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Biogeosciences Discussions

Interactive comment on "Latitudinal distribution of *Trichodesmium* spp. and N_2 fixation in the Atlantic Ocean" *by* A. Fernández et al.

Anonymous Referee #2

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Fernandez et al. present a latitudinal distribution of the diazotroph Trichodesmium and N2 fixation during two cruises in the N. Atlantic. Their cruises are during Nov.-Dec., 2007 and Apr.-May, Oct 2008. They show that the highest abundances of Trichodesmium and N2 fixation rates are between 5°S and 15°N during both cruises, with much less in the S. Atlantic gyre. These rates and distributions are then correlated to aerosol optical depth (AOD) and subsequently iron input. Finally, they scale their rate measurements up to admittedly conservative total N. Atlantic N2 fixation rates of ∼6 TgN yr-1 and S. Atlantic rates equal to ∼1.2 TgN y-1.

Overall this is a well-written manuscript, and one I recommend for publication in Biogeosciences. I rank the scientific significance, scientific quality, and presentation quality as good. However, prior to publication I hope the authors can address a few items:

1. Please note your detection limits for the PO4 measurements. The text says that standard colorimetric methods were used and the detection limit of this technique approximates the presented N. Atlantic concentrations.

2. Please provide more detail regarding the AOD. Specifically, you use seasonal data. Is there data on a finer temporal resolution (8-day, or daily) just prior to each measurement? Is there a way to estimate deposition? Or residence times of dust derived Fe in the mixed layer (perhaps Croot et al. 2004 GRL could be helpful). My thought is that data on a finer temporal resolution may help explain why during 2008 Trichodesmium distributions were shifted south. Where was the ITCZ during the different cruises?

3. A possible contributor to the further south distribution of Trichodesmium during the 2008 campaign is the B-V frequency over the upper 125m. Figure 3 shows the peak is broader and shifted south. Is this possible?

4. Please explain in a bit more detail the argument regarding vertical migration and water column stability on lines 20-23 page 2205. Wouldn't a less stable water column result in mixing of nutrients up or cells down and thus less energetic expenditure to migrate?

5. Did you look at the integrity of cells that came through the ship's non-toxic water supply? Was there any type of physiological measurement that might indicate if the cells were stressed from the pump system (e.g. Fv/Fm comparison of trichomes collected using different methods?) Please note if information exists.

6. In the last paragraph of section 3.4 the sentence. . . "There was a strong correlation between surface N2 fixation and euphotic layer integrated N2 fixation" is expected. N2 fixation by Trichodesmium is light dependent and occurs in the surface of the ocean. I am not sure what this correlation adds? Please explain.

7. The 2nd paragraph of sec. 4.2 needs work. It seems to argue that phosphorus is not a control on N2 fixation because it is high in the South Atlantic but low in the

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North Atlantic. The low PO4 in the N. Atlantic is likely the consequence of the dust (Fe) stimulated diazotrophy. PO4 is likely high in the South Atlantic because Fe inputs are low. This is stated towards the end of the paragraph. However, I do not believe the statement that P availability is unimportant in controlling the large-scale distribution of N2 fixation in the Atlantic. PO4 was measured here and not P availability. The DOP pool is available to Trichodesmium and is drawn down in the North Atlantic relative to the South Atlantic. Clearly P is important for diazotrophy, though because of the DOP pool it is not limiting.

8. Section 5, end of first paragraph presents a range of geochemical estimates for whole Atlantic N2 fixation. By whole Atlantic do you mean N. Atlantic? Isn't the Knapp et al. 2008 estimate a N. Atlantic study? Likewise, Hansell et al. 2007(?) have lower estimates than those presented here.

9. In the last paragraph of the paper you estimate contribution of N2 fixation to the total new N input in the N. Atlantic. This is likely an overestimate as the input of atmospheric anthropogenic N is relatively large. See review by Duce et al. 2008.

10. Lastly, throughout the manuscript please write N2 fixation rates when speaking of measured rates and N2 fixation when speaking in general terms about the microbial process (i.e N2 fixation rates were highest between 5°S and 15°N not N2 fixation was highest between 5°S and 15°N)

Interactive comment on Biogeosciences Discuss., 7, 2195, 2010.