

Interactive comment on “Simulation of the snowmelt runoff contributing area in a small alpine basin” by C. M. DeBeer and J. W. Pomeroy

Anonymous Referee #1

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The submitted manuscript “Simulation of the snowmelt runoff contributing area in a small alpine basin” by C. M. DeBeer and J. W. Pomeroy present a study of the snowmelt processes on slopes of different orientation in an alpine region. Special focus is given on the effects of the initial snow cover cold content on the snow cover depletion and the timing of meltwater contribution from different parts of the snow cover. This snow cover characteristic and its effects has been so far scarcely dealt with in the literature and is often widely ignored in common snowmelt models. The paper therefore represents a valuable contribution to snow hydrology as a whole. The approach used in the paper to account for the differences in snow cover cold content and to distribute them over an entire basin are simple yet effective, even though they were so far only implemented and tested in a relatively small study area with a relatively simple topography. The transferability of the technique to larger, more complex basins should be the focus

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of future work. The conclusions reached are well founded in the results and clearly demonstrate the importance of including the warming process in an accurate prediction of snow cover depletion and runoff contributing area. The explanation of the scientific methods and assumptions are sufficient but could be clarified somewhat, especially in regards to model calibration and the limitations of the presented approach (see specific comments below). A slightly more detailed analysis of some of the results would further enhance the main arguments of the paper (again see specific comments). The title adequately reflects the contents of the paper and the abstract provides a good overview of the intents and results of the study. The paper is well structured, well written and adequately put into the context of earlier work done by the authors and other scientists. The Figures and Tables are appropriate and clear.

I would recommend publications after some minor revisions.

Specific comments:

p. 976 line 19 “...roughly 2 km away. Snow depths were recorded using Campbell Scientific SR50 sonic ranging sensors at each of the stations (at the two outlier stations, the sensors were oriented perpendicular to the sloping ground surface). To monitor the internal snowpack temperature, a series of fine-wire thermocouples was installed vertically at the two outlier stations, beginning at two cm...” Please be consistent whether to write numbers under 10 in words or numbers.

p. 979 line 19: The next two paragraphs explain the model calibration. A more detailed explanation of this process would certainly enhance the clarity and transparency of this process to the reader. For example: How many runs were done? Were the parameter chosen randomly by the computer or were they chosen according to experiences and expectations of the researchers? What objective function was used to determine the optimal parameter set? Etc.

p. 980 line 24 “Mt Allan cirque” is missing a “.” after Mt.

p. 987 line 14 “The basin contains some forested areas in the lower region, where the tundra snow modelling framework in this study is not expected to apply.” Unless I’ve missed it this is the first time that the authors mention that their approach is limited to basically non-vegetated surfaces. A clear statement of this fact earlier in the paper (f.e. Method Section) would be helpful in my opinion.

Figures 4 and 5: These are in my opinion two key figures of the paper as they show the improvements made in the prediction of the SCD when using the inhomogeneous melt approach developed by the authors. While a qualitative improvement is clearly visible and discussed in the paper, it would certainly be nice to have an objective statistical comparison (e. g. regression coefficient, average errors between the two predicted and the observed area fraction) that would allow the quantification of the improvements. A short mention and discussion of this analysis should then also be included in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 971, 2010.