

Author Response to Reviews of

Glacial runoff buffers droughts through the 21st century

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Earth System Dynamics Discussions

RC: Reviewer Comment, **AR: Author Response,** Manuscript text

We thank the reviewers for their consideration throughout this process. Only one reviewer requested changes on the most recent version of the manuscript. We respond to the suggestion directly below. A revised manuscript with changes highlighted is attached.

1. Reviewer 3

1.1. Minor revisions suggested

RC: *Thanks a lot for answering my comments and for the additional analysis to estimate the potential effects of methodological limitations! In my eyes the analysis has shown that the enhancement of the moisture source term can have an impact on the results. Nevertheless, the impact of glaciers remains. I think the added section in the appendix (B2.1) explains very well your additional analysis and shows honestly the potential limitations.*

I have only one last suggestion for the manuscript: Can you add one to two sentences in the conclusion which reflect the possible methodological limitations (shown in B2.1 and the sentences added to the Discussion)? I think this would be important, so that also readers who do not dive into the Discussion and Appendix, know that the drought buffering is probably not only coming from the glaciers itself but also due to limitations regarding precipitation inputs etc.

Since you spend a lot of time and effort to analyse the effects, adding some conclusive remarks in the Conclusion about this should be rather straightforward.

AR: *Yes, good point. It was an oversight that we did not edit the conclusions before. I suppose we were optimistic to think that readers will want to read the whole thing!*

We have added three sentences referring to the limitations indicating areas for future improvement. We have separated the conclusions into two paragraphs to aid readability. Inspired by the reviewer's comment, we have also glossed the "GCM" acronym again for the benefit of readers who haven't thoroughly read earlier sections.

New sentences read as follows:

Our analysis also indicates work that can be prioritized to improve future projections of glacial drought buffering. First, our method can be applied at smaller scale, analysing runoff per glacier catchment rather than aggregating into large-scale basins, which will correct overestimation of moisture when glaciers are in the wettest part of a large basin. Second, our method can be refined to partition glacial effects on SPEI from non-glacial enhancement of moisture (such as parameterized orographic precipitation) in glacier models. Third, more fundamental work ...