

Documentation of Response to Minor Revisions EGUSPHERE-2025-2424:

Dear Joseph MacGregor,

Thanks so much once again for your close reading of the resubmission. I address all the points below and document the changes with line numbers for the new version without track changes below.

I appreciate the comments on the abstract, which has now been rewritten to a large extent.

- 2-3: This statement is directly contradicted by the second sentence of the Introduction (15-18) concerning the partitioning of the mass imbalance.

- “, leaving those latter less studied margins” is an incomplete statement.

You are right, that I have remained inconsistent in this initial reasoning. I have now adapted the initial sentences in the Abstract (L1-4) to:

‘The Greenland ice sheet (GrIS) and its peripheral glaciers and ice caps (PGIC) have received a lot of attention with respect to its marine-terminating margin, where ice discharge contributes a significant amount to ice mass loss. However, a similar fraction of the mass loss is caused by surface melt, leaving the ice predominately via the less studied terrestrial margins.’

- “Relying on” should really be “Using existing”

I have now made that change accordingly

- “making up 96.4% of the total GrIS (93.1% of 76514 km)” is almost a non sequitur. To the casual reader (and even to me, after reading the entire MS twice), it’s not obvious what distinction is being made that would make the two values different.

You are right that this phrasing was unhelpful and the additional numbers neither helpful nor instructive. The 96.4% pertains to the land-terminating margin for both GrIS and PGIC, while the numbers in brackets to the two regions separately. I have now only referred to the two regions separately:

‘Using existing ice masks and a dataset for lake distribution we extract the land-terminating sections, making up 93.1% of the total GrIS (70900 km) and PGIC (170590 km) margin.’

In the following sentence I have removed the ‘a’ before ‘evidence’.

- 6-7: This sentence about ArcticDEM won’t make sense to the casual reader, who likely already considers ArcticDEM to be “high resolution” (especially the 2 m tiles) and likely sufficiently validated, and isn’t clear what other “high-resolution DEMs” are referred to. As I mentioned in my quick-access review, the Pléiades comparison is fine but doesn’t add much, and I feel the same about this sentence.

Thanks for the comment. While I agree that previous studies show the great potential of the ArcticDEM, I am still surprised by its ability to capture morphologies at this scale in the range of meters, considering that we still tend to investigate these features exclusively with UAV imagery elsewhere (like in the Himalaya). And I was honestly doubting for a long time, whether the ArcticDEM would be able to capture the margin at all (aside from the correct placement of ice

masks). But point taken – and I see that reviewers were equally less concerned about this issue – hence I have shortened the sentence and taken away the ‘strong’ in front of ‘evidence’.

‘The study provides evidence for the ability of the ArcticDEM to capture even very steep margin morphologies at a regional scale.’

- “a large prevalence of these extremely steep features” quite vague

From this sentence onwards I have now completely restructured the abstract to more concretely address the earlier estimate of ice marginal cliffs in Greenland but more importantly address the weak discussion of scientific implications as noted below.

- As I and R1 commented on, this MS should better connect to the scientific implications of the dataset you generated. This is now done better in the MS but not well reflected by the concluding sentence of the abstract.

The restructured remaining abstract from L9 now reads:

With geolocated morphologies, future studies will be able to identify to what degree past presence of lakes, bed topography or ice dynamics and past climate at and upstream of the margin can explain under which conditions the ice margin terminates in steep or shallow slopes.

I have removed the earlier used ‘glacierettes’ with ‘glaciers’, following an earlier comment, and this somehow has returned to the original wording.

27: Here and throughout the MS, directions “South-West”, “North-West” etc. can simply be “southwest”, “northwest”.

Thanks, I have now amended that throughout.

133: Bad LaTeX internal reference for Section number.

I apologize for this error having been introduced in the revision. It is now amended.

Figure 2 caption: Panels E and F mislabeled as D (repeated) and E.

Thanks for catching this, now amended.

