**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "Aircraft measurements of carbon dioxide and methane for the calibration of ground-based high-resolution Fourier Transform Spectrometers and a comparison to GOSAT data measured over Tsukuba and Moshiri" *by* T. Tanaka et al.

Anonymous Referee #1

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General Comment

The instrument and its measurement technique are well written. However, major revisions are needed before the publication in AMT due to the following reasons.

(1) The difference from the previous TCCON validations by other groups is not clear. Tsukuba and Moshiri is less spatially uniform area than other sites such as Lamont. Does the aircraft campaign improve the precision of the CO_2 vertical profile measure-

ment? The precision and flight altitude range requirement for the TCCON calibration has to be clearly mentioned. Is the flight altitude up to 7 km enough for validation? New findings from this experiment are not clear. Moshiri data bias looks larger than other TCCON data. Does Moshiri have possibility to be a validation site for GOSAT in conclusion?

(2) The validity using only a few aircraft data for the GOSAT validation should be discussed. How large is the day to day validation at Tsukuba and Moshiri?ãĂĂIf the variation and clear sky bias is small, the authors might be able to use the clear sky GOSAT data other than the ones of aircraft observation days. The authors mentioned the GOSAT data on Feb. 14 is released only for RA. It is not clear RA and GU data have same bias or not. Also the Aug. 30 GOSAT at Taiki was not used due to the clouds. If the Aug. 30 GOSAT data is not precise enough and day-to-day variation is small, the other method such as monthly mean data should be discussed. Recent ACOS B2.9 product provided by NASA JPL has achieved 1-3 ppm precision. The author should compare with these data, too.

Scientific Comments

(1) P. 1846: Are the objectives of this paper the evaluation of GOSAT data precision (random) or accuracy (or bias) or both? The difference between GOSAT and aircraft observation include both bias and random errors. To distinguish systematic bias and random error, one method is to compare the surface pressure retrieved from GOSAT TANSO O2A band data with the in-situ data because a barometer is accurate and precise and O2 density is vertically uniform. Did the author compare the GOSAT level 2 product with the surface pressure by a barometer?

(2) P1850, Line 20: The authors mentioned that Moshiri is located in mountainous area. Is there any difference from other TCCON site? Why different topography data is needed for the GOSAT validation purpose? Did the authors request the target observation on Aug. 26 for Moshiri and Aug. 30 for Taiki? How do the authors use or correct

the GOSAT data near Moshiri? The relation between Moshiri and Taiki is described in P1851 but the purpose of the Taiki measurement is not clear.

(3) P1850, Line 26; Kumagaya is located far outside the TANSO-FTS IFOV circle of Tsukuba. The spatial distribution (or uniformity) within the Kanto Plain has to be discussed.

(4) P1852, Line 16: The reason why the a-priori information is needed should be briefly mentioned. The figure of the averaging kernel helps the understanding.

(5) P1853, Line 8: The possible reasons why Feb 14 data was filtered out should be mentioned. Which one is an actual reason? Is it due to large AOT? On Feb. 14 CO2 has larger bias but CH4 is lower.

(6) P1854, Line 20: The author mentioned "The faster scan: speed (20 kHz) of the g-b FTS at Moshiri than the TCCON norm decreased the signal to noise ratio." But if the g-b FTS data is averaged, it seems that the precision can be improved. The difference at Moshiri is still too large considering lower SNR and FVSI.

(7) P1855, Line 18: "The relatively large low bias due to the influence of the cirrus clouds was also seen in XCO2 on 14 February 2010." The brief explanation why the cirrus clouds produce lower XCO2 is needed.

(8) P1860 -1863, Tables 1-4: It is not clear why the aircraft data is different between tables 1-2 and 3-4. Is it related to the averaging Kernels? The brief explanation is needed.

(9) P1870, Fig 7: GOSAT L2 data by NIES has the known bias and random errors. The readers misunderstand that GOSAT data has significant errors. The error bar of GOSAT data should be included in the figure and the known bias should be clearly described in the figure or its caption. In addition to NIES Level 2 data, the use of ACOS B2.9 data by NASA JPL should be considered.

Technical Comments

(1) P1851, Line 18: "The algorithm is . . .. code " is strange.

(2) P1853, Line 3: What is the unit of the mean squares of the residual spectra?

(3) P1854, Line 25: What do you mean by "resulting the future"?

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