

Exploring Global and Local Weather Trends

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Purpose

In this project, I analyzed and compared temperature data for the globe and Philadelphia to compare where I live to overall global temperature trends. To complete this analysis, I extracted global and local annual temperatures using SQL for comparison in Google Sheets to determine common and contrasting trends in temperature. This analysis was conducted as part of my completion of Udacity's Data Analyst Nanodegree. Global and local temperature data was provided by Udacity.

Methodology

To make the comparison, I first used a SQL query to extract annual temperature data for the globe and Philadelphia. To extract this data, I used the following query:

```
WITH
p_data AS (
  SELECT year, avg_temp AS phl_temp
  FROM city_data
  WHERE city = 'Philadelphia'),

g_data AS (
  SELECT year, avg_temp AS gd_temp
  FROM global_data)

SELECT g_data.year, p_data.phl_temp, g_data.gd_temp,
ROUND(AVG(g_data.gd_temp) OVER (ORDER BY g_data.year ASC ROWS 4
PRECEDING),2) AS g_MA5,
ROUND(AVG(p_data.phl_temp) OVER (ORDER BY g_data.year ASC ROWS 4
PRECEDING),2) AS p_MA5
FROM p_data
JOIN g_data
ON g_data.year = p_data.year
WHERE g_data.year > 1899
ORDER BY g_data.year;
```

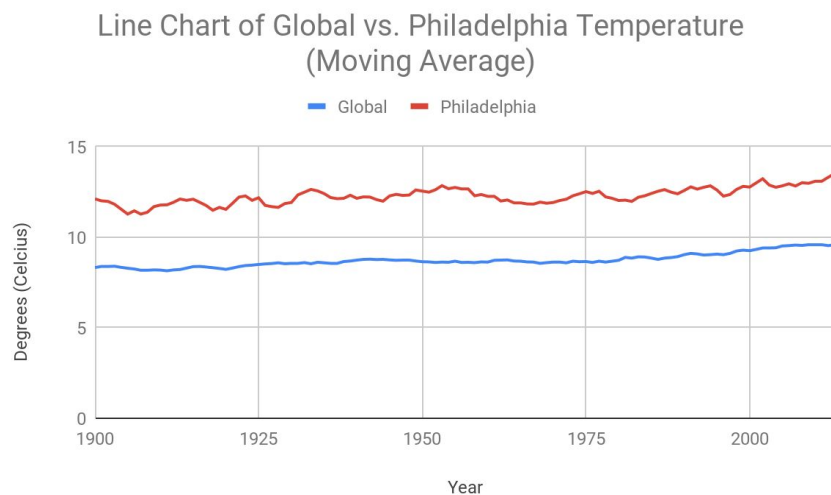
This query creates common table expressions for global and Philadelphia annual temperature data to join into one table. The query also uses a window function to calculate the 5-year

moving average for global and Philadelphia data. The moving average for each year is calculated to take the average temperature of that year and the preceding four years. I then exported the table output to a CSV, and uploaded the data to Google Drive for analysis using Google Sheets. I then plotted the results on a line chart.

This query also filters the data for temperatures from 1990 onwards. In a previous attempt to query and plot data to compare global and Philadelphia temperatures, I noticed that a line plot comparing the change in annual temperature was generally more variable for years before 1990. The variability in earlier temperatures may be due to changes in measurement technique over time, and therefore may not be reliably compared to later temperature data. So I decided to instead only plot data since 1990 as this seemed to be the year after which change in temperature data was less variable.

Findings

The final visualization compares the 5-year moving average between global and local Philadelphia temperature since 1990¹, and is depicted below:



Summary Statistics of Global and Philadelphia Temperatures 5-Year Moving Average

Statistic	Global	Philadelphia
Mean	8.740	12.288
Variance	0.136	0.200
Minimum	8.140	11.480
Maximum	9.580	13.500

¹ The 5-year moving averages were calculated from 1990 to 2013. 2013 was the last year in which global and Philadelphia temperatures were available for both geographies.

Observations

Since 1990, annual temperatures in Philadelphia have been higher than that of the globe.

Whereas global temperatures since 1990 have been below 10 degrees celsius, in Philadelphia, the annual temperature has always been above 10 degrees. Since 1990, the 5-year moving average for global temperatures has ranged from a minimum of 8.14 degrees celsius to a maximum of 9.58 degrees. Whereas for Philadelphia, temperatures have ranged from 11.48 to 13.50 degrees celsius.

Since 1990, both Global and Local Philadelphia temperatures have increased over time.

Since 1990, both global and Philadelphia temperatures have trended upwards over time. In 1990, the 5-year moving average of global and Philadelphia temperatures were 8.32 and 12.11 degrees respectively. In 2013, the 5-year moving average increased for the globe and Philadelphia temperatures to 9.57 and 13.50 degrees respectively.

Since 1990, the increase in temperature in Philadelphia has been more variable than global temperatures. A visual analysis of the above line chart shows generally more variability in annual temperatures overtime for Philadelphia than the globe. A calculation of the variance of global and Philadelphia moving average of annual temperature confirms this observation: the calculated variance for global data was 0.136, and the calculated variance for Philadelphia was 0.200.

We cannot tell from the data why this is so, but it may be due to the global temperature trend being smoothed by greater variability of climatic factors across diverse geographies (i.e. Philadelphia is a small geography in only one regional climate, whereas global average temperatures smooth out the variability of annual temperature trends among many different regional climates across the globe.)

In the most recent years, the rate of increase in Philadelphia temperatures has increased, whereas the rate of increase across the globe has decreased. In the last few years of the charted moving average data, you can see a sharper increase in Philadelphia's red line of the 5-year moving average than that of the more gradual increase in the globe's 5-year moving average blue line. Most recently, both annual temperatures have increased, but the increase has been higher in Philadelphia.