Project: Exploring Weather Trends

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1. What tools did you use for each step? (Python, SQL, Excel, etc)

a. I used two SQL queries to extract my data from the database:

i. Global Data:

```
SELECT *
FROM global_data
```

ii. Local Data: (for San Jose, CA)

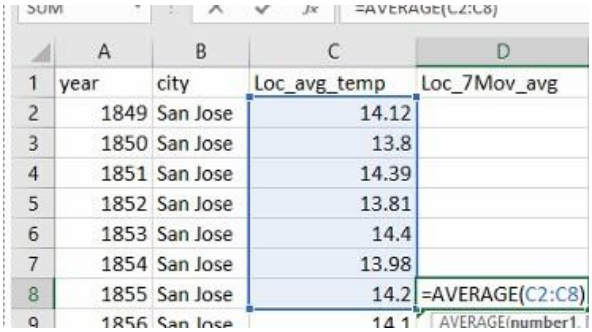
```
SELECT year, city, avg_temp
FROM city_data
WHERE city = 'San Jose'
```

b. I exported the data to CSV files using Download CSV the link

c. I used MS Excel to convert the CSV file to XSLX file, calculate the moving average and create the charts.

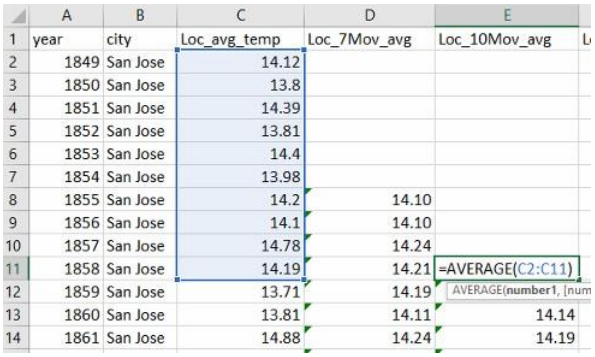
2. How did you calculate the moving average?

I tried 7, 10, 20-year moving averages to see which average is better to smooth out data. To calculate the moving average in MS Excel, I used the AVERAGE function (the same approach as in the lesson) as shown below:



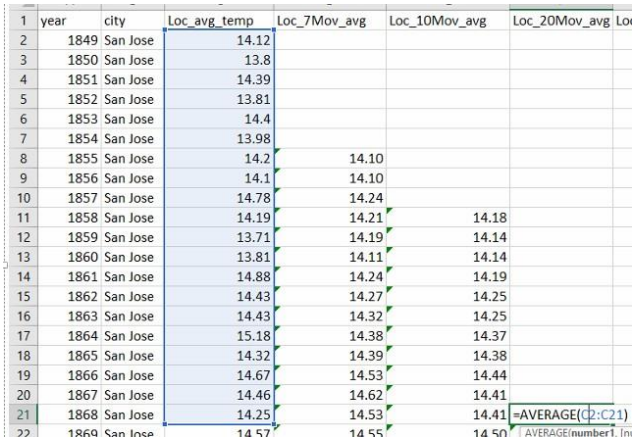
	A	B	C	D
1	year	city	Loc_avg_temp	Loc_7Mov_avg
2	1849	San Jose	14.12	
3	1850	San Jose	13.8	
4	1851	San Jose	14.39	
5	1852	San Jose	13.81	
6	1853	San Jose	14.4	
7	1854	San Jose	13.98	
8	1855	San Jose	14.2	=AVERAGE(C2:C8)
9	1856	San Jose	14.1	AVERAGE(number1, [

Figure 1: 7-year Moving Average



	A	B	C	D	E
1	year	city	Loc_avg_temp	Loc_7Mov_avg	Loc_10Mov_avg
2	1849	San Jose	14.12		
3	1850	San Jose	13.8		
4	1851	San Jose	14.39		
5	1852	San Jose	13.81		
6	1853	San Jose	14.4		
7	1854	San Jose	13.98		
8	1855	San Jose	14.2	14.10	
9	1856	San Jose	14.1	14.10	
10	1857	San Jose	14.78	14.24	
11	1858	San Jose	14.19	14.21	=AVERAGE(C2:C11)
12	1859	San Jose	13.71	14.19	AVERAGE(number1, [num
13	1860	San Jose	13.81	14.11	14.14
14	1861	San Jose	14.88	14.24	14.19

Figure 2: 10-year Moving Average



	year	city	Loc_avg_temp	Loc_7Mov_avg	Loc_10Mov_avg	Loc_20Mov_avg
2	1849	San Jose	14.12			
3	1850	San Jose	13.8			
4	1851	San Jose	14.39			
5	1852	San Jose	13.81			
6	1853	San Jose	14.4			
7	1854	San Jose	13.98			
8	1855	San Jose	14.2	14.10		
9	1856	San Jose	14.1	14.10		
10	1857	San Jose	14.78	14.24		
11	1858	San Jose	14.19	14.21	14.18	
12	1859	San Jose	13.71	14.19	14.14	
13	1860	San Jose	13.81	14.11	14.14	
14	1861	San Jose	14.88	14.24	14.19	
15	1862	San Jose	14.43	14.27	14.25	
16	1863	San Jose	14.43	14.32	14.25	
17	1864	San Jose	15.18	14.38	14.37	
18	1865	San Jose	14.32	14.39	14.38	
19	1866	San Jose	14.67	14.53	14.44	
20	1867	San Jose	14.46	14.62	14.41	
21	1868	San Jose	14.25	14.53	14.41	=AVERAGE(C2:C21)
22	1869	San Jose	14.57	14.55	14.50	AVERAGE(number1, [n

