Reviewer 2:

Overall Assessment

This study presents a heat budget of Warm Deep Water across the Weddell Gyre based on in situ Argo float data. Though the main results are not qualitatively surprising, they provide a valuable observations-based benchmark for the processes that distribute heat across the gyre. The main weakness of this analysis is that it relies on relatively sparse in situ data and crude parameterizations for unresolved eddy mixing. Though the authors are thorough in acknowledging the limitations of their analysis, certain key results remain insufficiently constrained. Nevertheless, with some revisions, this work will be a valuable addition to the literature.

> We would like to thank the authors for the constructive criticism of the manuscript. We found the points raised and the suggestions to be extremely valuable, helping us to improve the overall manuscript. We would also like to thank them for taking the time to go through the paper in depth – we are very aware it's not the shortest paper. We hope we have answered and satisfied the concerns of the reviewer and will detail the key changes we have made throughout our responses to each point below. We provide the tracked changes manuscript to highlight these changes, as well as a pdf file of all figures, captions and tables, for easy viewing for the reviewer. Line numbers refer to the line numbers of the changes in the manuscript with tracked changes.

My main criticisms are as follows:

- ***Treatment of transient processes***: This study adapts the heat budget used by Tamsitt et al. (2016), who assessed zonal variations in heat fluxes along the Antarctic Circumpolar Current. Tamsitt et al. (2016) used five-day averaged output from the 1/6th-degree Southern Ocean State Estimate (SOSE). In this framework, "turbulent diffusion" has a clear physical interpretation. Since SOSE resolves time-mean and transient variations in the large-scale flow and mesoscale eddies, "turbulent diffusion" describes unresolved, subgrid-scale mixing. Here, the underlying dataset only provides (smoothed) time-averaged temperature and horizontal velocities, and all other processes (not counting vertical advection) are implicitly parameterized as "turbulent diffusion". While it may be reasonable to characterize eddy stirring as a diffusive process, it is problematic to treat transient variations in the large-scale circulation and temperature field in the same manner. There needs to be a more careful treatment of the heat fluxes associated with temporal correlations in the temperature and velocity field. The discussion in Section 3.1 should distinguish time-averaged from transient processes (i.e., via Reynold's decomposition) and clarify that only the former is resolved. If transient processes cannot be considered negligible, they should be treated as residuals rather than lumped with turbulent diffusion.

> Thank you for making this very good point. We have done our best to address these issues by acknowledging the limitations of the study. We now include the following in section 3.1:
>
> Equations 1.1 and 1.2 now include a 5th term, *R*, and added the following in line 150:
>
> "*R represents the unresolved transient processes excluded in this study (discussed below).*",
>
> followed by the following more in-depth discussion:
>
> *Line 168: "Note that given the constraints of the method used (i.e., our data resources are an objectively mapped long-term mean temperature field, and horizontal velocity derived from a long-term mean stream function of the Weddell Gyre, derived from in situ observations), we are unable to look at deviations from the mean, i.e., transient processes. This means, that the meaning of advective and diffusive heat fluxes are different from the ones quantified by Tamsitt et al. (2016). Their underlying numerical model resolves large-scale variations of the flow and temperature field and (partly) mesoscale eddies; these processes are part of the advection, while turbulent diffusion refers to unresolved small-scale processes. In our study, advection is computed from time mean quantities while the effects of mesoscale eddies are parameterised by horizonal turbulent diffusion. Large-scale variations of the flow field are not accounted for in our study. Thus, we have an additional, unknown 5th term in the heat budget in Eq. 1.1*

> *and 1.2, R, which represents the unresolved transient processes excluded from the study. Increased spatial and temporal coverage of in situ observations within the Weddell Gyre would be required to address these gaps (further discussed in section 5.2.2).”*

