Nat. Hazards Earth Syst. Sci. Discuss., 1, C2627–C2629, 2014
www.nat-hazards-earth-syst-sci-discuss.net/1/C2627/2014/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Automatic classification of manual snow profiles by snow structure" *by* F. Techel and C. Pielmeier

F. Techel and C. Pielmeier

techel@slf.ch

Received and published: 15 February 2014

We thank the two reviewers Dr. Thomas Wiesinger and Dr. Fabiano Monti for their helpful comments. The main issues addressed by the reviewers were:

Soft, surface layers – just loose layer or a slab? (T. Wiesinger):

This is indeed a difficult question. As we analyze manual snow profile recordings we do not know if very soft (hand hardness index 1) snow is sufficiently bonded to form a slab or if it is too loose and would slide as a loose avalanche. The hand hardness index is incapable to capture these small differences. Also not possible was the option to use stability tests to define the depth of the slab, as we analyze all profiles, also those not including a stability test. Thus we define a potential slab as any layers above a

persistent weak layer. –> we will comment on this issue in the methods and conclusion section

Ram hardness (T. Wiesinger) and snow density (F. Monti) measurements are more objective:

Ram hardness is certainly more objective than hand hardness. However, ram profiles are recorded almost only in Switzerland. Additionally, ram profiles do not detect very small thin layers which might be observed with the hand hardness test. As the classification should hopefully be applicable to other snow climates, ram hardness was on purpose not further investigated. Ram profile type (nominal classification 1 to 10, according to Schweizer and Wiesinger, 2001) did not yield consistent additional information (except for types 1 and 10, as discussed on 7455_7-10). Also, assigning a profile type is considered a relatively subjective procedure by the forecasters. –> we will address this in the revised manuscript

Snow density would be a valuable parameter to observe. However, currently layer-by-layer snow density is observed only in a very small proportion of the profiles in Switzerland (this is probably true for many other snow safety operations in the world). –> we will address this in the revised manuscript

Prominence of persistent weaknesses in the SNPKindex (F. Monti):

New snow weaknesses tend to stabilize quickly (within hours or days). In the long-term they are therefore less relevant for avalanche release. Also in our data-set, non-persistent weaknesses (very soft layers of new or decomposed snow) are very rare and generally close to the surface. These layers did not show up as a relevant variable to classify snowpack structure. However, we are aware that soft surface layers might evolve into a persistent weak layer with high temperature gradient metamorphism. –> we will comment on the prominence of the persistent weaknesses in the conclusions

Comparison of snowpack structure and snowpack stability (Rutschblock score and re-

lease type) (F. Monti):

15% of the 258 profiles did not contain stability information like from a standardized Rutschblock test (generally these were profiles in flat study plots). For the other profiles the correlation between stability and structure was poor (rho=0.33) but significant (see Table 4, 7465). This poor correlation was expected as snowpack structure and snowpack stability are two different properties of the snowpack. This was also the reason why we initially intended to develop a method to assess these two characteristics, currently mixed in stab01, independent from each other. For instance, a favorably structured snowpack might be unstable during and right after a snowfall (a new snow weakness), but this will stabilize rather quickly. The opposite might occur for an unfavorably structured snowpack (containing persistent weaknesses): potential weak layers persist for a long time, but they may not necessarily be unstable throughout a prolonged period. However, such persistent weaknesses could be reactivated for instance with new snow loading. The SNPKindex is not an indicator of snow stability but snow structure.

The other, more minor comments by the reviewers will also be commented on / included in the revised manuscript.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 7449, 2013.