Exploring Weather Trends
By Irene Florez

- **Project Overview:**
  Explore weather trends data using SQL, moving averages, and data visualization.

- **Observations**
  San Francisco has consistently experienced warmer average temperatures than the global average. And San Francisco has consistently followed the global temperature increase trend. As global average temperatures rise, so do average temperatures in San Francisco. In taking a look at the last few years of data, we see that both average San Francisco temperatures and global average temperatures are increasing.

  From 1849-2013, San Francisco average temperatures increased 14.94%. Globally, average temperatures increased 20.42% during that same period. The Pearson product-moment coefficient of the San Francisco average temperature per year to the Global average temperature per year for the years 1849-2013 is a correlation coefficient of .53.

  The most significant global average increases can be seen in the years following 1975. I took a closer look at the SF data from 1983-2003. During these years, San Francisco average temperatures showed a 7.69% increase. Global average temperatures increased 6.42%. The correlation coefficient of the San Francisco average temperature per year to the Global average temperature per year for the years 1983-2003 is 0.18.

- **Tools**
  - SQL
  - Google Sheets

- **Process**
  - Extracting the Data using SQL
    - Create the SQL query

```
-- Rename columns for joining
ALTER TABLE global_data RENAME COLUMN avg_temp to
global_avg_temp;
ALTER TABLE city_data RENAME COLUMN avg_temp to city_avg_temp;

-- Select the desired data
SELECT global_data.year, global_data.global_avg_temp, city_avg_temp
```

```
FROM global_data
INNER JOIN city_data
ON global_data.year=city_data.year
WHERE city = 'San Francisco';
```

- Save data as csv file

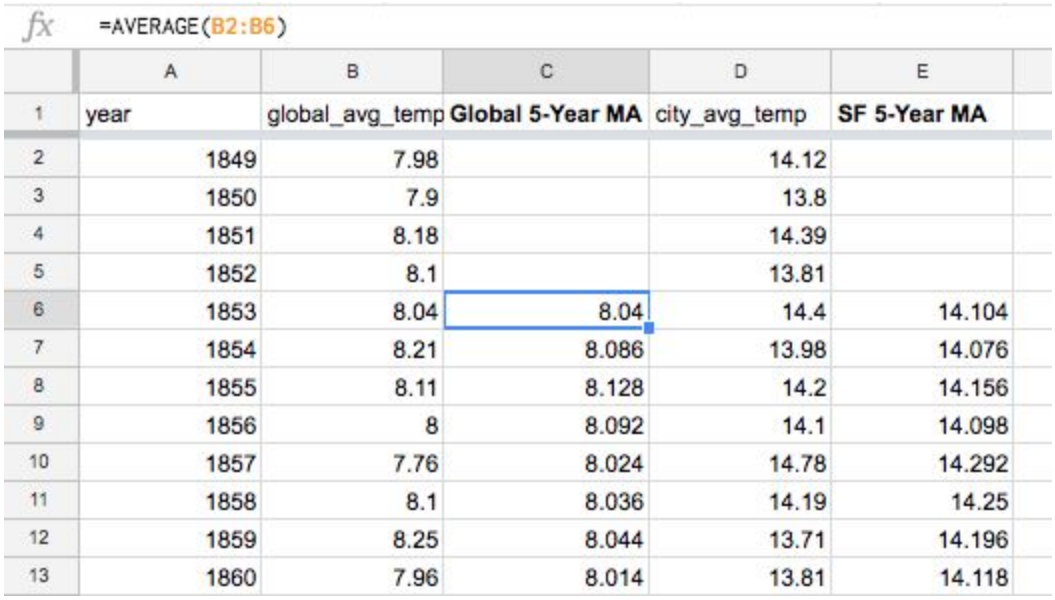
- Test the data. In this case because there were so few rows of data, I did a quick manual review by pulling all the data and making sure that the first SQL query method reflected the content/quantity in this manual pull of two larger data sets.

```
-- Select the desired global data
SELECT *
FROM global_data
-- Select the desired local city data
SELECT *
FROM city_data
WHERE city = 'San Francisco';
```

- Calculate the Moving Average

  "Moving averages is a smoothing approach that averages values from a window of consecutive time periods, thereby generating a series of averages."

