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Biogeosciences Discussions

Interactive comment on "Impact of atmospheric and terrestrial CO_2 feedbacks on fertilization-induced marine carbon uptake" *by* A. Oschlies

Anonymous Referee #1

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General comments

This is the first published work I am aware of that quantitatively assesses the impact of atmospheric and terrestrial CO2 feedbacks on the fertilization-induced marine carbon uptake. The sensitivity of oceanic CO2 uptake to the changes in the marine biological carbon pump is important to understanding global carbon cycle in terms of response to global warming, which might induce significant disturbances of the marine biological pump, and natural and purposeful ocean fertilization, in particular using iron. Although numerical models have been used to investigate this problem, the published results cover a large range, differring by a factor of 2 or more. This work is an interesting and

valuable study. It investigated the impacts of different assumptions used in the published works and conducted four sensitivity experiments in two scenarios over different time scales from annual timescales to millennial timescales. The main conclusion that the atmospheric and terrestrial CO2 feedbacks contribute a substantial fraction of oceanic carbon uptake in natural or purposeful ocean fertilization has important implications for understanding and predicting the impact of changes in the biological pump on atmospheric CO2.

The topic of this manuscript is within the scope of BG. The manuscript is well-written and presents new and comprehensive results with substantial conclusions. It should be accepted for publication with only minor revisions as outlined below.

Specific comments

1. Abstract: Considering the large uncertainty existing on the terrestrial feedback, the conclusion stated in the last two sentences might be too strong. For example, the sensitivity of land carbon storage to atmospheric pCO2 for the terrestrial component used in this study has changed from 1.2 PgC/uatm to 0.5 PgC/uatm.

2. Model: It will be helpful to the readers if the author can add a short description of UVic Earth System Climate Model. For example, the different components and horizontal and vertical resolutions.

3. Model experiments: I suggest using a table to summarize all experiments to replace Figure 1 and the text on page 4499, between line 3 and 21. There are many repeating information in current version.

Technical corrections

Page 4498, line 20: There is a dash in "pCO2-sensitive". It should be the same over the whole paper, either with a dash or no dash.

Page 4498, line 23: Remove extra "under" in the end of this line.

Page 4498, line 22: add “an” at the beginning of this line.

Page 4503, line 7: What does it mean by “a globally uniform perturbation of the biological pump”? Although the C:N ratio is the same, the strength of biological pump is different over different regions. Or else the model is a kind of box model?

Page 4509-4511: There is at least one number after each reference, representing where the reference is cited. Is this standard format?

Page 4512, Table 1: Does ASE represent “air-sea CO2 flux” or air-sea CO2 exchange?

Page 4517-4524, Fig. 2-9: put labels a-b at same position relative to the sub-panels and with smaller character. All x and y axis labels are too light.

Page 4517, Fig.2.: Reduce the size of the font in the legend. Remove “Different colors refer to the different experiments (see text)” in the caption.

Page 4518, Fig.2.: The legend and the text in the caption are duplicated. Remove one. Replace "delta" in the y label with a symbol of it . (do the same for some other figures).

Page 4519, Fig 4.: Remove text of “Color code as in previous figures” in the caption. The same for some other figures. Replace "int" in the y label with a symbol of it . (do the same for some other figures).

Page 4524, Fig 9.: remove labels “global, tropics. S. Ocean, and tropics, k=1” that follow the labels a, b, c, and d. They are duplicated with that in the caption. The color code in this figure is different from previous figures. Keep it the same.

Page 4525, Fig. 10.: Remove the last sentence in the caption. Keep the color code the same as previous figures.

Interactive comment on Biogeosciences Discuss., 6, 4493, 2009.