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Interactive comment on "The impact of improved satellite retrievals on estimates of biospheric carbon balance" *by* S. M. Miller and A. M. Michalak

Anonymous Referee #1

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This paper is an extension of a previous study that documented the information content of the OCO-2 retrievals in their version 7 (Miller et al., 2018). The extension concerns the improvement brought by versions 8 and 9. It could have been anecdotal but the results are striking enough to warrant publication, in particular given the wide use of version 7 (e.g., Crowell et al., 2019). It could also contribute to explain the increased realism claimed by some inversion results with version 9 (Chevallier et al., 2019, http://dx.doi.org/10.5194/acp-2019-213). The paper is concise, well written and quite pedagogical. I recommend publication after a few issues can be addressed.

- Throughout the text, the authors use the expression "robust constraint", but what is it? If for instance all OCO-2 L4 products had no better quality than the latest biosphere models at any scale, it could be found useless for land vegetation

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carbon accounting and therefore not robust for that application. I do not think that the chosen method can conclude to robustness. The authors need to qualify their conclusion better: they demonstrate improvement in the retrievals on the basis of a specific indicator, but what does this mean in practice?

- Crowell et al. (2017) should be updated to Crowell et al. (2019, http://dx.doi.org/10.5194/acp-2019-87).

- P. 3, l.9: the authors actually do not use more than 7 biome regions and therefore do not necessarily reach the point when they are no longer able to detect any variations in biospheric CO_2 sources and sinks.

- P. 3, l. 19: the choice of a year with a strong El Nino episode is surprising. How would the results change with a "normal" year?

- P. 3, l. 32: the authors need to give details about the seven models so that the reader can get convinced about their realism. For instance, I understand that Miller et al. (2018) used climatological model averages for technical reasons (lack of model availability for the target year): now that model outputs for 2015 are widely available, has this issue been sorted out?

- P. 6, l. 14: I have not seen that the community has deployed significant effort to improve their transport models or their error models in the past years. In comparison, the effort on retrievals, in particular in the OCO-2 team, has been huge. It is not fair to compare them to the rest.

- Legends of Figs. 3 and 4: what are target mode retrievals doing here?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-382, 2019.