

Answer to the reviewers.

## Reviewer 1

### 1. Instrument calibration and quality control

The calibration and QC procedures are too briefly summarized. The authors should provide a detailed account of the calibration steps for each instrument (laboratory and in-situ), specify the reference CTD profiles used, describe the evaluation of sensor drift, and justify the  $\pm 0.05$  psu criterion for applying corrections. A dedicated subsection "Instrument calibration and intercomparison" would strengthen reproducibility.

We have changed this value to 0.003 (was 0.05 psu). This threshold matches the instrument accuracy and does not change which datasets are corrected compared to 0.05 PSU. The CTD's are taken a few 100 m away from the hydrographic mooring to prevent any entanglement with the lines, which is why we initially chose a higher value than the lowest uncertainty range. But since we do not expect a large horizontal salinity gradient, we have changed this. Below a figure of the salinity difference between 2 CTD casts 54km apart, in Terra Nova Bay. We have also expanded the QC section and included the instrument calibration.

### Use of the term climatology

The manuscript refers to an "observational climatology" based on approximately ten years of data. As a 30-year baseline is normally required for a true climatology, the terminology is potentially misleading. Please use expressions such as multi-year mean, decadal mean, or provisional climatology, and clarify the exact temporal coverage.

I have changed this to 'multi-year mean'.

### 2. Quantification of measurement uncertainties

Instrument accuracies are reported, but there is no propagation of errors to obtain overall uncertainty in temperature, salinity, and current velocity. The paper would benefit from a quantitative uncertainty assessment, including calibration errors, sensor drift, and pressure variations. Confidence intervals or shaded uncertainty bands in key figures would communicate data reliability to users.

We have added the uncertainty bands in the figures. We have chosen the lower level in the salinity as the instruments are calibrated to this value.

### 3. Depth assignment and mooring motion

Depth determination across deployments is not described in sufficient detail. The authors should explain how mean depths were derived, whether time-varying pressure data were used, and how mooring motion was accounted for when merging consecutive deployments. Providing pressure time-series or a summary table of nominal versus mean depths would improve transparency.

Added: The depth averages described here is the mean depth derived from the pressure in m from the instrument. The depth in each file in SEANOE is the mean depth derived from the pressure during that deployment. Outliers from mooring motions did not affect the mean significantly as the mean and median taken from the time-varying pressure are within the same depth in m. We have clarified this in the manuscript

#### 4. Lack of tidal or spectral decomposition

Separating tidal/inertial from sub-inertial variability might be useful. The manuscript should include at least a basic spectral analysis of the velocity to point the most energetic component of the current field, and include a brief discussion of how high-frequency variability may influence (or not) the presented means and anomalies.

We have added a section and an extra figure to show the spectral analysis.

#### 5. Thermodynamic variable definitions

It is sometimes unclear whether the reported temperature refers to in-situ, potential, or conservative temperature. The authors should ensure consistent use of TEOS-10 terminology and explicitly state which variables (SA, CT, density) are used in each figure and calculation. Even density indicated as  $\Theta\rho$  is pretty unusual (at least to me)

We have made the variable terminology consistent throughout the paper in the text and figures.

#### 6. Conclusions somewhat over-generalized

Some of the final statements about implications for the stability of the Drygalski Ice Tongue and regional climate significance go beyond what the single-site dataset can substantiate. The conclusions should be more cautious and distinguish clearly between direct observational evidence and broader speculative implications.

We have changed the conclusion to make it more clear what observational evidence is and toned-down speculative implications.

#### Minor Comments

- Ensure consistency of units (prefer  $\text{g kg}^{-1}$  for salinity,  $^{\circ}\text{C}$  for temperature). Changed in text and figures
- Correct small typographical errors and check that instrument names and model numbers are consistent across text and tables. We have done a thorough read through.
- Clarify figure captions, especially for T-S plots and “daily climatology” curves, and specify whether density is potential or in-situ. Changed and specified in text.

I look forward to seeing this dataset published after careful revision.

#### Reviewer 2

Icebergs and upper ocean sensors: Two of the moorings are indeed quite close to the surface at 50m and 75m, respectively. This is higher up than most standard moorings deployed around the Antarctic. Are these deployment locations generally safe from drifting icebergs or calvings? You did mention an iceberg impact once, but perhaps provide 1-2 sentences on whether/why icebergs are not a big risk. A sentence is added to explain the risk of ice bergs to hydrographic moorings with subsurface instruments in polar regions. This is a significant risk, and we have likely lost the DITN2211 mooring to an iceberg.

