Response to reviewer 2 (Wang Xin)

Thanks for your helpful comments to improve this manuscript.

General Comments:

I carefully reviewed the manuscript of "A new global dataset of mountain glacier centerline and length" submitted by Zhang et al. In this paper, the European allocation is applied to the automatic extraction of global mountain glacier centerline, which proved to be a feasible and reasonable approach. The manuscript includes a detailed description of data production, processing method and accuracy evaluation. The dataset is publicly available and its overall quality is good, which includes 14 sub-datasets including all input, process and result data. Besides of the *GGCLDS* and *GGMLDS*, I think the shared DEM (*GGEDS*), which was mosaicked with each glacier regions as units, is also a reasonable choice for relevant researchers to study. Overall, the manuscript is well-written with clearly structure. I think this manuscript can be considered for publication after some minor correction and technical comments have been addressed.

Thank you.

Specific comments:

- According to the automatic checking algorithm for the global glacier outlines in this study, my understanding is that the glacier polygons with defects only on the P_{gec} are a high proportion in the *FGODS*, and they are probably to be supported by the automatic extraction tool. I suggest designing algorithms for this part of the *FGODS* to identify and repair them. The repaired glacier outlines are slightly distinguished from the RGI v6.0, so my suggestion is that their centerlines should be published as a supplementary dataset to increase the global coverage of this dataset.

  Thanks for your insights and suggestions. Inspired of your comments, we designed a geometry-based algorithm to repair *FGODS* and provided data users with their centerlines in the form of a supplementary dataset, and corresponding codes and results are in sub-datasets *CODES* and *SUP_220707*. Generally, the glacier outlines with large coverage included in *FGODS* are mostly generated by automated extraction algorithm rather than manual vectorization, which are always jagged and have geometric flaws. The repair algorithm we designed is divided into five steps: (1) Searching the external contour of a glacier (P_{gec}), (2) identifying the closed polylines that exist the common vertices with the P_{gec} and then deleting these closed polylines (if any), (3) iteratively searching the groups of closed polylines with common vertices within the glacier polygon, (4) traversing each group to delete the polylines except the longest closed polyline among them, and (5) merging remaining closed polylines and converting to a new glacier polygon. The comparison of three typical polygons of *FGODS* before and after processing by our repair algorithm are shown in Figure R1.

Note that the repairment of *FGODS* needs to consider two conditions of polygon geometry and glacier cover. The latter is very difficult and impossible to complete in current status, so the repair algorithm we designed only considers the former to prioritize the coverage of data users. The repaired glacier polygons are different from the RGI v6.0, such as slightly larger areas, local areas that may not match the actual glacier cover, etc. Therefore, we believe that the centerlines of these glaciers are not suitable for adding directly to the original dataset, nor for participating in the statistical analysis of the manuscript, and only provide data users in the form of supplemental datasets.

