Surface CO_2 Fluxes Implied by 5 Years of ACOS V3.5 GOSAT X_{CO2} Retrievals, 2009-2014

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A 5-year record of the Greenhouse Gases Observing Satellite (GOSAT) column CO_2 concentrations is now available, produced by version 3.5 of NASA's Atmospheric CO_2 Observations from Space (ACOS) full-physics X_{CO2} retrieval scheme using consistent calibration and bias corrections across the span. We use these GOSAT data to infer weekly surface CO_2 fluxes at 7.5°x7.5° resolution using a 4-D variational data assimilation system, based on the Parallel Climate Transitional Model (PCTM) off-line transport model driven by Modern Era-Retrospective Analysis for Research and Applications (MERRA) meteorology and mixing fields.

Compared to prior CO_2 fluxes taken from a recent version of CarbonTracker-CO_2 (CT2013, before modification of the TM5 convective mixing), the GOSAT data drive higher CO_2 uptake in Europe in 2010, mostly early in the growing season (Figure 1), though this shift in flux does not stand out as being especially large compared to those in other regions. Reduced uptake is found over northern Asia in the latter part of the 2010 growing season (Figure 1), consistent with the findings of Guerlet et al. (2013).

We tested the sensitivity of the GOSAT flux results to the a priori fluxes assumed, performing separate inversions with three different priors: 1) the CarbonTracker (2013) a posteriori fluxes, 2) a combination of Carnegie Ames Stanford Approach (CASA) land biospheric fluxes and Global Fire Emissions Database (GFED) fires from J. Collatz (NASA/GSFC) and Takahashi (2009) ocean fluxes, and 3) a combination of SiB4 land biospheric fluxes from K. Haynes (CSU) and modeled ocean fluxes from S. Doney and I. Lima (WHOI). We also de-weighted the prior flux constraint and GOSAT measurement outliers to test their impact.

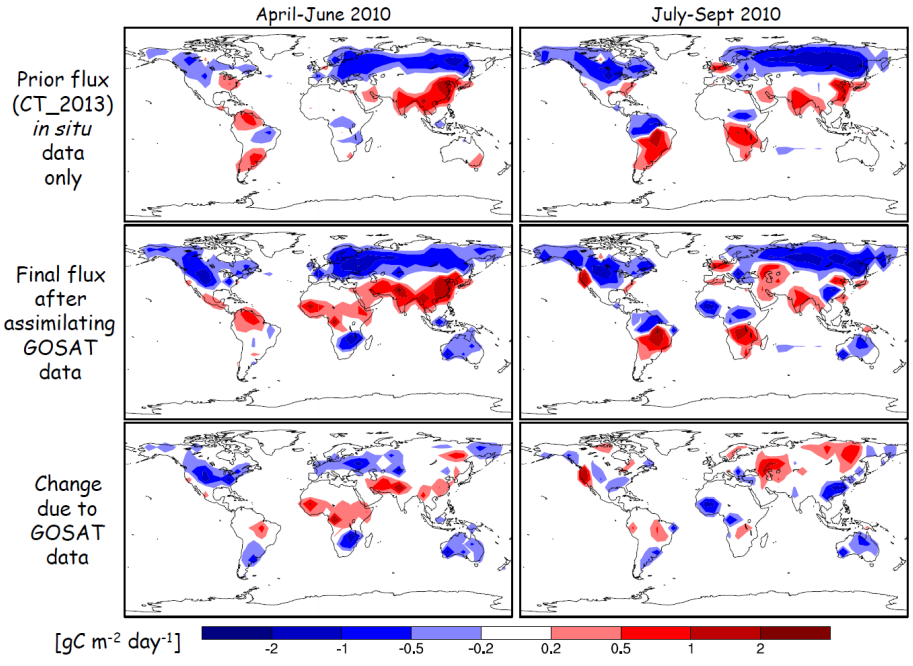

Figure 1. Surface CO_2 fluxes for mid-2010 before and after assimilating ACOS v3.5 GOSAT X_{CO2} retrievals into a 4-DVar inversion scheme, along with the shift caused by the GOSAT data.