Outline

➢ SQL commands (as below) were used extract the data:

Select * from city_data;

Select * from city_list;

Select * from global_data;

➢ Microsoft Excel was used to draw analytical charts;

➢ In order to fine tune the moving average, I had compared several charts applying different length; As such trend has existed for a long period of time which spanning over 250 years, in addition, from observation 20-year period seems possess almost identical trend as that of 50-year's, thus they both can be used for current analysis.

➢ Correlation to show the linear relationship between the two series

➢ Statistical report to show some key statistical measures, such as mean, mode, variance, skewness etc.

➢ Histogram to show the frequency distributions, which straightforwardly reflect the features of the two series. it is a good verification with the statistical summary.

Observation and analysis

1. **Moving averaging:**

   Kingston is cooler when compared with global temperature over the past 250 years, such difference was constant with time (**Chart 1-4**);
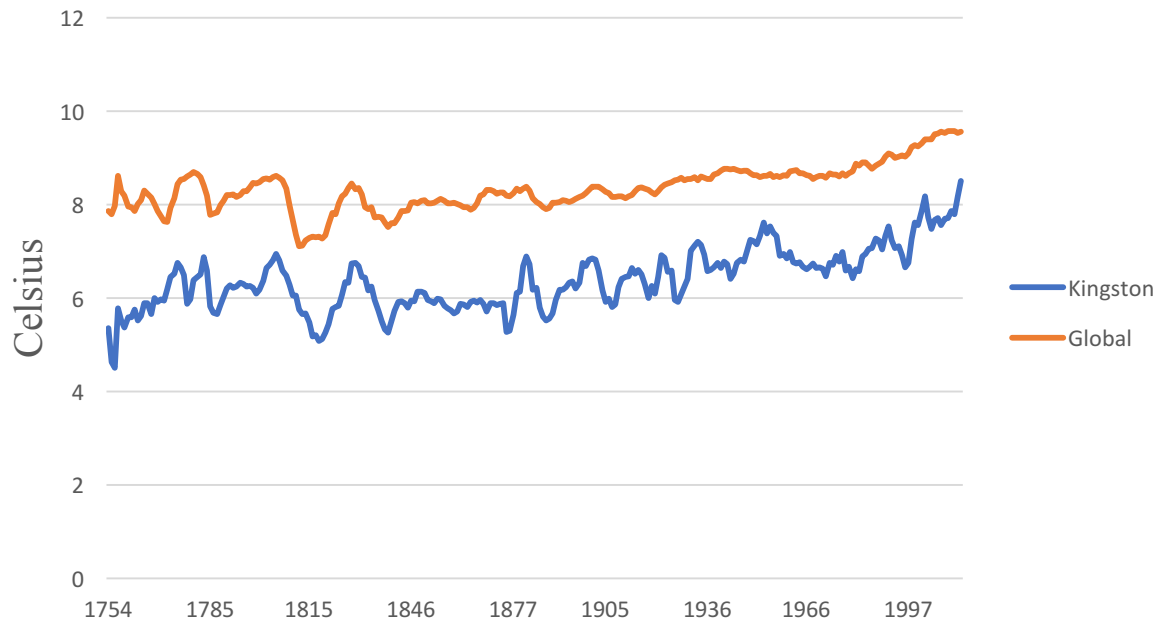
Chart 1. 5-Year Moving Average
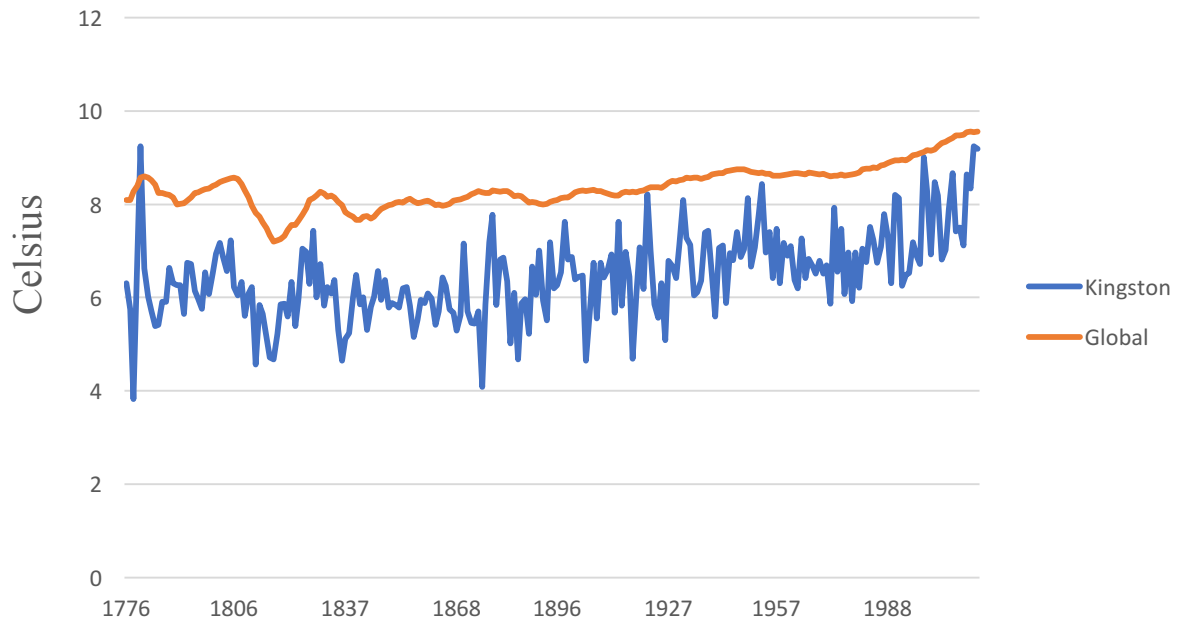

