Note: Be sure to include supporting documentation and make your work legible to maximize your chances for full credit on homework assignments. Note: You will need Excel or comparable graphical/analysis package to perform Task 2.

Has the climate changed in your "backyard" over the last half century? This hands-on analysis will allow you to discern whether changes in mean annual temperature have occurred in your favorite local, and the degree to which such changes may be related to natural variations in climate.

Tasks

1. **Acquisition.** Acquire annual calendar-year mean temperature data from your hometown through one of the following means:

   Go to http://www.wrcc.dri.edu/wwdt/time/ and pinpoint the location of your region of interest.

   a. Choose data type of either a "Point 4km x 4km", or "County or Equivalent Areas" and use the Google Maps interface to make your selection.
   b. Choose "Time Series" of "temperature". Select 1967 for *Start Year* and 2016 for *End Year*. For annual mean temperature, select December for *Month* and 12-months for *Span*.
   c. This will create a time series plot, as well as providing the data in text format below. If you copy as paste output into a text file and save as a .csv file (e.g., myfile.csv) it can be easily imported into Excel.

2. **Analysis.** From the dataset acquired in (1), you will need to either (i) enter the data manually, or (ii) import the data to your plotting software (e.g., Excel) and perform the following analysis. **(4)**

   a. Convert your data to standard units of Celsius using:

      Temperature [Celsius] = (Temperature [Fahrenheit]-32)/1.8

   b. Transform your dataset into temperature anomalies. *Anomalies* are departures from average, where the **average is defined over the period from 1981-2010**.
      i. Calculate the average temperature for 1981-2010.
      ii. Remove this value from each of the annual values observed (e.g., if your average was 30, and your values were 25, 27, 35, 33 your resulting values, or departures from the mean are -5, -3, +5, +2).
   c. Plot the time series of the temperature anomalies for your city versus time. Be sure to label your axes appropriately and include a title. Your plot should be interpretable by your friends that aren't in this class, so be sure to provide enough information. *You will be turning this in.*

3. Interpretation.

   a. Estimate the linear trend. A trend describes the rate of change of a variable over a given period of record. Excel will estimate a trend in degrees per year using a linear least squares approach using the function linest(Val1:Val2), where Val1 is the first year of record and Val2 is the last year of record. This gives you a trend in **degrees per YEAR**, so convert

this to **degrees per DECADE** by multiplying by 10 and report this number in your writeup.

b. Describe how this simple trend analysis alone provides an incomplete picture of *global* climate change and its *causes*. **(2)**

*513 students only [extra credit for 313 students]

Explore the relationship between mean annual temperature to both the El Nino-Southern Oscillation (ENSO) and Total Solar Irradiance (TSI). A csv file http://webpages.uidaho.edu/jabatzoglou/CLASSES/GEOG313/HW/HW3data.csv is provided for you that synthesizes both the winter Multivariate El Nino Index (positive values indicate El Nino conditions, negative La Nina conditions) and the annual mean total solar irradiance in W/m2. To do this you should perform a qualitative graphical analysis of the relationship between ENSO and temperature of your region (e.g., scatterplot), as well as TSI and temperature of your region. You should also perform a linear quantitative analysis using either correlation and linear regression. **(3)**