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Biogeosciences Discussions

Interactive comment on "Nitrous oxide distribution and its origin in the central and eastern South Pacific Subtropical Gyre" *by* J. Charpentier et al.

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General comments

We are deeply thankful for the useful comments of the anonymous reviewer. All your comments have been considered to enhance the revised version of this paper.

Specific comments

Response to specific comments:

1. The terminology has been corrected in the revised version, as suggested.

2. The Introduction section tries to briefly show the "state of the art" about microbiological processes that involve nitrogen transformations; therefore, I think that nitrite

oxidation must be mentioned. However, as you say, the role of nitrous oxide in this process is far from established. Some changes have been introduced to clarify this point.

3. Certainly Wrage et al. (2001) do not include kinetic data because theirs is a review about the present knowledge on nitrifier denitrification. The citation has been changed to the original source (Poth and Focht 1985). As for the conclusion of Sutka et al. (2006), the equality of nitrous oxide produced by denitrification and nitrifier denitrification refers to its isotopomeric signature and does not correspond to this part of the discussion.

4. Nitrifier denitrification has been referred to several times, as has the entire process from ammonium to nitrous oxide or nitrogen, to reflect that the reduced nitrite is produced by the same bacteria. That is the assumption of Wrage et al. (2001) (original source of the figure). We think that this description of the process is better.

5. As in item 3, the work of Schmidt et al. (2004) is a review and shows the current knowledge about isotopomers, including the statement introduced by Toyoda et al. (2002). The citation has been changed to the original source.

6. I think that the core of this paper is the interpretation of the isotopic and isotopomeric data to establish the possible mechanism responsible for forming nitrous oxide in the water column. The data showed do not differ much from the data presented previously by other authors in different marine regimes (e.g., Popp et al. 2002; Toyoda et al. 2002; Yamagishi et al. 2005). We offer, in this paper, a reinforcement of the interpretation of this data considering the current knowledge about the bacterial transformation of nitrogen in the sea. Also, we have outstanding and useful data to enhance our discussion, such as nutrient availability and particle accumulation. To change the sense of the discussion seems pointless to me.

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7. $\delta^{15}N_{bulk}$ has been defined as equivalent to conventional $\delta^{15}N$ (Toyoda and Yoshida 1999). We found that $\delta^{15}N_{bulk}$ shows no significative variation through the water column. This part of the discussion has been changed to clarify this point.

8. We argue that non-bacterial nitrous oxide production (such as assimilatory nitrate reduction) can be a source of N_2O given the O_2, nitrate, and light conditions indicated, as other authors have also suggested (Oudot et al. 1990). However, we have no evidence that this process is actually occurring. The discussion has been changed to clarify this point.

9. I think that the description of the mechanism proposed by Toyoda et al. (2002) is essential to understand the interpretation of isotopomeric data in the context of the discussion.

10. Again, the mechanistic interpretation of isotopomeric data is the central part of this paper. Although we have no conclusive evidence that nitrifier denitrification is actually occurring in the water column, the data available and the current biogeochemical knowledge allow postulating this hypothesis with a reasonable degree of confidence.

11. Although nitrifier denitrification has the same isotopomeric signature as denitrification (only for nitrite reduction), the supporting evidence suggests that denitrification is not occurring at the oceanic stations. Thus, we are able to postulate nitrifier denitrification as a possible mechanism occurring parallel to ammonium oxidation. At the coastal station, the strong alongshore circulation and the evidence of denitrification (deviation from Redfield ratio) make the interpretation more complicated. That is why the model (pages 1687-1688) is not applied at the UPX station.

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Interactive comment on Biogeosciences Discuss., 4, 1673, 2007.