Chart 2. 10 Year Moving Average

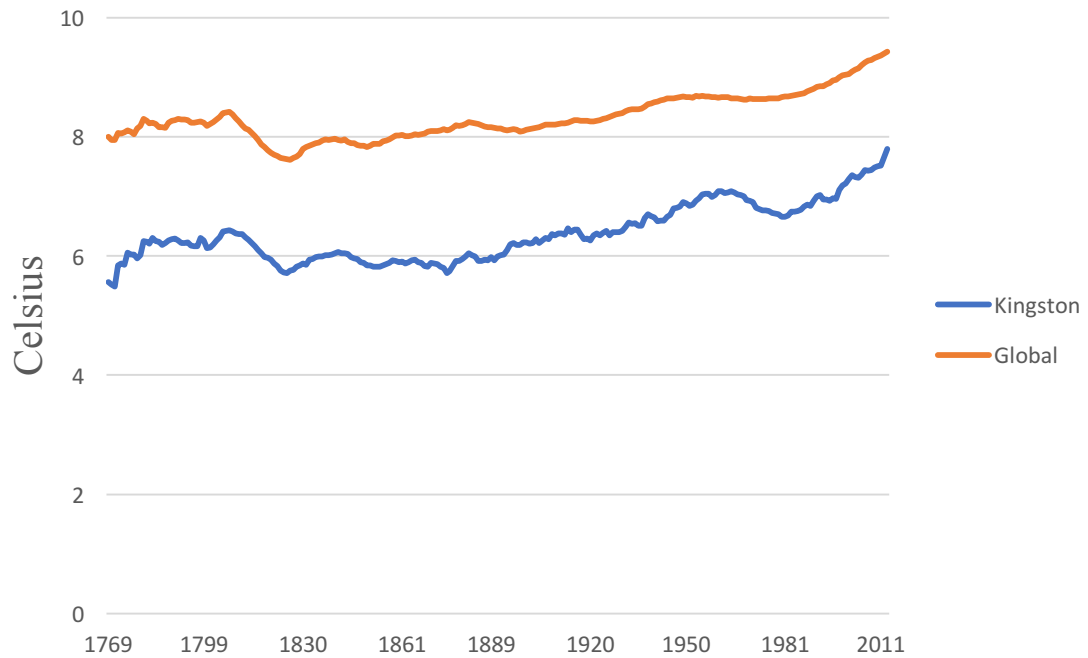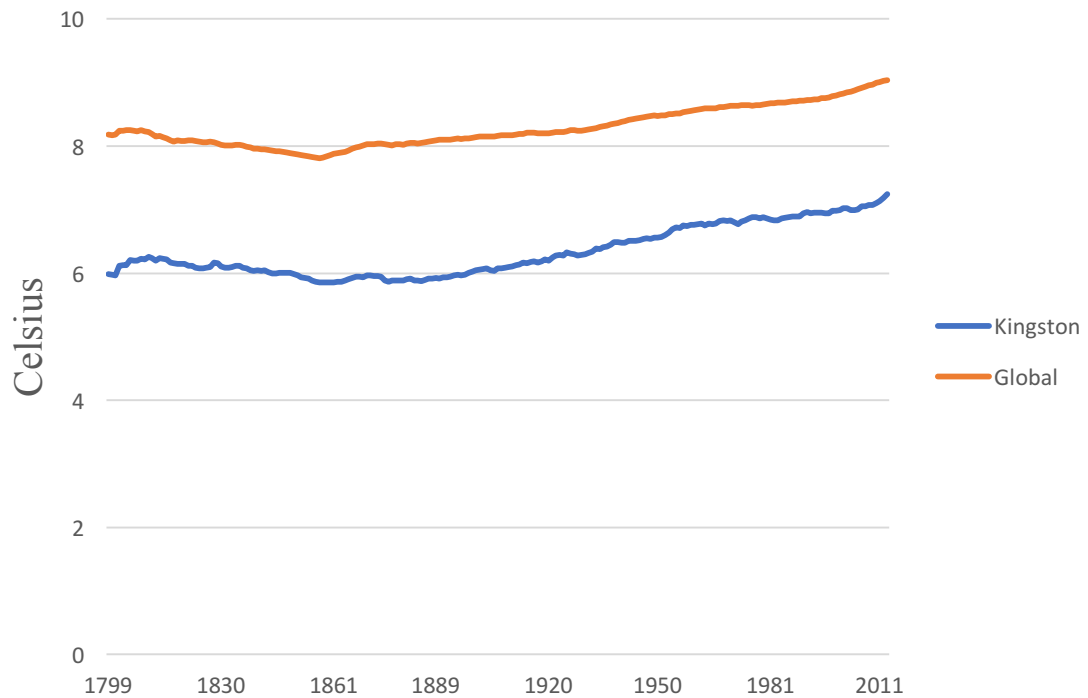**Chart 3.** 20 Year Moving Average

Chart 4. 50 Year Moving Average

2. Correlation:

It is obvious that the temperature all over the world has been on a raising pattern in general with several fluctuations among. This relationship can be measured by correlation. The two-series correlation is 0.71, which shows a high positive linear relationship.

3. Variance:

The temperature in Kingston is more dispersed than the global. It can be verified by the statistical summary which shows a larger variance of Kingston annual temperature (**Table 1**).

Table 1. Statistical summary

	Kingston	Global
Mean	6.4	8.4
Median	6.4	8.4
Mode	5.9	8.0
Standard Deviation	1.0	0.6
Sample Variance	1.1	0.3
Skewness	-1.1	-0.4
Range	9.9	4.0
Minimum	-0.7	5.8
Maximum	9.2	9.7

4. Distribution skewness:

Skewness is a term in statistics used to describe asymmetry from the normal distribution in a set of data. We can see both the distribution of Kingston and Global are not normal distributions, they are asymmetric. The histogram chart and statistic report show they have negative skewness, Kingston is more negative skewed (**Table 1**). That is to say, there is a larger probability that the annual average temperature falls below its mode value both in Kingston and globally. This is a crucial descriptive feature of the distributions, and also very useful in prediction and simulation.

5. Distribution mean and mode:

The histogram shows the frequency distribution of average temperature concentrates for both Kingston and the global. The global distribution concentrates in the range from 8 to 10 Celsius, while Kingston is from 6 and 8. It can also be verified by the statistical summary, which shows larger mean and mode value of the global series (**Chart 5**).

Chart 5. Temperature frequency historgram: Kingston vs the Global