

## ***Interactive comment on “Comparison of the GOSAT TANSO-FTS TIR CH<sub>4</sub> volume mixing ratio vertical profiles with those measured by ACE-FTS, ESA MIPAS, IMK-IAA MIPAS, and 16 NDACC stations” by Kevin S. Olsen et al.***

**Anonymous Referee #1**

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General comments: This paper describes a comparison of CH<sub>4</sub> profiles retrieved from the GOSAT TANSO-FTS TIR with measurements by ACE-FTS, ESA MIPAS, IMK-IAA MIPAS, and NDACC. Although this manuscript presents results that would be of interest to readers of AMT, I found some of the authors' explanations difficult to follow. Therefore, some revisions are needed before it can be accepted for publication.

[1] p1, line14-15: “with and without smoothing” p9, line13: “To reduce biases caused by over-counting, when comparing TANSO-FTS to MIPAS, and by smoothing, when comparing TANSO-FTS to ACE-FTS,…” What is “smoothing” in this study? Please

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add a detailed description in Abstract and text to help the readers. Additionally, the authors should explain why they show correlation results based on both smoothed CH<sub>4</sub> profiles (Fig. 8) and unsmoothed CH<sub>4</sub> profiles (Fig. 9). What can we learn from this comparison?

[2] p7, line13: “internal variability for each instrument” Due to insufficient description, I don't understand the meaning of “internal variability” in Sect. 3 and Fig. 1. Green lines (TANSO-FTS) in Fig. 1 show the difference between the GOSAT TANSO-FTS CH<sub>4</sub> retrievals and the a priori profiles. On the other hand, blue lines (MIPAS) are the difference between IMK-IAA MIPAS and ESA MIPAS. I don't understand how were the internal variabilities of ACE-FTS (p7, line25-33) and NDACC (p8, line9-15) evaluated. Does “the variability of NDACC data” mean the difference between NDACC CH<sub>4</sub> profile and TANSO-FTS CH<sub>4</sub> profile? In addition, can the authors explain the reason why they were compared in the same figure despite a different definition?

[3] p8, line20-27: “coincidence criteria” There is a lack of explanation why the coincident criteria were set as “within 12 hours and within 500km” for ACE-FTS and NDACC and set as “within 3 hours and within 300km” for the MIPAS data. For example, did the authors examine latitudinal and longitudinal dependence of TANSO-FTS data within 500km or 300km? I would show the spatial variations of TANSO-FTS CH<sub>4</sub> in the collocation circle at a particular height (the upper or middle troposphere). In addition, can the authors discuss the validity of their method by comparing the coincidences (e.g., statistics for match-upped data) in present study to those in the previous validation papers on the GOSAT data.

[4] p16, line31-34 “We also compared the differences shown in Fig. 10 to TANSO-FTS retrieval parameters: land or sea mask, sunglint flag, incident angle, both along the scan path and GOSAT track path, and observation mode (see Kuze et al., 2009). We found no biases in our coincident TANSO-FTS dataset related to any of these parameters, or whether the observation was made during night or day.” Can the authors show the features of the GOSAT TANSO-FTS biases related to land or sea mask and

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the other parameters in the previous section (or in Appendix)? It is not appropriate to discuss these important points without showing here.

Other minor revisions: [1] p4, line32: “the Halogen Occultation Experiment” → “the Halogen Occultation Experiment (HALOE)” [2] p7, line38: “the IMK-IAA data has” → “the IMK-IAA data have” [3] p12, line23: “have a much smaller affect on” → “have a much smaller effect on”? [4] p15, line34: The Pearson correlation coefficient R2 of NDACC (0.9929) is different from that shown in Fig. 8. [5] p19, line13: Please update information on Bader et al., 2016, ACPD. [6] p19, line10: in reference list of Côté et al. (1998), “formulations” → “formulation” [7] p20, line19: Please update information on Errera et al., 2016, AMTD. [8] p21, line33: in reference list of Picone et al. (2002), “1486” → “1468” [9] p21, line11: in reference list of Raspollini et al. (2014), “Annal. Geophys.” → “Ann. Geophys.” [10] p28: a legend of Fig. 2, “NDDAC” → “NDACC” [11] p34: In Figs. 8 and 9, “x” of “y = mx+b” is not printed. In addition, “R” of “R2” is not printed. [12] p35: In Fig. 10, the unit of “Latitude” is not printed.

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