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Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of XCH₄ derived from SWIR spectra of GOSAT TANSO-FTS with aircraft measurement data" *by* M. Inoue et al.

Anonymous Referee #2

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The manuscript "Validation of GOSAT XCH4 using aircraft measurements" by M. Inoue et al. describes an intercomparison of GOSAT XCH4 (V2.00) with in-situ aircraft measurements of CH4. To derive XCH4 fromt the aircraft measurements, the in-situ profiles had to be extended above and below the altitude coverage of the aircraft. A large part of the manuscript explains how this has been achieved.

Please note that I have also reviewed Inoue et al., Validation of XCO2 derived from SWIR spectra of GOSAT TANSO-FTS with aircraft measurement data, Atmos. Chem. Phys., 13, 9771-9788, doi:10.5194/acp-13-9771-2013, 2013. Unfortunately, several of the points I had criticized in the discussion version of that manuscript also apply in one

way or the other to this one.

One important difference: I criticized the curve-fitting interpolation method in Inoue et al. 2013 because I think there are better alternatives (Carbontracker, various inversion models) for CO2. However, you don't really seem to have many alternatives for CH4.

General comments:

- I don't really understand why you try so hard to avoid using the GOSAT SWIR CAK (same issue with Inoue et al. 2013). The difference may be small but why not do it properly?

- in my opinion, the proposed method of extending the aircraft measurements with the ACE/HALOE climatology is flawed (check Geibel et al. 2012 for the reasons). Retrieval theory tells us that the GOSAT a priori profile is the most reasonable choice because that is what the retrieval falls back to when there is no other information. Any other choice of profile will only introduce an additional bias and never improve anything. Just imagine the extreme case where the aircraft coverage would be close to zero: with ACE/HALOE you would still get a bias despite the fact that there is no information from the aircraft measurement! If you think otherwise, you should explain much more why you think your choice is better.

- the main problem with connecting XCH4 and aircraft profiles is that the largest error contribution comes from the part of the column that was not (!) measured by the aircraft. Geibel et al. 2012 described how to calculate and minimize this systematic error. In that paper, the aircraft covered about 80% of the column. If I understand the description right, some of the aircraft measurements in this manuscript covered only 2-7 km altitude. That corresponds to only 36% coverage. In other words: 64% of the total column were not measured but guessed. You cite Geibel et al. 2012 but I think you should have also followed their suggestions to minimise the bias. Even if you cannot make use of their iterative approach to minimise the bias in the TCCON calibration factor, their method of calculating the error components of the different regimes of the

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atmosphere would be benefitial.

- even though this information is so important, there is no overview of the altitude coverage of the different aircraft platforms.

- Comparison with ground based FTS data (Sec. 3.3.3): there is no figure to support your results. Also the description of how you compared your data to TCCON data (p. 4747, l. 15-17) is very vague. For example, Which stations did you compare to? Please be more specific!

Specific comments:

- The title is somewhat misleading. A proper validation should provide more than just a comparison of two datasets. It should rather be called "Intercomparison of ...".

p. 4739, l. 6-10: the use of "above" and "below" is ambiguous when you use pressure as a vertical coordinate. Please rephrase. A figure might help to show which part of the profile was taken from which source. This was partly done in Fig. 8. However, this figure - along with all others - uses geometric altitude as the vertical coordinate.

p. 4741: sorry, from the description in the text it is not clear to me how Fig. 4 was derived. Was this derived from aircraft measurements at SGP? If so, what was the altitude coverage of the aircraft measurements? This number is not provided in any of the tables. How was the above-troposphere value derived?

p. 4742, l. 11-18: I find it somehwat unusual to consider values outside a 1-sigma range to be outliers and remove them. That is a very strong filtering criterion which leaves you with a very smooth dataset with very limited variability. Was that really necessary?

Sec 3.3.3: "Comparison with validation by ground-based FTS data"? Either comparison or validation!

p. 4748, l. 5-8: the idea by Geibel et al. was to minimize biases introduced by fill-

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ing the domain not covered by the aircraft measurements (which turned out to be the largest error contribution). I would not be surprised if your biases were the result of the climatological profiles that you used to extend your aircraft profiles (see my arguments above).

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4729, 2014.