Exploring Weather Trends Project

✓ Step 1: Extract the Data from the Database

- **List of codes:**

1- Exploring the city_list in order to identify the cities available in Egypt

```
SELECT *
FROM city_list
WHERE country = 'Egypt';
```

Output: just two cities, Alexandria (2nd big city which I live in) and Cairo (the Capital which I favorite).

2- Extracting data for the two cities from **city_data** tables and export it to CSV files. Data is filtered by country (Egypt), ordered by the city then year to be sure data is arranged well.

```
SELECT *
FROM city_data
WHERE country = 'Egypt'
ORDER BY city, year;
```

3- Extracting all global data from the **global_data** table and export it to CSV file.

```
SELECT *
FROM global_data
ORDER BY year;
```

✓ Step 2: Manipulating Data in Excel Spreadsheet

1- **Opening CSV Files:** I opened CSV files in MS Excel which is preferred for me to analyze the data.

2- **Adjusting Data:** I noticed the data which belong to Alexandria, Cairo and global are different in their Start and End as in **(Table 1)**, for that I started in 1791 when I compared between Alex. and global data, in 1808 between Cairo and global data and 1808 among Alex, Cairo and global data.

City	Country	Start	End	No. of years
Alexandria	Egypt	1791	2013	222
Cairo	Egypt	1808	2013	205
Global		1750	2015	265

Table 1: The Start and End of Data Available in the Database Lists

3- **<u>Moving Average (MA)</u>:** It is calculated by taking the average of a set of numbers (for example 10 first numbers in the set) and shifting the start and the end by one number until reaching the last number of the data. I used 10 years moving average to smooth out data to make it easier to observe long term trends and not get lost in yearly fluctuations. I found the effect of using the MA in **<u>(Table 2)</u>** such that Correlation Coefficient increased from +0.79 to +0.95 which means that it became closer to +1 (Strong Positive Correlation) as shown in **<u>(figure 1)</u>**, so that we can conclude that the relation is nearly linear so we can *estimate the average temperature in my city (Alexandria) based on the average global temperature*. Also we can observe that before using MA the Standard Deviation (Stdev) has big difference and after using MA the difference became small.

	After the MA		Before the MA	
	Alex_10Y_MA_temp	Global_10Y_MA_temp	Alex_avg_temp	Global_avg_temp
Avg	20.28	8.38	20.32	8.40
Stdev	0.433	0.467	0.605	0.543
Correlation	*0.95*		*0.79*	

Table 2: The Data Analysis Before and After using 10-year MA

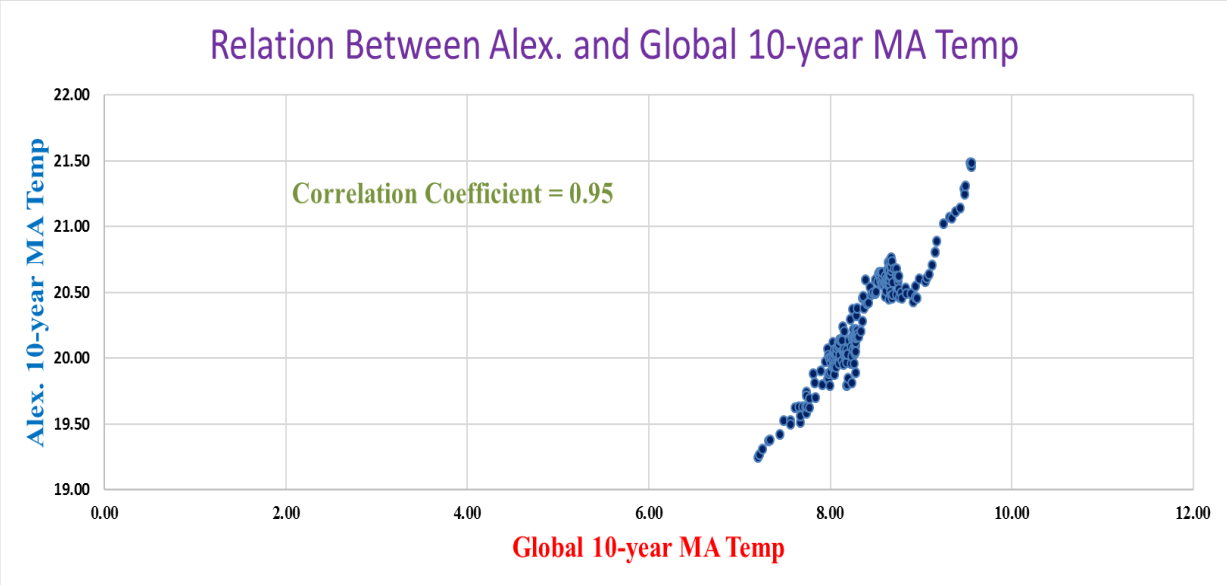

Figure 1: Semi-linear Relation due to the Strong Positive Correlation

✓ Step 3: Data Visualization:

