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Biogeosciences Discussions

Interactive comment on "Origin and fate of the secondary nitrite maximum in the Arabian Sea" *by* P. Lam et al.

Anonymous Referee #1

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Review Journal: Biogeosciences Discuss. Title: Origin and Fate of the Secondary Nitrite Maximum in the Arabian Sea Author(s): P. Lam et al. MS No.: bg-2011-76 MS Type: Research Article

The present manuscript explores important N-cycling processes, in particular those associated with production and removal of NO2-, in the Arabian Sea. The region of sampling is of global interest as the Arabian Sea constitutes one of the three major oxygen minimum zones in the world's oceans. Under conditions of low oxygen or anoxic conditions, organic matter mineralization may proceed by pathways using oxidants other than molecular oxygen, e.g. denitrification. In denitrification nitrite/nitrate is used to oxidize organic matter producing N2. On the order of 10–20% of global oceanic nitrogen (N) loss to the atmosphere is estimated to occur in the oxygen minimum zone of the

Arabian Sea. The authors utilize a combination of 15N-incubation experiments, functional gene expression analyses, nutrient profiling and flux modeling to investigate the coupling between overall NO2- balance and active N-loss in the Arabian Sea. It was concluded that NO2- accumulated in the Central-NE Arabian Sea mainly due to nitrate reduction and to a certain extent from ammonium oxidation. Rates of NO2- consumption (anammox, denitrification and dissimilatory nitrate/nitrite reduction to ammonium) were not experimentally detectable, although loss of NO2- through oxidation to nitrate was predicted from modeled NO3- changes. The discrepancy between NO2- accumulation and lack of active N-loss in the Central-NE Arabian Sea was suggested a consequence from the deficiency of organic matter, directly required during heterotrophic denitrification and indirectly by anammox. Data provided in the manuscript supported that NO2- accumulation corresponded to a more long-term integrated N-loss in waters of the Arabian Sea.

Overall evaluation The manuscript is well-written and constitutes an important contribution that applies cutting-edge analytical techniques to the frequently debated question associated with N cycling and the nitrite maxima observed in oxygen deficient waters of the Arabian Sea. The authors provide solid and convincing experimental evidence combining a range of quantitative and qualitative analytical approaches. References included in the text are up-to-date and to the point (there are some recent additional references that should be added), which confirms a solid scientific impression. I cannot find anything fatal in their analysis that would severely compromise their conclusions. The overall impression is therefore excellent and I hereby provide my warmest recommendation for publication of this excellent and important manuscript. There are a few minor comments, but in no sense should they obstruct from publication.

âĂČ Minor comments p. 2361, l 19. . . ."detection limits 20, 30, 100 and 100 nm, respectively". Please note and clarify the difference between limit of detection and limit of quantification.

p.2362, l1. What would the consequences be from an organic matter composition

different from the assumed Redfield stoichiometry ?

p. 2366, l4-5. Redundant. Remove ?

p. 2370, l19-22. Any suggestions for eventual alternative electron acceptors ?

p. 2371, l9-12. Please provide the lowest rates that were detected using modeling and 15N incubations. What was the precision of rate measurements ?

Interactive comment on Biogeosciences Discuss., 8, 2357, 2011.