Sonora 2008 Field Campaign
International Research Experience for Students (IRES)

Exercise 3: Diurnal Variation of Land Surface Conditions at Tower Site

Eddy covariance towers measure a range of different meteorological states and fluxes, including the radiation, energy and water balances. More importantly, these measurements are made at a high temporal resolution (100 times per second) and then averaged to every 30-minutes or every hour. We can study the diurnal variation in land surface conditions at the eddy covariance tower in Rayon to understand some of the basic changes occurring during a short period of several days.

In this exercise, we want to understand the diurnal variations of precipitation (PREC), incoming solar radiation (RSIN), soil moisture (SM1) and soil temperature (TS1) at the Rayon site over the period July 23, 2004 to August 6, 2004, coinciding with the Soil Moisture Experiment in 2004 (SMEX04). The data are organized by Year (Y), Month (M), Day (D), Hour (H) and Minute (MM). Incoming solar radiation is measured by a pyranometer in W/m^2, precipitation is measured by the rain gauge in mm/30-minutes, soil moisture is measured by a Stevens Hydra probe at a depth of 5 cm from surface and is in volumetric fraction (with maximum value of soil porosity at 0.4), soil temperature is measured by a thermometer at 5 cm depth from surface and is in degrees Celsius. The data is collected at 30-minute intervals (hour 0 is midnight).

1. Utilize the dataset provided in the zip file (EddyTowerData.zip) to graph the temporal variation in precipitation, incoming solar radiation, soil moisture and soil temperature. At what times in the day does rainfall typically occur at the site (during the day or night)? Were there any cloud covered days during the period? What happens to soil moisture and soil temperature after rainfall events? What happens to soil temperature during cloudy days? What are the overall trends in soil moisture and temperature during the period? Develop your own interpretations and then discuss with your fellow students.

2. Develop scatterplots of the following variables and determine if a linear regression would explain some of the observed variations. Discuss the physical mechanism that would lead to the most significant relationships found.

a. Soil temperature (TS1) and incoming solar radiation (RSIN).
b. Soil moisture (SM1) and soil temperature (TS1).
c. Soil moisture (SM1) and precipitation (PREC).
d. Soil moisture (SM1) and incoming solar radiation (RSIN).

Linear regressions are of the form: $Y = mX + b$, where Y is the dependant variable (on y-axis), X is the independent variable (on x-axis), m is the slope of the regression and b is the intercept.