Geophysical Research Abstracts, Vol. 9, 03123, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03123

Fracture properties of faceted snow

D. McClung

University of British Columbia (mcclung@geog.ubc.ca/ Fax: 604-822-6050)

Faceted snow is one of several types of weak layers responsible for slab avalanche release which can involve vertical collapse during shear failure. In this paper, I present precision measurements from direct simple shear experiments on cold, faceted snow. The data include estimates of friction angles and they include both vertical and horizontal displacement under strain-softening shear failure. In addition, the data also include stress estimates and displacements during catastrophic shear fracture. The data show that fracture ensues while the sample is in a state of dilatancy in accord with concepts from critical state soil mechanics. Thus, it appears that the fracture condition is satisfied while the sample is in a dilatant state with dynamic collapse (vertical deformation) following after the fracture condition is satisfied. The measurement precision for the deformation is on the order of 0.01 mm.

Friction angles representing increase in peak shear stress (before fracture) with applied normal load are shown to be in the range of 50 - 60 degrees for faceted snow. These values may be compared with approximate values from shear frame tests of only a few degrees. In combination, the data suggest that shear frame measurements may be interpreted in a dynamic sense only with and that shear frame tests must involve the complexity of dynamic collapse. Further, the lab test data suggest that the initiation of fracture in avalanches occurs in a state of dilatancy for faceted snow not from a collapsed state as some have speculated on based on field observations.