

Exploring Weather Trends

Introduction

In this project, local and global temperature data is analyzed to explore and compare the temperature trends.

Data

Data source and export

Local and global temperature data was extracted from a database. Here are the SQL queries that were used in the provided workspace connected to a database:

- First, check the list of cities in order to select the closest biggest city:
`select * from city_list;`
- Obtain temperature data from the closest big city – Bratislava, Slovakia:
`select * from city_data where city='Bratislava';`
- Obtain global temperature data:
`select * from global_data;`

Data was exported to csv:

- bratislava_data.csv
- world_data.csv

Prepare data for visualization

Csv files were imported to Excel with proper formatting and data types, in order to create visualization. To smooth out the lines, moving average over 5 years was used instead of yearly averages. The 5-year moving average was calculated as follows:

- navigate to the fifth value of the yearly average temperature (year 1754)
- insert formula to calculate the average value from the 5 values of the yearly average temperature in a row (that is, create average for years 1750-1754)
- propagate the formula for the rest of the rows

Local data starts a couple of years earlier when compared to global data. However, some of these early local data is missing (years 1746-1749). The early measurements were dropped and not used in the comparison. On the other hand, local data end with the year 2013, while global data with the year 2015. The last two years from the global data were dropped as well. The final year range is therefore 1750-2013.

Except for visualization showing direct comparison between the local and global temperature data, a chart showing the difference between the local and global temperature was used to observe the temperature differences in more detail. This chart was created by subtracting the global 5-year moving average temperature from the local 5-year moving average temperature.

Other considerations in data visualization:

- in the data exploration, visualizations using average temperatures and 3-year moving average was created as well to compare with 5-year moving average visualization, in order to gain additional insights and select the proper visualization (not included in this report)
- all elements in the visualizations were adjusted in order to create clear chart
 - x and y axes – adjusted to minimize white spaces around
 - descriptive chart title and the titles of x and y axes
 - number formats
 - legend to distinguish local from global data
 - colors

Comparison of local and global data

The local and global temperature data is shown in Figure 1. Figure 2 shows the differences between the local and global temperature data over the years.

Bratislava is on average hotter than the world when it comes to whole time range – the differences are between 0°C and 3°C (see Figure 2). The smallest difference is in the years 1941-1944.

Both the local and global average temperature tend to increase over time. The local average temperature was most of the time below 10°C before 1990, and the global average temperature was below 9°C in the same period. In the contrast, the local temperature didn't drop below 10°C in the last 20 years and even exceeded 11°C during the last 5 years. Similarly, the global temperature exceeded the limit of 9°C over the last 20 years.

The local average temperature trend is not an exact copy of the world temperature trend. For example, when the world temperature was decreasing at the beginning of the 19th century, Bratislava's temperature first increased and only then decreased. Similar observation can be made for the beginning of 1830s and 1880s. On the other hand, when the world's temperature was approximately at the same value during 1940s, Bratislava experienced a rather big drop in the temperature and then a steep increase.

Local temperature trend shows more significant rises and drops starting from the beginning of the 20th century when compared to the global trend. In Bratislava, warmer years alternate with cold years, or even extremely cold years; the most apparent is the above mentioned first half of 1940s. On the other hand, the world temperature differences are much less significant in this period. However, there are big differences in the first half of the 19th century, which is mirrored by the bumpy line in the graph.

The coldest and warmest years in Bratislava and world. The lowest average temperature in Bratislava occurred in 1750s. The other more significant temperature falls happened in about 1771, 1785-1790, 1816, 1840, 1891, 1941-1944, 1956-1958, 1966 etc. (the minima on the line are considered). On the other hand, the warmest periods are the end of the 18th century, 1820s, 1938, period between 1948-1954, and the last 20 years – here are the average temperatures above 10.3°C.

Does any extremely cold or warm year in the world fall into the mentioned time periods? Based on the observation of the world trend, the years around 1771, 1785-1790, 1816, 1840 could be considered as the extremely cold years when comparing the years before/after. As discussed above, the world temperature trend is more smooth beginning from 1850. Therefore, the cold years after 1850 are not

considered as extremely cold. The hottest world years are 1757, 1781, beginning of the 19th century – again, due to smooth line since 1850 it is more difficult to distinguish extremely warm years. To sum up, while the coldest periods for Bratislava and world before 1850 happened in similar time periods, there are some differences when it comes to the warmest years. For example, the warm period in Bratislava occurred at the end of the 18th century, while in the world at the beginning of the 19th century.

