

Atmos. Chem. Phys. Discuss., referee comment RC2
<https://doi.org/10.5194/acp-2022-506-RC2>, 2022
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Comment on acp-2022-506

Prabir K. Patra (Referee)

Referee comment on "Using Orbiting Carbon Observatory-2 (OCO-2) column CO₂ retrievals to rapidly detect and estimate biospheric surface carbon flux anomalies" by Andrew F. Feldman et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-506-RC2>, 2022

Review of "Using OCO-2 column CO₂ retrievals to rapidly detect and estimate biospheric surface carbon flux anomalies" by Feldman et al.

This paper tries to estimate CO₂ fluxes based on a pure observational based system, using OCO-2 measurements of XCO₂ and basic meteorological measurements from reanalysis. The CO₂ flux calculation (divergence) method is similar to that has been applied to NO₂ measurements from space commonly for estimation of NO₂ emissions from hotspots. One major difference between CO₂ and NO₂ systems of flux derivation is the data density and the interference from land biosphere fluxes, with peculiarities arising from the lifetimes of the two species of concern. The manuscript is overly descriptive, and was very difficult to read for me. I have marked a few minor things on the PDF, but those I think not so important to discuss if the present form or anything close to this would be accepted for publication. As the authors have acknowledged it is very difficult to separate the influences of far and near fields on CO₂ flux estimation based on different area consideration in Fig. 3, application of divergence methods probably remained skeptical for CO₂ research given the data density and data quality of CO₂ (as mentioned earlier large difference in signal-to-noise ratios for CO₂ and NO₂ due to lifetimes), unless probably focussing at a hotspot. The validation exercise by comparing with Carbon Tracer is a bit strange, because the LPJ simulated biosphere fluxes will already give a reasonable correlation with CT or any inversion for that matter. The manuscript draft should be revised in a less descriptive way in my opinion before consideration for publication, e.g., use more Tabular contents even for the experimental description.