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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simultaneous ground-based observations of O_3, HCl, N_2O, and CH_4 over Toronto, Canada by three Fourier transform spectrometers with different resolutions" *by* D. Wunch et al.

Anonymous Referee #3

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This paper presents an inter-comparison of three different Fourier transform spectrometers differing in design and resolution. The importance of the instrument line shape and the resolution for the retrieval of total column amounts of trace gases is discussed. It was shown that the lower-resolution instruments could measure O3, CH4, HCl and N2O to within 3% of the higher-resolution instrument. This work showed a very good characterisation of the retrieved column amounts from the three instruments and provided a detailed study on the causes of the discrepancies. This paper is suitable for publication in ACP if the recommendations of the anonymous reviewers 1 & 2 are taken

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into account and the comments below are addressed.

1) On section 2.2, 3rd paragraph. Please explain, why the spectra of the U of T FTS are apodized with a triangular function. Would it not be better to use the boxcar apodization and taking the ILS into account during the retrieval?

2) The aim of the paper is to compare instruments of different resolution. Please explain, why different resolutions could lead to different results, especially how errors in the spectroscopic line list could influence the results for different resolutions.

3) Please define modulation efficiency and phase error and how they parameterise the ILS.

4) The imperfect ILS is described for the U of T FTS, but what is the reason for the misalignment of the TAO-FTS?

5) Pick-off mirrors: We assume that the Doppler shift resulting from the relative rotation of Earth-Sun system is taken into account in the retrieval. In my opinion the use of the pick-off mirrors has the consequence that different instruments look at different locations on the solar disk. If this is correct, please quantify the error resulting from the Doppler shift due to the rotation of the sun.

6) Please define EAP and PHS. Is it possible to retrieve the ILS from these parameters? If these parameters give an indication for the stability of the ILS, I would like to see how these parameters vary over time. This would allow to check the statement that the ILS is constant over a few months for ground-based measurements. Short-term fluctuations are often important and should be quantified, if possible.

7) It would be interesting to know if the authors considered recording spectra from the TAO FTS, downgraded to the resolution of the two lower-resolution instruments and evaluating/comparing the results. I think that this would be very useful.

8)Why were comparisons using the averaging kernels according to the formalism described in Rodgers and Connor, (2003), not applied here? I think that doing this would

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have been very useful for this study.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 10883, 2006.