

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

**S. Walter et al.**

Received and published: 10 November 2006

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 N<sub>2</sub>O 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 N<sub>2</sub>O 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).

We agree with the referee that the inclusion of the currents would be a useful additional

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

information. However, we do not explain and discuss the currents in detail, because this would be far beyond the scope of the manuscript.

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 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, and LSW).

In the section 2.2 we give a brief overview of the related water masses, necessary to support the presentation of the measurements and the discussion. All water masses mentioned in the discussion are named here.

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).

We agree with the referee that the long distance of interpolation results in some uncertainties. Unfortunately up to now the data set is not large enough to give a higher resolution. The isopycnal levels were chosen according to the shape of N<sub>2</sub>O profiles, which give in our opinion the best compromise to illustrate the distribution of N<sub>2</sub>O in the North Atlantic.

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?

To correlate the N<sub>2</sub>O concentration with the nitrate and oxygen concentration the shape of the N<sub>2</sub>O profiles was considered, whereas the N<sub>2</sub>O maxima were chosen as the main criterion.

The Chapter 5.2 is slightly confusingly written: two potential factors are named that may influence the N<sub>2</sub>O production but neither temperature nor the oxygen concen-

trations 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.

In this context a plot of N<sub>2</sub>O against temperature is not very helpful because you only see a N<sub>2</sub>O maximum at about 10°C, without any further information. A T-S-diagram gives you also information about the correlation to the water masses. The correlation between N<sub>2</sub>O and oxygen is given by the correlation between delta N<sub>2</sub>O and AOU.

To more clearly combine the water density with the definition of water masses and N<sub>2</sub>O concentrations would be helpful for the reader.

We think that Fig 8 is appropriate for this purpose.

If I understand it correctly the SACW is characterized by a density around 27.5 and n<sub>2</sub>O concentrations of 25-30nmol/L. Is this water mass detectable in the subpolar, subtropical and tropical waters likewise?

The SACW is clearly detectable in the tropics and trails off in the subtropics. We did not find its signal in the subpolar waters. However, the water masses are not characterized by the measured N<sub>2</sub>O concentrations. N<sub>2</sub>O is, due to its biological origin, not a typical water mass tracer such as CFC's.

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?

In Fig. 8 the colour denotes not the density but the N<sub>2</sub>O and delta N<sub>2</sub>O concentration.

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.

We do not agree with the referee. We think that this part belongs to the discussion, not to the results because it goes beyond a pure presentation of results.

Finally, the chapter 6 presents a summary, no conclusions.

We agree with the referee and changed the text.

Some minor comments: Page 994, line 16 North Atlantic and E.?

This layout problem will be fixed in the final ms version.

Page 995, line 8-9. Is it important to distinguish between by-product and intermediate product?

Yes, because for the production processes it makes a major difference if a molecule is only a by-product or is a real intermediate. An intermediate implies a set of enzymes dedicated to form or transform a molecule. This is true for N<sub>2</sub>O in the denitrification sequence but it is not true for N<sub>2</sub>O formation via nitrification.

Page 995, last line, formation pathways are not really discussed at least no biological ones because no measurements of N<sub>2</sub>O generation were performed. Rather the transport of preformed concentrations is suggested.

We agree with the referee and changed the text.

Page 1002 lines 18 and 23 good agreement

We agree with the referee and changed the text.

Page 1003, line 10, is it really no correlation or not significant on the denoted level?

No correlation (see discussion).

Page 1007 line 3 the word demineralization does not sound familiar to me.

We agree with the referee and changed the text.

---

Interactive comment on Biogeosciences Discuss., 3, 993, 2006.

**BGD**

3, S772–S775, 2006

---

Interactive  
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper