

## ***Interactive comment on “Retrieval of CO<sub>2</sub>, CH<sub>4</sub>, CO and N<sub>2</sub>O using ground- based FTIR data and validation against satellite observations over the Shadnagar, India” by Mahesh Pathakoti et al.***

### **Anonymous Referee #2**

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#### General comments:

This manuscript presents a study of greenhouse gases using a ground-based Fourier Transform Infrared Spectrometer of the type Bruker IFS 125M equipped with an InSb detector and CaF<sub>2</sub> beamsplitter. The measured spectra are analyzed using the GFIT-2014 code and the retrieved VCD and Xgas products are presented. The XCO<sub>2</sub> retrieved from the ground-based FTIR are compared to the XCO<sub>2</sub> retrieved from OCO-2 and the XCO retrieved from the ground-based FTIR are compared to the XCO retrieved from MOPITT satellite observations.

The paper is poorly written and presented. Crucial information for the clarification of the

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statements put forward is missing. One of my main criticisms is that the study covers a period of only 5 months with 50 days of measurements, which is very short time. As the measurement started approximately 3.5 years ago, the study period should be extended to at least a year. The other points are mentioned below in the specific comments section.

The authors highlight correctly that ground-based total column greenhouse measurement are very relevant in this part the world and will thus be an added value. However, these measurements need to be very precise and accurate to be useful for model studies or satellite validation. A proper demonstration over a longer period of time is therefore needed for the site. I recommend that the comments highlighted in this review should be addressed before it goes further in the review process and is considered for AMT publication.

#### Specific comments:

Page3 Line 122: What is meant by the range of SZA in the boxes? Are these examples from 4 days?

Page 4 Line 125: What kind of solar tracker is used for the measurement? This information is missing in this paper as well as in the reference paper of Mahesh et al., 2016. As this is the first demonstration of measurements it is important to give a description of the solar tracker and give a plot which shows the tracking accuracy of the solar tracker. This is relevant for the Xgas products.

As on each day observations were made with an internal NIR source, a plot of the ILS should be provided to show the stability of the instrument.

As mentioned in section 3. TCCON does not use the “PROFFIT” code for gas retrievals. PROFFIT (PROFile FIT) is a code used mostly by the NDACC-IRWG community.

What kind of a priori – daily?, monthly?, yearly? – is used from the WACCM and why? TCCON type retrievals use their own daily a priori generated from the TCCON a priori

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generation tools. Those should be used for the analysis. Figure 2 should be exchanged with a plot of XAir and a zoom of the XAir for one long day of measurement should be shown. What is the reason for the variation of the O2 VCD in Fig 2 b?

Section 4.1: Discuss the results of Xgas values rather than the VCD of the gas products. As the VCD of gas contains some instrumental and measurement errors which are cancelled out while calculating the Xgas values.

The satellite comparison section is very weak. A detailed description should be given in relation to the satellite data - which version of the data is used, filter . . . and what is the expected result for a similar co-incidence as selected in this paper. The reported bias is very high compared any other publications. This should be checked with either the same settings as other papers or using the settings of this paper for a few TCCON stations and compare the results to those of the satellite retrieved data. As it is now, the author makes several assumptions and nothing concrete is shown to prove them.

Page 7 line 263: Here I am totally confused, is IFS 120HR or IFS 125M being used for the study?

The authors do not show the measurement precision of the target gases. Rather they provide the upper and lower limits seen in the limited 5 month period. A clear demonstration of the measurement precision should be provided.

Page 8 line 274: the authors mentioned earlier that the ILS was very stable then why is it still in the error budget?

Please provide error bars in the top panel plots of Figure 6.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-7, 2019.