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Sensitivity of the Stability of Stratovolcanoes to Volcanic Activity and Ground Acceleration: the Teide-Pico Viejo Complex in Tenerife, Spain

R. Del Potro (1), M. Hürlimann (2), H. Pinkerton (1)

(1) Department of Environmental Science, Lancaster University, UK, (2) Department of Geotechnical Engineering and Geosciences, Technical University of Catalonia, Spain. (r.delpotro@lancaster.ac.uk / Fax: +44 (0) 1524 593985 / Phone: +44 (0) 1524 593975)

Giant volcanic landslides are one of the most hazardous geological processes due to their volume and velocity. However, the causes of these enormous mass movements remain unresolved. Alongside slow rate persistent weakening processes, generally there is a factor which ultimately triggers a flank failure. Magmatic intrusions generate small magnitude earthquakes close to the surface as well as applying a mechanical load on the edifice and may generate excess pore fluid pressures. A combination of these phenomena during a volcanic crisis could bring the edifice to a stage near limit equilibrium where a small increase in the volume intruded or a small earthquake could trigger a flank failure. Bigger magnitude earthquakes could also trigger landslides during periods of volcanic dormancy.

The aim of the study is to assess the stability of the Teide-Pico Viejo stratovolcano, in the central part of Tenerife, under potential future scenarios of renewed volcanic activity and pseudostatic conditions. The significance of this study is highlighted by an increase of seismic activity in the area over the last two years. The sensitivity of the stability of the actual complex and previous (inferred) cones, to ground acceleration and magmatic intrusions is gauged by using a combination of limit equilibrium and finite element models. Our results indicate that under most conditions earthquake acceleration is more significant than magmatic intrusions. The high uncertainty embedded in the models does not allow for a quantitative analysis. To overcome this problem a stochastic approach is suggested