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A multi-sensor approach integrated to slope failure modeling for monitoring an active volcanic area: the 2011-2014 eruptive phase of Mount Etna.

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This work presents an integration of various remote sensing datasets and a geotechnical modelling to perform a morphological reconstruction of a volcanic area, Mount Etna, where rapid changes can occur.

In January 2011, a sequence of short and violent eruptions started at the “New Southeast” crater (NSEC) of Etna, leading to the formation of a cinder cone that has is presently the highest peak of the volcano.. This cone is located at the top of the steep slopes of Valle del Bove and it represents an element of concern because of its potential destructive evolution.

A multi-sensor and multi-temporal dataset has been gathered to investigate the morphological changes of the summit area of the volcano, above ~3000m, especially around that new crater. **WorldView** and **Pleiades** stereopairs have been used to calculate high resolution Digital Elevation Models and orthoimages at different epochs between 2011 and 2014. **COSMO-SkyMed** interferometric pairs provide additional information.

Finally, a probabilistic model has been developed to assess the stability of the NSEC, quantify the possible unstable volumes and define the covered area from the a potential collapse. The modeling has been implemented by introducing strength parameters from volcanoclastic-like materials.

From a geomatic point of view, our approach may constitute an advance in the monitoring capability of inaccessible areas through the combination of various high resolution optical and SAR interferometry space images.

In the future data from other missions could boost the capabilities of our method, such as those acquired by **Sentinel 1**, active from April 2014.

Our probabilistic model, once further validated, could contribute to define a methodology to evaluate instabilities induced by mechanisms influencing the load of the magma column at the base of a cinder cones that, in case of sufficient pressure, may be destabilized and the gravitational load of the cones themselves.

In relation to hazard assessment issues, such investigations contribute to the understanding of the causes that can determine a collapse of even greater proportions and to the definition of risk mitigation actions for downslope human activities.

Finally, in a large and high volcano in continuous and persistent activity like Mount Etna, it is not always easy to conduct monitoring activity from the ground, and with a persistent hazard, especially near the summit. Therefore the approach of multi-sensor assimilation observations gathering various EO data is promised to becoming increasingly used in the future also considering a deeper assimilation with ground based and UAV observations.