> We also discuss these limitations and attempt to make them clearer in the discussion:
>
> Line 597*: “This is a key consideration, which means that the sum of the 4 heat budget terms, especially in the east, cannot be viewed as the heat tendency (which should be zero in a closed system), but that it additionally consists of unresolved processes (i.e., “R” in Eq. 1.1 & 1.2). These include mesoscale eddy activity that is not fully represented by parameterization via turbulent diffusion. We know that the eastern part of the eastern sub-gyre is dominated by an intense mesoscale eddy field (Ryan et al., 2016, Leach et al., 2011 and Gordon and Huber 1984). Wilson et al. (2022) show, using idealised models, that transient eddies are responsible for most of the southward heat transport in the eastern limb of the Weddell Gyre. In addition, as discussed in section 3, a process not accounted for is regional-scale variations in the temperature and flow fields. This process might be particularly important in the eastern sub-gyre, where the boundary to the gyre is poorly-defined due to the openness of the topography. Indeed, Schröder and Fahrbach (1999) suggest that there is no continuous current marking the eastern boundary, and that baroclinic shear instabilities lead to a breakdown of the eastward-flowing current in the northern limb of the gyre, and that the current “reforms” in the westward-flowing southern limb. The geometry of the eastern sub-gyre might therefore be sensitive to interannual to decadal variations in the wind forcing, potentially affecting the time mean heat flux convergence in this area.”*
>
> Line 611*: “In the eastern sub-gyre region, recirculated “cold-regime” WDW (modified primarily through heat loss) comes into contact with incoming “warm-regime” WDW (Gordon and Huber, 1984). The “warm-regime” WDW represents relatively warm WDW advected into the gyre at the eastern inflow zone at about 30° E, driven by mesoscale eddies (Deacon 1979; Orsi et al. 1993; Orsi et al. 1995; Gouretski and Danilov 1993, 1994; Ryan et al., 2016). When comparing the two terms in Fig. 3a and 3c, while the magnitude is much larger in Fig. 3a (horizontal mean advection), horizontal turbulent diffusion displays the opposite signs and partially compensates in the eastern sub-gyre region in Fig. 3c. The terms do not cancel, and thus imply that the missing R term is significant in this region (although, large errors associated with mean horizontal advection also imply that mean advection is poorly represented in this region). This is not easily remedied, since the eastern Weddell Gyre is a region with poor data coverage, including from Argo floats, though at the time of writing, efforts are underway to close this key observational gap.”*
>
> Line 625: “*We’d like to acknowledge that our framework of inferring the heat budget is rather traditional, in which we parameterize the effects of eddies by means of horizontal diffusion. A more advanced approach is represented by the temporal-residual-mean framework (McDougall and McIntosh, 2001), in which the effects of eddies are decomposed into eddy-induced advection (adding an eddy-induced velocity to the time mean velocity in the advection term of the tracer equation) and eddy-induced diffusion. The latter can be decomposed into isopycnal and diapycnal diffusion (Groeskamp et al., 2016). We acknowledge this framework to be more physics-based than our classical approach, yet, given the limitation of our dataset, the estimation of the eddy-induced velocities is not straightforward. At the same time, Sevellec et al. (2019) demonstrated the usefulness of the temporal-residual-mean framework when applied to interpreting eddy-driven horizontal buoyancy transports from mooring-based observations acquired in Drake Passage. In particular, they highlight importance of eddy-driven horizontal transports in the direction perpendicular to the mean flow. For future work it would therefore be intriguing to demonstrate, whether the application of this framework to our data set would represent a major step forward towards closing the heat budget in the eddy-rich eastern part of the Weddell Gyre and around Maud Rise, where our approach does not lead to satisfactory results.*”

