Atmos. Chem. Phys. Discuss., 8, S2688–S2690, 2008
www.atmos-chem-phys-discuss.net/8/S2688/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of HNO_3, $ClONO_2$, and N_2O_5 from the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS)" *by* M. A. Wolff et al.

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Received and published: 14 May 2008

We thank D.-Y. Wang for his comments. In the following we present his original comments (in italics) and our responses below.

1.) In the comparisons with satellite data, I believe the authors need to show the combined instrument errors, e.g. the mean of quadratically combined ACE-FTS and SMR total (systematic plus random) errors.

As mentioned in section 2, the uncertainties reported for the ACE-FTS v2.2 VMRs are the 1σ statistical fitting errors from the least-square retrieval process, assuming a normal distribution of random errors. Because these fitting errors do not consider systematic contributions nor parameter correlations, we think that for the statistical com-

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parisons (satellite and aircraft instruments) the described mean absolute and relative difference are more appropriate to evaluate the quality of the comparisons. Therefore, we used the combined error only for the single profile comparisons, when no statistics were available. The next ACE-FTS data version will account for systematic error contributions, such as the error propagation of the temperature and pressure retrieval errors (Boone et al, 2005). We added this information to the manuscript.

2.) MIPAS ESA and MLS/Aura data are retrieved at pressure coordinates. Their comparisons with ACE-FTS in Figs 4 and 6 are in altitude coordinates. How did you complete the transformation? In some cases, it is not a straightforward matter. For example, the ESA MIPAS altitude registration uses the so-called engineering data and has known errors (e.g. Wang et al.: Validation of stratospheric temperatures measured by MIPAS on ENVISAT, J. Geophys. Res., 110, D08301, doi:10.1029/2004JD5342, 2005). To avoid the influence of the error in the ESA MIPAS altitude registration, it is strongly suggested that the comparisons should be conducted in pressure coordinates. This can be easily done for ACE-FTS since it retrieves altitude and pressure simultaneously. This issue should be addressed properly.

We agree with the reviewer that the transformation from pressure levels to altitude levels for the two named data sets might introduce additional errors. However, for consistency throughout the paper and because the ACE-FTS VMRs are retrieved and made available on an altitude grid, we think that showing all comparisons as altitude profiles rather than pressure profiles is the better choice. Therefore, we did not change the data presentation, but included a paragraph in section 3 (Validation approach) to describe the transformation process we performed for the two data sets retrieved on pressure levels:

We report all comparisons on the 1-km ACE-FTS altitude grid. Profiles from all but two of the comparison instruments are retrieved on altitude levels and interpolated on to the ACE altitude grid as described below. However, two of the data sets, MLS and MIPAS ESA, are retrieved on pressure levels. As recommended by ESA for the use of the

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MIPAS ESA data product comparisons should be done in the pressure domain in order to avoid additional errors introduced by the pressure to altitude transformation (Ridolfi et al, Atmos.Chem.Phys., 2007, 7, 16, 4459-4487). To keep this influence as small as possible and at the same time provide consistency with the other comparisons, we performed the following procedure. The VMR profiles of the pressure-gridded comparison instruments are interpolated in log(p) to the pressure-levels of ACE-FTS, which correspond to simultaneously retrieved ACE-FTS altitude levels. Using this approach, the comparisons, shown for MLS and MIPAS ESA, are performed in the pressure domain, although in the plots they are presented on altitude levels.

3.)The comparison with FIRS-2 (section 5.3, Fig. 14) has only a single profile, and shows large differences, in particular for CLONO2, and N2O5 with the unknown reason. Is it necessary to present it here, at least for CLONO2, and N2O5?

Since there is very little comparison data for N2O5 and ClONO2, we wanted to show all available data. Unfortunately, both FIRS-2 measurements are very noisy and at this point, we can not exclude some unknown systematic influence. Therefore, we decided (in accordance with D.-Y. Wang's suggestion) to remove these comparisons. However, we hope that the ongoing analysis of the FIRS-2 balloon flight data will reveal whether the large errors and discrepancies are due to retrieval problems or indicate a real feature.

Minor Changes in Fig. 2: Figure Caption: ***ACE-FTS and SMR and****;, delete the second* ***and****;. Also,* ***using Eq. (2)****, should be (3) or (4).* We changed the figure captions accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2429, 2008.

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