Francisco Pineda
3-3-2019

Los Angeles Vs. The World:
A comparison of average temperatures

Introduction:

The effects of humans adding large concentrations of greenhouse gases to the atmosphere are currently being studied by various scientist around the world. Greenhouse gases traps the sun's infrared energy and releases it as thermal energy raising the temperature of the atmosphere. An increase in the amount of thermal energy in the atmosphere can change global climate patterns (Gregory et al, 2007). These changes in climate patterns are a concern around the world as they can affect the ability of humans to grow crops, cause sea level rise and effect the ability of people to survive or live comfortability in various areas of the world (Burke et al, 2008) (Gregory et al, 2007). These changes in climate patterns caused by human linked greenhouse gas emissions has been termed climate change. Climate change has been linked to the increase of droughts, heat waves and the high intensity cyclones (Alley et al, 2003).

Method:

For this comparison study I have collected the yearly average temperatures of a the city I work in, Los Angeles, California, and compared it to the yearly average global temperature. This information was collected from a database using SQL queries, and exported as CSV files. These queries are shown below.

SQL queries:

```
SELECT year, avg_temp FROM city_data WHERE city = 'Los Angeles' AND country = 'United States'

SELECT * FROM global_data
```

Using google sheets I edited the CSV files and calculated the moving average of the temperatures over the previous five (5) years for both the Los Angeles and Global data set. Los Angeles City only has temperature data going back to 1848. Therefore the first moving average I was able to calculate was for the year 1853. For comparison purposes I removed all global data prior to 1848 for the global temperature, and then calculated the five (5) year moving average. The Los Angeles dataset did not include 2014 and 2015 years so I removed those years from the Global dataset.

I copied and pasted the values of moving average and years for both the Los Angeles and Global datasets into new excel sheet files and then exported these as CSV files. Then using the Pandas and Matplotlib Python packages I then imported the these CSV files into a jupyter notebook where I plotted the moving average of temperatures vs. the year for the Los Angeles and Global datasets on separate plots (Figures 1 and 2). I then created a plot that showed both the global and Los Angeles datasets plotted together (Figure 3).

Francisco Pineda
3-3-2019

Results:

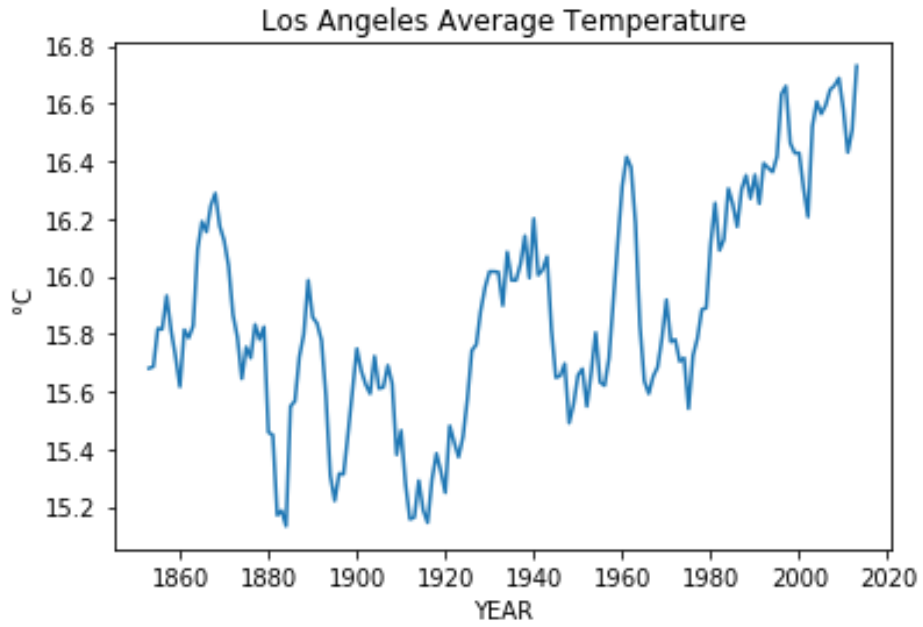

Figure 1: Moving average of temperature in Los Angeles 1854-2013

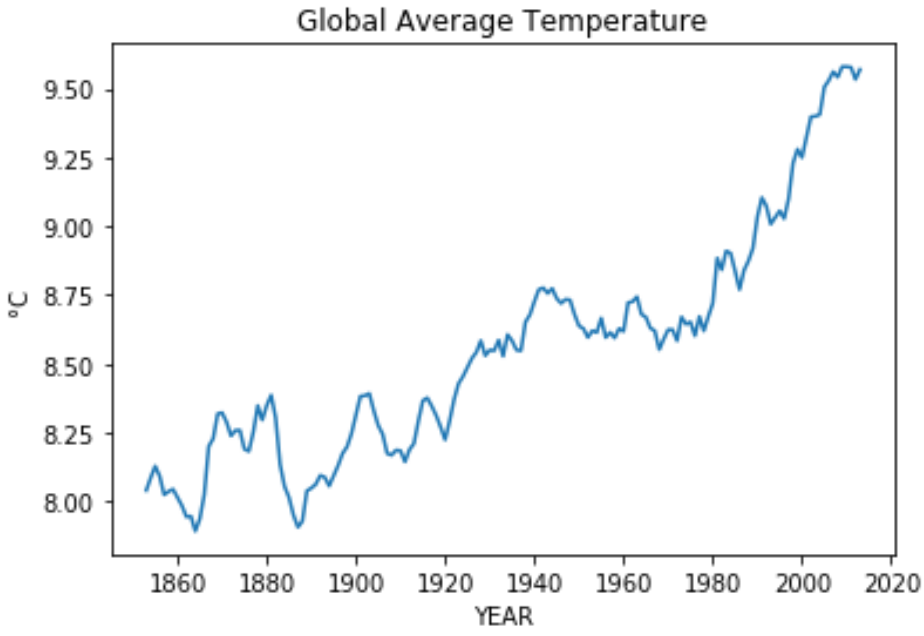

Figure 2: Moving average of global temperature 1854-2013

Francisco Pineda
3-3-2019

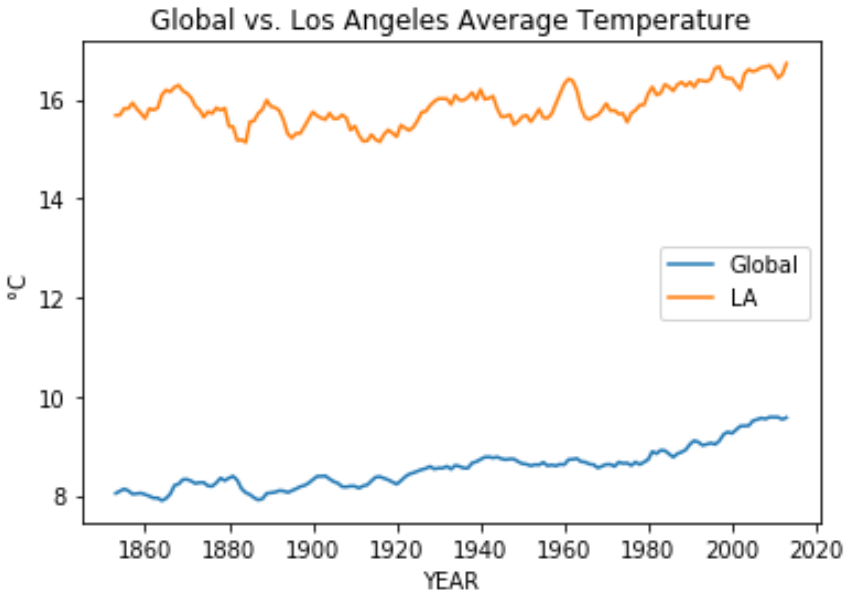

Figure 3: Moving average of Los Angeles and global temperatures 1854-2013

Observation 1:
Between 1853 and 2013 both Los Angeles and Global datasets show an increase in the moving average temperature of over 1 degree celsius. Specifically the moving average of temperatures increase of approximately 1.5°C for the global dataset and approximately 1°C for the Los Angeles dataset.

Observation 2:
The Global dataset has an slightly higher standard deviation then the Los Angeles dataset. Specifically the standard deviation for the Global and Los Angeles moving averages are .43°C and .38°C respectively. These were calculated using Numpy's built in standard deviation function.

Observation 3:
There appears to be decrease in the moving average temperatures for both the Los Angeles and Global Datasets in the mid 1880s. Los Angeles has its lowest moving average of the entire dataset in 1884 with a moving average temperature of 15.132°C. The Global dataset moving average temperature fell to 7.906°C in 1887 only slightly above the datasets lowest value of 7.892°C for the moving average of the year 1864. One possible explanation for this is the volcanic eruption of Krakatoa. Volcanic ash and sulfur dioxide released during such an eruption can cause global changes in average temperature. Studies have

determined that this is what happened in the year following this eruption (Clifford and Portman, 1988). This would explain the decrease average temperature shown in both the Los Angeles and Global datasets.

Observation 4:
Using Numpy's build in Correlation Coefficient function I was able to calculate the correlation coefficient for both datasets. The correlation coefficients for each data set were .57 and .91 for the Los Angeles dataset and Global dataset, respectively. Both of these correlations are positive which show that as the years increase the moving average increase as well. The difference of .57 and .91 for the correlation coefficient of the Los Angeles and Global datasets respectively shows that relationship between year and moving average temperature is more linear for the Global dataset. Viewing Figures 1 and 2 it does appear that the plot of the Global data is more linear.

Further possible studies ideas: Taking another city at an equivalent latitude in the Southern Hemisphere to determine possible differences between cities in the Northern and Southern Hemispheres.

Francisco Pineda
3-3-2019

References

1. Gregory, J., Stocker, T., Lemke, P., & Bindoff, N. (2007). Climate change 2007: the physical science basis. *Contribution of*.

2. Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P., & Naylor, R. L. (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*, *319*(5863), 607-610.

3. Alley, R. B., Marotzke, J., Nordhaus, W. D., Overpeck, J. T., Peteet, D. M., Pielke, R. A., & Wallace, J. M. (2003). Abrupt climate change. *science*, *299*(5615), 2005-2010.

4. Clifford, F.M., Portman, D.A. (1988). Major Volcanic Eruptions and Climate: A Critical Study *Journal of Climate*