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The seasonal cycle of atmospheric CO_2 in South America over the last ten years seen by GOSAT

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The number of in-situ CO_2 measurements in the Southern Hemisphere is very limited. This leads to large uncertainties in estimates of regional carbon fluxes by in-situ based inverse models. Satellite-based CO_2 measurements, on the other hand, are available in the Southern Hemisphere with a dense spatial coverage. By evaluating these, the regional carbon cycle can be studied in more detail and the results of carbon cycle models can be validated against the satellite data.

Here, we present a comparison of atmospheric CO_2 data provided by the Greenhouse gases Observing SATellite (GOSAT) and in-situ based inverse models for South America from 2009 to 2019. The seasonal cycle of atmospheric CO_2 concentrations measured by the GOSAT satellite shows differences in both, amplitude and timing, compared to in-situ based atmospheric inversions. To determine the reason for these discrepancies, we use the TM5-4DVar atmospheric inversion model assimilating GOSAT satellite data to obtain GOSAT based land-surface fluxes. This allows us to identify sub-regions responsible for the differences. In order to gain a deeper understanding of the underlying processes, we also analyse various climate parameters, fire emission data, and vegetation proxies (for example Solar Induced Fluorescence, SIF). By doing so, we aim at improving our understanding of the mechanisms that influence the seasonal carbon cycle in South America.