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Detecting and monitoring past and present movement rates of slope deformations in Lienz (Tyrol, Austria)

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Slope deformations cause a considerable threat to settlements and infrastructure in mountainous environments. Analysing slope behaviour retrospective covering time spans beyond some years back is crucial input for sound stability prognoses as slope deformations might reactivate under different conditions as at present.

In Eastern Tyrol, northwest of Lienz, two examples of deep-seated gravitational slope deformations (DSGSDs) within mica schists and gneiss of the Schober Gruppe ranging between 700 and 2900 m a.s.l. were chosen as study sites for combining different methods for assessment of movement rates. The advantage of this area is a modern geological map (Linner et al. 2013) and an already existing reconstruction of the glacial chronology (Reitner et al 2016) as a time constraint for the onset of DSGSDs.

The slope between Thörl (2507 m a.s.l.) the village of Oberalkus (1284 m a.s.l.) is characterised by a saw-tooth slope profile due to a series of antislope scarps as a result of deep-seated toppling (Reitner & Linner 2009). This was enabled by joints and faults steeply dipping into the slope. The uppermost part reveals a 300 wide graben structure where now fossil rock glaciers have their root zone. The activity state of the slope deformation is unknown.

The other case is the slope SE' of Schleinitz (2904 m a.s.l.) and S' of Neuralpscheid, showing a sagging-like slope deformation in crystalline bedrock. This is characterised by big scarps in the upper part, partly dissecting relict rock glaciers and a bulging toe with total disintegration due to rock creep. This toe has been the source area for devastating debris flows throughout history, which resulted in the build up of a huge hyper-trophic alluvial fan NW of the city of Lienz.

For the long-term detection of deformation rates and defining the historic baseline to tie reactiviation periods to conditioning factors, we sampled the antislope scarps and (normal) scarps for cosmogenic nuclide dating with in total 14 samples. For age constraints of the mass movement features we took in addition 8 samples of periglacial and glacial deposits linked to the DSGSDS.

The last decades and present movement rates are processed with satellite InSAR (Interferometric synthetic aperture radar) acquired from ERS, ENVISAT and Sentinel-1. The combination of movement rates derived from these two methods should enable a better assessment of the current status of slope deformation since their onset as well as its potential future development.

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