Explore Weather Trends - Project 1

Project link (https://colab.research.google.com/drive/17evZQmb5BsI8Y3QyMIMXZ_rrcBu6xP__?usp=sharing)

Steps taken to prepare the data

Part 1 - Extracting from SQL Database

1. Find my closest city from the city_list using this query:

```
SELECT * FROM city_list
WHERE country = 'United States'
```

2. Extract the temperature data for Washington

```
SELECT cl.city, year, avg_temp
FROM city_list cl
JOIN city_data cd ON cl.city = cd.city
WHERE cl.city = 'Washington'
```

3. Extract the global data

```
SELECT * FROM global_data
```

Part 2 - Read data and Create visualization with Pandas and Matplotlib

1. Import neccessary packages
2. Read the csv files and convert them to pandas DataFrame
3. Inspect, check and deal with NaNs

> There are 5 missing data in Washington. I chose to fill with the closest 10 year value.

4. Prepare the variables for plotting

> I was getting errors initially since both data sets have different length. To work around this, I decided to plot within the "*middle ground years*" of both data sets. I found this by getting the minimum and maximum years in both data sets and only plot within this "*middle ground years*". Then I set the index for both data sets as year, then set my year variable to the "middle ground year" values.

5. Create a line plot to compare both data sets

Part 2 as follows

In [ ]:

```
# imports and read csv to pandas

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

%matplotlib inline
plt.style.use('fivethirtyeight')

# read csv to pandas
global_temp = pd.read_csv('global_data.csv')
wash_temp = pd.read_csv('washington_temp.csv')
```

In [ ]:

```
# check if wash temp has any NaNs
wash_temp.isnull().any()
```

In [ ]:

```
# which rows has nulls
null_rows = wash_temp[wash_temp['avg_temp'].isnull()].index.tolist()
null_rows
```

In [ ]:

```
# fill in NaNs with value of nearest 10 year mean

# for rows [3, 4, 5, 6]
wash_temp['avg_temp'] = wash_temp['avg_temp'].fillna(value=wash_temp.l
oc[0:10]['avg_temp'].mean(), limit=4)

# for row [37]
wash_temp['avg_temp'] = wash_temp['avg_temp'].fillna(value=wash_temp.l
oc[30:40]['avg_temp'].mean(), limit=1)
```

In [ ]:

```
# check the replaced NaN values
print(wash_temp.loc[3:6]['avg_temp'])
print(wash_temp.loc[37]['avg_temp'])
```

In [ ]:

```
# check if any null data
global_temp.isnull().any()
```

In [ ]:

```
# Get the 10 year rolling average for Washington temp
wash_temp['MA10'] = wash_temp['avg_temp'].rolling(10, min_periods=1).m
ean()
wash_temp.head(10)
```

In [ ]:

```
# Get the 10 year rolling average for Global temp
global_temp['MA10'] = global_temp['avg_temp'].rolling(10, min_periods=1).mean()

# see first 3 rows
global_temp.head(3)
```

In [ ]:

```
# assign variables for plotting
washMA10 = wash_temp['MA10']
globalMA10 = global_temp['MA10']

# Since global and washington data are different lengths
# I'll compare the same slice of years from Washington and Global data
# I'll find the middle years for fair comparison
print('Min and Max year for Washington ', min(wash_temp['year']), max(wash_temp['year']))
print('Min and Max year for Global Temp ',min(global_temp['year']), max(global_temp['year']))
print('\nFor comparison, need to start at ' + str(min(global_temp['year'])) + '\nAnd end at ' + str(max(wash_temp['year'])))

# see first 3 rows
global_temp.head(3)
```

In [ ]:

```
# assign year as index
wash_temp = wash_temp.set_index('year')

# see first 3 rows
wash_temp.head(3)
```

In [ ]:

```
# assign year as index
global_temp = global_temp.set_index('year')

# check index, see first 3 rows
global_temp.head(3)
```

In [ ]:

```
# get values of global_temp MA10 from 1750 to 2013
# global and washington temp need to have same length for comparison
global_MA10 = global_temp.loc[1750:2013]['MA10'].values
global_MA10.shape
```

In [ ]:

