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Atmospheric Measurement Techniques Discussions

Interactive comment on "Five years of CO, HCN, C_2H_6, C_2H_2, CH_3OH, HCOOH, and H_2CO total columns measured in the Canadian High Arctic" *by* C. Viatte et al.

Anonymous Referee #2

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The manuscript "Five years of CO, HCN, C2H6, C2H2, CH3OH, HCOOH, and H2CO total columns" by C. Viatte et al. presents a very interesting new dataset of tropospheric trace gases that can be connected to biomass burning and anthropogenic pollution. Individually, all these gases have been measured before. However, measuring them all together and especially in the very sparsely covered Arctic is a significant scientific achievement. It also illustrates nicely the full potential of FTIR instruments for multi-species measurements – which is far beyond what other methods can provide.

The manuscript is generally well written. However, some parts are somewhat lengthy. Especially the introduction could be shortened by 20-30%. The conclusions could also

be more concise.

Specific comments:

- please shorten the introduction. 5 pages in AMTD format is a lot, 3 might also do.

- the order of subsections in Section 2 is not logical. You should exchange subsections 2.2 with 2.3. This way, you would start with the description of the FTIR measurements in 2.1, continue with the discussion of microwindows in 2.2. After that, all the remaining subsections would be related to the OEM retrieval parameters.

- p. 11361/2: calculation of the Sf matrix. Even though Batchelor et al. (2009) might have done it like that, I think it is not a good idea to make large perturbatiuons in the 5% range to calculate Jacobians. In the linear case, it might not matter. However, even in a slightly non-linear case, 5% perturbation is a huge change. Partial derivatives should be calculated with infinitesimal changes!

- p. 11364, Eqation (5): this equation is only valid if one measurement has a significantly higher vertical resolution than the other, so that its averaging kernel can be neglected (identity matrix). Is this the case for ACE-FTS? Otherwise, you would get a complicated convolution of both averaging kernels.

- Section 3.1: this section should be better structured. I would suggest to introduce two subsections: one discussing CO, C2H6, and C2H2 at the beginning and a second one discussing HCN, CH3OH, HCOOH, and H2CO which starts at p. 11366, l. 28.

- Section 3.1/Fig. 9: the measured (!) seasonal variabilities are the main science contribution from your work and should be given adequate space. You should split Fig. 9 into two independent figures: one for CO, C2H6, and C2H2 and another one for HCN, CH3OH, HCOOH, and H2CO). It might also be a good idea to somehow include the WACCM model results for the corresponding years. After all, WACCM is what you would have to rely on if you did not have the measurements. Therefore, difference between measurements and model results is the new information provided

by the observations.

- Section 3.2: some of the correlations with ACE-FTS are not that good. You should discuss this more. According to Table 5, the two species with the smallest R have the highest number of coincident measurements.

- the conclusions are too lenghty. Please cut the summary part and focus on what you have learned from the measurements – e.g. with respect to what WACCM says about seasonal variability.

Figures:

- Figure 1 is too messy and not very useful. It should be dropped.

- Figure 9 is too busy. Please split according to the suggestions above.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 11345, 2013.