

## ***Interactive comment on “Spatio-temporal measurements and analysis of snow depth in a rock face” by V. Wirz et al.***

**V. Wirz et al.**

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We thank our anonymous referee for his valuable comments and constructive suggestions. The manuscript has been modified since the first publication for TCD. We reformulated all paragraphs, commented by the referee, to make the paper more clear and precise. Additionally we inserted a new figure to quantify that highest snow depth always occurred at the same locations throughout the winter.

Anonymous Referee #AR2

General comments

The authors have conducted valuable and thorough field work and present a good data analysis. In its very nature the conclusions might be limited to the investigated

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area. Similarly, the data is from one (two) winter season(s) and this might also limit the general nature of the conclusions. Both issues are pointed out by the authors. Still the work presents some important findings and is an important step in the evaluation of snow cover variation, which is important for many fields.

Specific comments

1) AR 2: The coefficient of variation (CV) is used by the authors (e.g. P1393, P1394) to describe the variation of the snow depth HS. However, spatial variation of snow depth distribution in the rock face is only evaluated qualitatively (visually, e.g. red circles in Fig. 4). Is it possible to quantify this spatial variation? if so, the strength of the paper would be improved.

AC: We used the coefficient of variation to describe the variability of HS and HS changes of all periods (Table 3). In Fig. 4 the red circles mark areas with a high snow depth during the entire winter. We now added a new figure (Fig. 1 below), which shows how often a cell had a snow depth of the highest 5% of this observation day. Further, we added the CV of HS for each slope class in Fig. 6 in the manuscript (Fig. 2 below).

2) AR 2: The way the surface roughness parameter VRM is calculated is presumably quite important for the correlations. Therefore I think it is necessary that it is described in more detail than done on P1390, L10.

AC: We reformulated this paragraph. See also answer to specific question 12 in the Author Comments to AR1.

3) AR 2: On P1395 it is shown that flatter parts in the rock face have less snow than the steeper parts. This is counter-intuitive as also mentioned by the authors. It is therefore important to mention (as is already done) that this is most likely because the flat areas are wind scoured, and that therefore that generalization of the observations to other areas might be difficult.

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AC: We reformulated this paragraph to now read:” Most of the near-horizontal areas in the rock face occur on wind-exposed ridges or close to the summit, where airflow often accelerates. This may explain the high proportion of gently-sloping snow free cells observed in the rock face. However, this might not be the case in rock faces where flat areas are less wind exposed.”

4) AR 2: On P1398, L13-15 it is commented that no avalanching was observed during the observation period. I believe that in such a steep rock face there is considerable amounts of snow coming down as small sluffs during snowy periods. These are hard or impossible to observe. The fact that such mass wasting was not observed in the field does therefore not give very much weight to the argument presented.

AC: Yes, we agree that considerable amounts of snow might have come down as sluffs during storms. We deleted this statement in the manuscript.

Technical corrections and typing errors

In addition to the points above I suggest the following suggestions are considered:

- P1384, L6: It would be good to point out even more clear that the resolution of one metre refers to the spatial grid of interpolated snow depth measurements and not the resolution of the individual snow depth measurements. For example “...was used to obtain a grid of interpolated snow depth (HS) data with a grid resolution of one metre.”
- P1384, L27: You could be more specific by using “snow avalanche formation” instead of “snow avalanches”.
- P1386, L10: add the word “has”: “...laser scanning (TLS) has increased the...”
- P1387, L18: add the words “snow depth”: “...the longest records of snow depth observations worldwide...”.
- P1390, L11: To simplify, remove the words “in this context” or change to “in this study” or simply “here”.

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- P1390, L25, 26 (and throughout the manuscript): What does disposition mean? Is it the same as aspect?
- P1391, L28 (and throughout the manuscript): The meaning of exposition is not clear. Do you mean aspect?
- P1397, L14: The authors name is Essery not Esseroy. This is correctly spelled in the reference list.
- P1400, L17: “Micro scale” is misspelled.

AC: We reformulated all mentioned paragraphs and changed the misspellings throughout the manuscript. The term exposition was replaced by slope aspect and disposition by setup throughout the manuscript.