I took two key considerations in visualizing Data

First: To show the Correlation, I used Scatter Plot between Global 10-year MA temp as horizontal axis and Alex.10-year MA temp as vertical axis **(Figure 1)**.

Second: To show the trend of the temperature over time, I used Line Chart in the following figures considering the Time as horizontal axis and the temperature as vertical axis.

1- Line chart shows Alexandria average temperature compared with Global average temperature. We notice more fluctuations appearing in the two lines **(Figure 2)**.

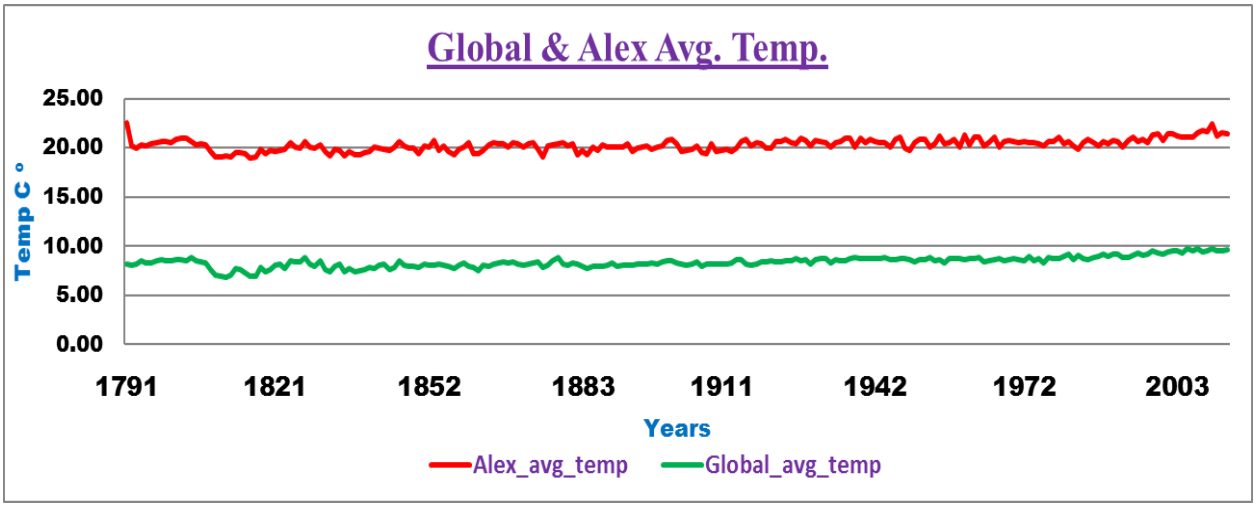

Figure 2: Alexandria average temperature compared with Global average temperature

2- Line chart shows Alexandria 10-year moving average temperature compared with Global 10-year moving average temperature. We can notice that the two lines in **(Figure 3)** became smoother than before in **(Figure 2)**.

