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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Southern hemispheric halon trends and global halon emissions, 1978–2011" *by* M. J. Newland et al.

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We thank the referee for their comments which have helped to improve the quality and clarity of our manuscript.

Referee comment:

The abstract states that "The continued increase of H-1301 mixing ratios means that the contribution of the halons to total tropospheric bromine is not declining" is true for now, but will change relatively soon according to Figure 4 because of faster decline in H-1211 relative to the increase of H-1301.

Author response:

We have now changed this having realised that the measurements actually show total tropospheric bromine beginning to very slightly decline from 2008-2011. We have then added a sentence to the abstract concerning the predicted futures of the halons based on the predicted release rates and the calculated banks.

"The observations suggest that the contribution to total tropospheric bromine from the halons at Cape Grim has begun to decline from a peak in 2008 of about 8.1 ppt. An extrapolation of halon mixing ratios to 2060 based on reported banks and predicted release factors shows this decline becoming more rapid in the coming decades, with a contribution to total tropospheric bromine of about 3 ppt by 2060."

Referee comment:

In the analysis section, the authors explain excluding the pre-1989 H-1211 and H-2402 but the data are present in the inset graphs in Figure 1.

Author response:

The data excluded were analysed on the original GC setup with a Chrompak column. Seven of these samples were re-analysed using an Agilent column, these are presented. Five samples (for H-1211 and H-1301, four for H-2402 and H-1202) were also re-analysed using the new GasPro/AutoSpec setup, these are also presented.

We have rewritten Section 2.2 to try to make the different setups used for analysis more clear. We have also included a full table of the measurements presented in the supplementary information with details on which setup was used for the analysis. We hope that this will make the issue a lot clearer.

Referee comment:

More explanation is needed for the differences in measurements between the three groups, especially since UEA and NOAA are using the same calibration scale. What are the AGAGE values based on, e.g. do they make up their own standards and calibration scale? If so, have there been any direct inter-comparison exercises between

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the groups?

Author response:

We have included the information that the halons are reported by AGAGE on the SIO-2005 scale in the calibrations section. However to our knowledge there has been no published inter-comparison exercise between the two scales (NOAA-2006 and SIO-2005). Both NOAA and AGAGE halon data are presented in the WMO reports and while differences have been mentioned there has been no consensus reached on which data is more accurate and so both sets continue to be presented.

The UEA measurements reported on NOAA scales agree very well within the measurement uncertainties for H-1211 for the whole overlap period (from 1998) and for H-1301 after 2002. For H-2402 we do not have a conversion factor to NOAA scales and therefore continue to use the UEA calibration scale.

Referee comment:

It would be helpful to have errors in Table 2 for each compound based on the lifetime from Montzka and Reimann in addition to those based on the revised lifetime. If possible errors on the HTOC and AGAGE calculations in Table 2 would be useful. It's difficult to tell if the differences are significant or not.

Author response:

The errors presented for the cumulative emissions based on the revised lifetimes are based on the range of the revised lifetimes presented in Table 4. Therefore there are no comparable errors for the emissions derived using the WMO lifetime (which is just given as 16 years).

There are of course errors associated with the derived annual emissions for each year, as shown in Figure 2, but these are effectively cancelled out when the cumulative emissions are calculated.

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Referee comment:

Section 5 on the source of H-1202 is very interesting. It would strengthen the argument considerably if the authors actually tested existing H-1211 fire extinguishers. Is this feasible?

Author response:

This has not been feasible. See response to referee 1 concerning P.29302L.17ff. for further details.

Referee comment:

Section 6.2, is there a reference for the 1-D atmospheric model?

Author response:

There is no reference for the model. It is a 1-D photolysis model and is used simply to confirm that which can be inferred from the 2-D model which is that halon mixing ratios fall rapidly to zero above the model domain (>23 km). This is also shown by the balloon flights.

Referee comment:

Section 7 on cumulative emissions and halon banks seems very speculative and probably should not be included in the paper without further data driven justification.

Author response:

We are not sure what the referee is referring to as being speculative. If it is the calculation of cumulative emissions and banks, these are straightforward calculations based on our top-down estimates of emissions and production data reported by HTOC. They also act as a very useful check on the consistency between reported production and our understanding of the atmospheric budget of H-1211.

If it is the calculations of the emissions and banks made using our revised lifetimes,

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we have now split the section on cumulative emissions and banks as described in the opening paragraph of the responses, so that those calculated with the WMO lifetimes are now separated from those calculated with the alternative lifetimes we derive. Even so these new lifetimes come from the now published Laube et al paper and we feel that it is important to show what implications these have for top-down emission estimates. The fact that the remaining bank of H-1211 looks particularly small when using the alternative shorter lifetime raises the questions as to whether the production reported to HTOC has been under-reported and illustrates that there are still considerable uncertainties in the atmospheric budget of H-1211.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 29289, 2012.