

Assessing the Utility of Atmospheric CO₂ Observations from Space (ACOS) V2.10 Greenhouse Gases Observing Satellite (GOSAT) Column CO₂ Retrievals by Comparing to Independent CO₂ Measurements

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Here we evaluate the constraint provided by ACOS v2.10 GOSAT column CO₂ retrievals on sources and sinks of CO₂ at weekly to seasonal time scales by comparing it to the constraint provided by other CO₂ measurement types, such as surface and aircraft profile data from NOAA's *in situ* measurement program, as well as column CO₂ measurements from the Total Carbon Column Observing Network (TCCON). The metric used is the fit to independent CO₂ measurements – those same data sources above that were not included in each inversion.

For our prior, we use both optimized and projected fluxes for 2009-2010 from CarbonTracker (2010 release) run forward through the Parameterized Chemistry Transport Model at 0.5°x0.67° resolution (lat/lon) on 40 vertical layers. We then assimilate the different data products individually (i.e. GOSAT-only, TCCON-only, etc.) to solve for weekly CO₂ flux corrections on a 4.5°x6° grid, using our variational data assimilation approach. Before assimilating the GOSAT data, we apply a bias correction consisting of a 3-parameter fit for each of three data types: ocean glint, high-gain land, and medium-gain land.

We assess each data type by comparing the modeled measurements given by the optimized concentration fields obtained with that type to both: a) those given by the prior fluxes and b) the measurements left out of the inversion. Using the fit to the TCCON column CO₂ measurements as a metric, for example, the bias-corrected GOSAT data improve the fit compared to that given by the prior, as well as that given by the surface *in situ* NOAA data. This suggests that the GOSAT retrievals have utility, at least for constraining the short-term flux variability.

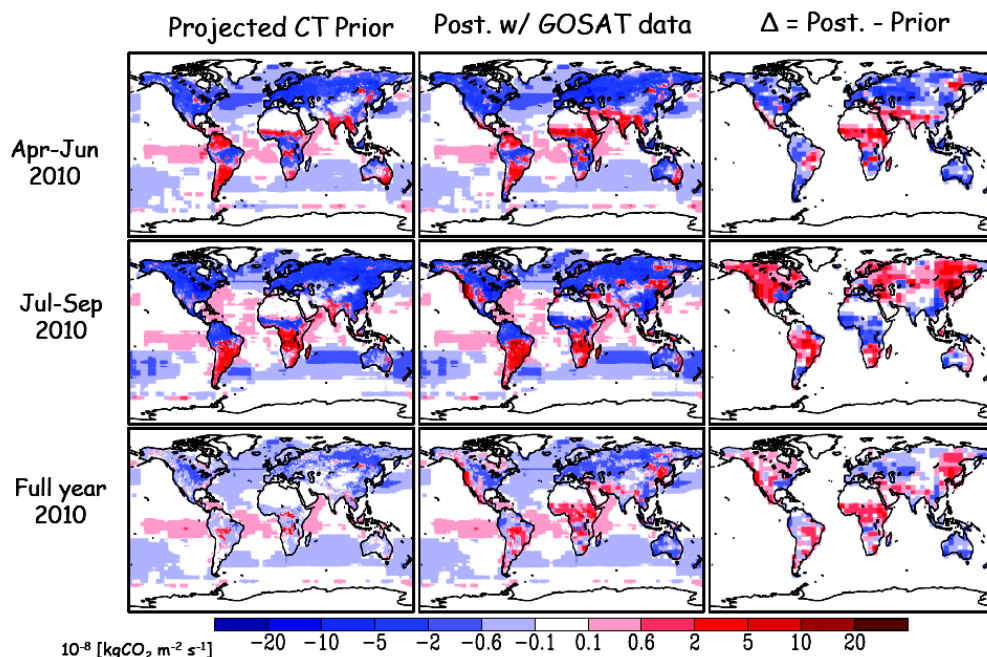


Figure 1. Flux correction obtained by inverting ACOS v2.9 GOSAT column CO₂ measurements in our variational carbon data assimilation system (right column), along with the projected CarbonTracker prior (left) and the posteriori (center) fluxes. Weekly fluxes were estimated on a 4.5 x 6 deg (lat/lon) grid.