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Interactive Comment

Interactive comment on "Validation of ozone measurements from the Atmospheric Chemistry Experiment (ACE)" *by* E. Dupuy et al.

E. Dupuy et al.

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We thank Anonymous Referee #1 for his/her valuable comments, which we feel have helped improve the manuscript. We hope to have replied to each comment to the satisfaction of the Referee. We have made efforts to implement all the suggested changes, including possible additions to the manuscript, while trying not to add to its length. Our responses are detailed below, with the original comments indicated in italics.

This paper is a thorough intercomparison of the early results from ACE/FTS and ACE/MAESTRO with a variety of concurrent measurements from other satellites and from ground and balloon measurements. The authors find a high bias of FTS with respect to many other instruments in the mesosphere. They find general agreement *within uncertainties of FTS with other instruments between 16 and 44 km. They find a bias of MAESTRO sunrise measurements with respect to the sunset measurements when compared to POAM and SAGE sunrise and sunset measurements. Overall, I think that this paper will provide a useful reference for intercomparisons of many instruments.*

All of the comparisons are useful and important to record in the literature. However, the paper does not go the important further step that I would consider to be the most important. The SAGE and HALOE measurements extend over a 25-year time period providing a key long-term dataset of so-called "self-calibrating" solar occultation measurements of the ozone profile. This dataset has been extensively used in the literature and in assessments to demonstrate the long-term decline in stratospheric ozone and to search for beginnings of attributable ozone recovery. The solar occultation measurements on ACE could and should continue this important record. To do so requires an assessment of any offset between the measurements during the overlap period of the satellites. For this purpose, Figures 2-5 are the most important. They show some clear differences that would need adjustment to make a consistent dataset. I understand that it is beyond the scope of this paper to actually put together continuous time series from multiple satellites, but I would like to see some clear recommendation as to how to use the ACE data to continue the important satellite solar-occultation time series.

Preparing a continuous time series of results from solar occultation satellites is a long term goal for the ACE team and other groups. Separate studies are currently underway to use ACE data to continue the time series started by the SAGE instruments (for example, McLinden et al., “Utility of ACE-MAESTRO Ozone Profiles for Continuity of the SAGE Time Series”, presentation at 37th COSPAR Scientific Assembly, Montreal, Canada, July 2008). Since different techniques could be used to combine datasets from the solar occultation satellites, we think the most useful information we can provide for these time series studies are the comparison results and observed biases outlined in Section 5 and summarized in Sections 7 and 8.

Overall the paper is very long and somewhat tedious to read. The comparisons to the multitude of other ozone measurements are useful, but overwhelming. I think of this kind of exercise as using the ACE measurements as a transfer standard to compare other measurements that are not co-located. If the authors accept this view, it would be interesting for them to reach some conclusions about what they have learned from this comparison about those other measurements.

Using the ACE measurements as a transfer standard is also an interesting future use of the ozone data products. However, since the focus of this work was the assessment of the current ozone data products for ACE-FTS and ACE-MAESTRO, we feel that investigating the use of the ACE dataset as a transfer standard is beyond the scope of the current paper.

It would be helpful to the reader if the authors could figure out how to reduce the number of figures from 47 to a smaller number. I do not have specific suggestions on this, but will comment below on some of the issues I have with a few of the figures.

Because the analyses were performed for both ACE instruments and because we used one or more datasets from nearly 20 different instruments or sets of instruments, we think that the number of figures cannot be reduced further. We took care to limit the number of figures in the paper to two per comparison dataset (one for ACE-FTS and one for ACE-MAESTRO) when possible. For additional comments, see the replies to Anonymous Referee #2 and to Dr. Chi.

Figures 2 and 4: I believe that there are standard error of mean bars on the graph, but I cannot see them. It would be useful to state that they are there in caption. This is significant because it says that the differences are real.

In some plots, the error bars giving the standard errors of the mean are not visible because they are smaller than the line width. A statement has been added to the

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caption of Figure 2 (Figure 1 in revised manuscript) to clarify this point.

Figure 6: the legend is very small and difficult to read.

The comparison figures and the legends were formatted to be readable when they occupy one column width in ACP. However, because of the ACPD formatting, this figure had to be shrunk to fit both the figure and the caption within the page size.

Figures 34 and 35: What are the standard errors of the mean?

Figures 34 and 35 (now Figures 33 and 34) have been replotted to include the standard errors of the mean, shown as error bars on the mean relative difference profiles. Caption has been corrected accordingly.

Figures 36 and 37: I didn't find these useful.

Figures 36 and 37 (Figures 35 and 36 in revised manuscript) summarize the results of the comparisons with ozonesondes and lidars described in Section 6.6. They also illustrate the consistency of the ACE data with respect to latitude. There are no systematic meridional biases found in the mean relative differences.

Figures 40 and 41: These are unreadable. I get no message from them.

Figures 40 and 41 (now Figures 39 and 40 in revised manuscript) illustrate the annual and interannual variations (shown by the yearly color-coding) of the ozone partial column amounts from ACE and the ground-based FTIR instruments. They also show the temporal distribution of the coincident measurements for each station. As was mentioned for Figure 6 (now Figure 5), these figures were made as large as possible for publication in ACPD. In ACP, the figures will extend across two columns and each will occupy nearly one full page. In addition, the latitude and longitude of each station have been added to the figures and the grid lines (placed every 10%) have been removed for clarity (see reply to Anonymous Referee #2).

The conclusion reached via Figure 46 is that there is remarkable agreement between ACE-FTS and other measurements in the 16-44 km range. But there are also remarkable differences, particularly with SAGE II and HALOE. Because I think that these are important time series to be continued, I think that the differences need to be highlighted in the conclusions.

The ACE-FTS comparison results are highly consistent in the stratosphere, between 16 km and 44 km for nearly all comparison datasets. With the notable exceptions of the Eureka lidar and of Odin/SMR, the mean VMR relative differences remain within the range 0 to +10% (with an average value of +4%) for all comparisons. To highlight this agreement, the wording at the beginning of Section 7.1, describing the ACE-FTS results and Figure 46 (now Figure 45), has been clarified. Furthermore, to address the comments of Anonymous Referee #2, we have replaced the "typical values" by average values when giving the results, in the relevant sections and in Table 7.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2513, 2008.