

Interactive comment on “Nitrous oxide in the North Atlantic Ocean” by S. Walter et al.

Anonymous Referee #3

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Vertical profiles and horizontal patterns of the nitrous oxide distribution in the North Atlantic Ocean are described based on three extended data sets sampled on east-west transects. CTD data, nitrate and oxygen concentrations have been evaluated along with the N₂O data. A comprehensive overview of large scale variability of the concentration is nicely given. Additionally, interesting features related to water masses have been identified in this large data set. New insights in the generation mechanisms of N₂O are not gained but suggestions on the origin of water masses with specific concentrations are given. This sort of information is new and has not yet been presented. Figure 8 is especially interesting and convincingly shows that the water masses in the North Atlantic are marked with different concentrations of this gas. The water masses and currents play a crucial role in this paper. Therefore it would be nice to include the currents in figure 1 (or show them in an insert). This is helpful to follow the discussion on page 1005. The map could also help to clarify the purpose of section 2.2 on the

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hydrography of the North Atlantic. The information given there seems random since it is not concentrated on the ones named in the discussion (SACW, AABW, LSW). Figure 3 and its description have one major problem which is the long latitudinal distance of interpolation. Between 10 and 35 deg. N are 1500NM with no data coverage. This region needs to be blanked to clarify what the real gradients are. Fig 3d includes quite some speculation. The description on page 1000 has to be adapted accordingly (e.g. line 22 page 1000). Why is the hypothetical border between layers set to 1000m in the results section (Fig. 7) and to 2000m in the discussion chapters 5.2 and 5.3? The Chapter 5.2 is slightly confusingly written: two potential factors are named that may influence the N₂O production but neither temperature nor the oxygen concentrations are plotted versus nitrous oxide. Moreover, temperature may only indirectly act upon the generation. Therefore these aspects may be combined with the water masses/origin of waters to elucidate the differences in concentrations. To more clearly combine the water density with the definition of water masses and N₂O concentrations would be helpful for the reader. If I understand it correctly the SACW is characterized by a density around 27.5 and n₂O concentrations of 25-30nmol/L. Is this water mass detectable in the subpolar, subtropical and tropical waters likewise? The green colour (AAIW and MW in Fig. 8) denotes a density between 27-28, but is it the same green colour in Fig. 7 a-f? The comparison of the data from this study with the one of Oudot (2002), page 1006, line 8-20, and the differences in the reference may be moved to the results section. Finally, the chapter 6 presents a summary, no conclusions.

Some minor comments: Page 994, line16 North Atlantic and E.? Page 995, line 8-9. Is it important to distinguish between by-product and intermediate product? Page 995, last line, formation pathways are not really discussed at least no biological ones because no measurements of N₂O generation were performed. Rather the transport of preformed concentrations is suggested. Page 1002 lines 18 und 23 good agreement Page 1003, line 10, is it really no correlation or not significant on the denoted level? Page 1007 line 3 the word demineralization does not sound familiar to me.

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