

Interactive comment on “Global stratospheric fluorine inventories for 2004–2009 from Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) measurements” by A. T. Brown et al.

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Global stratospheric fluorine inventory for 2004 - 2009 from Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) measurements and SLIMCAT model simulations

Response to Reviewers' Comments

We thank the reviewers for their comments. These comments are repeated below,

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followed by our response.

Reviewer 1:

1. “what about the ability of the model to reproduce observed trends?”

The following has been added to the paper:

“Results from SLIMCAT have been included in many previous studies which have looked at the trends of stratospheric gases or have compared model profiles which depend on stratospheric loss rates or transport timescales. Monge-Sanz et al (2007) showed that the model produced a realistic stratospheric Brewer-Dobson circulation and therefore could model the transport of tropospheric source gases through the stratosphere. Brown et al (2011) showed that the model reproduced the observed profiles of fluorine-containing species in that stratosphere. Kohlhepp et al (2012) showed that when forced with ERA-Interim analyses the model performed well in reproducing the ground-based observations on column HF, which is a measure of total fluorine in the atmosphere.”

2. “I would recommend discriminating between the observed and modeled species in the Tables A1-A4 (e.g. by adding a title line with ACE-FTS for the first eight columns, SLIMCAT for the next 10 entries); the authors should also quote the respective contributions of the observations and model inputs to important derived numbers, such as the mean stratospheric volume mixing ratios (in Table 4) or trends.”

Tables A1-A4 now distinguish between ACE-FTS and SLIMCAT VMRs. The species are divided into two clearly marked groups. In addition to this, new columns have been added which gives the total percentage contribution of species from ACE and SLIMCAT.

3. “Finally, the reference to section numbering is completely wrong throughout the paper.”

These references have been changed.

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4. "The title should mention the non-negligible model contribution to this study; otherwise it's misleading. Also but of less importance, I don't see why "inventories" is in the plural form. I would suggest to change the title to "Global stratospheric fluorine inventory for 2004–2009 from Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) measurements and SLIMCAT model simulations"

The title has been changed.

5. "Page 16888, line 15: I would refer to Kohlhepp et al. (ACP, 12, 2012)"

The following changes have been made:

"Additionally, FTIR measurements of total column abundances from the Network for the Detection of Atmospheric Composition Change (NDACC) have shown an increase in the HF column between 2000 and 2009 (Kohlhepp et al., 2012)."

6. "Page 16888, line 24: "long-term changes" is an overstatement for a six year time period! Replace "long-term" e.g. with "recent."

This change has been made.

7. "Page 16890, line 14: what is the origin of the CF₄ lifetime value mentioned here (>2300 yr)? A reference is needed. In WMO-2011, it's > 50000 yr."

This error has been corrected and a new reference to the 2011 WMO report has been added.

8. "Page 16894, line 14: the COF₂ molecule is also a target of the ground-based FTIR network and evidences of its recent upward (but weak) trend are also presented in Duchatelet et al. (ACP, 9, 2009)"

This reference has been added.

9. "Page 16896, section 5: the latitude bands have been selected such as to extend up to 70_N and 70_S. Hence the question of the impact of winter vortices on the ACE-

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FTS measurements and their significance in peculiar dynamical conditions is open. The authors have used the MAD statistic to sort out the data. We could wonder if derived meteorological parameters would not have been more appropriate for the data selection. Could the authors comment on that?"

It was found that using the MAD was sufficient to remove the winter vortices. This was tested by removing all data from the winter (and early spring) months and recalculating the profiles calculated for this study and comparing them to this profiles calculated used in this study. There were no significant differences between these profiles. In addition using DMP to filter the data also did not significantly change the data.

10. "Page 16898, line 21: the authors should refer to relevant articles dealing with the age-of-air"

A reference to (Waugh and Hall, 2002) has been added.

11. "Page 16904, line 15: this last sentence seems incomplete."

This sentence is now complete.

12. "Table 1: the authors could consider adding a column with the lifetime of the various species, to made available useful information about the source gases at a glance"

This has been done

13. "Table 4: could the authors comment on the larger values determined for the slope of total fluorine profile, e.g. in 2007 for both extra-tropical subsets? Do they have any significance? And why are the slopes significantly lower in the tropical regions?"

The mean VMR for 2007 is not exceptional and neither is the profile thus it is likely to be due to an underestimation of errors, and thus reducing the overlap between the 2007 and other values.

The slopes in the tropics are likely to be affected by the upwelling through the tropopause. This would produce higher VMRs in the lower altitudes in this region than

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in the extra-tropics which would then reduce the slopes. This explanation has been added to the paper.

14. "Page 16889, line 7: "Section 3" instead of "Section 2" and so on throughout the manuscript"

This has been changed.

15. "Page 16891, line 1: "This study found an agreement" (remove that)"

This has been changed.

16. "Page 16891, line 15: I think that the Mark IV instrument is abbreviated MkIV instead of Mk-IV"

This has been changed.

17. "Table 2: replace CHF₂Cl by CHClF₂"

This has been changed.

18. "Table 6: reword "contribution which contribute"

This has been changed

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