Author responses to comments by the editor and one referee

Manuscript tc-2025-5733: Contrasting dynamics of lake- and marine-terminating glaciers under same climatic conditions

Dear Cheng Gong,

Thank you for your positive summary and your constructive comments. We are grateful for the input and look forward to a publication in The Cryosphere. Below our responses.

Florian Vacek,

on behalf of all authors

Comments by the editor

Reviewer Comment:

After reading the revised manuscript, I remain somewhat unclear about the glacier velocities shown in Figs. 5 and 7. In particular, for LT, the velocity appears to decrease from approximately 0.8 km/yr at about 8 km from the terminus to approximately 0.5 km/yr near the terminus. This down stream deceleration is unusual for lake terminating glaciers and therefore deserves further explanation. By contrast, MT shows a much higher terminus velocity of approximately 1.6 km/yr, about four times larger than that of LT. I suggest that the authors elaborate on this contrast and discuss the possible controls on the different velocity patterns, as well as their impact on calving.

Related to this point, I wonder whether the bed topography differs substantially between the two glaciers and whether this could help explain the observed velocity differences. It would be useful to include the bed elevation/topography in Fig. 3, or otherwise provide additional information on the glacier beds in the text.

Author Response:

The ITS_LIVE velocity map (Gardner et al., 2025) (Fig. 1) shows that flow velocities are generally slower at LT compared to the center of MT. This is already the case at the beginning of LT where it branches off from MT. Along the flowline of LT itself, velocities increase slightly toward the glacier front. The slower flow velocities at the start of LT could be caused by the bedrock geometry. The overall elevation drop is likely higher for MT than for LT, since the latter terminates in Lake Motzfeldt at about 160 m above sea level, whereas MT extends to sea level. Bedrock data from BedMachine (BM) Version 5 (Morlighem et al., 2022) indicates a small bump at the start of LT which could additionally slow down the flow (Fig. 2). Unfortunately, bedrock measurements in South Greenland, and specifically on Qooqqup Sermia, are notoriously difficult to obtain, rely on indirect estimates, and are unreliable (Morlighem et al., 2017; Santin et al., 2026). However, recent measurements by Santin et al. (2026) with AIRETH, a redesigned helicopter-borne ground-penetrating radar, show that that the bedrock elevation at LT is even higher than reported in BM and that the bedrock slope toward the glacier front is likely less steep (Fig. 2). Measurements with the same system along the marine terminus of Qooqqup Sermia could not recover reliable bed returns, indicating a greater ice thickness. As a result, the bedrock geometry

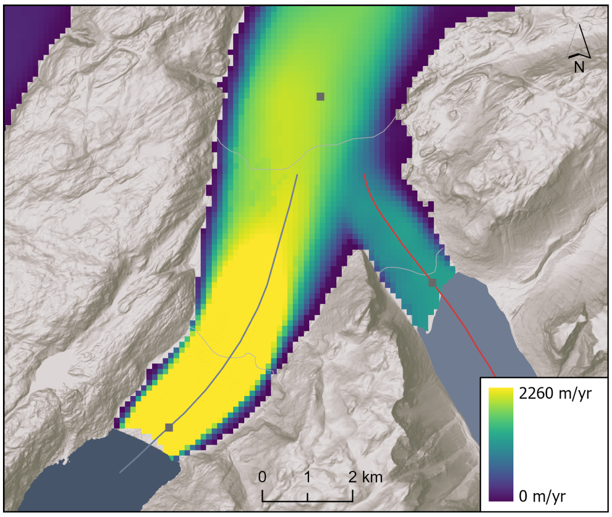

Figure 1: ITS_LIVE flow velocity map for Qooqqup Sermia (Gardner et al., 2025).

beneath LT is now better constrained, while BM remains unreliable at MT, making a comparison of bed geometry between the two termini difficult. In addition to the bedrock geometry, it appears as LT is fed by the slower lateral ice from the margins of MT rather than by its fast central trunk.

In the revised manuscript, we update figure 3 and include BedMachine, AIRETH measurements and our bathymetry measurements. Furthermore, we add a paragraph, similar to the one above, to the dynamics of LT (5.2), discussing why flow velocities could be slower there compared to MT.

