Project_Exploring Weather Trends

September 10, 2021

1 Exploring Weather Trends

We would like to understand how the temperature of New York has been changed during the past 250 years compared with the global temperature by looking at 10-year moving average data plotted by a line chart. The tool used here is Python.

1.1 Questions

- Question 1) What was the temperature range for each?
- Question 2) What is the average temperature gap?
- Question 3) Can we decrease the gap soon?

1.2 Data gathering

Get the data from database by writing SQL query.

The query executed without error and pulls the intended data with CSV format.

Find the moving average on the Spreadsheet. Select 10 cells and find average and copy & paste all the way down.

(*Captured images are attached on the last page.)

1.3 Data cleaning

[1]:
```
# import all packages and set plots to be embedded inline
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sb
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)

%matplotlib inline
```

[2]:
```
dfg = pd.read_csv('global_data.csv')
dfg.head()
```

[2]:
```
   year  avg_temp  10-Years MA
0  1750      8.72          NaN
1  1751      7.98          NaN
2  1752      5.78          NaN
3  1753      8.39          NaN
4  1754      8.47          NaN
```

[3]:
```
dfg.isnull().sum()
```

[3]:
```
year           0
avg_temp       0
10-Years MA    9
dtype: int64
```

[4]:
```
dfg = dfg.dropna()
dfg.isnull().sum()
```

[4]:
```
year           0
avg_temp       0
10-Years MA    0
dtype: int64
```

[5]:
```
dfc = pd.read_csv('city_data.csv')
dfc.head()
```

[5]:
```
   year     city         country  avg_temp  10-Years MA
0  1849  Abidjan  C??te D'Ivoire     25.58          NaN
1  1850  Abidjan  C??te D'Ivoire     25.52          NaN
2  1851  Abidjan  C??te D'Ivoire     25.67          NaN
3  1852  Abidjan  C??te D'Ivoire       NaN          NaN
4  1853  Abidjan  C??te D'Ivoire       NaN          NaN
```

[6]:
```
dfc.isnull().sum()
```

[6]:
```
year              0
city              0
country           0
avg_temp       2547
10-Years MA    70530
dtype: int64
```

[7]:
```
dfc = dfc.dropna()
dfc.isnull().sum()
```

[7]:
```
year           0
city           0
country        0
avg_temp       0
```

```
10-Years MA    0
dtype: int64
```

[8]:
```
dfc.tail()
```

[8]:

	year	city	country	avg_temp	10-Years MA
46434	2009	New York	United States	10.14	10.60
46435	2010	New York	United States	11.36	10.74
46436	2011	New York	United States	11.27	10.77
46437	2012	New York	United States	11.97	10.84
46438	2013	New York	United States	12.16	11.08

[9]:
```
dp = np.arange(46177, 46184, 1)
dfc = dfc.drop(index = dp)
```

[10]:
```
dfc.describe()
```

[10]:

	year	avg_temp	10-Years MA
count	254.000000	254.000000	254.000000
mean	1886.417323	9.521220	9.470000
std	73.599702	1.011606	0.601472
min	1759.000000	0.250000	7.730000
25%	1823.250000	9.092500	9.100000
50%	1886.500000	9.550000	9.440000
75%	1949.750000	10.027500	9.885000
max	2013.000000	12.160000	11.080000

[11]:
```
dfg.describe()
```

[11]:

	year	avg_temp	10-Years MA
count	257.000000	257.000000	257.000000
mean	1887.000000	8.381206	8.353961
std	74.333707	0.559981	0.452483
min	1759.000000	6.780000	7.203000
25%	1823.000000	8.090000	8.059000
50%	1887.000000	8.370000	8.275000
75%	1951.000000	8.700000	8.642000
max	2015.000000	9.830000	9.594000

[12]:
```
dfc.describe() - dfg.describe()
```

[12]:

	year	avg_temp	10-Years MA
count	-3.000000	-3.000000	-3.000000
mean	-0.582677	1.140014	1.116039
std	-0.734006	0.451625	0.148989
min	0.000000	-6.530000	0.527000
25%	0.250000	1.002500	1.041000
50%	-0.500000	1.180000	1.165000

```
75%   -1.250000  1.327500     1.243000
max   -2.000000  2.330000     1.486000
```

