Interactive comment on “A process-based approach to estimate point snow instability” by B. Reuter et al.

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Please find our response to the reviewer’s comments in the supplement.

Interactive comment on The Cryosphere Discuss., 8, 5825, 2014.

Reply to Referee #2 (Bruce Jamieson) RC C3160 / SC C2799

General comments
An excellent contribution. Well argued and very well referenced. Specific comments

The relationship between critical crack length and crack propagation propensity could be clearer. Shorter cut lengths in PST tests (assumed similar to critical crack lengths) are not simply e.g. inversely, related to crack propagation propensity.

In various papers, Gauthier related validated propagation propensity to cut lengths less than 50% of column length. However, the PST tests used here are not modeled to capture crack lengths less than 50% of the column length. Thus, it would be helpful if the authors could clarify the relationship between crack length and crack propagation propensity, as well as further clarify the validation of the model.

We agree that Gauthier and Jamieson (2008) combined a threshold of critical crack length with the experimental PST fracture result to define crack propagation propensity and hence we will change the wording on page 5829 in lines 3-4.

We will add the following sentence:

"A slope-parallel shear strength over shear stress formulation is not being used because the SMP is an indentation test measuring an effective strength resulting from the mixed-mode breaking of bonds at the tip."

Page 5835 line 5. Some clarification of the failure mode in the stability criterion is needed. The shear stress term in the denominator of Eq. 5. is traditionally slope parallel e.g. Habermann et al. (2008), but this is not the case for strength derived from the SMP (numerator in Eq. 5.). A statement that "slope-parallel shear strength over shear stress is not being used because ..." would be helpful.

We will add the following sentence:

"A slope-parallel shear strength over shear stress formulation is not being used because the SMP is an indentation test measuring an effective strength resulting from the mixed-mode breaking of bonds at the tip."

Page 5837 line 5 – 14: If the deflecting beam is never supported by closing the gap between the slab and the bed surface, say so, and note that this may be different from real slab bending over collapsing weak layers.

We will add the following sentence:

"In our model, the deflecting beam is never supported by closing the gap between the slab and the bed surface which, however, may be the case in field experiments in particular with soft slabs."

Page 5831 line 18: hand hardness index for each manually identified layer.

We will change as suggested: “… for each manually identified layer...”

Page 5833 line 23-24: presumably this because snow is much more sensitive to dynamic stress than quasi static stress. This is worth mentioning.

We will add the following sentence:

"In our model, the deflecting beam is never supported by closing the gap between the slab and the bed surface which, however, may be different from real slab bending over collapsing weak layers."

Page 5837 line 1 - 15. If the deflecting beam is never supported by closing the gap between the slab and the bed surface, may be used. This may be difficult due to the combined effect of slab thickness and slab flexibility.

We will add the following sentence:

"In our model, the deflecting beam is never supported by closing the gap between the slab and the bed surface which, however, may be the case in field experiments in particular with soft slabs."

Technical comments on clarity & presentation

Page 5831 line 19: Hand hardness index for each manually identified layer.

We will change as suggested: “... for each manually identified layer...”