Geophysical Research Abstracts
Vol. 19, EGU2017-16772, 2017
EGU General Assembly 2017

How to determine wet-snow instability

Ingrid Reiweger (1) and Christoph Mitterer (2,3)

(1) BOKU University of Natural Resources and Life Sciences, Department of Civil Engineering and Natural Hazards, Vienna, Austria, (2) University of Innsbruck, Division of Geotechnical and Tunnel Engineering, Innsbruck, Austria, (3) BfW Austrian Research Centre for Forests, Innsbruck Austria

Processes leading to wet-snow instability are very complex and highly non-linear in time and space. Infiltrating water changes wet-snow strength and other mechanical properties. A high liquid water content presumably favors fracture propagation, which consequently has an influence on the formation of wet slab avalanches. The weakening of snow due to liquid water within the snowpack might be gradual (melt event) or sudden (rain-on-snow event). There are several feedback mechanisms between liquid water and snow stratigraphy, making the weakening process complex. We used modelled stability indices to determine periods with high wet-snow instability. These indices were either based on energy and mass balances indicating critical amounts of water within the snowpack or on simple hydro-mechanical relationships. In addition to the modelled indices, preliminary field studies investigated the fracture initiation and fracture propagation propensity within wet snowpacks. We therefore performed Rutschblock and propagation saw tests in faceted weak layers with different volumetric liquid water contents. Results of simulations and field experiments showed that a critical amount of liquid water combined with a pre-critical snow stratigraphy were relevant for wet-snow instability. The critical amount of water was assumed to drive both failure initiation and fracture propagation. The simulated indices and observed stability tests indicated a high wet-snow instability when the volumetric liquid water content within faceted weak layers exceeded 3. Within our propagation saw test measurements crack propagation propensity even slightly decreased at very low liquid water contents compared to completely dry conditions, presumably due to capillary forces. For liquid water contents higher than 3-4%, however, crack propagation propensity strongly increased, which we assume was due to the weakening of bonds between grains within the increasingly wet weak snow layer. Our results could be used to deduce general rules for supporting wet-snow avalanche forecasting programs.