On a similar note, having moorings extending into the euphotic zone really calls for including biogeochemical sensors or at least a fluorometer, which would clearly foster a multi-disciplinary interest in the moorings. The potential interest is accordingly mentioned in the last paragraph, but are there any plans to include such sensors in future deployments?

Yes, the current outlay of DITN has an oxygen sensor at 115 m depth and should be recovered in 2026.

Figures: The figures are mostly fine. Including all the time series in each of the many subpanels makes it sometimes difficult to recognize details, although one can see features like seasonality and interannual differences. For the primary purpose of providing an overview, I think this is fine.

Thanks, the details and interpretation of the data are being prepared in a separate manuscript.

Fig7: I assume the colors of isopycnals in the top panels correspond to the density-colorbar? I would go with a standard TS-diagram, using simple black contour lines. The colors in the colorbar are really difficult to see. Unless I didn't understand the idea behind the current design, I think it will be much easier to recognize. I'd recommend black contours with 1 or 2 density labels included and then the increments mentioned in the caption for clarity.

Isopycnal colors changed to black contour lines and inline density labels.

Fig 9: This is a useful way of outlining the major current ellipses, but again uses 16 small panels. Another idea to display the dominant average currents is to include vectors of the mean currents in the overview map in Fig.1. The text already provides a nice general overview, but to make it really reader-friendly, one could include the mean currents at the mooring locations and a few circulation arrows in Fig.1.

We have changed this figure to a 4x1 plot. The seasonal signal in the currents is not significant, and this makes it more reader friendly. We have moved the original figure to the appendix.

Stratification: Since stratification is mentioned prominently, perhaps the authors can consider to show an average CTD profile from the deployment CTDs in the beginning of the paper. Along with a broad overview of currents in the map, this would nicely introduce the water column structure in this region, which could further be used to motivate the choice of the sensor depths in the moorings.

I have added a figure (Figure 1) with a summer CTD profile and a winter and summer ARGO profile in Terra Nova Bay to show the change in stratification.

L37: relatively

Changed in the text.

L170: "temperatures in the top 400m show a clear..." not clear

L175: again, I'd refer to 275m instead of 200-400m

Changed in the text.

Results section general remark: it would be helpful to point to specific figure and subpanels in the text, wherever certain features are mentioned in the mooring records. Reading these sections is sometimes a little tedious when trying to connect text and figures and distracts from reading.

We point now to the right figure and subpanel throughout the text to improve readability.

L223 HSSW, formed

Changed in the text.

L244 and following lines: did you mean to refer to fig 9? Currently, fig 9 is not mentioned in the text  
Figure (now) 10 referred in this section.

L262: "...changes may affect the stability of the ice tongue..." – so what is the expectation for the stability? Are there any signs or projections for enhanced warm water or other conditions that may lead to the erosion of the ice tongue?

Previous studies looking at ice tongue stability mainly found that a decrease of pack ice around the ice tongue was destabilising and was an important driver for the calving. The Drygalski Ice Tongue has not been surrounded by pack ice during the summer months for year. We therefore do not think this is the main driver. At the same time, CDW is intruding further onto the continental shelf, which will play a large contributor to basal melting of both ice shelves and ice tongues. Earlier this century there was a major calving event of the Drygalski Ice Tongue as large ice bergs of the Ross Ice Shelve collided with the ice tongue. We think it will likely be a combination of CDW intrusion and more

frequent and larger ice bergs that will lead to the partial or complete calving of the Drygalski Ice Tongue.

Impacts of warm water on Antarctic ice shelf stability through basal channel formation | Nature Geoscience: <https://www.nature.com/articles/ngeo2675>

Frontiers | Basal mass balance and prevalence of ice tongues in the Western ross sea: <https://www.frontiersin.org/journals/earth-science/articles/10.3389/feart.2023.1057761/full>

Frontiers | Seasonal variations in Circumpolar Deep Water intrusions into the Ross Sea continental shelf : <https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2023.1020791/full>

L274 extent

Changed in the text.

#### Other changes

Figure changes

CTD & ARGO summer and winter profile to show the stratification break down.

Figure 6, 7, 9 added uncertainty bands based on values in Table 1.

Figure 10, removed the seasonal variability and plotted the current velocity per depth. Changed for a 4x4 plot to a 4x1 plot. There was no significant changes per season, so no information is lost, while it improves the readability.

