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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model Sensitivity Studies of the Decrease in Atmospheric Carbon Tetrachloride" *by* Martyn P. Chipperfield et al.

Anonymous Referee #2

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Review of "Model Sensitivity Studies of the Decrease in Atmospheric Carbon Tetrachloride" by Chipperfield et. al.

This manuscript reports on the impact of uncertainties in the removal rates of CCl4 by photolysis, ocean uptake, and degradation in soils on the 3D chemical transport modeled decay rate of CCl4 in the atmosphere. Overall, the manuscript is very well written and offers an update on the long standing issue of discrepancies between modeled and measured CCl4 based on updated information on the removal processes.

The manuscript offers an important contribution to understanding the model/measurement discrepancies in CCl4. It doesn't provide a final answer but does show that the discrepancies can be minimized by adjusting the rate of loss processes within their respective uncertainties or by increasing emissions in the

model. The manuscript also points to the large uncertainties in the recently calculated ocean loss by Butler et al. as a significant contributor to the overall model uncertainty, more so than the photolytic or soil losses. Another factor that may contribute to the discrepancy is the modeled radiative transfer and transport from the troposphere to the stratosphere.

The authors use a significant amount of data for their comparisons, including ground based monitoring networks for in-situ and column data, aircraft data, and satellite data. This data, together with use of the most recent information on losses, strengthens the authors comparison and conclusions. The figures and references are appropriate, however the units for Figure 6 should be ppt.

I recommend publishing the manuscript after addressing the clarification comments below.

1. In section 2.2 ACE; there should be a reference for the last sentence in the first paragraph, especially since both references in this section are still in press. This assumes that a previous reference would have the high bias discussed.

2. In section 2.5 TOMCAT 3-D Chemical Transport Model; do the authors have an estimate of the range of uncertainty in the modeled photolysis rates associated with errors in the model radiative transfer code, ozone distribution, etc. Could this overwhelm all other uncertainties?

Also in this section it should be stated how the ocean and soil sinks are distributed and if there are temporal variations. It is an important factor and should be included in the description.

3. In section 3.2 Impacts of uncertainties in sinks; the authors state that "resolving the issue of the absolute difference in the concentrations reported by the two networks will be important. . .". Is there a plan to do this?

Also in this section, the authors indicate the overall lifetime variability associated with

model transport can be significant because of meteorological variability. The authors should consider acknowledging this point in the introduction and emphasize that the focus of this manuscript is to evaluate uncertainties in the loss processes in the model on atmospheric CCl4 under the model conditions specified. Also include, as stated in the conclusions, studies with multiple 3D models could be used to address this in a separate study.

4. In section 3.3 Interhemispheric gradient; the authors state that the 2006-2009 observations track each other and display a similar seasonal cycle. I only see this for parts of each year, but not enough to justify saying they track each other and have a similar seasonal cycle. The timing in their cycles is often different. The similarity between the two groups is that the magnitude of the IHG values are more similar in this time section than the others.

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