We would like to thank referee #3 for the effort in evaluating, commenting, and thus improving our manuscript and for the time spent to perform this work.

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.*

   We'll replace NDACC/FTIR and NDACC in the whole document by NDACC-IRWG.

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.*

   We will add a sentence in the introduction stating that the here presented mid-infrared XCO2 product is not a standard NDACC/FTIR product and that it is at the moment not available via the NDACC database.

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.*

   We want to check our datasets for shifts or biases caused by e.g. instrumental failure or change of instruments for the whole dataset of all used sites. The duration of these datasets varies from several to up to 20 years. We also want to compare datasets recorded continuously and datasets that have been only recorded during campaigns.

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?*

   We agree that a profiling retrieval would likely improve the sensitivity of the NDACC XCO2 product. Such further development of our here presented approach could be presented in a future study. For the current study we decided to present retrieval as simple as possible. This simplicity is an important aspect and assures that the method can be correctly and consistently applied for different sites and time periods:

   The retrieval strategy is kept rather simple, which is an advantage:

   - perform a simple scaling retrieval (TCCON also only performs a scaling retrieval). This retrieval means a clear and simple constraint and can be very easily used at any measurement site. A profile means a more sophisticated constraint, which has to be clearly specified in order to assure consistency between the sites.

- we use a fixed a priori. We want to use the retrieval result as stability criterion for the NDACC/FTIR measurement and by a fixed and well traceable a priori (WACCM) we can attribute the variations in the retrieved XCO2 to the NDACC/FTIR measurement.

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.*

    See minor issues 7

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 a priori data. This sentence blurs the point.*

    The sentence will be changed to: The CO2 a priori information used by the TCCON retrieval for the actual TCCON dataset varies from day to day, which has to be properly considered for comparisons with other datasets.

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.*

    The NCEP p-T data used for the NDACC retrieval are available e.g. via the Goddard automailer (Lait, 2005).
    Lait, L.R.: Using the Goddard Automailer, available at:
    http://code916.gsfc.nasa.gov/Data_services, 2014.

    This information will be added.

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?*

    We used the same ratio method for all NDACC XCO2 sites, the O2 ratio method was only used for the TCCON dataset. Our focus is to offer a tool that can be used for all NDACC-IRWG sites for the whole series. The suggested comparison would only be possible for a small subset of our datasets, which could be the subject of another publication.

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

    Sentence will be changed to: …we require that the standard error of the so calculated monthly mean is smaller….

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.*

    Will be changed

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?*

    First we take TCCON data as reference to check the quality and the influence of the a priori on the dataset. This step is necessary to correctly assess the influence of the a priori on the

seasonal cycle. After that we use the model for the comparisons with the whole NDACC series.

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?*

We observe a bias of about 2.5%, where 2% can already be explained by the known bias in the O2 spectroscopy (Wunch, 2010, please note: the calibration factor 0.989 is for CO2/O2). So mir-nir CO2 line intensities seem to be in agreement within 1%.

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.*

Will be changed to: We developed an XCO2 model that is 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"*

Ok

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

Ok

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

Ok

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

Ok

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

Will be changed to: "shows different XCO2 a priori and their effect on the time series"

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

Will be changed to: "our simple XCO2 retrieval strategy for NDACC-IRWG spectral data"

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

Ok

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

Ok

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:'*

Ok

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

Ok

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

Ok

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

Will be changed to: "…means shown in the comparisons in Sec. 3.2.2, 4 and 5.1"
Or "…means shown in the comparisons Fig. 4 to Fig.8."