

We thank the editor J. Fürst for the management of the review process and the constructive feedback. We hope that all points made by the two reviewers have now been resolved and that the manuscript can be published.

## Response to reviewer comments

Reviewer 1:

I thank the authors for revising the manuscript. Nearly all my previous comments have been satisfactorily addressed. I only have two minor remarks (below) and recommend acceptance of the manuscript after these have been addressed.

Thanks you very much for the constructive feedback. We have addressed now the remaining point.

Section 2.5 (Volume uncertainty). The formula used for calculating the relative volume error is correct as it is. It could be useful though to include in the manuscript how the formula for the relative volume error is derived. It is based on the underlying equation where  $V = A \cdot H = A \cdot (s - b)$  where  $s$  is surface height,  $b$  is bed height and  $A$  is area. Error propagation of the product ( $A \cdot H$ ) gives  $\text{eps}_V/V = \sqrt{(\text{eps}_A/A)^2 + (\text{eps}_H/H_{\text{mean}})^2}$ . Furthermore, error propagation of the subtraction ( $s - b$ ) gives  $\text{eps}_H^2 = \text{eps}_b^2 + \text{eps}_s^2$ . Combining these gives  $\text{eps}_V/V = \sqrt{(\text{eps}_A/A)^2 + (\text{eps}_s/H_{\text{mean}})^2 + (\text{eps}_b/H_{\text{mean}})^2}$ , which as it seems is the equation that was used by the authors.

Thank you very much for the further explanation of this formula. We have revised the text in the manuscript and supplement and integrated the suggested details of explanation. We also added information about the different uncertainty components and their origin. We hope it is now clearer.

L218-220: "The total glacier volume of the Alps at their LIA maximum extent is calculated as  $280 \pm 43$  km<sup>3</sup> of which  $99.6 \pm 12.6$  km<sup>3</sup> remained in 2015 (-64%). Considering the uncertainty (15.3%) and a possible underestimation due to missing glaciers of 4.8%, the LIA volume could be as high as 336 km<sup>3</sup> and as low as 237 km<sup>3</sup>."

This may need some further revision. In case there is indeed a likely underestimation of LIA volume because of missing glaciers, then the correct approach (I think) would be to simply add the 4.8% to the 280 km<sup>3</sup>, i.e. 293 km<sup>3</sup> would be the best LIA volume guess. The  $\pm 43$  km<sup>3</sup> error bounds would then approximately apply to the new volume estimate, but it would be even more correct to add uncertainty in the missing glacier volume to the previous 43 km<sup>3</sup> uncertainty estimate. The combined error could be calculated using  $\sqrt{43^2 + X^2}$  where  $X$  is the error (in km<sup>3</sup>) for the missing glaciers.

Thank you for the suggestion to also consider the volume of the missing glaciers in the total. You are right that including this part would give a more realistic value, but in our impression this component is so uncertain, that we would prefer to not include it and keep the mean LIA volume value as is. We have added this information to the main text and supplement to make our choice clearer.

Reviewer 2 (Arindan Mandal):

The authors have satisfactorily addressed my previous concerns and incorporated the suggested or necessary changes. The current version of the manuscript is well-written, and I do not have any further major concerns, aside from a few minor or technical corrections that should be addressed before publication.

Thank you very much, we are happy to hear that all the important points have been amended satisfactorily.

Line numbers are according to the revised manuscript file (without track-change version).

L15-17: I think '(-57%)' should be after '4244 km<sup>2</sup>' as it is like the authors did for volume loss in the second part of the sentence.

We have rewritten the sentence.

L48-50: Can you re-check the sentence because it sounds a bit awkward in its current form. The authors may change something like: 'In the Alps, glaciers reached their maximum extents several times between 1250 and 1850/60, with the exact timing varying by glacier.'

We have rewritten the sentence.

L58-60: Here, I would suggest using decimal numbers consistently. 2271.6 → 2272 km<sup>2</sup>

Done.

L104-106: Please remove 'the' in front of 'glaciers'

Done.

L110: The glacier → Glaciers

Done.

L247: Please expand COP DEM here, I understand it is Copernicus DEM, but it would be better for the readers.

Done.

L270: I would suggest changing 'analysts' to 'studies'

Done.

L309-311: Here, 'namely' is not fitting/sounding well because after 'namely' values are there. Instead, they may change it to something like: '...after 1931, with -29.4 km<sup>3</sup> and -3.8 km<sup>3</sup> reported by Mannerfelt et al. (2022), compared to -32.8 km<sup>3</sup> and -3.5 km<sup>3</sup> observed in this study.'

We have rewritten the sentence.

L311: 'rate' and 'values' in this case is same, so please remove any of it.

Done.

L387-388: For volume change uncertainty values, please be consistent with the decimal numbers.

We have checked the uncertainty values and decided not to include decimals for consistency.

Figures S4: What is the unit of the acceleration rate (legend colorbar), please add it in the colorbar for easy comprehension, like as it in the Fig S6/S10.

We have explained the meaning of the acceleration rate in the caption. Since it's a relative increase factor (e.g. threefold increase) it has no physical unit.