Hydrology and
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Discussions

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Interactive comment on "Complexity and performance of temperature-based snow routines for runoff modelling in mountainous areas in Central Europe" *by* Marc Girons Lopez et al.

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General comments

The study evaluates snow and runoff performance of 64 snow routine alternatives based on degree-day approach in large sample of catchments (54) located in Swiss and Czech Republic. The snow routine variants are coupled with HBV conceptual hydrologic model and model simulations are evaluated in terms of observed daily runoff and snow water equivalent observations/estimates. The results indicate that exponential snowmelt function with no refreezing and seasonally variable degree-day factors are the most reliable/robust/accurate variants for snowmelt runoff simulations in se-

lected catchments.

Overall, this is an interesting study which is worth to publish. The topic is relevant and within the scope of the journal. The study is clearly written and has a good structure. The analyses and interpretations are based on larger sample of catchments which allows to draw interpretations/conclusions that are relevant for large region of similar physiographic conditions in Central Europe.

I have only few comments/notes which can be considered (in my opinion) to add/extend/improve clarity and generality of findings. These include:

1) Perhaps it will be possible to refer here in general to variants of degree-day snow approach, not strictly limits the analysis to HBV variants. The results can be used/implemented in degree-day routines of different hydrological models. In this study, the variants are coupled with HBV concept of rainfall-runoff transformation, but I believe, at least the evaluation of snow efficiency is relevant to general degree-day approach.

2) When coupling the 64 snow routine variants with HBV model, there is another interesting question, which can be discussed and this is the robustness/uncertainty of other HBV model parameters. How consistent/different are the other HBV model parameters for different snow variants? Are, for example, field capacity or nonlinear runoff generation (beta) parameter values similar or compensating some effects of different snow routines?

3) It is not clear which part of the snow accumulation/melt phases are described/evaluated by selected snow objective function? For some practical applications, for example, it will be interesting to see the difference in maximum snow water equivalent between the routines, or to what extent the model over or underestimates snow cover duration? To what extent are these aspects covered in current snow efficiency evaluation? Does a good simulation mean well represented maximum SWE or snow cover duration? Perhaps there are some differences in such efficiency between

the variants.

4) In our recent study (Sleziak et al., 2020) we found that there are quite significant differences in snow model performance (by using standard HBV degree-day approach) between lowland and alpine catchments in Austria. (Differences in terms of overestimation of snow cover in alpine and underestimation of snow cover in flatland catchments). Did you observe similar findings here?

Specific comments

1) Abstract. Is the last sentence needed?

2) Introduction: It will be interesting to extend somewhat this section by refereeing to ways how can be/are degree-day routine parameters estimated in hydrological models.

3) Data: How close are gridded snow water equivalent data to observations? Is there some bias related to the fact that this dataset is based on some type of degree-day model?

4) Runoff model efficiency. Why only Nash-Sutcliffe based on logarithmic transformed discharges? It will be interesting to see also the model performance in terms of snowmelt runoff peaks.

5) P.15, l.355: Figure 3 or Figure 4?

6) Figure 4. Will it be possible to show such case for a year in the validation period?

7) Results: Will it be possible to present runoff and snow model efficiencies for each catchment in the Supplement?

References:

Sleziak et al. (2020) The effect of the snow weighting on the temporal stability of hydrologic model efficiency and parameters, Journal of Hydrology.

57, 2020.