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Atmospheric Measurement Techniques Discussions

Interactive comment on "The Greenhouse Gas Climate Change Initiative (GHG-CCI): comparative validation of GHG-CCI SCIAMACHY/ENVISAT and TANSO-FTS/GOSAT CO_2 and CH_4 retrieval algorithm products with measurements from the TCCON network" *by* B. Dils et al.

Anonymous Referee #2

Received and published: 21 February 2014

General Comments

This study provides an assessment of column-averaged dry-air mole fractions of CO2 and CH4 measured by the GOSAT/TANSO-FTS and ENVISAT/SCIAMACHY instruments using a suite of retrieval algorithms. The resulting datasets were compared with each other in a round robin exercise and with ground-based TCCON FTIR measurements. This work was performed as part of ESA's GHG Climate Change Initiative.

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Interactive Discussion
Discussion Paper

A total of ten algorithms/data products were evaluated: two for SCIA XCO2, two for GOSAT XCO2, two for SCIA XCH4, and four for GOSAT XCH4. The differences between the SCIA data products were found to be significantly larger than those between the GOSAT products, particularly for single measurement precision. Overall, all XCO2 algorithms achieve the required precision threshold for inverse modelling (8 ppb), but none achieve the relative accuracy requirement (0.5 ppm) although there are challenges in assessing this criterion due to limitations in the distribution of TCCON sites and their station-to-station biases. For XCH4, the GOSAT algorithms meet the inverse modelling thresholds for precision (34 ppb) and relative accuracy (10 ppm), but the SCIA algorithms do not, possibly due to the use of spectra recorded after 2005, when the SCIAMACHY detector performance was degraded.

Space-based measurements of these two gases are of considerable interest at the moment, and with the upcoming launch of OCO-2, a new CO2 dataset should soon be available. Given the stringent precision and accuracy thresholds imposed by the scientific requirements, exercises such as that described here are an important for assessing and improving GHG measurement capabilities. This study is thus timely and relevant. The manuscript is generally well written and provides a systematic and thorough description of the intercomparisons. I recommend publication in AMT after the minor corrections below.

The abstract states that the goal of this intercomparison was to identify strengths and weaknesses of the datasets to determine which algorithms would proceed to the next round of the GHG-CCI project. Did such a decision result from the work?

The first reviewer comments on the simplistic use of distance and time criteria to match the satellite data to TCCON, and notes the more robust approach of Guerlet et al. (2013). Although a full reanalysis using more robust coincidence criteria is unlikely, if the authors follow the reviewer's recommendation to add a discussion of problems associated with the geometric colocation scheme and better schemes, they should also mention the approach of Wunch et al., ACP, 2011 (http://www.atmos-chem-

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phys.net/11/12317/2011/acp-11-12317-2011.html). This paper is referenced, but in a different context. It defines a dynamically informed coincidence criterion between ACOS GOSAT XCO2 and TCCON, using the temperature at 700 hPa as a tracer of dynamically-driven variability in XCO2 and thus allowing for a broader comparison with larger sample sizes.

Technical Corrections

Page 8681, line 4 – ENVISAT, respectively, using . . .

Page 8681, line 6 and page 8683, line 12 – FTSs

Page 8681, line 22 – For XCO2, all . . .

Page 8681, line 27 – For XCH4, the . . .

Page 8681, line 28 – fails to meet

Page 8681, line 28 – < 34 ppb threshold for inverse modeling, but . . .

Page 8682, line 17 – Earth's

Page 8685, line 4 and page 8686, line 8 – full physics vs. Full Physics – use one consistently throughout

Page 8686, line 9 – referred to in . . .

Page 8686, line 10 and elsewhere – change "take on" to "implementation of" or "version of" or something less colloquial

Page 8687, line 5 – in Section 3.2.

Page 8688, line 24 – in which OR where . . .

Page 8688, line 25 and elsewhere – corresponds to (not corresponds with)

Page 8690, line 7 – a priori correction

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Page 8691, line 24 – data pairs

Page 8692, line 1 – data points

Page 8692, line 11 and elsewhere – change “till” to “through” (or to “until” where appropriate)

Page 8693, line 21 – Table 3 and Fig. 4a show the . . .

Page 8693, line 22 – over the different stations, AND the error bars . . . (or new sentence after stations)

Page 8696, line 2 – 42320 points . . .

Page 8699, line 23 – above-mentioned

Page 8701, line 27 – N/northern vs. s/Southern – choose one format throughout

Page 8712, Table 2 caption – number of data points (N).

Figures 1, 2 – y-axis label should be XCO2 (corr – orig), XCH4 (corr – orig), preferably with units included

Figure 3 – The caption and axis labels are not very informative – add better explanation and labels.

Figures 4,7,10,13 – The y-axis labels do not agree with the information in the caption – correct this.

Figures 7,13 – Change GOSA to GOSAT in the panel labels.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8679, 2013.