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Exploring Weather Trends

In this project I compare the temperature trend in Oslo with the global temperature trend throughout the years 1750-2013.

Tool used: SQL, MS EXCEL

1. I extracted the data from the database using these SQL queries:

```
FROM city_data
  INNER JOIN global_data
        ON city_data.year = global_data.year
WHERE city_data.country='Norway'
AND city_data.avg_temp IS NOT NULL
AND global_data.avg_temp IS NOT NULL
```

2. The 10 year moving average over all years is calculated as:

$$\overline{p_n} = \frac{1}{n}\sum_{i=1}^{n} p_i$$

where n = 10.

I chose the 10 year moving average to watch the trend in temperatures over the years 1750-2013. The moving average smooths the local fluctuation in initial dataset.

However I have not used more years for calculation of the moving average, because I did not want to smooth the local temperature trend. However, I did smooth some local extreme values, as it is showed in Table 1. And Table 2.

Variation and standard deviation for the moving average have much lower values, f.e. Oslo variance has dropped from 0.81 to 0.18.

As a matter of fact, with computed 10 years moving average Oslo temperatures smoothed all values greater then 4, and the stand-alone year maxima were simply lost as it is showed in Table 2. The same applies for global temperatures – stand-alone maxima are smoothed.

Oslo [°C]	Year average (initial data)	10 year moving average
Average	2.37	2.37
Median	2.40	2.26
Mode	3.06	2.14
Min	-2.24	1.68
Max	4.55	3.89
Variance	0.81	0.19
Standard deviation	0.90	0.44
Global [°C]		
Average	8.36	8.34
Median	8.37	8.27
Mode	7.98	8.24
Min	5.78	7.20
Max	9.73	9.56
Variance	0.33	0.19
Standard deviation	0.58	0.44

Table 1: Statistics comparison of the original data set consisting of the year average temperature with the calculated 10 year moving average in Oslo and globally as it was calculated in MS EXCEL build-in functions.

Year	Temperuture >4 °C	Moving Average Oslo [°C]
1934	4.23	2.72
1975	4.01	2.70
1989	4.39	2.54
1990	4.55	2.82
2000	4.52	3.28
2005	4.26	3.51
2006	4.43	3.77
2008	4.16	3.89
2011	4.14	3.67

Table 2 shows the local maxima in initial dataset compare to the the 10 years moving average dataset.

Increase in average temperature	Oslo [°C]	Global [°C]
1845-1900	+0.26	+0.39
1900-2013	+1.10	+0.95

Table 3: Increase in initial mean temperature, which was calculated for the period 1750-1845. Initial mean temperature is 2.12°C for Oslo and 8.03°C globally.

Correlation coefficient between the global moving average and the moving average in Oslo has been calculated by CORREL function in MS EXCEL. Ref.: https://support.microsoft.com/en-us/office/correl-function-995dcef7-0c0a-4bed-a3fb-239d7b68ca92#:~:text=The%20CORREL%20function%20returns%20the,the%20use%20of%20air%20conditioners

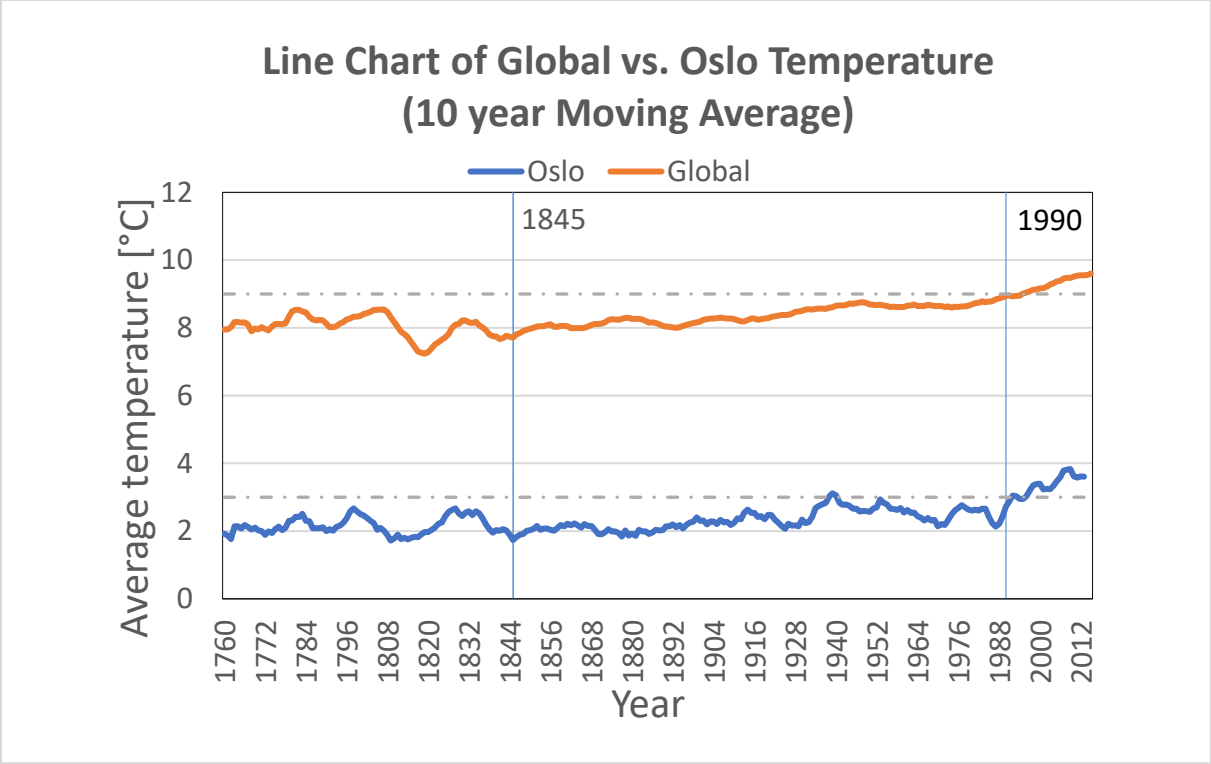

Fig.1: Line chart compares the global moving temperature average (orange) with the moving temperature average in Oslo (blue) over the years 1750-2013. Moving average is calculated in 10 year period.

Observations coming from the Fig.1:

1. Oslo is colder about 6 degrees than global average. Throughout the years 1750-2013 the average temperature for Oslo is 2.4°C and global average temperature is 8.4°C.

2. Global temperatures before 1895 oscillate around 8°C with the local and global minimum 7.2°C in 1819. After 1895 we can see linear increasing of mean temperature,but ca. from 1940-1975 there is a plateau with average temperature 8.6°C. After that plateau the average temperature is uprising linerally again and in 1995 exceeds 9°C . In 2013 the mean global temperature reaches 9.6°C.

3. Oslo dataset is characterized with much bigger variance and standard deviation compare to the global dataset (see Table 1). Up the year 1895 the average temperature oscillates around average 2.1°C towards the higher temperatures, and often exceeds 3°C. After 1895 the temperature average is rising linearly,with local drops around the year 1928, 1970 and 1987. After 1993 the 10 year average exceeds 3°C and uprising trend continues.

4. Both lines of the moving temperature average shows uprising. Correlation coeficient between two datasets is 0.81.

5. Table 3 shows how is the temperature increasing in period 1845-1900 and 1900-2013. Based on the Fig 1 and Table 3 we can approximate that after the year 1990, temperature is linearly increasing 4 times faster in Oslo and 2 time faster globally compare to the period 1845-1900.