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DSGSD to rockslide transition at the Saline ridge (Valfurva, Italy) constrained by dating, remote sensing and time-dependent modelling

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Deep-seated slope deformations (DSGSD) in alpine environments are characterized by huge volumes and long-term evolution. They can creep slowly for thousands of years or experience a transition to fast, potentially catastrophic rockslides, depending on the pattern and rate of progressive failure driven by rock properties, relief, loading history, and fluid circulation. The reconstruction of the DSGSDs long-term evolution is thus required to assess their geohazard potential. Riva et al (2017) proposed that large rock slopes undergo paraglacial progressive failure for long time after deglaciation, eventually resulting in the differentiation of postglacial rockslides with mature shear zones and high sensitivity to hydrological forcing. We tested this model at the Saline Ridge, on the NW side of Mt. Confinale (Central Italian Alps). The 1500 m high slope is affected by an active DSGSD, characterized by a confined basal shear zone with associated slip >100 m in the upper sector, and by reactivation of inherited fracture systems as gravitational morpho-structures (Agliardi et al., 2001). The lower slope sector is partially collapsed and hosts the 20 Mm^3 Ruinon rockslide. This is suspended on the valley floor and slips at fast seasonally variable rates, currently representing a major landslide threat (Crosta et al., 2017).

To achieve a complete understanding of slope evolution, we integrated morpho-structural observations, absolute dating, radar interferometry and numerical modelling. We constrained long-term slope evolution by Cosmic Ray Exposure dating (CRE), using both ^{10}Be and ^{26}Al cosmogenic nuclides on quartz extracted from six phyllite samples from key morpho-structures. We maximized the chronological information by performing Schmidt-hammer exposure age dating at 21 sites (DSGSD morpho-structures, moraine, rockslide and rock glacier deposits). The present-day style of slope activity was characterized by performing a long-range (up to 4000 m) reprocessing of a GB-InSAR monitoring dataset, collected since 2006 to monitor the Ruinon rockslide. Long-range, distributed GB-InSAR data, acquired at extremely high temporal frequency and spatial resolution (1.5 m in range, 8.6 m in azimuth), allowed detecting non-linear displacement trends in different slope sectors over a decade. Finally, we integrated all the observations in a time-dependent numerical framework using DaDyn-RS, a damage-based creep model considering up-scaled rock mass properties and able to account for the effects of deglaciation and damage-dependent fluid occurrence (Riva et al., 2017). Our results demonstrate a Late Glacial DSGSD initiation and an early Holocene rockslide nucleation inside a continuously evolving DSGSD, with increasing strain localization, deformation rates and sensitivity to external agents. Our approach allows to effectively identify DSGSD with potential progressive evolution, and prioritize site-specific monitoring and Early Warning studies.

Agliardi, F., Crosta, G., & Zanchi, A. (2001). Structural constraints on deep-seated slope deformation kinematics. Engineering Geology, 59(1), 83-102.

Crosta, G. B., Agliardi, F., Rivolta, C., Alberti, S., & Dei Cas, L. (2017). Long-term evolution and early warning strategies for complex rockslides by real-time monitoring. Landslides, 1-18.

Riva, F., Agliardi, F., Amitrano, D., & Crosta, G. B. (2017). Damage-based time-dependent modelling of paraglacial to postglacial progressive failure of large rock slopes. JGR: Earth Surface. doi: 10.1002/2017JF004423