- ***Representation of eddy-mixing and turbulent diffusion***. To account for unresolved eddies, the authors assume their net effect on the time-mean heat budget can be parameterized as a diffusive process. While this is a reasonable and standard approach, I am unconvinced that the effects of eddy mixing are within the bounds of uncertainty presented here. I particularly question the validity of the heat budget analysis east of Maud Rise, where numerous studies have demonstrated that mesoscale eddies have leading order control of heat transport in this region (Ryan et al. 2016, Wilson et al. 2022). Since these eddies mix water-mass properties on subseasonal scales and create spatial gradients much smaller than the smoothing filter used to create the temperature climatology, it is no surprise the heat budget does not come to closing in this area (Figs. 2-5). While it is useful to see Figure 2 in its current form, the subsequent analysis should be limited the analysis to the open-ocean areas east of Maud Rise, where the horizontal temperature gradients are weak and the eddies are not as energetic. In my opinion, the data are insufficient to provide a valid heat budget elsewhere. Additionally, I would like to see stronger acknowledgment in the Abstract that the effects of eddy mixing are highly uncertain.

> We agree with the authors and have now computed the zonal means and integrations to focus solely on west of Maud Rise, as suggested by the reviewer. The upper panels in the figures 5-7 & 9 show the zonal mean heat budget terms in Wm^{-2}. Overall, the numbers are changed (the net terms are obviously smaller due to a smaller area coverage), but the interpretation of the results remains unchanged. Indeed, the sum of the heat budget terms closes within uncertainty bounds for the SL (0.3 ± 3 TW). The heat budget still does not close for the IC, due to the influence of high diffusivity values from the Sevellec et al. dataset (Fig. S4, 3c, 6). We have also edited the text, to remove any descriptions of analyses east of Maud Rise which are no longer included, and added text to describe the new analysis and emphasise the importance of eddying processes. For example,
>
> *Line 470: "Unresolved eddying fluctuations are most likely to be an important factor when assessing the heat budget east of the Prime Meridian in the Weddell Gyre, a region we know to be dominated by a mesoscale eddy field (e.g., Schröder & Fahrbach, 1999; Leach et al., 2011; Ryan et al., 2016). We therefore exclude the region east of Maud Rise in the regional analysis in section 4.2."*
>
> We also added the following sentences to the Abstract:
>
> Line 14: "*While the results are somewhat noisy on the grid scale, and the representation of the effects of eddy mixing is highly uncertain due to need to parameterize them by means of turbulent diffusion, the heat budget (i.e., the sum of all terms) closes (within the uncertainty range) when integrated over the open inflow region in the southern limb, whereas the interior circulation cell remains unbalanced*"
>
> Line 28: "*Temporal deviations from the mean terms are not included due to study limitations. In order to appreciate the role of transient eddying processes, a continued effort to increase the spatial and temporal coverage of observations in the eastern Weddell Sea is required.*"

- ***Over-reliance on arbitrary and ad hoc methods***: While budget analyses like this study inevitably involve some amount of arbitrary decisions, this study does so to an excessive extent. For example, in line 188, the authors arbitrarily define an uncertainty range for the diffusivity coefficients, and no rationale is given beyond the unsupported claim that these values are sufficiently large. Another example is when the authors split the Weddell Gyre into "interior cell" and "southern limb," where the former is eventually subdivided into northern and southern limbs. There is no clear rationale for why this is done, and the differences among these regions are sensitive to how the parts are defined. For the last example, if the goal is to highlight these meridional variations in the heat budget balance, a cleaner approach would be to compute a zonal average of the budget terms west of Maud Rise. I document other instances of these arbitrary and sometimes perplexing methodologies below.

> 1. Diffusivity: We acknowledge the diffusivity is arbitrarily defined, based on values in the literature. This is a key component of the paper that the authors hope to rectify in future research by using tracked floats within the gyre to estimate diffusivity. We have now decided to define the κ_H and κ_V values based on findings from Donnelly et al (2017) given the results are thorough and provide estimates for within the Weddell Sea for both vertical and horizontal, and the authors do a thorough comparison with other estimates in the literature. Thus, κ_H is now 247±63 m^2s^{-1} (the error range also coming from the paper) and κ_V is now $(2.39 \pm 2.83) \times 10^{-5}$ m^2 s^{-1}. We think this provides a justified foundation to the study and is also more representative of the gyre, especially west of Maud Rise. We also include the approximate locations of the ship stations from Fig 3 in Donnelly et al (2017) in Fig. S4a, showing the map of κ_{Hx}.

