GIS 5103
GIS Programming

Fall 2019

Exercise 1a

Assigned September 5

Objectives

- Learn about APIs for pulling data over the internet
- Learn how to run a Python script
- Practice computational thinking

In this exercise you will be working with daily Tallahassee weather data from September 2018 to August 2019. The National Centers for Environmental Information (NCEI), which is part of the National Oceanic and Atmospheric Administration's (NOAA), provides historic weather data.

1 Getting the Data

Weather data can be download from NCEI by clicking through their website or by using their application programming interface (API). An API is a set of rules for communicating with software. NCEI has designed an API that allows a user to pull specific data from their database over the internet. Getting the data requires manually editing a very long URL. Although this URL is complicated, understanding it allows you to easily change the dates or locations for a different data download.

The URL we will use to pull Tallahassee data is:

https://www.ncei.noaa.gov/access/services/data/v1?dataset=daily-summaries&dataTypes=PRCP,SNWD,SNOW,TAVG,TMAX,TMIN,AWND,WDF2,WDF5,WSF2,WSF5,PGTM,WT01,WT02,WT08,WT03&stations=USW00093805&startDate=2018-09-01&endDate=2019-08-31&units=standard

Here is how to read it:

- https://www.ncei.noaa.gov/access/services/data/v1?
  location of the API on the internet
- `dataset=daily-summaries&`
  the dataset we want
- dataTypes=PRCP,SNWD,SNOW,TAVG,TMAX,TMIN,AWND,WDF2,WDF5,WSF2,WSF5,PGTM,WT01,WT02,WT08,WT03
  the variables we want
- `stations=USW00093805&`
  the name of the weather station
- `startDate=2018-09-01&`
  the start date for the weather data to pull
- `endDate=2019-08-31&`
  the end of the date range
- `units=standard`
  convert from metric to standard units

The full set of rules can be found here:
`https://www.ncei.noaa.gov/support/access-data-service-api-user-documentation`.
Their manual data download website can help identify the types of data available and the names of variables and weather stations (`https://www.ncdc.noaa.gov/cdo-web/datatools/findstation`).

We will get the data two different ways:

1. Paste the (really long) URL into a web browser. After a little time, the screen should be filled with values separated by commas. In the web browser click `File > Save as`. Call it `tlh weather data browser.csv` and save it somewhere on your hard drive where you will remember it. (It may automatically download in some browsers. If so, use Excel or a text editor to save as a .csv file.)
2. Run the python script `tlh weather get data.py`. See directions in `exercise1b.pdf`.

The full data dictionary can be found in the course directory (`GHCND documentation.pdf`). Below is a summary of the data we are using:

- STATION = station identification code (17 characters)
- DATE = year of the record (4 digits) followed by month (2 digits) and day (2 digits)
- AWND = Average daily wind speed (meters per second or miles per hour as per user preference)
- PRCP = Precipitation (mm or inches as per user preference, inches to hundredths on Daily Form pdf file)
- SNOW = Snowfall (mm or inches as per user preference, inches to tenths on Daily Form pdf file)
- SNWD = Snow depth (mm or inches as per user preference, inches on Daily Form pdf file)
- TAVG = Average of hourly temperatures (Fahrenheit or Celsius as per user preference, Fahrenheit to tenths on Daily Form pdf file)
- TMAX = Maximum hourly temperature (Fahrenheit or Celsius as per user preference, Fahrenheit to tenths on Daily Form pdf file)

- TMIN = Minimum hourly temperature (Fahrenheit or Celsius as per user preference, Fahrenheit to tenths on Daily Form pdf file)
- WDF2 = Direction of fastest 2-minute wind (degrees)
- WDF5 = Direction of fastest 5-second wind (degrees)
- WSF2 = Fastest 2-minute wind speed (miles per hour or meters per second as per user preference)
- WSF5 = Fastest 5-second wind speed (miles per hour or meters per second as per user preference)
- WT01 = Weather Type: Fog, ice fog, or freezing fog (may include heavy fog)
- WT02 = Weather Type: Heavy fog or heavy freezing fog
- WT03 = Weather Type: Thunder
- WT05 = Weather Type: Hail (may include small hail)
- WT08 = Weather Type: Smoke or haze

2 Questions

This is an exercise in computational thinking: how would you break the problem into smaller pieces to get this accomplished? This is not a "Python" exercise, so it does not matter that you are not familiar with the language. Record the answers in a Word document or text file, and email them to bdjohnson@fsu.edu.

1. What was the highest max temperature?
2. How many days was the maximum temperature 90 degrees or higher? (just the number of days, not the specific dates)
3. How many days had more than a 30 degree swing from the low to the high?
4. What was the highest temperature each month?
5. How many days had at least a `Thunderstorm` event? (Note: include both days with *just* a Thunderstorm *and* days with multiple events that included a Thunderstorm)
6. What was the average daily precipitation on Thunderstorm days?
7. How many days had exactly two weather events?
8. Summarize the number of days the wind was blowing in each of the cardinal directions (based on fastest 2 minutes each day).
   - East: $[45, 135)$ (Note: $45 \leq$ degrees < 135)
   - South: $[135, 225)$
   - West: $[225, 315)$
   - North: $[315, 45)$