# Exploring Weather Trends

1. **To prepare data visualization, I have used MS Excel.**

2. **Extracted data from using SQL**

   - **Generated data for city: San Francisco (SF)**
     SELECT year, avg_temp
     FROM city_data
     WHERE city = 'San Francisco'
     ORDER BY year;

   - **Generated data for global**
     SELECT *
     FROM global_data
     ORDER BY year;

3. **Download:** Once the output is generated you can see the Download CSV file option, Click on Download button. Save the csv file as an Excel file.

4. **Calculate Moving Average:** for both city data and global data. (In this report considered 10 years average for calculating moving average).

   For calculating Moving Average: For each year calculate the Arithmetic Mean that is taken from the past 9years plus the current year.
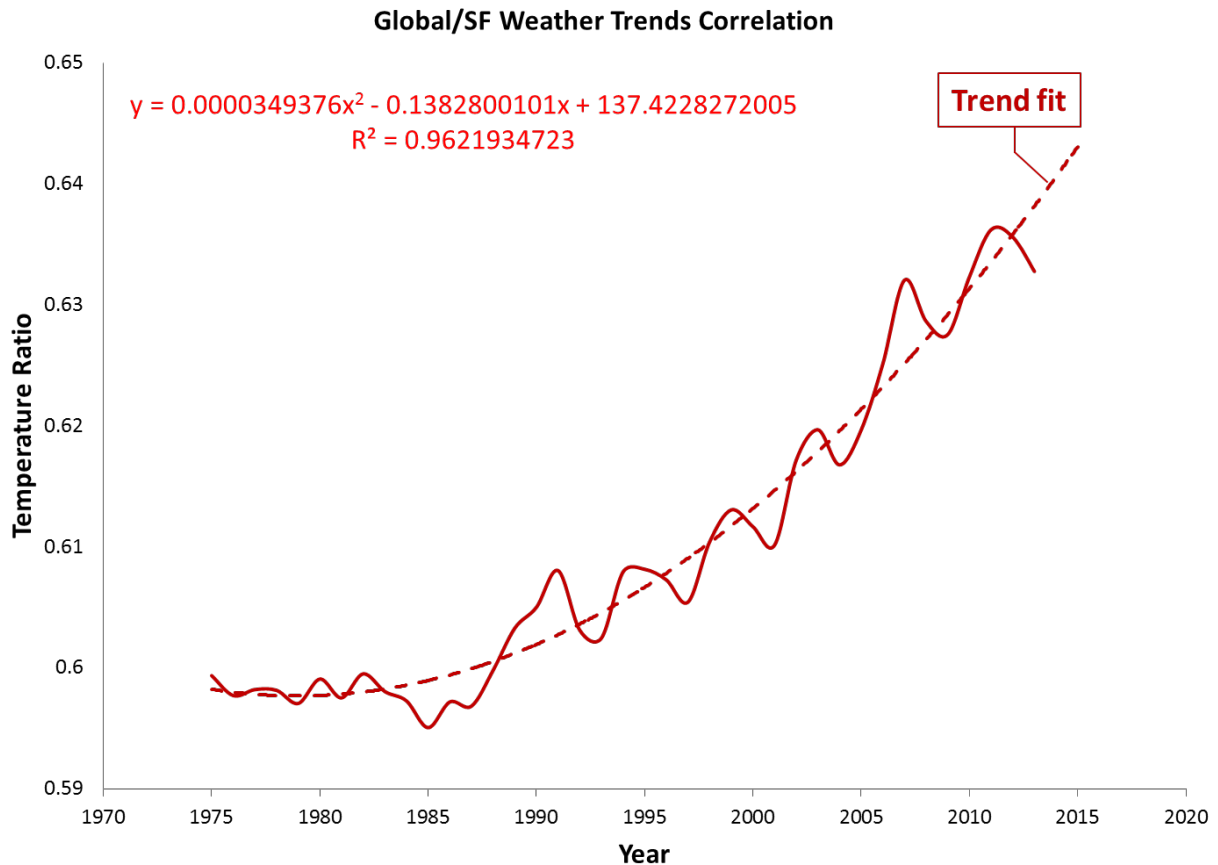
5. **Key Consideration for deciding the trends:**
   - Observing change in temperature over the years.
   - How city temperature varies with respect to global temperature?
   - Forecasting the city temperature for a known Global temperature value.
   - Comparing the change over the temperature with respect to overall average temperature through-out the years.
   - Finding the maximum and minimum average temperature for both city and global.
   - Relationship between the city and global temperature.