To explain our choice, we have added on Line 185:

"*For the remainder of the Weddell Gyre, we define* κ_H *as 247 ± 63* m^2s^{-1} *and* κ_V *as (2.39 ± 2.83) x* 10^{-5} m^2s^{-1} *based on the estimates provided by Donelly et al. (2017), which are derived from ship-based observations throughout the Weddell Sea in combination with velocity estimates from the ECCO live access server.*"

2. Sub-regions: We did provide a rationale on how we defined the sub-regions. We define our regions based on our knowledge of the mean horizontal circulation. This is done by using the stream function, where we focus on the eastward flowing northern limb and the westward flowing southern limb. Originally, we defined the SL as the area as indicated by streamline where the westward flow extends the full zonal extent of the gyre, whereas the IC is defined as the region fully enclosed by a single streamline (i.e., a "true" gyre circulation). This, however, resulted in a slight overlap between regions, which we acknowledge may lead to ambiguity regarding our interpretation of the results. Thus, we have now defined SL as the open inflow region, where the streamlines indicate a westward inflow from outside the gyre in the east, all the way to the western interior, whereas the IC is still defined by its single, fully enclosed streamline, and is thus representative of recirculating water masses.

In order to make our choices more transparent, we have now added a map clearly marking these two regions in Fig. 4, as well as clearer explanations of our subregions:

Line 298 (opening to Section 4.2): "*In this section, we consider the zonal variation of the heat budget, for two regions: (1) the open southern limb (SL) and (2) the interior circulation cell (IC). The open SL region (i.e., the magenta stippled area in Fig. 4)) is defined by the stream function as 16* $\leq \Psi \leq$ *26 Sv, which describes the open inflow zone where water masses enter the gyre, and spans the entire zonal extent of the double gyre system, from just west of Gunnerus Ridge (~33°E) to ~50° W, where the streamlines veer northwards to follow the coastline of the Antarctic Peninsula. The southern boundary of the SL is the southernmost streamline that does not intersect with the coastline (16 Sv). This definition of the SL enables us to focus on the water that enters the gyre from the east, and circulates the entire zonal extent of the gyre, thus reaching into the south-western interior. The IC region (i.e., the blue stippled area in Fig. 4) is defined as* $\Psi \geq$ *26 Sv, which is the largest streamline that spans the entire zonal extent of the double gyre system, this time forming a fully enclosed circuit. This definition of the IC allows us to focus on the recirculating waters of the gyre, from just west of Gunnerus Ridge to near the continental shelf edge of the northern tip of the Antarctic Peninsula (~50° W). For both regions the area east of Maud Rise (3° E) is omitted, due to large uncertainties east of Maud Rise (discussed in Section 5).*"

3. The reviewer suggested that we compute the zonal average of the heat budget terms to highlight the meridional variations.

We have also now computed the zonal and meridional means and integrations for the whole Weddell Gyre region west of Maud Rise. These figures are shown below. We find these new results to be a useful validation of our regional analysis. We have therefore included them and the description above in the supplements (Section S8, Figs. S7-8). This is because the regional analysis focuses on a spatial analysis of the heat distribution and is more comprehensible in terms of the analysis which leads to our final schematic in Fig. 10. We add the following in the opening paragraph of section 4.2, line 324:

"*We also provide a zonal and meridional analysis of the entire region marked by both blue and magenta stippling in Fig. 4 in the supplements (Figs. S7 and S8). These analyses provide results that agree with the analyses presented in this section and are described in section S8.*"

And the following description in the supplements, section S8:

