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Interactive comment on “Top-down, bottom-up and physical controls on diatom-diazotroph assemblage growth in the Amazon River Plume” by M. R. Stukel et al.

Anonymous Referee #2

Received and published: 24 November 2013

In this article the authors explore the reason for the diatom-diazotroph assemblages (DDA) bloom in the Amazon river plume. The authors nicely find that it is not only bottom up pressures (i.e. availability of needed nutrients) that lead to these blooms, but in particular the blooms occur when grazing pressure dips further from the river nutrient loading. Long periods in suitable water is needed as the growth rates are so slow. This combination of effects, and following of Lagrangian particles to elucidate the competing effects is really nice. I do however have some reservation on the document and suggest some improvements.

The major comment I have is:

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Though the article makes a point that it concentrates on the DDA, I think it would be a lot better if more attention was given to all the diazotrophs. It is important to consider the results found here in context of the other diazotrophs and the model shows distinct geographic distribution of the 3 types of diazotrophs. The authors make much that their model includes 3 types of diazotrophs while other model usually have just one: this begs the question of how do they all exist in the model: what is special about each that leads it to live where it does. It would be very nice to have a more complete explanation of why each diazotroph exists where it does, which develop blooms and which do not. This could even be done in context of the Lagrangian particles: when/where do other diazotrophs take over; what are the grazing/nutrient pressures on each when there are switches in dominant types. Though the paper can still concentrate on the DDA, knowing more about the other competing species would put these results into better context.

Things that seem to be important to understand: how important is the fact that DDA grow faster when nitrate replete, while other diazotrophs do not? Though the sensitivity experiments have some interest (though see below) it does not test such on/off type switches. What happens if DDA have only one maximum growth rate etc. How important are the different growth rates versus different grazing levels impact the distributions? How important are the relative assumptions in grazing needs and nutrient needs?

On more minor points:

- It would be good to have a paragraph in the introduction which gave a fuller description on the three diazotroph types, especially DDA's as they are less well known. This would then connect to the model description and provide an explanation of model choices (e.g. why DDA have two coefficients reducing the maximum growth rate)

- there is very little observations of DDA's blooms: so much of the results here are just "model" - I think a little more attention should be given to this point (a few more

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sentences).

- A matter of taste, but I found the number of acronyms very hard to follow. Since they are not mentioned often it would be less confusing to write out in full ARP, WTNA etc.
- Though I appreciate the sensitivity experiment I have some concerns: 4 months seems very short (though I understand the computational cost) - but would some parameters appear more important in the longer term (e.g. riverine N, P etc). As mentioned before, there is no test on on/off type parameters, or on differences (e.g. if remineralization on N and P were not so different): these could be considerably more sensitive. I find Figure 9 hard to follow, especially given the poor resolution. But it also only looks at gross values - not for instance in changes in distributions and patterns that given the nature of this study may be more important.
- Though probably from my own ignorance, I also had some difficulty following the discussion of Figure 10. The authors state that the nutrients separate based on DIP:DIN ratios. I can't quite understand how they see this on the figure. Other comments made on this figure are also a bit difficult to see. I suggest a bit more discussion of what aspects of the figure should be looked at to see these points for those of us with limited understanding of PCA. It would be a pity to lose the insight gained from this analysis.
- line 26: what do you mean by "loading score"
- table 1a: N:P ratio of diaz is repeated twice
- why are UMD and DDA "growth penalty" different? (Occam's razor approach would suggest they should be the same).

Interactive comment on Biogeosciences Discuss., 10, 13931, 2013.

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10, C6819–C6821, 2013

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