

Exploring Weather Trends

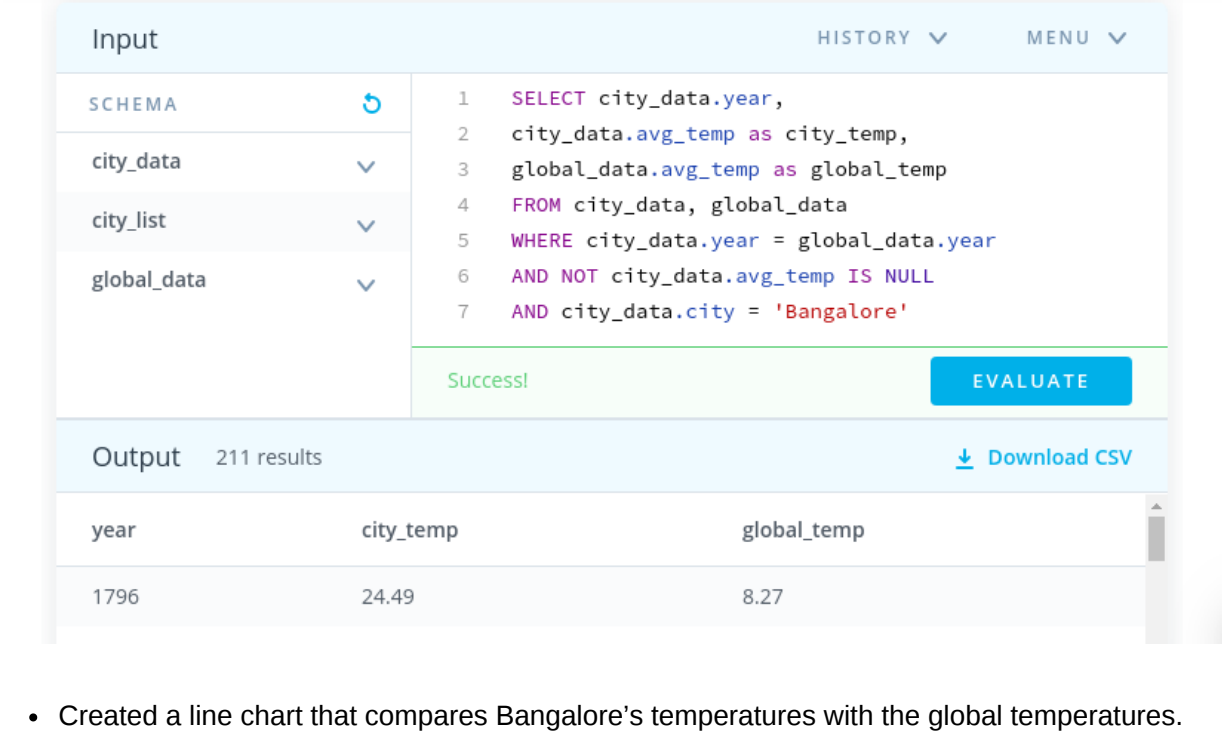
Summary

In this project, I analyzed local and global temperature data and compare the temperature trends where I live (Bangalore) to overall global temperature trends.

Project outline

Goal is to create a visualize and prepare a write up describing the similarities and differences between global temperature trends and temperature trends in Bangalore. To do this:

- Extracted the data from the database using SQL Query



- Created a line chart that compares Bangalore's temperatures with the global temperatures. For this purpose **moving average** rather than the yearly averages in order to smooth out the lines, making trends more observable.
- Made observation based on the line chart.

Steps taken to prepare the data to be visualized

Python is used to extract and visualize the data

```
In [1]: import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
```

```
In [7]: data=pd.read_csv("../Weather_Trends/results.csv")
```

```
In [8]: data.head()
```

```
Out[8]:
```

	year	city_temp	global_temp
0	1796	24.49	8.27
1	1797	25.18	8.51
2	1798	24.65	8.67
3	1799	24.81	8.51
4	1800	24.85	8.48

```
In [9]: data.isnull().sum(axis=0)
```

```
Out[9]: year          0
city_temp      0
global_temp    0
dtype: int64
```

There are no null values in the dataset

```
In [10]: sum(data.duplicated())
```

```
Out[10]: 0
```

There are no duplicate values

Moving average Calculation

Moving averages are used to smooth out data to make it easier to observe long term trends and not get lost in daily fluctuations. For example, let's say you wanted to visualize the sales trend at a clothing retail store. You start with daily data, and your chart looks too volatile to interpret because more people shop on the weekends. You could sum up sales by week, but that may take out some of the detail you wanted to see. Using a moving average, you can both smooth out the daily volatility and allow you to observe the long term trend.

