Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09847, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09847
EGU General Assembly 2008

Deriving snow stability from micropenetration resistance

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Information about snow cover stability is important to predict avalanche danger. Traditionally, stability evaluation is based on manual observations of snow stratigraphy and stability tests, which are time consuming. The SnowMicroPen (SMP), a snow micropenetrometer, has been developed to measure vertical, high resolution penetration profiles. We have analysed the penetration signal to derive snow stability. The proposed stability algorithm was developed by comparing the SMP profiles to the corresponding manual profiles including stability tests. The algorithm identifies the potentially most unstable weak layer and calculates a strength index based on structural properties of the weak layer. Taking into account the slab properties, a stability index is calculated which estimates the probability of skier triggering. The algorithm was verified with about 60 SMP profiles by comparing the automatically determined weak layer location to the identification by visual inspection of the penetration signal. In most cases, the location was identical. In order to provide high resolution, the SMP in combination with the proposed algorithm shows high potential for providing snow cover stability information with high resolution in time and space.