Figure 3: 20-year Moving Average

3. What were your key considerations when deciding how to visualize the trends?

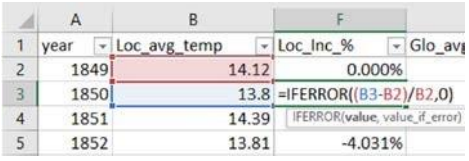
The key consideration was to determine the timeframe for data visualization; Looking at the local temperature data for San Jose, the data covers the period between **1849** to **2013**, where in the global temperature data covers the period between **1750** and **2015**. Therefore, the analysis was performed for the range between **1849 to 2013**. To make sure local and global temperature data is mapped correctly, I used VLOOKUP to retrieve the global temperature data worksheet into the local data worksheet.

Another consideration was to adjust the starting point for each chart as follows:

- 7-year moving average starting point: 1855 (1849 + 7) See figure 6
- 10-year moving average starting point: 1858 (1849 + 10) See figure 5
- 20-year moving average starting point: 1868 (1849 + 20) See figure 4

To help assess the data variance and frequency of change between global and local temperature levels, I calculated the following:

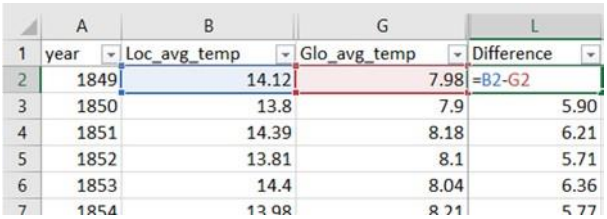
- The Global & Local annual change percentage:



	A	B	F	
1	year	Loc_avg_temp	Loc_Inc_%	Glo_avg
2	1849	14.12	0.000%	
3	1850	13.8	=IFERROR((B3-B2)/B2,0)	
4	1851	14.39	IFERROR(value, value_if_error)	
5	1852	13.81	-4.031%	

G	K	L
Glo_avg_temp	Glo_Inc_%	Differenc
7.98	0.000%	
7.9	=IFERROR((G3-G2)/G2,0)	
8.18	IFERROR(value, value_if_error)	

- The Local/Global temp. average difference:



	A	B	G	L
1	year	Loc_avg_temp	Glo_avg_temp	Difference
2	1849	14.12	7.98	=B2-G2
3	1850	13.8	7.9	5.90
4	1851	14.39	8.18	6.21
5	1852	13.81	8.1	5.71
6	1853	14.4	8.04	6.36
7	1854	13.98	8.21	5.77

Also, I used Pivot table to calculate the Max, Min, Average, Standard Deviation, High/Low (%) change as follows:

3	Average of Loc_avg_temp	Average of Glo_avg_temp
4	14.45	8.55
5		
6	Min of Loc_avg_temp	Min of Glo_avg_temp
7	13.22	7.56
8		
9	Max of Loc_avg_temp	Max of Glo_avg_temp
10	16.23	9.73
11		
12	StdDev of Loc_avg_temp	StdDev of Glo_avg_temp
13	0.505	0.460

15	Average of Loc_Inc_prcnt	Average of Glo_Inc_prcnt
16	0.152%	0.146%
17		
18	Max of Loc_Inc_prcnt	Max of Glo_Inc_prcnt
19	9.907%	7.275%
20		
21	Min of Loc_Inc_prcnt	Min of Glo_Inc_prcnt
22	-8.698%	-7.475%
23		
24	Max of Difference	Min of Difference2
25	7.20	4.86

All the calculations above were summarized in table 1 and table 2 below

Observations:

- The San Jose is hotter than the global temperature (please refer to Min, Max and Avg. columns in the table below)
- The local (San Jose) and global temperature levels are both increasing.
- The global moving average experiences less fluctuations than the local moving average in San Jose.
- The global temperature levels have a smaller variance than the local temperature changes.
- To determine the slope, we used the Linear TREND function for the local and global temperature data, we got the following the following equations:
    - Local temperature: $y = 0.0049x + 14.041$
    - Global temperature: $y = 0.0033x + 7.8644$

  By comparing the two slopes ($slope\ 1 = 0.0049$) & ($slope\ 2 = 0.0033$), we note the local trend is increasing more rapidly than the global trend.

