

Interactive comment on “Understanding snow-transport processes shaping the mountain snow-cover” by R. Mott et al.

Anonymous Referee #1

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General Comments

This manuscript investigates the dynamics of snow transport in mountain terrain near Davos, Switzerland. Wind speeds and directions were collected from a total of 24 stations throughout the winters of 2008/09 and 2009/10. Elevation and snow depth data over the region were also used. The wind fields in the region were modelled for two topographies (minimum and maximum snow) and five wind speeds (although only results for 2, 4, and 7 m/s are discussed), the results of which were used to model snow depth in the region - including snow distribution by saltation/suspension and heterogeneous deposition of precipitation.

The modelled wind fields and snow depth changes compare well to measurements. Both measurements and model results demonstrate that the change in snow depth is

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dependent on the topography and the presence of a thick snow cover. The model was also run with snow drift removed. A comparison of the mean and standard deviation of snow depth change from measurements and both models suggests that preferential deposition is more important in the bowl area while snow drift is more important on the slopes.

These results are important to aid in the development of snow transport models for mountain terrain and for parameterizations of snow distribution; both of which can be used to improve avalanche prediction and our understanding of drift formation.

The manuscript text is well written and organized, although the final sub-section is difficult to follow. The figures need improvement, as information is missing and formats are inconsistent or unfinished. In general, the conclusions drawn are supported by the results and most of the following comments are minor in nature, in the interest of simplicity and improving clarity.

Specific Comments

1) For readers unfamiliar with the region a very brief description of conditions during the study would be helpful. For example, what were: the range of temperatures; the seasonal extent of the snow; and the amount of precipitation? How snow-free is the summer?

2) The definition and use of "HS_{max} situation" is confusing and unclear. Is this the date each winter when average snow depth is maximum? Or is this the yearly maximum snow depth for each location or grid square? Since the concept is only used on page 870 and Fig. 8 perhaps it isn't needed. It would be simpler for Fig. 8 to refer to HS on 9 April 2009 or "the time of peak accumulation on 9 April 2009" as on 872-3.

3) The descriptor of "simple statistics" isn't necessary. It is more clear to state that you used the mean and standard deviations.

4) Perhaps "Observed and modelled" aren't needed in the titles of Sections 3.1 and

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3.2.1.

- 5) No heights or elevations are given for the wind speeds discussed throughout the paper.
- 6) 872-23: Do you mean that the met data was used to update Alpine3D every hour? Or was it only used to initialize the model?
- 7) 874-1: What is "a snow-fall event without precipitation"?
- 8) 871-4: You could refer to Fig. 3 here to confirm your claim.
- 9) 875-14,15: Are these positive offsets or absolute differences?
- 10) 875-23: You have chosen the term "bowl" to refer to a specific location, so it confusing here to refer to "two bowls".
- 11) 877-8: Is "HS at the HS_{max} situation" just the same thing as saying " HS_{max} "?
- 12) Figs. 1, 4, 5, 6, 8, 13: The x and y axes are not labeled.
- 13) Fig. 1: If a shadow plot must be used, the direction of lighting should be given. "Colored areas indicate" should be "Colored lines enclose". Most importantly, it is unclear if "lowest" and "highest" refers to elevation or to the position in the figure. The labels T1, T2, and T3 used in Table 1 should be added to the figure.
- 14) Fig. 4: "was originally" should be "is".
- 15) Figs. 5 and 6: Are six examples really needed here? It would also be reasonable not to present data if an avalanche has occurred.
- 16) Fig. 6: Instead of "mask" could you say something like "Only data for the regions defined in Fig. 1 are shown"?
- 17) Figs. 11 and 12: Why are "P" notations used in Fig. 11 but dates are used in Fig. 12? The use of a line graph to present this data is misleading, since the points in time are not evenly spaced. Perhaps a bar graph would be more clear.

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Technical Corrections

- 1) 867-22: Should "on snow distribution" be "of snow distribution"?
- 2) 869-14: Web-sites are usually given in the reference list.
- 3) 869-14: Reverse yellow and red as "red and yellow stars in Fig. 1, respectively".
- 4) 869-15 and throughout: Italics are used for non-English words. There is no need to italicize 'ridge' and 'bowl' throughout. (They could be capitalized such as "The Bowl".)
- 5) 869-25; 879-4; and 879-7: TLS and HS_{max} are used before they are defined. "terrestrial laser scanner" should be "Terrestrial Laser Scanner (TLS)".
- 6) 870-9,10,11,16: These four occurrences of "(Author et al., Year)" should be "Author et al. (Year)".
- 7) 876-19: "Fig. 5" should be "(Figs. 5 and 6)".
- 8) 877-5: "changes in snow depth"
- 9) 877-26: "smooth", not "smoothen"
- 10) 878-11: "became smooth", not "smoothened"
- 11) 879-9: " μ " should be " σ ".
- 12) 879-7: Parenthesis should be used around "the bowl... (Fig. 1)", not a colon.
- 13) 883-14: "this would be a..." should be a new sentence.
- 14) Table 1: "Pearson", not "Pearsons".
- 15) Figs. 3 and 7: The legend variables should be italicized and subscripted.
- 16) Fig. 7: The wind speeds (4 and 7) are missing from the legend.
- 17) Fig. 8: The titles at the top of panels a and b should be DEM_S and DEM_W .

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18) Fig. 10: DSM should be DEM.

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