Biogeosciences Discuss., 4, S1338–S1340, 2007
www.biogeosciences-discuss.net/4/S1338/2007/

Biogeosciences Discussions

Interactive comment on "Adjoint sensitivity of the air-sea CO_2 flux to ecosystem parameterization in a three-dimensional global ocean carbon cycle model" *by* J. F. Tjiputra and A. M. E. Winguth

J. F. Tjiputra and A. M. E. Winguth

Received and published: 11 September 2007

The authors thank referee #1 for his/her valuable and critical evaluations and comments, which significantly improved the overall quality of the manuscript. Below are the responses for every comments raised by referee #1:

Referee#1: The overall objectives of the manuscript are indeed somehow confusing. Do the authors aim at understanding the potential impact of the climate change on air-sea CO2 fluxes or do they want to understand how their model behaves?

The manuscript objective has been clarified. The goal of the study is to explore the sensitivity of the model results, which (discussed later in the manuscript) can be used to address future question associated with the climate change.

R1: The abstract is particularly symptomatic: It is said that ?reducing the herbivores? ingestion parameter in the model by 25% could increase the global uptake of atmospheric carbon by 6 PgC?, which looks to me as the result of a sensitivity test for a better understanding of the model since it is very unlikely that the climate change will affect only herbivores in the future. However the next (and last) sentence is ?Thus, climate induced changes in the marine ecosystem structure are of importance for the future uptake of atmospheric CO2?. This is likely true, but I do not see anything in this study that support this conclusion (and certainly not the previous sentence).

The authors agree with referee1 that the abstract is confusing; therefore, it has been substantially revised.

R1: The conclusion is also weird, with its long last paragraph about what are the weaknesses and limitations of the current study. I suggest that the authors do reconsider the structure of their manuscript. This last paragraph should be a part of a ?discussion? section in which they should also explain their strategy to use this adjoint model approach to address the impact of future climate change on ecosystem and thus on the air-sea flux.

The revised manuscript's structure is modified as suggested. We have included a discussion section, which provide detail discussion on the strategy of addressing future climate change related questions by applying the adjoint method.

R1: In section 3, they should try to avoid ambiguities about the significance of their results with respect to climate change by making it more ?technical and complete? about what we learn about the model with these sensitivity tests.

The interpretation of the study's results with respect to climate change is minimized. In addition, we have added more detail analysis with respect to the sensitivity results.

R1: I have a last comment. Figure 1 shows that there is a large discrepancy between the seasonal cycle of the air-sea flux of the model and that of the Takahashi et al.

BGD

4, S1338–S1340, 2007

(2002) climatology. It is unclear how was performed the comparison since there is very little data available in the climatology. Is there a bias due to the lack of data or is it a problem with the model itself? This is of importance since the authors discuss in details the case of the Southern Ocean throughout the paper. This problem should at least be address in the ?discussion? section.

The revised manuscript has included more detail explanation on how the data are compiled and compared with the model output. We have also included further discussion on the bias shown in the Southern Ocean.

Interactive comment on Biogeosciences Discuss., 4, 1377, 2007.