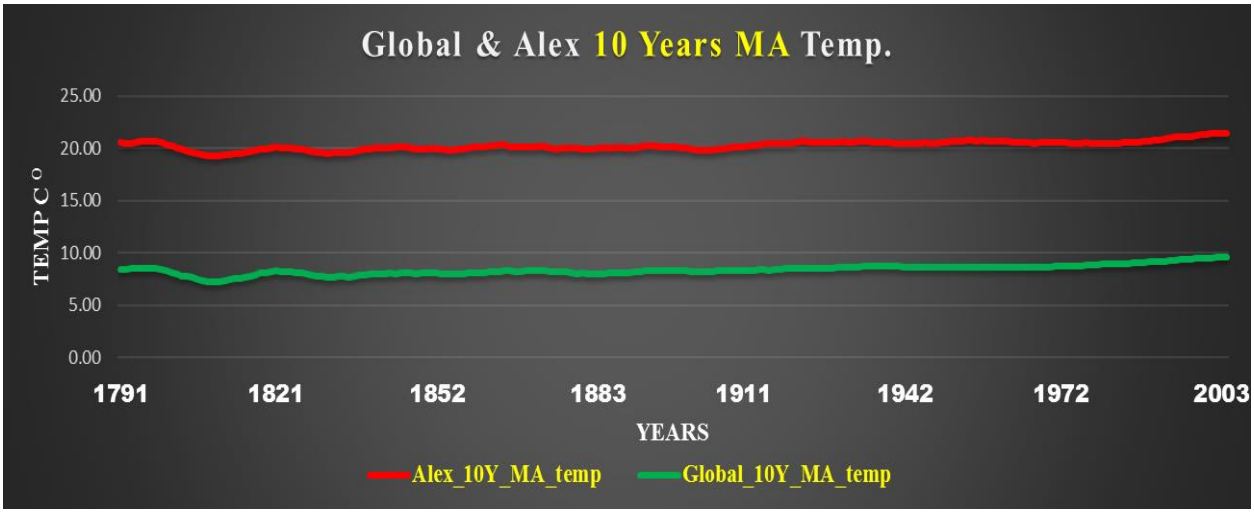

Figure 3: Alexandria 10-year MA temp compared with Global 10-year MA temp

3- Line chart shows Cairo average temperature compared to Global average temperature. We notice more fluctuations appearing in the two lines **(Figure 4)**.

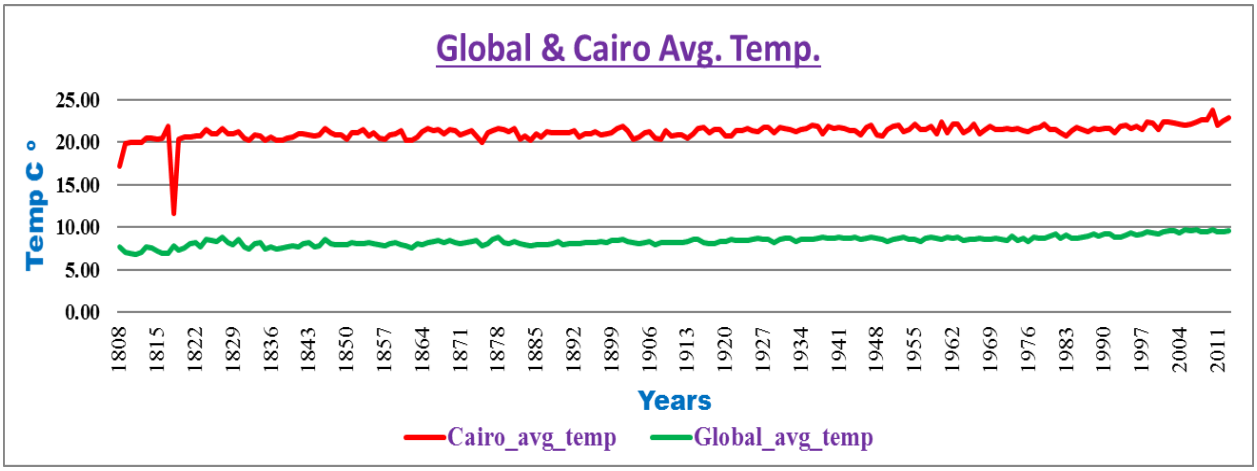

Figure 4: Cairo average temperature compared with Global average temperature

4- Line chart shows Cairo 10-year moving average temperature compared with Global 10-year moving average temperature. We can notice that the two lines in **(Figure 5)** became smoother than before in **(Figure 4)**.

