Exploring Global and New York Weather Trends

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2018-05-10

Tools:

SQL: extract data.
Excel: calculate moving averages and make tables.
Origin: plot line chart.

Procedures:

1. Extract data from the data base using SQL.
2. Calculate moving average in Excel.
3. Plot data using Origin and make observations.
4. Present my observations with suitable visualizations.

Extracting Data:

1. Pick the nearest city. First I exported the cities in United States, and from there I found that the nearest city in the list is New York.

```
SELECT *
FROM city_list
WHERE country='United States'
```

2. Export New York data and global data to Excel.

```
SELECT *
FROM city_data
WHERE city='New York' AND country='United States'
```

```
SELECT *
FROM global_data
```

Moving average:

In the Excel sheets, I calculated 5-year averages for both New York and global temperatures. For example, the moving-average over 5-year period for year 1975 is the average from year 1971-1975.

I found 5-year moving average yields meaningful information. Average over a shorter period still had too much details and obscured the long-term trend. Average over a longer period smoothed out important details and wiped out the periodicity.

Choice of visualization:

I am more comfortable plotting data in Origin. So I transfer the original and averaged data to Origin and plotted all the following figures.

When considering what visualization methods to use, I think line charts and tables combined can present a more complete picture of my observations. Line charts can directly present the big picture, the trend, and the difference. Tables can list out the most important keys. Tables can also point out differences and changes that are not directly readable from line charts.

Key findings:

Summary:

Similarities	Differences	Visualizations
Smaller fluctuations after 1850, in both data sets	New York temperature fluctuates more than global	Figure 1 and Table 1
Temperatures keep increasing after year 1850	New York is hotter than global	Figure 2, *right*, and Table 2
Accelerated increase after year 1975	Speed of temperature increase is faster in New York than global	Figure 2, *right*, and Table 3
temperatures fluctuates periodically, with a period of around 10 years	Periodicity is more pronounced in New York data	Figure 2, *right*

Visualizations:

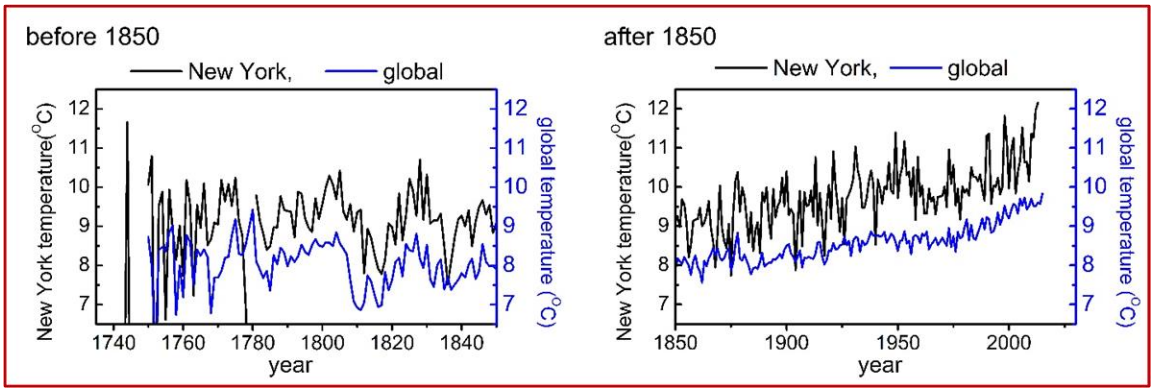

Figure 1 Comparison of temperature fluctuations before and after year 1850. Both global and New York temperatures fluctuate in a bigger range before year 1850, than they fluctuate in the years after 1850. Before 1850, the fluctuation of New York and global temperatures are ± 1.5^{O}C. After 1850, New York temperature fluctuation is ± 1.0^{O}C, and global temperature fluctuation is ±0.5^{O}C. In the years after 1850, it is also apparent that New York temperature fluctuate more than global temperature.

	before 1850	after 1850
New York (^{O}C)	± 1.5	± 1.0
global (^{O}C)	± 1.5	± 0.5

Table 1 Temperature fluctuation of New York and global average before and after 1850. Before 1850, both New York and global temperatures fluctuate in the range ± 1.5^{O}C. After 1850, New York temperature fluctuate in the range of ± 1.0^{O}C, larger than the global temperature fluctuation range of ± 0.5^{O}C.

	1850	2013	difference
New York (^{O}C)	9.0	11.2	+2.2
global (^{O}C)	8.0	9.6	+1.6

Table 2 Temperatures at year 1850 and 2013, and their differences. Both global and New York temperatures gradually increased after year 1850. New York is hotter than global almost all the time. This is interesting because I think New York is very cold.

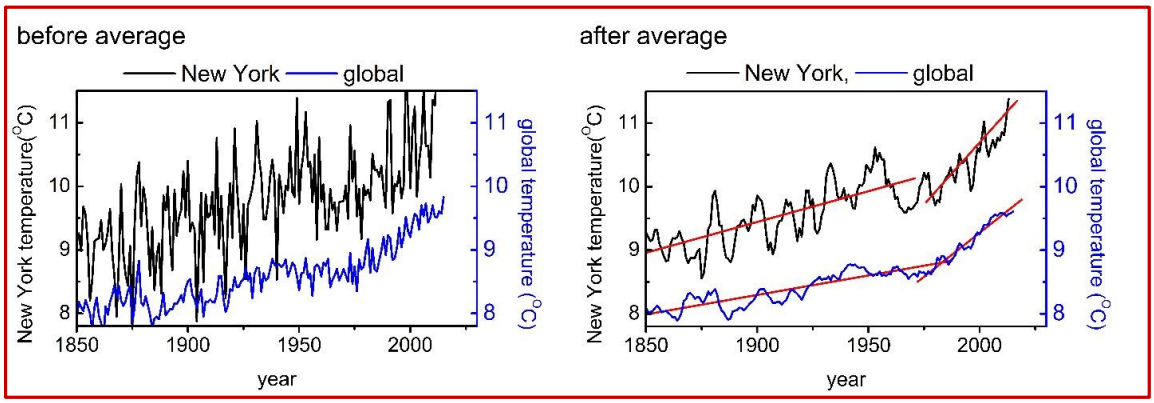

Figure 2 Temperature increase is accelerated after 1975. This acceleration is not readily visible before moving average, but become apparent after 5-year moving average. (Red straight lines are linear fitting of the data in the region). You can also clearly see the periodicity of fluctuation after moving average, especially in New York data. The periodicity is less pronounced but apparent in global data.

	1850 to 1975	1975 to 2013	fold of acceleration
New York (^{O}C/year)	0.01	0.039	4
global (^{O}C/year)	0.006	0.027	4.5

Table 3 Speeds of temperature increase and acceleration. The speed is always faster in New York than global. Both speeds are accelerated in New York and global after year 1975.