Moving average calculation in python: Since moving average involves calculating average for a particular time period. So we have to find a way that takes the dataframe and a particular period and gives us the moving average for that particular period. Fortunately, python has inbuilt function for this which do exactly this job. Pandas rolling function:

DataFrame.rolling(self, window, min_periods=None, center=False, win_type=None, on=None, axis=0, closed=None) We need to only focus on window attribute for calculating moving average in this case. Here, window is the Size of the moving window. This is the number of observations used for calculating the moving average which is same as the period that I have mentioned earlier. Each window will be a fixed size.

```
In [13]: data['city_MA_10'] = np.round(data.iloc[:,1].rolling(window=10).mean() ,
1)
```

```
In [15]: data.head(20)
```

```
Out[15]:
```

	year	city_temp	global_temp	city_MA_10
0	1796	24.49	8.27	NaN
1	1797	25.18	8.51	NaN
2	1798	24.65	8.67	NaN
3	1799	24.81	8.51	NaN
4	1800	24.85	8.48	NaN
5	1801	24.49	8.59	NaN
6	1802	25.44	8.58	NaN
7	1803	25.22	8.50	NaN
8	1804	25.67	8.84	NaN
9	1805	25.01	8.56	25.0
10	1806	24.87	8.43	25.0
11	1807	24.25	8.28	24.9
12	1813	24.23	7.74	24.9
13	1814	23.91	7.59	24.8
14	1815	23.79	7.24	24.7
15	1816	23.30	6.94	24.6
16	1817	23.60	6.98	24.4
17	1818	23.94	7.83	24.3
18	1819	23.86	7.37	24.1
19	1820	23.91	7.62	24.0

```
In [16]: data['world_MA_10'] = np.round(data.iloc[:,2].rolling(window=10).mean()
,1)
data.head(20)
```

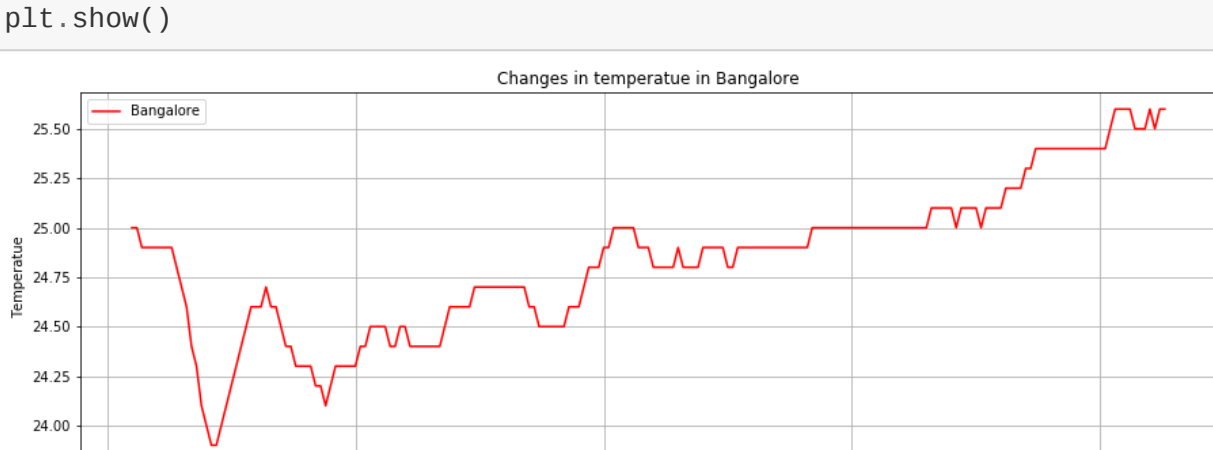
```
Out[16]:
```

	year	city_temp	global_temp	city_MA_10	world_MA_10
0	1796	24.49	8.27	NaN	NaN
1	1797	25.18	8.51	NaN	NaN
2	1798	24.65	8.67	NaN	NaN
3	1799	24.81	8.51	NaN	NaN
4	1800	24.85	8.48	NaN	NaN
5	1801	24.49	8.59	NaN	NaN
6	1802	25.44	8.58	NaN	NaN
7	1803	25.22	8.50	NaN	NaN
8	1804	25.67	8.84	NaN	NaN
9	1805	25.01	8.56	25.0	8.6
10	1806	24.87	8.43	25.0	8.6
11	1807	24.25	8.28	24.9	8.5
12	1813	24.23	7.74	24.9	8.5
13	1814	23.91	7.59	24.8	8.4
14	1815	23.79	7.24	24.7	8.2
15	1816	23.30	6.94	24.6	8.1
16	1817	23.60	6.98	24.4	7.9
17	1818	23.94	7.83	24.3	7.8
18	1819	23.86	7.37	24.1	7.7
19	1820	23.91	7.62	24.0	7.6

