

On behalf of all the co-authors, I would like to thank the reviewer, Referee #2, Rakesh Bhambri, for his thoughtful and constructive comments which helped us to improve our study. We have responded to comments as follows:

NOTE

Anonymous Referee #1 Comments (Black font)

Authors Responses (Red font)

Specific changes that were made in the manuscript (Blue italic)

1. This study presented a new glacier inventory for four time periods (1990, 2000, 2010, 2020) covering the Karakoram and surrounding region (upper Shyok basin) using Landsat satellite imagery and reported insignificant area loss in the study area. The manuscript is very well-written and nicely structured. I have given some minor suggestions for improvement. The important issue is an outline of the Karakoram region. The present study modified the extent of Karakoram (L131) presented by Bhambri et al. (2017) but did not mention the reasons for this change. Bhambri et al. (2022) recently reported no international standardization on the Karakoram extent. Therefore, consistency in the spatial extent of the Karakoram region is needed to quantify, analyze, and compare databases of natural and cultural resources for scientific investigation on a common platform and harmonization of scientific studies. Comparing glacier numbers and area statistics with previous studies is impractical (section 4.1) as all the studies on Karakoram glaciers have different area coverage. Bhambri et al. (2022) provided a most appropriate digital outline of the Karakoram region based on two decades (1920s and 1930s) long discussions and descriptive enumerations of the Royal Geographical Society (RGS) and the Survey of India (SoI). I suggest using this most common outline (open access) for the extent of the Karakoram and using the same outline to extract previous glacier inventory data on the same platform for comparison and modify section 4.1. If you do not want to use this outline, for the sake of harmonizing scientific studies, you can change the title to "Interdecadal glacier inventories in the Karakoram and the surrounding region since the 1990s".

Response: Thank you for your valuable comments. We noticed that there are several boundaries in the Karakoram Mountains with subtle differences in extent. The Karakoram boundary we used is a revised version with reference to Bhambri et al. (2017) developed by our team (can be freely accessed with the link "<https://github.com/1923xfmingynu/Subdivision-Of-High-mountain-Asia>") (see Figure 1).

In section 4.1, we make comparison between our glacier inventory with others at the same region scales, for instance, when we compared with SCGI, we identified the minimum part based on glaciers in SCGI contained in our Karakoram boundary to ensure the comparison has practical significance. We hold that the original title "Interdecadal glacier inventories in the Karakoram since the 1990s" is more reasonable.

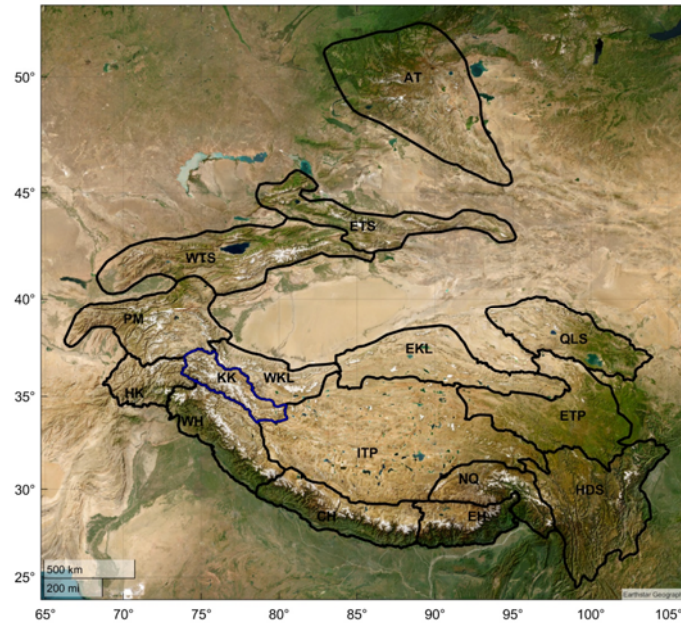


Figure 1 Sub-divisions of high mountain Asia

Suggestions

2. L41-42 Uncertainty is the same ± 3.68 in two sentences. If it is the same, write accordingly. You can write ± 3.7 .

Response: Thank you for pointing out the mistake. Actually, it's different. We corrected it.

“Our assessments using independent multiple digitization of 37 glaciers show that the KGI is sufficiently accurate, with an overall uncertainty of $\pm 3.68\%$. We also performed uncertainty evaluation for the contiguous glacier polygons using a buffer of half a pixel, which resulted in an average mapping uncertainty of $\pm 5.21\%$.”

3. L50 Present results in single-digit after the point ($23.4 \pm 28.8 \text{ km}^2$). Please carefully check the entire manuscript. In some places, it is single-digit (e.g., L300), and in others in double-digit.

Response: Thank you for your suggestion. We have modified the results in the whole paper to retain the two-digit decimal accuracy.

