

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2021-94

Caroline Clason (Referee)

Referee comment on "Glacial runoff buffers droughts through the 21st century" by Lizz Ultee et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-94-RC2>, 2021

General comments

This study, by Ultee and co-authors, uses the results of existing GCM simulations and global glacier modelling to assess the importance of glacier runoff for drought buffering in the SPEI (Standardized Precipitation-Evapotranspiration Index). The SPEI is modified to quantify drought buffering by glacier runoff for 56 glacier catchments and compared with a baseline that does not include glacier runoff. The rationale for this work is outlined clearly within the introduction, and one of the key findings - that glacial drought buffering might extend beyond the end of the century despite passing glacier basin peak water for many regions - is a fascinating one that warrants further study. Overall, I found this to be a well-written and well-devised study that will be of benefit to researchers working on glacier-fed water security, and I identify no major issues with the manuscript.

Specific comments

Abstract - I think the abstract currently does a good job of explaining the "bare bones" of the study, but would benefit from some additional overview of the methods employed and key outcomes.

Line 110 – This is probably just something that I've seen and thus can never unsee, but you could consider changing SPEI_w to SPEI_G as currently it looks a bit like 'spew' and 'G' seems more representative.

Line 106 – could the title of section 2.1 be a little more snappy?

Line 144-145 – I'd suggest writing out the four variables here for clarity rather than having to refer to Table 1 which doesn't appear for a few pages.

Lines 147, 169, and 188 – This could be down to personal preference, but while I appreciate the idea of using headline results as section headers, I wonder whether this would be better changed to a description of the wider content in each section. E.g. "Impact of glacier runoff for basin water supply"; "Glacier runoff influence on drought severity and frequency", and "Influence of glacier cover for drought buffering".

Figure 1 – I'd include the region / country name for each panel for ease of comparison. I also wondered whether it might be worth exploring changing one (or both) of the colours, as where they overlap it produces a brown-ish colour that's not so dissimilar to that for the "without glacier runoff" scenario. Maybe changing the colour would still result in a bit of a "muddy" overlap, in which case stick with what you've got.

Figure 4 – the blue and green colours here are quite dull on my screen (the median gets particularly lost in the blue box plots), so might warrant brightening up for ease of viewing.

Figure A1 – as for Figure 1, I'd suggest including region names within each panel, and/or consider grouping the panels in this large figure by region, to allow easy intra-region comparison.

Lines 293-312 – because the SPEI is such a central component of the methodology here, I'd consider moving this detail into the main manuscript methods.

Lines 330-342 – as comment above.