Lab 1: Introduction to R

Goals:

- Familiarize yourself with R.
    - Loading data
    - Writing functions
    - Calculating basic univariate statistics
    - Making plots
- Familiarize yourself with eddy covariance data.

Hints:

- Follow best practices for creating graphs (units, labels, etc.), *even if you are not explicitly told to do some in the question*.
- Don't forget units!
- Include an informative caption with all graphs.

0. Load the data

Save TdrTsoilWindLaiPrecParTaVpdMay2001-Daytime.txt to your lab data folder. Read this data file as a data frame in R.

You should now see a data frame with 872 observations (daytime hours during May 2001) of 12 variables, in the following order:

- Month
- Day
- Hour
- Minute
- Tdr (% soil moisture by volume)
- Tsoil (°C)
- Wind ($m\ s^{-1}$)
- Lai ($m^2\ m^{-2}$)
- Prec (mm)
- Par ($\mu mol\ m^{-2}\ s^{-1}$)
- Ta (°C)
- Vpd (kPa)

Add a header following the process we used in class, and add a new variable for year (2001). Convert Vpd from kPa to Pa.

1. Plot time series of data

Create a R-formatted variable of dates following the process using the ISOdate function that we used in class. Now make a time series of air temperature (Ta) and soil temperature (Tsoil), *on the same graph*.

1a. Save the graph to your output folder and add it to a Word document.

1b. Describe the time series of air temperature and soil temperature. How do they vary/change during the time period?

1c. Describe the relationship between air temperature and soil temperature. How do they differ? Why do you think that is?

2. Make a scatterplot of two variables.

Now make a scatterplot of Par (photosynthetically active radiation, in W m-2) vs. air temperature (Ta), this time with points and no lines. Calculate the linear regression line using the `lm` function and add it to the plot using `abline`.

2a. Save the graph to your output folder and add it to a Word document.

2b. How are these variables related to each other? Why do you think that is?

3. Calculate basic daily weather statistics from the half-hourly data.

Now use R's built-in univariate statistical functions to calculate summary statistics of the weather at Duke Forest during May 2001.

3a. What was the maximum air temperature (Ta)?

3b. What was the minimum soil temperature (Tsoil)?

3c. What was the mean soil moisture (Tdr)?

3d. What was the total amount of precipitation (Prec) that fell?

3e. Now a tricky one: What was the **total amount** of shortwave radiation (in megajoules, MJ) received over a 4x4 meter plot on **May 1**, 2001 if you assume that Par represents the half-hourly mean shortwave radiation and is representative of the entire plot area? Hint: you will need to do unit conversions (1 μmol Par ≈ 0.5 W shortwave radiation); if you are unsure of the conversions, check the textbook, ask your classmates, or search the internet.

4. Write and use a function.

Write a function that converts temperature from Celsius to Fahrenheit. Convert both Ta and Tsoil to Fahrenheit.

4a. What were minimum, maximum, and mean air temperature during May 2001 in Fahrenheit?

4b. What were minimum, maximum, and mean soil temperature during May 2001 in Fahrenheit?

4c. Recreate the plot from question 1 with the new units and paste in the Word document.

Submit your answers as a Word document on the Assignments page of ICON. Also submit your final R script (Lab1.R).