

## Exploring Weather Trends

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**Step 1:** SQL Queries for querying city\_list, examination of cities and identification of closest city (Pune) and downloading temperature data for Pune. Querying global\_data for downloading temperature data for the world.

```
SELECT *  
  
FROM city_list cl  
  
WHERE cl.country = 'India'  
  
ORDER BY cl.city ASC;
```

```
SELECT  
  
year,  
  
avg_temp  
  
FROM city_data cd  
  
WHERE cd.city = 'Pune';
```

```
SELECT *  
  
FROM global_data
```

**Step 2:** MATLAB code for generation of plots for city and global moving averages across time. Handling of missing data also done. 5 year moving averages were calculated for the data using for loops. Missing data was detected whenever present and accounted for by calculating moving average across timeframes where data was available. This has an inherent limitation when data is not available for more than 5 consecutive years. However, such a case was observed only once throughout the data set and hence can be tolerated in this case.

The script:

```
% Import the csv files to two matrices  
city_data = readtable('C:/Users/sangh/Downloads/city_data.csv');  
global_data = readtable('C:/Users/sangh/Downloads/global_data.csv');
```

```
city_data = table2array(city_data);  
global_data = table2array(global_data);
```

```
% Compute moving averages across time for both the tables  
dim_city_data = size(city_data);  
dim_global_data = size(global_data);  
ma_city_data = zeros(dim_city_data(1),1);  
ma_global_data = zeros(dim_global_data(1),1);
```

```

for ind = 5:1:dim_city_data(1)
    temp_arr = city_data(ind-4:ind,2);
    num_el = sum(ones(size(temp_arr))-isnan(temp_arr));
    temp_arr(isnan(temp_arr)) = 0;
    ma_city_data(ind,1) = sum(temp_arr);
    ma_city_data(ind,1) = ma_city_data(ind,1)/num_el;
end

for ind = 5:1:dim_global_data(1)
    temp_arr = global_data(ind-4:ind,2);
    num_el = sum(ones(size(temp_arr))-isnan(temp_arr));
    temp_arr(isnan(temp_arr)) = 0;
    ma_global_data(ind,1) = sum(temp_arr);
    ma_global_data(ind,1) = ma_global_data(ind,1)/sum(ones(size(global_data(ind-4:ind,2)))-
isnan(global_data(ind-4:ind,2)));
end

ma_city_data(1:4,1) = [NaN NaN NaN NaN];
ma_global_data(1:4,1) = [NaN NaN NaN NaN];

city_data = [city_data ma_city_data];
global_data = [global_data ma_global_data];

```

```

% Convert arrays to table
city_data = array2table(city_data,'VariableNames',{'Year','City Temperature','City Moving Average 5
years'});
global_data = array2table(global_data,'VariableNames',{'Year','Global Temperature','Global Moving
Average 5 years'});

```

```

% Plot the data
plot(city_data{:,1},city_data{:,3},'r');
title("Pune vs Global (5 years) Moving Average Temperatures: 1750 - 2015");
ylabel("Temperature moving average across 5 years (degrees Celsius)");
xlabel('Year');
xlim([1750 2015])
xticks(1750:10:2015);
xtickangle(90);
yticks([7:1:26]);
grid on
hold on
plot(global_data{:,1},global_data{:,3},'b');
legend('Pune City Data','Global Data','Location','best')
hold off