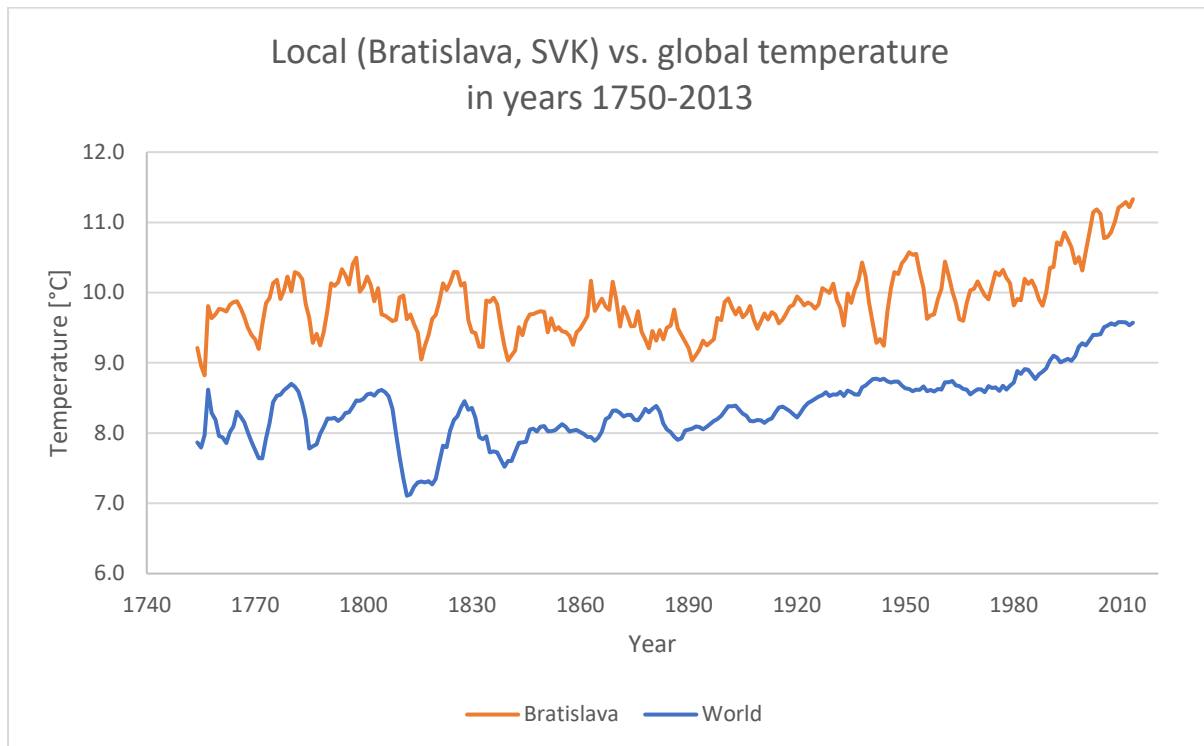


Figure 1 Comparison of local (Bratislava, SVK) to global temperature data in years 1750-2013. 5-year moving average.

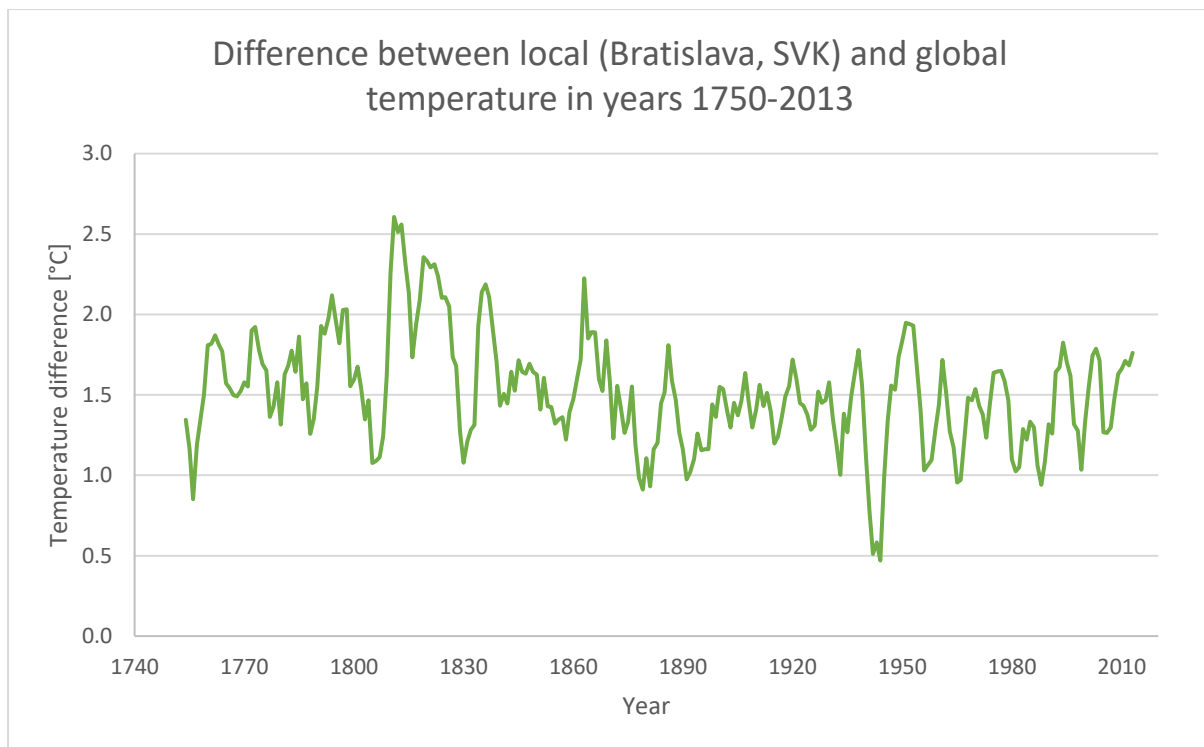


Figure 2 Difference of temperatures in Bratislava, SVK and world in years 1750-2013. 5-year moving average.