4. L59 Most glaciological studies usually avoid referring to countries' names for the Karakoram region. If you mention Pakistan in the first sentence of the introduction, then India and China must also be mentioned for the sake of neutrality. If you like, you can refer to the contested nature of this particular mountain region with different territorial claims between the different nation-states in a very general way. This is one aspect which creates continuous problems for ground truthing and field measurements. See Baghel and Nüsser (2015).

Response: Thank you for your suggestion. We have revised it to avoid referring to countries' names for the Karakoram region.

“The Karakoram mountains are centred in western Tibetan Plateau (see Fig. 1a and 1b) and host more than 20000 km² of glaciers, making this region one of the most glacierized areas outside of the polar regions.”

5. L89 "Moreover, the presented areas of glacier coverage differ partially substantially for the different available inventories (Bolch, 2019; Bolch et al., 2019)." Here you can mention Bhambri et al. (2022).

Response: Thank you. We have updated the corresponding references.

6. L91 "delineation with the exclusion of glacierized areas in glaciated areas steeper than 40°." Here two terms, 'glacierized' and 'glaciated', are used, and I could not understand them. Please see Cogley et al. (2010) for these terms.

Response: Thank you for your suggestion. We revised this sentence and unified the use of professional terms.

“The two versions of the GAMDAM inventory (GGI15 and GGI18) were generated by manual delineation with the exclusion of glacierised areas steeper than 40°.”

7. L133 "The data were identified and processed using Google Earth Engine." For image processing or glacier mapping?

Response: This refers to image processing. We have modified this sentence. The preliminary extraction of glacier outlines is implemented on GEE, while the manual revision and statistical analysis are finished on the local computer.

“The satellite images were identified and processed using Google Earth Engine (GEE).”

8. L153 for Karakoram boundary modified.... Please see my comment above.

Response: Referring to the reply to the first comment, we changed the statement to *“The Karakoram boundary is a reasonable revised boundary with reference to Bhambri et al. (2017) and can be accessed freely via “<https://github.com/1923xfmingynu/Subdivision-Of-High-mountain-Asia>”.* And we will add boundary data to the data assets.

9. L175 Bolch et al. (2010) used TM3/TM5 band ratio instead of NDSI. Therefore, Bolch et al. (2010) TM3/TM5 band ratio threshold must be different from NDSI.

Response: Thank you for your suggestion. We corrected the references.

“A similar threshold was also used for generating glacier inventories for large regions elsewhere (e.g. Ke et al. (2016))”

10. L201 Please omit etc.

Response: Thank you for your suggestion. "etc." has been removed

11. L218 Double space between can be

Response: Thanks. The error has been corrected.

12. L223 Double space between developed processing

Response: Thanks. The error has been corrected.

13. L293 This paper was published in 2006 (Granshaw and G. Fountain, 2017). Please check.

Response: Thank you for pointing out the mistake. The corresponding references have been updated and the references in the entire manuscript have been checked.

14. L394 between 0 "and" 50°

Response: Thank you, it has been revised.

15. L414 "Karakoram boundary used by us is a little different from that in previous studies (Bolch et al., 2019; Bolch et al., 2012)," I don't think this is little difference. Also, please see my suggestions for the Karakoram boundary above.

Response: As stated in the reply to the first comment. Here we have made further modifications and clarifications.

“However, due to the different approaches, data sources and methods among different glacier inventories, cannot be compared without a high level of uncertainty, so this is only a qualitative comparison. The Karakoram boundary used by us is different from that in previous studies (Bolch et al., 2019; Bolch et al., 2012; Bhambri et al., 2022), so the qualitative comparison is also only for areas covered by both inventories.”

16. L438 Scherler et al., (2018)

Response: Thank you. We have corrected the citation format of the references.

References

Baghel, R. and Nüsser, M., 2015. Securing the heights: The vertical dimension of the Siachen conflict between India and Pakistan in the Eastern Karakoram. *Political Geography* 48, pp. 24-36.

- Bhambri R., Chand, P., Nüsser, M., Kawishwar, P., Kumar, A., Gupta, A.K., Verma, A., Tiwari, S.K., 2022. Reassessing the Karakoram Through Historical Archives - Environmental Change in South Asia: Essays in Honor of Mohammed Taher, in: Saikia, A., Thapa, P. (Eds.), Springer International Publishing, Cham, pp. 139–169. https://doi.org/10.1007/978-3-030-47660-1_8
- Bolch, T., Menounos, B. and Wheate, R., 2010. Landsat-based inventory of glaciers in western Canada, 1985–2005. *Remote sensing of Environment*, 114(1), pp.127-137.
- Cogley, J.G., Arendt, A.A., Bauder, A., Braithwaite, R.J., Hock, R., Jansson, P., Kaser, G., Moller, M., Nicholson, L., Rasmussen, L.A. and Zemp, M., 2010. Glossary of glacier mass balance and related terms.
- Granshaw, F.D. and Fountain, A.G., 2006. Glacier change (1958–1998) in the north Cascades national park complex, Washington, USA. *Journal of Glaciology*, 52(177), pp.251-256.