Atmos. Chem. Phys. Discuss., 10, C6933–C6936, 2010
www.atmos-chem-phys-discuss.net/10/C6933/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emission location dependent ozone depletion potentials for very short-lived halogenated species" *by* I. Pisso et al.

Anonymous Referee #2

Received and published: 29 August 2010

Review of: Emission location dependent ozone depletion potentials for very short-lived halogenated species – Pisso et al.

This paper outlines a methodology for calculating Ozone Depleting Potentials (ODPs) of very short-lived (VSLS) species based on combined tropospheric and stratospheric trajectory modelling. The anthropogenic source gas n-propyl-bromide (n-Pb) is used as an example calculation (idealised 20 day lifetime tracer) with results indicating larger ODP values than previous studies. Unlike long-lived source gases, VSLS are typically poorly mixed in the troposphere and thus ODP calculations need to consider location/timing of emission and more detailed tropospheric transport. A treatment of convection in the calculation significantly influences the resulting ODP values. The importance of convection in the transport of VSLS to the stratosphere is still uncertain and

subject to debate. According to this paper, the ODP of a source gas is also sensitive to model parameterisations of convection.

There are two parts to the methodology described in this paper, namely the tropospheric calculation and the stratospheric calculation. I would say that more focus is given to the tropospheric calculations and in particular the spatial variations in transport. The tropospheric chemistry is approximated by a fixed 20-day lifetime, which seems reasonable. Less discussion is given to the stratospheric calculation and in particular the stratospheric chemistry. The details of this will affect the calculated ODP. In the real atmosphere the altitude at which active chlorine/bromine is released will affect the region in which ozone can be destroyed (i.e. halogens from VSLS can destroy O3 immediately in the lowermost stratosphere). The use of a fixed alpha factor to scale loss from bromine to chlorine is an approximation. More fundamentally here, the amount of ozone destroyed by chlorine/bromine will not just depend linearly on the time spent in the stratosphere. If an air parcel reaches a high altitude, where the photochemical lifetime of ozone is short then ozone will reach an equilibrium (and actually at high altitudes bromine chemistry is not so efficient). Overall, the authors should add in more discussion about the limitations of the assumptions of the stratospheric chemistry on the ODP with regard to (i) the accurate calculation of the absolute ODP and (ii) as a possible cause of differences with other published studies (which may or may not have made similar approximations).

This paper provides a useful method towards a consistent approach for important ODP calculations for both VSLS and also longer-lived species. The paper is mostly well written in my view and I recommend for publication in ACP following a few minor suggestions below and also the comments above.

Specific Comments:

p. 16278. Line 12. Add 'fixed' to get 'a fixed 20d lifetime'.

p. 16278, l.14: 'season variation' change to 'seasonal variation'.

p. 16278. Lines 19/20. Move 'also' to 'values also extending'. Put a comma after 'mid-latitudes'.

p. 16279. Lines 1-3. There are other classes of halocarbon not included here (e.g. solvents like CCl4). Better to say 'long-lived halocarbons (e.g. CFCs...)'?

P. 16279. Line 13-14. 'halogen-containing' should be hyphenated (also in other places).

P. 16279. Lines 18-20. It would be good to also list a paper based on observations (e.g. from Pfeilsticker/Dorf group). A recent example is:

Dorf, M., A. Butz, C. Camy-Peyret, M. P. Chipperfield, L. Kritten, and K. Pfeilsticker, Bromine in the tropical troposphere and stratosphere as derived from balloon-borne BrO observations, Atmos. Chem. Phys., 8, 7265-7271, 2008.

p. 16279, l.25: You could include a value for the 'alpha-factor' here describing the relative efficiency of Br-ozone loss compared with Cl-ozone loss on an atom-by-atom basis.

p. 16279, l.25: The ability of the major iodine-containing VSLS to contribute to any stratospheric iodine loading is mostly hindered by their short photochemical lifetime (e.g. CH3I, 7 days; WMO, 2003). Emissions have been shown to be large in many areas (WMO, 2007).

p. 16280, l.11: 'detailed the spatial distribution' change to 'details of the spatial distribution'.

p. 16287, l.13: Hossaini et al. (2010).

p. 16290. Line 25. 'calculations runs'? Needs editing.

p. 16291. Line 13. Change to 'southwards over the ..'.

p. 16295. Line 6. 'halogen emitted halogen'? Needs editing.

p. 16295. Line 8. 'but....expensive'. This sentence is not clear and is incomplete.

p. 16295. Line 16. 'is believed'. Either give a reference for this statement or change it to 'we believe'.

p. 16295. Line 17. Change to 'as good a representation...'

Figures 1 and 4. Please use labels (a), (b), (c), (d) in the plots and captions to avoid referring to left/right up/down.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 16277, 2010.