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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bromine and iodine chemistry in a global chemistry-climate model: description and evaluation of very short-lived oceanic sources" *by* C. Ordóñez et al.

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Anonymous Referee #2

RC: Referee comments - AR: Author replies

RC: This paper describes a parameterisation of natural oceanic sources of short-lived halocarbons and incorporates it into a global chemistry-climate model. The scheme includes a number of minor halocarbons which are not normally considered. The derived emission estimates are compared with previous studies and evaluated by comparing the model-predicted mixing ratios with surface and aircraft data.

Overall, this is a useful and well-written paper and I think it should be published in ACP. It provides new determinations of the short-lived halocarbon sources and improves the basis for including these in global models. I have a number of minor comments listed below.

Detailed Comments:

RC1: Abstract. Line 9. You should make it clear that the emissions are constant within a region, but different between different regions. The text gives 90 degrees as the latitude limit but this is misleading as the sources will not extend that far (certainly not in the south). Can you find a better way of describing the high latitude band.

AR1: That part of the text has been changed to: "Constant oceanic fluxes with 2.5 coast-to-ocean emission ratios are separately imposed on four different latitudinal bands in the extratropics (20°–50° and above 50° in both hemispheres)". In addition, "50°–90°" has been changed to "above 50°" in some parts of the text.

RC2: Abstract. Line 14. Change 'lower' to 'surface mixing ratio' to avoid confusion.

AR2: Changed.

RC3: P. 27423. Line 18. Halons can also contain chlorine.

AR3: In the previous version of the manuscript we defined "halons" as "organic compounds containing bromine and fluorine, primarily used as fire extinguishing agents". There are different definitions of "halon", which may lead to some confusion. As an example, the iodocarbon CH3I is sometimes considered as a halon (Halon 10001; see eg. NIST: http://webbook.nist.gov/chemistry/form-ser.html). The word "halon" is also commonly used as a synonym for "bromofluorocarbon", as we did in the text.

The latest WMO Ozone Assessment Reports mainly consider halons that contain bromine, fluorine and sometimes chlorine (e.g. Halon-1202, CBr2F2; Halon-1301, CBrF3; Halon-1211, CBrClF2; Halon-2402, CBrF2CBrF2). They do not use that terminology for any VSL halocarbons like CH3I. Seinfeld and Pandis (1998) define halons

as “bromine-containing halocarbons, primarily used as fire extinguishing agents”. In the revised version we refer to halons as “long-lived organic compounds containing bromine and other halogen atoms, primarily used as fire extinguishing agents”. This should be broadly consistent with the terminology used by WMO and Seinfeld and Pandis (1998).

RC4: P. 27428. Line 16. Change ’..three most short-lived..’ to ’three shortest lived’.

AR4: We have changed “most short-lived” to “shortest lived” everywhere in the text.

RC5: P. 27431. Section 4.2. This section describes the development of the parameterisation scheme in words. Although the scheme is fairly straightforward it would be useful to summarise the final method in an equation which contains the chl-a parameter observed and the scaling (and any other) factors. This would make the work usable and reproducible by other modellers.

AR5: In the part of the text introducing the parameterisation of bromocarbon emissions now we indicate that we calculate emission fluxes (E) for each species as

E = 1.127 * 1e5 * f * r * chl-a.

See the text for the description of the parameters in the formula. There we also indicate the initial values of f tested for each bromocarbons, and later in the text we give the values of f for the different iodocarbons.

RC6: P. 27436. Line 12 and Table 3. Say in the table caption that these are your calculated lifetimes. Also, say in the text how you calculate them (I presume a lifetime weighted by the tracer distribution and not a simple average of loss rates).

AR6: Now we indicate both in the text and in the corresponding column of the table that the lifetimes we report have been calculated in our study. We also mention in the text that “the atmospheric lifetime of a given halocarbon is calculated as the ratio of its global atmospheric burden to the total removal rate from the atmosphere by photolysis and reaction with OH as simulated by CAM-Chem”.

RC7: P. 27437. Line 4. Typo CHB3.

RC8: P. 27439. Line 12. Typo CH2 BrCl (no space).

AR7 & AR8: Both typos have been corrected.

RC9: P. 27447. Line 29. ’but it cannot account’. This is not true. The surface boundary condition could easily account for a long-term trend if you ran the model for a multiannual period.

AR9: The referee is right. That sentence has been changed to: “The constant lower boundary condition used for the longer-lived CH3Br is sufficient to reasonably reproduce the observed mixing ratios, but it would be necessary to run the model for a multiannual period with time-varying lower boundary conditions to account for the known decline in the anthropogenic sources of this species”.

RC10: Figure 6. This plot is low resolution and should be improved.

AR10: Figure 6 has been improved.

RC11: Figures 7 - 10. It seems more logical to me to show the TTL panels in the top of the figure.

AR11: As the text discusses first the tropospheric profiles (close to the sources) and later the UTLS profiles (far from the sources), we decided to start showing the tropospheric profiles and later the UTLS profiles. However we understand the referee’s suggestion and have decided to follow it. We have carefully revised the whole text and have checked that changing the order of the plots does not interfere with the flow of the paper, as long as both the UTLS and the tropospheric portions of each figure remain in the same page. We will make sure that is the case in the ACP version.

RC12: Figure 11 Caption. Typo: H2ICl

AR12: Changed to CH2ICl.

References

Seinfeld, J. H. and Pandis, S. N.: Atmospheric Chemistry and Physics: From air pollution to climate change, ed. John Wiley & Sons eds., New York, USA, 1998.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 27421, 2011.