Response to reviewer comments

September 21, 2025

Thank you for your detailed and helpful review. In this document, reviewer comments are in **black** and our comments are in **red**. New text added to the manuscript is in blue.

1 Reviewer 1

Thank you for your responses to my suggestions. I am happy with the responses with one exception: I apologize my comment on the finite resolution of the ADCP data was not clear. I was not referring to its use in computing fine scale parameterization but rather in its use in computing Richardson number. Because the instrument response causes small scale motions to be smoothed (Polzin 2002), shear is underestimated significantly and hence Richardson number is biased high. Hence, the value estimated from the ADCP is not comparable to the stability value of 1/4. Additionally, as noted elsewhere, Ri is computed with in-situ shear but only a single N2 profile, and so is not complete. For these reasons (plus that my eye does not see a strong correlation between epsilon and low Ri regions in the authors' data) I suggested that this section be toned down by i) using Ri as a qualitative indicator and removing reference to where the estimated (high-biased) values are ¡1/4, and i) toning down the claims that there is strong agreement between epsilon and low Ri.

Thank you for your clarification. We have removed references to Ri $<$ 1/4

from the results and discussion. The methods section now adds the following to the introduction of Ri:

Our values of Ri are biased high because the ADCP underestimates vertical shear (Polzin et al., 2002), thus we will confine our discussion of Ri to relative values.

The results and discussion of RI now reads: The region of high turbulent kinetic energy dissipation rate ε in the inflow (Figure 3d) coincides with instances of low Ri captured at 40 km (Figure 3h). Turbulent kinetic energy dissipation rate is larger than 10^{-8} here, one to two orders of magnitude higher than the background value (Figure 3d). Dotto et al. (2025) found similar results for the outflow of DIS. Although areas of high ε extend beyond areas of low Ri, ε is higher and Ri is lower in the upper watercolumn and close to the seabed. We observe areas of low Ri that are not associated with high values of ε, e.g. at 25 km along the transect.

We have removed references to Ri from our discussion of correlations. The relevant sentences now read: They also coincide with areas of high vertical current shear and high along slope velocity (Figures 9 and 7).....Ri is low in the area of high turbulent kinetic energy dissipation rate observed along the east dive track at -1 km from the ice front (Figure 9).

2 Reviewer 2

In this revision, the authors have thoroughly and thoughtfully addressed my concerns with their earlier draft. As a result, I think the manuscript is improved to the point that it is acceptable more-or-less as is. I did, however, spot a number of issues, all rather minor and mostly typographical in nature, and I think those should be addressed before the paper is formally accepted. Those remaining issues are listed below.

Lines 7-10: I note that, in response to Reviewer 1, the authors changed to a non-italic font for units. However, the units are italicised in the abstract. I

agree with Reviewer 1; non-italic throughout is best. Thank you for pointing this out, we have corrected this in the abstract.

Line 16: "... areas of the cavity not accessed during this study." Thank you, this change has been made.

Line 40 (and elsewhere): The flow along the ice shelf base is referred to as a "buoyant plume". While plume theory is often used as the basis for reduced-physics models, it is not an accurate description of reality. A better description might be a "buoyant current". Thank you, we have changed all instances of plume to current.

Line 41: "... modifying the properties of both the inflowing water, which ultimately interacts with ice near the grounding line, and water carried by the buoyant current out of the cavity." Thank you, this change has been made.

Line 60: "... dense mCDW inflow, ...". Thank you, this change has been made.

Line 87: "... at 1 s-1 [or 1 Hz if you prefer] frequency ... " or "... at 1 s intervals ...". Thank you, this change has been made.

Line 99: "... microstructure data from the ALR were processed ...". Thank you, this change has been made.

Line 126: "... is a measure of the vertical mixing of ...". Thank you, this change has been made.

Line 240: I agree with Reviewer 1. "Barotropic jump" is not an "oceanographic term for an abrupt change in water column thickness". A search for the word "jump" in the cited Wåhlin paper brings up no occurrences. Why not just stick with "The ice shelf draft induces an abrupt change in water column thickness, blocking flow along isolines of water column thickness, and thus limits barotropic inflow to ...".

Thank you, we have adopted your preferred wording.

Lines 257-259: Or possibly throughflow from beneath Crosson Ice Shelf?

Possibly, but this has not been well studied. We have added a reference to a throughflow nonetheless. The additional sentence reads: Alternatively, warmer water might be able to enter the DIS cavity from the neighbouring Crosson Ice Shelf cavity (indications of a deep connection are described in (Girton et al., 2019), however, they observed flow from DIS to Crosson)

Line 262: "... a valuable addition to our knowledge ..."

Thank you, this change has been made.

Line 281: "... from the ice-ocean interface ...".

Thank you, this change has been made.

Line 348: "... to navigate a step in water column thickness ...".

Thank you, this change has been made.

Line 349: "... increased rates of turbulent kinetic ...".

Thank you, this change has been made.

Line 352: "...than the ice front draught."

Thank you, we have changed the text, but we think it should be 'ice front draft'?.

Line 356: "... Bay, found ...".

Thank you, this change has been made.

Line 377: "... kinetic energy dissipation is not commonly modelled ...". There are examples of - models being used, although they are uncommon.

Thank you, this change has been made.

Line 428: "... lead to high heat fluxes."

Thank you, this change has been made.

Line 430: "... for stably stratified water ...".

Thank you, this change has been made.

Lines 490-491: "...from DIS inflow and outflow temperatures agree with published ranges of ice shelf melt rates ...".

Thank you, this change has been made.

Line 496: There is a parenthetical question mark, which presumably should be deleted.

Thank you, we have corrected the citation error that led to this.

Line 512: "... for the use of ...".

Thank you, this change has been made.

References

Dotto, T. S., Sheehan, P. M. F., Zheng, Y., Hall, R. A., Damerell, G. M., & Heywood, K. J. (2025, May). Heterogeneous Mixing Processes Observed in the Dotson Ice Shelf Outflow, Antarctica. *Journal of Geophysical Research: Oceans*, *130*(5). doi: 10.1029/2024jc022051

Girton, J. B., Christianson, K., Dunlap, J., Dutrieux, P., Gobat, J., Lee, C., & Rainville, L. (2019). Buoyancy-adjusting Profiling Floats for Exploration of Heat Transport, Melt Rates, and Mixing in the Ocean Cavities Under Floating Ice Shelves. In *Oceans 2019 mts/ieee seattle* (p. 1-6). doi: 10.23919/OCEANS40490.2019.8962744

Polzin, K., Kunze, E., Hummon, J., & Firing, E. (2002). The finescale response of lowered ADCP velocity profiles. *Journal of Atmospheric and Oceanic Technology*, *19*(2), 205–224. doi: 10.1175/1520-0426(2002)019⟨0205:tfrola⟩2.0.co;2