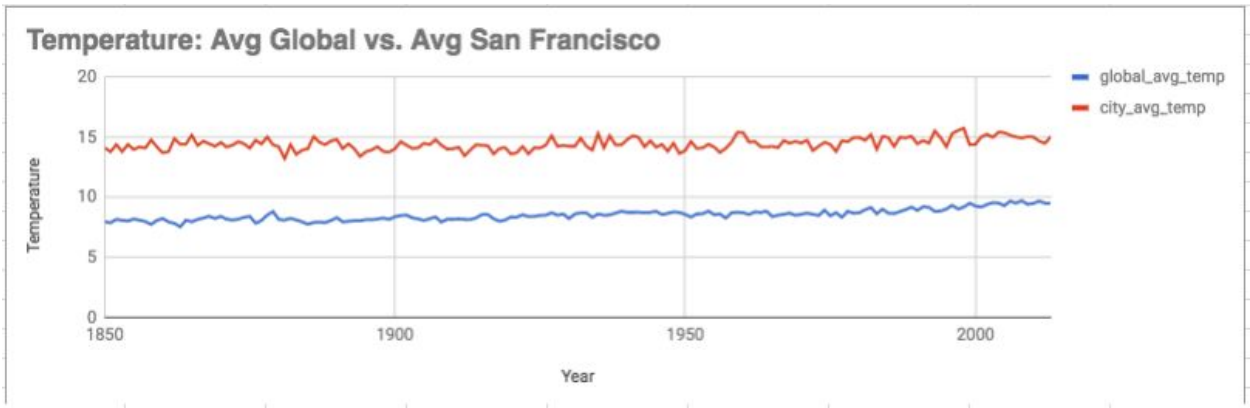
  Once I had downloaded the data, I calculated 5-year, 7-year, and 10-year Moving Averages. I used the moving average calculation to smooth out the tiny fluctuations in the data and make the larger trend more evident.
  To calculate the 5-year moving average, for example, I created a formula that summed up the first five global temperatures and then divided the number by 5. So, for example, the sum of the global temperatures from the year 1849-1853 is 40.2. Once divided by 5, the moving average for those five years equals 8.04. Then I applied that formula to the rest of the global temperature data so that every year after 1853 had a corresponding calculated 5-year MA. Read more about moving averages: http://uc-r.github.io/ts_moving_averages