6. Line chart and Observations:

**Global vs. SF Weather Trends**
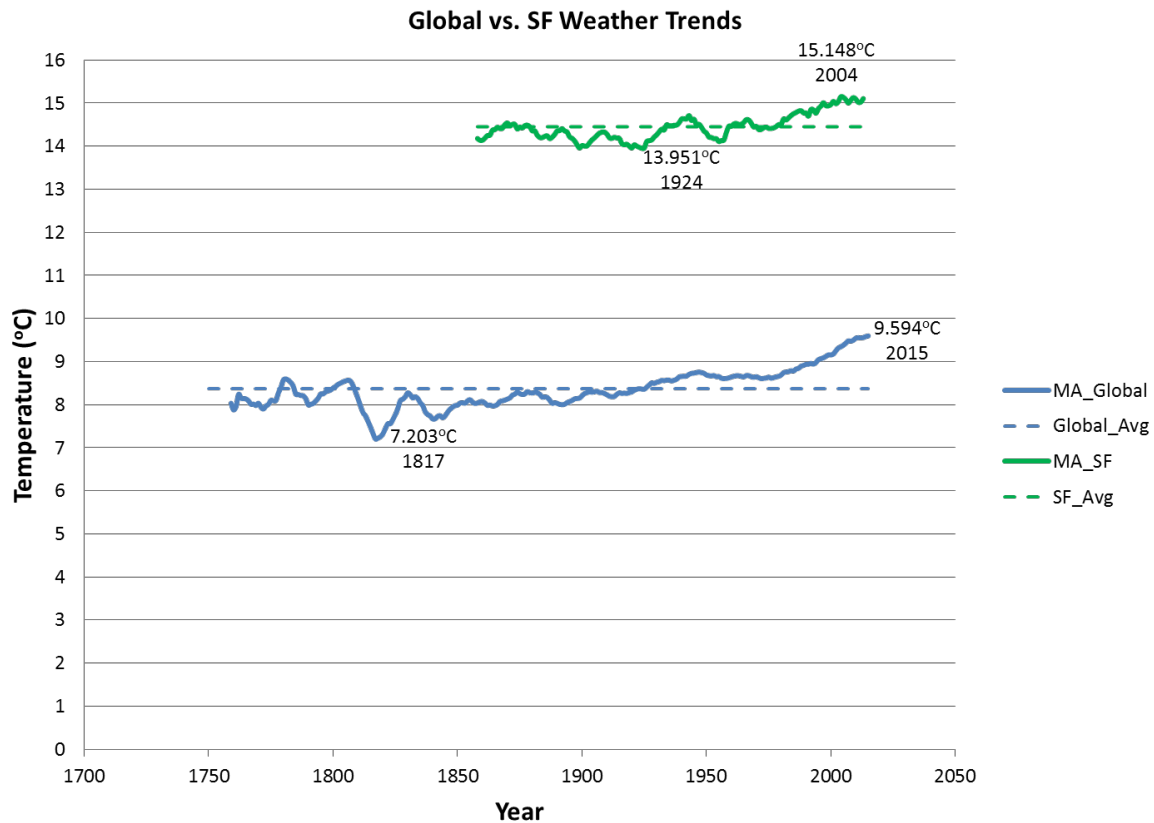
OBSERVATION:
- Both city and global temperature increases over the years.
- From the year 1975, global average is growing faster than that of the SF city average temperature.
- For Global temperature,
    - Minimum temperature recorded in 1817 (7.203 ^{o}C).
    - Maximum temperature recorded in 2015 (9.594 ^{o}C).
    - After 1922, we can see the global temperatures are always above the overall global average temperature.
- For SF city temperature,
    - Minimum temperature recorded in 1924 (13.951 ^{o}C).
    - Maximum temperature recorded in 2004 (15.148 ^{o}C).
    - After 1975, we can see the SF city temperatures are always above the overall SF city average temperature.

