

Progress on Recent Carbon Cycle Studies in Oklahoma and California

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We report initial results from two collaborative regional carbon cycle studies. First, tower and aircraft measurements were performed as part of the U.S. Department of Energy (DOE) Atmospheric Radiation Measurement Program's Cloud and Land Surface Interaction Campaign (CLASIC), during June 2007. Measured data include continuous CO₂, CO mixing ratios collected from a 60m tower and airborne platforms, continuous ²²²Rn concentrations at the 60m tower, flask sampling for CO₂, N₂O, CH₄, and other species from tower and aircraft, and CO₂ heat and water fluxes from eddy flux towers. Here we describe horizontal transect and Lagrangian air-mass-following missions that will be used to quantify emissions from urban areas and regional photosynthetic uptake by vegetation. Second, in October, 2007, we began measurements at two tall towers in California, including continuous CO₂, CO, CH₄, and ²²²Rn at the Walnut Grove tower near Sacramento, and twice daily flask sampling at both Walnut Grove and Sutro Tower above San Francisco. Initial estimates of emissions, based on the Walnut Grove measurements, demonstrate the presence of strong regional emissions of CO₂, CO, and CH₄, likely from multiple source sectors in the Bay and Sacramento Valley areas.

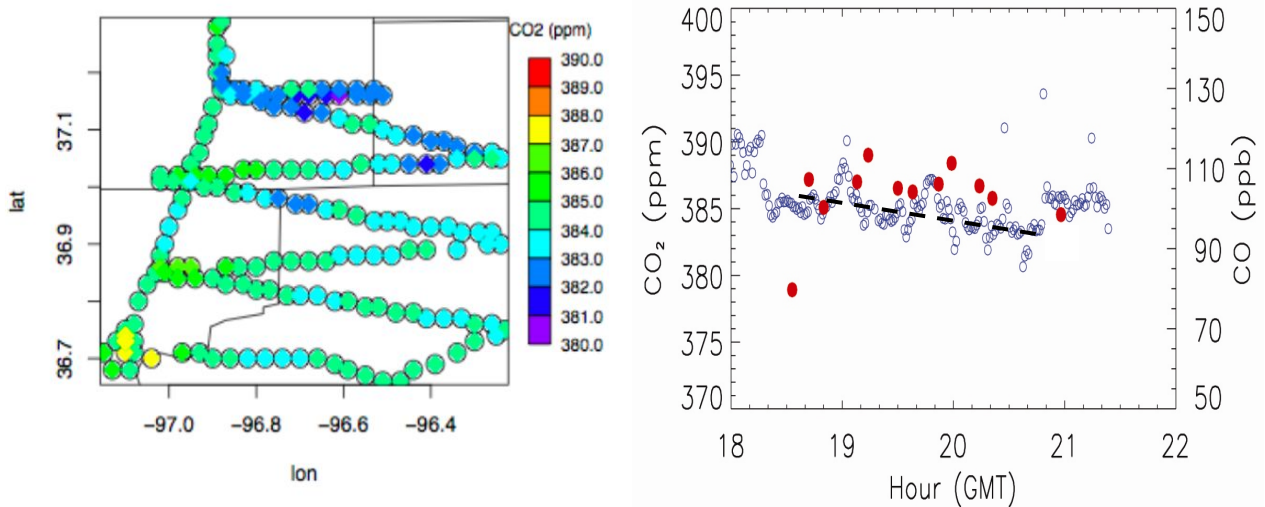


Figure 1. (*left panel*) Aircraft trajectory showing CO₂ mixing ratio measured during an air-mass following experiment, on June 22, 2007, and (*right panel*) the time series of CO₂ and CO (from flasks) measured during the flight. Following a climb from the airport Ponca City, Oklahoma (97.5W, 36.7N, lower left) to 2 km above ground level (agl) (near -96.5, 36.65N in dip near bottom of panel), the plane descended to 1 km agl (near -96.4, 36.8 on lower right) and flew a series of level legs in the boundary layer from south to north across the mean wind (from 18:40 to 20:45, indicated by dashed line on right panel), before returning to Ponca City. After observing higher CO₂ mixing ratios in the Ponca City airspace (yellow dots on left panel, time < 18:20), CO₂ gradually decreased by ~2 ppm during the Lagrangian portion of flight (along dashed line), and then rose by ~3 ppm when the plane started the return to Ponca (near 20:50 on right panel). CO mixing ratio (red dots on right panel), which serves as a tracer of combustion, was near 80 ppb at 2km (18:30 on right panel), increased to 100-115 ppb when the plane re-entered the boundary layer during the air mass following experiment, and remained near 100 ppb for the one flask collected during the return.