[39]:
```
dfc.loc[197]
```

[39]:
```
index                 46382
year                   1957
city               New York
country       United States
avg_temp               10.5
10-Years MA           10.39
Name: 197, dtype: object
```

1.4 Visualization

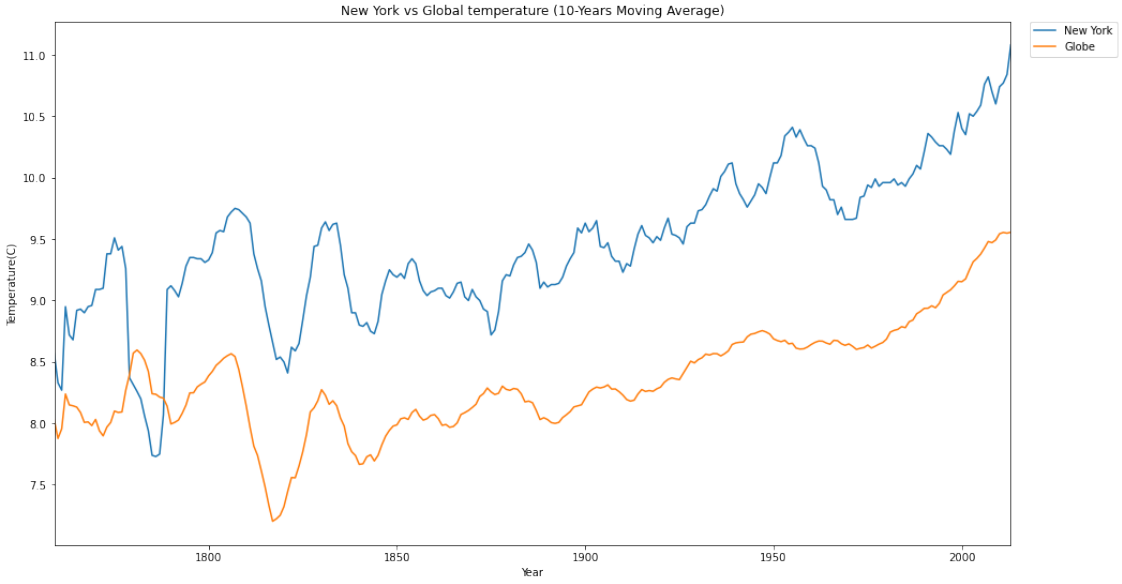
[13]:
```
plt.figure(figsize = [16,9])

plt.errorbar(x = dfc['year'], y = dfc['10-Years MA'], label = 'New York')
plt.errorbar(x = dfg['year'], y = dfg['10-Years MA'], label = 'Globe')

plt.legend(bbox_to_anchor=(1.02,1), loc = 'upper left', borderaxespad = 0)

plt.title('New York vs Global temperature (10-Years Moving Average)')
plt.xlabel('Year')
plt.ylabel('Temperature(C)')
plt.xlim(1759,2013)

plt.show()
```



Because there is a categorical variable, year, and a quantitative variable, temperature, I selected two line charts in the same plot. I also added a legend meaning each data with different colors.

(1) both lines curve upward over the experimental years by and large.

(2) however, the temperature of New York were below the global average for only about 30 years between 1750 and 1800,

(3) temperature gap has been around 1.12 Celsius degree since then without reversing each other.

(4) the gap was the largest in 1957.

1.5 Answer

- Question 1) What was the temperature range for each(City/Globe)? **7.73 ~ 11.08 (C) / 7.20 ~ 9.59 (C)**
- Question 2) What is the average temperature gap? **1.12 (C)**
- Question 3) Can we find decreasing the gap soon? **No, the gap is increasing.**

1.6 Appendix

Refer to the next page.

