

Interactive comment on “Prior biosphere model impact on global terrestrial CO₂ fluxes estimated from OCO-2 retrievals” by Sajeev Philip et al.

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The comments posted below is on a referee's behalf:

The investigators have conducted a series of OSSEs to assess the impact of prior biospheric fluxes on posterior fluxes in CO₂ flux inversions using OCO-2 data. The lack of robust regional flux estimates is a major issue in the flux inversion community. It is known that the choice of prior fluxes can impact posterior flux estimates, contributing to discrepancies between different inversions. This study has conducted the most detailed and thorough sensitivity analysis to date to quantify the potential impact of the prior fluxes in CO₂ inversions. The manuscript is well written and I recommend it

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for publication in ACP with minor revisions to address my mostly technical comments below.

Comments

1. Page 4, line 3-4: Change “NEE flux (balanced biosphere)” to just “NEE flux”.
2. Page 4, line 28: How different is the diurnal variation between the truth and the prior models? This information could be included in the Supplement.
3. Page 6, line 2: Change “CO₂ at August” to “CO₂ on August”.
4. Page 6, line 13: OCO-2 XCO₂ is not actually retrieved using Equation (1). Rather, the retrieval is expressed as Equation (1), after the fact.
5. Page 6, line 16: Please add “column” between “a” and “averaging” kernel.
6. Page 6, lines 32, 34, 35, etc...: Please change “model grid” to “model grid box” when discussing the model grid boxes. For example, on lines 34-35 it should read “the jth model grid box” instead of the “jth model grid”.
7. Page 7, line 5, and page 8, line 31: Same comment as above regarding the “model grid” vs “model grid box”.
8. Page 7, Equation (3): Shouldn't this equation be similar to Equation (1) since the observation operator is transforming the model into the observation space? For example, the “ya” and “Ma” in this equation should be the same as “ca” and “XCO_{2a}” used in Equation (1), respectively. The only quantity that should be different in this expression is “f(x)”, which represents the simulated profile.
9. Page 7, line 37: Something is missing between “Similar” and “to prior error statistics”. Should this say “Similar to our treatment of the prior error statistics. . .”
10. Page 8, lines 20: Figure S2 is useful for the reader who is unfamiliar with the TransCom domains. Furthermore, it has the numerical ordering of the regions that is

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useful for interpreting Table 3. I would suggest moving this into the main manuscript.

11. Page 10: Figures S5 and S7 show the spatial distribution of the results and complements the information shown in Figures 3-5. I would suggest moving Figures S5 and S7 in the main section of the manuscript, which currently has only five figures.

12. Page 11, lines 31-33: I don't understand the statement here that the NEE estimates are more sensitive to the prior error when there are sufficient observations available and large differences between the truth and prior. Is this due to the inversion approach used here? Is it because the prior error is a relative error so when the flux is larger, the error is also larger, which gives the inversion more flexibility in adjusting the fluxes?

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1095>, 2019.