

Review of Aguiar et al., first revision

The manuscript has gained a lot in clarity, but part of the narrative is still confusing and does not seem to hold. In particular, from section 3.1 to 3.2, then 3.2 to 3.3, the years where the described events start seem to change. I suggest changes in this document in order to clarify the chronology of the events and verify that the proposed mechanisms are valid.

Major changes

For each reanalysis, please indicate

- In the text at the beginning of section 3.2, the dates of the polynyas given in section 3.1;
- On figures 3 to 7, these same dates should be represented as vertical bars with different colours and/or line styles, for example.
- In the text at the beginning of section 3.3, the dates at which AABW formation occurs in each sea inferred from figures 3 to 7;
- On figures 8 to 10, again potentially as vertical bars or shaded rectangles of different colours for the different regions.

Then throughout the text, check that you do describe what happens at those dates that are specific to each region and each reanalysis. For example page 11 line 18, you explain that the Weddell Sea sector does not show the same changes as the other two regions in 2004 in UR025.4. That is not surprising, since as you write page 8 lines 22-23, there WSBW is formed only in 2008 and 2009! Likewise, page 12 you write that WSBW formation occurs “in the first few months of the time series” for SoSE, yet your description page 8 mentions WBSW pulses later, in 2006 and 2007.

Minor changes

Throughout the text: despite the language check, there are a lot of typos, blank spaces or letters missing.

P1, l9: Change “despite” into “although”.

P1, l23: “longer and more elegant” than what?

P3: Potentially split section 2 into two subsections, one about “Reanalysis and observational products” starting line 10, and one about “Methods” starting P5 l7.

P4, l25-26: This sentence has no clear link with the one after. Move it somewhere else, or add some transition.

P5, l32: “their links with the processes being evaluated” – reference needed.

P7, l14: mostly in the Weddell Sea.

P8, l12 and l20: this comment is valid throughout the manuscript and **was already made during the previous round of reviews**: give the actual values! Don’t just write that it increases

P8, l22: for clarity, write ECCO2 instead of “the previous reanalysis product”.

P8, l25: the behaviour of SoSE is similar to that of ECCO2 only until 2008. Please discuss what happens from 2008 onwards.

P10, l13: see major comment, give clearly “the periods and locations”.

P10, l27-28: no, it is not apparent that cooling was the main mechanism. You do not show it, and you even soften your argument several lines later by writing that cooling could be “favouring deep convection”. I’d remove the sentence l27-28 and keep the ones after.

P11, l12: what do you mean by “consistent with the changes in temperature”? That it happens simultaneously? That the increase in salinity and temperature makes sense you think (if so, explain why)?

P11, l24 onwards: not proven. You need to talk more about the timing of the events, how the salinity anomaly would propagate from the surface down.

P13, l4-6: where do you show the properties of the AABW varieties?

P14, first paragraph: again, please give the values. What is the “very shallow depth”? What do you mean l10 by “a much smaller scale”? Give depth / volume values.

P14: so you seem to say that the polynya opening in SoSE is the consequence of WDW upwelling. What is causing it? You don’t need to formally prove it, but check if someone has looked at that already or suggest potential mechanisms.

P15, l1: this comment is the one reason I waived my anonymity already in the previous round of reviews: No, this is not what Heuzé et al. (2013) says! **As said during the previous review**, please change to Kjellsson et al. (2015) or Heuzé et al. (2015). Note that your author response document says you did change it to Heuzé et al. (2015).

P16, l1: where can that “be seen”?

P16, l6: likewise, where do you show that it is colder and with lower salinity?

P17, l17: “a higher content” than what?

P17, l31: the long-term warming of the bottom waters has been found by other people with other models (although related to your reanalyses). Cite for example Martin et al. (2012) <https://link.springer.com/article/10.1007/s00382-012-1586-7> or Dufour et al. (2017) <http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-16-0586.1>

Figure 8: typo in caption, this figure shows ECCO2, not UR025.4