

A global surface CO<sub>2</sub> flux dataset (2015–2022) inferred from OCO-2 retrievals using the GONGGA inversion system

Zhe

Jin

Peking University

Poster

Accurate assessment of the size and distribution of carbon dioxide (CO<sub>2</sub>) sources and sinks is important for efforts to understand the carbon cycle and support policy decisions regarding climate mitigation actions. Satellite retrievals of the column-averaged dry-air mole fractions of CO<sub>2</sub> (XCO<sub>2</sub>) have been widely used to infer spatial and temporal variations of carbon fluxes through atmospheric inversion techniques. In this study, we present a global spatially resolved terrestrial and ocean carbon flux dataset for 2015–2022. The dataset was generated by the Global ObservatioN-based system for monitoring Greenhouse GAses (GONGGA) atmospheric inversion system through the assimilation of Orbiting Carbon Observatory 2 (OCO-2) XCO<sub>2</sub> retrievals. We describe the carbon budget, interannual variability, and seasonal cycle for the global scale and a set of TransCom regions. The 8-year mean net biosphere exchange and ocean carbon fluxes were  $-2.22 \pm 0.75$  PgC yr<sup>-1</sup> and  $-2.32 \pm 0.18$  PgC yr<sup>-1</sup>, absorbing approximately 23% and 24% of contemporary fossil fuel CO<sub>2</sub> emissions, respectively. The annual mean global atmospheric CO<sub>2</sub> growth rate was  $5.17 \pm 0.68$  PgC yr<sup>-1</sup>, which is consistent with the National Oceanic and Atmospheric Administration (NOAA) measurement ( $5.24 \pm 0.59$  PgC yr<sup>-1</sup>). Europe has the largest terrestrial sink among the 11 TransCom land regions, followed by Boreal Asia and Temperate Asia. The dataset was evaluated by comparing posterior CO<sub>2</sub> simulations with the observations from Total Carbon Column Observing Network (TCCON) retrievals and Observation Package (ObsPack) flask observations. Compared with CO<sub>2</sub> simulations using the unoptimized fluxes, the bias and root mean square error of posterior CO<sub>2</sub> simulations were largely reduced across the full range of locations, confirming that the GONGGA system improves the estimates of spatial and temporal variations in carbon fluxes by assimilating OCO-2 XCO<sub>2</sub> data. This dataset will improve the broader understanding of global carbon cycle dynamics and their response to climate change. The dataset can be accessed at <https://doi.org/10.5281/zenodo.8368846>.

Poster PDF

[zhe-jin-poster.pdf](#)

Meeting homepage

[IWGGMS-20 Workshop](#)

[Download to PDF](#)