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Potential collapse of the Cumbre Vieja's volcanic edifice (Canary Island; Spain).

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The younger south part of the La Palma island (Cumbre Nueva) has been growing rapidly southwards and continues to do so to this day; historical volcanic eruptions has occurred during years 1585, 1646, 1677, 1712, 1949 1971. Should a new landslide potentially dangerous happen in the near future? That is the reason we are concerned with modeling the rock slope stability of the south-west flank of the Cumbre Vieja. This scenario of collapse is discussed by Ward and Day (2001) and Day (1999) in the central and south part of Island: the Cumbre Vieja. These authors estimate the potential volume of a future Cumbre Vieja collapse, dropping 150 to 500 km3 of rock in the form of debris avalanche into the Atlantic Ocean, inducing the tsunami wave.

In the work we examine the slope instability of the western flank of La Palma Island using the both FDM and FEM numerical codes, respectively Finite Different Method and Finite Element method. This report examines the potential instability of Cumbre Vieja volcanoes with exclusively variation of Mohr-Coulomb criterions and groundwater height into the volcanoes (geotechnical parameters). The calculation model is utilized to predict the behaviour of a potentially massive flank failure at Cumbre Vieja volcano on the La Palma Island. In this contribution, we present an application of the 2D numerical approach of stability of western flank of La Palma, using both numerical codes of calculation: Finite different method (FDM; 2D FLAC Slope version) and Finite elements method (FEM; ADELI computer code calculation).

In this contribution the mechanical characterisation of the volcanic rocks of Cumbre Vieja are partially deduced to the laboratory tests (density, porosity, Young modulus) and by the authors working to the Canary Islands (c', '): it's the Mohr-Coulomb criterions. From of field geological investigations, a west east cross section through the Montana del Fuego has been chosen for mechanical modelling and stability calculations (south of Cumbre Vieja. The first time FDM numerical code used the Factory of Safety for establishes the both conditions of normal stability (Fs > 1 or more) and instability (Fs < 1) of Cumbre Vieja volcanoes). In the second time the both FDM and FEM calculation gives the elasto-plasticity deformation of Cumbre Vieja collapse using different stages of degraded geotechnical parameters into the volcanic rocks (simulation of hydrothermal alteration).

The results of calculations shows that potential failure of Cumbre Vieja is parallel to the boundary between Cliff-formation sequence and substratum corresponding at a large circular plane of failure (no inclined plane) such as collapses of flank of volcanic edifices in the Canary Islands, noted Debris Avalanches. The mechanical modelling give the shape of failure: a semi-elliptical shape plotted with different positions within the Cumbre Vieja western flank.