Geophysical Research Abstracts
Vol. 21, EGU2019-12773, 2019
EGU General Assembly 2019

Influence of discontinuities on failure initiation, internal deformation and kinematics of an active deep-seated rock slide in an high alpine environment (Ötztal valley, Austria)

Christina Rechberger and Christian Zangerl

Institute of Applied Geology, University of Natural Resources and Life Sciences, Vienna, Austria (christina.rechberger@boku.ac.at)

In order to understand and identify the influence of the structure of the rock mass on rock slide formation and deformation processes, the highly active, deep-seated "Marzell" rock compound slide in the Ötztal valley (Tyrol, Austria) has been examined. The investigated rock slide is situated at the SE-facing slope above the Marzell valley glacier and measures about 400 m in width and 600 m in height (main scarp at 2850 m a.s.l.). Geologically, the rock slide is located within the fractured, foliated poly-metamorphic rocks of the Ötztal Crystalline basement (i.e. paragneisses, mica schists and banded amphibolites).

A multi-disciplinary approach comprising of i) geological-geomorphological mapping, ii) tachymetric and GPS survey campaigns, iii) analyses of airborne laserscanning data (ALS), iv) analyses of historic and current ortho-images, and v) manual wire-extensometer measurements, was applied to reconstruct the rock slide evolution and to develop a geometrical-kinematical rock slide model. Given that rock discontinuities influence the geomechanical failure behaviour and thus the failure geometry, a major focus was set on rock mass characterization based on discontinuity mapping. Additionally, kinematical analyses considering the structural inventory was carried out to identify modes of rock mass failure and preliminary discrete element modelling (UDEC) was performed to study rock slide kinematics and failure mechanisms.

Geomorphological features such as primary and secondary scarps, uphill and downhill facing scarps, graben structures, trenches and tension fractures indicate the evolution of two time-delayed rock slide systems. Geodetic survey results show a high recent activity of the rock slide of several decimetres per year. Based on the geological structures and the measured displacement rates, six individual rock slide slabs can be identified. These slabs are separated by discrete failure surfaces/shear zones that were formed partly or totally along pre-existing NNE-SSW and E-W trending fault systems. The detailed discontinuity analyses of foliation planes, joints, and brittle fault zones show a major influence on the rock slide failure mechanism, failure geometry and kinematics. Kinematically, the SE directed slope movement caused extensional structures near the head scarp (horst and graben, trenches, fractures) and to bulging and slope steepening at the lower part of the rock slide. Results from the numerical 2-D discontinuum model are discussed with respect to: i) the structural influence on failure geometry (from pre-failure to current failure state), ii) the internal structures (e.g. horst and graben) and deformation behaviour of the sliding mass, and iii) the existence and formation process of a basal shear zone.