Atmos. Meas. Tech. Discuss., 7, C3738–C3741, 2014
www.atmos-meas-tech-discuss.net/7/C3738/2014/

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 #3

Received and published: 15 November 2014

Review of "Using XCO2 retrievals for assessing the long-term consistency of NDACC/FTIR data sets" by Barthlott et al.

This paper is a study and comparison of two similar but different methods of determining a mean mixing ratio of CO2. The authors develop a simple model for predicting this value at specific globally extended sites and compare them as well. The purpose is to develop an internal check and calibration for long term consistency in spectroscopic data. This is an important contribution for the evaluation of multiple long term data set evaluation. I found a few important issues that are needed to be addressed before final publication.

Main Issues

1. NDACC is a much larger organization with a much broader suite of observations then the FTIR instruments and discussed here. This should be made clear early in the manuscript and a appropriate nomenclature used, for instance NDACC-IR as opposed to just NDACC.

2. NDACC-IR has very specific retrieval strategies for 10 required species. But it does not have a CO2 specified retrieval strategy. The procedure employed here of course uses the MIR high-resolution NDACC-IR spectra. It may be the retrieval strategy developed here will be adopted by the NDACC-IR community but should not be confused with a standard NDACC-IR product. This should also be made clear in the text.

3. Reading of the paper suffers from the lack of an at least, semi-quantitative definition of the term 'long-term consistency'. It is easy enough for the reader to have a view of what this is, but since it is the primary point of the paper it should be defined probably in the introduction.

4. The most important issue: The 'NDACC-IR retrieval' used here employs profile scaling even when the data have high spectral resolution in the MIR. It is shown that the scaled single a-priori (WACCM) inflicted a bias. Why was the NDACC-IR standard procedure of profiling with appropriate constraints not used? This seems a glaring misuse of the standard NDACC-IR techniques when its primary attribute could be used to obvious advantage. Section 4.2 discusses the difficulty of gaining the seasonal cycle amplitudes by not employing the MIR data to its full extent. Here a correction is found to mitigate it but could it not have been avoided?

5. See minor issues 7 below. It is not transparent in this paper the calibrations performed to acquire the final TCCON product (aircraft, O2, spectroscopic parameters). The paper yet finds very good agreement. Still some brief discussion of these would clarify these effects.

Minor Technical Issues

1. L170: " For the TCCON retrievals the CO2 a priori information varies from day to day, which has to be properly considered if one wants to setup a TCCON-like XCO2 retrieval." To my understanding, you are not comparing to a TCCON-like retrieval rather the actual TCCON data product retrieved by the very specific TCCON retrieval which mandates specified apriori data. This sentence blurs the point.

2. L192: NCEP data for pressure and temperature for NDACC are supplied at the NDACC DHF at www.ndacc.org. p-T data for TCCON are supplied elsewhere. The t-P data you use is one or the other or a third? This must be stated clearly.

3. Sec 2.4: For sites that do both TCCON and NDACC O2 is measured on some days when NDACC spectra is also taken. Was the O2 ratio method of determining XCO2 used on the NDACC-IR data for these coincidences as a comparison?

4. L288: Its not fully clear which 'mean' is referred to the daily or monthly.

5. L327: "precision is mandatory for' might more accurately be 'precision is considered mandatory for' since not all carbon cycle science uses 2/mil precision data.

6. Sec4: " As for the validation of the model (see previous Section), we use the TCCON XCO2 data set as reference." Since the NDACC data is compared to the model and the model used Carbon-Tracker and MLO data its not clear this statement that the TCCON data is a reference?

7. Sec 4.1 Is the TCCON data calibrated to aircraft standards that are calibrated to GAW standards? Then if there is a bias inflicted on the TCCON data from the erroneous O2 spectroscopy is this not removed? Then the 2% might well be 1% mir-nir spectroscopy differences plus the .989 empirical aircraft calibration?

Other Minor Issues / Typographical

1. L14 : This sentence does not make sense.: As XCO2 model we developed and used a simple regression model fitted to CarbonTracker results and the Mauna Loa CO2 in-situ records.

2. L60: "measurements have been obtained" should be "measurements were obtained"

3. L67: "is no straight way" to "is no direct way"

4. L80: "as well as seasonal and latitudinal patterns" might better be "as well as seasonal cycles with latitudinal variations"

5. L81: "which is a problem in" might better be "which must be accounted for in"

6. L84: "shows different XCO2 a priori" should be "shows the effect of different XCO2 a priori"

7. L106: "our simple NDACC XCO2 retrieval setup" might better be "ourXCO2 retrieval strategy for NDAC-IR spectral data"

8. L341: 'all yielded consistently' change to 'all consistently yield '

9. L371: ' data can be paired' change to 'data is paired'

10. L380: 'In order to investigate this agreement in more detail, we have a look on different time scales:' to 'We investigate this agreement in more detail by looking at different time scales:'

11. L393: ' A detailed documentation' to 'Detailed documentation'

12. L449: 'rationing' should be 'ratioing'

13. L565: ' means we showed in the comparisons before.' should be changed to ' means shown in the comparisons in Sec[??]. referencing the section. âĂČ

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