"*The zonal and meridional means and integrations for the whole Weddell Gyre region west of Maud Rise (i.e., SL + IC) were also computed for the heat budget terms. These figures are shown below. The zonal mean in Fig. S7 is very similar to the IC analysis, although it shows a net zero contribution of mean advection, which makes sense because of the gyre-characteristics of the circulation, where westward flowing southern and eastward flowing* *northern limbs cancel with each other: heat is advected into the gyre east of 10 °E, and then advected out of the gyre west of 40 °W. Horizontal turbulent diffusion dominates as a heat source east of ~25 °W, dominated by high values along the northern boundary. The mean contributions in the upper panel show three zonal peaks at 0 °E, 20 °W and 45 °W. These are related to the recirculation about the eastern sub-gyre, and the western sub-gyre respectively. The peak at 20 °W is particularly interesting as this is where the bottom bathymetry transitions from complex in the east to smooth in the west, which is known to impact diffusivity (Whalen et al., 2012) and overall circulation dynamics (Sonnewald et al., 2023).*

The meridional mean in Fig. S8 also shows the closure of the mean advection component where the main heat source due to mean advection occurs in the southern limb (south of ~63°S) and the main heat sink due to mean advection occurs in the northern limb (north of ~63°S). Again, this agrees with all previous findings in the paper. Horizontal turbulent diffusion removes heat in the southern limb, and becomes a source of heat in the northern limb, with peaks occurring at ~61°S and ~59°S. These peaks might be related to the meridional change in the northern boundary across the area we are averaging over.”

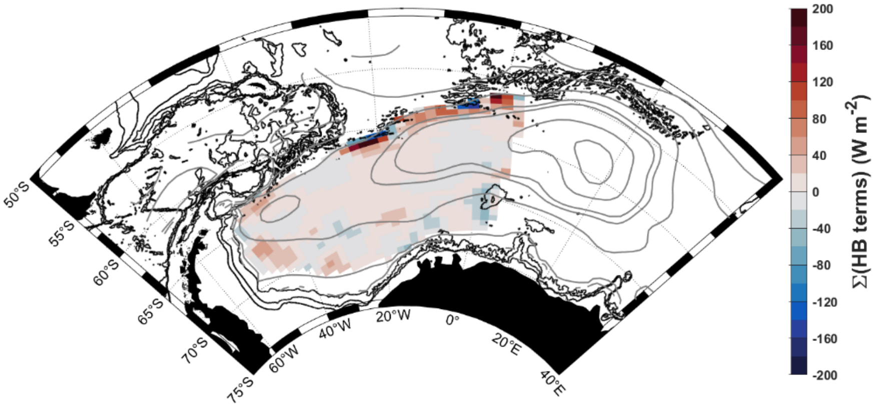

Fig. 1. Map of total area for the figures below.

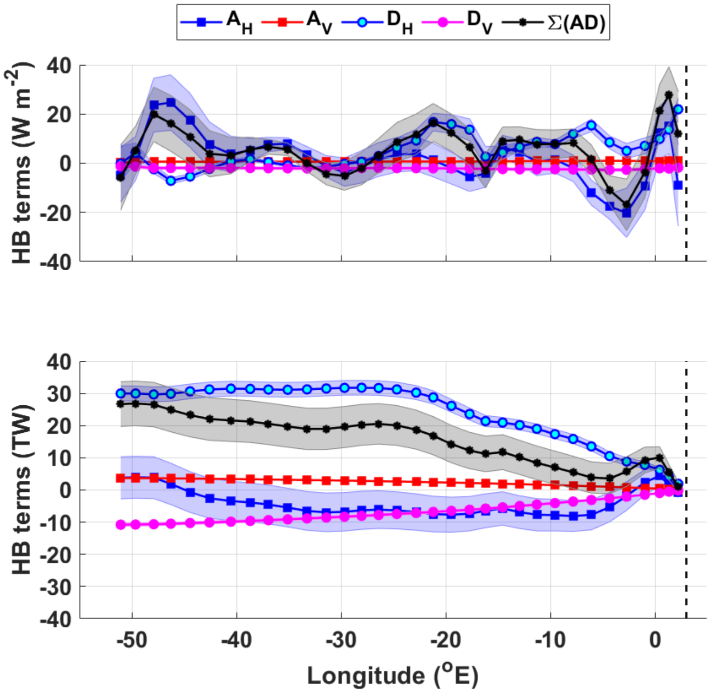

Figure S7: upper panel: the zonal mean heat budget terms, in Wm^{-2}, for the whole Weddell Gyre west of 3 °E; lower panel: the corresponding cumulative heat budget terms in Terawatts (TW). The key for the legend is listed in Table 2. The dashed vertical line marks the approximate longitude of Maud Rise, at 3° E. The shaded errors provide the associated propagated error (detailed in section 3.2 and the supplement). The total region is marked by both blue and magenta stippling in Fig. 4.

