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Earth System Dynamics
Discussions

Interactive comment on "Seasonal discharge response to temperature-driven changes in evaporation and snow processes" *by* Joost Buitink et al.

Anonymous Referee #3

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The paper "Seasonal discharge response to temperature-driven changes in evaporation and snow processes" aims at testing the hypotheses that both seasonal changes in snowmelt and enhanced evaporation can exacerbate low flows, and that changes will increase with temperature under realistic warming. I think this study fits very well with the scope of ESD journal and it addresses an important and timely topic. However, the authors should first address some major issues before this manuscript can be considered for possible publication.

My first concern is related to the structure and readability of the paper. I found the description of the method really poor, fragmented, and the results section is a mix of both

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findings and methods. Overall, I believe that this paper structure makes the manuscript confusing and difficult to read. Why not add a “case study” and “Experimental setup” sections before describing the results? Also, the authors described figure 2.a and then they jumped to figure 3, while the remaining part of figure 2 is described only after. A solution could be to split figure 2 into different ones. Try to be more consistent.

My second concern regards the swapped method introduced in this study to understand how the individual forcing variables affect the hydrological cycle. I found this approach quite atypical, and an adequate justification should be included for why such an approach is employed. I am not deeply familiar with this swapped approach, but there is no reasoning provided for why such an approach should be preferred over other statistical approaches.

Another serious issue is the model structure. Several major hydraulic works and flood control measures were constructed over the years in the Rhine basin, strongly modifying its hydrological cycle and flood responses. How are those structures included in your distributed efficient hydrological model? This can be a major issue as major hydraulic works may have a higher influence than the forcing variables analyzed in this paper, thus compromising the findings and conclusions of the study.

Linking to the structural issue of the manuscript, the authors can clearly mention in the new “Experimental setup” section that the swapped and changing-temperature approaches are meant to answer the two hypotheses of this study (see introduction). Moreover, to further improve the readability of the paper, the authors could better connect the two hypotheses of the introduction with the results summarized in the conclusions. Right now everything is there, but it takes quite some time to grasp the main take-home message.

The authors mentioned in the conclusions that “Here we selected a resolution of 4×4 km, so we can use the ERA5 forcing data without downscaling methods (adding uncertainty and potential errors)”. However, if ERA5 has a resolution of 0.25degree, how

it is possible not to downscale the dataset to adapt it to a higher resolution of 4km?

". . . yet these results can be interpreted for the many different basins around the globe depending on both rain- and snowfall". This sentence should be rephrased as you do not know what can occur over other basins with totally different characteristics. The results of this study cannot be generalized to other studies without proper large-scale validations. The same applies to other generalizations introduced in the conclusions. Include study limitations in the conclusion section

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