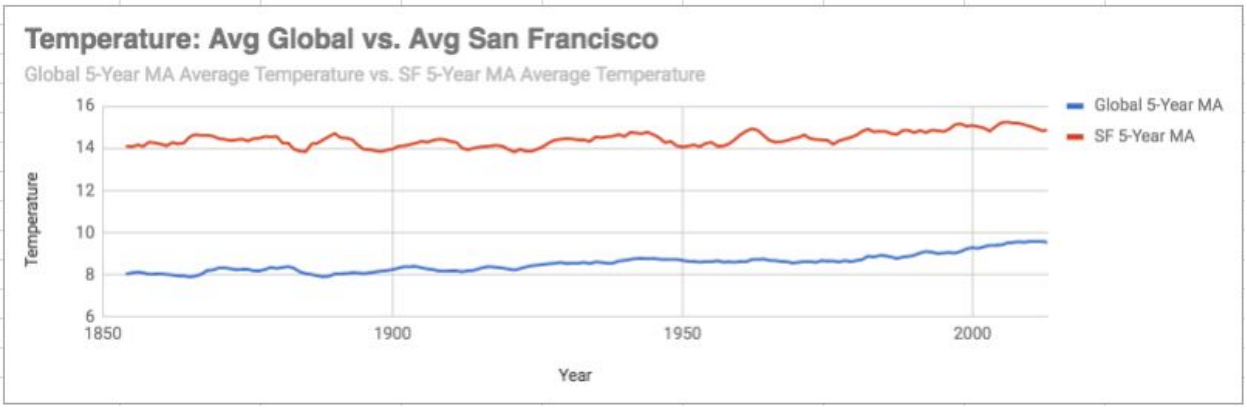


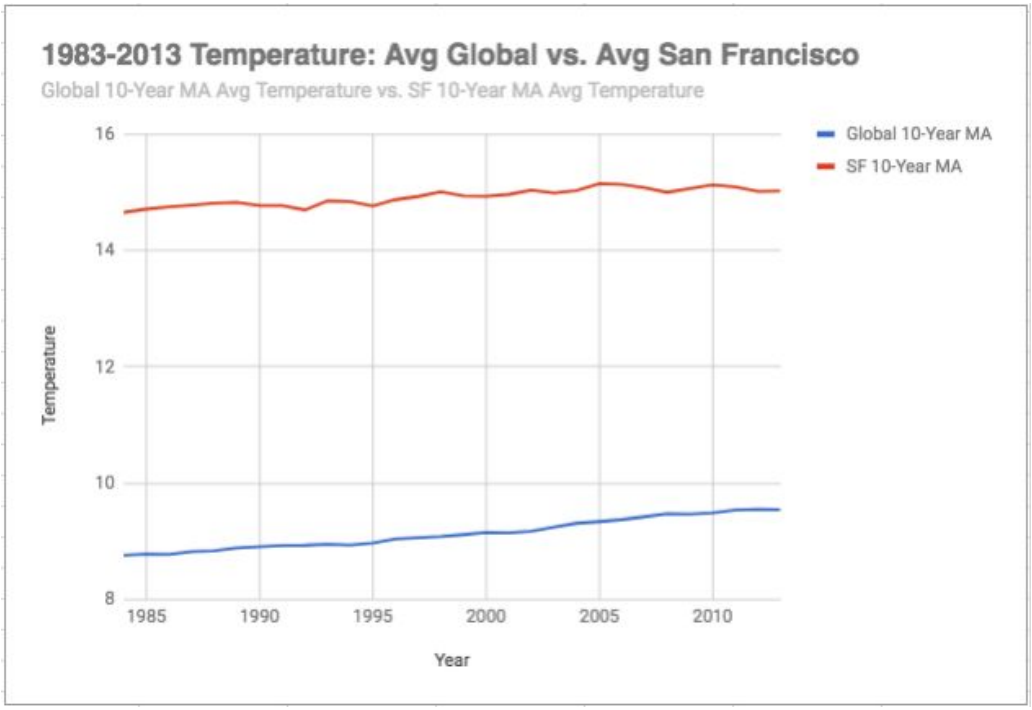
	A	B	C	D	E
1	year	global_avg_temp	**Global 5-Year MA**	city_avg_temp	**SF 5-Year MA**
2	1849	7.98		14.12	
3	1850	7.9		13.8	
4	1851	8.18		14.39	
5	1852	8.1		13.81	
6	1853	8.04	8.04	14.4	14.104
7	1854	8.21	8.086	13.98	14.076
8	1855	8.11	8.128	14.2	14.156
9	1856	8	8.092	14.1	14.098
10	1857	7.76	8.024	14.78	14.292
11	1858	8.1	8.036	14.19	14.25
12	1859	8.25	8.044	13.71	14.196
13	1860	7.96	8.014	13.81	14.118

    - Create data charts using the Google Sheets Chart Editor

- Data Visualizations
    - Key Considerations:
        - Line graphs can show even small changes over time
        - Line graphs allow comparison of two or more items
        - Line graphs help to determine the relationship between two sets of values, with one data set always being dependent on the other set
        - 5 or 10 year periods are useful moving average spans.


Temperature: Avg Global vs. Avg San Francisco
global_avg_temp
city_avg_temp
Temperature
Year
20
15
10
5
0
1850
1900
1950
2000


Temperature: Avg Global vs. Avg San Francisco
Global 5-Year MA Average Temperature vs. SF 5-Year MA Average Temperature
Global 5-Year MA
SF 5-Year MA
Temperature
Year
16
14
12
10
8
6
1850
1900
1950
2000


1983-2013 Temperature: Avg Global vs. Avg San Francisco
Global 10-Year MA Avg Temperature vs. SF 10-Year MA Avg Temperature
Global 10-Year MA
SF 10-Year MA
Temperature
Year
16
14
12
10
8
1985
1990
1995
2000
2005
2010