Exploring Weather Trends

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Steps taken to prepare the data

1. First, to get my City's name, I ran the below SQL Query:

   ```
   SELECT city
   FROM city_list
   WHERE country ='Lebanon';
   ```

   ```
   city
   Beirut
   ```

   Noticing that the search condition 'Beirut' on the city_data table does not output the same number of rows found in global_data table.

   Thus the below join query was used to only generate results for rows where year in city_data table matches the year in global_data and city is equal to Beirut in city_data table.

   ```
   SELECT c.year, c.avg_temp as avg_temp_beirut,g.avg_temp as avg_temp_global
   FROM city_data as c, global_data as g
   WHERE city ='Beirut' and c.year = g.year;
   ```

2. The result CSV file opened in Excel. Two records having NULL avg_temp_beirut column values were deleted:

   Figure 1

year	avg_temp_beirut	avg_temp_global
1791	21.57	8.23
1792	18.79	8.09
1793	19.73	8.23
1794	12.42	8.53
1795	21.3	8.35
1796	18.98	8.27
1797	19.23	8.51
1798	19.32	8.67
1799	20.13	8.51
1800		8.48
1801	20.56	8.59
1802	20.29	8.58
1803	23.22	8.5
1804	21.96	8.84
1805	12.97	8.56
1806		8.43

3. Calculating Moving Average with Excel

Used the AVERAGE() function to calculate the 10 years, 50 years moving averages for Global avg_temp and Beirut avg_temp:

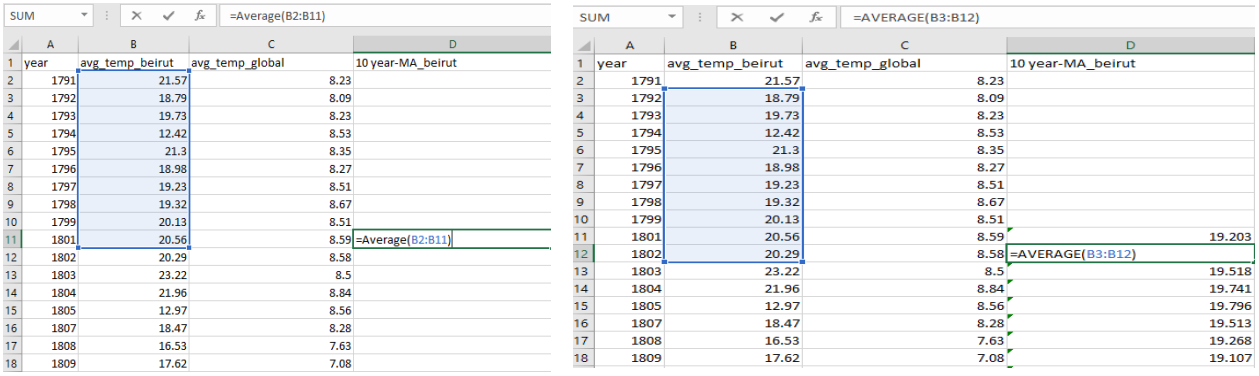

Figure 2-10 Years Moving Average

4. Calculating Pearson's Correlation Coefficient with Excel

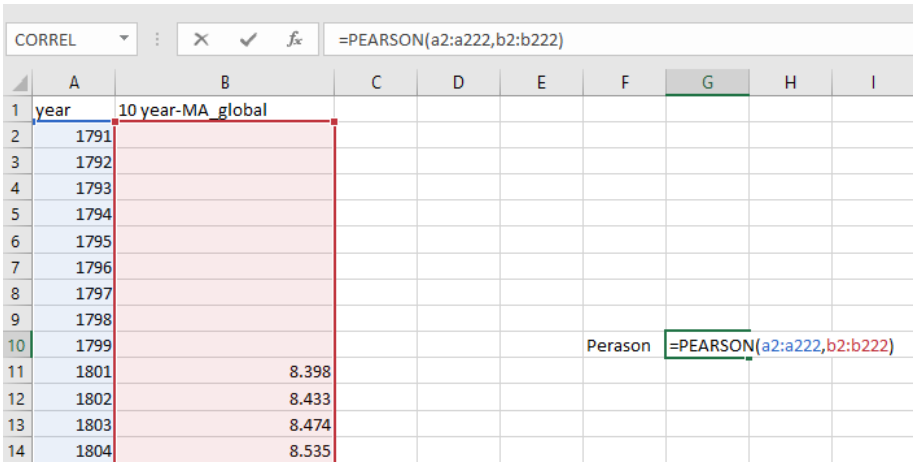

Figure 3

5. Key considerations

The key consideration is to visualize the data in way that allows us to validate or invalidate the relation between the average Global temperature and Beirut average temperature over the years.

