

Biogeosciences Discuss., author comment AC1
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Reply on RC2

Carolin Löscher

Author comment on "Reviews and syntheses: Trends in primary production in the Bay of Bengal – is it at a tipping point?" by Carolin R. Löscher, Biogeosciences Discuss.,
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Dear Dr Singh,

Thank you for this encouraging and constructive review, I am especially grateful for providing missing information and references for table 1. It is indeed quite a challenge to find everything and I am happy that you kindly provided what I didn't see.

In the revised version of the manuscript I included missing references/ information in table 1 as suggested, and included all your other comments:

Line 13: due their -> due to their

- changed accordingly

line 33: "carbon flux from the atmosphere into the ocean of 45- 50 Tg C per year". This flux is too low. This should be Peta-gram (Pg) per year, and even higher >90 Pg per year (Sabine et al., 2004; Sarmiento & Gruber, 2002). Longhurst et al. (1995) provided flux is Gt (giga tonnes) per year, which is same as Pg per year.

- Apologies for the confusion, which has been modified to 'carbon flux from the atmosphere into the ocean of 45- 50 Pg C and up to 90 Pg C per year per year (Sabine et al., 2004; Sarmiento & Gruber, 2002; Longhurst et al., 1995).'

Line 47: delta -> δ

- changed accordingly

Line 47: "isotope records lastly were enriched for delta15N, indicative for nitrogen fixation". I understand what is meant here but it could mislead/misinterpreted as high $\delta^{15}\text{N}$ (enriched in ^{15}N) would mean no nitrogen fixation.

- Good point, this resulted from a somewhat narrow nitrogen fixation perspective, I have changed it to 'isotope records of $\delta^{15}\text{N}$ where in the range considered indicative for

nitrogen fixation (Dähnke and Thamdrup, 2013).

Line 47: "enriched for delta 15N", there is a technical issue here. $\delta^{15}\text{N}$ is defined mathematically, it can be high/low, positive/negative but cannot be enriched/depleted. Reservoir may be enriched/depleted in 15N. So I would just say: "enriched in ^{15}N "

- Agreed, and changed accordingly, this is actually an important distinction.

Line 49: "on a geological time scale" is redundant as "geological record suggests" and "last glacial maximum" are parts of the same sentence.

- It is redundant and has been removed.

Line 51: Indian ocean -> Indian Ocean

- Changed accordingly.

Line 54 and elsewhere: Primary production, by definition, is a rate of fixed carbon. So "rates" is redundant in "Primary production rates".

- Changed throughout the manuscript.

Lines 58-59: "Some of those earlier measurements were, however, likely biased as a result of trace metal contamination before trace metal clean techniques were available" Most (if not all) primary production incubations are not done in trace metal clean equipment.

- I was not aware of this, I was thinking along the lines of acid washing etc and cited another collection of data, which essentially referred to rates having possibly be boosted by unwanted trace metal additions. However, this is actually a valid point, how would we know. The rates are probably as good as they are now.

Line 67: Table1 -> Table 1

- Changed accordingly.

Line 70: "three monsoon". winter and summer, what is the third one?

- Changed to 'two'.

Line 73: "one to two orders of magnitude below the Arabian Sea" one sounds reasonable, two seems to be quite stretched.

- The statement is based on the overviews provided by Naqvi and colleagues from 2010, but I agree, if we compare the data conservatively, one order of magnitude is correct. Therefore, this has been changed.

Lines 111-115: seems some grammatical issue with the sentence.

- Agreed, I split the sentence and modified it as follows: 'A community shift in small cyanobacteria may be somewhat speculative and quantitatively not chiefly be relevant for bulk primary production. However, an overall increase in abundance of small

cyanobacteria in concert with a decrease of eukaryotic primary producers would be expected to impact BoB biogeochemistry, especially with regard to the spatial expansion and the intensity of the OMZ through modified export production and respiration in low oxygen intermediate waters.'

Line 127: "Over the last two decades, primary production in the global ocean has decreased (Gregg et al. 2003; Behrenfeld et al. 2006)". Since the references are old, it will be helpful to mention the exact duration of the decade. Also, see this recent article by Kulk et al. (2020) that proposed a non-linear trend in productivity.

- There were studies suggesting that primary production in the global ocean has decreased based on satellite data from 1998 to 2015 (Gregg et al. 2003; Behrenfeld et al. 2006), a recent study, however, derived a nonlinear trend in primary production from a similar time episode, between 1998 and 2018 (Kulk et al., 2020).

Line 179: cycles able -> cycles that are able

- Changed accordingly.

The suggested references were included in the manuscript.

Thanks, again for the helpful insights.

All the best

Carolin Löscher