

Authors reply to Anonymous Referee #1

“Strong acceleration of glacier area loss in the Greater Caucasus over the past two decades”

by L. G. Tielidze, et al.

The Cryosphere Discuss.,

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Dear Referee #1,

Thank you very much for your comments which we help to increase the quality of our manuscript. Please find in the following a point-by-point reply to your review.

All corrections and changes we did in the text are marked in **green**.

Best regards,

Levan Tielidze on behalf of all co-authors

Summary

The research article ‘Strong acceleration of glacier area loss in the Greater Caucasus over the past two decades’ presents two new glacier inventories dating from 2000 and 2020 based on optical remote sensing data as well as topographic properties derived from ASTER GDEM dating from 2011. The data contributes to the global GLIMS data base. As the area of investigation is important from the perspective of socioeconomic of even political indications of glacier loss as well as for the long time series which exist there, I consider this study as an important contribution of glacier change assessment.

Thank you for positive feedback and please see our detailed comments below.

General comments

The study is clearly structured and presented with a detailed error analysis. What is bit confusing is that the tables and Figures illustrating both inventories are placed in the section ‘5.1 Glacier Inventory 2000, and that The histogram of the glacier area distribution displays two lines referring to the elevation distribution within the outlines in 2000 and 2020 which seem to be based on just one DEM. The first issue could be solved by shifting graphs and tables to 5.2, for the histograms I am not sure how realistic this type of area distribution on a fixed altitude is.

The distribution of figures is just a technical issue and we believe this is easily manageable by technical team before final publication. The most important point is that all suitable figures are appropriately referred in both sections (5.1 and 5.2) and not just 5.2.

Regarding the DEM, we have explained this now in the discussion section as follows:

“The main explanation that we only used ASTER DEM (2011) in this study is that the SRTM DEM (2000) does not cover the entire study area. Furthermore, some pieces of existing SRTM DEMs are damaged for the Caucasus region and are not applicable for glacier parameter calculations. We also had an attempt to use 12.5m resolution of PALSAR DEM from 2007, but the difference between ASTER and PALSAR is only 4 years and the latest one also does not cover the entire Caucasus region.

We acknowledge, however, that for retreating glaciers and minimum elevation in the 2020 inventory there is a bit of overestimation, as the terminus is located on the former glacier surface represented by ASTER DEM. But considering the ASTER DEM uncertainties and uncertainties of other DEMs that we could potentially use, this overestimation should be acceptable. The impact on other parameters such as mean elevation would be even smaller.”

Please see P16 L366-375

Detailed comments

Line 318: Presenting the Russian Paper of 1911 is a great thing – I would really like to have the inventories a bit better presented. Currently, we only find the number on annual area change rate- but are the older inventories covering the exactly same area and glaciers as the one presented in the study? Could you add total areas?

A very good suggestion and thank you for this. However, we prefer showing the data for the other inventories in a table rather than the suggested figure. This is because that the spatial coverage and completeness of the first glacier inventory (Podozerskiy, 1911) might not be exactly the same samples as ours and we would stress that these can not be compared in regard to total numbers.

Please see P13 L321-322

Figure 11: I would like to have error bars/ uncertainties in this Figure

Done.

Figure 12 and captions: I do not get the meaning of the different types of circles – what are nominal glaciers?

The circles representing nominal glaciers provide size information (area of the disk) at the location of the glaciers as given in the WGI-XF (see L115-117). As not all glacier extents were properly digitized prior to the now available studies (Tielidze 2016; Tielidze and Wheate, 2018), the RGI included these nominal glaciers as circles (see Cogley, 2009). Due to missing decimals in the geographic coordinates, often several glacier circles are found at the same place.

Line 377: I think I know what you mean by accumulated loss, but maby cumulated would be clearer?

We think that "accumulated" is correctly written here. i.e. this means that accumulation before 2005 was much less than ice loss after 2005. In other words, we refer to mass balance terminology here.

419: Would be great to have a map or extent of previous inventories replicated if existing and possible due to copyright reasons.

You probably mean the map of some large glaciers showing all outlines from previous inventories. If so, we included a similar map of Tsaneri Glaciar (one of the largest glaciers in the Greater Caucasus) at the end of the supplement. We also remind you that the glacier outlines from previous inventories are available in GLIMS (see screenshot below).

