Authors' Response to Anonymous Referee #1 Interactive comment on "Three-dimensional model evaluation of the Ozone Depletion Potentials for n-propyl bromide, trichloroethylene and perchloroethylene"

We thank Referee #1 for consideration of our article. Regarding the revisions recommended (shown in italics):

1) The most important question I have is regarding the performance of the utilized model with respect to vertical transport which is crucial when dealing with very short-lived substances (VSLS). Whether these species are able to reach the stratosphere and contribute significantly to ozone depletion or not is highly dependent on the speed of the vertical transport and therefore on its implementation in the model (see other recent VSLS modeling studies, e.g., Gettelman et al., 2009; Aschmann et al., 2009; Hossaini et al., 2010). I am aware that the MOZART-3 model is often used and well established in the community so that tedious repetition of implementation details is not necessary here but I think this aspect deserves a little more attention since it is most relevant for this study.

Also the authors state that the MOZART-3 model has been extensively evaluated with observations (p. 17895) but the studies that were cited only contain comparisons with long-lived species like ozone or water vapor that are less affected by the vertical transport velocity. Perhaps it is possible to include references to studies which actually show that MOZART-3 is able to reproduce also realistic distributions of shorter-lived substances?

Although we have discussed doing such a study with various measurement investigators, we are not aware of any detailed comparisons of short-lived substance measurements with MOZART-3; such a study is known to be difficult to implement due to the importance of detailed wind information in the atmosphere at the time of the measurements. Vertical transport speeds in the upper troposphere are not easily observed and must usually be obtained indirectly.

Note that the dynamics in MOZART-3 are driven by the meteorology fields produced by a separate run of WACCM (version 1b; Sassi et al., 2004, as cited in our article). The assessment of CCM transport for the CCMVal study recently (Neu et al., 2010), notably the summary in Figure 5.19, indicated that WACCM 3 is among the best current-generation CCMs for most of the atmospheric dynamics diagnostics. The UT/LS assessment in CCMVal (Gettelman et al., 2010) indicates that WACCM 3 performed well on tropical transport and reasonably well in extra-tropical transport diagnostics. While we cannot directly answer the referee's concern for MOZART-3 as driven by WACCM 1b in this study because these recent evaluations of UT/LS relate to WACCM 3, we believe the performance of WACCM 3 in CCMVal suggests that the MOZART-3/WACCM 1b combination represented short-lived substance distributions in the atmosphere as well as any model of that time. We are adding discussion of this issue to the revised manuscript.

2) General remark regarding the structure of this paper: I would suggest to introduce subsections into section 2 and 3. Both sections contain a lot of information and additional paragraphs would increase clarity and readability. Moreover it would be appropriate to add a "Discussion and conclusions" section to summarize the work and concentrate the discussion of the results in one place.

We concur with this recommendation, and we are adding subsections to the Methodology and Results sections and introducing a Summary section after Results in the revised manuscript.

3) p.17897, section 3: "Each CTM perturbation is run to steady state, ...". It would be interesting to know how long it takes to reach the steady state for your model experiments.

The two nPB MOZART runs and the 51.7 Tg yr^{-1} TCE run reached year-to-year near-steady-state adequate for ODP calculation in 7 model years; the 12.9 Tg yr^{-1} TCE run required an 8th year to confirm a good atmospheric lifetime (partially due to an operational problem in year 7 of that run), PCE required 9 years, and CFC-11 required 10 years. This information is being added to the revised manuscript.

4) Emission rates for nPB, TCE and PCE: Are these values arbitrarily chosen? I realize that the magnitude of these fluxes is most likely irrelevant for the calculation of the ODPs but I wonder especially in the case of TCE and PCE whether you don't use the values of the Reactive Chlorine Emissions Inventory you cite at p. 17900.

The emission rates for candidate replacement compounds are initially chosen to produce a global O_3 column decrease reasonably close to that for the 80 ppt CFC-11 perturbation (the denominator for the ODP calculation). We unfortunately did not state this in the version of the article for review in ACPD, and we are correcting that in the revision.

The comparison to RCEI TCE and PCE emissions, on page 17900 lines 20 to 25, was intended mostly to emphasize that this past emissions level for these two short-lived chlorocarbons would not likely have had major effects on atmospheric ozone. Such low annual emissions, particularly for TCE, would probably have resulted in too numerically small an O_3 perturbation in MOZART-3 to satisfactorily calculate ODP.

5) Typo in the references for Pan et al. (2007): "extratropical"

We thank the referee for catching this typo, and it is corrected in the revised manuscript.

References (not included in previous version of the article)

Gettelman, A., Hegglin, M. I., Son, S.-W., Fujiwara, M., Tilmes, S., Pan, L., Hoor, P., Lee, H., Manney, G. L., Birner, T., Stiller, G., Rex, M., Kremser, S., Wuebbles, D., Walker, K. A., and Anel, J. A., Upper Troposphere and Lower Stratosphere, Stratospheric Processes And Their Role in Climate (SPARC) Report on the Evaluation of Chemistry-Climate Models, edited by Eyring, V., Shepherd, T. G., and Waugh, D. W., World Meteorological Organization, SPARC Report No. 5, WCRP-132, WMO/TD-No. 1526, chapter 7, 253-304, June 2010. Accessed through http://www.atmosp.physics.utoronto.ca/SPARC.

Neu, J., Strahan, S., Braesicke, P., Douglass, A., Huck, P., Oman, L., Pendlebury, D., and Tegtmeier, S., Transport, Stratospheric Processes And Their Role in Climate (SPARC) Report on the Evaluation of Chemistry-Climate Models, edited by Eyring, V., Shepherd, T. G., and Waugh, D. W., World Meteorological Organization, SPARC Report No. 5, WCRP-132, WMO/TD-No. 1526, chapter 5, 149-190, June 2010. Accessed through http://www.atmosp.physics.utoronto.ca/SPARC.