

## ***Interactive comment on “Global carbon tetrachloride distributions obtained from the Atmospheric Chemistry Experiment (ACE)” by N. D. C. Allen et al.***

### **Anonymous Referee #2**

Received and published: 22 July 2009

#### General comments

The paper reports on the first upper troposphere to mid stratosphere global distribution of carbon tetrachloride from the ACE-FTS. The ACE-FTS observations are compared to balloon measurements (from MkIV instrument) as a kind of validation. The comparison gives satisfactory agreement. The observations are also compared to 3 chemical transport models. The shape and the gradient of the profile are in good agreement but ACE overestimates the simulations. The larger values measured with ACE in the troposphere are attributed by the authors to the difficulties of the retrieval for the lowest altitudes in limb viewing observations. Finally, they derived the CCl<sub>4</sub> lifetime that is in

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agreement with those reported in literature.

The main comments I have and that need to be addressed before publication in ACP are:

1) Characterization of the errors. The errors are defined and characterized in the section that describes the retrievals. They are only evocated at the end of the paper (p13309, lines 13-16) and discussed briefly only for the troposphere. This needs to be discussed earlier in the manuscript (in section 2 for example) and with additional details for both the troposphere and the stratosphere as the 2 regions are discussed in the paper.

2) Comparison with the MkIV measurements. This comparison is presumably used to try to validate the CCl<sub>4</sub> profiles retrieved from ACE. I'm aware about the difficulty to find dataset to validate such untypical satellite products. However, I'm reserved on the usefulness of this comparison and on the conclusions one can draw as currently presented in the manuscript. The MkIV measurements are of same nature than the ACE measurements: Fourier transform technique, same band used, same spectroscopic data used (I assume it is not precise in the text), etc. So, if some biases arise from the instrumental technique or from spectroscopic problems, this would not be reveal by the comparison. The authors state that ACE measured larger tropospheric CCl<sub>4</sub> in the troposphere than the values reported at the surface but the comparison with MkIV observations, in good agreement with ACE, would suggest that they are correct. Have the MkIV observations been compared to other measurements performed by other techniques? At p13302, l9-12, references are given to aircraft measurements made by other instrumental techniques. How these measurements compared to MkIV measurements?

Specific comments

1) p13300, l26: could you precise the contribution of CCl<sub>4</sub> to the atmospheric chlorine budget?

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- 2) p13301, I11: precise from which lifetime the CCl<sub>4</sub> lifetime mentioned is reduced to 26 years.
- 3) p13301, I27: “reducing anthropogenic radiative forcing”: could you quantify?
- 4) p13303, I25-27: Is it possible to roughly estimate the effect of neglecting line mixing in CO<sub>2</sub> Q-branch?
- 5) p13304, I16-17: “improve the precision of the global distribution”: this is related to the major comment 1 and need more discussion.
- 6) p13304, I25: how many measurements are included in the average?
- 7) p13305, I10: the term “upper stratosphere” (also used elsewhere in the text) is not very well appropriate as the measurements are not going higher than 30 km.
- 8) p13305, I14-15: Can the asymmetry be attributed to the smaller emissions in the southern hemisphere?
- 9) p13305, I23-24: First, are the difference significant if the errors in the observations are considered? They should be large in this altitude region for which one are close to the detection limit. Second, the authors attribute the hemispheric difference to the severity of the polar vortex in the southern hemisphere. Are the profiles inside the vortex also discarded of the average in this case as explained in the last paragraph of section 2? If yes, the argument of the severity of the polar vortex fails, doesn't it?
- 10) p13306, I4: “the concentration at ground level had declined” from what “to approximately. . .”
- 11) p13307, I4-6: Are the differences consistent with the decrease of CCl<sub>4</sub> emissions from 1997 to 2004-2007?
- 12) p13309, I6-10: The authors state that ACE overestimate CCl<sub>4</sub> in the troposphere compared to surface measurements and attribute this to the difficulty of the retrieval in the lowest altitudes of the limb viewing measurements. As already mentioned, this

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overestimation has to be investigated through comparison with other measurements and evaluate and discuss according to the errors. Moreover, the comparison with the models shows not only an overestimate in the troposphere but also in the stratosphere. An evaluation of the implication that this overestimate (if really significant, tbc) would have on chlorine budget would be valuable for the paper.

Technical correction P13309, I24: replace Fig 13 by Fig 10?

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 13299, 2009.

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