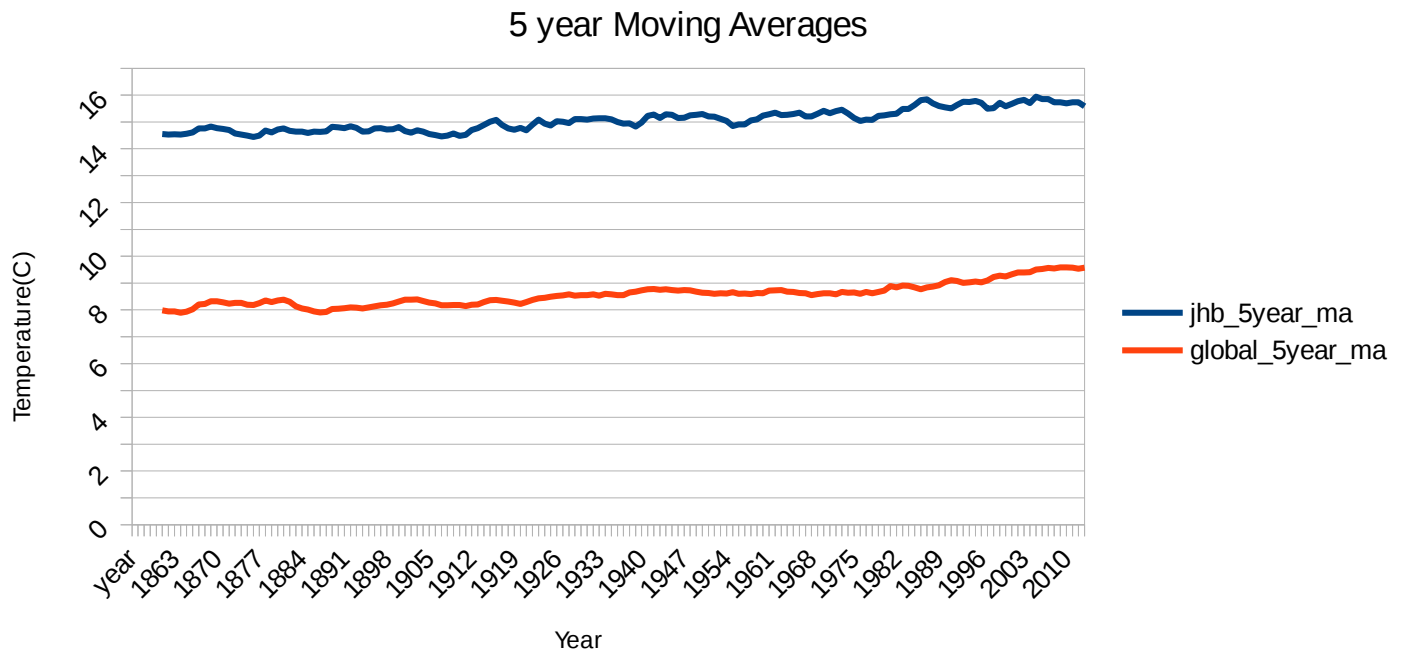


### Steps taken to prepare data to be visualized

1. Run SQL query to retrieve relevant information from the database:

```
SELECT city_data.year,  
  
       global_data.year,  
  
       city_data.city,  
  
       city_data.avg_temp AS JHB_avg_temp,  
  
       global_data.avg_temp AS Global_avg_temp  
  
FROM city_data, global_data  
  
WHERE ((city_data.year = global_data.year) AND (city_data.city = 'Johannesburg'));
```

2. Once information was retrieved, I downloaded it and then opened the CSV in LibreOffice Calc. Once opened I made columns for JHB moving average and global moving average. And then calculated a 10 point moving average, a 20 point MA and a 5 point moving average for Johannesburg average temperature and global average temperature. I finally decided to use a 5 year moving average.
3. Once my 5 year Moving average was calculated, I put my city's MA and the global MA into a line graph for my visual representation of the data.
  - I decided to use a 5 point moving average because of my key considerations on how best to visualize the trends. The 10 year MA and 20 year MA did not display the data nicely. The 5 point MA shows a clearer representation of the increases and decreases in temperature over the years. A 5 point moving average responds more quickly to changes in the observed data than a 10 or 20 point MA. By observing the MA we can see that there has been and continues to be an uptrend, suggesting that the temperatures will continue to rise at a yearly rate.
  - I used the Y axis to represent temperatures and the X axis to represent years, I considered it best to structure the graph this way to best represent the relationship between the sets of data and also show similarities and/or differences.
  - I calculated the moving average by taking the average temperature for a subset of 5 years for JHB average temperature and global average temperature. I used the AVERAGE() function in LibreOffice Calc (AVERAGE(C2:C6) for JHB and AVERAGE(E2:E6) for global. Just to be sure that I was doing it correctly in LibreOffice Calc, I did a manual calculation :  $(C2+C3+C4+C5+C6)/5$ .



#### Observations:

- My city is considerably hotter on average than the global average. By at least double on average. This difference has been consistent over time.
- There doesn't seem to be any indication that when the global average rises or drops that my city's average temperature will rise or drop at the same point in time. For instance, in the year 1981 there's a notable decrease in temperature in Johannesburg, where there is a rise in the global average temperature at this time. However, This does not indicate that when there is a rise in the global average there will be a drop in JHB average temperature, or vice versa. There is no correlation to suggest this.
- The overall trend suggests that the world will continue to get consistently hotter. This trend has been steady over the last few hundred years.
- While it may seem as though the global temperature has increased at quite a steady pace over time, Johannesburg's temperature seems to have risen at somewhat irregular intervals as the line graph shows more frequent spikes and dips in the data than for the global average.

#### Correlation coefficient

The correlation coefficient for the data sets is 0.729, which shows a strong positive linear relationship between the global average temperature and Johannesburg's average temperature. This relationship suggests that an overall increase in Johannesburg average temperature is associated with an overall increase in global average temperature, they are strongly related.

#### Multiple city comparisons:

The cities I have chosen to add to the visualization are Gaborone, Durban and Windhoek. When I represented the moving averages for these cities, I noticed that all three cities average temperatures are considerably higher than that of Johannesburg and the global averages. I am not surprised to see that Gaborone, Durban and Windhoek are higher than the global average because of my first line graph where we can see that Johannesburg is also higher. This makes sense since Johannesburg, Gaborone, Durban and Windhoek are all located on the southern

hemisphere where it is known to be hotter year round. It is interesting to see that Johannesburg's average temperature is a good 4-5 degrees lower than that of Gaborone, Durban and Windhoek. I would have assumed that Johannesburg's average temperature would have been very similar to the other 3 cities I had chosen, especially Durban since Durban and Johannesburg are in the same country, and South Africa is really not a large country. As we observed with Johannesburg's MA and the global Ma that the temperature has continued to increase yearly, the same is true for Gaborone, Durban and Windhoek.

My favourite cities average temperature compared to JHB and global average temperatures

