

## ***Interactive comment on “A multi-year observation of nitrous oxide at the Boknis Eck Time-Series Station in the Eckernförde Bay (southwestern Baltic Sea)” by Xiao Ma et al.***

**Xiao Ma et al.**

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Thank you very much for the comments. They are thought-provoking and helpful to improve our manuscript.

Quantifying the concentrations and dynamics of dissolved N<sub>2</sub>O in seawater is important for understanding the climate change, but conducting measurements of sufficient duration to determine trends over seasonal, interannual, and decadal time frames for any marine ecosystem remains a challenging task. A long-term Time-Series Station like Boknis Eck in the Eckernförde Bay can provide invaluable information for documenting the role of oceans in relation to N<sub>2</sub>O, hence this type of study is significant

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for our scientific understanding. The paper is well-written and clear. I only have few comments/suggestions below:

Lines 95-96: more information is needed on seawater sample collection.

Reply: The sampling procedure is described in detail in lines 95-100 on page 3. Thus we do not see a need to revise the text.

Lines 108-109: The N<sub>2</sub>O concentration of standard gases should be provided.

Reply: We have added this information in the method section.

Line 154-155: : : dry mole fractions of atmospheric N<sub>2</sub>O at the time of the sampling. This description is not the fact since atmospheric N<sub>2</sub>O at the time of the sampling has not been measured and the monthly average of N<sub>2</sub>O data measured at Mace Head was used to N<sub>2</sub>O<sub>eq</sub>.

Reply: Thank you for pointing this out. We modified the sentence. It reads now: “Since the atmospheric N<sub>2</sub>O mole fractions were not measured at the BE Time-Series Station, atmospheric dry mole fractions of N<sub>2</sub>O were derived from the monthly average of N<sub>2</sub>O data at Mace Head, Ireland (AGAGE, <http://agage.mit.edu/>), instead.”

Lines 185-193: NH<sub>4</sub><sup>+</sup> concentrations should be provided in the text as well as Figure 2.

Reply: Both reviewers requested to show additional temperature, salinity, chlorophyll a and ammonium data. These data were not explicitly shown in our ms because they have been published already in Lennartz et al.: Long-term trends at the Boknis Eck time series station (Baltic Sea), 1957–2013: does climate change counteract the decline in eutrophication? *Biogeosciences*, 11, 6323–6339, <https://doi.org/10.5194/bg-11-6323-2014>). However, in order to provide this obvious lacking information, we decided to include the seasonal and annual variations of temperature, salinity, chlorophyll a and ammonium in a new supplement to our manuscript.

Lines 221-222: The expression caused misunderstanding.

Reply: We would like to change it to “The seasonal variations of NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup> were significantly correlated with each other ( $[\text{NO}_3^-]=11.59[\text{NO}_2^-]-0.51$ ,  $R^2=0.80$ ,  $n=72$ ,  $p<0.0001$ ) and high concentrations were observed for both in winter.”

Lines 239-243: Does N<sub>2</sub>O correlate with NH<sub>4</sub><sup>+</sup>?

Reply: There is no straightforward relationship between N<sub>2</sub>O and NH<sub>4</sub><sup>+</sup>. By the way, we realized that there were some problems with the calibration of pH data and, therefore, this part will be deleted.

Line 462: The year of 2015 should be 2005?

Reply: Thank you for pointing out the mistake. It should be 2005, which is the beginning of the N<sub>2</sub>O measurement.

Line 476: There is no temperature data provided at all in this study but with a conclusion ‘Temperature plays a modulating role for the N<sub>2</sub>O emission at the BE Time-Series Station’. I suggest to provide t data in Figure 2 and more t data provided in related discussion in the text

Reply: We would like to show temperature data in the supplement. Also will rewrite the relevant text in section 3.5 to explain how temperature modulates N<sub>2</sub>O emissions in. See our reply to reviewer #1 as well.

Figure 2: It would be better for the authors to provide the vertical profiles of t, s, density, NH<sub>4</sub><sup>+</sup> and Chl a.

Reply: The data is now shown in the supplement.

Figure 6: The vertical profiles of hydrological parameters, such as t, s and density are needed to help understand the possible influence of physical processes on N<sub>2</sub>O distribution as discussed between lines 301 and 309.

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Reply: Vertical profiles of temperature, salinity, NH<sub>4</sub><sup>+</sup> and Chl a are shown in supplement. Mixed layer variations can be seen in Fig. 4.

Figure 8: title is needed for x- and y-axis at figure b and d Figure 9: title is needed for x- and y-axis

Reply: We have added new titles in the figures.

Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2019-165/bg-2019-165-AC2-supplement.pdf>

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2019-165>, 2019.

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