Outline

1. What tools did i use?
   Step 1: Used SQL to extract data into a csv file, then downloaded it
   Step 2: Uploaded the csv file into Python, did all the calculation and visualization using Python

   ` SELECT 'LOCAL' "TYPE", YEAR, AVG_TEMP FROM CITY_DATA WHERE CITY='HANOI'

UNION ALL

SELECT 'GLOBAL' "TYPE", YEAR, AVG_TEMP FROM GLOBAL_DATA `

1. How did i calculate the moving average?
   I use the function **DataFrame.rolling(x).mean()** with x as the number of years

2. What were my key considerations when deciding how to visualize the trends?
   I want the visualization to be clear, easy to follow and minimize all the excessive information

---

Import libraries

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [ ]:
```
import warnings
warnings.filterwarnings("ignore")
```

Upload CSV file

In [ ]:
```
df = pd.read_csv("results.csv")
```

In [ ]:
```
df.head(5)
```

Out[ ]:

	type	year	avg_temp
0	LOCAL	1840	21.00
1	LOCAL	1841	21.30
2	LOCAL	1842	21.16
3	LOCAL	1843	21.26
4	LOCAL	1844	20.78

In [ ]:
```
local_df = df[df['type']=='LOCAL']
local_df
```

Out[ ]:

	type	year	avg_temp
0	LOCAL	1840	21.00
1	LOCAL	1841	21.30
2	LOCAL	1842	21.16
3	LOCAL	1843	21.26
4	LOCAL	1844	20.78
...	...	...	...
169	LOCAL	2009	22.59
170	LOCAL	2010	22.57
171	LOCAL	2011	21.03
172	LOCAL	2012	22.09
173	LOCAL	2013	23.10

174 rows × 3 columns

Calculate moving average

In [ ]:

```
local_df['moving_avg'] = local_df['avg_temp'].rolling(10).mean()
local_df.dropna(inplace=True)
local_df.loc[:,]
```

Out[ ]:

	type	year	avg_temp	moving_avg
13	LOCAL	1853	21.51	21.021
14	LOCAL	1854	21.45	21.088
15	LOCAL	1855	21.10	21.130
16	LOCAL	1856	20.69	21.074
17	LOCAL	1857	20.89	21.080
...	...	...	...	...
169	LOCAL	2009	22.59	22.063
170	LOCAL	2010	22.57	22.140
171	LOCAL	2011	21.03	22.064
172	LOCAL	2012	22.09	22.060
173	LOCAL	2013	23.10	22.108

161 rows × 4 columns

In [ ]:

```
global_df = df[df['type']=='GLOBAL']
global_df
```

Out[ ]:

	type	year	avg_temp
174	GLOBAL	1750	8.72
175	GLOBAL	1751	7.98
176	GLOBAL	1752	5.78
177	GLOBAL	1753	8.39
178	GLOBAL	1754	8.47
...	...	...	...
435	GLOBAL	2011	9.52
436	GLOBAL	2012	9.51
437	GLOBAL	2013	9.61
438	GLOBAL	2014	9.57
439	GLOBAL	2015	9.83

266 rows × 3 columns

In [ ]:

```
global_df['moving_avg'] = global_df['avg_temp'].rolling(10).mean()
global_df.dropna(inplace=True)
global_df
```

Out[ ]:

	type	year	avg_temp	moving_avg
183	GLOBAL	1759	7.99	8.030
184	GLOBAL	1760	7.19	7.877
185	GLOBAL	1761	8.77	7.956
186	GLOBAL	1762	8.61	8.239
187	GLOBAL	1763	7.50	8.150
...	...	...	...	...
435	GLOBAL	2011	9.52	9.554
436	GLOBAL	2012	9.51	9.548
437	GLOBAL	2013	9.61	9.556
438	GLOBAL	2014	9.57	9.581
439	GLOBAL	2015	9.83	9.594

