Influences on the Variability of CO_2 Measured at Continental Tall Tower Sites

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An analysis of sampling footprints for tall tower monitoring sites indicates that measurements are sensitive to upwind surface fluxes on scales of hundreds of kilometers. We have analyzed calculated footprints for the CMDL monitoring site at the WLEF-TV tower to investigate factors contributing to observed variability in measured CO_2 mixing ratios. Footprints were generated using the Stochastic Time-Inverted Lagrangian Transport (STILT) model and convolved with spatially and temporally resolved CO_2 flux estimates (Figure 1). Hourly ecosystem CO_2 fluxes were estimated using the Simple Biosphere (SiB) model. Variability because of fossil fuel and ocean sources is also considered. Preliminary results indicate that much of the day-to-day variability in CO_2 mixing ratios results from variability in transport, while day-to-day variability in the modeled ecosystem fluxes has a comparably small effect.

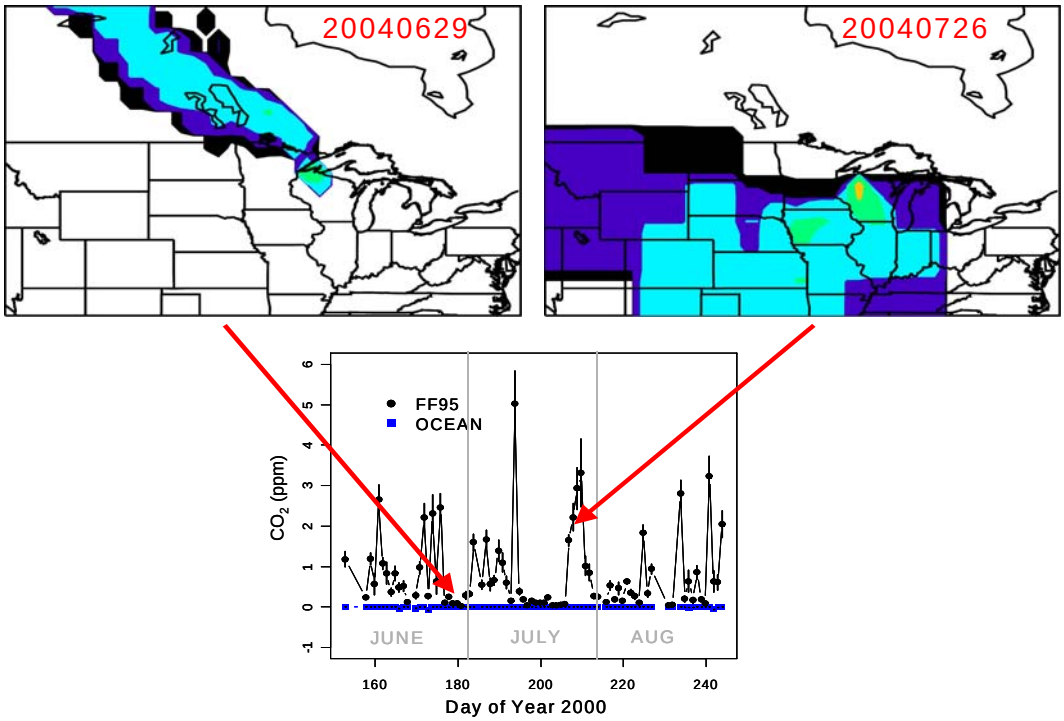

Figure 1. Typical STILT-generated 5-day footprints for WLEF (top). The cases shown illustrate the two predominant summertime flow regimes. The bottom panel shows calculated CO_2 mixing ratio changes at WLEF because of upwind fossil fuel and oceanic fluxes. The contribution of oceanic fluxes to modeled CO_2 variability is negligible, while the influence of fossil fuels depends strongly on the recent transport history of sampled air.