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Comment on essd-2021-210

Anonymous Referee #1

Referee comment on "A global CO_2 flux dataset (2015–2019) inferred from OCO-2 retrievals using the Tan-Tracker inversion system" by Zhe Jin et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-210-RC1, 2021

This paper describes a global terrestrial biosphere and oceanic CO2 flux dataset (2015-2019) inferred from OCO-2 b9 retrievals using Tan-Tracker inversion system. The fluxes are provided daily at 2° (latitude) x 2.5°(longitude) spatial resolution. The dataset was evaluated against OCO-2 retrievals and column CO2 observations from TCCON observation network.

While high quality carbon flux estimates are urgently needed to provide policy support and to advance global carbon cycle science, I find four major caveats in generating the dataset:

- The data thinning and filtering method. The study used several steps to remove outliers by comparing to model simulations, and to make sure the number of observations is less than 20000. There is nothing wrong to filter the observations before assimilations. However, the observations spatial gradient after filtering (Figure 2) is so different from the original observations that the assimilated obs could hardly be treated as OCO-2 retrievals anymore. For example, the mean value over northern Amazon is about 405 ppm before filtering, but it is equal or less than 400 ppm after filtering. The study used prior fluxes that were constrained by surface observation network, which is very sparse in the tropics. Thus, the strict filtering can filter out the real signals in the data. It is not clear in the paper what the bases are for the filtering threshold (e.g., 2ppm absolute differences between observations and model simulated values).
- Relative biases between ocean glint and land observations. This study used both ocean glint observations and land observations in the flux inversion. However, it was shown that ocean glint and land observations of the ACOS-OCO2 b9 retrievals have relative biases, and normally only inversions using land observations are discussed (1–3).
- The inferred flux spatial pattern. This study showed that the net fluxes across the 11 land TransCom regions are net sink except in tropical south America (Table 5), which is very different from previous studies that showed large efflux over northern tropical

Africa (2, 4). This difference is most likely due to the aggressive filtering method. Since the inferred fluxes from this study are very similar to the prescribed prior fluxes (Figure 8), it is hard to say how much the posterior fluxes are really constrained by OCO-2 retrievals.

- Uncertainties for the posterior fluxes are not provided. Even though the regional aggregated fluxes have uncertainty estimates, the uncertainties are not provided in the gridded dataset. I would suggest including the uncertainty estimates.
- Evaluation dataset. The study used independent OCO-2 retrievals and TCCON observation network to evaluate the posterior fluxes. However, it is not clear how the independent OCO-2 retrievals were selected. Since OCO-2 retrievals were all retrieved with the same methodology, they are not totally independent even some of those retrievals were not assimilated. Normally, aircraft CO2 observations and surface CO2 flask observations are used as independent observations to evaluate posterior fluxes.

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