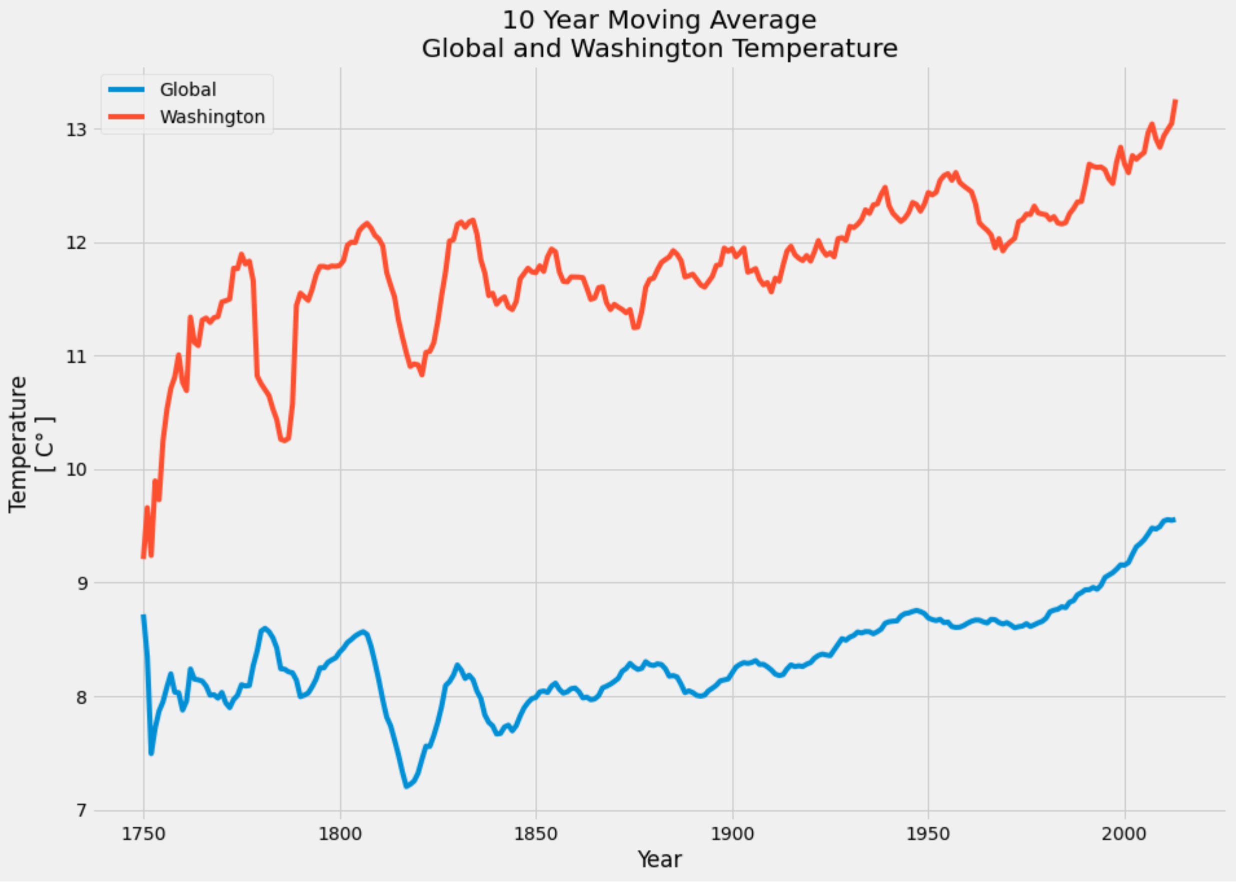
```
# get values of wash_temp MA10 from 1750 to 2013
# global and washington temp need to have same length for comparison
wash_MA10 = wash_temp.loc[1750:2013]['MA10'].values
wash_MA10.shape
```

In [ ]:

```
# get correct length of years 1750 to 2013
years = global_temp.loc[1750:2013].index

# make sure its same shape
years.shape
```

In [ ]:

```
# Create Plot

fig, ax = plt.subplots(figsize=(14, 10))

ax.plot(years,global_MA10, label = "Global")
ax.plot(years, wash_MA10, label = "Washington")

ax.set(title = "10 Year Moving Average\nGlobal and Washington Temperature",
       xlabel = "Year",
       ylabel = "Temperature\n[ C° ]")

plt.legend()
plt.show()

fig.savefig('global_washington_ma10.png', bbox_inches='tight')
```



