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Ocean Science
Discussions

Interactive comment on "Can the boundary profiles at 26N be used to extract buoyancy-forced AMOC signals?" *by* Irene Polo et al.

Anonymous Referee #2

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In manuscript "Can the boundary profiles at 26N be used to extract buoyancy-forced AMOC signals?", Polo et al. examined vertical profile of density in at 26N and its relation to AMOC and to the buoyancy forcing subpolar North Atlantic, in both forced and couple models. Their results suggest that depth structure and the lagged covariances between west and east boundaries at 26N may provide useful information for detecting density anomalies of high latitude origin in more complex model and observations, although time filtering and longer time series are required. The paper is well-organized and well-written over all, but I do have a couple of concerns regarding the realism of the 1 degree model and how fast the density signal transferring from subpolar to subtropical North Atlantic and some clarification and/or discussion are needed.

Title: Spell out AMOC

Line 7: "The temporal variability of the Atlantic meridional overturning circulation (AMOC) is driven . . ."

L135: Given the central relevance to the topic, it is required to include a simple comparison of the T/S/density profiles between model and RAPID for, let's say, a five-year period 2005-2009, to see characteristically how similar/difference they are. And this should be in the paper, not in the supplementary, I understand that profile of density gradient is shown in supplementary, which is fine. Why focus on density gradient there?

L149: Here I think the modeled standard deviation for monthly mean AMOC need to be listed too for comparison with the RAPID value (4.4 Sv).

L215: Should Fig. 1a be Fig. 1c?

L299: The speeds in the forced models are consistent with the lag found between boundaries, but more importantly, are these speeds realistic? It needs some discussions regarding how fast the density signal transfers. A speed of 0.3-0.4 m/s seems really fast to me (until I saw 2m/s later in GC2 experiment), what does this speed represent? Do we have observational/theoretical supports? The subpolar density exhibits a significant variability in the last several decades, why we do not see similar variability in the south.

L314 and later in this section: 2004-2010 should be 2004-2009

L325: It seems to me an overstatement that the model and observations are very similar here. Not only the PC differ significantly for the first half of the time series, but also the model EOF pattern exhibit much lower magnitude. Also, is the length of the record the only key factor that leads to the difference between BUOY and CTRL (and RAPID)? Although Figure 1b with longer record does show a significant correlation between CTRL and BUOY (in AMOC), the similarity is mainly due to the decadal variability during 1970s-1990s, for which I am not sure if there is any observational support. The similarity/difference between the two experiments display significant time-dependence.

L372: The phase speed in GC2 is faster than in the forced simulations by a factor of 5-7 and clearly need some explanations. How robust are the model results, especially, to different model resolution?

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