sea along the Sciara del Fuoco, with the result that periodically the slope reaches conditions of gravitational instability and landslides may occur with tsunamigenic effects. These events were shown to be rather frequent, and locally can cause serious damage, like in the case of the two 30^{th} December 2002 tsunamis that affected the whole Stromboli coast: the waves reached the height of 10 meters in several places, fortunately without casualties. The model we apply in this work adopts a Lagrangian approach, first developed in Tinti et al. (1997), with a moving reference frame, and considers the mass divided into blocks on which centres of mass (CoM) we apply the motion equations. The goal of the study is to analyse the dynamical evolution of the mass bodies detaching from the north-west flank of the volcano. We consider several cases in order to study the effect of the mass geometry (e.g. shape, mass distribution, volume) and detachment position on the landslide motion, and to explore its tsunamigenic potential. In particular we compare the potential of subaerial to submarine landslides, and we study the time evolution of the landslide Froude number that is known to be related to the efficiency of the transfer of energy from the sliding body to the sea water waves.