Figure 11, added a spectral analysis figure

Abstract	due to its -> which has
Line 20	added 'presently'
Line 21	it -> the glacier, The tip of the ice tongue extends ->The glacier then thins to the extent that the tip, located above
Line 24	added 'in the ocean' & 'floating'
Line 54 – 56.	Added 'Figure 2 shows the seasonal evolution of stratification in Terra Nova Bay, based on a summer CTD profile and Argo float observations from both summer and winter (Argo, 2000).'
Figure 1 caption	DITN mooring was first deployed in December 2014, DITD was first deployed in February 2017 and DITS was deployed from February 2017 until January 2020.
Line 67	Changed 'close to' to 'below'
Line 68-69	added 'around' & 'density larger than 1028 kg/m <sup>3</sup> '
Line 74	added 'relatively'
Line 77-79	added 'The stratification driven by the AASW and the breakdown of the stratification driven by the HSSW formation is shown in Figure 2. The CTD profiles are also used for instrument calibration, as described in section 2.1 .' and Figure 2.
Line 86 – 89	changed 'Its proximity to the ice tongue and near-surface coverage makes it well suited to study subsurface circulation and potential meltwater influence.' -> 'The upper instruments are at risk of collisions from icebergs calving off the Drygalski Ice Tongue, which are frequent in the area and can extend to great depths. Despite this risk, the setup is unique and essential for studying subsurface processes. Its proximity to the ice tongue and near-surface coverage make it particularly well suited to investigate subsurface circulation and the influence of meltwater.'
Line 105-107	added 'Measurement uncertainty is represented as shaded bands in the figures and is based on the manufacturer-specified initial accuracy for each instrument and measured variable.'
Table 1	Added the accuracy in PSU for salinity, and added to caption ' and the accuracy has been determined by lab experiments (NOAA PMEL , 2021)'

Line 132 – 134 Added: The depth averages described here is the mean depth derived from the pressure. The depth in each file in SEANOE is the mean depth derived from the pressure during that deployment. Outliers from mooring motions did not affect the mean significantly as the mean and median taken from the time-varying pressure are within the same depth in m.

Line 144 - 154 added: ‘The SBE37SM(P) instruments are calibrated before deployment by the CSIRO Oceanographic Calibration Facility to a factory calibration. The salinity is calculated with through the conductivity and temperature. The accuracy of the salinity measurements have been examined by Uchida et al. (2008). The initial accuracy is found to be 0.003 PSU, or in TNB 0.0030 g/kg. Across different CTD instruments from Seabird, during long-term deployments (>1 year) accuracy drifts to 0.01 PSU (0.01008 g/kg in TNB) in regions of strong temperature gradients (Wong et al., 2023). These uncertainties are below the range of seasonal and interannual variability and the instrument errors are solely in the range of the winter conditions and these instruments are very stable (Sea-Bird Scientific , n.d.). The variability during winter is still valuable information as the instrument errors are a shift, rather than noise. In addition to the factory calibration, a full-depth CTD cast was conducted right after each mooring deployment and again prior to recovery to use for the instrument drift calibration. The CTD profiles were obtained within a few hundred meters of the mooring location, as close to the mooring site as the environmental condition allowed, with a safety buffer to avoid entanglement with the mooring lines.

Line 164 - 165 changed 0.005 to 0.003 and added ‘This value is chosen as it is the upper bound of the uncertainties within CTD instruments.’

Line 166 – 169 added: The temperature sensors were not adjusted post-deployment. Sea-Bird temperature sensors are highly stable and exhibit substantially lower drift than salinity, which is derived from conductivity and temperature. Applying a post-deployment temperature calibration to the SBE37SM(P) and SBE56 instruments would therefore likely introduce additional noise rather than improve data quality (Sea-Bird Scientific, n.d.).

Line 180 - 181 added ‘This mean is calculated by the median of the pressure derived depth values, to account for the mooring deflection due to strong wind-induced currents.’

Line 182 - 184 ‘by the distance offset from an instrument that does measure the pressure’ -> ‘based on linear interpolation and spacing between two known depths - i.e. between the bed anchor, and an SBE37SM(P). The instrument depths vary between deployments, so combining the datasets requires caution to account for differences in measurement levels.’

Line 186 added: derived depth, & in the order of a few meters,

Figure 6, 7, 9 Added in caption ‘The calibration error and sensor drift are represented in the as uncertainty bands, based on the uncertainty of the corresponding instrument.’

Line 190 - 191 added ‘This has no significant impact on the mean and median of the pressure derived depth, as they are short lived (order of hours) events.’

