Geophysical Research Abstracts, Vol. 9, 06073, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06073

Structural and geometric back-analysis of the 1934 rock slide event in Tafjord (Norway) and implications for rock slide detection

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In the night of the 7th February 1934 about 3 million m^3 of rock fell down from the Heggura mountain on the northern flank of the Tafjord (Møre og Romsdalen county, central Norway). The impact of the rock mass caused a huge tsumani in the fjord which destroyed nearby villages and led to 40 casualties.

The 1934 landslide scar is still active with frequent rockfall activity and a potentially unstable area in the surroundings of the 1934 scar is currently studied and monitored within the Åknes/Tafjord project. The understanding of the failure mechanisms of the 1934 event is essential for the hazard assessment of the present potential instabilities.

The structural and geometric back-analysis of the 1934 collapse is based on high-resolution digital elevation models (HR-DEM) derived from aerial and also terrestrial 3D laser scanner data, as well as on measured orientations of the foliation and the fractures in the vicinity of the scar. HR-DEM analysis permits the identification of relevant structures, especially in inaccessible terrains. Consequently, the characteristics (orientation, roughness, percentage of rock bridges) of the basal sliding plane, as well as those of the lateral shear plane have been determined. These data are then used for the structural and geometrical model of the 1934 event, which can be compared to the observed geomorphic features on the monitored instabilities. The back-analysis notably helps for the detection of instabilities by putting in evidence the relevant structures implied in the slope instability. The pre-failure topography and the volumes of the 1934 collapse are also determined. Finally, all the characteristics of the failure surfaces also allow for a geomechanical back-analysis of the 1934 rock slide.