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Atmospheric Measurement Techniques Discussions

Interactive comment on "Using XCO_2 retrievals for assessing the long-term consistency of NDACC/FTIR data sets" *by* S. Barthlott et al.

Anonymous Referee #4

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Review of Using XCO2 for long-term consistency check of NDACC/FTIR data

This paper calibrates the long term NDACC record using XCO2 a model derived from TCCON, Mauna Loa, and the CarbonTracker model. The error estimates from these comparisons are on the order of 0.4% (1 ppm), which is large for CO2 error, but small compared to variations in other remotely sensed species. The authors are aware of the sensitivity of the NDACC and have accounted for it through the application of the NDACC averaging kernel. Their model is validated with the TCCON system and then used in the calibration of the NDACC sensors back much longer than the TCCON record, using input from Mauna Loa.

General Comments

The differences between retrieving with two very different priors (NDACC (TCap) and NDACC(WACCM), red and black, respectively, showing a blunted seasonal cycle for the flat prior in figure 1) plus the analysis in section 5 shows that the NDACC product has almost no sensitivity to the surface and is driven by the mid-Troposphere. Comparing directly to TCCON will rely heavily on the a priori information for the surface to 5 km. For this reason, direct comparison to TCCON in Figures 6 and 7 are not of much interest for validation and can be confusing to the purpose of the paper. For example, figure 1 makes the sensitivity point shown in Figure 7. The primary validation is the indirect validation of NDACC through comparison of NDACC to the model, and model comparison to TCCON shown in Figures 5 and 8. Also the analysis in section 5 should be referred to in regards to figure 1, which is otherwise very puzzling.

I would additionally stress why CO2 is chosen for validation in the paper. The reader would also be interested in what the other species produced by NDACC are, and what their variability is.

Specific Comments

Abstract, line 11. "As XCO2 model" change to "An XCO2 model".

Section 2.3, Eq 1, line 18. This equation should specify the units, e.g. 'where Ps is the surface pressure' change to 'where Ps is the surface pressure in Pascals'. The first term should have Avogadro's number multiplied and the molecular mass should be in kg/mole. H2Ocol in the second term should be specified as molecules/m2.

Section 4.1 line 18 First, the rationing for our NDACC product is made by DPC (Eq. 1) and for the TCCON product by O2 (Eq. 4). I think should be "ratioing" but could be worded better.

Conclusions This process was done in order to calibrate NDACC spectra. If I understand, the bias is fine (as it could be explained by spectroscopy and/or O2 ratioing); the stability of the difference is the important metric? This should be made more clear.

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Figure 4. For a column measurement, the y axis is better in hPa as 50% of the column is between 0 and 5 km, whereas on this figure 0-5 km is only about 12% of the plot.

What does a column averaging kernel value of 4.5 mean? This should be explained, as the ideal column AK would have a value of 1 (as defined in Connor et al., 2008 Eq. 8). A value of 4.5 says that differences between the true value and the prior at 30 km would by multiplied by 4.5. Is this trying to make up for the fact that the AK is 0.25-0.5 between 0 and 5 km?

In Figure 5-8, middle plot, are the axes per mil or ppm or percent?

Figure 7, 8 should refer back to figure 5 rather than Figure 6.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 10513, 2014.