Black: referee's comments red: authors' answers
First of all, we want to thank the two referees for the detailed analysis of our paper.
For the details, please look into the paper with keeping track of changes.

Anonymous Referee #1

In this paper, the TCCON and NDACC XCO measurements are compared against each other on six sites. The methods of calculating the XCO for TCCON and NDACC are discussed, and the differences between two datasets have discussed and investigated. The bias in XCO between TCCON and NDACC is about 5.5% at three Northern Hemisphere sites, but it is about 0.3% at three Southern Hemisphere sites. The hemispheric dependence in bias is attributed to their smoothing errors. The smoothing error of TCCON data is relatively large compared to NDACC data, resulting from its averaging kernel and a priori profile choice. After using the scaled WACCM model data as the a priori profiles for TCCON and NDACC measurements, the biases at six sites become relatively consistent (5.6-8.5%). The remaining ~7% in bias is mainly due to the scaling factor of the TCCON data. The uncertainties of both datasets are discussed in the paper. By comparing with AirCore measurements, the TCCON data is 6-7% underestimated. Meanwhile, the error in the fitting slope is about 2%, which is less than the bias. This bias in the TCCON XCO data should be corrected in the TCCON community as the TCCON data is widely applied for satellite and model validations.At last, the authors show an example of comparing TCCON and NDACC measurements with CAMS model data. This highlights that the smoothing correction must be applied when comparing with FTIR XCO data, especially for TCCON. Meanwhile, it also shows that the TCCON XCO is about 5.2% larger than the CAMS data, which has been assimilated with IASI-A –B and MOPITT satellite observations.The paper is nicely written with illustrative figures and I don't see any obvious errors. The paper is important for the TCCON community, as a systematic bias is found in their XCO data. Data users should be pay attention to consider the smoothing correction when comparing the ground-based FTIR measurements with satellite observations or model simulations. I therefore suggest it can be published after correcting/considering a few relatively minor points.

P4 line 10-11. In this paper, the 3% is adopted as the TCCON uncertainty for all six sites, while NDACC data has different uncertainties at different sites?
As the retrieval settings are completely same in the TCCON network: instrument, retrieval windows, retrieval parameters, and so on, we use the same uncertainty for all the TCCON data. However, NDACC retrieval settings and error estimations are variable depending on site-specific conditions, e.g. humidity, instrument, location and retrieval software.

P4 line 17. "0.0035 - 0.007" to "0.0035 - 0.0070"
Corrected

P8 line 23. Please write the full name for "MkIV" and "ACE-FTS" for the first time
Added

Table 5. Why the TCCON systematic smoothing error at Bremen is only 0.2%, which is much less than other sites?
The TCCON smoothing error is estimated according to Eq. 14. Where (I-A) is positive in the troposphere and negative in the stratosphere. The relatively small systematic smoothing error of 0.2% at Bremen is due to the fact that scaled NDACC a priori profile is larger than the TCCON a priori profile in the troposphere and in the stratosphere. Therefore, the complementary contributions from the stratosphere and troposphere make the systematic smoothing error small. On other sites, NDACC a priori profile is less than the TCCON a priori profile in the troposphere and larger than the TCCON a

priori profile in the stratosphere, therefore the combination of the contributions from the stratosphere and troposphere make the systematic smoothing error large.