

Response to reviewer 1

Thanks for your helpful comments to improve this manuscript.

General Comments:

Based on the glacier axis concept, Zhang et al. produced the global mountain glacier centerlines using the latest global glacier inventory and the digital elevation model data of corresponding glaciers. This research is challenging and heavy workload. The authors used the automatic checking algorithm to identify 10,764 glaciers with flawed outlines and mark the location of the defects. The centerline and related data of 198,137 worldwide mountain glaciers were automatically obtained by the compiled extraction tool, which is very important parameters for glacier research. The published datasets include not only the result data such as glacier centerline and maximum length, but also the key data such as DEM of glacier-covered and its buffer region and the glaciers of flawed outlines. The dataset has high quality, and the manuscript is generally well organized and written. The manuscript can be accepted after addressing my following comments.

Thank you.

Specific comments:

- The manuscript mentioned that the automatic extraction tool does not support ice caps, nominal glaciers and some glaciers of flawed outlines, which accounts for 8.48% of the total number of worldwide mountain glaciers. I think it is necessary to add more details to the manuscript, including providing data users with possible approaches calculated the centerlines of these glaciers.

Thanks for your insights. We have added the new section 4.2.3 ‘Uncertainties and possibilities for improvement’ in the manuscript, and the part focusing on explaining these problems is as follows:

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.

- L243-L263: 100 random results for accurate evaluation in each region. Did you decide it yourself or refer to others? The number of glaciers in each region is different. Can a certain

proportion be used to select centerlines, and the assessment results are possibly more convincing?

Thanks for your insights and suggestions. The number of input glaciers from different glacier regions in this study varies greatly: Iceland (R06) with 435 glaciers is the least and Central Asia (R13) with 52,858 glaciers is the most. Randomly selecting a certain proportion of centerlines in different regions for visual verification is a good approach, but not applicable to this study because the resulting gap of the sample size is probably orders of magnitude. Therefore, we decided to randomly select an equal number of centerlines from different glacier regions as the samples for visual verification.

- It is suggested to move the notes in Figure 1 after the caption of Figure 1.

Thanks for your suggestion. It has been moved from the Figure 1 to the caption of the Figure 1.

