# Estimating North America Carbon Fluxes Through Lagrangian Inverse Modeling for $CO_2$ and OCS

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Understanding biospheric $CO_2$ fluxes is paramount if climate studies are to be able to analyze the response of terrestrial ecosystems to climate change and monitor fossil fuel emissions reductions. Carbonyl sulfide (OCS) may be a useful tracer to provide a constraint on Gross Primary Production (GPP). Here we simulate both OCS and $CO_2$ using the Stochastic Time-Inverted Lagrangian Transport (STILT) model coupled with various biospheric fluxes, such as fluxes estimated from the Simple Biosphere (SiB) model, CarbonTracker, and from the Carnegie-Ames-Stanford Approach (CASA) model. The STILT model is driven by Weather Research and Forecast meteorological fields. This study uses measurements of OCS and $CO_2$ in 2008 from the NOAA/ESRL tall tower and aircraft air sampling networks, with ~ 6,000 observations in total. Biospheric OCS fluxes are estimated from a GPP-based model coupled with the GPP estimates from above mentioned biosphere models. The Soil uptakes of OCS from SiB and *Kettle et al 2002* are assessed in the Lagrangian data assimilation framework, and are optimized using atmospheric observations of OCS and molecular $H_2$. Empirical boundary curtains are built based on observations at the NOAA/ESRL marine boundary layer stations and from aircraft vertical profiles, and are utilized as the lateral boundary conditions for OCS and $CO_2$ for North America. Comparison of the simulations for both OCS and $CO_2$ using different biospheric fluxes provides an opportunity to assess the performance of both the biospheric models and the representation of atmospheric transport. In addition, we will estimate the carbon fluxes for North America from a joint inversion for OCS and $CO_2$ in a Bayesian synthesis framework, in which the GPP and Respiration are separately optimized for each vegetation type.

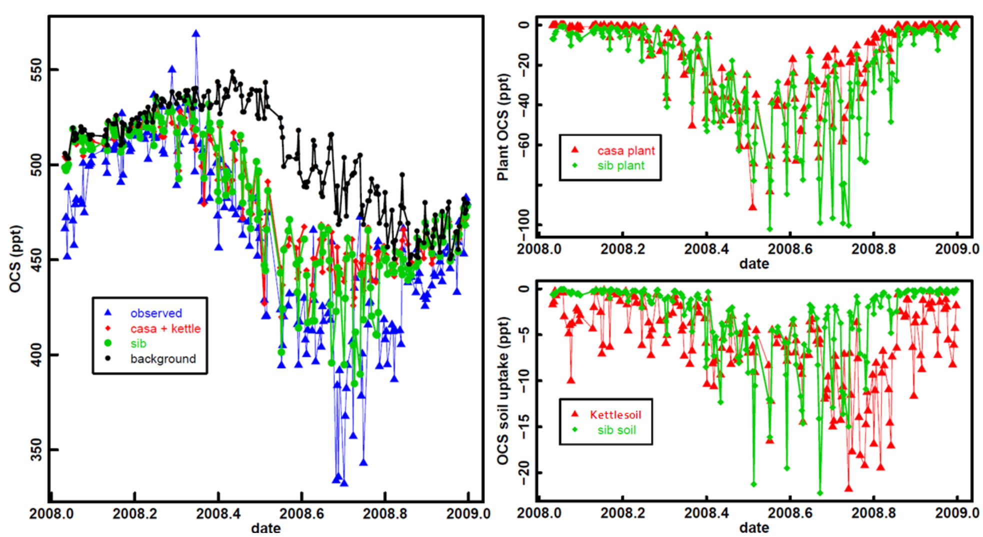


**Figure 1.** Modeled and observed tall tower OCS concentrations at LEF (left), and simulated OCS components: plant and soil uptake (right).