Goal: Examine a small set of carbon flux graphs and related meteorological information to better understand the relationships between these factors and speculate as to what factors actually control the carbon flux.

Background: Scientists studying the critical zone often install flux towers to measure the exchanges of energy, water and carbon above and below the surface of a hillslope or sub-catchment to help document the interactions of all these factors. This exercise is designed to examine these relationships before a short lecture on this topic so that groups of students might investigate these relationships on their own. We will be examining data drawn from the Ameriflux Network , a collaborative effort among over 150 sites across the Americas to promote high quality data, practices, and a common data format.

Introduction: The purpose of this exercise is for you to compare and contrast data from four eddy correlation measurement sites to discover and think about the causal or physical relationships among these variables. We will talk more about eddy correlation and data networks later in this unit. Note that not all these sites have the same kind of vegetation. Most of the graph variables will hopefully be familiar from Unit 1. This is real data so expect a certain amount of ambiguity. What you need to do over the next 10-15 minutes is to get in small groups, read the handout and answer the discussion questions as a group. Be prepared to share observations and discuss you answers with the rest of the class later. Your primary task is to look for parameters that are correlated (have the same general shape or trends) and to think about and look for factors that might control the magnitude of the CO2 flux (FC). Focus primarily upon relationships between the parameters for a single site; although you might also see consistent patterns from one site to another. The bottom-line question we will be addressing throughout this unit is "What controls the annual shape of the carbon flux curve?"

Set-up: Break the class into groups of two or four students. Pass out a set of 4 graphs to each group.

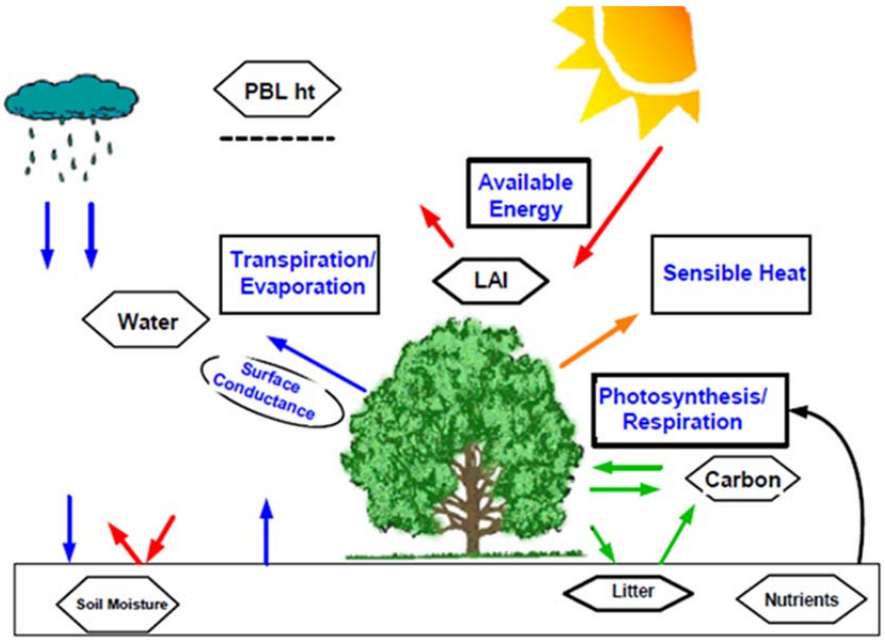
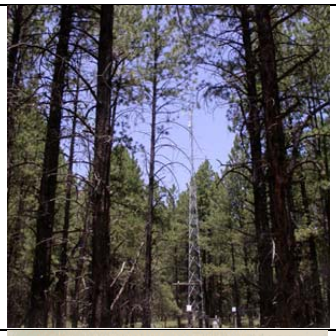


Figure 1: Inter-related factors affecting the carbon cycle (Baldocchi, UCB)

Description of the Data Plots:

Site, Location	Photo	Site, Location	Photo
Valles Caldera, NM 35.9 N, 106.6 W 2542 m Ponderosa Pine data from 2007 mlitvak@unm.edu (part of JBC CZO) NSF - active burned in 2013		Konza, KS 39.1 N, 96.9 W 443 m short-grass Prairie data form 2012 brunsell@ku.edu NSF - active	
Walker Branch, TN 36.0 N, 84.3 W 343 m Deciduous Broadleaf Forest data from 2001 tilden.meyers@noaa.gov DOE TCP - inactive		Manitoba, Canada 55.9 N, 98.5 W 254 m Evergreen Needleleaf Forest data from 2004 mgoulden@uci.edu DOE TCP -inactive	

There are 12 annual graphs per page with displaying the following information:

Air temperature (Ta) deg C Value @ = Avg	Net radiation (Rn) W/m2 Value @ = Avg	Wind speed (u) m/s Value @ = Avg
CO2 flux (Fc) umol/m2/s Value @ = Total gC/m2	Latent heat flux (LE) W/m2 Value @ = Avg	Vapor pressure deficit (VPD) kPa Value @ = Avg
Soil water content (SWC) % Value @ = Avg	Sensible heat flux (H) W/m2 Value @ = Avg	Water Concentration (H2O) mmol/mol Value @ = Avg
Soil temperature (Ts) deg C Value @ = Avg	Ecosystem respiration (RE) umol/m2/s Value @ = Avg	Precipitation (Prec) mm Value @ = Total mm/yr

Graph notes: Depending upon the site, the heights and depths of these measurements is irregular. These graphs plot daily averages derived from 30 minute data and bars representing monthly averages of the daily data. The precipitation data has been scaled up so that each spike represents a daily total. Negative CO2 fluxes are into the ecosystem; positive CO2 fluxes are into the atmosphere. A blank graph means that parameter was not measured. The vertical grid is roughly every 2 months. The scales on each graph are fixed to facilitate comparing different sites.

Names: _____

Discussion Questions

Directions: Each group should address the following questions and be prepared to discuss with the rest of the class. Turn in this sheet at the end of class.

1) Which parameters are primarily associated with the energy, water or carbon cycles?

Energy Cycle	Water Cycle	Carbon Cycle

2) Which parameters appear to be correlated? Can you explain why they are correlated?

3) What parameters control the direction and magnitude of the CO2 flux? Explain?

4) What additional biospheric factors probably also play a role in the timing of the CO2 fluxes?

5) What other ecosystems might be interesting to explore using these diagrams and what questions would you ask?