

Dear Reviewer,

Thank you for your thorough and constructive review of our revised manuscript. We appreciate the time you took to independently re-run portions of our analysis and to identify several important methodological issues. We have addressed all comments below and believe the manuscript is substantially improved as a result. Our point-by-point responses follow, with changes to the manuscript indicated where relevant.

DEM co-registration

We thank the reviewer for identifying this issue and for independently re-running the co-registration with a manually digitized validity mask. Following the reviewer's suggestion, we manually digitized validity polygons around the high-quality central areas of both DEMs in ArcGIS Pro to exclude these border regions prior to co-registration. A sentence describing this step was added to Section 3.4. We also updated the co-registration pipeline to use xDEM's NuthKaab implementation directly. The improvement in stable terrain NMAD is substantial: for IGM 1954, pre-core-registration NMAD decreased from 32.99 m to 13.87 m and post-core-registration NMAD from 27.82 m to 11.30 m; for Pléiades 2025, pre-core-registration NMAD decreased from 17.66 m to 3.84 m and post-core-registration NMAD from 45.10 m (a failed optimization on the artifact-contaminated DEM) to 3.82 m. These values are consistent with the reviewer's independent estimates of 14.1 m (pre) and 9.1 m (post) for IGM and ~3.5 m for Pléiades; remaining small differences reflect differences in polygon extent. Table 2 and all downstream uncertainty estimates have been updated accordingly.

We note a secondary effect of the improved Pléiades masking on uncertainty propagation: the variogram range fitted to the reduced stable terrain increased from 187 m to 660 m, reflecting longer-range error correlations consistent with systematic photogrammetric biases (Hugonnet et al., 2022). This yields a larger reported uncertainty for the 2000–2025 Pléiades epoch (± 0.382 m w.e. yr^{-1} vs. ± 0.17 m w.e. yr^{-1} previously), which we consider more appropriate given the reduced stable terrain extent. The 2000–2025 signal is strongly corroborated by the independent ASTER 2000–2018 estimate of -0.610 ± 0.062 m w.e. yr^{-1} , which remains highly significant.

Mass balance calculation

We thank the reviewer for this careful and important correction. We acknowledge that our methods text incorrectly described the mass balance calculation as a "time-weighted mean area approach following Cogley et al. (2011), and we apologize for this error. The correct formulation, following Zemp et al. (2019) and Thibert et al. (2008), is:

$$\text{MB} = (\Delta \bar{h} \times A_{\text{start}}) / (\bar{A} \times \Delta t) \times \rho$$

where $\Delta \bar{h}$ is the mean elevation change over the start-epoch glacier area A_{start} , $\bar{A} = (A_{\text{start}} + A_{\text{end}})/2$ is the mean glacier area, and Δt is the epoch duration. In our previous submission, $\bar{A}$ was computed correctly but was only used to calculate volume change and did not enter the specific mass balance calculation. We have corrected the equation in both the code (Notebook 3,

Step 3) and manuscript (Eq. 1), updated the citation to Zemp et al. (2019), and updated all reported mass balance values accordingly.

Glacier code fragmentation

We thank the reviewer for identifying this issue. We confirmed that several glaciers changed inventory codes between 2000 and 2019 due to fragmentation (e.g. CL108101048 → CL108101048A/B/C) and disappearance (e.g. CL108130001, CL108130002). We replaced the string-based area lookup in Notebook 3 Step 3 with an intersection-based spatial join rather than a representative point join, as intersection correctly handles cases where a glacier has retreated significantly within its start-epoch boundary such that its representative point no longer falls within the start polygon. Fragmented glaciers now correctly sum the areas of all fragments, and disappeared glaciers correctly receive an end area of 0.

Specific comments

I. 291: We have incorporated the density uncertainty of $\pm 60 \text{ kg m}^{-3}$ (Huss, 2013) into our mass balance uncertainty estimates by combining it with the elevation-derived uncertainty as $\sigma_{\text{MB}} = \sqrt{(\sigma_{\text{elev}}^2 + \sigma_{\rho}^2)}$, where $\sigma_{\rho} = |\Delta \bar{h} / \Delta t| \times (\sigma_{\text{ice}} / \rho_{\text{water}})$, following Zemp et al. (2019). This has been implemented in Notebook 3 Step 4 and all reported uncertainties updated accordingly.

I. 309: The reviewer is correct. We have updated the Sen estimator notation in Eq. 6 to use $(y_j - y_i) / (x_j - x_i)$, where x denotes the year and y the observed value, consistent with the original formulation in Sen (1968).

Fig. 4 legend: Corrected. The median and percentile legend elements now use Line2D rather than Patch. We apologize for missing this in the previous revision.

I. 404: We have revised the wording to remove the ambiguous use of 'significant.' With updated mass balance values, the Las Termas subcomplex showed a lower mass loss rate from 2018–2024 ($-0.32 \pm 0.19 \text{ m w.e. yr}^{-1}$) compared to 2000–2018 ($-0.49 \pm 0.07 \text{ m w.e. yr}^{-1}$), though this difference does not clearly exceed the combined measurement uncertainty ($\pm 0.20 \text{ m w.e. yr}^{-1}$). The manuscript has been updated to reflect this.

I. 477: Corrected to $p = 0.01$.

I. 800: DOI updated to <https://doi.org/10.1038/s41598-024-52481-x>.

I. 802: Updated link to <https://bibliotecadigital.ciren.cl/items/507f7130-4e5c-437f-891b-cd98ade9f72a>.

I. 1165: Appendix figure numbers and captions: Figure numbers and captions have been added to all appendix figures following The Cryosphere guidelines (Fig. A1, Fig. B1, Fig. C1).