

## ***Interactive comment on “A new formulation of equivalent effective stratospheric chlorine (EESC)” by P. A. Newman et al.***

**K. Pfeilsticker**

klaus.pfeilsticker@iup.uni-heidelberg.de

Received and published: 13 April 2007

The present paper (Newman et al.,) reports on a new formulation of the equivalent effective stratospheric chlorine (EESC), and attempts to forecast the EESC for the coming decades. Notwithstanding that such a study could make a very valuable contribution to prognose the future threat of the ozone layer by halogens, it largely fails to calibrate the forecast with past and present field data. As argued in more detail below, this is most important to assess the EESC of stratospheric bromine, for which 25 % is known to come from other sources than CH<sub>3</sub>Br and the halons (e.g., Dorf et al., 2006). Also, since the calculation of EESC involves parameters such as ages of stratospheric air masses (and their age distribution) and fractional release factors (fi) for the species under consideration, a robust approach would need to calibrate the model result with

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

real field data. Fortunately, the latter are available for chlorine and bromine (e.g., Engel et al., 2002; Froidevaux, et al., 2006; Dorf et al., 2006; WMO 2007 Chapt 1,), but due to any reason the authors do not consider these results. Finally, the authors correctly state (section 5.3) that the latitudinal dependent a factors (i.e., the relative ozone loss potential of a bromine vs a chlorine atom) should be taken into account when assessing the ozone loss potential for bromine. In fact such a study on latitudinal dependent a factors was conducted in the recent past (Sinnhuber et al., 2006), but the results thereof have not been considered in the present study.

Recent research has indicated that the amounts of stratospheric chlorine and bromine are larger than the release of the corresponding halogens by the longer-lived species (> 6 month) considered in the present paper. For example, the recent WMO report (WMO-2007, chapt. 2) states that while for chlorine this additional content is estimated to 50 ppt (1 to 2%) it is much larger for bromine (5 ppt or 25 %, WMO-2007 Fig. 2.3, and Table 2.8). This finding relies on the observation that (a) very short-lived species (VSLS) may directly enter the stratosphere (e.g., Pfeilsticker et al., 2000; and unpublished data from two tropical soundings from Engel et. al.), and (b) that total stratospheric bromine is larger than due to the influx of CH<sub>3</sub>Br and the halons (e.g., Dorf et al., 2006, WMO-2007). Furthermore, our in-situ soundings of BrO (from which Bry is inferred) at low, mid and high-latitudes indicate, that this additional bromine (from very short-lived species and their product gases) becomes readily available upon entry into the stratosphere. In consequence, about 3 - 8 ppt (mean 5 ppt, Table 2.8, chapt. 2 WMO 2007) of additional bromine needs to be added to the stratospheric Bry compared to when only CH<sub>3</sub>Br + halons are considered (e.g., Fig. 3b of the present study). Further, a recent study on a factors which has correctly taken into account this additional bromine indicates that on an annual average a = 69 (Sinnhuber et al., 2006). In fact, the larger a factor compared to the ones calculated in previous studies is mostly justified by that the additional bromine (~5 ppt) becomes readily available in destroying ozone upon its entry into the lowermost stratosphere. Considering this additional bromine, a back of envelope calculation reveals that, the EESC was about

10% larger than calculated by the authors for the turn of the millennium.

Dorf, M., J. H. Butler, A. Butz, C. Camy-Peyret, M. P. Chipperfield, L. Kritten, S. A. Montzka, B. Simmes, F. Weidner, and K. Pfeilsticker, Observations of long-term trend in stratospheric bromine reveal slow down in growth, *Geophys. Res. Lett.*, 33, L24803, doi:10.1029/2006GL027714 2006.

Engel A., M. Strunk, M. Müller, H.-P. Haase, C. Poss, I. Levin, and U. Schmidt, Temporal development of total chlorine in the high-latitude stratosphere based on reference distributions of mean age derived from CO<sub>2</sub> and SF<sub>6</sub>, *J. Geophys. Res.*, 107 (D12), doi:10.1029/2001JD000584, 2002.

Froidevaux, et al., Temporal decrease in upper atmospheric chlorine, *Geophys. Res. Lett.*, 33, L23812, doi:10.1029/2006GL027600, 2006.

Newman et al. A new formulation of equivalent effective stratospheric chlorine (EESC), *Atmos. Chem. Phys. Discuss.*, 7, 3963-4000, 2007.

Pfeilsticker K., W.T. Sturges, H. Bösch, C. Camy-Peyret, M.P. Chipperfield, A. Engel, R. Fitzenberger, M. Müller, S. Payan, and B.-M. Sinnhuber, Lower stratospheric organic and inorganic bromine budget for the arctic winter 1998/99, *Geophys. Res. Lett.*, 27, 3305-3308, 2000. Sinnhuber et al., The contribution of anthropogenic bromine emissions to past stratospheric ozone trends: a modelling study, *Atmos. Chem. Phys. Discuss.*, 6, 6497-6524, 2006.

---

[Interactive comment on Atmos. Chem. Phys. Discuss.](#), 7, 3963, 2007.

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)

[Discussion Paper](#)