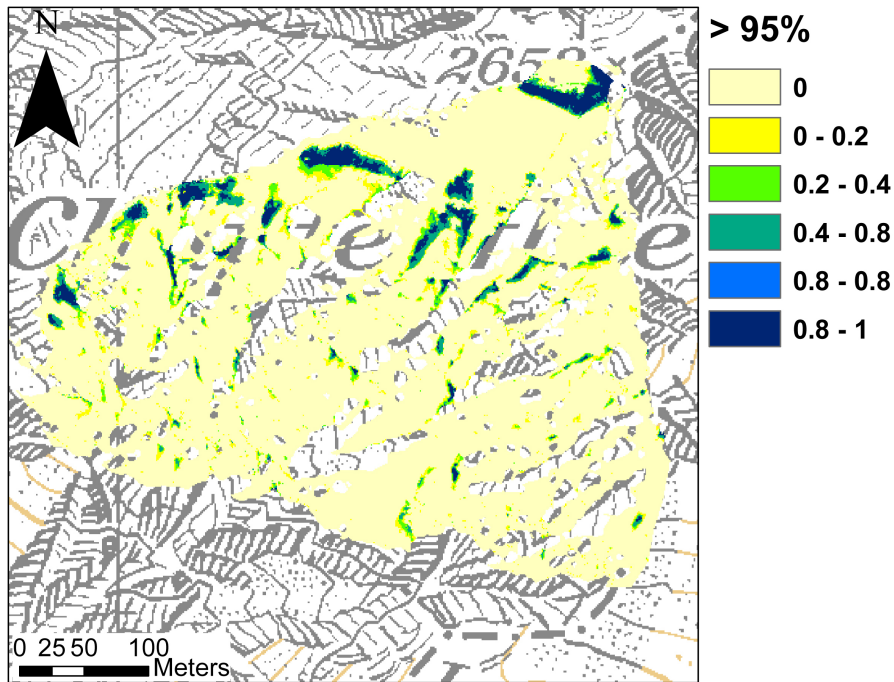
Please also note the supplement to this comment:

<http://www.the-cryosphere-discuss.net/5/C1116/2011/tcd-5-C1116-2011-supplement.pdf>

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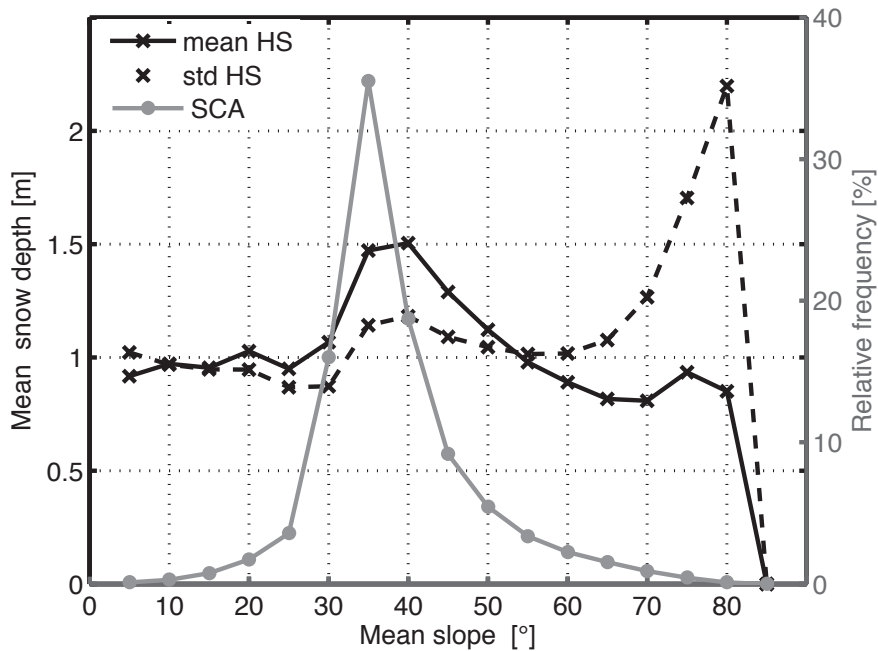
Interactive comment on The Cryosphere Discuss., 5, 1383, 2011.

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**Fig. 1.** Frequency of cells with highest HS per observation day over the winter 09. The frequency shows how often the HS was within the range of HS of 5% of the cells with highest HS of this observation day.

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**Fig. 2.** Left axis: Histogram (classes with a step width of 5° slope) of the mean HS (left axis) and its CV. Right axis: Relative frequency of the snow covered cells (SCA) in the rock face on 27 March 2009.

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