Biogeosciences Discuss., 6, S116–S120, 2009
www.biogeosciences-discuss.net/6/S116/2009/

Biogeosciences Discussions

Interactive comment on "Contribution of riverine nutrients to the silicon biogeochemistry of the global ocean – a model study" *by* C. Y. Bernard et al.

Anonymous Referee #3

Received and published: 14 February 2009

Review - Biogeosciences Discussions

Manuscript : Contribution of riverine nutrients to the silicon biogeochemistry of the global ocean - a model study

C.Y. Bernard, H.H. Dürr, C. Heinze, J. Segschneider, E. Maier-Reimer

GENERAL COMMENTS:

The manuscript brings in a model study coupling the riverine input of nutrients to a global biogeochemical model. Until now there have been just a few studies considering the role of riverine nutrient inputs to the global ocean biogeochemistry, and this is an

important step to improve current knowledge on this subject.

The manuscript is concise and easy to read. However there were a few points that should have been addressed in the "Results" and "Discussion" section, that could improve the manuscript quality. These points will be addressed in the "Specific Comments" section of the review.

About the use of semi-colon: it should be avoided to improve the readability of the text. Preferably use shorter sentences.

SPECIFIC COMMENTS:

Abstract, Page 1092, line 8:

a) What do the authors mean exactly by "biogeochemical state"? It is true that coupling riverine nutrient inputs to the model is an improvement, but it would also be useful for the readers to have a comparison of the results of a model run with and without river nutrients, with a global ocean database such as the World Ocean Atlas for instance. The authors could compare the distribution of dissolved silica, and dissolved phosphate (or nitrate) in the surface ocean layer.

b) The manuscript would also benefit from an estimate of how much of the global primary production (and export production) is sustained by riverine silica inputs. Since the authors also found "hotspots" for silica inputs, regional estimates would be interesting for the reader too.

Page 1095, line 18:

The model resolution is poorer in the tropics (390 km). Does that apply also to the equatorial band? If yes, does the model have enough resolution to simulate the nutrient cycles in the Amazon plume depicted in figure 4? Which area (latitude, longitude) was integrated for the results shown in figure 4?

Lines 25-26:

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Is it possible to have a reference for the link to the HAMMOCC5 and MPI-OM web page? What is the difference between the web page and the document of Maier-Reimer et al., 2005?

Page 1096, lines 10-12:

Why the authors did not consider the atmospheric silica input? In the model study (Cotrim da Cunha et al., 2007), the aeolian silica input was 5.75 Tg Si a-1 (considering that dust contains ˜30% Si, and that only 7.5% of it is soluble i.e. readily available for the phytoplankton (Moore et al., 2002). This is comparable (and non-negligible) to the riverine silica input.

Lines 20-27:

It would be clearer to the reader if the authors explained already in the first paragraph that the nutrients N and P are linked by the Redfield ratio.

Page 1099, lines 6-10:

It is very good that the authors show the amount of CPU hours needed for each model run.

Lines 23-end: I suppose not, but did the authors use the COSCAT freshwater input in the model? Or did you use the MPI-OM freshwater input to the ocean? This should be clarified.

Page 1101, lines 5-10:

Could you give names and a brief description of each one of the runs? You could use a table to show the amount of river nutrients inputs in each one of them.

Page 1102

Here again one may ask if the model has enough resolution for analyzing the results in small areas such as the Java Sea.

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Lines22-26:

Did you run a simulation only with C, N and P and no silica? This would be an interesting way to test the "effect" of riverine silica in ocean biogeochemistry. In this manuscript, since all river nutrients were added together, one may ask how important the contribution of riverine silica really is to the ocean biogeochemistry.

Page 1103:

Please refer to the general comment about the use of semi-colon.

Page 1104:

Could you give numbers to compare the eolian, rain, and river inputs?

Page 1107:

Lines 17-18: The sentence "The active recycling..." is not clear. What happens in coastal upwelling regimes?

Lines 21-23: the authors could cite the model study of (Giraud et al., 2008), where the coastal cells of the model had the vertical mixing coefficient enhanced to "simulate" nutrient resuspension in this area.

Page 1108:

Here the authors could create a section like "Future/Perspectives".

Page 1109:

The manuscript would benefit from a section where the limitations of this model study are addressed, before the conclusions.

Another question that was not fully addressed in the manuscript is : Model results suggest that river Si enhances photosynthesis. In this case, could you give an estimate of how much (in gC yr-1, for instance) does river Si affect/impact the global ocean primary and export productions?

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Interactive Comment

Page 1118:

Figure 4 caption: Please explain first the upper panels, then the lower panels.

REFERENCES:

Cotrim da Cunha, L., Buitenhuis, E.T., Le Quéré, C., Giraud, X. and Ludwig, W., 2007. Potential impact of changes in river nutrient supply on global ocean biogeochemistry. Global Biogeochemical Cycles, 21(GB4007): doi:10.1029/2006GB002718.

Giraud, X., Le Quéré, C. and da Cunha, L.C., 2008. Importance of coastal nutrient supply for global ocean biogeochemistry. Global Biogeochemical Cycles 22(GB2025): doi:10.1029/2006GB002717.

Moore, J.K., Doney, S.C., Glover, D.M. and Fung, I.Y., 2002. Iron cycling and nutrient-limitation patterns in surface waters of the World Ocean. Deep-Sea Research Part II, 49(1-3): 463.

Interactive comment on Biogeosciences Discuss., 6, 1091, 2009.