Plotting Beirut average temperature and the average Global temperature on the same graph using the same vertical axis did not provide enough details due to the huge difference in average Temperature of around 10°C between both datasets.

Thus, it is better to have two separate vertical axis, with a different scale for each dataset in order to better spot the changes and fluctuations. As well getting a more detailed overall idea about the trend.

Discussion

As can be seen from Figure-4, Beirut on average has been Hotter relative to the average Global temperature; and the difference has been consistent throughout the years.

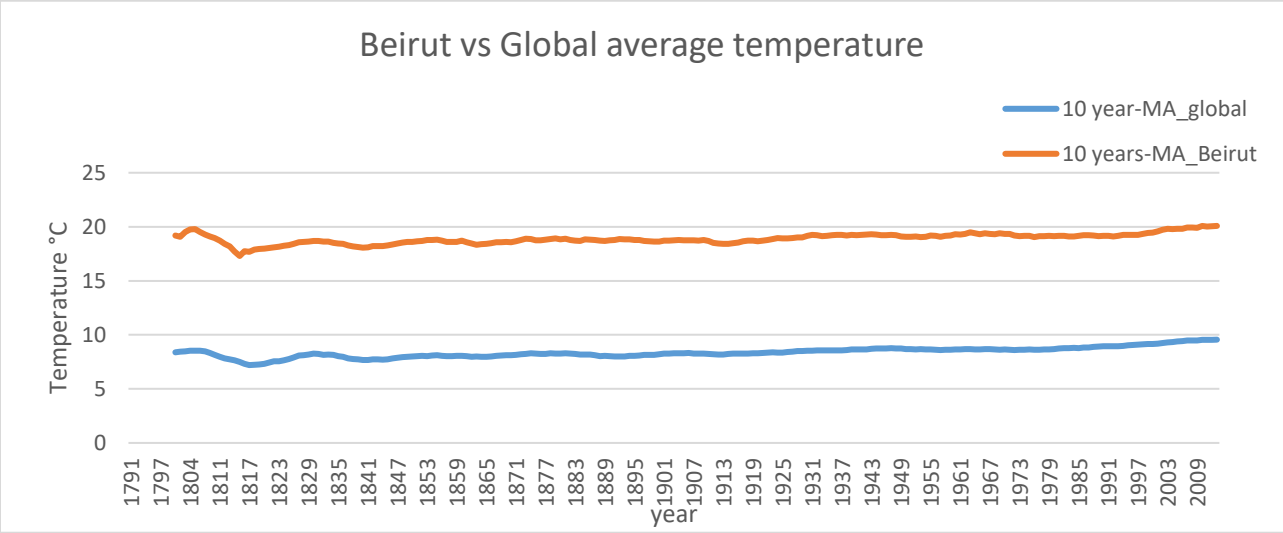

Figure 4- Beirut vs Global Temperature (10 Years moving Average)

Figure-5 shows some periods of Average Temperature fluctuations but later characterized by a more confident upward trend.

