

Comment on the reply to the first comment on “Validation of XCH₄ derived from SWIR spectra of GOSAT TANSO-FTS with aircraft measurement data” by M. Inoue et al.

The manuscript becomes clearer. However, I still have some comments.

Dear anonymous referee #1,

Thank you very much for your careful reading of our manuscript and valuable comments.

Comment on “Validation of XCH₄ derived from SWIR spectra of GOSAT TANSO-FTS with aircraft measurement data” by M. Inoue et al.

General:

This paper describes the validation results of GOSAT XCH₄ Ver. 02.00 with aircraft measurement data from various projects and sites. The validation of the satellite measurement of greenhouse gases is important to estimate the global and temporal variations of the emission and sink of them.

The paper is well described and it should be published after some revisions.

Comments and questions:

2.2.6

p13, 11 equation (4)

Here ‘Trend’ is a constant value. But year to year variation of growth rate is large for CH₄. Are the fitting errors caused by this constant trend small enough for all sites?

We show “Trend” in the equation (4) and its fitting error at four sites (PFA, NHA, SGP, CMA) in Table R-1. The fitting error is about 0.7-0.8 ppb/year, and we consider that the fitting error caused by the constant trend is small for all sites.

Table R-1. Trends of aircraft-based XCH₄ and their fitting errors at each site.

site	Trend [ppb/year]	Fitting error of Trend term [ppb/year]
PFA	5.0	0.8
NHA	5.2	0.8
SGP	4.0	0.7
CMA	4.8	0.8

I understand that the fitting error of 'Trend' is small. Please make some comments in the manuscript.

p13, 123-25

Did you examine seasonal dependences only for two sites?

In addition to the two sites (SGP and RTA) shown in the manuscript, we examined seasonal dependences of the uncertainties at another two sites (LEF and SGM).

It is better to describe that you examined seasonal dependences of the uncertainties at four sites although you only show for two sites.

2.3

Does 'temporally matched' mean the time difference less than 24 hrs or some shorter time? I guess that the maximum time difference is much shorter than 24 hrs because most of aircraft measurements and GOSAT observations maybe performed during daytime.

"Temporally matched" does not mean the time difference less than 24 hours (or some shorter time). More simply, it means that the GOSAT data and aircraft measurement data are obtained on the same day at each site. The maximum time difference was about 9 hours.

It is also better to describe that the maximum time difference was about 9 hours in the manuscript.

Fig. 7

The differences between aircraft-based XCH₄ with CAK and without CAK seem to have seasonal (or some temporal) variations. Can you explain this?

At this point, we do not have sufficient information to explain the seasonal variations you pointed out. However, we consider that since this may be related to the fact that CAK is a function of solar zenith angle, we may have to use aircraft-based XCH₄ with CAK when possible.

I see. Could you comment on the possibility of solar zenith angle dependency and it is small enough (or not) compared with other uncertainty?

Table 6

The increasing rate of matched data number is much larger over land than that over ocean.

Do you know why?

We believe that your question means why matched data number becomes much larger over land than that over ocean by expanding the spatial coincidence criteria (from $\pm 2^\circ$ boxes to $\pm 5^\circ$ boxes). Most of aircraft sites with much observation data (e.g., SGP, AAO, HIL, LEF) are located in inland. Even if we expand the spatial coincidence criteria, even the $\pm 5^\circ$ boxes cannot cover ocean regions. It means that expanding to $\pm 5^\circ$ boxes can lead to much larger matched data over land than ocean.

Sorry for confusing. I mean that the increasing rates of matched data number between direct and curve-fitting are larger over land (43 to 1543: 35.9 times, 102 to 8060: 79 times) than those over ocean (3 to 23: 7.7 times, 10 to 207: 20.7 times).