

Thank you to the editor and referees for the time that they devoted to the review process. We are pleased to learn that the editor has deemed the manuscript suitable for publication in *The Cryosphere* pending minor revisions and we recognize and appreciate the role that the reviewer comments have played in improving the manuscript to this point. We have detailed our response to each of the remaining comments in bold below:

Minor comments

l. 26: "Greenland Ice Sheet mass loss has rapidly accelerated since the turn of the century" It is unclear how "acceleration" is defined here, but I assume a significant decreases in ice sheet mass balance. With recent summers having been relatively less warm, I do not think this acceleration is significant anymore; rather the annual mass loss has become persistent but has recently not increased (or accelerated).

We agree that acceleration was not the most appropriate descriptor here and have edited the text to more accurately point to the persistent mass loss that has occurred in recent decades. Additionally, and in accordance with the reviewer comment below, we have also removed the comparison to other sources of sea-level rise from this sentence

- **Previous submission: "Greenland Ice Sheet mass loss has rapidly accelerated since the turn of the century (Hanna et al., 2014, 2024; Khan et al., 2015; Kjeldsen et al., 2015; Mougnot et al., 2019; Ootosaka et al., 2023; The IMBIE Team et al., 2020; Velicogna et al., 2020), becoming the largest single frozen source of global sea level rise and second largest among all sources after thermal expansion of the warming oceans (Cazenave et al., 2018; Horwath et al., 2022)."**
- **Revision: "The Greenland Ice Sheet has undergone persistent mass loss since the turn of the century (Hanna et al., 2014, 2024; Khan et al., 2015; Kjeldsen et al., 2015; Mougnot et al., 2019; Ootosaka et al., 2023; The IMBIE Team et al., 2020; Velicogna et al., 2020)."**

l. 42: As a result, I also think that GrIS mass loss recently did not keep up with that of mountain glaciers.

Thank you for raising this point. We now see that more recent estimates place the mass loss from mountain glaciers at ~18% greater than that from the GrIS (The GlaMBIE Team, 2025). We have edited the sentence in question as follows to remove the outdated comparison with mountain glaciers and have added The GlaMBIE Team, 2025 reference:

- **Previous submission: “While highly variable, mass loss from the Greenland Ice Sheet has consistently raised global mean sea level by over 0.5 mm yr⁻¹ in recent decades—a rate that outpaces that of the Antarctic Ice Sheet (Smith et al., 2020; The IMBIE team et al., 2018; The IMBIE Team et al., 2020) and is approximately equal to that of all other glaciers combined (Cazenave et al., 2018; Zemp et al., 2019).”**
- **Revision: “While highly variable, mass loss from the Greenland Ice Sheet has consistently raised global mean sea level by over 0.5 mm yr⁻¹ in recent decades, contributing to sea-level rise at approximately twice the rate of the Antarctic Ice Sheet (Cazenave et al., 2018; Horwath et al., 2022; Smith et al., 2020; The GlaMBIE Team et al., 2025; The IMBIE team et al., 2018; The IMBIE Team et al., 2020).”**

We have also modified the first sentence of the abstract accordingly:

- **Previous submission: “The Greenland Ice Sheet has become the largest single frozen source of global sea level rise following a pronounced increase in meltwater runoff in recent decades.”**
- **Revision: “The pronounced increase in meltwater runoff from the Greenland Ice Sheet in recent decades represents an important source of global sea-level rise.”**

l. 50-56: This may be a good location to stress that the conversion from surface melt to runoff (and hence GrIS surface driven mass loss) is very different among the leading regional climate models, as a result of their simplified snow models and different firn layer initialisations (Glaude and others, 2023, doi:10.1029/2024GL111902).

Thank you for bringing this study to our attention. We have edited the paragraph in question to note the uncertainty in SMB projections due to the differences between polar RCMs:

- **Previous submission: “Over Greenland, there has been both an acceleration of solid-ice discharge and a decline in SMB over the past few decades (van den**

Broeke et al., 2009a; Mankoff et al., 2019; The IMBIE Team et al., 2020); however, increased runoff has caused SMB to decline at a rate twice that of the observed increase in dynamic ice loss (Box et al., 2022; Fettweis et al., 2017, 2020; Mote, 2007; Noël et al., 2017). Consequently, SMB reductions have surpassed discharge as the largest source of mass loss (Mouginot et al., 2019) and, according to global climate models (GCMs) from CMIP5 and CMIP6, SMB losses are expected to exceed mass accumulation on their own by the year 2100 unless the most ambitious mitigation efforts are implemented (Noël et al., 2021).”

- **Revision: “Over Greenland, there has been both an increase in solid-ice discharge and a decline in SMB over the past few decades (van den Broeke et al., 2009a; Mankoff et al., 2019; The IMBIE Team et al., 2020); however, increased runoff has caused SMB to decline at a rate twice that of the observed increase in dynamic ice loss (Box et al., 2022; Fettweis et al., 2017, 2020; Mote, 2007; Noël et al., 2017). Consequently, SMB reductions have surpassed discharge as the largest source of mass loss (Mouginot et al., 2019) and, according to dynamically downscaled CMIP5 and CMIP6 global climate model (GCM) output, SMB losses are projected to exceed mass accumulation on their own by the year 2100 unless the most ambitious mitigation efforts are implemented (Noël et al., 2021). This timeline, however, contains considerable uncertainty as differences in prescribed bare-ice albedo and firn model parameterizations have been shown to yield a twofold spread in simulated runoff between the three leading polar Regional Climate Models (RCMs) under a common future radiative forcing, with RACMO – the RCM used to derive this estimate – underestimating future runoff relative to HIRHAM and MAR (Glaude et al., 2024).”**

l. 60 and subsequent discussion: Along the same line as my comments above on the significance of trends in mass loss, is the GBI increase still significant when the last years are also considered?

We have edited this portion of the text to note that the positive trend in Greenland blocking was most pronounced from the 1990’s through the early 2010’s:

- **Previous submission: “The negative trend in SMB has coincided with a more persistently negative North Atlantic Oscillation (NAO) and an increase in atmospheric blocking episodes over Greenland (Bevis et al., 2019; Fettweis et**

al., 2013; Hanna et al., 2015, 2016, 2018b, 2022; Hofer et al., 2017). Indeed, previous studies have shown a statistically significant increase in summer Greenland blocking since the turn of the century using a variety of blocking detection methods (Davini and D'Andrea, 2020; Hanna et al., 2022; Woollings et al., 2018), which has played a key role in encouraging melt via multiple contrasting mechanisms. The positive trend in surface melt..."

- **Revision: "The decline in SMB has coincided with a more persistently negative North Atlantic Oscillation (NAO) and an increase in atmospheric blocking episodes over Greenland (Bevis et al., 2019; Fettweis et al., 2013; Hanna et al., 2015, 2016, 2018b, 2022; Hofer et al., 2017). Indeed, previous studies have shown a statistically significant increase in summer Greenland blocking between the 1990's and early 2010's using a variety of blocking detection methods (Davini and D'Andrea, 2020; Hanna et al., 2022; Lee and Polvani, 2026; Luu et al., 2024; Woollings et al., 2018). While multi-year mean summer Greenland blocking frequency has declined since its peak around 2010, interannual variability has remained anomalously high with extreme blocking episodes again facilitating record-setting melt of the ice sheet in 2019 and 2023 (Bonsoms et al., 2026; Cullather et al., 2020; Lee and Polvani, 2026; Luu et al., 2024; Tedesco and Fettweis, 2020). More frequent blocking has played a key role in encouraging melt via multiple contrasting mechanisms: The increase in surface melt..."**