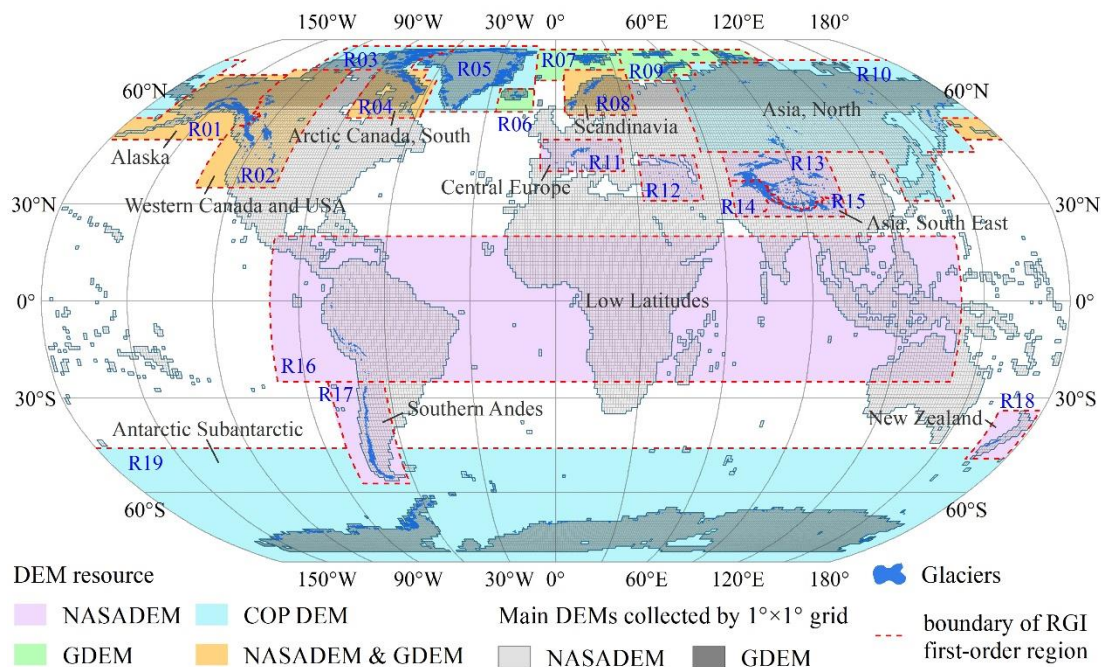


Figure 1. Distribution of global glaciers, first-order glacier regions, and DEMs. The background is the global DEM grid (1°×1°) covered by NASADEM and GDEM. GDEM and COP DEM represent the ASTER GDEM v3 and the Copernicus DEM, respectively. **Notes:** R03: Arctic Canada, North; R05: Greenland Periphery; R06: Iceland; R07: Svalbard and Jan Mayen; R09: Russian Arctic; R12: Caucasus and Middle East; R13: Asia, Central; R14: Asia, South West.

- L267-L271: Overall success rate or average success rate? How is it calculated?

Thanks for your insights. 99.74% is the overall success rate, which was calculated by the quantity ratio of the generated centerlines and all input glaciers. It has been modified to ‘overall success rate’.

- L305-L315: Is it necessary to list a table to better understand?

Thanks for your suggestion. This part describes the distribution of the flawed glacier outlines (*FGODS*) and ice caps in RGI v6.0, as shown in Table 2. We have added a reference to Table 2 in the section.

Table 2. Preprocessing results of different glacier regions and information of input datasets.

Region	Region Name	Total	Ice Cap	Nominal glacier	Flawed glacier	Glacier input	DEM input
R01	Alaska	27108	0	0	704	26404	NASADEM, GDEM
R02	Western Canada and USA	18855	0	0	1564	17291	NASADEM, GDEM
R03	Arctic Canada, North	4556	650	0	47	3869	COP DEM
R04	Arctic Canada, South	7415	953	0	63	6409	NASADEM, GDEM
R05	Greenland Periphery	20261	1658	0	1547	17247	COP DEM
R06	Iceland	568	133	0	1	435	GDEM
R07	Svalbard	1615	144	0	12	1460	GDEM
R08	Scandinavia	3417	0	4	75	3338	NASADEM, GDEM
R09	Russian Arctic	1069	460	0	0	609	GDEM
R10	North Asia	5151	5	116	136	4899	COP DEM
R11	Central Europe	3927	0	2	76	3849	NASADEM
R12	Caucasus Middle East	1888	0	339	2	1547	NASADEM
R13	Central Asia	54429	1545	0	28	52858	NASADEM
R14	South Asia West	27988	295	0	1946	25792	NASADEM
R15	South Asia East	13119	289	0	4	12826	NASADEM
R16	Low Latitudes	2939	0	0	724	2215	NASADEM
R17	Southern Andes	15908	623	0	3828	11734	NASADEM
R18	New Zealand	3537	0	0	0	3537	NASADEM
R19	Antarctic Subantarctic	2752	419	0	7	2327	COP DEM
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Note: GDEM and COP DEM represent ASTER GDEM v3 and Copernicus DEM, respectively.

Technical corrections:

- L37 Add a space after 'changes'.

Thanks for reminder. It has been modified.

- L77 '; the' -> ', their'.

Thanks for reminder. It has been modified.

- L124 'However' -> 'Nevertheless'.

Thanks for reminder. It has been modified.

- L195 'was' -> 'are'.

Thanks for reminder. It has been modified.

- L225 'a glacier' -> 'glaciers'.

Thanks for reminder. It has been modified.