

## ***Interactive comment on “Modelling the vertical distribution of bromoform in the upper water column of the tropical Atlantic Ocean” by I. Hense and B. Quack***

### **Anonymous Referee #2**

Received and published: 23 January 2009

#### General comments

This is a timely study, given the increasing importance placed on understanding  $\text{CHBr}_3$ , which aims to better understand the factors which influence their concentrations in the water column. It present novel results, is generally well written, and is in the context of this journal. However, I have some problems with some of the methodology.

Ultimately, the importance of this work is to show how the outgassing of  $\text{CHBr}_3$  to the atmosphere is effected by various parameters. The work shows, unsurprisingly since it is the surface concentration of  $\text{CHBr}_3$  which controls the outgassing, that photolysis and volatilisation are the 2 most important factors in this regard. However, both of

these are treated in a very crude way in this work. I strongly recommend that the authors improve the treatment of these factors (see specific comments below) before this manuscript is accepted for publication.

One of the main conclusions is that wintertime fluxes are an order of magnitude higher than summertime fluxes. This model result seems to be mainly driven by large seasonal changes in the wind field, although a complete treatment of photolysis and of volatilisation may well change this result significantly. Thus there needs to be some discussion of the wind field - comparison with observations - how localised is it to this area etc. Also, as far as I know, there is there no experimental evidence for large seasonal changes in  $\text{CHBr}_3$  fluxes - some discussion of measurements would be advantageous.

#### Specific comments

P4920 L23. Implies that reactive bromine observed by Read et al. (2008) in MBL is due to  $\text{CHBr}_3$ , which is unlikely to be the case (most reactive bromine in the MBL is believed to be from sea spray).

P4921 L10 "organic matter, i.e. phytoplankton" ambiguous sentence, needs rewriting..

P4921 final paragraph. The conversion of  $\text{CHBr}_3$  to  $\text{CH}_2\text{Br}_2$  via reductive hydrogenolysis (Vogel et al., 1987) under anoxic conditions (as discussed in Quack et al. 2007) should surely be included in list of  $\text{CHBr}_3$  decay processes.

P4923 L2. A vertical resolution of 1 m is much too coarse in the upper layers to satisfactorily parameterise UV photolysis.

P4925 L 11-19. The photolysis parameterisation is extremely crude; it relies on an annual average irradiance and a very rough estimate by Carpenter and Liss (2000) of the photolysis turn over time. Given the importance and of seasonal changes in the computed  $\text{CHBr}_3$  sea-air fluxes, the authors should specifically include absorption cross sections and quantum yields for photolysis of  $\text{CHBr}_3$  in water (see I. Nicole, J.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

de Laat, M. Dore, J. P. Duguet, H. Suty, Environ. Technol. 12, ( 1991 ) 21-31 and W. M. Kwok, C. Zhao, Y.-L. Li, X. Guan, and D. L. Phillips, J. Am. Chem. Soc. 126 ( 2004 ) 3119-3132.) , plus monthly or seasonal average irradiances (rather than annual average).

P4925 L 23. The authors should fully justify their value for the half-life due to hydrolysis and halide substitution of 4.37 years - since this is outside the range of 5-74 years reported.

P4926 L 3. Similarly, where does the time scale for remineralisation of detritus come from? It needs fuller justification.

P4926 L 14. Setting the atmospheric concentration of CHBr<sub>3</sub> constant will affect the conclusions regarding seasonally variability of CHBr<sub>3</sub> emissions. For self-consistency, it would be much better to calculate the CHBr<sub>3</sub> MBL atmospheric concentrations from the calculated sea-air emissions and a seasonally-changing prescribed (atmospheric) radiation field.

P4932 L 5-10, and Fig 6. The seasonal variation of wind speed seems quite extreme &#8211; and of course has a large bearing on the results of this work. Is this replicated by measurements or other models?

P4933 L 23. As stated in the General Comments, some discussion of what previous measurements reveal about seasonal changes is warranted, plus how the modelled fluxes agree with previous measurements.

Technical corrections

P4933 L 23. Remove ) after m-2 h-1.

Table 1 does not seem to show experimental data, despite the caption.

Figure 4 should include error bars for the CHBr<sub>3</sub> measurements. Bobs in the caption should be Obs.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Fig 6 Plots a and c are the wrong way around.

---

Interactive comment on Biogeosciences Discuss., 5, 4919, 2008.

**BGD**

5, S2853–S2856, 2009

---

Interactive  
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

S2856

