

Review of "Sudden, local temperature increase above the continental slope in the Southern Weddell Sea, Antarctica" by Elin Darelius, Vår Dundas, Markus Janout and Sandra Tippenhauer

Summary comments

Using a collection of CTDs (historical, COSMUS expedition 2021 and seals) and moorings, this study looks to report on an observed "sudden" increase in the temperature and salinity of Warm Deep Water north of the Filchner Trough in the Weddell Sea starting in 2019. These properties do not appear to be advected downstream towards the ice shelf as downstream observations do not show a signature of the upstream changes. I found this paper interesting and given the recent interest in regime changes of the Filcher-Ronne Ice Shelf, believe that it will also interest the community. In general, it is well written and presented but at times I found the expression and messaging could be tightened up. In particular, a few plot tweaks would make the story much easier to follow. Hence, I recommend acceptance of the paper subject to consideration of some minor, detailed suggestions below.

Detailed comments

Abstract

Perhaps it's helpful for the reader here to know about the cruise CTDs? (And in general what new observations are presented in this paper.)

Introduction

L23. I find 'features' a little awkward

L35. 'equals'? I think you mean is at the same depth?

L47. I think the introduction would have more impact if you close with why we should care about sudden changes in T/S of WDW.

Data and Methods

Conductivity-Temperature-Depth (CTD) profiles

L55-56. So what is the actual number used? Even just a total in the caption in A1 would be fine.

L64-65. So the water sampling is being used for the OPS? Were any corrections made?

L67-69. I found the words used inconsistent throughout the manuscript. Can you please go through and make all phrasing the same. See also comment below about adding the regions to a Figure please.

Mooring records

L73. Add reference to Figure 1?

L73-81. I find it a bit confusing that one moorings is named by its depth and the other by longitude. I guess this is historical (to be consistent with earlier papers)? If not, would it be better to name in terms of their importance to the story? Upstream/downstream etc?

Results

L83. 'depth east of the FT'. North-east or even just north? (M31 to me is east)

L95. 'smaller' I would prefer higher or above

L98. 'relatively late' can you be more explicit please. When? Was there anything anomalous, climatically, around this time?

L99. Why is the data here (A2) binned into the regions? And what does the red dots mean?

L103. "The WW is about 0.025 and 0.01 g kg⁻¹ fresher than the mean value and the previously observed minimum, respectively"

I don't understand the 'and' here? Why are there two numbers?

L104. 'Fig4' → 'Fig4a'. Is that unusual? So you are highlighting the absolute number but Figure 4 to my eye, shows ~0.1 variability which is ~10 times more than the amount you're looking to emphasise?

L106. 'Darelius et al, in review' is this allowed in this journal? Perhaps there is a preprint?

L118. I think this is the start of your 'sudden increase', right? So I think it would help the reader if you signpost this paragraph as being important. L124, could be re-phrased and inserted so we come full circle. As I understand it, Figure 2 and 6 are the main results of the paper and could be highlighted as such.

L127. 'average' which is?

L130-138. I don't follow which aspects of the described change are being attributed to changes in EKE? Perhaps some of the text from the discussion should be brought here?

Discussion

L139. Perhaps this is a new section (not a sub section)?

L143. Suggest re-phrasing 'maximum_2w' as people just reading this part won't know what that means

L147. This would be easier to follow if each of the three ways were numbered.

L147. Relevant → 'important'?

L151.

The effects of the observed temperature increase for these **3** processes will be briefly discussed below.

So we have:

1. HSSW

2. FRIS melt
3. Bottom water

Can you please then break up the following text into 3 paragraphs or subsections that address each of these. At the moment I get a little lost, based on the content that is presented, I'm not sure the above is the best way to structure the discussion but if you think that's true, then the earlier material should be made consistent.

L155. It's unusual to me that Figure 7 isn't discussed in the results?

L161. 'Back of the'

L162. Is a 10% change significant? E.g. do we know what the interannual variability of HSSW production is? (I'm hoping for something similar to L180.)

L185. 'Fig' in front of the references

L182. A small re-phrase, drawing together what the reader is supposed to conclude would help I think. Something like: 'Thus, we think that the WDW temperature increase influences bottom water temperature up to..., which is outside the trend of'

L187. So I take it, each of these ideas will now be discussed (following two paragraphs)? Can you signpost it please.

L189-L208. What would be involved in testing how plausible this mechanism is here? It's not my area but perhaps a reduced order model might help corroborate the author's suggestions? Some inspiration could be taken from the mixing estimates given in the Methods in (Meredith et al., 2022) for example.

L209. Here and elsewhere I think it should be: 'Ryan et al (2020)'. See L217 too

L209. For the uninformed reader (this one too, quite a while since I read that paper!).. Are you saying that the time series discussed in Ryan et al. (2020) matches?

Figures

Figure 1.

Please highlight the four regions of interest on this map (Figure 3-5). Or another 'b' panel if it gets too busy.

Relatedly, much is made of:

west of the FT (25-31W)

north of the FT (31-35W)

east of FT (35-45W)

upstream of the FT region (10-20W)

Can these longitudes be drawn or highlighted on the map?

Can the mooring and CTD profile be different colors please.

Figure 2.

Can the x-axis on a) be a tiny bit wider, would make the dashed line more visible.

Is it worth having a tiny map on this Figure to show where this profile is? You could take the inset off Figure 1 and put it here? Or repeat it without all the green/yellow/black dots.

Figures 3-5. Can they please have a discrete colormap.

Figure 3. 'Temperature maximum' meaning? Time window? I note this is stated in text for later figures:

we consider the mean and maximum temperature in two-week-long windows (Fig. 6a-d)

did I miss something?

Figure 4. Caption 'west' $\leftarrow \rightarrow$ 'east'

Figure 5. There appears to be an artefact on the colormap.

Figure 6. It's a nice Figure but there is a lot going on. I wonder if the black maximum line would be worth showing on Figure 3? It would give the reader a better sense of the findings of the paper, earlier.

The black line on the legend says 'range' but says maximum in the caption. In general, I suggest only explaining things once.

Is it worth showing the raw timeseries? Or is it too noisy without a two week filter? I imagine it's similar to Figure 7. What kind of window filter was used?

References

Meredith, M. P., Inall, M. E., Brearley, J. A., Ehmen, T., Sheen, K., Munday, D., et al. (2022). Internal tsunamigenesis and ocean mixing driven by glacier calving in Antarctica. *Science Advances*, 8(47), eadd0720. <https://doi.org/10.1126/sciadv.add0720>