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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The evaluation of the potential of global data products for snow hydrological modelling in ungauged high alpine catchments" *by* Michael Weber et al.

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Response to Anonymous Referee #2

Review of "The evaluation of the potential of global data products for snow hydrological modelling in ungauged high alpine catchments" Weber et al.

General overview The authors present an evaluation of snowpack and hydrological modeling outcomes in a well-characterized and gauged catchment using parameterizations derived from regional and global datasets. They also evaluate the influence of three different global digital elevation models on the derivation of model inputs such as

slope, aspect, and solar insolation as well as the impact on model results. The goal was to illustrate and quantify the impacts of using these products to estimate snowpack and runoff in ungauged catchments in snow-dominated mountainous regions. The purpose and need for the study are reasonably clear and such work is important for the advancement of snow and mountain hydrology, in general. While it appears that the work and results are technically sound, I found the manuscript very difficult to follow and as such am unable to fully evaluate their results. I recommend a major revision. Specifically, I recommend: . . .

Author's answer: We would like to thank the reviewer for taking his/her time to read the manuscript and providing us with a very constructive feedback. Furthermore, we thank him/her for mentioning the importance of this work regarding advancements in snow/mountain hydrology. We have thoroughly considered all of his/her comments and address them point by point in the following.

General comments:

1 – I recommend reorganizing the methods and results to more concisely lay out the study (methods then results), including the use of additional tables or figures as recommended in the "Specific comments" section

Author's answer: We will follow your recommendation and will restructure the manuscript. More details on this point are given in the answers to the relevant specific comments.

2 – I recommend rewriting the manuscript with an eye toward brevity and clarity, including working with an English speaking editor. The manuscript is overly long, repetitive, and full of awkward and difficult to follow sentences.

Author's answer: Following your suggestions, the updated version will be better streamlined and we will particularly take care that repetitions will be eliminated where possible. Regarding the language issue, a native speaker will perform a proof read on the

updated manuscript. Please find also more details in the respective answers to the specific comments.

Specific comments:

Introduction: At some point in the introduction, there needs to be a clear statement or bulleted list of the research questions. These questions should then guide the organization of the rest of the paper.

Author's answer: In the last paragraph of the introduction, we will present shortly but in more detail the structure of the paper, as we agree that this will improve better readability. Moreover, we will formulate our two main goals as research questions with bullet points in the introduction, both regarding the overall question how far it is possible to use globally available input data for snow-hydrologic modelling in ungauged high alpine catchments: âĂć To which extent can we use different global meteorological data products varying in product type and spatial scale to simulate snow depth and further snow hydrological parameters as well as runoff in a high alpine catchment? âĂć What is the influence of different characteristics of topographic parameters like slope, aspect and altitude due to different DEM products with different resolutions on snow hydrological simulations in a heterogeneous high alpine catchment?

Section 2, 3, 4: These appear to be all methods, yet there are partial results mixed in. It would be much clearer, if it were a single methods section with subsections on the catchment, the model method, and the input datasets. Then the first subsection under results could compare the inputs of the various datasets, followed by the rest of Section 5. Otherwise, it is very difficult to follow.

Author's answer: As noted in the general comments, we will restructure the manuscript according to your suggestions. The method section will now contain descriptions of the catchment, the model, and the input datasets. The Sections 4.2 and 4.4 will be moved as subsections to the results section.

Page 5, line 138: The term "gradient" should be replaced with "relief". "Relief" refers to the absolute difference in elevation of a region, whereas "gradient" refers to the slope.

Author's answer: Thank you for pointing out this linguistic subtlety to us. We will change "gradient" to "relief".

Page 5, line 142: The term "knee wood" should be replaced by "krummholz", which is the more internationally recognized term for dwarf woody alpine vegetation.

Author's answer: We will replace "knee wood" by "krummholz".

Introduction, lines 112-124: Much of this should be moved to the methods section as it is repetitive.

Author's answer: We will shorten this paragraph. In the updated version this paragraph will be in the methods part.

Page 5, line 160-199: A figure or table would greatly help the reader understand the model structure and underlying component calculations.

Author's answer: CHRM is a widely used model for investigating snow hydrological questions. A very general structure is presented in Weber et al. (2016). The modules and underlying component calculations are described in detail in Pomeroy et al. (2007) and the other papers cited in the paragraph. We will reference this and point out more clearly the structure and description of the model in the updated version.

Page 8, line 201-202: Why is the reference referred to as representing the "gauged basin mode"? It would help if the methods section started out with statement about how the study is organized, such as "The approach we use is to model snow and runoff in the well-characterized RCZ using the CRHM and in-situ measurements. Then we repeat the modeling process using alternative datasets. In order to do this, we first describe the watershed, the model, the derivation of the datasets. . .." Moreover, the derivation of the reference model needs to be more clearly explained. Are you using a single meteorological station's data (Mt. Zugspitze DWD station) to drive the catchment

model and compare the results at two other stations in the catchment (LWD, DWD)? Use of standard three-letter station abbreviations for all stations in the study would help clarify this, too.

Author's answer: We will follow your suggestion to shortly outline the method steps undertaken at the beginning of the methods section, which will increase readability. The reference setup is referred to as 'gauged basin mode' since it uses in situ measured driver data directly measured within the gauged RCZ. Indeed, we are using data from a single meteorological station for the reference meteorological data input. We will point this out more clearly in the updated version along with a better description of the reference data. The reason why we 'just' use the DWD data as meteorological input is the following, which will also be clarified in more detail in the manuscript: For the reference setup, we used meteorological data measured at the DWD station on Mt. Zugspitze since it is the best dataset in terms of continuity and data quality measured directly within the catchment. Due to some longer data gaps, especially at the end of the winter season and the summer time, we did not use the meteorological LWD data as driver data. We will add in line 145 that besides the gaps in summer, there are also some gaps during winter, mainly at the end of season. In general, we agree that three-letter abbreviations for all stations would be good. For the two in situ stations LWD and DWD in the RCZ we used three-letter abbreviations. To avoid confusion, we name the DWD station situated at Mt. Wendelstein 'DWD_Wendelstein'. We think that for this study it is ok to extend the latter station name, as we also do not use three letters to describe the results of the global meteorological and DEM datasets.

Page 10, line 257: What does PUB stand for?

Author's answer: The acronym PUB stands for predictions in ungauged basins and is defined on page 3, line 74.

Figures 3 and 4: These figures are introduced in the text and appear before section 4.3 which describes the DEM parameterizations. It was unclear, at first, why the DEM

datasets were part of the graphs. It would be clearer to present methods in one full section and results in the next. As it is, some results are mixed in with each method section.

Author's answer: We will follow your recommendation and will restructure the manuscript. Regarding the graphs you mentioned (Fig. 3 & 4), we think that in order to exceed a not too high number of graphs in the manuscript in total, and not to be repetitive, that the additional information showing the information related to the DEMs is ok. However, we will mention more clearly in the text that the graphs consist of more information than the meteorological input data sets described in the section, where the graphs are already presented and that the further datasets shown in this graphs, will be described in the following (sub)section(s).

Page 18, line 432: What does 'thunderstruck' mean? Do you mean that there are data gaps to power outages caused by lightning strikes?

Author's answer: We will change it to lightning strikes.

References

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