Global/SF Weather Trends Correlation

$y = 0.0000349376x^2 - 0.1382800101x + 137.4228272005$
$R^2 = 0.9621934723$

Trend fit

Y-axis label: **Temperature Ratio** (0.59, 0.6, 0.61, 0.62, 0.63, 0.64, 0.65)

X-axis label: **Year** (1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015, 2020)

OBSERVATION:

Above line chart shows the temperature ratios between Global and SF city for the years 1975-2013. Graph is plotted by taking the ratio of global temperature divided by SF city temperature for each year. I used polynomial trend line to get the best fit for the given data. I also captured the equation and R^2 from which we can get correlation coefficient (R=0.98041). From the R value, we can see that this equation is a good fit to the current data. This equation can be used to predict the SF city temperature for a known global temperature.

I have used this equation to validate the temperature data between the year 2001-2013 and we can also predict the SF temperature for the year 2014 and 2015. This is shown in the below line chart.
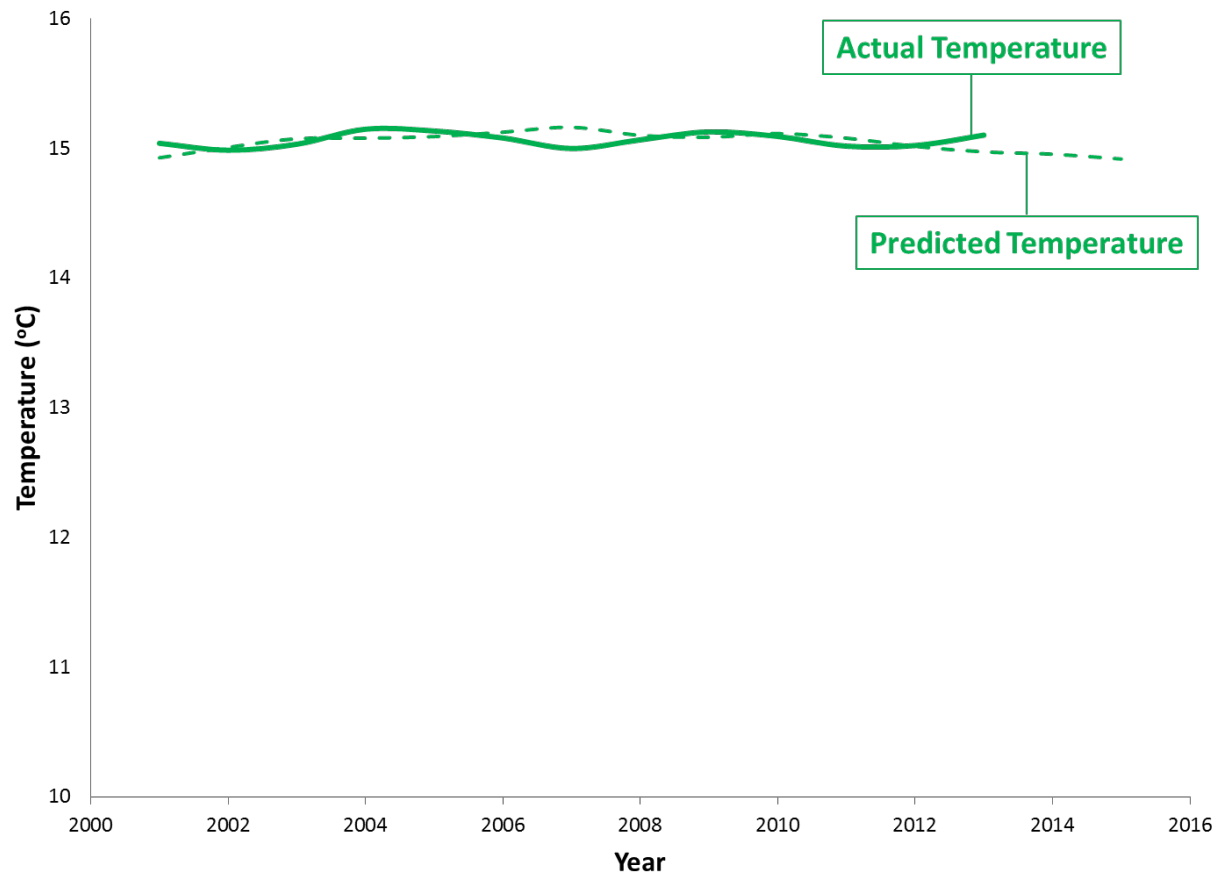
Plot showing the comparison between the actual temperature and the predicted temperature for SF city. The Predicted temperatures for the year 2014 and 2015 are 14.955 $^{\circ}$C and 14.918 $^{\circ}$C respectively.