

Interactive comment on “Changes in ocean circulation and carbon storage are decoupled from air-sea CO₂ fluxes” by I. Marinov and A. Gnanadesikan

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Response to reviewers

We thank the reviewers for their encouragement of this work and for their constructive suggestions. Our response is given below.

Reviewer 2 raises two major issues:

II.1. Whether the use of a simple biogeochemical model affects the results.

In fact by allowing the surface preformed nutrients to remain relatively constant, the OCMIP restoring model has proved useful in analyzing the dynamics of ocean carbon

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storage. This restoring allows us to decouple the direct effects of mixing on ocean carbon storage via the transport of carbon and nutrients to the deep ocean from the indirect effect of mixing in changing surface nutrients (as shown in Marinov et al. 2008a). This is also true for the use of surface restoring in temperature and salinity. We now make this point in two separate paragraphs in the manuscript, and have as suggested, moved this discussion from the caveats to the methods section.

II.2. Whether numerical diffusion is important.

Gnanadesikan et al. (2003) shows that the model solutions do a pretty good job at reproducing the Gnanadesikan (1999) scalings, with relatively weak diapycnal upwelling in low latitudes at small diffusion. This is likely because the forcing fields vary relatively smoothly in time (we use monthly-varying forcing) and because the third-order advection scheme we use is relatively non-diffusive. (Recent simulations by the coauthor find very different results with a more up-to-date version of the model so this point is well taken!). We have added language to the penultimate paragraph of the methods section discussing this point.

We have made all the wording changes suggested by this reviewer.

Interactive comment on Biogeosciences Discuss., 7, 7985, 2010.