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The Cryosphere Discussions

Interactive comment on "Shear failure of weak snow layers in the first hours after burial" *by* Benjamin Reuter et al.

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In "Shear failure of weak snow layers in the first hours after burial" by Reuter et al., fracture mechanical properties of persistent and nonpersistent weak layers were measured in a cold room laboratory using shear frames, particle tracking, and a snow micropenetrometer. Note that nonpersistent can be hyphened or not, in my view.

I enjoyed reading this manuscript and, as someone who is keenly aware of the bias towards the study of persistent weak layers in snow science, I appreciate the focus on nonpersistent weak layers. As the authors point out, failures on nonpersistent weak layers are less common in avalanche fatalities, although I think it's entirely possible that there are more avalanches on nonpersistent weak layers than on persistent weak

layers worldwide. Thus, I find the motivation of this study excellent.

I found the manuscript well written and the experimental approaches and findings well supported. Most of my critiques are minor and are included as an annotated PDF. I have a few general criticisms:

1) It's not clear how the linear elastic limit was determined. From what I can tell, it was visually estimated from the stress/strain curves. Given the scatter in these points, there is substantial uncertainty in this estimate. That uncertainty is not reflected in the results, i.e. Table 2.

2) Although I appreciate the focus on nonpersistent weak layers, it is not a new finding that these weak layers are as weak or often weaker in shear than all the other types. Roch (1966) and Jamieson and Johnston (2001) have both previously showed this.

3) Likewise, the authors suggest that "Conditions for sufficient strengthening, when decomposing fragmented particles are no longer prone to fail, could be studied in the future." Although this hasn't been done in a laboratory, there is lots of evidence about waiting for a day or two for nonpersistent weak layers to strengthen. For instance, in Bair (2013) I found that waiting 24 hr after new snowfall dropped the number of avalanches to a median value of zero. The result is significant at $p < 0.01$ for over 1000 days of avalanche control work with explosives at a ski area where 87% of avalanches fail on nonpersistent weak layers.

4) Making the data available on request does not satisfy The Cryosphere's data policy (https://www.the-cryosphere.net/about/data_policy.html#data_availability). I suggest adding them as a supplement or putting them in a publicly accessible repository.

Overall, these criticisms are minor and I would recommend publication after addressing them.

NB 2019-01-28

Bair, E. H. (2013). Forecasting artificially-triggered avalanches in storm snow

at a large ski area. Cold Regions Science and Technology, 85, 261-269. doi:10.1016/j.coldregions.2012.10.003

Jamieson, J. B., & Johnston, C. D. (2001). Evaluation of the shear frame test for weak snowpack layers. Annals of Glaciology, 32, 59-68. doi:10.3189/172756401781819472

Roch, A. (1966). Les variations de la resistance de la neige. Scientific Aspects of Snow and Ice Avalanches, 182-195.

Please also note the supplement to this comment:
https://www.the-cryosphere-discuss.net/tc-2018-268/tc-2018-268-RC1-supplement.pdf

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