Do the Work: Explore the Data

We're going to build a visualization of monthly temperature anomaly data from NOAA.

First, let's understand what a temperature anomaly is, and then we'll take a look at the data. Temperature anomalies are a useful measure in climate science because they tell you how much above or below normal a temperature is. Let's say the normal high temperature for December averages around 38 degrees (F) where you live. If you get up tomorrow and it's 35 degrees, then you've got a temperature anomaly of -3 degrees. If, however, you get up tomorrow and it's 45 degrees, then you've got a temperature anomaly of +7 degrees.

With that in mind, let's look at the temperature data from NOAA, which you can find online at https://www.ncdc.noaa.gov/cag/global/time-series/globe/land_ocean/p12/12/1880-2017.csv

If, for some reason, that file isn't available, click here to access our copy of the data.

The measurements are in degrees Celsius.

```
Global Land and Ocean Temperature Anomalies
Units: Degrees Celsius
Base Period: 1901-2000
Missing: -999.0000
Year,Value
188001,-0.00
188002,-0.12
188003,-0.14
188004,-0.05
188005,-0.07
188006,-0.18
...
201707,0.83
201708,0.81
201709,0.78
201710,0.73
201711,0.76
201712,0.80
```

The base period tells us how "normal" is measured. We'll look at this in more depth in a moment...

The temperatures start in 1880, in January (01). The value (-0.00) is the temperature anomaly for the entire month. More on this in a moment, too...

We've got data up through December (12), 2017.

201712,0.80

Year

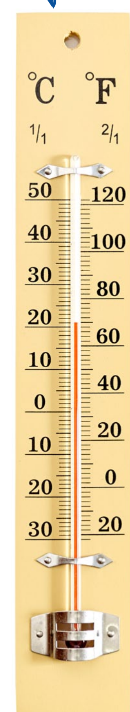
Month

Temperature anomaly (scientists use Celsius, so this is 0.80C).

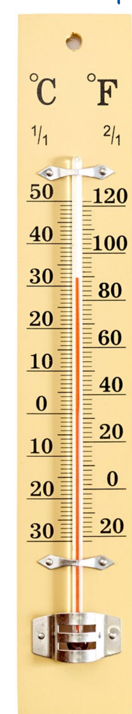
Practice with temperature anomalies

If the normal April high temperature in your town is 70 degrees Fahrenheit, what is the temperature anomaly for April 7 if the high temperature that day is 89 F?

Normal high temperature for April.



High temperature on April 7.



Your answer:

Questions about the data

Before we go any further we should, like any good scientist would, ask a few questions:

What does this data represent?

What does "base period" mean?

And who's measuring these temperatures?

The temperature data

The data is a combination of land and sea surface temperatures, averaged over the entire globe. Some areas have better temperature data than others so the average temperature might be computed directly using measurements, or computed indirectly using sparse data from the area and estimated from other nearby regions. All these regional averages are combined and compared to "normal", and the difference is the anomaly. Do that every month since 1880, and you get the data in the file you downloaded from NOAA.

The base period

The base period tells us how to measure "normal" so we know how to calculate the anomaly. The file header tells us that NOAA used the average temperatures of each month from 1901-2000 to compute "normal".

So, to compute the normal temperature for January, we would take the average temperature for January 1900, January 1901, January 1902... January 2000 and compute the average of all those averages! That is then the normal temperature for January. Do the same thing for every month and you have the normal for each month.

Why pick those years as the base period? Those years are familiar to most people alive today, and that range establishes a fairly long term average for comparison purposes. All we need is some sensible definition of "normal" to see long term trends.

Who's measuring these temperatures?

That's a great question. Measuring temperatures accurately is an incredibly complex science. Back in the day, sailors used to measure ocean temperatures by dipping a bucket in the ocean and taking the temperature of the water in the bucket. Needless to say, we have much more sophisticated temperature gathering tools these days, including high-tech buoys that are constantly keeping track of ocean temperatures all over the globe, and weather stations in all corners of every country.

Analyze the data

Make sure you've downloaded the JavaScript data file gta_data.js:

https://github.com/bethrobson/CCC/blob/master/gta/gta_data.js

(you can click on the link)

Once you have, open it up and take a look. Pick out all the temperature anomalies for January, for the years below. Write them in to the spaces below, and see if you notice a trend:

January 1880: ________	January 1960: ________
January 1900: ________	January 1980: ________
January 1920: ________	January 2000: ________
January 1940: ________	January 2017: ________