In [ ]:

```
wa = round(wash_temp.loc[1750:2013]['avg_temp'].mean(),2)
gl = round(global_temp.loc[1750:2013]['avg_temp'].mean(),2)
# Washington average temperature from 1750 to 2013
print('Washington Mean : ', wa)
# Global average temperature from 1750 to 2013
print('Global Mean : ', gl)
# Washington and Global difference
print('Washington and Global difference in Mean Temperature : ', round
(wa - gl,2))
# Median Temperature
print()
wa_median = np.median(wash_temp.loc[1750:2013]['avg_temp'])
gl_median = np.median(global_temp.loc[1750:2013]['avg_temp'])
print('Washington Median Temp : ', round(wa_median,2))
print('Global Median Temp : ', round(gl_median,2))
```

- Overall in average, **Washington is 3.52 C° warmer** at 11.88 C° **compared to the global average** of 8.36 C°. The median temp in Washington is 11.92 C° while the global median is same as the mean at 8.36 C°.

In [ ]:

```
print('Washington\'s')
print(round(wash_temp.loc[1750:2013]['avg_temp'].describe(),2))
print('\nGlobal\'s')
print(round(global_temp.loc[1750:2013]['avg_temp'].describe(),2))
print()
print('Year of min avg temp in Washington : ', wash_temp.loc[1750:2013
]['avg_temp'].idxmin())
print('Year of max avg temp in Washington : ', wash_temp.loc[1750:2013
]['avg_temp'].idxmax())
print()
print('Year of min avg temp Globally  : ', global_temp.loc[1750:2013][
'avg_temp'].idxmin())
print('Year of max avg temp Globally : ', global_temp.loc[1750:2013]['
avg_temp'].idxmax())
```

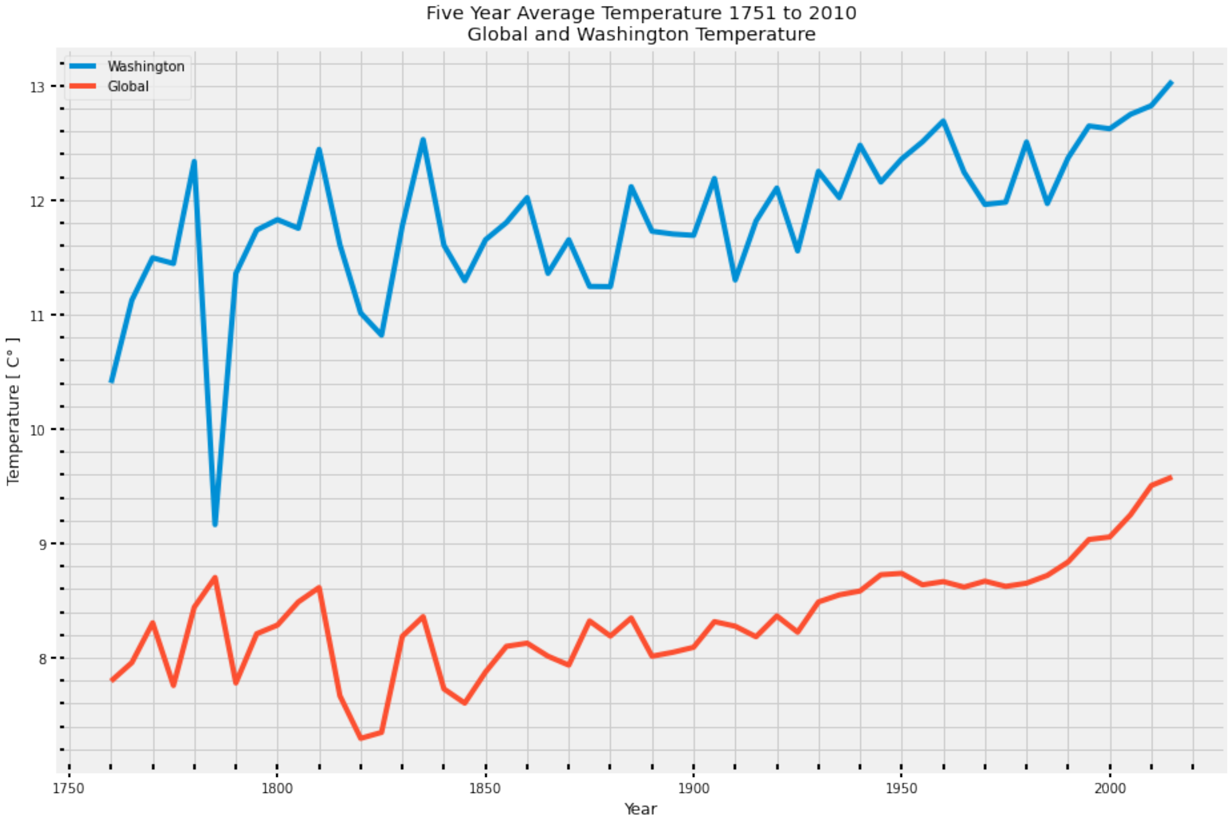
- Washington's temperature ranged from **coldest 3.15 C°** a which is a one-time occurence in 1779 and **warmest at 14.19** C° in 2013. Its **standard deviation is 1.03 C°** which means that we can expect that in average, Washington's temperature to **fall within 1.03 C° of the mean temperature of 11.88 C°**.
- Global temperature is more consistent with a standard deviation of **0.58 C°**. The **coldest temperature is 5.78 C°** in 1752 and **warmest at 9.73 C°** in 2007. Global temperature can be expected to **fall within 0.58 C° of the mean temperature of 8.36 C°**.

