Biogeosciences Discuss., 10, C1106–C1110, 2013
www.biogeosciences-discuss.net/10/C1106/2013/

Biogeosciences Discussions

Interactive comment on "Nested atmospheric inversion for the terrestrial carbon sources and sinks in China" *by* F. Jiang et al.

F. Jiang et al.

jiangf@nju.edu.cn

Received and published: 19 April 2013

We thank the anonymous referee 3 for his/her comprehensive review and detailed suggestions. These suggestions help us to present our results more clearly.

Referee 3: A study by Jiang et al addresses important issue of the evaluating a trend in China's net terrestrial biosphere fluxes over the last decade. Authors apply inverse model setup similar Transcom-3. The paper largely follows approach and inherits technical details from Deng and Chen 2011. A study has a potential for contributing to top-down and bottom-up synthesis of the regional carbon cycle budget analysis for which RECCAP could serve as most recent example. In this context its publication is justified after improving the analysis and the manuscript. The choice of the prior flux

datasets and inversion method are not causing much concern. However several details do require clarifications and revisions, thus the manuscript should be revised to correct the problems, or resubmitted in case revision takes much time. It is recommended to devote ample time for revision given the volume of the required analysis. Several mistypes and omissions indicate that the manuscript has not been thoroughly checked prior to publication at BGD; checks should be improved in final version

Specific comments

1) Folowing the text (p 1187) one would assume BVOCs are converted to CO2 in a matter of a day. On the other hand atmospheric chemistry kinetic mechanisms usually describe that BVOCs end up as CO, not CO2, after reacting with OH. And it takes some time (1-2 month) to convert CO to CO2, obviously enough for air to escape from China region. The discussion should be revised accordingly. As emissions of BVOCs along with those of CO serve as a leak of emitted carbon not detectable by CO2 observing network and inversion, authors are right to consider the question in relation to the China's carbon budget. However, the discussion presented here does not sufficiently reflect recent progress in the treatment of the chemical source of CO2 in the problem of global atmospheric CO2 transport.

Response: Thanks for this comment. We agree that the BVOCs will end up as CO through atmospheric oxidization, and then, be converted to CO2 after reacting with OH. Though the atmospheric lifetimes of reactive BVOCs are short (mostly less than 1 day), the conversion from CO to CO2 is slow, usually take 1 - 2 months. Hence, the observations in or around China cannot directly sense the contributions from the atmospheric oxidization of reactive BVOCs. And hence, without considering the full chemistry, we may have under-measured the terrestrial carbon sources in the CO2 measurements within and near China. The same would also be true for other regions of the globe, in such a way that the net effect on any region would be small. This is one of the reason that we conduct this nested inversion rather than regional inversion. In our global-scale inversion, CO2 observations around the globe were used and regional

BGD

10, C1106–C1110, 2013

biases in the inverted net CO2 flux due to BVOCs-CO-CO2 conversions are expected to be small. We will update the discussion about the contribution of reactive BVOCs in our revision, and according to the suggestion of referee 2, we will add a table by splitting the CO2 sources and sinks budgets over China by accounting all the flux components and non-CO2 species oxidation.

2) Source of the original data should be cited accurately: p 1181, line 13. "Data of land cover is obtained from http://lpdaac.usgs.gov (LP DAAC, 2001)" The land cover classification/legend not shown and reference to data set are not given, need to cite more specifically. p 1182, line 21. Similar problem with fossil fuel emissions dataset, the original reference would be required here. Citation as "the fossil fuel emission field, which is obtained from Carbon Tracker 2010 (http://carbontracker.noaa.gov)" is not sufficient.

Response: Thanks for this comment. We have revised the citations as follows in the revised paper.

"The partition scheme in China is mainly based on land cover types, i.e. forest, crop, grass, and desert. MODIS land cover data for the year 2007 with the University of Maryland (UMD) classification scheme (Hansen, et al., 1998) was used in this study, which was obtained from http://lpdaac.usgs.gov (LP DAAC, 2001)."

"...These two types of fluxes are (i) the Miller Carbon Tracker fossil fuel emission field, which is constructed based on CDIAC 2007 (Boden et al., 2010) and EDGAR 4 databases (Olivier and Berdowski, 2001). Global, regional and national fossil-fuel CO2 emissions until 2007 were compiled in CDIAC 2007. The emissions in 2008 and 2009 are extrapolated from the 2007 CDIAC statistics using energy consumption statistics from the BP Statistical Review of World Energy 2010. More detailed descriptions could be found in the document of Carbon Tracker (http://carbontracker.noaa.gov)."

3) BEPS model setup description used in this study is missing. Details should include model resolution, spin-up, vegetation, soil data, meteorological data, remote sensing

BGD
10, C1106–C1110, 2013

data and other parameters which have changed since Chen 1999 publication.

Response: Thanks for this comment. We will add the description of BEPS model setup in our revision.

4) Nested TM5 setup for China is different from one for North America (Deng 2011), its description is missing.

Response: Thanks for this comment. The setup of TM5 is shown in Page 1182, Lines 8-9: "TM5 is run at a horizontal resolution of $3^\circ \times 2^\circ$, with 25 vertical layers with the top layer at about 1 hpa", however, we also think that it is too simple, we will add more detailed setup in our revision.

5) Interpretation of the results should be more careful. p 1188 Based on comparison with mean flux results by Piao et al authors concluded "these probably imply the increase of the carbon sink in China in 2000s". The statement is not justified because the techniques used here and in Piao et al are different. Suggest withdrawing the statement.

Response: Thank you for your suggestion. We have removed that sentence in the revised paper.

6) The inversion presented in this study is very similar in transport model resolution and observation dataset being used to the operational and semi-operational inverse model estimates for the same period and region that are reported by Carbontracker, LSCE, MPI-BGC systems. Thus it is important to compare with available fluxes and report range of differences to understand better the range of flux uncertainty stemming from differences in model setups, prior fluxes and region aggregation.

Response: Thanks for this comment. In this manuscript, we only compared our results with the ones of Deng and Chen (2011) and Le Quéré et al. (2009). According your suggestion, we will further compare our results with results from Carbontracker, LSCE and MPI-BGC systems and give more discussions on uncertainties in our revision.

BGD

10, C1106–C1110, 2013

Technical corrections

p 1178 Abstract: “Bayes theory” – Is usually cited as “Bayesian approach”

p 1184 WDCGG Correct writing is: ”World Data Centre for Greenhouse Gases"

p 1190 line 8 “BESP” – should it be BEPS? “OPA- PISCES-T” – spaces are not needed.

Response: We have made corrections accordingly in our revision.

Reference:

Hansen, M., R. DeFries, J.R.G. Townshend, and R. Sohlberg (1998), UMD Global Land Cover Classification, 1 Kilometer, 1.0, Department of Geography, University of Maryland, College Park, Maryland, 1981-1994.

Olivier, J.G.J. and J.J.M. Berdowski (2001). Global emissions sources and sinks. In: Berdowski, J., Guicherit, R. and B.J. Heij (eds.) The Climate System, pp. 33-78. A.A. Balkema Publishers/Swets Zeitlinger Publishers, Lisse, The Netherlands. ISBN 90 5809 255 0.

Boden, T. A., Marland, G., and Andres, R. J.: Global, regional, and national fossil-fuel CO2 emissions, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, TN, doi:10.3334/CDIAC/00001V2010, 2010.

Interactive comment on Biogeosciences Discuss., 10, 1177, 2013.