

Authors reply to Dr. Maria Shahgedanova's comments

“The Greater Caucasus Glacier Inventory (Russia/Georgia/Azerbaijan)” by L. G. Tielidze and R. D. Wheate

With regard to the data for the 1960s, derived from the topographic maps and the Catalogue of Glaciers of the USSR, the data presented here suffers from the problem faced by many other papers – there is no reliable accuracy assessment. Representation of glaciers on the 1:50000 maps is questionable as they were compiled by geodesists rather than glaciologists and issues of snow or debris cover were often neglected. The quality of data presented in the Catalogue also varies. So one can't just assign a 2.1% error to glacier areas as in the 1960s (p. 8; line 3); it is likely to be higher. The way to deal with this problem is either to re-map areas of a decent sample of glaciers of different size and type using aerial photographs or to use Corona instead.

We agree there wasn't reliable accuracy assessment before, but we don't think that 1:50000 maps are questionable as they were created by the best specialists for that time. Also, creation of the topographical maps is Geodesists job and not glaciologists and this does not stop us using their data. In addition, these maps are the only source nowadays that completely cover the entire Caucasus mountains, as the Corona and survived original imagery covers just small individual sections. Also the large scale topographical maps from 20th century are widely used for glacier assessment and inventories (Granshaw and Fountain, 2006; Andreassen, et al., 2008; Tennant et al., 2012; Tennant and Menounos, 2013; Winsvold et al., 2014; and many others). The USSR glaciers catalog is also often used for the former USSR glacier comparison with modern dataset (Khromova et al., 2014; Kotlyakov et al., 2015; Lynch et al., 2016 etc..). As for the uncertainty, after manuscript revision, our uncertainty increased over the $\pm 4.4\%$.

Another important issue with error analysis is that errors due to mapping by individual operators are not quantified. I suggest that glaciers of different sizes should be mapped by several operators to quantify the error.

We agree. Please see P. 5 - “**3.2 Glacier error assessment**” section.

In my view, the paper has a wrong balance between the introduction, description of study area and review of previous studies. I would place a review of the existing literature first and write it in a critical way showing which new or under-researched questions this paper addresses. I suggest that the authors should substantially cut the description of the study region as it contains a lot of information that is not directly relevant to the paper. There is no need to describe what is where, just show the western, central and eastern sectors on the map.

We agree, please see P 1-4. We changed first three section and Fig. 1.

Meteorological stations: The authors should exclude all those located in urban areas such as Vladikavkaz. The authors mention stronger temperature trends at this site which is most certainly due to an urban effect.

According the Dr. F Paul suggestion, we deleted all meteorological data.

Tables 2 is too long and should be included as a Supplement at best. Can you present data on a map somehow?

We agree, Please see P. 2 - Fig. 1 and Supplement - Table 1.

Table 3: Show data for west-central-east as well as north and south. Changes in the eastern sector is your contribution so bring them out.

We agree, please see P. 7-8 – “**4.1 Area and number change**” section, Table 3 and Fig. 4.

Tables 4 and 5: Again too much for the main text. It may be better to show changes in glacier areas rather than absolute values (which can go to a supplement). You comment about differences between the Elbrus and the Kazbek massifs but it is not easily seen from the tables which present glacier areas rather than change. If you show the changes in graphical

<i>format, it will illustrate your statements better.</i>
We agree, please see P. 8 – Fig. 4, and Supplement P. 4-7 – Table – 3-4 and Fig. 1-2
<i>P. 14, line 5: I would omit Kolka from this assessment; it's a catastrophic loss of ice which is not comparable with gradual area reduction.</i>
We agree, please see P. 9, L. 8-10
<i>Retreat of glacier termini: Why only 14 glaciers? This does not give you very good statistics.</i>
We agree. We chose 30 glaciers with four different classes. Please see P. 11 “ 4.3 Glacier length change ” section and Supplement – Table 5.
<i>P. 21 Line 5: Why is geology important?</i>
We changed this sentence, please see P. 11-12. L. 37-1
<i>P. 21 Lines 10-15: Not all of your comparisons make sense. Glaciers in the European Alps are much larger, in the Kodar they are much smaller and these are cold-based glaciers. In Kamchatka, they are altogether different and affected by volcanic activity. Looks like a random selection of papers for comparison.</i>
We agree. We deleted this paragraph. Please see P. 11-12, “ 5 Discussion ” section
<i>P. 22 Line 20: I am not sure how geology affects faster loss of glacierized area in the east. I also can't see the difference in the warming rates between west and east (especially given that the only really high-altitude station, Klukhorsky Pereval, is in the west). It is more likely to be an effect of (i) drier climate in the east especially in comparison with the very humid western sector; (ii) lower elevations in comparison with the central sector) and (iii) size and type of glaciers prevailing in the regions. That's were insufficient data analysis shows: you need to analyse your changes in glacierized area according to glacier type, size and elevation and compare these categories for western central and eastern sectors as well as north and south (to account for the influence of the North Atlantic Oscillation).</i>
We deleted sentence about the “geology affect”, Please see P. 13, “ 6 Conclusions ” section. Also, as we already mentioned, we deleted all meteorological data according the Dr. F. Paul suggestion. In addition, for glacier characteristic we added new section. Please see P. 9-10 “ 4.2 Glacier characteristics ”

References

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