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Ocean Science Discussions

Interactive comment on "How does ocean ventilation change under global warming?" *by* A. Gnanadesikan et al.

Anonymous Referee #1

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Review of "How does ventilation change under global warming?" by Gnanadesian et al.

This manuscript uses several recent coupled GCMs to examine how the ocean ventilation might evolve in a higher CO2 climate. Even though the increased stratification reduces the subduction of younger mixed layer waters below the thermocline, the authors suggest that a decrease of upwelling from deeper, hence older, waters is responsible for younger waters modelled at intermediate depth. They brifely examine the implications for the biological cycle.

This manuscript is interesting and reconciles apparently contradictory trends (thermal stratification vs. younger water below the thermocline). It uses some of the recent

IPCC AR4 simulations as well as older and simpler models. I recommend publication with following minor changes.

I also have a question that can be translated in a suggestion: why not use density projection, which is much more appropriate to follow water masses (i.e for figs. 1 and 3) ?

Detailed comments:

Intro: discussion on effet of Walker circultion and impact of enhanced hydrological cycle on ventilation a bit quick. Description of likely mechanisms is needed.

Description of simulations:

- I would add the IPCC AR4 runs terminology in here (pictnrl, ...)

- the R30 model is very different from the other two and attribution of different behavior difficult.

Results:

- 3rd paragraph:

- which observations are used for CFC-12 age ?

- value of isolines on Fig 1 are missing or hard to read. Color scales should be the same. Would benefit from being computed on a isopycnal rather than isobath.

- there is a problem in the west: the discrepencies need to be discussed.

- last 2 phrases: It is unclear what the authors are getting at. The link with the radiative forcing argument needs to be clearer.

- Fig. 6: difference between top and bottom curves unclear. Please add the zero line in fig 6d. At end of caption, "diffusive" should be "diffusion".

- Fig. 7: Please add the zero line in fig 7c

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Discussion:

- Second phrase: shouldn’t "young" be "old" (injected at the base) ?

- what does 1b in "(1b) Where w is ..." stand for ?

Conclusion:

- The PRINCE2 model is extremely coarse:

- why not use previous models ?

- what impact may this have on the results presented in Fig. 9 ?

- Fig. 9 does not have color and caption description is wrong (left, right instead of top, down or a, b) - revise text accordingly

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Interactive comment on Ocean Sci. Discuss., 3, 805, 2006.