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Analysis of a large, seismically-induced mass movement after the December 2018, Etna volcano (southern Italy) seismic swarm

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In the last decades, satellite monitoring techniques allowed to discover non-catastrophic slope movements triggered by earthquake shaking and involving deep blind sliding surfaces of old paleo-landslides. Understanding the triggering and attenuation mechanisms of such mass movements is crucial to assess their hazard. On December 2018, the Etna volcano (southern Italy) began a very intense eruption, accompanied by a seismic swarm with magnitudes up to 4.9. Synthetic Aperture Radar data from Sentinel-1 and ALOS-2 identified some local displacements over a hilly area to the southwest of the Etna volcano, near Paternò village. We evaluated the contribution of seismically-induced surface instabilities to the observed ground displacement by employing a multidisciplinary analysis comprising geological, geotechnical and geomorphological data, together with analytical and dynamic modelling. The results of our study allowed us to identify the geometry and kinematics of a previously unknown paleo-landslide. A pseudostatic, limit-equilibrium back-analysis of the landslide mass highlighted that the displacements detected by InSAR data were caused by the undrained seismic instability of the landslide mass, which was dormant before the volcanic eruption, under the light-to-moderate seismic shacking of the December 26, Mw 4.9 earthquake. Such a new observation allowed to identify the geometry and kinematics of a previously unknown landslide mass and confirms that earthquakes have a cumulative effect on landslides that doesn't necessarily manifest as a failure but could evolve in a catastrophic collapse after several earthquakes. Such an aspect must be adequately investigated to identify unknown quiescent landslide bodies and to prevent the effects of their potential collapse during an earthquake.