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The Cryosphere Discussions

Interactive comment on "Spatial and temporal variability of snow depth and SWE in a small mountain catchment" *by* T. Grünewald et al.

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The capability of terrestrial laser scanners (TLS) to provide increased accuracy in assessing small watershed scale snowpack assessment is substantial. Grüenwald et. al., (2010) provides one of the initial test studies of this system. The research and the results are important, and worth publication. The current paper has too much focus on a SWE ablation causation section that has insufficiently comprehensive input data to yield important correlations. The section examining the actual accuracy and potential of the TLS needs to be expanded to be the main focus. This is one of the first uses of TLS for basin wide swe determination, and demonstrating the efficacy has to be well documented before moving to data interpretation. I suggest the authors take a look at some of the figures used in the presentation of TLS work by the Gala-

had Project (http://www.galahad-euproject.org/upload/dl/Deliverables/Deliverable_D7-4%20upd.pdf) (Figures 2, 3, 4 and 10).

Page 4 line 9: The sentence implies this is the first study using TLS to complete a basin SWE estimates. However, having read two others published, it should be noted as one of the first studies.

Page 5 line 19: The field of view from the TLS station should be provided. An actual photo view is better than a map view, as the instrument perspective is useful. This is one of key elements not just to citing the instrument, but to its potential errors. This is provided by Schaffhauser et. al. (2008) and was quite useful to this reader. The basic parameters of TLS would also be useful here, as noted in Table 1 of Prokop et. al. (2008), this background information is important in this relatively new application of TLS.

Page 5 line 21: it is noted that there is a good agreement with Tachymeter measurements. Were the tachymeter measurements made simultaneously and if so how often? Is not the tachymeter dependent on correct density assumptions as well? What was the comparison to stake or probe depths? A scatter plot here would be useful.

Page 6 line 25: Do not use references from prairie or arctic settings to illustrate swe changes in this setting. Dickinson and Whitely (1971) not in reference list.

Page 7 line 12: The key assumption is that density variability is accurately assessed as a function of radiation and snow depth. This could well be true, but is not demonstrated here at all. Figure 4 of Prokop et. al., (2008) can provide a start to this, but even here the variation of density with radiation and snow depth is not quantified.

Page 10 line 26: Histograms do a poor job a illustrating the temporal variations. A time series plot is needed here to show the density and swe changes.

Page 13 line 13: Melt rate scatter plot could show this point better versus more than just slope in Figure 9.

Page 13 line 26: To quantify changes in swe causes by meteorological and topographic variables would require an energy balance model, which is not used here; thus, the weak correlations are not a surprise. The following two pages digress from the key focus of assessing swe. The energy balance available for melting is not fully quantified and the derivation of quantitative functions to explain swe change are not appropriate (equation 2 and 3).

Page 14 line 7: Vague sentence, rising not raising heterogeneity.

Page 14 line 9: Clear and not clearly

Page 14 line 22; statistical.

Page 14 line 24: to a satisfactory degree.

Page 14 line 26: Moving to a 2.5 m resolution an unlikely solution to the problem, particularly given the input data resolution for most parameters. This cannot be a realistic goal or suggestion without having first attempted an energy balance model of the watershed. It is unlikely that such a small input data scale would not add spurious results due to extrapolation of input data.

Table 1: Provides inadequate information to be of use. Add number of samples taken and the some measure of the variability. This is where the number of samples in each radiation class and snow depth class can be included along with their mean and variation, could be done in figures as well.

Figure 7: No legend for lines.

Interactive comment on The Cryosphere Discuss., 4, 1, 2010.