

## ***Interactive comment on “Observations of XCO<sub>2</sub> and XCH<sub>4</sub> with ground-based high-resolution FTS at Saga, Japan and comparisons with GOSAT products” by H. Ohyama et al.***

### **Anonymous Referee #1**

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The manuscript by Ohyama et al. provides an overview of the measurements and activities at the TCCON station at Saga, Japan, during the first 3.5 years of operation. Like other TCCON stations, the site provides column-averaged dry-air mole fractions of CO<sub>2</sub>, CH<sub>4</sub>, CO, and other greenhouse gases. Setup and operation follow TCCON recommendations and standards with a notable exception: the solar tracker is protected by a glass cover instead of being outside like it is at most other TCCON sites. The TCCON observations were compared to aircraft profiles over Saga three times and agreed within expected limits. The authors also compared their data to XCO<sub>2</sub> and

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XCH<sub>4</sub> observations from the TANSO-FTS instrument on the GOSAT satellite and found agreement well within the uncertainties. In addition, they analyzed seasonal patterns in their observations and tried to correlate anomalies and patterns with different origins of the observed air parcels (derived from trajectory analysis).

The manuscript is solid and well written. It provides a good overview of the activities at the Saga site. However, I believe it could be improved by cutting parts that just describe standard TCCON procedures and elaborating more on issues that are special to the Saga station (see list below). In the current version, the manuscript tries to cover many things but lacks focus.

Topics that should receive more attention:

- I am not so happy with this stand-alone approach for the Saga station. Japan has a relatively high density of TCCON sites and aircraft overpasses. How do your results compare to the other Japanese stations? Are the anomalies in Sec. 4.3 specific to Saga or can they also be seen at other Japanese stations?
- Saga is the only station in the TCCON network that uses a glass cover. There should be more on how this cover affects the retrieved spectra and how this effect is corrected.
- I think one of the most important features of the Saga station is the availability of aerosol profile observations from a lidar instrument. This is quite unique in the TCCON network. The analysis of the aerosol-induced effects deserves its own section or at least subsection.

Minor issues:

- Section 2.1 (p. 8262, l. 26-27): do you keep the pump running during the measurements? Most TCCON sites prefer not to in order to avoid vibrations from the pump influencing the measurements.
- Section 2.3: looking at Fig. 1, I find that the variations in modulation efficiency are not that small. The more or less continuous loss from July 2011 to July 2013 is more

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or less expected (slow degradation of initially optimal alignment). But what happened after that?

- Section 3.1: is there any difference in your described procedure compared to standard TCCON/GGG operation? If not, the whole section could be shortened.

- Section 3.2: the 0.1 Hz resolution of your pyranometer should be good enough to detect solar intensity variations (SIV) for data screening. Most TCCON sites only use 1 Hz data from the solar tracker quadrant diode to accomplish the same task. However, I have my doubt that a global radiation measurement from a pyranometer is a good way to detect SIV. A small cloud passing in front of the sun will only have a very small effect on global radiation (if at all). That is why the quadrant diode signal (which is a proxy for direct solar radiation) is probably a much better indicator - even at a low sampling rate.

- Section 3.2 (p. 8265, l. 19-24): did I misunderstand something? Are the PVC side walls of the solar tracker dome transparent?

- Section 4.1: please be more explicit about the results from the aircraft campaign. You cite Messerschmidt et al. 2011 for CO<sub>2</sub> but not Geibel et al. 2012 for CH<sub>4</sub> - even though the profile extension errors for CH<sub>4</sub> are more critical due to your limited flight altitude coverage. Was Saga the only station that was overflown during these campaigns?

- Tables 1 & 2: maximum flight altitude would be useful to compare to the tropopause height.

Language:

I did not find enough typos to start a list and the manuscript will be copy-edited anyway. However, I noted that very often present tense is used to report about past events (e.g. p. 8274, sentence spanning l. 24-26).

References:

Geibel, M. C., Messerschmidt, J., Gerbig, C., Blumenstock, T., Chen, H., Hase, F.,

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Kolle, O., Lavrič, J. V., Notholt, J., Palm, M., Rettinger, M., Schmidt, M., Sussmann, R., Warneke, T., and Feist, D. G.: Calibration of column-averaged CH<sub>4</sub> over European TCCON FTS sites with airborne in-situ measurements, *Atmos. Chem. Phys.*, 12, 8763-8775, doi:10.5194/acp-12-8763-2012, 2012.

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, 8, 8257, 2015.

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