Geophysical Research Abstracts, Vol. 9, 08160, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08160

Investigation and modelling of periglacial rock fall events in the European Alps

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Slope stability of steep rock walls in glacierised and permafrost-affected high-mountain regions is controlled by many different factors such as geological and geomechanical characteristics, topography, hydrology and also glaciation and permafrost occurrence. Changes in one or more of these factors may reduce the slope stability and eventually lead to a rock fall event. Recent rock falls and also ice avalanches in the European Alps and other high-mountain regions reveal the severe hazard potential related to such slope instabilities. The general tendency in high-mountain areas with a scenario of accelerated future warming could be a widespread reduction in stability of formerly glacierised and perennially frozen slopes.

Based on investigations of recent rock fall events, this study investigates different parameters controlling the stability of high-mountain rock walls, especially in view of ongoing climatic change. To this aim, detachment zones of different rock fall events are investigated based on field work, analyses of aerial and terrestrial photos and digital elevation models in order to build a basis for subsequent modelling. The main purpose of the modelling is to reproduce the rock mass instability at the detachment zone and to understand the processes leading to failure and the sensitivity to different parameters. Modelling is done with UDEC (Universal Distinct Element Code by Itasca), a two-dimensional numerical program based on the distinct element method for discontinuum modelling. Preliminary modelling results for the Tschierva rock fall (Piz Morteratsch, 1988) are presented. The influence of different geological and geomechanical characteristics, permafrost degradation and deglaciation on slope stability is assessed. Of particular interest for this study are varying water pressures due to permafrost degradation and changing confining pressure as a result of glacier retreat.