Reply to Referee #1

General comments: The manuscript describes a newly developed stability index derived from SMP-measurements. It combines weak layer strength (micro-structural strength) with a rough measure of the additional stress. The authors figured out that the index was positively correlated with the results of compression tests (performed concurrently with the SMP-measurements) and that it discriminated well between point stabilities rated as either 'poor' or 'fair' and those rated as 'good'. Although some problems could not be solved (e.g the corresponding variations in point stability to slope stability) it seems that the index is able to emulate some of the complex interactions between slab and weak layer properties. The paper contains the first relating quantitative investigation in this field and is an important contribution for a better understanding of snow stability; it can be accepted with minor revisions.

Specific comments and technical corrections:
page 4688, on line 2 the authors refer to the SABRE penetrometer; it would be nice to cite the corresponding paper from Mackenzie (2002).

We will add this reference in the revised manuscript.

page 4690, equation (1: the unit of energy is Nm; in this sense the first term (Fu*umax) is correct, but the second term (Fu2/2K) yields Nm2.

Thanks for pointing this out. The factor K can be called stiffness, but in our 1-D approach where we relate force to displacement it is equivalent to a spring constant with units N m^{-1} (in a stress-strain relation K would correspond to the modulus with units: Pa).

page 4691, line 4: ea is indicated with 0.036 Nm, while ea in Fig. 2 is denoted with 0.0036 Nm; the authors should check the correct value.

Thanks for pointing this typo out. The correct value is 0.0036 Nm.

page 4691, equation (4): does $\Delta\sigma$ correspond to $\Delta\sigma_g$ (as indicated on line 19 of the previous page)?

Thanks for pointing this typo out. There should be no subscript g.

page 4691, line 21 -24: the authors should specify the relation between the new index and the classical index (a table with the corresponding values would be worthwhile).

As described in the manuscript the new index cannot be related directly to the classical one, in particular due to the fact that the SMP-derived microstructural strength we use is larger than the shear strength as measured with the shear frame. Accordingly, the value of 1 that traditionally discriminates between stability and instability is higher, i.e. about 200. Of course, as pointed out in the manuscript we could scale our values of stability by dividing them by 200, but we prefer to show the actual values.

page 4694, line 11: delete the last ’in’ at the end of the line.

We will change this as suggested.

Table 1: does this table result from the authors investigations or is it a citation? (according to my state of information the common CT scores are: easy: CT 1- 10; moderate: CT11-CT20; hard: CT21-CT30).

The classification is based on Jamieson (1999) and adapted to three stability classes. For example, a compression test score of 13 corresponds about to a Rutschblock score of 3.
We will make this clearer in the revised manuscript.

It would be worthwhile to explain the abbreviations for the fracture character: SP. . .sudden planar, SC. . .sudden collapse, RP. . .resistant planar, PC. . .progressive compression, B. . .non-planar break.

We will explain the abbreviations in the revised manuscript as suggested.

Table 3: The caption should include a short legend that IQR means ’interquartile range’ and QVC means ‘quartile coefficient of variation’.

We will add this in the revised manuscript.

Figure 1: The second sentence of the caption should read as follows: ’K denotes the elastic modulus (after Wright, 2012)’

We will change as suggested (and change elastic modulus to stiffness or spring constant).

Figure 2: ea is indicated here with 0.0036 Nm, while ea in the text (page 4691, line 4) is denoted with 0.036 Nm; the authors should check the correct value. The dashed lines in Figure 2 are hardly to read.

As described above the correct values is 0.0036 Nm. We will improve Figure 2.

Figure 3: How does the stability index on the y-axis relate to the classical index (see my previous remark)?

See reply above.

Figure 4: How does the stability index on the y-axis relate to the classical index (see my previous remark)?

See replay above.

The second sentence of the caption should read as follows: ’Dashed line indicates the split value (212) for the classification. . .’

We will change as suggested.

Reference

Jamieson, J.B., 1999. The compression test - after 25 years. The Avalanche Review, 18(1): 10-12.