Analysis

How temperature changes in Bangalore over the time ?

```
In [18]: plt.figure(figsize=(15,5))
plt.grid(True)
plt.plot(data.year,data.city_MA_10,color='red',label='Bangalore')
plt.legend(loc='best')
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.title("Changes in temperature in Bangalore")
plt.show()
```

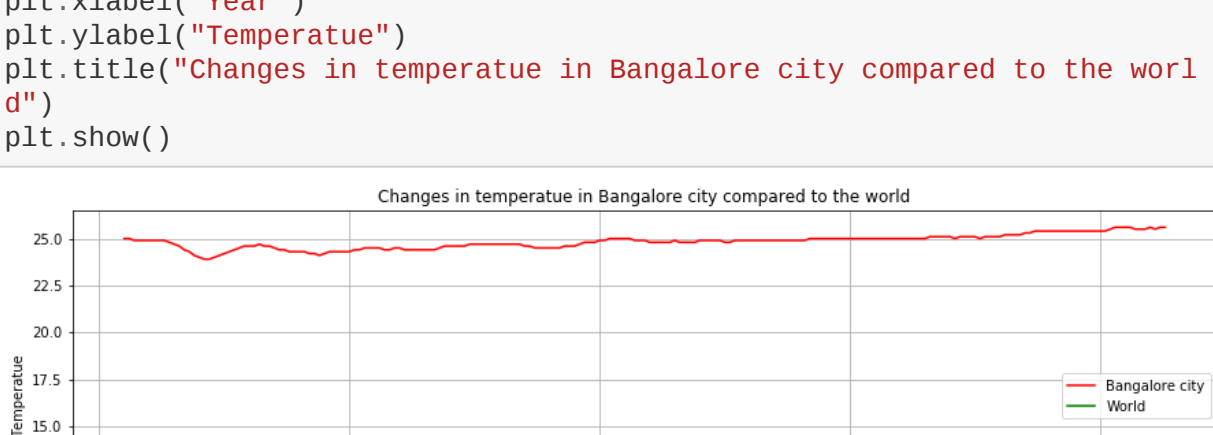


- During 19th century, the lowest average temperature in Bangalore city was 11.9 degree and the maximum temperature was 25.0 degree. During this century there is a significant rise in temperature.

- But , during 20th century the maximum and minimum temperature was 25.4 and 24.8 respectively. So, there was only 1.4 degree rise in the temperature over 100 years which was quite good compared to the previous century .

How do the changes in your city's temperatures over time compare to the changes in the global average?

```
In [20]: plt.figure(figsize=(15,5))
plt.grid(True)
plt.plot(data.year,data.city_MA_10,color='red',label='Bangalore city')
plt.plot(data.year,data.world_MA_10,color='green',label='World')
plt.legend(loc='best')
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.title("Changes in temperature in Bangalore city compared to the world")
plt.show()
```



- As we can see from the graph , there is much more difference between the average temperature in Bangalore city compared to rest of the world. This difference was not consistent.

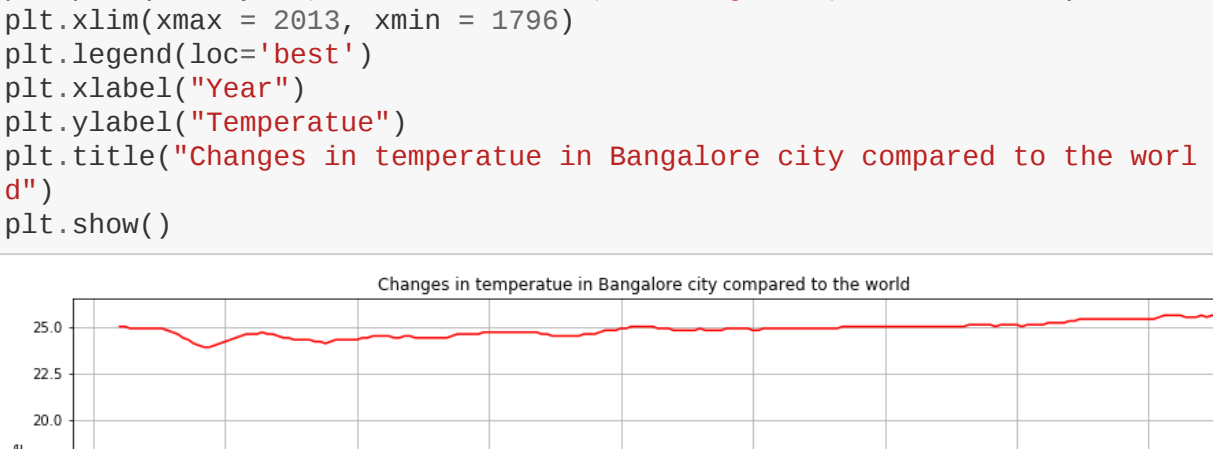
- We can see from the graph there is fluctuation of temperature in Bangalore city during 1800-1825 and 1850-1875 .