Figure 3: 1. Move the A/B panel labels to above their respective panels and append them with GrIS/PGIC. Otherwise, you force the reader to the caption to clearly distinguish between the two. Same for Figure 9. 2.

Thank you for the valuable suggestion, I have implemented that now.

If possible, I suggest removing the radial portion (not the perimeter) of the colored line for the circles. That will make it easier to distinguish the sizes of the pie slices for each margin type. May not be easy to do. Could just remove the colored line altogether and color the basin label instead.

Thank you for the suggestion, this would indeed improve readability. Somewhat challenging but possible, now adapted in Figure 3 and Figure 9. Note that I also removed the black frame around both figures, which I think aesthetically makes sense standalone but won't hold for the Copernicus requirements and is not strictly necessary.

Figure 6:

1. Label all panels with A/B/C/etc.

Done, and increased font size slightly.

2. Lead with the *good* cases on top.

Done, thanks for the suggestion.

3. Label vertical exaggeration in top left panel and make it same for all panels if it isn't already.

Thanks for the excellent suggestion, I have done with the exception of the scaling for one margin section where the elevation difference is much larger than everywhere else, which would have squished the rest. I have noted that in the caption though.

4. Change vertical ticks to round numbers.

Done.

5. Use shading instead of vertical lines, so that it is easier to see the overlap. Blue lines (or shading) should probably then be a different color, though. I do like this figure overall.

Done. Turned blue to green.

Figure 8: I mentioned this previously, but the cell numbers seem fairly irrelevant to most readers to me.

Changed/removed. In the process shifted the labels slightly and increased font size of A/B.

281: There are several paragraphs of discussion here before 5.1 begins. These paragraphs should also get their own subsection header. Perhaps "Interpretation of margin types" or something similar?

Thanks for noting, indeed this should have received a separate section. We have implemented that, also adding a separate subsection ('Interpretation of margin morphologies') when we discuss the actual slope distributions and ability to capture morphology, considering this is the focus of the study, only building on the actual margin type.

317: "arguably" seems unnecessary here.

Removed.

318: "ICESat", or is "ICESat-2" being referred to?

Thanks for catching this, indeed ICESat-2, amended.

323: "exaggerated" perhaps unintentionally implies subterfuge. "overestimated" would be better.

Thanks, changed. Following this also changed 'proposition' to 'estimate' at end of same paragraph.

Figure 10: A separate legend for the colors / margin types is needed, as the median circles are far too busy for labeling as is done to be effective.

I have added a legend for the median length symbols. To make the figure less busy and also in line with the numbers referred to in the text (where we only note length of near-vertical margin irrespective of underlying terrain) I have combined the data for all near-vertical sections. While this removes the identification of near-vertical sections over steep terrain most often being especially short, I believe it may be better to have a leaner figure than pushing this additional message. I have adapted the caption accordingly.

I have also added thin lines in between the dots to the region markers to make clear where the data belongs.

Note that during the revision of the figure data I realized a mistake in my code, which resulted in the median lengths of all the margin sections on the ice sheet for steep and near-vertical sections to be slightly off. This is now adapted in L346f, with median lengths for steep sections 540 m (not 485 m) and for near-vertical sections 475 m (not 471 m). The change does not affect the take away but rather emphasizes the point made that margin section lengths decrease the steeper they become.

