Author Response

Thank you for the additional review and comments. Our responses (in black) to the comments (in gray) are below. References to line numbers refer to the revised manuscript, prior to additional minor revisions.

1. Comment 2d re: pressure melting term. The authors state that "future work could include this term and examine this question" but I think they should also cite past work in the manuscript that has already done that: Werder, M. A. (2016). The hydrology of subglacial overdeepenings: a new supercooling threshold formula. Geophysical Research Letters, 43(5), 2045-2052.

- This work by Werder (2016) is indeed a good reference to cite. We include Werder (2016) along with Clarke (2005) as foundational work on pressure melting that can be used to further our model in the future.
- At line 512, we add: “The subglacial hydrology component can also be expanded to include additional terms representing mechanisms such as the pressure-dependence of the melting point (e.g., Clarke, 2005; Werder, 2016).”

2. Author response "the work from Dow et al. (2022) suggests that the changes in channels influences the surrounding subglacial environment, for regions up to 100 km of either side of the channel." This may be the case, but before using this citation as justification, the authors should examine the extent to which this statement is a function of the model architecture (whereby N or pressure is, by definition, the same in channels as it is in the immediately adjacent sheet, as the latter is bounded by the mesh element edges where channels are defined) and the chosen model parameters. The quantitative value of 100m is surely a function of parameters such as the prescribed sheet width feeding the channels and sheet conductivity?

- Thank you for encouraging further investigation towards this citation. In Dow et al. (2022), they conduct various tests examining the sensitivity of basal water pressure to different poorly constrained parameters, including channel and sheet conductivity. They conclude that the size and distribution of the channels are relatively insensitive to these parameters, though we do note that their Figure 3 indicates that the pressure of the surrounding areas vary by a small percentage. Dow et al. (2022) also acknowledge that there are dependencies on mesh size, but conclude that this is negligible on catchment scales. We believe that the 100 km on either side of the channel approaches that scale. Regardless, in the revised manuscript we are cautious with our claims associated with this citation. We solely use this citation to indicate the plausibility of Antarctic subglacial channels, and that regions immediately adjacent to channels may have pressures that track the channel pressures.
- At line 475, we modify our sentence to re-emphasize that our results are only applicable to regions where the subglacial water pressure is dictated by channelized drainage: “Our findings therefore apply only to regions where channelized drainage systems dictate the water pressure.”

References

Clarke, G. K.: Subglacial Processes, Annual Review of Earth and Planetary Sciences, 33, 247–276, https://doi.org/10.1146/annurev.earth.33.092203.122621, 2005.

Dow, C. F., Ross, N., Jeofry, H., Siu, K., and Siegert, M. J.: Antarctic basal environment shaped by high-pressure flow through a subglacial river system, Nature Geoscience, 15, 892–898, https://doi.org/10.1038/s41561-022-01059-1, 2022.

Werder, M. A.: The hydrology of subglacial overdeepenings: A new supercooling threshold formula, Geophysical Research Letters, 43, 2045–2052, https://doi.org/10.1002/2015GL067542, 2016.