

# ***Interactive comment on “Water column biogeochemistry of oxygen minimum zones in the eastern tropical North Atlantic and eastern tropical South Pacific Oceans” by C. R. Löscher et al.***

## **Anonymous Referee #2**

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This review article is difficult to read. It attempts to address many aspects on the water column biogeochemistry of the ETNP and the ETNA OMZ, but does not succeed to provide a unifying and digestible manuscript. It is largely an assemblage of many facts that are not sufficiently well tied together. The English is often confusing, at times misleading, and written in complicated style, which makes some sections (not all) hard to follow, in particular when it gets really detailed. A very large amount of work has gone into writing this paper, but this is still an unfinished product that requires a better red thread, i.e., several key arguments, and a better thought-through logic that invokes these key arguments throughout the text. The reader would benefit from the presentation of clear major conclusions that synthesize the diversity of observations

better. I would recommend to leave out sections and details that are obsolete for the development of these key arguments. The level of detail needs to be adjusted to make the review digestible. The subdivisions definitely helped in the writing, but not necessarily in educating the reader, because the section ends and starts don't flow into each other. In particular, several times the authors end a section by using a style of the kind "this should be done in the future ..." or "this is in agreement with the hypothesis of ..." and then stop without developing the argument further. This makes the endings for the subdivisions often very abrupt so that the reader gets the impression that the thoughts are cut off and insufficiently thought to the end. Apparently different authors have written the subsections, which adds to an overall incohesiveness of the whole manuscript. It is encyclopedic in some parts, but limited in others, which is of course the problem with any review, but other reviews do a much better job in joining the different parts together and help the reader connect the different parts together. Often the information provided is not sufficiently well explained for a non-specialist to understand the implications. Since this review often reports key findings of work done by specific research groups at the University of Kiel and their associates, there is a lingering doubt, how much the review is biased to present certain paradigms from these research groups. It is often not clear how much these paradigms support or oppose earlier or other views by other research groups. There is too little discussion on this. The selected figures are too few. I would have liked to see more figures accompanying the text. Please add a table of contents for the MS.

Specific comments: P4500: I.14-15 Can Fe and Mn and SO<sub>4</sub> reduction really be distinguished based on O<sub>2</sub> levels? 4501, I.10 connect sentence. 4501, I.24-25: Explain how? In a review such a sentence sounds odd and offers nothing. 4502: I.2 leave out visual. 4502, I.7 leave out brackets.

Overall comments to section 2.2: This section lacks a distinct thought structure. The reader is exposed to a lot of information that does not seem to have a particular logic or goal. In addition, this section does not arrive at a conclusion that is used at the detailed

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level that is provided here. Please reduce to the essential that is needed to support your major line of argument.

4503, I.25 "to move forward.." The conclusion comes at an odd place and is phrased oddly. Move this together with your other conclusions to the end and synthesize better with the rest of the text.

Section 3: This section is very interesting, but as for the other section, it is poorly integrated. The information density is high, but what is critical for the reader to know? A hierarchy is needed. Better to be guided by a particular argument one wants to put forward than to present everything that is known even it is very interesting.

What is known about the temperature dependence of viral activity in the ocean?

4504, I.25: none-particle bound community: odd term.

4506. I. 27: Do you imply that microbes are protected in aggregates? Is the more direct evidence for this claim?

4507, I.1: Again the term "move forward" is used in the middle of the summary. Such a sentence is not needed in this summary.

4507, I.1 'lead' instead of 'led':

Section 4:

4507, I.23 leave out 'are'

4508, I.2-5. Again, recommendations for further research are made. If you find this so important to include, why don't you move your recommendations to a separate section rather than repeatedly distracting from the flow of the text with these inserts? It would be more useful if the sections are tied together better.

4508, I.11, who is 'they'?

4508: I.20 Is it necessary to use present the 5kPa partial pressure unit instead of one

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commonly used unit. This adds just unnecessary extra info.

4508, I.28: Move up verb in this sentence. Very hard to understand meaning.

4508: Section 4.2 fits better with section 2.