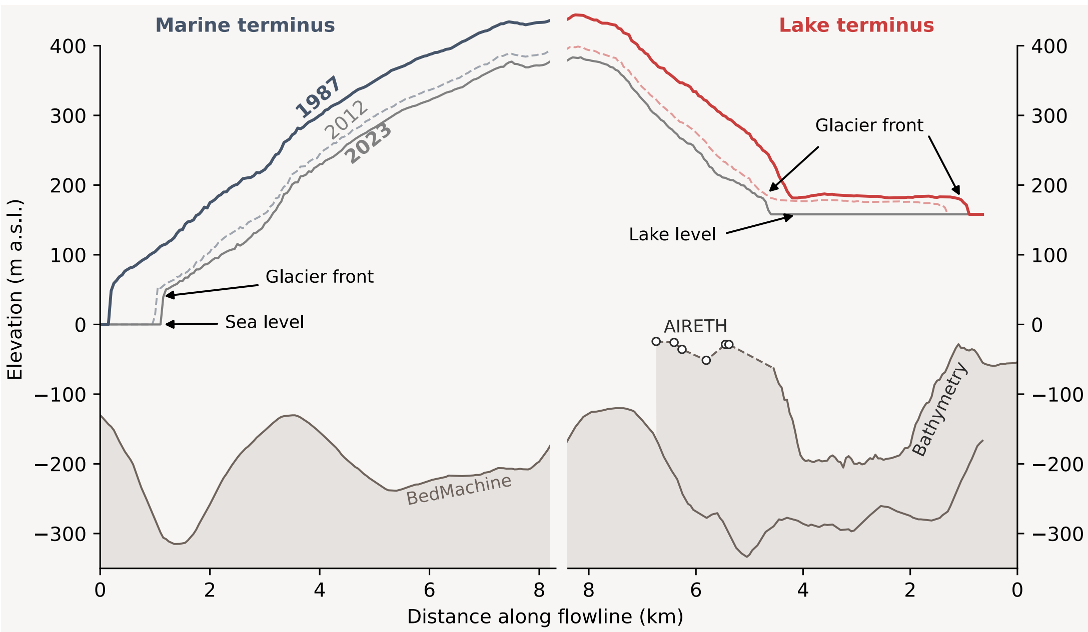

Figure 2: The updated Figure 3 in the manuscript, including available bed topography estimates and measurements. AT MT only BedMachine is available. AT LT our bathymetry measurements as well as the AIRETH measurements from Santin et al. (2026) show large discrepancies to BedMachine.

Reviewer Comment:

line 46–47: Please clarify the relevance of mentioning the palaeo-record of the Qoqquup Sermia system here. At present, the connection to the current study is not clear.

Author Response:

The idea of mentioning the paleo-record was to have a complete overview of what research has previously been done on this glacier system, as research on Qooqqup Sermia is quite limited. The paleo-record itself is not connected to our findings and can be removed, if required.

Reviewer Comment:

Line 152: Please check the formatting of “38|200 kHz”?

Author Response:

Changed to : "single-beam echo-sounder with a 38 and 200 khz combi transducer"

Reviewer Comment:

Line 154: 5 Hz

Author Response:

Changed.

Reviewer Comment:

Line 205: Please check this sentence. The phrasing is unclear, especially “...1.7m yr-1 8 km ...”

Author Response:

Changed to"...decrease continuously to approximately 1.7m yr-1 at a distance of 8 km from the glacier front." .

Reviewer Comment:

Line 249: Remove “yr-1; the unit of duration should be a unit of time, not a rate.

Author Response:

Removed.

Reviewer Comment:

Line 329: Add a comma after “Eqalorutsit Kangilliit Sermiat”.

Author Response:

Added.

Reviewer Comment:

Figure 8: The caption should specify which retreat rate is shown, including the relevant glacier/terminus and time interval.

Author Response:

Specified.

Reviewer Comment:

Figure A3: Please specify in the caption which terminus is shown.

Author Response:

Specified.

Comments by an anonymous referee

Reviewer Comment:

The authors claim to "identify" low subaqueous melt rates, but this doesn't explain how they reached that conclusion, as there are no observations of thermal forcing on the glacier side of the sill. Instead, the authors "infer" low subaqueous melt rates.

Line 10 and L421 both use identified. I suggest changing these to "infer" instead of "identify."

Author Response:

Changed to "infer".

Reviewer Comment:

Figure A3 Panel B: How do the authors know that the undercutting in the image is from a plume and not a wave notch? The undercutting at the water line appears to span the entire subset of the image. Are there other images from the non-plume areas of the terminus that do not show this feature?

Author Response:

In other images of the glacier front, no wave notch is visible. However, the rest of the glacier front (non-plume area) is covered by an ice melange and therefore the water line is not visible (see panel a of the same figure), which makes it difficult for us to identify a potential wave notch. However, based on the morphology and the coincidence of the undercutting with the plume area, we believe the plume to be the cause of the undercutting.

References

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