

## ***Interactive comment on “Characterizing biospheric carbon balance using CO<sub>2</sub> observations from the OCO-2 satellite” by Scot M. Miller et al.***

### **Anonymous Referee #1**

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The authors analyze the information content of the OCO-2 XCO<sub>2</sub> retrievals in terms of surface fluxes. They first look for typical patterns originating from surface fluxes in real XCO<sub>2</sub> measurements and then use a simulation framework to document this performance. I found it particularly difficult to follow the logic of the paper and to evaluate the soundness of the approach. As a preliminary step for publication, the authors should seriously invest in making their study accessible to the broad audience of ACP. As a second step, I would like to highlight the following issues.

- The paper concludes to a limited utility of OCO-2 retrievals for flux estimation with current retrieval algorithms and transport model. This may be correct, but is

orthogonal to the claim made by Liu et al. (2017). The disagreement should be clearly stated.

- Section 3.1 and the first part of Section 3.3 reinvent the wheel. See, e.g., Olsen and Randerson (2004) and Worden et al. (2017). Similarly, l. 23-28 are just an adaptation of an old argument (Rayner and O'Brien, 2001).
- The retrieval error simulations of Fig. 3 look overly optimistic in comparison to the validation results of Wunch et al. (2017).
- Section 3.2 looks for flux patterns in XCO<sub>2</sub>. Most top-down studies from OCO-2 would use a Bayesian approach where flux-error patterns are looked for. This is more challenging because the signal is even smaller (while the paragraph in-between p. 5 and p. 6 suggests that the two approaches are rather equivalent with respect to the measurement information content). One should therefore discuss this limitation and further tone down the conclusions of the paper.

## References

Liu, J. et al. Contrasting carbon cycle responses of the tropical continents to the 2015–2016 El Niño. *Science* 358, eaam5690 (2017). Olsen, S. C., and J. T. Randerson (2004), Differences between surface and column atmospheric CO<sub>2</sub> and implications for carbon cycle research, *J. Geophys. Res.*, 109, D02301, doi:10.1029/2003JD003968.

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Discussion paper



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