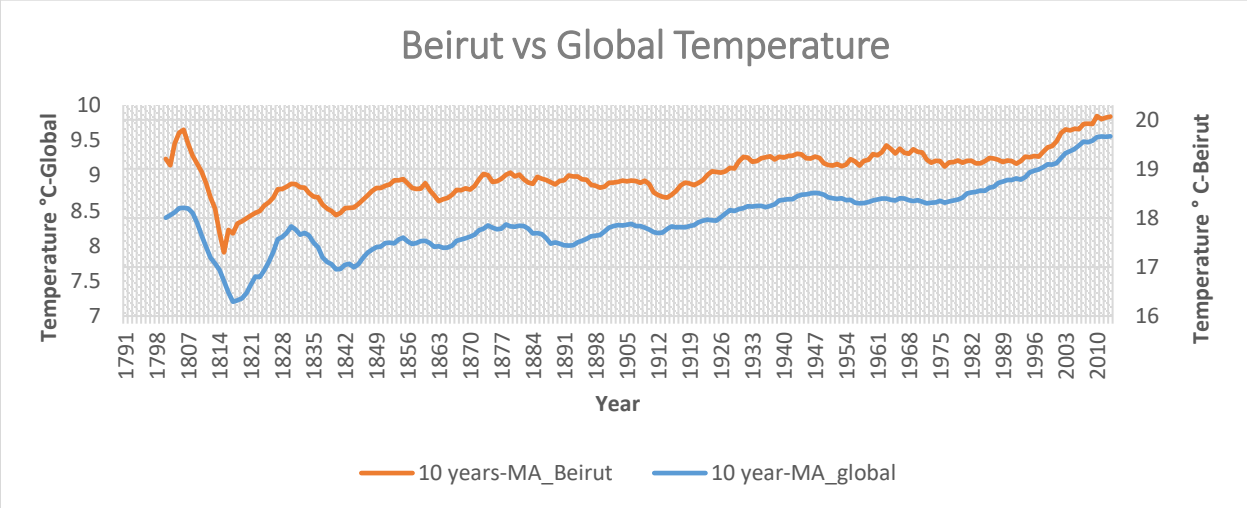

Figure 5- Beirut vs Global Temperature (10-Years MA). This graph shows more details about the trend over the years.

The average temperature in Beirut shows more variability. The fluctuations in average temperature between warm and cold years is much more visible in comparison to the global average temperature fluctuations.

This might be due to the fact that the global average includes average temperatures from different regions of the world like temperatures collected from cities located in the Northern and Southern hemispheres.

From Figure-5, a significant drop in average temperature was observed at the beginning of the 1800's where the average global temperature decreased more than 1°C from 1805 to around 1817 compared to a dip in the average temperature in Beirut to more than 2°C from 1805 to around 1815. Following with a climb in temperature from 1818 to 1830.

This drop might have been the effect of climate anomalies due to a series of Volcano eruptions recorded from 1800 to1815, notably the 1815 Mount Tambora eruption.

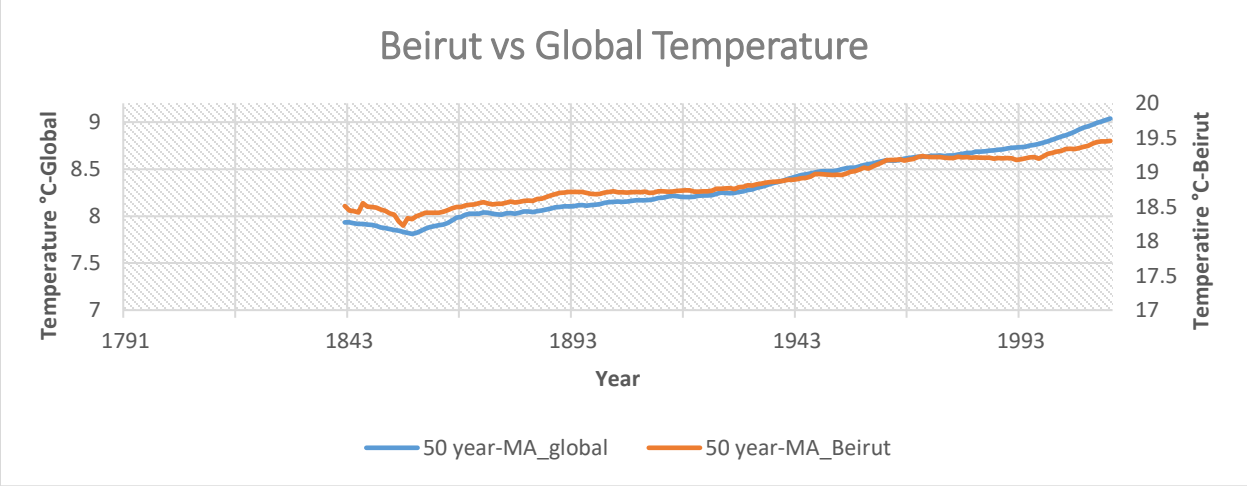

Figure 6- Beirut vs Global Temperature (50-years moving average)

