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Ocean Science Discussions

Interactive comment on "Impact of hydrographic data assimilation on the Atlantic meridional overturning circulation" *by* G. C. Smith et al.

Anonymous Referee #1

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The manuscript shows a comparison of some AMOC properties from an interannually forced hindcast model simulation and from an assimilation integration to those data provided by the RAPID / MOCHA mooring array across 26.5N. The intend is to provide an initial step towards the development of an ocean assimilation system that can determine AMOC for climate prediction experiments. I have the following concerns and suggestions. I recommend major revisions.

1. It is my understanding that the hindcast simulations use only one cycle (1958-2005) of the interannual forcing. Any credible analysis of any hindcast simulation forced with such interannually varying surface forcing should be based on at least several cycles of such forcing. The idea is to compare model results from two subsequent cycles and determine for your analysis that the solutions do not differ from each other in some

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measure. The authors must extend their control simulations for at least 3-4 forcing cycles. Otherwise, I do not believe the robustness of their results.

2. It is rather surprising not to see any spatial distributions of the simulated meridional overturning circulation. In addition, the authors should show the model bottom topography details especially near the western boundary along with the erroneous circulation they keep referring to. Even the high resolution model does not have enough resolution west of the WB2 line. Please also show the northward heat transport distributions.

3. There are several references to Baehr et al. (2009, OSD) paper without much discussion. This paper seems rather similar to the present manuscript in its contents. The authors should include a discussion of Baehr et al. and of how the present manuscript advances science further.

4. Both the Abstract and Discussion stresses that some initial condition properties existed for 3 years. However, this is not really shown in the manuscript.

Some other points:

- p.2671, l.14: ... allows ...

- p.2671, l.16: What is the difference between the AMOC and RAPIP / MOCHA arrays?

- p.2672, l.12-13: Here, the high resolution model resolution is stated as 1/3 degree, not 1/4.

- p.2672, l.19: What is the tracer mixing in ORCA025? It is not eddy resolving. I hope you are still using the GM90 scheme.

- p.2672, l.20: Blanke and Delecluse 1991 or 1993?

- p.2672, l.25: I suspect the forcing is to the end of 2005, since the integrations are that long.

- p.2672, l.27: Replace "Common" with "Coordinated".

OSD

6, C964–C966, 2010

- p.2673, l.14: What do you mean by "innovations"?

- p.2677, l.22: "is manifest" ??

- p.2680, l.10: What is the reason for this better agreement?

- p.2680, l.28: Both here and elsewhere, I suspect you really do not mean formation but rather entrainment problems.

- p.2681, l.9: show

- p.2681: Why don't the rapid array profiles extend to the surface in the figures?

- p.2682, l.9: I do not see improvements in the 1500-3000 m range in the related figure.

- p.2685, l.15: I do not see this intensification in the figure.

- p.2685, l.24: "upper mid-ocean".

- p.2687, section 5: This section is implying that the AMOC equilibration time is rather short, i.e., order months to a few years. In my experience it is order several hundred years, if not longer!

- p.2703: Please make the upper and bottom panels the same size in the abscissa.

- p.2715: Caption appears to be incorrect.

Interactive comment on Ocean Sci. Discuss., 6, 2667, 2009.