Atmospheric Measurement Techniques
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Discussions

Interactive comment on "Comparisons of CH₄ satellite GOSAT and ground-based FTIR measurements near Saint-Petersburg (59.9 N, 29.8 E)" *by* N. M. Gavrilov et al.

Anonymous Referee #1

Received and published: 8 October 2013

Gavrilov et al. describe ground-based FTS measurements of column-averaged methane at St Petersburg and a comparison with GOSAT data.

General remarks

Previous GOSAT validation studies have been based upon the use of TCCON data. It is nice to see that also FTS measurements of the NDACC network are now used for validation of GOSAT methane as it had been successfully performed in the previous case of ENVISAT validation. Complementary use of methane data from both NDACC and TCCON networks has become possible after a complex process elaborating non-

trivial recipes on how to achieve agreement between NDACC and TCCON data of methane, as documented in a series of papers by Sussmann et al.

Previous GOSAT validation studies have been based upon (TCCON) sites below 55 N and it is certainly interesting to look at a station located at 60 N as done in this paper.

Therefore, we encourage publication in AMT. However, the paper needs several major revisions prior to final publication.

Major points

1) I perfectly agree with the comments of "anonymous referee #3" (dated 23 Sep 2013, unfortunately entitled "referee #1" within the review-text). I would request to address all comments of referee #3 properly before the paper can be finally accepted. In particular I confirm, the use of the standard deviation as a proxy for the statistical error of a mean (bias) is not correct. The (95 % confidence) standard error of the mean (2 sigma / sqrt(n)) should be used instead. As stated by referee #3 this implies that two major conclusions of the paper will be reversed: The bias derived by Gavrilov et al. does not agree with the bias derived by Yoshida et al., and in fact is significantly different considering 95 % confidence intervals. Furthermore, it can only be concluded that the limited data set of Gavrilov et al. does not allow to infer statistically significant differences between the biases for GOSAT V01 and V02. Correct your wording throughout the text, to make clear whether you are talking about i) "standard deviation" (of one data set), "standard deviation of differences" (between two coincident data sets), "standard error of the mean (bias)" (see above).

2) The authors follow the NDACC retrieval strategy suggested by Sussmann et al. (2011), but important site-specific details are not mentioned. What are the mean degrees of freedom for signal, what is the mean water vapor column at St. Petersburg? Why do you restrict solar zenith angles to +/- 3 h around local noon? Did you look at a possible airmass dependency of you retrievals? Also the station altitude is missing.

3) I do not agree with the statement (p 7043, l 10): "For validation of satellite observations of greenhouse gases, the special monitoring network TCCON (...) was set up. While satellite validation is an important goal of TCCON it is certainly not the only goal. The authors are invited to read Wunch et al. (2011) and amend other TCCON goals.

4) Clarify on p 7049: What is limiting the statistical error of your bias compared to Yoshida et al.: the limited number of measurements at St. Petersburg or the high variability at St. Petersburg?

Technical corrections

1) You use various non-standard wordings for XCH4: "methane column-mean mole fractions (abstract)", "average CH4 mole fractions (abstract)", "column average mole fractions of methane (p 7043)", "column methane mole factions (p 7050)". Use either "column-averaged dry-air mole fractions of methane" or simply "column-averaged methane".

2) p 7046, l 24-26: Is 16.9 larger than 17.0?

3) p 7046, l 25: -13 > -13 ppb; ppb is also missing at several other places in the text.

4) p 7047, l 1-3: "When several ground-based or satellite XCH4 values were registered during a day, we used respective daily means in Tables 1 and 2." This explanation should be placed earlier in relation to the first time where Table 1 is addressed. Also clarify: Does Table 3 also show number derived from daily means? Add this information to the caption of Tab. 3.

5) p 7047, l 11: 17 pp > 16.9 ppb

6) p 7049, l 7: I cannot see the range 0.01 – 1.8 % from Tables 2 or 3.

7) p 7049, l 8: 0.2 +/- 0.8% > 0.2 % with a standard deviation of the differences of 0.85 %.

8) Use 1 decimal for ppb's (example 16.9 ppb) throughout the text, never use rounded

values (example 17 ppb).

9) Tables 1-3: Medians are given in the Tables. The Discussion only deals with the mean values. Therefore you could remove the medians from the Tables.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7041, 2013.