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Biogeosciences Discussions

Interactive comment on "Production and consumption mechanisms of N_2O in the Southern Ocean revealed from its isotopomer ratios" *by* N. Boontanon et al.

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We thank Prof. N.E. Ostrom for his very critical and valuable comments. Almost all of the suggestions done by him have been accepted as described in the following PTP response:

RC = Referee's Comments; AR = Authors' Response

RC-Page 7823, line 2: Perhaps indicate that the contribution of N2O to overall warming is small but still significant; particularly as emissions of N2O are expected to increase in the near future.

AC- We will follow referee suggestion.

RC-Line 12: Please describe specically what "seasonal variation at the surface" refers to. . . I assume this is in reference to the velocity and nature of the surface currents.

AC- Yes, this refers to the velocity and surface currents, and we will describe more detail in the manuscript.

RC- Page 7824, line 24: It would be good to reference papers describing the methodology here. I recall that Karen Casciotti has a recent paper out and Rockmann and Bren-ninkmeijer similarly published one in 2003 or 2004.

AC- We will refer to the reference that use the similar methodology.

RC- Page 7825, line 4: Indicate that the PreCon Unit is provided by Thermo-Finnigan. You may wish to reference Brand (1995: Isotopes and Envir. Health, 31: 277-) with regard to the PreCon.

AC- We will follow to the referee advice and also include those reference.

RC- Page 7826, line 6: Define delta-N2O as the concentration in excess of that expected from atmospheric equilibration.

AC- We will describe for the delta-N2O.

RC- Line 14: What depth does "subsurface" refer to?

AC- Subsurface refers to the depth 150-300 m.

RC- Line 17: Rather than referring to the "literature" compare to results in "other ocean environments".

AC- We will follow to the referee advice.

RC- Page 7827, line 1: Please state the actual site preference value referred to.

AC- The value of site preference will be show in the text.

RC- Line 12: Rather than stating “another ocean” specify which ocean.

AC- We will follow to the referee advice.

RC- Lines 20-25: Are the authors suggesting that gas injection and bubble collapse lower the concentration of N2O below saturation values? Please be very clear on this point.

AC- We believe that this process is a possible way to make N2O undersaturation. However, we will make it clearer.

RC- Page 7828, line 20: Rewrite as “. . . is consistent with the values expected to result from isotopic equilibration with the atmosphere”.

AC- We will rewrite as the referee suggestion.

RC- Line 13: I don’t believe that “equilibrium fractionation” is the correct term in this context. We don’t know what the isotopomer values or fractionation factors are for the alpha and beta N atoms in N2O during air-water equilibration as this has never been determined. The surface values presented in this paper may be one of the few data sets providing this information.

AC- Yes, until now we have no data of N2O isotopomer during air-water equilibrium. However, we will use the other term which more

RC-Page 7829, Line 17: Why would the beta site be more active than the alpha site?

AC- We do believe that side N would easier to react than center N due to its position in the molecule.

RC- Page 7830, line 1-4: Confusing wording; rewriting needed.

AC-Line 1-4 will be rewrite to be clearer.

RC- Line 10: Please be more clear. Decomposition will yield ammonium, not N2O. Decomposition followed by nitriïňĄcation will yield N2O.

AC- We will rewrite as the referee suggestion.

RC- Page 7831, lines 3-8: The authors have neglected many recent studies addressing SP values associated with production of N2O in pure culture as well as isotope effects during N2O reduction. This is a major oversight and limitation to the manuscript.

Yamagishi et al. (2005) would be appropriate here.

AC-We will refer and add more recent data about site preference.

RC- Page 7832, lines 5-10: This is another area where there has been much discussion in the recent literature that is not referenced here. Schmidt et al. (2004) is a fairly good recent reference but several others have touched on production mechanisms.

AC-We will refer and add more recent information in the production mechanisms.

RC- Lines 12-15: The authors need to reference pure culture studies that define the SP values expected during different production pathways. See Sutka et al. (2006; 2008) and Toyoda and Yoshida (2005).

AC-We will refer to the references that the referee suggestion.

RC-Lines 21-24: The authors need to refer to a series of ar ticles that define the SP iso- topomer effects associated with N2O reduction (Ostrom et al., 2007; Jinuntuya et al., 2008; Yamagishi et al., 2006).

AC-We will refer to the references that the referee suggestion.

RC- Page 7835, lines 3-14: The writing here is confusing in that it suggests that there is production of N2O and flux to the atmosphere. But the authors indicate that fluxes are from the atmosphere into the ocean. I believe that they are indicating a production rate at depth; but overall the fluxes are from the atmosphere into the ocean. Please revise the writing to avoid this confusion. This point is also confusing in the Abstract.

AC-We will rewrite in this part.

RC- Page 7835, line 24: This sentence is not clear. I am not certain what “marine move- ment” refers to and why there is reference to “glacial region”. Please revise.

AC- We will rewrite as the referee suggestion.

Interactive comment on Biogeosciences Discuss., 7, 7821, 2010.