Atmospheric Sciences 5270: Wind Power Meterology
Exercise 4

This exercise is based on Section 12: The Climate Adjustment Process in the *Wind Resource Assessment Handbook*.

Problems:

1. (a) Calculate and plot the annual mean wind speeds, $v(y_i)$, for all 15 years, y_i, and for both sets of Oklahoma Mesonet stations (group one and group two, with each group on a single plot) from the daily-averaged wind speed data, which is available for each year and group on the class web page.

   (b) Then calculate the average annual mean wind speed, $\bar{v}$, and standard deviation of the annual mean wind speeds, $\tilde{\sigma}_A$, for each station, and finally

   (c) $\tilde{\sigma}_A$ as a percentage of the average annual mean wind speed,

   $$\sigma_A = \frac{\tilde{\sigma}_A}{\bar{v}},$$

   for each station.

   (d) What do you notice about the varation of the annual mean wind speeds?

2. You will be assigned a specific pair of stations to analyze for this problem. One will be the monitoring, or *target*, site, for which you will use just one year (2011) of data. The other will be the reference site, for which you will use 15 years of data (1997-2011).

   (a) Assess the quality of the two wind speed data sets. In this case, that means checking for excessive missing data, and comparing the reference site to another reference site.

   (b) Calculate the correlation of daily average wind speeds between the target site and reference site for the one-year overlap period. Also make a scatter plot to assess the correlation visually.

   (c) Develop a relationship between the daily average wind speeds at the target site and reference site for the one-year overlap period. We will discuss how to do this in class. Matlab code for this will be posted on the class web page.

3. (a) Apply the relationship to each year's record of the daily average wind speeds at the reference site to produce an estimate of the daily average wind speeds at the target site.

   (b) From the estimated daily average wind speeds at the target site for each year, calculate the estimated annual mean wind speed for that year.

   (c) Finally, calculate the estimated average annual mean wind speed for the target site.

   (d) How does your estimate compare to the observed annual mean wind speed for the target site from Problem 1(b)?