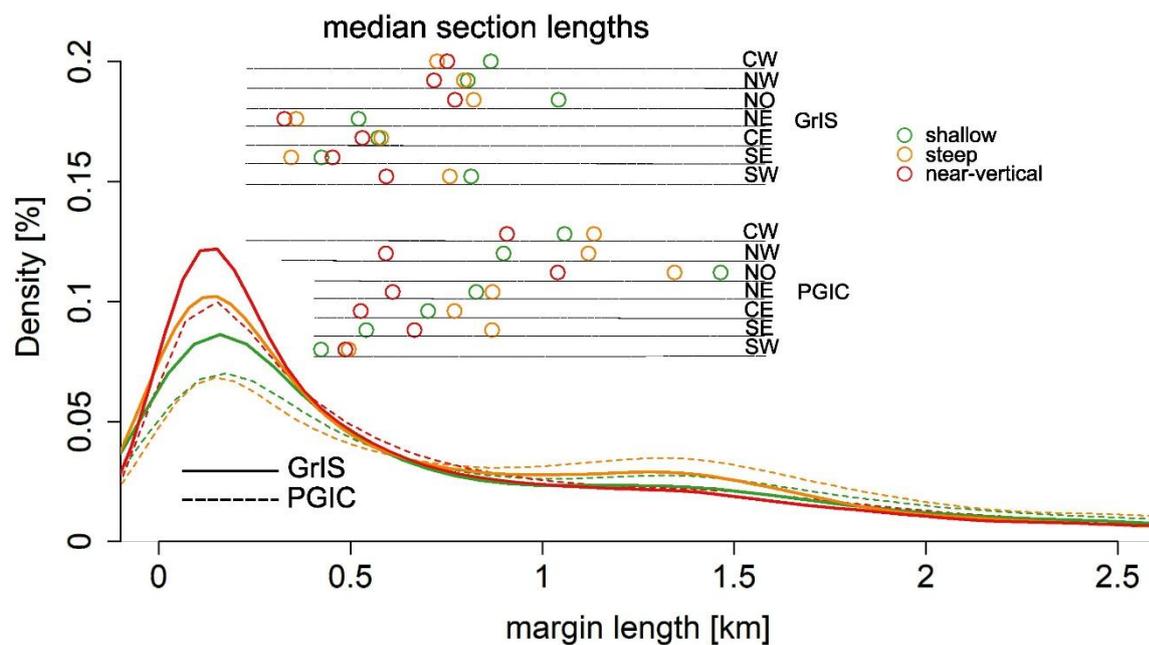


Figure 1: Updated Figure 10.

I have added our thanks to both Editor and reviewers in the Acknowledgement section.

While rereading I additionally adapted the following wordings, sorry for missing those earlier:

L16: I now just refer to the ‘one half’ of mass loss attributable to mass loss via the terrestrial margins in line with how the abstract is rewritten and acknowledging this more conservative estimate from the citations given.

L113: DEMs (typo)

L141: erroneous brackets removed

L173: ‘the ArcticDEM’ and reduced that sentence to ‘allowing for a comparison to the ArcticDEM’ since I now basically say ‘ability of ArcticDEM to capture morphologies’ in three consecutive sentences already.

L182: Added ‘Equation’ to the number, which was previously missing.

L214: ‘the ArcticDEM’, although I am not 100% sure if having it written without the article in general is also fine. But used with article elsewhere.

L242: Added ‘individual’ to make the two numbers more readable in brackets.

L231: Remove erroneous ‘was’ before ‘based’

L271: 29.4%, not 29.0% typo – see also Table 3, to sum to 100%.

L315: ‘these’ rather than ‘this data’

L342: ‘margin types have different properties in their extent’ changed to ‘margin types vary in their extent’

L349: Corrected typo in ‘Maximum connected shallow margin lengths are above 33 km with steep and near-vertical margins never longer than 20 km.’

L357: Removed ‘with closer scrutiny’ for being unnecessarily wordy

L370: Changed ‘believe’ to ‘have evidence’ considering we actually provide a citation here on data.

L373: Removed ‘potential’, duplicate word in same sentence

L383: Changed the citation from (Abermann et al., 2020) to (Steiner et al., 2022) as the actual discussion happens in the latter, while the issue was a motivation for the earlier. Both papers are already cited in the manuscript elsewhere.

L395: Removed ‘for individual locations’, being a repetition from ‘location’ just before

L396: ‘low-lying outlet’

L403: ‘any’, typo

L422: ‘samples’, typo