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Biogeosciences Discussions

Interactive comment on "Production of oceanic nitrous oxide by ammonia-oxidizing archaea" *by* C. R. Loescher et al.

Anonymous Referee #1

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General Comments

This manuscript adds to the growing body of evidence for the dominant role of ammonia-oxidizing archaea in nitrous oxide (N2O) production in the ocean. The authors provide field data from the eastern tropical North Atlantic (ETNA) and the eastern tropical South Pacific (ETSP) on N2O concentration as well as abundance and expression of bacterial and archaeal amoA genes, which show that the much more abundant archaeal amoA genes generally covary with N2O concentration especially in the ETNA. These data are supplemented with incubation experiments with seawater where inhibition of archaeal activity led to decrease in N2O production. Finally, a pure culture of an archaeal ammonia oxidizer is demonstrated to produce N2O with the enhancement of N2O yield at low oxygen levels.

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The manuscript is worthy of publication in Biogeosciences. The only substantial comment I have is on Section 7 (potential pathways of N2O production). Based on the 15N site preference data from the culture the authors conclude that N2O production occurs during the oxidation of ammonium to nitrite and not from the reduction of nitrite to N2O. However, I believe that the latter pathway (nitrifier denitrification) cannot be ruled out as an important mechanism. In fact, using labelled nitrite Nicholls et al. (2007) concluded that reduction of nitrite is the dominant metabolic pathway responsible for N2O production in the Arabian Sea. Moreover, the isotopic data presented by Santoro et al. (2011) also suggest that nitrifier denitrification may be a significant contributor to N2O formation, particularly at low oxygen levels. The sensitivity of N2O yield to the ambient oxygen concentration itself points to a reductive pathway. Are the site preference data available for the experiments the results of which are presented in Fig. 7?

Specific (minor) Comments

Page 2096, line 9: Please change “described” to “reported”.

Page 2096, line 12: Please move “(ETSP)” to between “Pacific” and “Oceans”.

Page 2097, first paragraph: Several statements are not supported by references (e.g. lines 9-10).

Page 2100, line 7: Please change “present” to “observed”.

Page 2102, line 19: Please change “is also depending on” to “also depends on”.

Page 2104, lines 4-7: Similar prediction has also been made by Naqvi et al. (2010).

Section 8.1 (methods summary): It is unusual (in Biogeosciences at least) to describe the methods in the end. Could this be moved forward?

Page 2104, line 11: Please change “according” to “following”.

Page 2104, line 19 (accordingly): According to what?

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Page 2106, line 20: Please change “CTD” to “CTD casts”.

Page 2107, line 8: Please remove “with”.

Page 2115 (Fig. 1): Stations corresponding to profiles I-VI may be identified in the map.

Additional References

Naqvi, S. W. A., Bange, H. W., Farías, L., Monteiro, P. M. S., Scranton, M. I., and Zhang, J.: Marine hypoxia/anoxia as a source of CH4 and N2O, Biogeosciences, 7, 2159-2190, 2010.

Nicholls, J. C., Davies, C. A., and Trimmer, M.: High-resolution profiles and nitrogen isotope tracing reveal a dominant source of nitrous oxide and multiple pathways of nitrogen gas formation in the central Arabian Sea, Limnol. Oceanogr., 52, 156–168, 2007.

Interactive comment on Biogeosciences Discuss., 9, 2095, 2012.