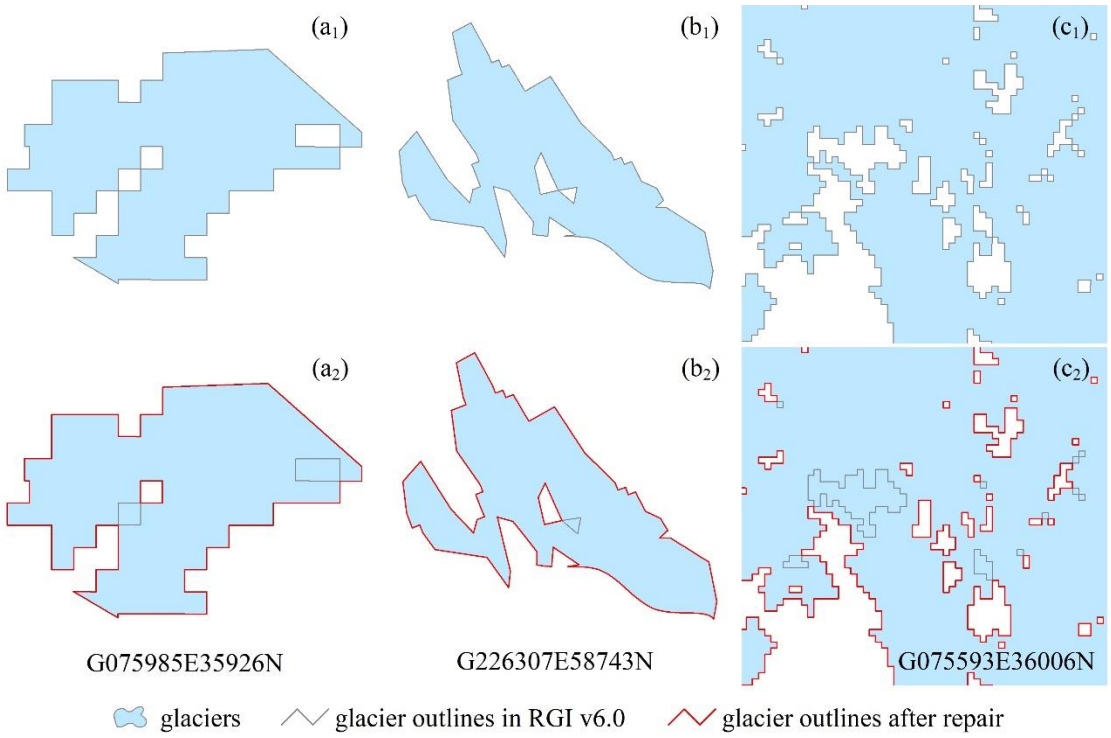

Figure R1. The schematic of the geometry-based algorithm to repair *FGODS*. Panels (a_1, b_1, and c_1) demonstrate the glacier polygons before repair, and panels (a_2, b_2, and c_2) are after repair.

- In general, the accuracy of 89.68% is acceptable for the results of fully automatic algorithm, but I am more concerned about the precautions for future readers to adopt the current dataset, the limitations of the dataset, and the possibility for improvement in the future. It is suggested to add a new chapter 4.2.3, focusing on the above problems.

Thanks for your insights and suggestions. The new chapter 4.2.3 'Uncertainties and possibilities for improvement' has been added as follows:

4.2.3 Uncertainties and possibilities for improvement

Although we compared the two current global length datasets, it is still difficult to accurately reflect the quality of the dataset in this study. For some glaciers that are not provided centerlines in this dataset, data users need to update the corresponding glacier outlines and could use the automatic extraction tool provided in this study to generate their centerlines,

which involves the defective glacier outlines (*FGODS*), nominal glaciers and ice caps of the RGI v6.0. Specifically, the centerlines of the *FGODS* rely on the glacier outlines that meet the requirements of this study. These glacier outlines include glacier inventory data from other sources, or the *FGODS* that are repaired by some algorithms or manual process. Nominal glaciers are similar to *FGODS*, and also require users to obtain corresponding glacier outlines. Automatic approaches dividing ice caps from glacial complexes into individual glaciers are currently limited, and data users can only use their own criterion to divide ice caps and then use our tool to generate centerlines. In addition, prioritizing the coverage of this dataset, we designed a geometry-based algorithm to repair FGODS and provided data users with their centerlines in the form of supplementary dataset, and corresponding codes and results can be seen in sub-datasets *CODES* and *SUP_220707*.

The automatic extraction algorithm in this study is more suitable for application to single-outlet glaciers, particularly valley glaciers; it is not suitable for ice caps, flat-top glaciers, and tidal glaciers that are widely distributed in the Antarctic, sub-Antarctic, northern Canadian Arctic, and other areas. In short, the uncertainties in this dataset come probably from the centerlines of some slope glaciers and the ice caps that are not identified in RGI v6.0, or a few centerlines with unpredictable quality due to the input data such as the incorrect glacier polygons, erroneous DEMs. In future work, better glacier inventory and more accurate DEM are useful for the improvement of centerline quality. On the other hand, optimizing the automatic glacier segmentation approach, DEM-based extraction algorithm of glacier feature lines and centerline trade-off algorithm are also probable ways to further improve the accuracy of glacier centerlines. In addition, it is probably beneficial to further clarify the type of each glacier in the glacier inventory for the estimates of centerline accuracy.

- If there are the qualified glacier outlines corresponding to the glaciers in the FGODS in the future, I hope to supplement their centerlines to this dataset in time.

  Thanks for your good suggestion. Since our dataset is in an open storage database, releasing of updated datasets are allowed at any time. We will update their centerlines to this dataset in time, if the qualified glacier outlines corresponding to these glaciers that are not provided centerlines are released in the future.

Technical corrections:

- L74 Delete 'of'.

  Thanks for reminder. It has been modified.

- L108 'better' -> 'smaller'.

  Thanks for reminder. It has been modified.

- L120 'ASTERGDEM'-> 'ASTER GDEM'

  Thanks for reminder. It has been modified.

- L208 total global mountain glaciers or total glaciers?

  Thanks for reminder. It has been modified to ‘global mountain glaciers.’

- L362ã€• L488 Missing the name of horizontal axis.

  Thanks for reminder. The names of horizontal axes are all the ‘Glacier level’, and it has been added to the 21 corresponding figures.