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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.

Anonymous Referee #2

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This paper presents a comprehensive intercomparison between ACE-FTS and other instruments. The target species are three of the main total reactive nitrogen (NO_y) species, namely, HNO_3, $ClONO_2$, and N_2O_5 in the stratosphere. Although the paper length is relatively long, the paper is well-organized and a robust conclusion is drawn from a quantitative analysis. I recommend this paper will be an ACP publication after adequately addressing my major and minor concerns described in detail below.

Major comments.

1. Data quality against the presence of polar stratospheric clouds (PSCs) in a line of sight

Since the intercomparison was made even for winter vortex periods, PSCs would present in a line of sight. Do not they affect the retrieval process and hence the retrieved values? This is not only for ACE-FTS, but also for all other instruments. This should be mentioned. If they does not affect the retrieval, the authors should state it in a quantitative sense. The ACE-MAESTRO measures the aerosol extinction (AE) coefficient. Do the ACE-FTS HNO_3/$ClONO_2$/N_2O_5 values depend on the magnitude of AE coefficient?

In regard to this, if temporal uptake of HNO_3 in the PSC particle occurred, the HNO_3 value should be lowered. This effect should also be carefully treated in the comparison. $ClONO_2$ and N_2O_5 values would also be lowered by heterogeneous reactions on the particle.

2. Comparison with SPIRALE

For altitudes between 19.3 and 20.7 km (hereafter referred to as region A), SPIRALE measured PSCs with enhanced values of a conjunction aerosol counter. Above these altitudes between 20.7 and 22 km (region B), SPIRALE measured reduced values of HNO_3. The authors hence speculates that HNO_3-containing particles were fallen from B to A, resulting in permanent denitrification in B. But my concern is that temporary uptake would continue to take place in A, lowering the HNO3 values also in A. The authors do not discuss temperature information at the measurements. How about this?

"Particle greater than 1 micron." Is this diameter or radius? The particle size distribution plots are welcome here in order to provide a more roust discussion. A falling speed of the particle should also be discussed, compared to the geo-graphical locations of backward air parcel trajectories both from A and B.

3. Comparison with FTIR

Discussion on comparisons with the Arctic stations can be shortened. The largest relative differences reported here are less important information. The authors only say that

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there are inhomogeneities in the distribution of chemical species under coincidence criteria (1000 km in separation and 24 hours in time difference) used in their study. This is not a surprising thing. I would suggest that the authors only show the differences excluding the winter vortex period.

Minor comments.

2.1, Line 6, It is unclear to me what an earlier retrieval is. Give a more explanation for this.

2.2, Line 13, How do the standard profiles of H_2O_2 determine?

2.3, Line 2, What are the previous retrievals for HDO, O_3, HNO_3, and COF_2? Is it v1.0? The authors should explain the relation among earlier retrievals, standard profiles, and previous retrievals.

In Fig. 2, Eq. (3) is used for calculating mean relative differences, not Eq. (2).

4.2, Line 19, A more careful analysis is needed to discuss large values of the mean relative difference and its standard deviation found in the southern high latitudes. At least, a distinction should be made for data obtained inside and outside the vortex. Are the low values of HNO_3 found mainly in temperatures below the existence temperature for NAT (T_{NAT})? A data separation using some threshold temperature might also improve the large values of the statistics. Comparisons should also be made separately by season, since the permanent denitrification is seen in spring to early summer when T above T_{NAT}.

4.3.3, Last paragraph, Comparisons were made for a wide latitude band between 30 and 90 degrees N. Is there any latitudinal difference in comparison results? The magnitude of the low bias at 30 km is smaller in the comparison with the daytime MIPAS (–30%) than in that with the nighttime (–50%). I assume that the daytime comparisons were made for lower latitudes, since the values of ACE-FTS (ss) are lager than those of the nighttime comparison.

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5.2, What is the spectral resolution of SPIRALE?

5.3, Also add discussion on a difference seen in HNO_3 at 26-30 km (Fig. 12).

6, Line 28, I think that "Atmospheric density profiles were calculated based on ..." is grammatically incorrect.

In Fig. 18, How about showing the total number of comparison in the legend? Such as SMR(1571).

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