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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Validation of ACE-FTS satellite data in the upper troposphere/lower stratosphere (UTLS) using non-coincident measurements" *by* M. I. Hegglin et al.

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The objective of the paper is to provide a validation of the ACE-FTS O3, CO and H2O remote measurements for the orbit between 5-15 km, an altitude range where most of other satellites observations which could be used for comparisons are little reliable. The validation here is based on the use of in situ measurements of the same species carried out by the German Falcon aircraft between November 2001 and July 2003 during latitudinal cruises from Africa to Northern Europe at various seasons within the SPURT programme. Since these flights were performed before the beginning of ACE-FTS science operations in February 2004, two methods are proposed for reducing the impact of atmospheric variability on the comparison of ACE-FTS and SPRUT climatologies: tracer-tracer correlations and vertical profiles relative to tropopause height.

Overall, it is concluded that ACE-FTS and aircraft O3 and CO agree respectively within ś5% and ś10% in the lower stratosphere, while the FTS O3 is found high biased by 40% in the UT, and H2O low biased by 20% in the LS and 40% in the UT.

Comments Although the methods proposed for comparing non-coincident aircraft and satellite climatologies may have some merit, I don't think the conclusions reached regarding the ACE-FTS performances are demonstrated and thus acceptable. The reasons for that are detailed below. a) It is not true that satellites are the only means to get information on tracers at global scale. This is true for CO but not for O3 and H2O. O3 climatologies are available from a large number of ozonesondes in both the UT and the LS particularly in the NH, coincident in time with ACE-FTS, which could be used for evaluating the performances of the instrument, as done for SAGE, HALOE etc. Similarly, water vapour measurements are available in the troposphere, up to 300 hPa with the old RS-80 Vaisala sondes, now up to 150 hPa with the recent RS92 version, whose data are assimilated in meteorological models available for ACE-FTS validation. b) Tracer-Tracer correlations The plots shown in Fig 4 are just illustrative. No quantitative information at all is derived. Tracer-tracer correlations hold in the stratosphere but not in the UT where large longitudinal and interannual variations of O3, H2O and CO are known to occur related to source distributions (pollution, biomass burning, etc.). In addition to the seasonal variation shown in Fig 4, the correlation changes in latitude in the stratosphere. The study would require some latitudinal separation. For deriving some quantitative information on CO and H2O in the stratosphere, I could suggest the authors to use ozone (after studying biases and variability in the ACE-FTS data by comparison with ozonesondes) as a reference.

c) Profiles relative to tropopause height. The comparison is restricted to 40-60°N in DJF and MAM (SON and MAM for H2O). Why not showing the other seasons and latitudes? Are the differences similar? Again, I have serious doubts about the usefulness of comparing 2004-2007 global NH ACE-FTS and SPRUT 2001-2003 Europe climatotologies in the troposphere where the concentrations of the species are highly

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variable in space and time. As in the case the tracer-tracer method, my feeling is that it could apply to the stratosphere only. Before deriving conclusions on possible biases, the approach itself should be validated, by comparing for example ACE-FTS O3 and H2O profiles with ozonesondes and meteorological models humidity profiles coincident in time.

Conclusion Tracer-tracer and profiles relative to tropopause height methods for comparing non-coincident observations may have some merit, but which needs first to be demonstrated. A possible approach suggested for this would be to perform similar comparisons with contemporary ozonesondes and humidity profiles. But until this is not done, the figures provided for the performances of ACE-FTS in the UTLS seem to me very premature and I would thus not recommend publication at this stage.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13861, 2007.