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Atmospheric Measurement Techniques Discussions

Interactive comment on "Preliminary validation of column-averaged volume mixing ratios of carbon dioxide and methane retrieved from GOSAT short-wavelength infrared spectra" by I. Morino et al.

Anonymous Referee #1
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The manuscript "Preliminary validation of column-averaged volume mixing ratios of carbon dioxide and methane retrieved from GOSAT short-wavelength infrared spectra" of Morino et al., submitted to Atmos. Meas. Tech., covers an important topic, namely the validation of the operational greenhouse gas data products of GOSAT. The topic is appropriate for Atmos. Meas. Tech. and I recommend its publication after the comments given below have been considered by the authors.

Abstract: It is stated that the precision "is considered to be about 1 percent". Is this a result of the validation or is this an assumption ? This should be a result of the validation but it is not clear from the paper how this conclusion has been derived. Please provide additional evidence that the precision is 1 percent (if this is in fact the case) and modify the paper accordingly (abstract, main part and conclusions).

Page 5615, line 12, page 5625, line 1 and line 12:
The precision of the GOSAT SWIR XCO2 and XCH4 is considered to be about 1%.
Correction
The one standard deviation of the scatter of the GOSAT SWIR XCO2 and XCH4 is about 1% after correction of negative biases of XCO2 and XCH4 by 8.85 ppm and 20.4 ppb, respectively.

Abstract: The statement that the GOSAT XCO2 retrievals show similar features as the g-b FTS data is not supported by Fig. 10. Please modify this statement.

Page 5615, line 13:

The latitudinal distributions of zonal means of the GOSAT SWIR XCO2 and XCH4 show similar features to those of the g-b FTS data.

Correction

The latitudinal distributions of zonal means of the GOSAT SWIR XCO2 and XCH4 show similar features to those of the g-b FTS data except negative biases of the GOSAT data.

Page 5625, line 16:

The latitudinal distribution of zonal averaged GOSAT SWIR XCO2 and XCH4 is broadly consistent with that of the g-b FTS.

Correction

The latitudinal distribution of zonal averaged GOSAT SWIR XCO2 and XCH4 is broadly consistent with that of the g-b FTS except negative biases of the GOSAT data.

General - relative accuracy: GOSAT has been specified to achieve a relative accuracy of 1 percent for CO2 and 2 percent for CH4 (eg, Nakajima et al., 2010). Has this requirement been met or is it not possible with the presented validation approach to verify this? Please add a discussion on this important validation aspect. From Tab. 2 I conclude that this requirement has likely not been met at least for CO2 as the station-to-station (average) differences often exceed 1 percent (e.g., there is a bias of more than 5 ppm between Orleans and Garmisch or Park Falls). I recommend to add to Tables 2 and 3 the total root-mean-square (RMS) of the average difference (in addition to the mean difference where errors cancel) as a measure of overall station-to-station bias which may be interpreted as an estimate of the achieved relative accuracy.

Tables 2 and 3

We changed "Total" in the last row of Tables 2 and 3 to "All data". The one standard deviation (1 σ) in the last raw of Tables 2 and 3 is the total root mean square (RMS) of the average difference calculated from all data of 62. Therefore the standard deviation is interpreted as an estimate of the achieved relative accuracy as you suggested. Then the relative accuracy of the GOSAT XCO2 and XCH4 is 1.23% and 1.06%, respectively. The requirement of the relative accuracy of GOSAT data is met approximately.

General - averaging kernels: Have averaging kernels been considered for the comparison ? Please add this information.

The averaging kernels have not been considered directly for the comparison. The averaging kernels of the GOSAT and g-b FTS are similar (Yoshida et al., 2010; Wunch et al., 2010b). The difference of between with and without consideration of the averaging kernels might be small.

Section 4.1, page 5621, line 8: Has the AOD been retrieved from GOSAT? Which wavelength?

Yes, the AOD has been retrieved at 1.6 micron from GOSAT.

Section 4.2, page 5621, line 16: It is unfortunate that the maps only show the last retrieved value because earlier retrievals are overwritten. Why have the data not been gridded (averaged) to avoid this?

We changed the plots to the gridded data.

Page 5621, line 14:

Figures 2 and 3 show the global distribution of GOSAT SWIR XCO2 and XCH4 measured in April and October 2009. When several GOSAT data were retrieved at the same observation point in the month, the latest retrieved value was overwritten in Figs. 2 and 3.

Correction

Figures 2 and 3 show the global distribution of the gridded data of GOSAT SWIR XCO2 and XCH4 monthly averaged over 1.5 by 1.5 degrees in April and October 2009, respectively.

Section 4.2, page 5621, line 25-26: I guess the statement that the precision is 1 percent is not based on the standard deviation of the monthly mean XCO2 over Australia, or ?

Yes it is.

Section 4.3.1, page 5622, line 15 and following: What is the selection criterium for the data shown on the left of Figs. 4 and 5 (and 7 and 8)? In many cases more data are shown on the left compared to the right but only for the right hand side the selection criteria are given. Please add this information.

We added the following sentence in Page 5622, line 18:

---- successfully retrieved. Therefore the number of the GOSAT data in the scatter diagram is less than that in the time series.

Section 5, page 5625, line 1 and following: Please see the comments on the "1 percent precision" statement given above.

Section 6, page 5625, line 12 and following: Please see the comments on the "1

percent precision" statement given above.
We corrected them.

Tables 2 and 3: Please also report the correlation coefficients. Please also give the average station-to-station bias (see comment given above).
Yes we did as you suggested.

Fig. 6: Please add the correlation coefficient.
Fig. 9: Please add the correlation coefficient.
We added the correlation coefficients in Figs. 6 and 9. The correlation coefficients are 0.378 in Fig.6 and 0.681 in Fig.9 respectively. We added these results in line 7 and line 15 in page 5623.