Input HISTORY MENU

SCHEMA

city_data

city_list

global_data

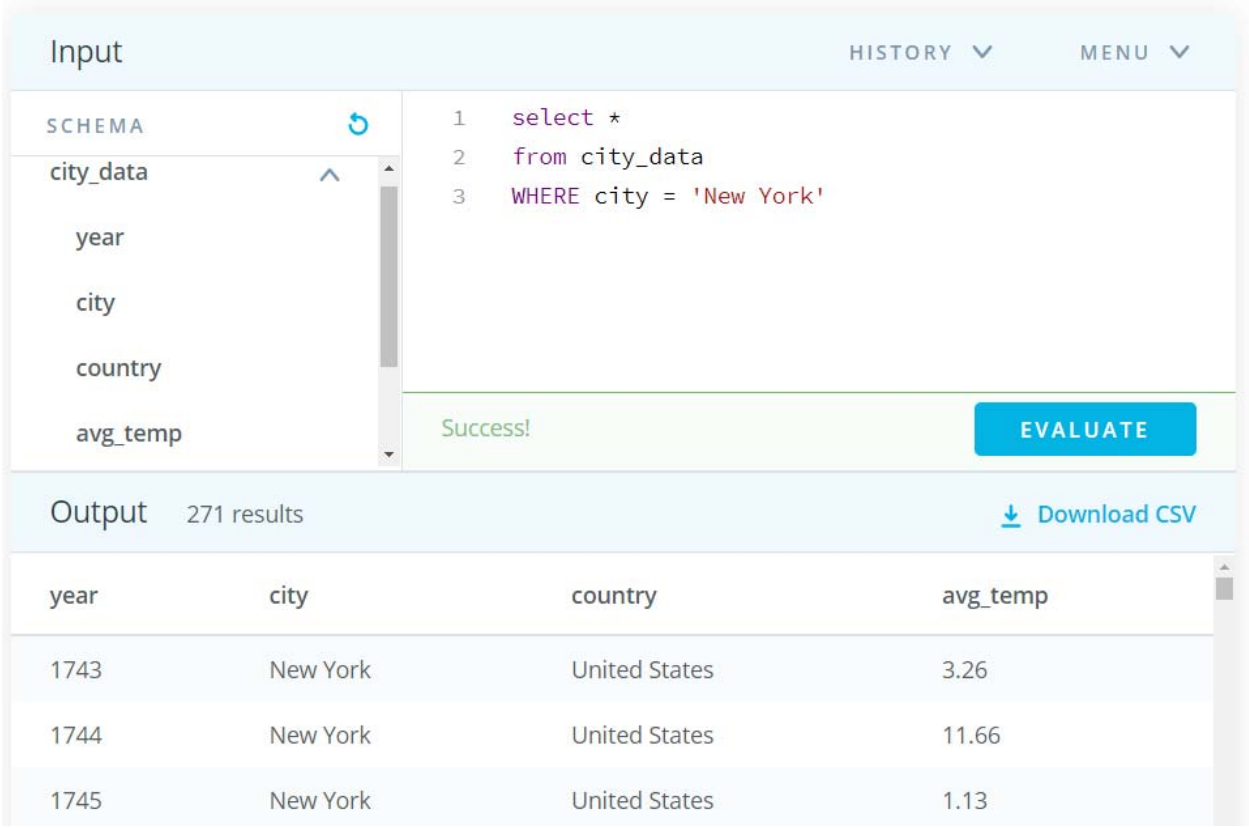
```
1  select * from global_data;
```

Success! EVALUATE

Output 266 results Download CSV

year	avg_temp
1750	8.72
1751	7.98
1752	5.78

year	avg_temp	10-Years MA
1750	8.72	
1751	7.98	
1752	5.78	
1753	8.39	
1754	8.47	
1755	8.36	
1756	8.85	
1757	9.02	
1758	6.74	
1759	=average(B2:B11)	
1760	7.19	7.877
1761	8.77	7.956
1762	8.61	8.239
1763	7.5	8.15
1764	8.4	8.143
1765	8.25	8.132


Input
HISTORY
MENU
SCHEMA
city_data
year
city
country
avg_temp
1 select *
2 from city_data
3 WHERE city = 'New York'
Success!
EVALUATE
Output
271 results
Download CSV
year
city
country
avg_temp
1743
New York
United States
3.26
1744
New York
United States
11.66
1745
New York
United States
1.13