EGU2020-22491
https://doi.org/10.5194/egusphere-egu2020-22491
EGU General Assembly 2020

Changes in the mechanical properties of snow relevant to crack propagation in the hours and minutes following loading

Karl W. Birkland[1], Bastian Bergfeld[2], and Alec van Herwijnen[2]
[1]USDA Forest Service National Avalanche Center, Bozeman, Montana, USA
[2]WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

Since most dry slab avalanches occur during or immediately following loading by snowfall or wind deposition, it is important to understand changes in the mechanical properties of the snowpack in the minutes and hours following loading. To investigate these temporal changes we conducted a series of 15 Propagation Saw Test (PST) experiments on a flat, uniform site. The existing snowpack at our site contained a layer of surface hoar buried 2 cm below the snow surface. We used a 5 mm sieve to add 10 cm of snow into a 120 cm by 30 cm cardboard frame and completely isolated our blocks. We then conducted PSTs on the buried surface hoar layer from 4 – 453 minutes after adding the sieved snow. We sprayed dye on the side of our tests and filmed them with a high speed camera at 3000 frames per second. Immediately following our tests we measured the density of the sieved snow, and we collected three SnowMicroPen (SMP) profiles along the length of each PST. In one case we collected SMP data at 10 cm increments along our beam prior to conducing our PST to better assess vertical and lateral variations in slab properties induced by sieving. We utilize Digital Image Correlation analyses of the high speed videos to assess the slab elastic modulus (E), the weak layer specific fracture energy (wf), and the crack propagation speed (c) of each test. All our tests fully propagated to the end of the PST columns. Critical cut lengths (rc) ranged between 1.5 and 9 cm, with rc generally increasing over time, in line with the gradual stiffening of the slab observed in the SMP measurements. Our results provide additional information about the temporal changes of mechanical properties immediately following loading, and will better inform modeling efforts attempting to assess these changes.