Now referring to Figure-6, we notice a modest Temperature increase between 1870's to 1930's. With the increase becoming more visible from 1930's until 1970's. Right after, the temperature hit a plateau during the late 1970's to a very slight increase towards the beginning of the 1990's but from late 1990's a significant rise in temperature average can be noticed up to 2013, this is more visible with the average Global temperature trend.

It is clear that the World is getting hotter. Moreover, when referring to 50 years moving average graph, which takes out the fluctuations and possible outliers, we could say in overall the upward trend has been consistent over the last few hundred years.

Additionally computing the correlation coefficient table-1, we can confirm that there is a positive strong relationship in the average temperature increase over years.

Temp	Pearson‘s Correlation Coefficient
Global 10 years MA	0.858115
Global 50 years MA	0.987487
Beirut 10 years MA	0.731382
Beirut 50 years MA	0.979375

Table 1-Pearson's Correlation Coefficient

Finally, from the scatter plot below, we can confirm the strong positive relationship between the average Global temperature and the Beirut average temperature. This allows us to estimate the average temperature in Beirut based on the average Global temperature.

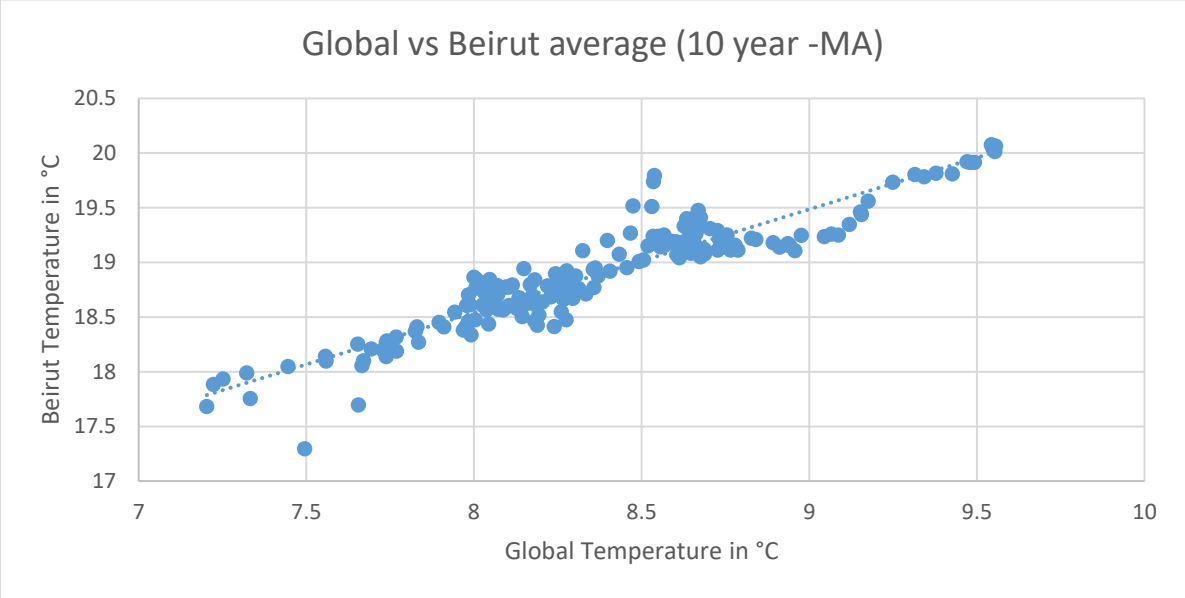

Figure 7- Scatter plot Global vs Beirut average Temperature (Pearson’s correlation coefficient = 0.93206)

References

https://en.wikipedia.org/wiki/List_of_large_volcanic_eruptions_of_the_19th_century

https://en.wikipedia.org/wiki/Volcanic_winter