- Although , during that time period Bangalore city's average temperature somewhat close to the global average temperature which indicates that Bangalore city was colder compared to today's time.

- From the graph , it is quite clear that Bangalore city is hotter on average compared to rest of the world.

Is your city hotter or cooler on average compared to the global average? Has the difference been consistent over time?

```
In [21]: plt.figure(figsize=(15,5))
plt.grid(True)
plt.plot(data.year,data.city_MA_10,color='red',label='Bangalore city')
plt.plot(data.year,data.world_MA_10,color='green',label='World')
plt.xlim(xmax = 2013, xmin = 1796)
plt.legend(loc='best')
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.title("Changes in temperature in Bangalore city compared to the world")
plt.show()
```



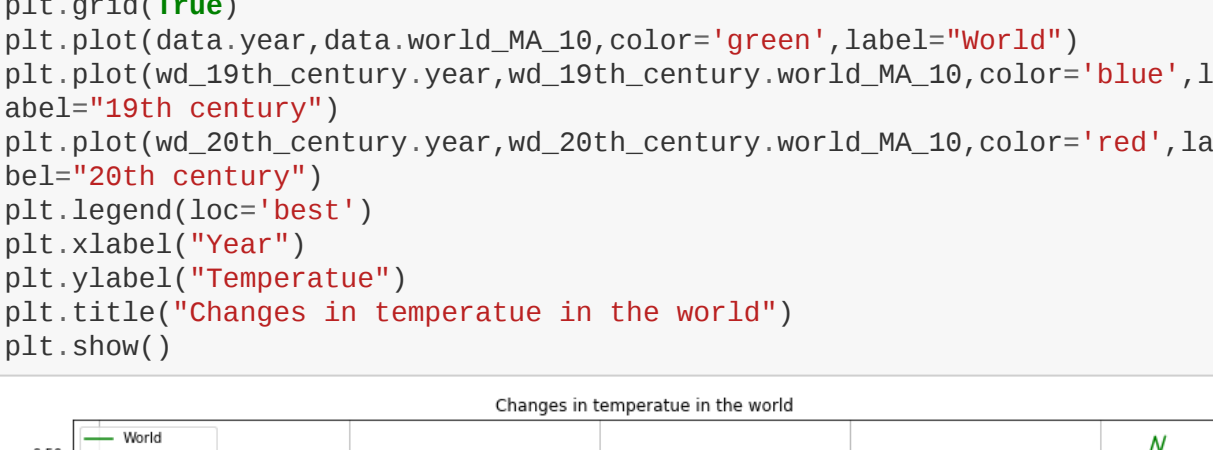
- Bangalore city was cooler compared to rest of the world during 1800-1825 where the temperature decreased from 25 degree to its lowest 11.9 degree in 1816 . During that period city was much cooler than rest of the world as the world average temperature is around 7.2 degree at that time . However Bangalore's temperature rose again all the way up to 24 degree and remain approximately in the range between 24-25 degree till 1862. From 1863, temperature again decrease to 19.4 degree and rose again to 24.7 degree in 1875.

- After 1875 , in both the cases average temperature rose constantly till date . Bangalore's temperature increased from 24.7(1875) degree to 25.6 (2013) degree . Whereas world temperature increases from 8.3(1875) degree to 9.6 (2013) degree .

What does the overall trend look like? Is the world getting hotter or cooler? Has the trend been consistent over the last few hundred years?

```
In [22]: wd_19th_century = data[(data.year>=1805) & (data.year<=1900)]
wd_20th_century = data[(data.year>=1900) & (data.year<=2009)]
```

```
In [23]: plt.figure(figsize=(15,5))
plt.grid(True)
plt.plot(data.year,data.world_MA_10,color='green',label='World')
plt.plot(wd_19th_century.year,wd_19th_century.world_MA_10,color='blue',label='19th century')
plt.plot(wd_20th_century.year,wd_20th_century.world_MA_10,color='red',label='20th century')
plt.legend(loc='best')
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.title("Changes in temperature in the world")
plt.show()
```



- The average global temperature increased from 7.2 degree to 9.6 degree.

- In terms of century, the global temperature was 7.2 degree at the beginning and at the end of the century the temperature was 8.6. So, over 100 years average temperature increased by 1.4 degree. For 20th century this difference was 1.0 degree .

- If we consider last 200 years record, then global temperature increased by 1.2 degree by each century on an average.