

Response to Dr. Adrien Gilbert' comments

This paper reports and describes a massive ice-rock avalanche that occurred in the Sedongpu valley in March 2021. The authors show that the detachment originates from a ridge at high elevation where previous events were already documented (Kääb et al., 2021). They show that the initial detachment is of about 50 Mm³ and that it produced a mass flow of unprecedented energy as untouched hills were overridden by the avalanche. The event has important implication as it dams an important river where hydro-power infrastructures and villages can be damaged by potential outburst floods. This event is really similar to the “Chamoli event” (Shugar et al., 2021) which received a lot of media attention recently and could be linked to climate change as suggested by the authors.

The authors use a complete and valuable dataset to describe the event for a rigorous assessment of its timing, size and intensity. I think the paper should be published as a brief communication after some minor revisions.

Reply: We thank Dr. Adrien Gilbert for your detailed and helpful comments on our manuscript. Below we present our point-by-point response.

General Comments:

1. To improve the discussion about the possible link with climate change I would add on figure 3 (d,e,f) the dates of all the documented events of the catchment (see Kääb et al. (2021) section 3.6). Can be a vertical straight line when an event occurred.

Reply: Following your suggestion, we have added a vertical arrow which indicates the dates of the documented three events.

2. Figure 3a and 3c should be replaced by figure S4 which is much better to understand the setup. Figure 3c is really unreadable.

Reply: Following your suggestion, we have moved the Figure S4 in the Figure 3.

3. In figure 3b, could you provide the whole DEM difference (do not cut at the catchment edge) ?

Reply: Following your suggestion, the whole DEM difference without cutting along the catchment edge are provided in new Figure 3b.

4. Be careful to provide high resolution figure in the final version.

Reply: We provided the high-resolution TIFF figures in this version.

Other comments and corrections:

1. L23-24: “*Sometimes the mass flow’s path can cross international borders making...*” It is a very specific situation, I don't think it is necessary here to mention this.

Reply: This sentence was deleted in the revised paper.

2. L35: “*The People’s Republic of China (PRC)*” Not clear what it is for me. You

mean "the Chinese government" ?

Reply: Yes. We have change it as “the Chinese government”.

3. L39: “*Exposure and vulnerability*” of what ? People ? Who or what is more/less exposed and vulnerable ?

Reply: We re-wrote the sentence as the following: “*Mass flow hazards of cryospheric origin are of significant concern across HMA, particularly when these flows have the potential to affect regions that are experiencing rapid changes in both the exposure and vulnerability of populations and infrastructure.*”

4. L41: “*PRC*” China ?

Reply: “*PRC*” was changed to “*China*”.

5. L115: “*as ~110 m s⁻¹ (~396 km/h)*” Not very realistic no? Maybe comment on this value here.

Reply: We have deleted this sentence in the revised manuscript.

6. L135: “*(see supplementary video)*” Need to appear in supplementary material (not only in the data availability section)

Reply: The video information were moved to the supplementary materials.

7. L137: “*the same vicinity*” of what ?

Reply: We have rewritten this sentence so that it now reads: “*Post-event field photographs and Pléiades orthophotos show that the source area of the March 2021 ice-rock avalanche is located <0.5 km to the north of the large (17 and 33 Mm³) avalanches which occurred in 2017 (Fig. 2d and Kääh et al., 2021)*”

8. L138: “*Fig. S4*” This figure should appears in the main text instead of figure 3a and 3c as figure S3 is equivalent to figure 3a and figure 3c is pretty bad. Figure S4 really helps to understand the setup.

Reply: The Figure 3a and 3c have been replaced by the oblique three-dimensional figures as suggested.

9. L141: “*the east of the ridgeline*” cite figure 2b

Reply: Done

10. L148: “*Anomalies*” compared to which reference?

Reply: Anomalies of minimum air temperature during different season were compared to the mean values during the period between 1980 and 2021. We have added this information in the caption of Figure 3.

11. L149: “*(Bomi, Milin, Nyingchi)*” What is the elevation ?

Reply: We have added the elevation of each station in Section 3.3.

12. L155: “Experienced considerably more earthquakes” On which time period ?
Reply: The time period is from 2000 to 2020. We have added the relevant period in section 3.3
13. L160-163: “The eventual 2021 failure at the ridge crest is more commonly associated with earthquake triggering in historical inventories (Densmore and Hovius, 2000) although the 2021 Chamoli event, which was also aseismic, was also sourced close to a ridge crest (Shugar et al., 2021).” Unclear sentence. I don't understand it.
Reply: For clarification, we have deleted this sentence and relevant reference in the revised manuscript because on reflection it adds little to the discussion in this paragraph and which centres on our interpretation that seismic activity may have been a conditioning, rather than triggering factor for this Sedongpu event.
14. L165a: “decrease in precipitation” Not visible, you could show trends on figure S7b but I don't think there is any change in precipitation.
Reply: We have revised the description as “Meteorological records from nearby monitoring station show a significant increase in mean air temperature but insignificant change for annual total precipitation change (Fig. 3a-b)”
15. L177: “The AWS recorded a small precipitation event (3.9 mm) in the morning of 22 March 2021...” It does not make any sense to compare two days as the daily variability is much larger than 2.5°C. At least try to compare against a multi-years (>10years) average to see if 22 march 2021 is particularly warm.
Reply: We agreed with your comment. And we did compare the mean, max and min air temperature on 22 March during the period from 1980 to 2021. The air temperature on 22 March 2021 was actually slightly lower than the multi-annual mean value. Thus, as suggested by your comment, the relevant comparison was deleted in the revised manuscript.
16. L192: “This event” give the number you find and basic description of the event.
Reply: We have adjusted the text so that it now reads: “The March 2021 event, and notable events that have preceded it (e.g. ~50 Mm³ ice-rock avalanche, 2017-2018, and the ~130 Mm³ glacier detachment in October 2018), reinforce the classification of the basin as a hotspot of catastrophic mass flow activity”
17. L195: “Whilst we do not focus in detail on the...” I don't think this discussion about the international influence is relevant since it is very specific to your case. I would delete this.
Reply: We thank the reviewer for their thoughts on this aspect of Section 4. We have decided to retain this sentence, but it now appears earlier in the manuscript, as per the suggestion by the other reviewer. Yes, what happens downstream is specific to

this event, but we feel that highlighting the trans-boundary nature of the hazard is important for placing the event in its wider geographical context. We anticipate that the readership will be interested in this detail.

18. Some corrections were also proposed by the reviewer in the original manuscript
Reply: All the corrections were incorporated in the revised manuscript.