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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.

J. Parajka (Referee)

parajka@hydro.tuwien.ac.at

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General comments

The manuscript presents the application of terrestrial laser scanning (TLS) for mapping of spatial and temporal changes in snow over a small region in the Swiss Alps. The main focus of the paper is to evaluate the variability and change in snow water equivalent (SWE), which is indirectly estimated from observed snow depth (by TLS) and a few snow density measurements. The results also discuss the correlations between SWE changes and simple weather and terrain parameters.

Overall this is a very interesting study, which is definitely within the scope of the journal and worth to publish. The TLS application for snow cover mapping is a novel approach

and this study is one of the first evaluations of its potential. I have just two general remarks, which may be worth to taking into account in the revision:

1) It is a novel approach, so it is, in my opinion, important to give more information about the methodology. In order to assist in future campaigns in different regions, it will be very useful to provide more details about the requirements, recommendations and experience for e.g. positioning of the instrument, timing of the campaigns, positional accuracy, potential sources of errors and corrections and other factors needed to take into account.

2) In my opinion, the presented results are somewhat unbalanced with respect to the title, which indicates the focus on both, snow depth and snow water equivalent variability. I would suggest to expand the results section and to evaluate in more detail also the spatial and temporal variability of snow depth. I think that snow depth is a primary variable observed by TLS, so it will be very interesting to see e.g. its changes in time and space, the dynamics of snow cover depletion (snow cover area changes), the spatial correlation of snow depth, etc. The snow water equivalent assessment is very important for many reasons, however it is not an observed variable here. Simply, I would suggest to put more stress on snow depth than linearly scaled SWE.

It is a very nice work and dataset and I look forward to see it published in the journal.

Specific comments

P7: more details about snow density measurements (location, variability) will be useful.

P9: the incoming solar radiation calculated by Alpine3D represents the potential or actual value (how are the clouds estimated)?

Results section: The evaluation of mean snow depth only for areas covered by snow is somewhat misleading. It is stated that the fourth campaign represents the end of the melt season, and the mean snow depth presented is larger than 1m. Please consider to revise the focus and to present also the averages over the whole region. The changes

e.g. in snow cover area would be also a very useful information. The same may apply for the SWE analysis. From hydrologic point of view, it is much more important to know the catchment mean of SWE rather than to estimate the mean SWE of snow covered area.

Results: Please consider to revise the term melt rate. It is somewhat confusing. It refers to the SWE change over two weeks, so there may be also other factors (as it is already stated in the text), which may affect this change (e.g. new snow/rain, wind?).

Fig2: For comparison, it would be very interesting to add here the map of snow depth observed by TLS.

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