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4, S1630–S1632, 2007

Interactive Comment

Interactive comment on "Variability in air-sea O<sub>2</sub> and CO<sub>2</sub> fluxes and its impact on atmospheric potential oxygen (APO) and the partitioning of land and ocean carbon sinks" by C. D. Nevison et al.

#### Anonymous Referee #3

Received and published: 14 October 2007

The authors use an atmospheric transport model (MATCH) with data-based climatological (annual and seasonal) and WHOI-model derived O2 and CO2 air-sea fluxes to explore the various O2 and CO2 terms that contribute to APO. Using the terms that are perfectly known in the modeled world, they also quantify errors in land and ocean carbon sink partitioning due to uncertainty or neglect of various terms.

This paper is well-written and the discussion is clear. The results are timely and interesting to the Biogeosciences readership. I recommend publication. I have only a few minor points of clarification to suggest.



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Minor points

Section 1 - Lines 8-10 p 2879: Where does the 1.4 factor come into equation 1 that is being discussed here? Or does this belong with Equation 3? Also, please clarify the last phrase.

#### Section 2

- In section 2, I would like to see a table that graphically describes the experiments done. This would go along with having a standard name or acronym for each experiment that would be used throughout the text. This should help the reader to follow and distinguish the various simulations and their interpretation.

### Section 3

- 3.1, please add references to studies in which the CO2 cycle in APO seasonal variability

- In the introduction, or maybe here in section 3 where the issue is mentioned, a few words describing the ?reinforcing effects of biology and circulation on O2 fluxes? would be helpful. These mechanisms may not be clear to all readers.

- In the discussion of the seasonal rectifier, p 2889 -2890, please clarify why the seasonal rectifier issue is eliminated when climatological fluxes are used. Again, not all readers may understand this at first glance, and a few words would help, and will clarify the important conclusion on p 2890, lines 21-23.

- Section 3.3, figure 6. Can you show the data for IAV in APO? If not, please explain why it is not shown.

- Section 3,4, figure 10 is dense. It needs to be introduced a bit better at about p 2893, line 8. What is the overall concept here? Also, adding labels on the axes to summarize the various combinations used would help. See comment under figures below.

Section 4

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- To support the conclusion that the WHOI ocean model is superior in capturing observed APO to the data-based climatologies, it would be nice to treat the issue of the equatorial bulge that appears to be not well captured with the WHOI fluxes more straight-on. Best would be to run climatological WHOI fluxes in MATCH and show that they are as good / better than the climatological data fluxes shown in figure 5f. Another, easier, option would be to iterate here in the conclusions that the apparent poor performance of the WHOI model in the equatorial bulge is believed due to seasonal rectification in MATCH and not due to the WHOI model itself.

Figures

- Figure 3: Remove ?first column? from the beginning of the caption. Address Takahashi year in 3rd to last line (my printout have a black box here).

- Figure 5: "Top row" should be "Left hand side" and Bottom row should be "right hand side"

- Figure 10: Please add a bit of text in the bottom of each axes that gives some indication as to what each is showing. Reference comments above.

-Figure 11: I suggests in the last two lines: "(gray dash-dot)", "(gray dotted)" for clarity

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