Geophysical Research Abstracts
Vol. 13, EGU2011-1978, 2011
EGU General Assembly 2011

Probability distribution of energetic-statistical strength size effect in alpine snow

David McClung (1) and Chris Borstad (2)

(1) University of British Columbia, Geography, Vancouver, B.C., Canada (mcclung@geog.ubc.ca, +1 604 822 6150), (2) University of British Columbia, Civil Engineering, Vancouver, B.C. (cborstad@gmail.com/1+604-822-6150)

Alpine snow in which avalanches form is a quasi-brittle material with an energetic (or fracture mechanical) strength size effect. However, there is also a probabilistic aspect to the size effect. In this paper, we present field data for un-notched tensile fracture of uniaxial samples and 3 point bending tensile experiments from a cold laboratory. In addition, we summarize field data on shear fracture tests of avalanche weak layers. Taken together, the argument is derived from more than 2000 tests, 90% of which are from field data. On the basis of the data, as well as simple theory relevant to un-notched quasi-brittle fracture, we suggest that the tensile and shear fracture data follow a gamma probability density function (pdf). For alpine snow, the gamma pdf is essentially equivalent to a normal pdf as in Daniels fibre bundle model for the implied distribution shape factor. However, the physical description of the failure process to derive the gamma pdf for alpine snow differs substantially from that in Daniels' classical fibre bundle model.