Landslide investigation in the Swiss Alps using the seismic refraction and reflection techniques together with a numeric method based on the sloping base-level concept

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The Glaive forest above Ollon in the Alps in south-western Switzerland is affected by a large landslide (600 x 400 m, average slope: 45o). The landslide is probably linked to the retreat of alpine glaciers and gypsum dissolution processes. Most of the area is underlain by gypsum. In the upper part of the landslide, the area is characterised by a relative smooth topography that is abruptly truncated by a typical scar where gypsum outcrops. Further down, an accumulation zone thickens progressively and it may extend under the Quaternary sediments that fill the valley. The depth of the failure surface is problematic, and hypotheses are essentially based on numerous and sometimes contradictory geomorphologic observations.

In this work, seismic refraction and reflection surveys were carried out to investigate the depth of the surface failure and the lithologies involved. Results were compared with those of a numeric method based on a modified version of the sloping base level.

A transversal seismic reflection profile was acquired together with a longitudinal refraction profile. For the SLBL analysis, two DEM were considered: a DEM of the present topography and another DEM calculated with the SLBL method that represents the landslide topography without the Quaternary fill of the plain.

Analysis of the seismic data provides a four layer model. The first layer is very thin and shows velocities varying from 400 to 1000 m/s. The second layer (25 m deep)

shows velocities of 1500 m/s; its lower limit probably corresponds to a failure surface. The third layer (40 m deep) shows velocities of about 3000 m/s and the last one has velocities from 4000 to 4600 m/s that correspond to a basal anhydrite layer. The discontinuity between the third and fourth layer is interpreted as a deep failure surface. This interpretation coincides with that of the SLBL method. The latter indicates a first shallow failure surface and second deeper one that extends under the Quaternary valley floor.