4509, I.2: replace 'to the' with 'in'

4510, , I.1 'pronounced'. Do you mean 'higher'?

4510, I.3-5. I don't understand this sentence very well. Can vertical velocities drive vertical tracer fluxes, or aren't vertical velocities derived from vertical tracer fluxes?

Section 5: Needs some restructuring. Again, the level of detail needs to be funneled such that the reader does not get completely confused by the sheer amount of information.

4512, I.21. Complicated sentence. Shouldn't this sentence be moved up? The key new paradigm is the spatial connection of N<sub>2</sub> fixation and N<sub>2</sub> loss. Make this more obvious.

4513, I.3. replace 'give'. The word give implies a causal relationship, whereby the N regime is a cause of the O<sub>2</sub> regime. There is, however, a mutual effect.

4513, I.17: Nitrification cannot be only N turnover process. In I.11 you say that dissimilar processes occur.

4513 I.27 - 4514: I.10 The extrapolation of the occurrence and significance of a process merely based on O<sub>2</sub> tolerance levels is very tentative and should be treated as such.

4514, I.12 leave out 'we could identify'. In essence N limitation was implied from experiments.

4514, I.11 to I.21. This is a very important section and strangely not given very much space or depth altogether compared to other detailed sections in the text. DOP discussion: Different paradigms or current views should be juxtaposed more clearly. What about Poly-P storage? Is the assumption of a Redfield stoichiometry justified? There

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is altogether a need for a separate P section or a section on CNPO stoichiometry in this paper.

4515, I.11. I saw a paper in ISME on N cycling on cyanobacterial aggregates by Klawnon et al. (2015). This might be a very useful reference to demonstrate co-existing N cycle processes in a cyanobacterial aggregate.

4516, I.1-2. Last sentence provides nothing.

Section 5.4. The title promises more than the text provides. This paragraph is more about the connection between Anammox and export fluxes than nutrient regeneration and primary production. Consider changing the title or do better justice to the title by including relevant information on nutrient regeneration and primary production.

## Section 6

Section 6.1 can be tied with the previous section 5.4. The section on stoichiometry comes too late. It would tie the different arguments together.

Section 6.2: The information here implies a major paradigm shift. I doubt many readers will understand this. Broaden this section, bring out its true significance and explain better. Section 6.2 is a very critical section, but unfortunately not explained well at all. It also ends very abruptly. Consider rewriting the whole paragraph. It is based on the argument put forward in Landolfi et al. (2013). Emphasize that this is a paradigm, but that the paradigm doesn't work too well for different reasons. The problem is that the section is quite confusing for a reader to figure out. I have difficulties understanding the meaning of the sentence 'Denitrification partly reverses the role of remineralisation in the nitrogen cycle of OMZ and acts to transform them into net sinks of fixed N, because ....' It's a huge sentence, very convoluted in style and very dense in information. The flow of the argument is interrupted by section 6.3 and then picks up in section 6.4. Restructuring is needed.

4517, I.16 Oxygenic respiration is the wrong term. Use Oxygen respiration. Biochem-

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ically the first sentence is misleading. A respiratory process does not regenerate an inorganic form of nitrogen.

4517, l.24 '... OMZs harbor diverse bacteria of the N cycle'.

4517, l.26, there are no nitrates, use singular.

Section 6.3 conveys a confusing message. Back to zooplankton, but very briefly. Is this section necessary or can this information be included elsewhere?

Section 6.4. This is a very informative section, but again, consider which key arguments you intend to put forward and focus on these. Introduce the optimality-based model. The term is not introduced prior.

Section 7: Section 7 should be tied with the previous section.

Section 8:

Retain style by providing an introduction paragraph

4525, l.25, remove 'indeed'

4526, l.25: What is exactly the recent hypothesis by Canfield et al. (2010)? This is written as if every reader should know this.

4527, l.21. 'implies'

Section 9:

4529, l.13: core community: State how you define a core community and what this means for OMZ.

Section 10: Cut out all your open questions from the text and paste them into this section.

4533, l.5. 'In detail, we aim....' . Who is 'we'? Shouldn't this be a general recommendation for further work?

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