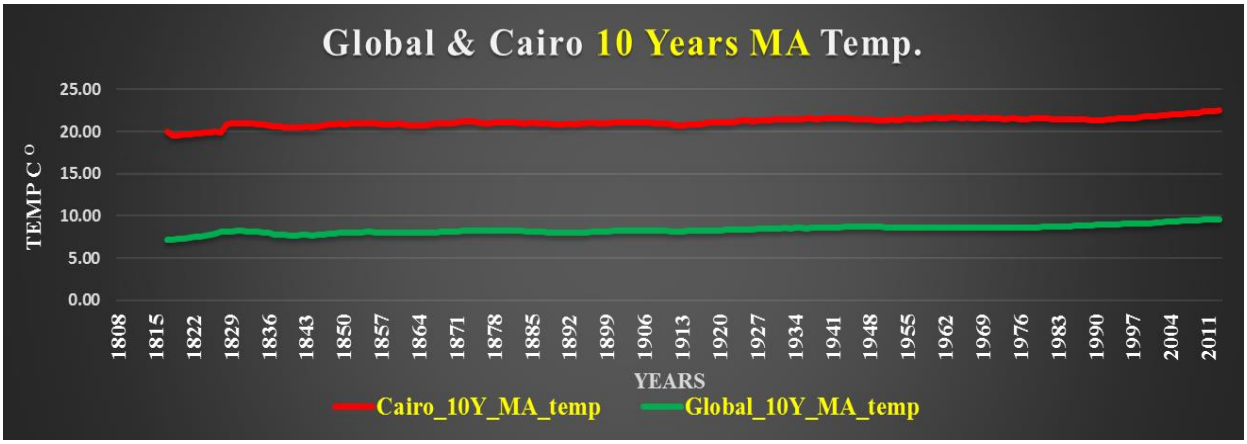

Figure 5: Cairo 10-year MA temp compared with Global 10-year MA temp

5- Line chart shows Cairo & Alex. 10-year moving average temperature compared with Global 10-year moving average temperature **(Figure 6)**.

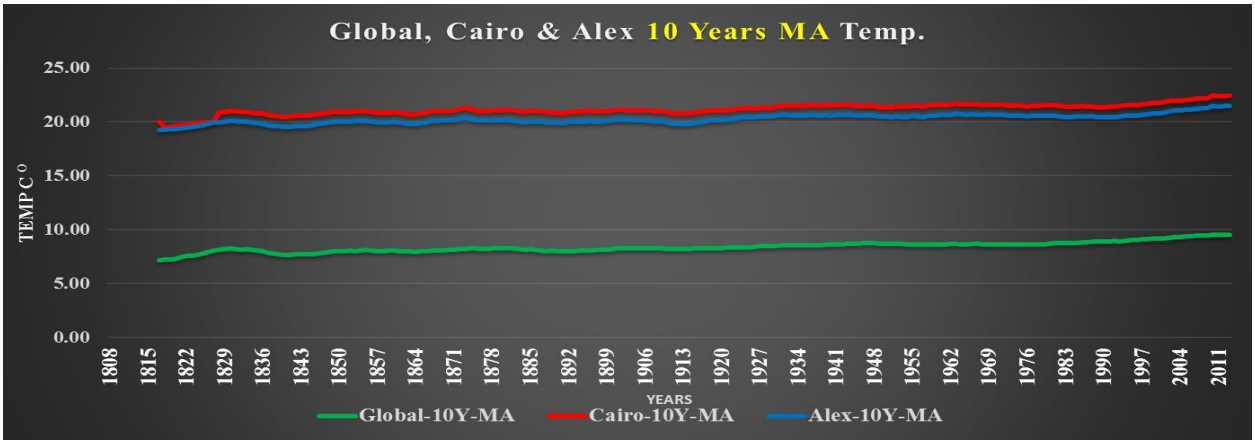

Figure 6: Cairo & Alex. 10-year MA temp compared with Global 10-year MA temp

✓ Step 4: Observations:

When checking data and charts, we find many observations:

1. Alexandria is hotter on average compared to the global average almost two times (Figure 3).

2. The difference between Alex. And global Average temp is almost constant over time except in the first 50 years from 1791 to 1840 (Figure 3), and the trend of temperature getting hotter year by year.

3. Over the past 200 years, we observed that the general trend of average temperature data is increasing constantly year by year until it reached its highest level in 2013 (21.44 C in Alex. and 9.61 in global), making 2014 the largest average temperature, as confirmed by the Japan Meteorological Agency (JMA) [(1)].

4. Cairo, as a favorite city, is hotter than Alexandria on average because it is more crowded (14 million people and 2 million vehicles) and it is far from the Mediterranean Sea compared with Alexandria **(Figure 4)**.

5. As mentioned before in Moving Average part the effect of using it increased the Correlation Coefficient from **+0.79** to **+0.95** which means that it became closer to **+1** (**Strong Positive Correlation**) as shown in **(Figure 1)**, *so that we can conclude that the relation is nearly linear so we can estimate the average temperature in my city (Alexandria) based on the average global temperature.*

[1] https://www.carbonbrief.org/explainer-how-do-scientists-measure-global-temperature. Visited on 28/9/2018