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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Inferring regional sources and sinks of atmospheric CO_2 from GOSAT XCO_2 data" *by* F. Deng et al.

Anonymous Referee #1

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The manuscript provides a well-written comprehensive study on regional sources and sinks of column-averaged atmospheric CO2 mole fraction (XCO2) derived from GOSAT observations. Three different inversions were run and compared to independent data from aircraft (HIPPO) and ground-based total column XCO2 measurements (TCCON). The text is somewhat lengthy, which is largely justified by a detailed and comprehensive introduction and description of the inversion system and used data sets.

My main concern is the fact that the three different inversions produce very different results for the net fluxes of individual regions. For example, depending on the choice of inversion, North America could either be a strong source or a weak sink – even though all inversions agree well with the independent observation data. Though the authors try to explain why one inversion produces one or the other result, this leaves

many questions. First of all, the reasoning behind setting up the three inversions with different parameters is not explained well. Therefore, it is hard to judge which of the three setups should be closest to the real world. This leaves the impression that the choice of inversion parameters is arbitrary and there is no optimal choice. If that is so, the authors would be overinterpreting their results. In that case, the system would simply not be able to provide useful regional estimates - at least not on the level of the TransCom regions that were used here. One could imagine, that a more systematic approach like an ensemble run could shine some light on this issue. However, this is not exactly my field of expertise.

General remarks:

- use past tense consistently in the manuscript for all the descriptions of what you did as well as your findings.

- labels are far too small in most plots!

- use consistent color code for all figures

- display latitudes with N/S and longitudes with E/W instead of +/-. Especially for longitudes, there is no "natural" sign convention.

- I would prefer if all time axes were either month or day of year

Individual corrections:

- p. 26334: the information about the XCO2_A, XCO2_B, and XCO2_C datasets is spread over several paragraphs. You should have a table that summarizes the properties of the three data sets as well as key parameters of runs A-C.

- p. 26335, l. 17: "... is then is computed ..."

- s. 3.2.1: all biases should be reported as bias +/- std deviation.

- p. 26348: mark the stations you used on the map in Fig. 2. Alternatively, provide a

table that lists all used station names and locations.

- p. 26349: again, always provide biases along with std deviation

Figures:

- Figure 1: axis labels very small, explain choice of latitude bands

- Figure 2: TCCON diamonds not ideal (use crosses?), labeling unreadable

- Figure 3: labels and color scale unreadable

- Figure 4: strange - Europe exactly 0 as a priori?

- Figure 5: labels unreadable, should keep consistent color scale with Fig. 4

- Figure 6: should probably be "... smallest uncertainty reduction obtained ..."

- Figure 7: labels unreadable, mean and standard deviation should be more clearly indicated - not just N(..., ...)

- Figure 8: plot is too busy, labels too small, the site indicator with the lat/lon in brackets is not very intuitive, would be better to mark the sites on the map in Fig. 2, consistent color code?, indicate year

- Figure 9: similar problems as Fig. 8, consistent color code, use TCCON station codes instead?, indicate year

- Figure 10: is is hard to see any difference between the 3 plots. If there is one, maybe you should plot this as difference from a priori (since the HIPPO data and a priori are the same on all plots)

- Figure 11: use consistent color code

- Figure 13: labels too small

- Figure 14: labels too small

- Figure 15: labels too small, lines too weak and poor choice of colors, why is the quality of the plots so bad?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 26327, 2013.