

## ***Interactive comment on “TCCON and NDACC X<sub>CO</sub> measurements: difference, discussion and application” by Mingqiang Zhou et al.***

### **Anonymous Referee #1**

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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

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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?

P4 line 17. “0.0035 - 0.007” to “0.0035 - 0.0070”

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

Table 5. Why the TCCON systematic smoothing error at Bremen is only 0.2%, which is much less than other sites?

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