

Interactive comment on “Nitrogen and oxygen availabilities control water column nitrous oxide production during seasonal anoxia in the Chesapeake Bay” by Qixing Ji et al.

Anonymous Referee #1

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The manuscript by Qixing Ji and colleagues investigates the controls on nitrous oxide concentrations in Chesapeake Bay. It is a topic that the authors are very familiar with and this expertise is reflected in the experimental design investigating the effect of nutrients and oxygen on nitrous oxide. The datasets are useful and should be published, but I recommend restructuring the manuscript to focus on the strengths of the work and dealing with the issues raised.

Major comments As can happen with studies which conduct repeated experiments at different time intervals with varying measurements, it is difficult at times to track all the activity. I believe there is a discrepancy between the Methods and Results, as Figure

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2 shows N₂O production rates for July, November, and May, yet in the Methods you state that the experiments were only conducted in July. Instances like this make it very difficult for the reader to follow.

I had a hard time relating the experiments with the estuarine environment. If you want to measure nitrous oxide emissions from Chesapeake Bay, the work conducted in this study is not what needs to be conducted. You would need high resolution surveys of key hydrographic parameters coupled with nitrous oxide measurements, either continuously or at targeted times. I recommend the authors focus more on the experiments as a means to better understand the controls on nitrous oxide production and use Chesapeake Bay as the contextual background, rather than attempting to explain nitrous oxide dynamics in this estuary.

Two examples of the mis-match between the datasets reported and the contextual description provided in the Introduction are (1) The abstract talks about intense N₂O efflux from estuaries, but the results show nitrous oxide concentrations close to air-saturation values. (2) The title mentions seasonal anoxia, but this is not shown in the results.

I am not sure if the May 2017 dataset is necessary in Figure 1. It is helpful in Figure 2 only.

You need to include a description of how you calculate N₂O production in the Methods section

The N₂O profiles puzzle me in the context of the other results. It looks like July 2016 is the only profile which has significant differences with depth, decreasing in concentration between 3 and 13 m. However, this time point is associated with the highest rates of N₂O production (Figure 2). Therefore, N₂O consumption is very important yet hardly mentioned in the manuscript. In context of your comment that estuaries are emitting large quantities of N₂O, the consumption processes deserve more attention.

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You should explain to the reader why you focused on the nirS gene and not other relevant genes

Minor comments

Page 1 Line 16 Change reducing to decreasing

Page 2 Line 11 Agriculture such as paddy fields?

Page 4 Oxidized nitrogen. I think this refers to NO₃ and NO₂. I recommend you write NO₃ and NO₂ if this is correct, as it avoids NO or NO_x. Also on Page 7, Line 18

Page 3 Line 21 It would help orientate the reader if you provide a short explanation for why you chose these 3 depths. For example, why did you only sample below the oxycline in anoxic waters and out of curiosity, why did you not compare anoxic and oxic?

Page 4 Line 14 Why do you inject N₂O to detect N₂O production? Is it an issue of detection limit? Or were you looking for N₂O consumption?

Page 4 Line 14 If you inject 1.2 nmol, how do you get 20 nmol L⁻¹? Presumably you verified these target concentrations on a few bottles and you should state the final concentrations achieved.

Page 5 Line 1. Again, presumably you checked the final concentrations of oxygen against your target concentrations. I suspect you also did the air-equilibration at a single temperature which you should state.

Page 5, Line 19 The alternative to injecting N₂O standards into crimp-sealed vials is to air-equilibrate at controlled temperatures. This might be easier?

Page 7, Line 13 Where is the intense efflux that you mentioned in the abstract?

Page 7, Line 13 If you are going to talk about saturation, you have to provide the saturation value for each of the three sampling occasions

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Page 8, Line 10 Are you surprised that there is a difference between a study in 1978 and a single experiment conducted 40 years later?

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