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Interactive comment on "Formulation of an ocean model for global climate simulations" *by* S. M. Griffies et al.

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I'd like to thank David Webb for his comments both in this short comment and below. Since Steve Griffies is on vacation, I wanted to respond to this part of his thoughtful review. A full (and official) response to the reviewers will be forthcoming.

When we speak about building a "realistic" model we are really talking about two different things. One is getting the large-scale hydrographic fields, large-scale flow, and vertical exchange correct. The other is that the model includes processes and parameter settings that try to represent what we know about the ocean as realistically as possible.

The two are not identical. For example, my own work has shown that one can get the mean pycnocline depth and northern hemisphere overturning "correct" through varying some combination of the Southern Ocean winds, tropical diffusion and lateral mix-

ing from mesoscale eddies (Gnanadesikan 1999). Models run with Hellermann winds (which are too weak in the Southern Ocean) and realistic levels of vertical diffusion give too weak an overturning and too shallow a pycnocline.Given an initial state with compensating errors, improving the realism of a given parameterization will not necessarily improve the model as a whole- it may just reveal some error in the forcing. Moreover, as we found while developing models for the Ocean Carbon Model Intercomparison Project (Gnanadesikan et al., 2004), improving the "realism" of a model with respect to one field (say temperature or salinity) does not mean that it will improve with respect to another (say radiocarbon or oxygen).

Because of this it is important to have papers that show whether a model responds to a certain change without worrying too much about whether the particular change makes the model more or less realistic- essentially pointing out to other modelers what sorts of things might matter. I would argue that this paper does exactly that, pointing out problems that can occur when freshwater fluxes are added, potential sensitivities with the tapering of the Gent-McWilliams flux, a sensitivity to eddy viscosity, as well as highlighting other improvements to model realism that are documented in other papers. This allows others who are developing models to evaluate the formulation of a "state of the art" climate model in the open literature.

There is a legitimate issue, however, about how to judge such a model's realism in terms of simulation. We felt that documenting both the simulation and the formulation was too much for one paper. A second paper that does look at the simulation in more detail, focussing on key regions where it does not do well and examining the role of surface fluxes in determining the final circulation, can be found at http://www.gfdl.noaa.gov/~a1g/abstracts/cm2_ocean.html.

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