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Interactive comment on “Observations of XCO₂ and XCH₄ with ground-based high-resolution FTS at Saga, Japan and comparisons with GOSAT products” by H. Ohyama et al.

Anonymous Referee #2

Received and published: 3 September 2015

This paper introduces the Saga TCCON station, the first 2.5 years of its operation, the particular environment in which it is located, and the relationship between its data and the GOSAT TANSO-FTS data. The paper discusses the impacts of the origin of air on the retrievals from the TCCON station, and the impacts of aerosol and high cirrus on the TANSO-FTS retrievals. It is suitable for publication in AMT after revisions.

General comments:

A major result from this paper is that the TANSO-FTS retrievals are significantly af-

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ected by aerosol and high cirrus, but this discussion is very short and incomplete. This section needs to be fleshed out, showing statistical significance, and including supporting plots for the statements that the biases are of a different sign for different aerosol types.

The analysis of the back-trajectories and their impacts on the relationships between $dXCO/dXCO_2$ and $dXCH_4/dXCO$ needs more discussion. Why lump all the summer-time data together and fit it with a single line (dashed lines in Fig 6)? What can you learn by fitting the different regions (types I–III) separately? Can you compare the relationships with known emissions factors for the three regions? If the data are dense enough, how does the seasonal cycle using only the type I data compare with the entire time series (wrt the trends, seasonal cycle amplitudes, etc.)?

Please include a map of all the locations you mention in the paper: Saga, Heteruma Island, Minamitorishima Island, Fukue Island, etc.

Technical comments (suggested changes between **):

P8259L22: tend to *cause an* overestimate or underestimate *in* the TANSO-FTS *retrievals*. P8260L9: move the Chevallier et al. citation to after "of CO₂" P8260L13: instead, try: space-based instruments*: the* Scanning... P8260L22: You're missing several references: Morino et al., Butz et al., Wunch et al. 2011. P8261L1: replace "under" by "following" P8261L4: remove "derived" P8264L5: Suggest adding the following sentence: "We use the standard implementation of GGG for TCCON retrievals, described briefly below."

Section 3.2 describes a screening method that does not conform to the TCCON standard. The screening on the pyranometer should no longer be necessary for GGG2014, as the fractional variation in solar intensity is now calculated from the interferograms themselves. Please comment on how the standard TCCON screening compares with yours.

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The screening based on solar zenith angles less than 70 due to the interface between the glass and polyvinyl is reasonable, but it should be clearly stated that this differs from the typical TCCON screen (82 degrees).

P8266L6: missing reference: Geibel et al. P8267L20: missing space between FTS and XCO2 P8267L23: form → from

P8268L9: You estimate the error from the difference in tropopause height. What is an estimated error from assuming that the BL and free-troposphere profile above the aircraft is constant? I believe you are underestimating your total errors.

P8268L20: 6-month (no "s") periods were employed to represent seasonal variation, ** low-pass filters with a 2-year cutoff frequency *were used* for the long-term trend*, * and a 150-day cutoff frequency *was used* for the short-term trend.

P8268L22-24: I'm confused by the distinction between the filtered datasets and long-term trends. Please clarify.

Fig 5: Please write the type numbers for each color in the caption.

References:

Butz, A., S. Guerlet, O. Hasekamp, D. Schepers, A. Galli, I. Aben, C. Frankenberg, J. M. Hartmann, H. Tran, A. Kuze, G. Keppel-Aleks, G. C. Toon, D. Wunch, P. O. Wennberg, N. M. Deutscher, D. Griffith, R. Macatangay, J. Messerschmidt, J. Notholt, and T. Warneke (2011), Toward accurate CO₂ and CH₄ observations from GOSAT, *Geophys. Res. Lett.*, 38(14), 2–7, doi:10.1029/2011GL047888. Available from: <http://www.agu.org/pubs/crossref/2011/2011GL047888.shtml>

Geibel, M. C., J. Messerschmidt, C. Gerbig, T. Blumenstock, H. Chen, F. Hase, O. Kolle, J. V. Lavric, J. Notholt, M. Palm, M. Rettinger, M. Schmidt, R. Sussmann, T. Warneke, and D. G. Feist (2012), Calibration of column-averaged CH₄ over European TCCON FTS sites with airborne in-situ measurements, *Atmos. Chem. Phys.*, 12, 8763–8775, doi:10.5194/acp-12-8763-2012. Available from: www.atmos-chem-

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