Biogeosciences Discuss., 10, C4643–C4647, 2013
www.biogeosciences-discuss.net/10/C4643/2013/

Biogeosciences
Discussions
Open Access

Interactive comment on "Natural ocean carbon cycle sensitivity to parameterizations of the recycling in a climate model" *by* A. Romanou et al.

Anonymous Referee #1

Received and published: 30 August 2013

Review Romanou et al. – overall statements

The manuscript "Natural ocean carbon cycle sensitivity to parameterizations of the recycling in a climate model" by Romanou et al. tackles the relevant problem of model sensitivities to both physical and biological model uncertainties. Unfortunately the methods used are partly not transparently shown in the text. In other cases they appear to be not always appropriate.

- The different hydrodynamic model results must be shown in the manuscript, especially those which induce the differences in the biogeochemical results.

- The application of (very) different remineralisation rates represents an almost trivial exercise simulating two different situations: an efficient export system and a near sur-

face recycling system. Concepts like the remineralisation length developed by others (Kriest and Oschlies, 2008) are not applied.

- Necessary ingredients of biogeochemical models like preferential remineralisation of different elements in particulate organic matter or the dynamics of the carbonate system governing the partial pressure of CO2 seem to be neglected or not discussed.

- In many cases the figures are in bad condition (too small, lettering wrong).

I suggest to accept the manuscript only after major revisions.

Detailed statements

The abstract should be enriched by some concrete results.

Page 11114 line 25: Specify "simpler". Which features induce a better skill for surface properties?

P 11115 line 17: ".. the remineralisation rate within two different ocean models". You mean the remineralisation rate in the biogeochemical model?

P 11116 Model description: Even though the model setup might be described elsewhere, please give the relevant issues here: How long was the spin-up of the coupled model? Which correction factors were applied? Which years were simulated? Is the present-day situation shown? Was the meteorological component free running or did you use reanalysed fields? Was the atmospheric pCO2 fixed or was it in response to the ocean? How did you handle ice dynamics?

P 11116 line 5: ".. the Russel or HYCOM oceans": avoid such slang. You mean the different simulated ocean dynamics, right?

P 11116 line 9: "Vertical coordinate is mass per unit area", please describe in detail.

Page 11117 line 16: How does the correction factor work? Has it implications on the pump mechanism?

Page 11117 line 27: “carbon submodel”: no carbonate system module included? Then all statements regarding CO2 and air-sea exchange become very difficult because physical and biological variations change the distribution of the species (CO2, HCO3-, CO3–) in the system and thus the partial pressure of CO2.

Page 11118 line 22: In your model you assume detrital C:N to be constant. Discuss this.

P 11119 Results: Give details of the different hydrodynamic outcome of the models, especially those which induces differences in biogeochemical results which are discussed later.

P 11120 detritus equation ff: Do you use constant C:Chl ratio? Give the numbers used for all the constants and justify the choices.

P 11121 line 1: Show the SST distributions.

P 11121 line 5: In Fig 2 plot a third column showing the differences between first and second column.

P 11121 line 9: You mean the subarctic front?

P 11122 line 11: Write “detritus concentration is larger ..”

P 11121 eq 6 ff: Give the values of the constants used and justify your choice.

P 11123 line 21: The effective remineralisation rate is a normalised parameter which cannot be translated into absolute numbers of nitrate concentration.

P11124 line 11: Your conclusion holds for the two models you have used. Be careful with generalisations.

P 11125 line 7: Here you refer to some aspects of the physical models. These features must be discussed in section “Model description” or “Results (physical)”.

P 11125 line 25: Why are diatoms less influenced by remineralisation rate changes?

P 11126 line 21: Which other nutrients? As you have a fixed ratio of elements in detritus all nutrients should be remineralised in the same way.

P 11126 line 24: The f ratio is defined as nitrate uptake divided by nitrate plus ammonium uptake. Please justify your definition.

P 11126 line 27: The results related to this very large interval of export efficiencies must have overlaps with observational data. If you compare your results with observational data, which is not essential for this paper, do it more precise: Give tables ore Taylor – Diagrams.

P 11127 line 3-7: This sentence is a mystery to me.

P 11127 eq 7: Comparing the magnitudes of the different summands, it becomes clear that the last one dominates. Discuss the meaning of it.

P11128 line 26 ff: This argument is misleading. Vertical mixing should increase when the vertical gradient of a tracer gets larger (as long the diffusion coefficient allows it). The explanation of higher DIC in the upper water when using higher remineralisation rates is trivial: It’s because most of the organic matter is remineralised near the surface when the corresponding remineralisation rates are high (or sinking speed low).

P 11129 line 1: Why “more diffuse”?

P 11129 line 10 ff: I have doubts whether this section can be used without simulating the carbonate chemistry.

P 11140 Table 1: Omit this table or give a substantial statistic for validation.

P 11142 ff Figures: Give for all figures correct values for longitudes and latitudes.

P 11142 Fig. 2: Indicate surface, 500m, 1000m, 3000m in relation to the graphs.

P 11146: Fig. 6 Give correct units for Chl and primary prod.

P 11147 Fig. 7: Enlarge.

P 11148 Fig. 8: Enlarge.

P 11149 Fig. 9: PgC yr-1 is not a concentration unit.

P 11150 Fig. 10: “DIC surface along -179”. Give the correct notation and possibly indicate the section in Fig. 9. The legend should say “red is ..”.

P 11152 Fig. 12: “06 refers to ..” I cannot see “06” or “08”.

P 11153 Fig. 13: “mmoles” you mean “mmol”?

Interactive comment on Biogeosciences Discuss., 10, 11111, 2013.