

Interactive comment on “Four Fourier transform spectrometers and the Arctic polar vortex: instrument intercomparison and ACE-FTS validation at Eureka during the IPY springs of 2007 and 2008” by R. L. Batchelor et al.

C. Paton-Walsh (Referee)

clarem@uow.edu.au

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General Comments

This paper represents a significant technical assessment of the comparability of measurements of total and partial column amounts of trace gases made from 3 ground-based FTIR instruments and one satellite-based FTIR. The data presented are important for the understanding of uncertainties inherent in these measurements and as such the paper is suitable for publication in AMT.

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Specific Comments

(1.) Page 2891: clarify the timing of simultaneous spectra: The current description implies that the PARIS spectrum will sample for only half the time that the “coincident” DA8 spectrum samples. If this is correct then why not compare 2 averaged PARIS spectra to each DA8 spectrum, and 1 PARIS spectrum to each HR125?

(2.) Page 2894-2985, last sentence of results section 4.2, the differences are comparable in magnitude to many (but not all) previous intercomparisons around the globe. Exclude at least the reference to Meier et al which yielded a much greater level of agreement than that shown in this intercomparison.

(3.) Agreement within one standard deviation is not the most rigorous statistical test of agreement between two sets of data. The “paired t-test” would be quite easy to apply to these datasets and would perhaps help justify (or not) claims that there was no significant differences (as stated for the comparison between ACE and the HR125 partial columns on line 17 page 2900.) The authors should consider applying this or a similar statistical test of significance or otherwise refrain from using the term “no significant bias”.

(4.) It is not clear how the improved coincidence criteria between HR125 and ACE-FTS were determined. Were the values of 10K for temperature difference and $0.3 \times 10^{-4} \text{ s}^{-1}$ for PV chosen arbitrarily or did application of these tightened coincidence criteria result in a much better level of agreement than say values of 12K and $0.4 \times 10^{-4} \text{ s}^{-1}$? The authors should clarify this point in the text.

Technical corrections

(1.) Line 1, page 2886 - A pedantic point: the description of the measurements being from the ground to 100km sounds odd to me. Perhaps from 610m to the top of the atmosphere would be more accurate?

(2.) Line 6, page 2886 - Even more pedantic the satellites don't pass nearby but sample

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nearby air.

(3.) Page 2887: The descriptions of the instruments are not entirely consistent. For instance, why are the corner-cube mirrors mentioned for PARIS but not for ACE or HR125, nor are the dynamically aligned flat mirrors of the DA8 described.

(4.) In the data analysis section the phrase “atmospheric profile” is used without first explaining that this means the changing volume mixing ratio with altitude above the ground.

(5.) Section 3.2: ACE-FTS v2.2 is mentioned twice first with updates in O₃, N₂O₅ and HDO and then just with O₃ updates.

(6.) Line 11, 2891 : “measurements were made to maximise the agreement between similar measurements” – it is not clear what is meant by this.

(7.) Page 2892-2893: “PARIS-IR consistently underestimates the total column of this gas” compared to the other instruments- (the true value is not known). Again in next sentence about HF - the bias is compared to the other instruments.

(8.) Line 11, page 2893 – not the cause of the discrepancy but a major cause or a significant contributor to the discrepancy.

(9.) Page 2894, line 12. Rephrase – the smoothing error masked differences caused by other uncertainties.

(10.) Section 5.1: presumably the HR125 was chosen as the sole comparison instrument because of its lower uncertainties? Clarify this in the text.

(11.) Line 15, 2896. The description of the partial columns as “comparable” is confusing here since you go on to determine strict coincidence criteria to determine comparability. Perhaps use the term “similar “ to avoid confusion.

(12.) Not all of the references are in proper alphabetical order, i.e. Wunch et al, Fast et al.

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