

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on hess-2022-60

Anonymous Referee #2

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Referee comment on "Significant regime shifts in historical water yield in the Upper Brahmaputra River basin" by Hao Li et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-60-RC2>, 2022

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The manuscript from Li et al. offers an analysis of the different drivers of hydrological regime shifts in the upper Brahmaputra, highlighting changing climate and glacier loss as major determinants. While the work is generally well written and shaped, there are some issues/suggestions to be considered before publication:

- A conceptual framework would greatly help you to shape the storyline. Actually, there are several studies showing regime shifts associated with glacier loss (see Huss & Hoch, 2018; concept of "peak water"). I think that your work provides further evidence in that direction, showing the magnitude of hydrological glacier influence over spatial gradients, and offering an important analysis of the turning points in regime shifts.
- I found the discussion a little bit lacking. As glaciers and the climate are the major hydrological drivers, what will it happen when glaciers disappear and the climate has shifted? Also, you should stress that the "climate shifts" are changes in precipitation patterns in your work
- Why did you choose this particular type of analysis to estimate drivers of regime changes? This is not sufficiently explained in the text
- It seems that the drivers of regime shifts depend on the considered part of the catchment. In general, the influence from glaciers is higher in the upper part and that from precipitation is higher at downstream locations. I think that translating this information into "spatial gradients/turning points" would greatly improve the quality of your work. Is there any relationship between the glacier cover in the catchment and the role of glaciers in driving the magnitude and direction of regime shifts associated with glacier loss or precipitation changes?

Please also consider these additional issues:

## **Abstract.**

I suggest you to remove useless adverbs such as "however, nevertheless, etc.". Try to shorten the abstract a little bit, e.g., discarding not essential sentences or summarizing some concepts

Line 15. Change "melt" with "loss". Cryospheric changes can increase the amount of available water, e.g. in rock glaciers

Line 18. Is it "stream head" correct word? I would delete the part ", as represented...downstream" in this sentence, useless for the abstract in my opinion.

Line 19. Delete "we found that"

Line 21. Delete "furthermore"

Line 23. Delete "however"

Line 25. Delete "nevertheless, we found that"

Line 28. What do you mean with "ecological restoration"? I would remove this word as "water management" is enough in this context. Either, you can use the word "water governance", which involves the management of water as well as the related ecosystems and resources

## **Introduction.**

Line 36. What do you mean with glacial snowmelt? Cryospheric drivers are snow and glaciers providing water across the melting process, i.e., glacier ice melt and snowmelt. Or do you mean the snowmelt occurring on the glacier surface? Please consider here the paper from Huss et al., 2017, which also includes the permafrost ice as a key component of the mountain cryosphere

Line 36. It is actually unclear to a layman what the Third Pole is. Please clearly and concisely define it the first time you name it

Line 52. "direction of change..." of what?

Line 54. "glacial snow". See same comment of line 36.

Line 84-85. "a reference...modelling". You already provided this sentence 8 lines earlier. Please avoid repetition.

## **Results**

Figure 3. I think the use of boxplots would greatly help interpretation.

Figure 5. I suggest you to provide the text and fitting lines for significant relationships only, to avoid figure overwhelming and help interpretation

## **Discussion.**

I think that an important work to be considered, that may help contextualising your storyline, would be Huss & Hock (2018) providing the concept of "peak water". I suggest you to reshape the discussion around this work. Your results clearly show that the upper Brahmaputra has already surpassed the Peak Water and is now in declining phase of hydrological changes associated with glacier loss. This conceptualisation would also help you to better discuss the turning points that different areas experienced during distinct years...the presence of these turning points should be better discussed, as it is one of the strengths of the chosen methodology.

Line 309-311. This is not true! See works from Huss and Hoch (2018), and in general the latest IPCC report on the ocean and the cryosphere, chapter dedicated to mountain environments...

Line 330. Please change "retractation" with "loss" or "recession". Also the sentence is unclear as written

Line 338. What do you mean with "ecological restoration"? It is unclear why this would help ecological restoration in particular. It is a general issue of water governance, after all, not just restricted to ecological restoration.

## **References**

Huss, M., Bookhagen, B., Huggel, C., Jacobsen, D., Bradley, R. S., Clague, J. J., ... Winder, M. (2017). Toward mountains without permanent snow and ice. *Earth's Future*, 5, 418–435. <https://doi.org/10.1002/2016EF000514>

Huss, M., & Hock, R. (2018). Global-scale hydrological response to future glacier mass loss. *Nature Climate Change*, 8(2), 135–140. <https://doi.org/10.1038/s41558-017-0049-x>

IPCC—Intergovernmental Panel on Climate Change. (2019). IPCC special report on the ocean and cryosphere in a changing climate. Geneva: Switzerland.