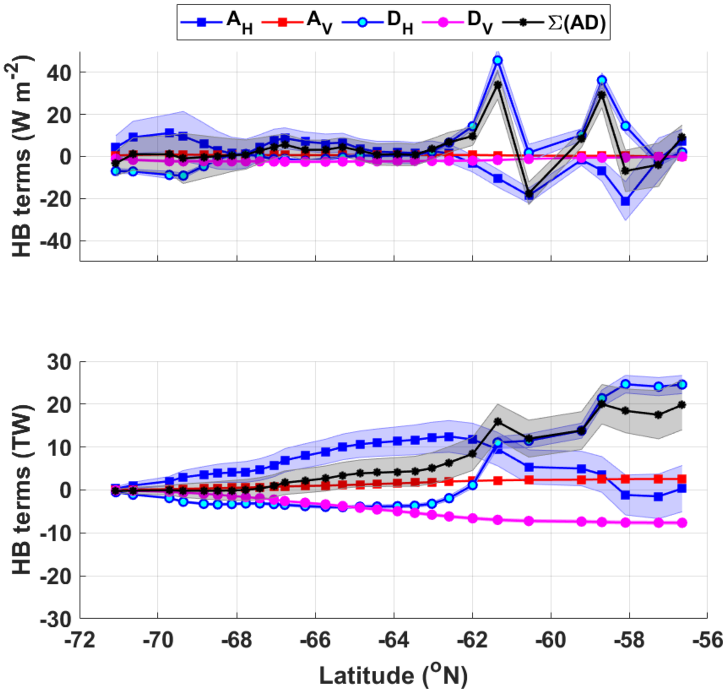

Figure S8: upper panel: the meridional mean heat budget terms, in Wm^{-2}, for the whole Weddell Gyre west of 3 °E; lower panel: the corresponding cumulative heat budget terms in Terawatts (TW). The key for the legend is listed in Table 2. The dashed vertical line marks the approximate longitude of Maud Rise, at 3º E. The shaded errors provide the associated propagated error (detailed in section 3.2 and the supplement). The total region is marked by both blue and magenta stippling in Fig. 4.

Detailed comments:

- Lines 25-: The plain language summary reads more like a second abstract. I think this needs to be more concise and less technical.

> We revised the summary as follows (Line 31):
>
> "***Plain Language Summary:*** *Ocean currents in the Weddell Sea are governed by a wind-driven clockwise circulating gyre, which is connected to the Antarctic Circumpolar Current to its north. Warm and salty deep water enters the Weddell Sea in its east, and is transported by the gyre circulation first southward, then westward, and back northwards again following the continental boundaries. During this circulation the water loses heat to the atmosphere and by contact with the ice shelves. Thereby the water becomes heavier, as also by salt released during the freezing of sea ice. The heaviest waters sink downwards along the Antarctic continental slope, eventually filling the deep abyssal ocean basins. The main source water mass for these processes and also the main source of heat to the Weddell Sea is called Warm Deep Water. Previous studies have shown the whole water column, especially in the deeper layers, is warming over recent decades in the Weddell Sea. The temperature of Warm Deep Water, however, fluctuates too strongly to tease out long-term trends from the "snapshot" data that is available to us. To better understand how heat is distributed in the Weddell Gyre within the Warm Deep Water, we combine temperature and velocity observations from a fleet of Argo floats freely drifting throughout the Weddell Gyre between 2002 and 2016. Using these observations, we estimate a heat budget in the layer that extends 1000 m deep from below the surface layer. This layer always includes the core of Warm Deep Water, regardless of its vertical position in the water column. Overall, large uncertainty prevents us from interpreting the results on a local scale, but interpretable features of heat flux divergence and convergence emerge when integrating the heat budget over large areas. The large-scale currents carry heat into the westward-flowing southern limb from the east, and upwelling brings heat upwards from below the layer throughout the whole gyre. Turbulent mixing, representing small scale processes, removes heat from the Warm Deep Water core through the top of the layer upwards into the ocean surface throughout. It also removes heat from the southern limb, northwards into the central gyre where Warm Deep Water recirculates and moves closer to the surface, as well as southwards towards the Antarctic coastline. Lastly, turbulent mixing also brings heat into the gyre across the northern boundary.*

