An Introduction to Time Series Data

# Learning Objectives

* Understand the advantages of using Pandas for tabular data
* Become familiar with more data types in Python
* Understand basic statistics useful for time series

# Skill Objectives

* Read in and examine tabular data with Pandas
* Preprocess data to prepare it for plotting and analysis
* Plot time series with Matplotlib
* Perform statistics with Scipy on time series data

# Python Libraries

* Pandas
* Numpy
* Scipy
* Matplotlib
* Datetime

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# Schedule

1. Hands-on, quick review of previous day’s information *(15 minutes)*
2. Interactive lecture working through a [Jupyter notebook](https://github.com/rybchuk/REU_ATOC/blob/master/day02_timeseries.ipynb) *(90 minutes)*
   1. Introduction of Pandas *(45 minutes)*
      1. Overview of dataframes
         1. Rows, columns, column names, index
      2. Determine who has experience with Pandas, then use breakout rooms for students to establish their groups and brainstorm some types of data that we could use with Pandas
      3. Introduce a common obstacle in working with time series data in Pandas: working with timestamps
      4. Plot time series of wind data
         1. First, show students how to plot one column
         2. Then, have them work in breakout rooms to plot a different column
   2. Overview of time series statistics *(45 minutes)*
      1. Describe statistics
         1. Mean, standard deviation, standard error, trendline, maximum/minimum
      2. Apply statistics to wind dataset
         1. First, show students how to find which columns have highest/lowest mean
         2. Then, have them work in breakout rooms to find the highest/lowest standard deviation
      3. Plot data with trendline
         1. First, show students how to plot one column with a trendline
         2. Then, have them work in breakout rooms to plot more columns with trendlines
3. Challenge *(90 minutes)*
4. Debrief *(30 minutes)*
   1. Students share their plots and what they learned
   2. Review the basic steps to process and analyze time series data