In [ ]:

```
# Get the mean temperature every 5 years
g = np.array(global_temp.loc[1751:2010]['avg_temp']).reshape(-1,5)
gl_mean_of_avg_temp = np.mean(g, axis=1)

w = np.array(wash_temp.loc[1751:2010]['avg_temp']).reshape(-1,5)
wa_mean_of_avg_temp = np.mean(w, axis=1)

wash_gl_diff = wa_mean_of_avg_temp - gl_mean_of_avg_temp
time_period = ((np.arange(1,54)) * 5) + 1750

def average_temp_every_5yr(period,avg_temp1,avg_temp2):
    avg_temp_5 = list(zip(period,avg_temp1,avg_temp2))
    df = pd.DataFrame(avg_temp_5, columns = ['Period','Washington','Gl
obal'])
    return df.set_index('Period')

print('Average Temperatures Every 5 Years\n')
average_temp_every_5yr(time_period,wa_mean_of_avg_temp,gl_mean_of_avg_
temp)
```

In [ ]:

```
# Create a plot
df = average_temp_every_5yr(time_period,wa_mean_of_avg_temp,gl_mean_of
_avg_temp)

fig, ax = plt.subplots(figsize=(14, 10))

ax.plot(time_period[1:], df['Washington'], label = "Washington")
ax.plot(time_period[1:], df['Global'], label = "Global")

ax.set(title = "Five Year Average Temperature 1751 to 2010\nGlobal and
Washington Temperature",
       xlabel = "Year",
       ylabel = "Temperature [ C° ]")

ax.minorticks_on()
ax.tick_params(which='major', length=10, width=2, direction='inout')
ax.tick_params(which='minor', length=5, width=2, direction='in')
ax.grid(which='minor')

plt.legend()
plt.show()

fig.savefig('global_washington_percent_change.png', bbox_inches='tight
')
```



> The huge spike in Washington's Temperature from 1780 to 1790 can be misleading, because these values are NaNs before being filled by the nearest 10 year data set.

- Beginning from **1751 to 1850**, **Global** temperature had variability in the **range of 0.6 C° to 1.4 C°**. In **Washinton** starting from 1800 had variability of in the **range of 0.6 C° to 1.8 C°**.
- **After 1850**, **Global** temperature has seen **smaller changes from 0.4 C° to 0.6 C°**. But in **1930 Global** temperature has seen a **steady climb** from 8.5 C° up to 9.5 C° by 2013.
- **After 1850**, In **Washington** temperature is **more varied from 0.6 C° to 1.0 C° range**. **Starting from 1930**, Washington's temperature has been **near or above 12 C°** and warmest at **14.19 C°** in **2013**.