- The highest difference between local and global temperature is 7.20 ^{c}. This was recorded in year 1864; where the lowest difference between local and global temperature is 4.84 ^{c}. this was recorded in year 1998 (see figure 7)

	Min	Max	Avg.	SD	highest Inc. (%)	Lowest Dec. (%)	Avg. Change
San Jose	13.22 ^{c}	16.23 ^{c}	14.5 ^{c}	0.505	9.907 %	- 8.698 %	0.152 %
Global	7.56 ^{c}	9.73 ^{c}	8.55 ^{c}	0.460	7.275%	- 7.475 %	0.146 %

Table 1: Global Vs. Local (Summary 1)

Highest Difference	Lowest Difference
7.20 ^{c}	4.86 ^{c}

Table 2: Highest & Lowest Average Difference

Key considerations when deciding how to visualize the trends
Wanted to time align the data for all the 3 categories (Global , Delhi, Hyderabad)
As 12 year moving average is taken for all the 3 categories, hence a line / trend chart is populated
w.r.t Year and Avg temperature

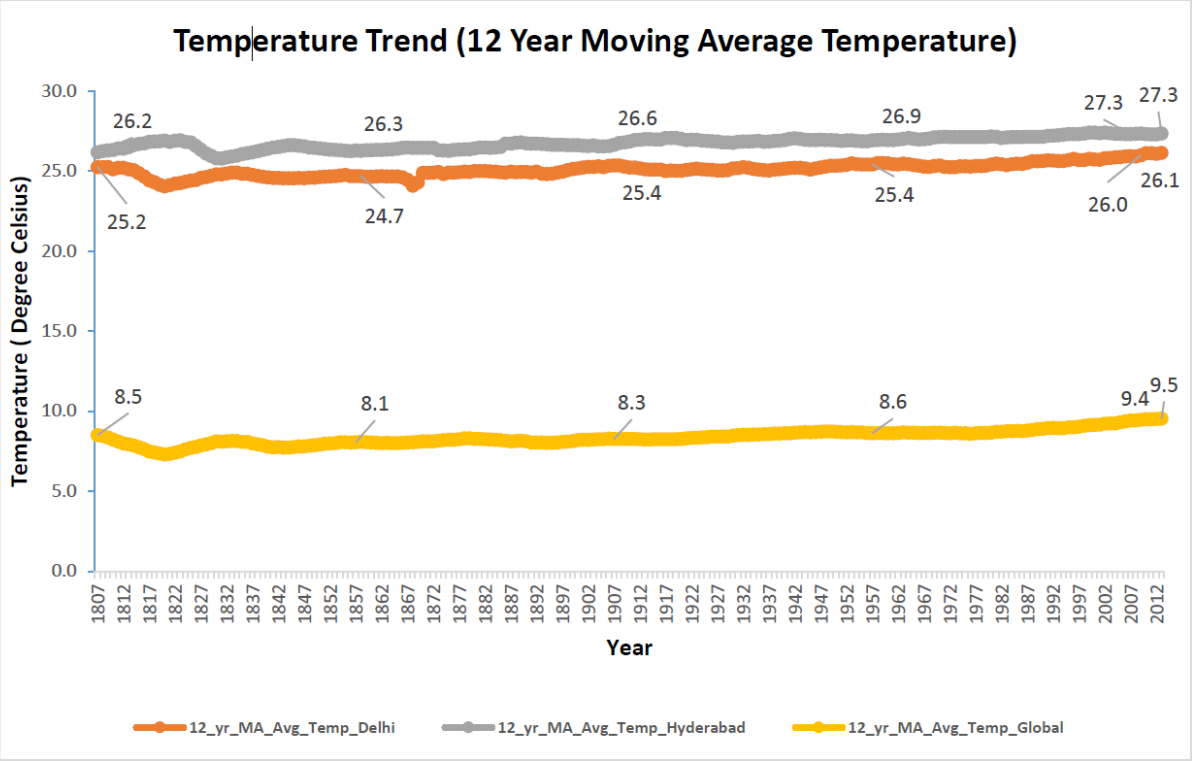


Figure 4: Graph

At least four observations about the similarities and/or differences in the trends

a) Global temperatures are very less compared to Hyderabad and Delhi
b) The temperatures for all the 3 categories have increased marginally in the last 200 years of data
c) The lowest temperatures found for Global (7.3 deg C) around 1820, whereas for Hyderabad (25.8 deg around 1830. and for Delhi (26 deg C) around 1820
d) Hyderabad temperature increment is more at present compared to Global and Delhi
e) Exactly 50 years from the year 1807, we observe that Global and Delhi have their temperatures dipped
but for Hyderabad it is consistent.
f) The global temperature remained consistent until the year 1957, but after 1957 increased.
there seems to be a lot of change in temperatures. Hence global temperatures are
g) At every 50 years interval, the temperatures are shown in chart ,
Hence we can observe that temperatures have changed by +/ -0.3
h) The correlation coefficient for (Global vs Delhi -> 0.937) and (Global vs Hyderabad -> 0.687)
So from above, the changes in Global temperature will have huge impact to Delhi when compared to Hyderabad
i) The difference in 12 year MA temperatures for Global (0.89) , Hyderabad(1.16), Delhi (1.04) (comparison done w.r.t 1807 vs 2013)