

## ***Interactive comment on “South Atlantic meridional transports from NEMO-based simulations and reanalyses” by Davi Mignac et al.***

**Anonymous Referee #2**

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In this manuscript, the authors assess the skill and differences of four different ORAs and two free running simulations of the South Atlantic, all based on the NEMO core, in the South Atlantic. They focus on the meridional volume and temperature/heat transports. They find that ORAs in general have higher skill, although even these have large discrepancies. They show that a large reason for that is the very limited ability to accurately represent the narrow boundary flows of the North Brazil Current

This is a well-written and clear manuscript, although scientifically not very exciting. Much of it is either unsurprising (ORAs are closer to observations than FRMs) or under-explored (what needs to be done in the ORAs to better represent the boundary currents). Nevertheless, I don't see a good reason to reject it, as the analysis by itself is sound

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I do, however, have some comments and questions

1) Just from reading the manuscript, it is not clear how this study is different from the Majumder et al (2016) paper. This needs to be better highlighted in the introduction section

2) It would be good to discuss the findings, especially that the models so poorly represent the boundary currents, in relation to OSSEs; i.e. which measurements are needed (and where are they needed) to improve the ORAs?

3) I was surprised to read that the ORAs are much less constrained before the 2000s, yet the authors chose to use the 1997-2010 period for their analysis. Why not start after the Argo era begins then? And why not include later years; 2010 is seven years ago! That would make much more sense to me.

4) The authors need to state much more clearly which of the observational data they use to assess the skill of the models have gone into the ORAs themselves. I.e. is the XBT-AX18 line, or WOA13, used in the data assimilation process of the ORAs? In other words, are these independent validations?

5) There could be more discussion of the features seen in the Cape Basin. Where do these come from? How are they related to MOC and the Brazil Current? Are they noise or signal?

6) For a study that focusses so much on boundary currents, it is surprising that there is no mention of how the boundary conditions have been implemented in the models? Are these all the same? Partial slip? What parameters have been used? Is there any relation between the way the boundary conditions are implemented and the skill of the ORAs/FRMs?

Minor issues:

- line 14: Start the abstract with a sentence about why the South Atlantic is relevant? The Introduction section starts with a few good paragraphs, and these might be sum-

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marised at the beginning of the abstract?

- line 43: Add 'possibly' before 'leading'?

- line 59: Explicitly state that most ORAs lack dynamical consistency?

- line 105: I thought most NEMO models were  $z^*$ ?

- line 111: What do 'W', 'SAT' and 'SAH' stand for?

- line 244: Why is this interpretation made? What is the motivation for this?

- Figure 2: How is 'spread' defined here? highest-lowest? standard deviation?

- Figure 3: Why does the size of the horizontal lines on the whiskers vary? What does this mean?

- Figure 5: How is the standard error defined here?

- Figure 8: What is the relevance at this line of 0.7 correlation? Is this the significance level? How calculated?

- Figure 11: What do the dashed circles represent above the top two bar charts?

Type-os etc:

- line 24: The word 'right' is confusing here, as it might also be interpreted as the right (as opposed to left) side of the plots?

- line 73: 'Focussing on'

- line 249: Is this correlation  $R$  or  $R^2$ ?

- line 372: 'near the boundaries'

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