```

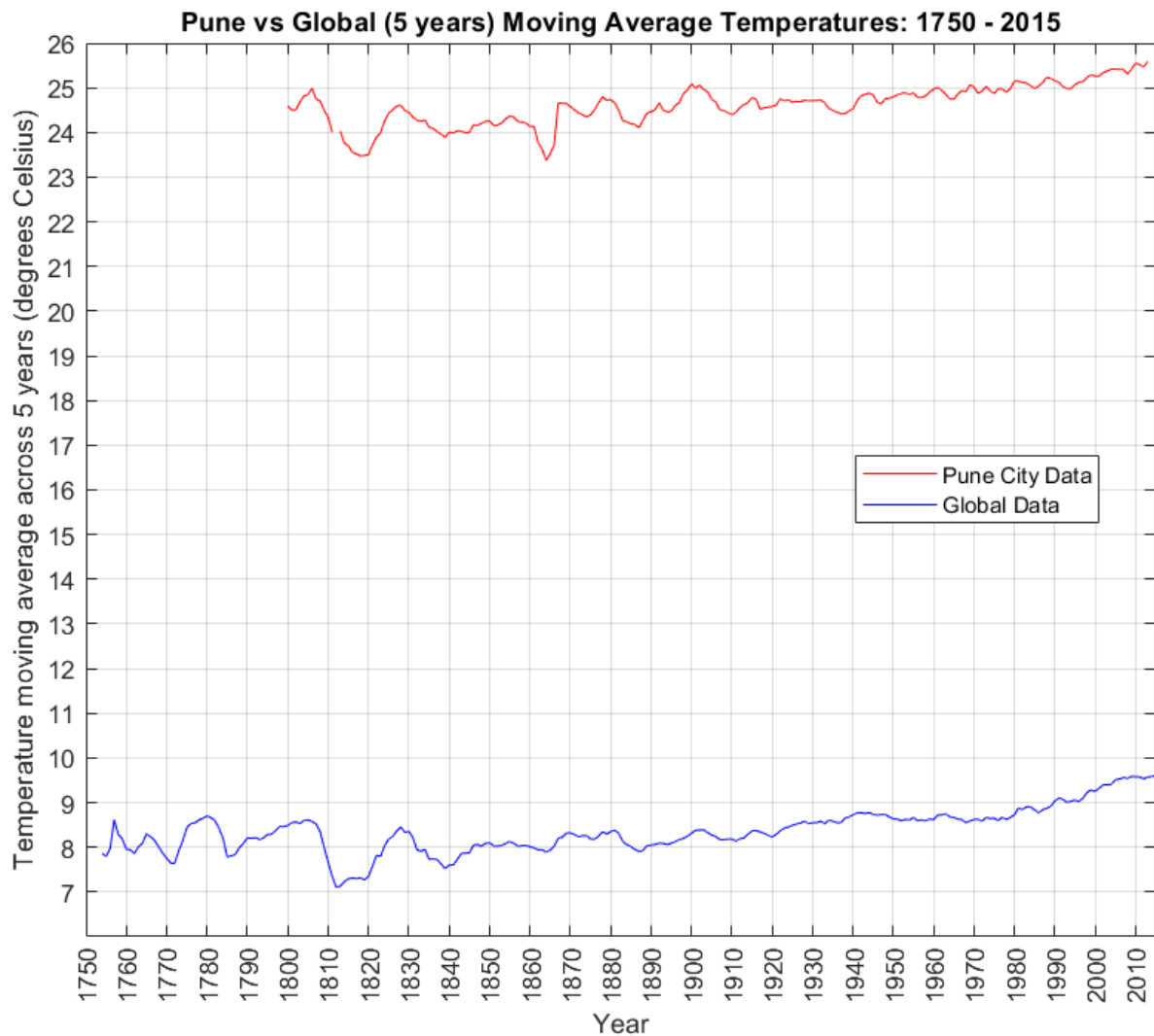


Fig1: Pune vs Global (5 years) Moving Average Temperatures: 1750 - 2015

#### Key Considerations:

1. Plot both the datasets on a single graph to precisely gauge the correlation between the two
2. Have some degree of continuity in the graph (although is broken at one stage where missing data was present in consecutive time slots). This was achieved by adapting the moving average to accommodate and capture average data for atleast some timestamps for which data was missing.
3. Being able to reuse the same script in order to derive similar observations for other data (not just the city closest to my home town).

#### Four Observations:

1. The temperature trends seem to move together indicating some degree of correlation between global and Pune city average temperatures. Case in point is the increasing trend of temperatures in degrees Celsius or the dip in temperatures between 1800 and 1830.
2. Towards the beginning of the twentieth century, both Pune city and global average temperatures show an increasing trend rising by nearly 1 °C.
3. There is movement towards a local minima and recovery between 1806 and 1830 in both global and Pune city temperature which may point to a global event that could have resulted in this change (Refer to Little Ice Age from Wikipedia).
4. The global averages (~8.37 °C) are much lower compared to Pune city (24.64 °C) across the reference period available for both of them that sheds light on the latitudinal location of Pune with respect to the Equator.