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REVISED MANUSCRIPT FOR CONSIDERATION

Dear Dr. Bühler

On behalf of my co-authors, let me thank you and the reviewer (Adam Emmer) for your prompt and positive handling of our revised manuscript:

"Glacial lake outburst flood hazard under current and future conditions: worst-case scenarios in a transboundary Himalayan basin"

We have undertaken the requested minor revisions. Below you will find our point-by-point final response to these comments, including on the issue of the likelihood and implications of the very high magnitude events we model here. On this point we have added further text to the discussion.

Please note, we have also edited the references to align to the journal style.

We believe this paper will generate lively discussion in the research community regarding large worst-case process chains involving glacial lakes.

Yours Sincerely,

Dr. Simon Allen

Referee #2: Adam Emmer

I have reviewed the previous version of this study in which I criticized the worst-case scenario approach. I thank the authors for substantial revisions they made and for addressing many of my comments. I have no concerns regarding the technical aspects of modelling which is sound; however, I'm still struggling with the worst-case scenario approach (scenario development) and find the modelled results detached from what has been observed in HMA in human-relevant temporal context. Strikingly, Veh et al. (2020; https://www.pnas.org/doi/10.1073/pnas.1914898117) estimated 100-y mean GLOF discharge 15,600 m3/s (compare to yours > 500,000 m3/s (!)) roughly corresponding to the peak discharge of the largest reported GLOF in the region (15,920 m3/s from Zhangzhanbo Lake). Indeed, extremely large mass movements occur in mountains (e.g. Chamoli with comparable volume to your scenarios), but should that be taken as a 'golden standard' for executing GLOF / process chain studies? In the model world, should we let 20Mm3 collapse to all GLOF-susceptible lakes in the HMA?

Considering indisputable interest for and potential utilization of this study by disaster risk reduction practitioners, I wonder what would be the return period of > 500,000 m3/s flood that is presented here? It is mentioned in discussion that it is probably > 200 years. Yes, perhaps much more. Is it still relevant for anyone or is the probability of such event far below the threshold of acceptable risk? Moreover, the authors basically conclude that hazard mitigation measures implemented at Jialongco are useless (and even counterproductive). Such statements might demotivate anyway difficult-to-implement (and expensive) hazard mitigation works and should be communicated carefully and put into broader context (for instance, their effectiveness for more likely lower magnitude triggers when it can prevent dam breaching for instance). For these particular reasons, I always call for (and Ashim knows that well from our previous collaboration 😊) considering a range of scenarios (ideally associated with probabilities or return periods) instead of the worst-case scenario.

I don't expect you to revise your study in line with my comments above, but I would be happy if you would consider it in your future studies.

We sincerely thank Adam Emmer for his valuable insights, as always. We absolutely agree that communication around the likelihood and implications of a worst-case scenario for disaster risk management are critical. In fact, one of the main motivations with this work is to initiate discussion in the research community around worst-case scenarios, which until now, are basically neglected (with only small, medium and large scenarios typically modeled). We are definitely not saying that such scenarios need to be the "golden standard" for GLOF process chain studies, but merely that they need to be at least considered. This point was already made in the GAPHAZ international guidance from 2017, but, ironically without actually providing any guidance on how to establish and model such worst-case events. We believe our study makes a valuable contribution to further this discussion.

The reviewer is absolutely right to remind that ultimately this discussion on the inclusion of, and implications of worst-case scenarios comes down to risk tolerance levels of local communities and their decision-makers. With this in mind we have moved some text, and expanded to create a final prominent paragraph in the discussion that focusses on this issue and we hope addresses the reviewers concern.

Note we have also included a reference to Veh et al. (2020), although of course, as we know from across the climate change risk management literature, we are starting to see and need to be preparing for events that may far exceed historical precedence.

Tab. 3: please consider showing dam breach parameters and considered released volumes

We have added dam breach width, which can be easily extracted from the model results. Release volumes of the initial avalanche are given in Table 1.

Fig. 4: please elaborate on why modelled discharge from lowered Jialongco is higher than modelled discharge from not remediated Jialongco

This is due to the fact that not only the lake level was lowered, but also the moraine dam was lowered and armoured. As a consequence, dam erosion was set to zero in the simulation, and the lowered freeboard results in a larger overtopping volume. We have elaborated the explanation of this in section 4.2.

Discussion section – please consider splitting into sub-sections

We have added two main sub-section titles.