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Study of a DSGSD in the Bagnes Valley (Switzerland, Valais): structural analysis and movements monitoring by DGPS and TLS.

Florence Delasoie, Clément Michoud, Andrea Pedrazzini, and Michel Jaboyedoff
Lausanne, Switzerland (florence.delasoie@unil.ch)

The DSGSD (Deep Seated Gravitational slope Deformations) phenomena occur in most mountainous landscapes. Despite these phenomena have been recognized worldwide as a major processes of mass wasting, the mechanisms of most mapped DSGSD are not well understood.
In the Bagnes Valley (Valais, Switzerland), 14 DSGSD have been detected. Geologically, the field is situated in metamorphic rocks: quartzite-schists, prasinite. This study focuses on the Barmasse area, which is the seat of a 1.5 square-km-large DSGSD. The deep-seated movements cause shallower landslides with important displacements that produce deformations on the cantonal road connecting the lower Bagnes valley to the Mauvoisin hydroelectric power plant. Moreover, frequent rockfalls are originating from the scarp of these landslides or from their scree slope. Due to the economical importance of the object at risk, the municipality of Bagnes and the canton of Valais set up a monitoring system to monitor the movements of the shallow landslide, and build protection dams to reduce the rockfall risk.

The aim of this study are 1) to characterize the mechanisms of the DSGSD in order to evaluate its activity and its future evolution and 2) to better understand the link between superficial and deep movements.

A multidisciplinary approach is used, containing field mapping, structural analysis, measurements displacement (Extensometers, DGPS and Terrestrial Laser Scanning), dendrochronology, geophysics, hydrogeology and computer modeling. Moreover, two boreholes make it possible to calibrate geophysical data and to build a 3D-model.
The preliminary results show that the mechanism of the DSGSD is mainly driven by large scale toppling of subvertical sets. 4 families of discontinuities have been detected in Coltop 3D: S1 (parallel to the stratification), J2/J3 (subvertical) and J4 (horizontal). S1 couple with J2/J3 makes a wedge mechanism rupture possible in the main scarp. A basal surface is located around 50 m depth confirmed by the SLBL method.
The movements measured on the DSGSD itself are low (mm/year), but the displacements of the shallow landslides are very important: they reach about 3 m/year in the scree slope. In the main scarp, the extensometers show displacements up to 2 m, since 2005. As indicated by dendrochronological analysis, the activity of these landslides is recent (2000 BP). The DSGSD result from the postglacial decompression (12'000 years). Today, the block deposits creep along the valley and the fracturing due to the DSGSD continues.