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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Quantification of different flow components in a high-altitude glacierized catchment (Dudh Koshi, Nepalese Himalaya)" *by* Louise Mimeau et al.

Anonymous Referee #1

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This manuscript describes the effect of different model variants on model performance and simulated flow components. They perform various model tests using the physically-based DHSVM model. Especially the evaluation of flow components is a novel aspect. However, I am afraid that I have a list of rather major concerns as described in detail below. Major revisions, including new computations, are needed to bring this manuscript to its full potential.

Flow component definition

Defining and simulating flow components is not trivial and it is interesting that the authors here test different definitions. However, this discussion would be even more valu-

able if the authors could relate their definitions to those suggested by Weiler et al. (2018) (this reference is included, but not put in relation to the definitions used here).

Depending on the definition of flow components it can be required to track the different types of water through the model. For instance, glacier melt which is added to the groundwater (or 'soil', see below) might there mix with water coming from rain or snow melt. I am not fully sure, whether and, if yes, how this is done in DHSVM. Please clarify!

Model evaluation

I am missing a comparison of daily observed and simulated flows using a measure like the NSE. Why are these results not shown?

Given the uncertainties in observed snow cover and mass balances: are the differences in model performances really significant? Overall, I am missing a quantification of uncertainties (please see Pappenberger and Beven (2006)

Model parameterization

I am not convinced about the choice of the parameter values. Can one really use standard values for the parameters for this application in a high-mountain environment? The authors also state: "As a results, soil depth outside glacierized areas ranges between 0.5 and 1 m. Under the glaciers, the soil depth was set to 2 m." Why should we expect deeper soils under a glacier than elsewhere?!? This seems more like a trick to ensure a delayed response rather than a physically-based representation. As there is no description of groundwater, I assume that groundwater is not represented explicitly. The unrealistic soil depths are probably needed to compensate for the missing groundwater.

For the more sensitive parameters: how would changes in reasonable ranges affect results?

Please also address the devil's advocate question: the tested model variants might

just compensate differently for other model errors and if the rest of the model would be 'more correct' results would be different.

Avalanche routine

I have several concerns with this routine. First of all, while I agree with the authors on the need to consider snow redistribution, the way it is described it largely ignores other ways of snow redistribution than avalanches (see Freudiger et al, 2017, for a recent review on snow redistribution in hydrological models). Secondly, the routine and its parameterization seem rather ad hoc and not fully motivated. Can the parameters be motivated? What is the effect of varying them? Furthermore, as far as I understand the text, only cardinal directions are considered. Isn't that an unrealistic assumption? Also, from my understanding, I would assume that the avalanche routine would result in unrealistic line patterns of snow accumulation.

Finally, the avalanche routine is based on Wortmann et al. (2016). This, however, is a reference to a manuscript which had been in review (HESS-D) but then has never been published in HESS. I do not think we should refer to rejected manuscripts. This means a much better description (and motivation) of the routine is needed in this manuscript.

Structure and language

Please do not mix results and discussion. This makes reading the manuscript much more difficult. I strongly suggest separating these two sections.

There are a number of typos and places were grammar or words could be improved.

Freudiger, D., Kohn, I., Seibert, J., Stahl, K. and Weiler, M. (2017), Snow redistribution for the hydrological modeling of alpine catchments. WIREs Water, 4: n/a, e1232. doi:10.1002/wat2.1232

Pappenberger, F., and K. J. Beven (2006), Ignorance is bliss: Or seven reasons not to use uncertainty analysis, Water Resour. Res., 42, W05302, doi:10.1029/2005WR004820.

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