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Seasonal and Interannual Variability of Australian Carbon Fluxes Seen by GOSAT

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The semi-arid Australian continent significantly influences the interannual variability of the global terrestrial carbon sink. Atmospheric inverse models can be used to estimate land carbon fluxes from CO₂ measurements, and study the underlying processes leading to their variability. The spatial coverage of in-situ CO₂ measurements over Australia is sparse, leading to large uncertainties in estimated carbon fluxes for the Australian continent. Satellite measurements of CO₂ offer an independent and spatially extensive source of information about the Australian carbon cycle.

Here, we examine the decadal data set (2009-2018) of atmospheric CO₂ mole fractions delivered by the Greenhouse Gases Observing Satellite (GOSAT) above Australia. We estimate land CO₂ fluxes from those measurements via the TM5-4DVAR inverse model and discuss their seasonal and interannual variability. Compared to flux estimates constrained by in-situ mole fraction measurements alone, GOSAT-based inversions suggest greater variability attributable to the seasonal dynamics of biogenic and fire fluxes. To investigate the mechanisms behind the variability, we compare to bottom-up carbon fluxes from the FLUXCOM and the TRENDY ensemble of global dynamic vegetation models.