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Interactive comment on "Bias corrections of GOSAT SWIR XCO_2 and XCH_4 with TCCON data and their evaluation using aircraft measurement data" *by* M. Inoue et al.

Anonymous Referee #2

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In this paper the authors describe the application of an empirical method for bias-correcting the operational GOSAT XCH4 and XCO2 datasets based upon a multi-variate linear regression of various geophysical retrieval parameters with the TCCON ground-based FTS data used as the reference dataset.

This paper is very well written and provides extensive details and analysis of the findings.

The main issue with this work is that the approach itself is certainly not novel or distinctly different from previous approaches as suggested in the manuscript. See for example Cogan et al., (2012) who utilise a very similar linear regression method for the University of Leicester GOSAT XCO2 data against TCCON data, in fact using many of

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Discussion paper

the same regression parameters as used here. Furthermore, Guerlet, S., et al. (2013) also perform a multi-variate linear regression using TCCON data as the reference for the bias correction of the SRON GOSAT XCO2 data, including an aerosol size parameter as one of their regression variables. Neither of these previous publications are referenced at all in this manuscript which is a large oversight on the part of the authors who instead compare primarily to the different method used by Wunch et al. This work does provide a far more extensive analysis, performing the correction for both land/ocean XCO2 and XCH4 data so does provide a valuable contribution to the literature but references and discussion should be made regarding the previous work in this area, Cogan et al., (2012) and Guerlet, S., et al. (2013). Indeed, a qualitative comparison of the bias correction obtained from this work compared to previous work may be of interest and provide further understanding of the underlying effects which can cause biases in various different retrieval algorithms.

The article would also benefit from a discussion of the potential effects of the final bias correction on flux inversions using the data (i.e. how are different sources/sinks likely to be affected), especially in regions where the bias correction is correlated to parameters such as albedo which themselves may be linked to surface type/vegetation. One example of this is the strong bias correction west-east across the US which correlates to croplands and hence will have a large effect on any carbon flux derived over the US.

Minor comments:

It would be useful to cite the recent Kuze et al., 2016 paper regarding the performance of the GOSAT TANSO-FTS instrument.

In various places the authors refer to “horizontal distributions” but later to “latitudinal distributions”. These are presumably the same thing and consistency in the usage should be checked.

Figures 2 and 3. The scale used on these figures is far too large. They should be updated with appropriate scales. Furthermore, the statistics for the regression lines

should be included on the plots.

Figure 6: This appears to show the GOSAT data plotted as individual points. The issue with plotting the data in this manner is that GOSAT performs many measurements at the same location, and overplotting them on top of each other can potentially be misleading as only the last plotted is visible. I would recommend gridding the data in an appropriate way.

References:

Cogan, A. J., et al. (2012), Atmospheric carbon dioxide retrieved from the Greenhouse gases Observing SATellite (GOSAT): Comparison with ground-based TCCON observations and GEOS-Chem model calculations, J. Geophys. Res., 117, D21301, doi:10.1029/2012JD018087.

Guerlet, S., et al. (2013), Impact of aerosol and thin cirrus on retrieving and validating XCO2 from GOSAT shortwave infrared measurements, J. Geophys. Res. Atmos., 118, 4887–4905, doi:10.1002/jgrd.50332.

Kuze, A., suto, H., Shiomi, K., kawakami, S., Tanaka, M., Ueda, Y., Deguchi, A., Yoshida, J., Yamamoto, Y., Kataoka, F., Taylor, T. E., and Buijs, H.: Update on GOSAT TANSO-FTS performance, operations, and data products after more than six years in space, Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2015-333, in review, 2016.

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