- Line 34: "Warm Deep Water, however, varies in its properties too strongly to tease..." It is unclear what "varies too strongly" means.

> Replaced with (line 42):
>
> *"The temperature of Warm Deep Water, however, fluctuates too strongly to tease out long-term trends from the "snapshot" data that is available to us."*

- Line 39: "interesting features..." Please replace "interesting" with a more objective adjective.

> Replaced with (line 51): "*interpretable features of heat flux divergence and convergence*"

- Line 53: "The CDW that enters the Weddell Gyre is commonly referred to as Warm Deep Water (WDW)..." This is a nitpick, but I understand WDW to be a modified variant of CDW rather than simply CDW that exists in the Weddell Sea.

Line 67: added the following *"becomes modified and is…"*

- Figure 1: Add contour labels for the streamlines, specifically the ones used to define IC SL subregions.

We tried this, but the labels were not clear due to the figure already being quite busy. Instead, we include a new figure, figure 4, which clearly shows the IC and SL subregions, and the associated streamline labels (page 13).

- Line 152: Please briefly state how Sevellec et al. (2022) obtained their diffusivity estimates.

Added the following (line 182):

"dataset provided by Sevellec et al. (2022), who derive horizontal diffusivities directly from Argo float trajectories by fitting a "pseudo-trajectory" to increase the spatial resolution required for the computation. Given this requires trajectory data without gaps in the record, estimates are missing for much of the Weddell Sea due to the presence of sea-ice."

- Lines 135-138: A couple of things here:

- Figure S1a and a summary of the accompanying discussion regarding the definition of the vertical boundaries of WDW should be included in the main text.

Done. Fig. 2 on page 6, along with the following text on line 152:

"This is to avoid incorporating highly seasonally variable surface waters from the analysis whilst also fixing the volume of water; (detailed explanation of the vertical boundaries is provided in the Supplements S1). Figure 2 shows selected vertical profiles with the upper and lower boundaries marked (the corresponding position of the profiles is found in Fig. S1, selected at random to provide a broad coverage of the Weddell Sea)."

- For Figure S1a, it would be helpful to include additional profiles to illustrate the variability of temperature profiles and the location of the upper boundary.

Done

- Regarding the previous point, are there regions where the lower boundary temperature is cooler than the upper boundary temperature?

We checked all vertical profiles within the Weddell Sea, and found this not to be the case. The pale blue regions to the north of the Weddell Sea in the map of vertical advection (Fig. 3b), indicate where the deeper water is cooler than the upper boundary temperature. We added the following statement in Section 3.1:

Line 156: "*Note the upper boundary temperature is always less than the lower boundary temperature within the Weddell Sea (there are regions where the opposite is true to the north of the gyre, within the ACC).*"

- Line 154: add "a" between acknowledging and lack.

done

- Lines 203-205: Please provide a more physical motivation for defining the IC and SL regions. These seemingly arbitrary definitions undermine the robustness of these results.

> We have sought to clarify our motivations in the opening of Section 4.2 on Line 298, as detailed in response to your major comment referring to "*Over-reliance on arbitrary and ad hoc methods" on page 4 of this document.*

- Lines 254: I would rephrase "useful information" more objectively and state specifically why we should trust the spatially averaged values when the local details are not considered reliable.

