Hydrology and
Earth System
Sciences

Discussions

Interactive comment on "Importance of snowmelt contribution to seasonal runoff and summer low flows in Czechia" *by* Michal Jenicek and Ondrej Ledvinka

Anonymous Referee #1

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This paper investigates the role of snow (and rain) on streamflow across 59 Czech catchments. The objectives of the study are: to quantify how snow storages affect spring and summer runoff and to quantify how much runoff snowmelt in generates compared to rainfall. The study uses data of 50 catchments and simulations using the HBV model. They show the following results: 1. Snow runoff fractions exceed snowfall fractions (Fig 3), from which they conclude snow produces more runoff than rain. 2. How much runoff occurs in particular months varies between snow rich and snow poor years (Fig 4), with overall more runoff in snow rich years. 3. Several streamflow signatures vary between snow rich and snow poor years (Fig 5). 4. Summer base flow depends on both SWE and summer P (Fig 6+7) 5. That also in models annual and

summer runoff strongly depend on the snow fraction (Fig 8).

These results are generally useful for the HESS' readership, as they address the important issue of how snow (and its anticipated future changes) affect river flow. However, before I can recommend publication of this article I think several things need to be addressed first:

- This HBV results suggest that snow produces runoff differently than rain. However, HBV treats snowmelt and rainfall largely similarly. This seems counterintuitive (or a paradox). It needs to become clearer in the modeling results how snowmelt is different than rain that leads to these runoff differences. Otherwise, I am not sure what we really learn from the presented results.

- The results listed above as 1-4 have all be shown before or are mostly trivial. There might be value in showing this again for the study catchments, but then I think the paper should better explain what we learn about the hydrology of these places, rather than largely use them as data for making some general statements.

- All results of groundwater recharge rely on the model output of an unvalidated flux (since no GW data are used). How do we have confidence they reflect actual groundwater recharge behaviours?

- The paper contains a lot of unclear statements or language that if (interpreted as written) is wrong. I made a list of suggestions below, but this list is far from comprehensive. Please check the paper another time critically. This is really important because for too many statements it remains unclear what the authors claim to be true, and thereby makes it even impossible to review

Detailed comments

L9: add the word "often" (or something similar), otherwise this general statement is false.

L11: (and in winter runoff). Not necessary to state, but maybe not bad to mention.

L14: model output, not model performance.

L15: the simulations are not "hypothetical" as they have been performed. I the paper intends to say something like "Hypothetical scenarios were modelled"

L19-20: "This was documented by [...] from snow to rain" This does not seem to be a logical statement. Maybe change the verb "documented"?

L22: would "reduced" be more specific than "affected" and therefore more informative?

L29: "largely affects" seems a bit odd. Maybe "often affects" or "can affect".

L30: "tend to occur" not "occurs".

L32: "to increase [...] climate changes". Why mention "precipitation"? And reword "to increase in air temperature" to "to increasing air temperatures". (And probably make "climate changes" singular).

L34: "during winter" may be an unnecessary (and sometimes wrong) specification here. In many mountain areas the shift from snow towards rain will be biggest in spring and fall (when temperatures are often near 0) compared to winter (when temperatures are generally below zero even when it gets a bit warmer)

L34: "a rate of"? I do not think this makes sense here. Please check what is intended to be said here.

L35: would "reduced" be more specific than "affected" and therefore more informative?

L37-38: I understand why you say "On the contrary" but this only makes sense by having the reader guess that this has an opposite effect on total streamflow generated (which you don't say, nor make it clear that this is what you're thinking about). Therefore I would try to reword this a little.

L39-40: "Changes in [...] and occurs earlier". Or "Reduced snow accumulation, and earlier and slower snowmelt cause earlier and less groundwater recharge (Beaulieu et

al., 2012; Foster et al., 2016)."

L41: to "lower elevations" (make plural)

L44-45: "Higher snowpack generates higher groundwater flow driven by snowmelt rates and thus contributes more to streamflow 45 (Barnhart et al., 2016)." Does not seem to be a logical statement. Do you mean something like "Higher snowpack dispro-portionally feed groundwater leading to more to streamflow (Barnhart et al., 2016)"?

L54: "were" seems redundant.

L57: Thus "using" not "uses"

L96: Consider removing "the" at the start of the sentence.

L110-111: "For this, we used a bucket-type HBV model (Lindström et al., 1997) in its implementation, called HBV-light (Seibert and Vis, 2012)" This sentence is clear, but I would recommend to rephrase it. (E.g. remove 'in its implementation")

L121: "Different weights were tested to achieve the best possible performance of the model" This seems somewhat vague and arbitrary. What made you choose the partic-ular weight in the end (i.e. what made them the "best")?

L133-134: "The similar procedures for model set-up and calibration was also used earlier in (Jenicek et al., 2018), although in different region." Fix the language of this sentence. For example by: something like "This procedure for model set-up and cali-bration was also used in Jenicek et al. (2018), although for different region".

L137: the simulations are not "hypothetical" as they have been performed. I the paper intends to say something like "Hypothetical scenarios were modelled"

L182: I am unsure what "simulated correctly" would really mean here. Do you mean "accurately simulated"?

L192-200: It is unclear to me to what extent these results originate from snow being

more effective in producing runoff than rain or whether this is because of the seasonal timing of precipitation (independent whether it's snow or rain).

L435: "This particular result proves that snow is more effective in generating catchment runoff compared to liquid precipitation" seems like an overly strong statement. Tone down the word "prove" and choose something like "indicates" or "suggests".

L454-456: ". An understanding of potential model artifacts might be important . . ." is very vague. Can it be made more specific?

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