Authors' **response** to the **comments** by Anonymous Referee #1

In this paper, the authors quantified the sensitivity of summer runoff to precipitation and temperature changes in two glacierized Himalayan catchments with contrasting climate based on a hydrological model. This study is well prepared, and the results are meaningful. However, there are still some questions needing to be clarified. Here are the Details:

We thank the reviewer for the careful comments.

Lines 48-49: This expression should be careful. In my opinion, the simulation is not as same as the observations. The observed data can represent the reality at a point scale but is hard to obtain, especially in the high mountain regions, while the simulation can systematically analyze for a basin-wide scale over a long period.

While we agree that observation and simulation both have their limitations and strengths, the point we make here is that when observations are scant (eg, in the studied catchments), model runs may be the only way to understand the sensitivities. Also, note that the discharge is a point measurement, it naturally integrates over the whole catchment.

Figure 1. The boundaries of the two study basins should be highlighted on the map.

The boundaries were not visible clearly enough due to the scale of the location map, which is why detailed boundaries were provided separately in Fig 2.

Lines 65-66: This sentence is inaccurate. As I see, the annual temperature of Chandra (-55â„ƒ) is lower than Upper Dudhkoshi (-4.7â„ƒ). In addition, the glacierized fraction of Chandra (0.25) is higher than Upper Dudhkoshi (0.20), and the former glacier area is more than two times the latter. These differences are significant and have a large impact on the glaciohydrology. So please revise it.

We shall modify the text in the revised text.

Lines 165-166: How to calculate the glacier area change? There is only the glacier mass balance change data in the supplementary Figure S3.

The present glacio-hydrological model did not consider the changes in glacier area, which was relatively small over the study period. We discussed this point in L 165-169.

In addition, have the model considered the compensation of snow and transforms into ice?

The snow module (Andreadis et al., 2009) in VIC does not consider compaction/firnification. Thus we have only snow or ice on the glacier surface. However, the effect of the snow metamorphosis is included in the paramterisation of the albedo change.

Supplementary Figure S1: How to deal with the observed data gaps?

In this figure (and also in Fig S2), we only considered months where the gaps were less than one week. Each point in the resultant plots is the mean over at least 2 (5) years in Chandra (upper Dudhkoshi). We shall add these details in the revised caption.

Line 220-225: I think the temperature before the ablation season can also influence the glacier melt and snowmelt since it controls the distribution of rainfall and snowfall in the accumulation season. Especially in the Chandra basin, where most precipitation occurs in the winter. Thus, I suggest that the authors should add a temperature sensitivity experiment before the ablation season.

Given that the mean temperature of Chandra catchment during Dec-Apr is less than –5^{o}C, the effect of warming on snow-rain partitioning is unlikely to be important. However, we shall explore this possibility.

Lines 312-317: How to define the glacier runoff in this paper and what is the difference between it and the glacier ice loss?

Glacier runoff is the sum of the snow melt, ice melt, and rainfall on the glacerised part of the catchment as defined in L 159–160. The glacier mass balance (= snowfall-snowmelt-icemelt) is defined in L 160–161.

Moreover, the results show that the glacier runoff contribution to the total summer runoff in upper Duhkoshi is higher than that in Chandra basin while the glacier cover in upper Duhkoshi is lower than that in Chandra and the former summer precipitation is much higher than the latter, which seems contradictory.
Thank you for pointing out this inconsistency. There was due to a calculation error. The revised glacier ice melt contributions to the summer runoff are 36 and 31% in Chandra and upper Dudhkoshi catchments, respectively. We shall correct the error in the revised text. This trend is also visible in Fig S7 where Chandra shows a larger annual glacier runoff.

Lines 351-354: How does the glacier hypsometry affect the mass-balance sensitivity, and how is this factor considered in the model?
The hypsometry of the glacier cover in the catchments were explicitly included in the VIC+DDF model used to compute glacier mass balance (L 154–155).

Lines 377-379: In my opinion, the results vary from different studies, I think the authors should discuss the reason for the difference among the studies at different basins rather than describe it as “largely in line with”.
We shall revise the sentence and add some relevant discussion.

Figure 7: The color scheme is too blurry to distinguish.
We shall revise the figure.

Line 389: The precipitation increased while the rainfall on glacier did not change, why? Please clarify it.
The higher precipitation contributed mostly to a positive storage change, i.e., snow accumulation on the glaciers (L 390).

Lines 464-466: The RCP2.6 scenario data has been used in this paper, but has no introduction (e.g. which general circulation model has been selected and the evaluation of the projected data).
Here we have used the data from Huss and Hock 2018 and Kraaijenbrink et al 2017. We referred the reader to these papers for the relevant details (L 279-281).

References

Andreadis, K. M., Storck, P., and Lettenmaier, D. P. (2009). Modeling snow accumulation and ablation processes in forested environments. Water resources research, 45(5).

Huss, M., and Hock, R. (2018). Global-scale hydrological response to future glacier mass loss. Nature Climate Change, 8(2), 135-140.

Kraaijenbrink, P. D., Bierkens, M. F. P., Lutz, A. F., and Immerzeel, W. W. (2017). Impact of a global temperature rise of 1.5 degrees Celsius on Asia’s glaciers. Nature, 549(7671), 257-260.