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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #3

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This is a well written and oranized manuscript that addresses a topic, the EESC and its uncertainties, that will be of great interest to researchers in stratospheric chemistry and transport. I was impressed by the thoroughness of the uncertainty analysis. I have a few comments and points for clarification:

1. The age-of-air spectrum, G. If consideration of G is considered worthwhile for determining stratospheric mixing ratio, why is it not used in calculating fractional releases? Presumably, the stratospheric mixing ratio in equation (4) could be determined using G. This neglects the dependence on transport path (independent of transport time), but, then again, so does the simpler formulation with just the mean age. On the other hand, the authors show that there is little sensitivity to the width of the age-of-air spectrum (Section 5.2). It would be worthwhile to carry this sensitivity to the extreme, Delta=0.

How much does consideration of G even matter, vs just using mean age?

2. Sensitivity to secular decrease in mean age (Section 5.7): On l. 16 the authors raise a good point, that the large sensitivity to declining mean age seems at odds with the previously analyzed sensitivity to mean age. But I dont understand the 3 sentence explanation that follows. It needs more elaboration. Part of the problem may be ...

3. Sensitivity of f to mean age temporal changes: The authors state in at least two places (l. 25, p.3981 and l. 21, p. 3982) that the fractional release, f, should increase with declining age. I would have thought the opposite: less time to arrive at point x from the tropopause means less time exposed to photolysis. Is this just a typo, or am I missing something? Does air somehow get lofted higher in a more vigorous circulation, passing through regions of greater photolysis? This would need to be discussed.

4. The transition from secular variation in mean age to random variation (paragraphs 4 to 5 in Section 5.7) is abrupt. And paragraph 5 starts with "To calculate the overall effect ...". Does this mean seculat trend and random variations together?

Minor points and typos:

1. p. 3965, l. 17: include –> are 2. p. 3967, l. 6: rho in equation (1) is mixing ratio *in* the stratosphere, not entering the stratosphere? 3. p. 3975, l. 20. "For a 5.8-year mean age ... versus mean age." Something's wrong here. 4. Fig. 2: Shoudn't panel (a) show CFC-11 with fractional release applied, to be consistent with panels (b) and (c)?

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