

## ***Interactive comment on “Constraints on global oceanic emissions of N<sub>2</sub>O from observations and models” by Erik T. Buitenhuis et al.***

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Thanks for this contribution to global marine N<sub>2</sub>O modeling. May I ask some questions regarding the model formulation and applied parameter sampling:

Line 148: Is there nitrification at 1  $\mu\text{molO}_2/\text{l}$ ?

Line 156: How is N<sub>2</sub>O consumption modeled? As a first order consumption term as applied in other studies? How large is gross consumption? What O<sub>2</sub> threshold do you use to separate nitrification, production from denitrification and consumption from denitrification? How large are aerobic and anaerobic remineralization fluxes in the model?

Line 166: Are modeled N<sub>2</sub>O concentrations not drifting substantially after such a spin

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up procedure?

Line 199: How many parameter perturbation simulations did you run? Which sampling technique is applied to vary parameters? Over which range are parameters varied? What does the legend in Fig 8/10 stand for? Could you illustrate the sampled slopes and resulting optimal slope? Are fluxes tied stoichiometrically to remineralization fluxes? Why is N<sub>2</sub>O consumption slope given as N<sub>2</sub>O/NO<sub>3</sub><sup>-</sup>? Does this make sense stoichiometrically?

Figure 6: Many global N<sub>2</sub>O modeling studies present N<sub>2</sub>O versus O<sub>2</sub> scatter plots for evaluation. What does this relationship look like in the model?

The N<sub>2</sub>O flux estimate of 2.4 $\pm$ 0.8 Tg N yr<sup>-1</sup> is much lower than what was reported in Suntharalingam et al. 2000/2012, on which the model builds (‘4.6 Tg N yr<sup>-1</sup> (comprised of 3.0 Tg N yr<sup>-1</sup> from the ‘nitrification’ pathway, and 1.6 Tg N yr<sup>-1</sup> from the low-oxygen pathway’, Suntharalingam et al. 2012). How come? Does your prior include these previous fluxes? Your N<sub>2</sub>O production at low O<sub>2</sub> is now  $\sim$ 10 times smaller compared to this previous model.

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