> Changed the wording to the following on line 317:
>
> "*However, much of the local (grid-scale) imbalances (i.e., the random noise part) cancels out in the net (zonally integrated) heat budget terms, allowing regional patterns not affected by the differentiation at the grid scale to emerge*"

- Figure 3: Apologies if I missed this in the text, but what fraction of A_H goes north versus southward to the shelf?

> To compute this, we would need to directly compute advective heat fluxes along the streamline 26 and 16 Sv. We have not included this, since the results were rather noisy, and we assume the cross-stream flow is unlikely to be significant given the velocity estimates are derived from the stream function. This would be an important component to consider if we were able to look at deviations from the mean, which is unfortunately missing from the analysis, as you rightly pointed out. What we can say, from the lower panels in Figs 5-6 (before, Figs. 3-4), is where heat enters- and is removed from- a layer, and piece this information together by comparing the different sub-regions. We do, in Figs. 8-9, provide direct turbulent diffusive heat fluxes, since this is not dependent on the more spatially variable (and thus noisy) velocity variable, and thus provides less noisy results.

- Line 319: I would argue that the budget does not close anywhere in the domain.

> This sentence was deleted.

- Lines 323-324: It is odd to disregard the easternmost values in this section and not elsewhere. More consistency is needed. See my third major comment.

> The authors agree with you. We now provide the zonal analysis for regions west of 3°E, i.e., the longitude of Maud Rise, throughout. As a result the SL heat budget does very nearly come to a close (0.3 ± 3 TW, or 0.002 ± 0.02 °C/yr), although the IC still does not come to a close.
>
> We deleted this sentence and the subsequent 4 sentences as they are no longer relevant.

- Line 494: I am not sure what "ellipses" refer to.

> We have clarified this now (line 573):
>
> "*we hypothesised that a larger bias due to the horizontal gradient of the upper boundary depth (i.e., mid-thermocline, Fig. S1b) was occurring at the gyre periphery (i.e., where the slopes of the isopycnals are largest), which may be contributing to the large positive and negative values that extend diagonally outwards from the centre of the eastern sub-gyre (i.e. forming roughly shaped ellipses) in horizontal mean advection in Fig. 3a.*"

- Lines 510-513: I suspect unresolved mesoscale eddies have a leading order impact on the mesoscale heat budget. In addition to the observational studies referenced in the following sentence, idealized modeling studies indicate that transient eddies (e.g., Wilson et al. 2022) are responsible for most of the southward heat transport in the eastern limb of the gyre.

> Thank you for bringing this up – the reference you cite is a really valuable addition. We have added the following sentence on line 601:
>
> *"Furthermore, Wilson et al. (2022) show, using idealised models, that transient eddies are responsible for most of the southward heat transport in the eastern limb of the Weddell Gyre."*
>
> We altered the discussion from line 597, as detailed on page 2 of this document.

- Line 543: To be more precise, there is a Taylor Cap rather than a Taylor Column over Maud Rise. It is also inaccurate to say that the water column above the Rise is "stagnant" since it does exchange water mass properties with the ambient fluid.

> Thank you for pointing this out, we deleted the word "stagnant" and replace column with "cap".

- Figure 8: This is a lovely summary figure.

> Thank you! We have now added a second panel describing the features in the form of a legend, to shorten and simplify the caption.

References:

Ryan, S., Schröder, M., Huhn, O., and Timmermann, R.: On the warm inflow at the eastern boundary of the Weddell Gyre, Deep-Sea Res. I, 107, 70-81, https://doi.org/10.1016/j.dsr.2015.11.002, 2016.

Wilson, E. A., A. F. Thompson, A. Stewart, and S. Sun (2022), Bathymetric control of the subpolar gyres and overturning circulation in the Southern Ocean, Journal of Physical Oceanography, 52, 205–223, https://doi.org/10.1175/JPO-D-21-0136.1.