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Atmospheric Measurement Techniques Discussions

# *Interactive comment on* "Consistent satellite $XCO_2$ retrievals from SCIAMACHY and GOSAT using the BESD algorithm" *by* J. Heymann et al.

**Anonymous Referee #2**

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General comments:

The paper by J. Heymann at al. is well written and gives a clear overview of the latest development of the BESD algorithm, particularly its application to GOSAT TANSO-FTS spectra. It clearly shows that GOSAT BESD is a valuable addition to the existing GOSAT XCO2 retrieval algorithms. The prospect of analyzing both SCIAMACHY and GOSAT data using the same algorithm is indeed a promising one as it potentially could eliminate inconsistencies between both XCO2 datasets as claimed by the authors. However the analysis in this paper fails to substantiate this claim and should be much enhanced.

Firstly, the 10 by 10 degrees collocation area used in the analysis is very crude. Not



only does using such a degrees based approach put high latitude stations at a disadvantage, Guerlet et al.(2013) showed that methods that take atmospheric dynamics into account yield significantly better sampling sizes and are thus more robust. The reason why this is critical, is that by using such a large static collocation area, the collocation bias (i.e. the bias between XCO2 at the TCCON site and the general collocation area) might become very significant. Therefore a matching pattern in the station to station biases between SCIA BESD and GOSAT BESD as described on page 1808 would NOT confirm, "that using the same retrieval algorithm for the evaluation of observations from different satellite instruments can help to make satellite-based XCO2 datasets consistent", but could merely be an expression of a quasi-identical collocation bias.

Secondly, when analyzing the consistency between GOSAT and SCIAMACHY BESD, the authors limit themselves to the TCCON collocation areas. This makes no sense. The TCCON network is very sparse and unevenly distributed around the globe. Furthermore Reuter et al. (2013) showed that differences between different XCO2 retrieval algorithms are fairly small at these TCCON sites, while they are substantial over regions that are not (yet) covered by TCCON, such as the Amazon rainforest. Therefore, the investigation of the potential reduction of the bias between GOSAT and SCIAMACHY by using the same algorithm, a key selling point for GOSAT BESD, should take a global look at the data.

Specific comments:

p1801, line 19: I don't see a collocation criteria based on altitude, nor do I see any methodology described on page 1802 on how to deal with strong differences in altitude. This is something that needs to be addressed given the inclusion of the Izana (2370m a.s.l.) TCCON site.

p1804, line 1: ...coefficient on the length of the...

p 1805 line 13: becomes better

Table 4: add altitude of TCCON sites

Figures 5,6 and 8: The statistical parameters in the plots are too small and already featured in the tables

References:

Reuter, M., Bösch, H., Bovensmann, H., Bril, A., Buchwitz, M., Butz, A., Burrows, J. P., O'Dell, C. W., Guerlet, S., Hasekamp, O., Heymann, J., Kikuchi, N., Oshchepkov, S., Parker, R., Pfeifer, S., Schneising, O., Yokota, T., and Yoshida, Y.: A joint effort to deliver satellite retrieved atmospheric CO2 concentrations for surface flux inversions: the ensemble median algorithm EMMA, Atmos. Chem. Phys., 13, 1771-1780, doi:10.5194/acp-13-1771-2013, 2013.

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.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 1787, 2015.