Atmos. Chem. Phys. Discuss., 10, C3157–C3159, 2010
www.atmos-chem-phys-discuss.net/10/C3157/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Vertical transport rates and concentrations of OH and Cl radicals in the Tropical Tropopause Layer from Observations of CO_2 and halocarbons: implications for distributions of long- and short-lived chemical species" *by* S. Park et al.

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Received and published: 26 May 2010

Reply to review #2

We have made changes to the manuscript to answer the suggestions of the reviewers and clarified a few points raised in review. We respond to the reviewer's comments below and a revised version of the manuscript including most of the changes suggested by the reviewers will be submitted to the editor. We thank the reviewers and the editor

for their time and effort and appreciate the recommendation for publication.

Major comments:

1. The listed papers are now referenced appropriately in the revised manuscript. Salawitch et al. (2005), Wamsley et al. (1998), Dorf et al. (2008), Sinnhuber and Folkins (2006), Gettelman et al. (2009), Aschmann et al. (2009), Hossaini et al. (2010), Laube et al. (2008), and Liang et al. (2010) have been added to Sect. 4.3 and discussed.

2. As suggested by the reviewer, we have estimated the contributions of chlorine and bromine from the VSL species via source gas injection versus degradation product gas injection, based on the observed profiles of CHCl3, CH2Cl2, CH2Br2, and CHBr3 in the TTL. This back-of-the-envelope calculation showed a potential maximum contribution of $\sim$2.3 ppt bromine with $\sim$40% from direct injection of source gas when assuming Bry removal from the TTL is negligible. For the chlorine species, $\sim$90% of $\sim$60 ppt chlorine contribution was from source gas injection pathway. Detailed discussion is given in Sect. 4.3.

3. Clear difference of this work from other previous studies is that we are using empirically inferred vertical transport parameters and photochemical conditions, to determine vertical distributions of tracers with various lifetimes in the TTL and showing how much of the VSL compounds can enter stratosphere by large-scale slow ascent through the TTL, which is the most important mechanism to transport air mass to stratosphere, versus other possible pathways (e.g., direct injection via rapid lofting above the tropopause, transport via midlatitude convection and/or warm conveyor belt into the lowermost stratosphere, and so on)

4. Detailed discussions about OH fields of the GMI and GEOS-Chem models and about the discrepancies between the modeled values and between modeled and our empirical values are out of the scope of this paper. We hope that our presentation in the literature will motivate people to investigate further the reasons for the discrepancies.

We have added a new table (Table 1) that contains the empirically-derived [OH] values illustrated in Fig. 6.

Minor comments:

a. page 6065 line 4: The definition from Gettelman and Forster [2002] has been included.

b. Page 6071, line 28: Corrected

c. Page 6075, line 14: Corrected. [OH] observations in Wennberg et al., 1998 were from STRAT and the data in the 1995 article were from SPADE.

d. Page 6077, bottom: A new table (Table 1) has been added, in which mean lifetimes given at each altitude are 500m-bin averages.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6059, 2010.