Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-213-RC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Objective evaluation of surface- and satellite-driven CO_2 atmospheric inversions" *by* Frédéric Chevallier et al.

Anonymous Referee #2

Received and published: 7 June 2019

This paper explores the flux constraint of the in situ network, GOSAT, and OCO-2 independently using two different transport models. As such, this paper is extremely important to the community as a benchmark of progress on satellite remote sensing and the relative information in different sensors on the carbon cycle.

The paper is well-written and thorough, and I recommend publication after a few minor additions and/or corrections.

One issue I can foresee is the use of the OCFP XCO2 product for GOSAT and the OCO-2 FP algorithm for OCO-2. A major conclusion of this paper is that GOSAT has serious issues with regard to its carbon cycle constraint. A paper by Takagi et al, perhaps in 2015, showed large differences between the different retrieval algorithms, and you might actually get similar results between OCO-2 and GOSAT if you were to

use the same retrieval algorithm. I believe this at least warrants some discussion in the manuscript.

Also, the small sensitivity to the two different transport models is a significant finding, as other studies have shown a very large sensitivity to transport. Can you comment on this lack of sensitivity? It is due to similarities between Era-Interim and Era-5? Prior flux constraint? You comment that LMDz5a and LMDz6a are very different models. I realize that this evaluation could be a series of papers on its own.

This reviewer especially appreciates the thorough evaluation by aircraft data, though the lack of TCCON evaluation is surprising. Has this evaluation been done? Despite some dependence between the space-based sensors and TCCON, other works have shown that surface inversions can at times actually agree better with TCCON.

Minor changes:

Page 2, Line 35: Should be Schuh et al, 2019

Page 6, Line 19: Could this be an artifact of the way that the NOAA growth rate is calculated (in the marine bdy layer or at Mauna Loa) vs. a global flux?

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