Line 204 ‘Between ~200-400 m’ to ‘at 275 m’ and ‘at 208 m’

Line 231 added ‘in-situ’ and ‘measured’

Line 235 added ‘measured in-situ’

Line 238 – 239 added ‘where the temperature is below the surface freezing temperature CT <~’ and ‘, depending on salinity’

Line 257 ‘between 300-600m’ to ‘at 275 m’

Figure 8 The isopycnals are plotted at 0.05 kgm<sup>-3</sup> intervals, with inline values. T

Figure 10 removed ‘per season’

Line 277 - 280 The prevailing direction of the flow measured in DITD is westward, ranging

- between north west and south west or in north east direction. -> The flow at DITD (Figure 10 (d)) has a westward tendency, ranging between north west and south west or in north east direction
- Line 290-302 added spectral analysis paragraph.
- Line 308 - 310 Changed: 'changes to these water masses can affect the stability and existence of this ice tongue, as warmer oceans could lead to the break off of the ice tongue. The long-term observations help with monitoring the water masses close to the Drygalski Ice Tongue and can detect any changes that might affect the stability of the ice tongue.' -> 'variability in these water masses is relevant for understanding ocean conditions in its vicinity and broader ice-ocean interactions (Wang et al., 2023). Long-term observations provide important context for monitoring hydrographic variability close to the Drygalski Ice Tongue.'
- Line 315 - 316 Changed: 'Therefore, this data set will increase our understanding how the Drygalski Ice Tongue affects' -> 'Together, these observations provide in-situ context for interpreting'
- Line 322 - 323 Changed: 'allows for the identification of key forcing mechanisms, such as' -> 'constrains variability associated with'
- Line 324 Added: rather than allowing direct attribution & supports future investigation of
- Line 325 Changed: hope -> aim
- Line 332 - 333 Changed: 'that may influence the stability and evolution of the ice tongue.' -> 'in the vicinity of the ice tongue that are relevant for understanding ice-ocean interaction, rather than assessing ice-tongue stability or evolution.
- Line 333 Changed: of the changes -> that complements changes
- Line 335 Changed: and enabling -> supporting

Added references:

- Gossart, A., Malyarenko, A., Cornelissen, L., Stevens, C., Miller, U., Zappa, C. J., Luca, N., Castagno, P., & Budillon, G.: Representation of polynyas in the Ross Sea coupled atmosphere–sea ice–ocean model P-SKRIPsv2, EGU sphere [preprint], <https://doi.org/10.5194/egusphere-2025-4332>, 2025.
- Uchida, H., Kawano, T., & Fukasawa, M. (2008). In situ calibration of moored CTDs used for monitoring abyssal water. *Journal of Atmospheric and Oceanic Technology*, 25(9), 1695–1702. <https://doi.org/10.1175/2008jtecho581.1>
- Wang, Y., Zhou, M., Zhang, Z., & Dinniman, M. S. (2023). Seasonal variations in Circumpolar Deep Water intrusions into the Ross Sea continental shelf. *Frontiers in Marine Science*, 10. <https://doi.org/10.3389/fmars.2023.1020791>
- Wong, A. P. S., Gilson, J., & Cabanes, C. (2023). Argo salinity: bias and uncertainty evaluation. *Earth System Science Data*, 15(1), 383–393. <https://doi.org/10.5194/essd-15-383-2023>
- Sea-Bird Scientific (n.d.). Frequently asked questions: CTD accuracy and effect of fouling/contamination on conductivity/salinity data. *Sea-Bird Scientific Blog / Service & Deployment FAQs*. Available at: <https://blog.seabird.com/faqs/> (accessed 9/1/2026).

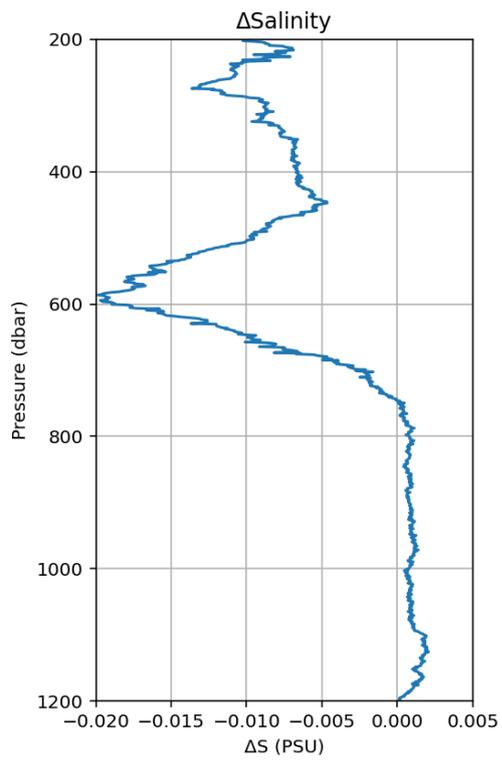


Figure 1: The salinity difference between 2 CTD stations within Terra Nova Bay, taken in January 2024 at a 54 km distance, within 24hrs of each other.