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Hydrology and Earth System Sciences Discussions

Interactive comment on "Statistical modelling of the snow depth distribution on the catchment scale" *by* T. Grünewald et al.

Anonymous Referee #1

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This paper presents a multiple regression analysis of the snow depth distribution at the meter resolution using terrain-based parameters (i.e. the regression variables are derived from the topography alone, except for the Winstral index). The data come from seven "alpine" sites (5 Alps, 1 Pyrenees, 1 Rocky) where snow depth was measured by airborne laser scanning at the km scale.

I am not a statistician so I hope that another referee will check the modeling approach and its discussion. From my perspective the objective is interesting, the dataset impressive and the method convincing. The results are well described in the light of previously published work. Actually the results are a bit disappointing but this is something the authors cannot be blamed for! The main conclusion is that the regression models seem stable in time but not in space. More specifically this study invalidates

the universality of the relationship found by Lehning et al. (2011).

The statistical analysis is restricted to the following conditions:

- only open areas

- only mountainous terrain

- near or at the time of the seasonal peak snow depth

- only terrain-based parameters

(1) The title of the paper is a bit vague in this respect. On the other hand, the reference to the “catchment scale” is not really informative in my opinion since a catchment could be defined at any scale. The authors could change “catchment scale” to “open alpine areas” in order to emphasize the difference with similar studies dealing with forested areas.

(2) The time of maximum accumulation is the most relevant for hydrology applications. Several studies have shown that most of the end-of-winter snow depth spatial variability is preserved during the melt season. However, according to the authors at least two sites were significantly affected by melt (ARO, HEF). Therefore one could just regret that no climatic information was included in the statistical models, especially because some meteorological station data should be available in every study site?

Minor comments

Conclusion, P3260 L16: do you expect to find a true global model given your results? Here it could be interesting to discuss how representative are the studied areas in terms of physiography and climate in comparison with other mountains?

L24: how to extend to vegetated areas? Airborne laser data will not be available.

Technical corrections

There are two “Winstral et al., 2002” in the reference list

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Fig. 4: “sub-aras”

References

Jost, G., Weiler, M., Gluns, D. R., and Alila, Y.: The influence of forest and topography on snow accumulation and melt at the watershed-scale, J. Hydrol., 347, 101–115, 2007

Lehning, M., Gruenewald, T., and Schirmer, M.: Mountain snow distribution governed by an altitudinal gradient and terrain roughness, Geophys. Res. Lett., 38, L19504, doi:10.1029/2011GL048927, 2011.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3237, 2013.