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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.

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This paper presents a very interesting study on a very relevant topic in snow hydrology. The use of readily available (from DEMs) topographic variables to predict the spatial snow cover variability is certainly of great interest to many researchers within the cryosphere community. The paper is well written, the conclusions drawn are well supported by the results. The topic matter is well within the scope of the journal and I would therefore recommend publication with only some minor revisions.

Specific comments:

I think that the resolution at which the authors eventually do all the analysis (400m)

should be mentioned clearly in the introduction. Reading the introduction as written now, the reader might expect a much higher resolution.

In the introduction the authors write: A “global” model, combining all the data from all areas investigated, could still explain 23% of the variability. Maybe it should be considered to change the word “still” into “only” as still would imply that 23% is a satisfactory result, which it probably isn’t especially since the authors themselves go on to explain that this suggests that local models cannot be transferred to other regions.

p. 3244 How were the 1m resolution digital surface models calculated from the ALS point clouds? A short description would be helpful.

p. 3244 The authors note that unrealistic extremely high snow depths values were eliminated and filtered by setting a threshold upon visual inspection of the data. Was there a clear “break” in the data that indicated these threshold values?

p. 3250 Only the manual aggregation concept after Lehning follows the HRU concept. The automated procedure seems to more closely follow the representative elementary area (REA) concept described for example by Woods et al. 1988 or Bloeschl et al. 2006. Since the authors exclusively use the automated approach later, the discussion of the HRU concept could be left out or a mention of the REA concept could be added.

p. 3254 The authors present an adequate explanation of why the grid size was selected to be 400m. However, considering the high spatial variability in snow cover but also in topography over alpine basins this resolution appears to be rather coarse. I agree with the second reviewer that this topic merits at least some more discussion and maybe some examples for one or two basins of how the results are affected by the chosen resolution.

p. 3257 The authors present the very interesting test of the models representativeness by arbitrarily moving the grid and rerunning the model. The discussion of this test seems a little short and could be expanded.

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Table 1: Maybe I missed it, but what is the “mean accuracy in the vertical direction” and how was this calculated?

Fig. 1 to 3 The panels on the right are fairly small and hard to read. Could those be enlarged slightly?

List of References:

ERIC F. WOOD, M. SIVAPALAN, KEITH BEVEN and LARRY BAND, 1988: EFFECTS OF SPATIAL VARIABILITY AND SCALE WITH IMPLICATIONS TO HYDROLOGIC MODELING. Journal of Hydrology, 102, 29-47.

G. Blöschl, R. B. Grayson, M. Sivapalan, 2006: On the representative elementary area (REA) concept and its utility for distributed rainfall-runoff modeling, Hydrological Processes, 9, 313-330.

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