

Interactive comment on “The 2015–2016 Carbon Cycle As Seen from OCO-2 and the Global *In Situ* Network” by Sean Crowell et al.

Anonymous Referee #1

Received and published: 6 March 2019

This manuscript explores the usefulness of OCO-2 data using a multi-model data assimilation/inversion framework. The manuscript is generally well written, except for some missing information at places or the page formatting that makes reading of the Figures difficult. It appeared to me, at the very end (page 45), that the authors are using a very old version of OCO-2 retrieval. That's a major cause for concern. I do not know how that affect the results presented in this study and their interpretations. Also I do not find much new information from this work, beyond what we already know from the existing publications using remote sensing data. However, the authors have done a commendable job in bringing together several models and have taken heavy workload in analysing them. In view of the above, I recommend publication of the manuscript as "Technical note" only in ACP or transfer to "Atmospheric Measurement Techniques".

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The scientific value of this paper is limited for publication a normal paper in ACP.

Specific comments: Page 3, lines 25ff: You may not be able to answer all these question, because the satellites do not see any parts of the globe seasonally uniformly (owing to the clouds in tropics and sunlight in the high latitudes. The data gap issue is not addressed here.

Page 4, line 20: I do not think this is only due to biases in the GOSAT, you may not simply discuss annual total CO₂ flux from Sun following satellite sensor - as the winter seasonal data are missing.

Page 4, line 23ff: Give a reference (in prep. is ok) or this doesn't make sense. Delete?

Page 6, line 5-7: How can you say that? Is there a common transport model using different assimilation technique?

Page 6, line 17-21: I tend to agree that use of single model is problematic for the flux assessments, but any given model should be rigorously evaluated. For instance, I would highly recommend you to simulate SF₆ or the likes as a dynamical tracer in all the models participating any such inter-comparisons, and present simulated horizontal and vertical gradients of SF₆ in comparison with measurements. Note that when you are working with XCO₂ the stratosphere is not negligible. Many studies have shown this clearly since 2012.

Page 8, line 17: what are land glint? how much fraction of land data are in glint mode. some additional information will be useful here. Please cite to Figure 1 here.

Page 11, line 8: How much of the para below is essential for this work?

Section 3.3: Should be shorten with some effort, these are pre-processing all global modellers do, but how much is essential is not clear. For example if you sampled the model for each of the data points and then took mean, will that work? If not, the whole paper raises an issue of applicability of the models for the purpose. Why not invest resources to develop models first and then estimate fluxes from satellite. For sure the

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dilemma you face here is not new, but need serious attention.

Table and Figure : Please, fix the page formatting. Its annoying to find the figure/table and captions on different pages

Page 19, line 19: I do not think so, at least for the 2nd peak in 2016

Page 10, line 1: Need to define H15 and P13 somewhere?

Page 23, line 17-22: Strange discussion. Why not the data are flagged before inversion. How do you know that your model transport is not at fault?

Page 24: Somehow this shouldn't be the case when there are supposed to be data coverage everywhere! is this an illusion because of the variable axis range? Can you compare the uncertainties in number and be more precise in your discussion here?

Page 27: line 2: I think this and earlier statements like this are loosely supported by numbers. You are saying ~ 1 PgC/yr values are similar in seasonal cycle, but a few fraction of a PgC/yr as different for annual flux!

Page 28: bottom row: TransCom 7 & 8? or 8 only?

Page 30, line 11: what if you do not measure during the wet season due to clouds?

Page 30, line 18-20: I do not think these smaller number are more difficult to interpret that the very large emission you mentioned earlier in this paragraph.

Figure 5: what are TransCom 03a, 05b or 09a? Show the region map in Fig. 1, you have wasted space for one more panel

Page 43: I thought one of the "Science" papers using OCO2 data has discussed this already? May be no need for a mention here.

Page 45: line 11: Aren't more and more people using LAI, rather than NDVI?

Page 45: line 23: I see this possibility as "remote" and out of place in the context of OCO-2 data inversion/assimilation. Suggest a deletion of APO related text.

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A5: no mention of transport model resolution?

Figure C2: Why doesn't the OCO2 values match with the model even after assimilation? these two sentences be merged - "The sites are arranged..." and "Plots are ordered..."

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-87>, 2019.

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