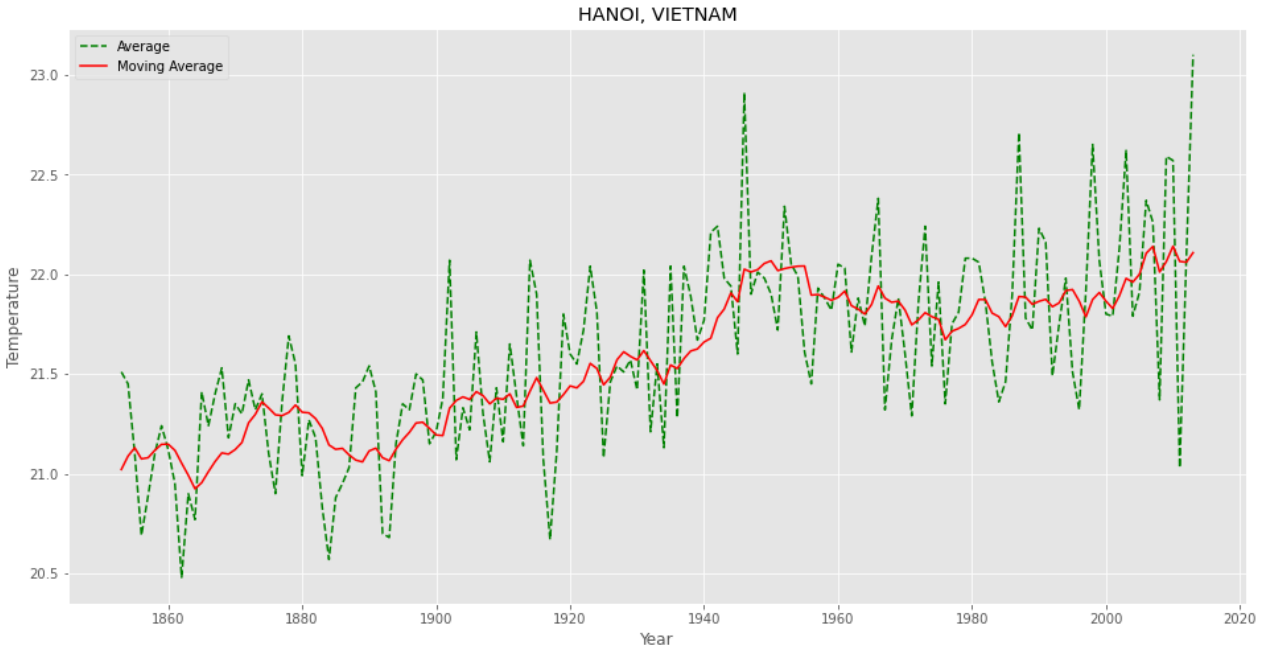
257 rows × 4 columns

Plot the results

In [ ]:

```
# Set names for each category
year = local_df['year']
avg_temp = local_df['avg_temp']
```

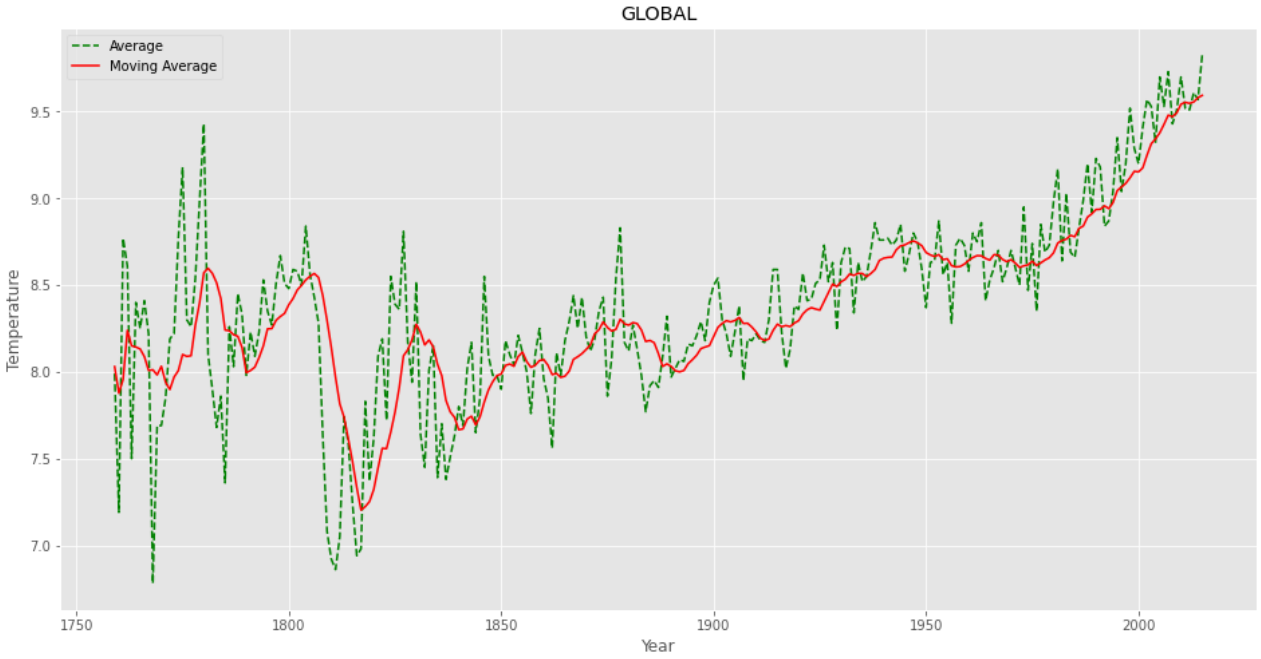
```
moving_avg_temp = local_df['moving_avg']
test = local_df[['avg_temp','moving_avg']]

plt.subplots(figsize = (16,8))

# Plot 1st set of data
plt.plot(year, avg_temp, 'g--', label = 'Average')

# Plot 2nd set of data
plt.plot(year, moving_avg_temp , 'r-', label = 'Moving Average')

# Create legend
plt.legend(loc = 'upper left') # để legend ở góc trên bên trái

plt.style.use('ggplot')
plt.title('HANOI, VIETNAM')
plt.xlabel('Year')
plt.ylabel('Temperature')

plt.show()
```



In [ ]:

```
# Set names for each category
year = global_df['year']
avg_temp = global_df['avg_temp']
moving_avg_temp = global_df['moving_avg']

plt.subplots(figsize = (16,8))

# Plot sets of data
plt.plot(year, avg_temp, 'g--', label = 'Average')
plt.plot(year, moving_avg_temp, 'r-', label = 'Moving Average')

# Create legend
plt.legend(loc = 'upper left')

plt.style.use('ggplot')
plt.title('GLOBAL')
plt.xlabel('Year')
```

```
plt.ylabel('Temperature')

plt.show()
```



Observations

The above charts compare the temperature between Hanoi (Vietnam) and the global. Here are some observations obtained from the charts.

- Overall, both Hanoi and the world witnessed a rise in temperature over the years.
- Hanoi's temperature was much hotter than the world's, ranging from 20.5 to above 23 Celcius degree, whereas the global temperature ranges from 6.5 to nearly 10 Celcius degree.
- While temperature trend in Hanoi tended to increase moderately, the world had seen a fluctuation in temperature during the period of 1770 to 1830.
- Over a few hundred years, Hanoi grew by 1 degree, from 21 to 22, whereas the world grew by nearly 2.6 degree, from 8 to 9.6 approximately