PROCEDURE

Extract Data Using SQL QUERIES and Export to CSV

Analyze data using pandas and matplotlib libraries in python

Visualize Data

Observations

Considerations for Visualization

Findings

Further Analysis

EXTRACTING DATA USING SQL QUERIES

To extract and view the list of cities

select * from city_list

To extract city temperature data

select * from city_data where city = 'Lagos'

To extract global temperature data

select * from global_data

CITY TEMPERATURE ANALYSIS

The closest big city to where I live is Lagos

In [1]:

```
#importing all necessary libraries
import pandas as pd
import matplotlib.pyplot as plt

#To display entire dataset
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows',  None)
```

In [2]:

```
# reading the CSV file

lagos_temp = pd.read_csv('C:/Users/user/Desktop/1.coding_datascience/UDACITY NANO DEGREE da
```

In [3]:

```
#exploring the columns and some few rows

lagos_temp.head()
```

Out[3]:

	year	city	country	avg_temp
0	1849	Lagos	Nigeria	25.98
1	1850	Lagos	Nigeria	25.87
2	1851	Lagos	Nigeria	26.10
3	1852	Lagos	Nigeria	NaN
4	1853	Lagos	Nigeria	NaN

In [4]:

```
# getting more information about the data

lagos_temp.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 165 entries, 0 to 164
Data columns (total 4 columns):
year        165 non-null int64
city        165 non-null object
country     165 non-null object
avg_temp    151 non-null float64
dtypes: float64(1), int64(1), object(2)
memory usage: 5.3+ KB
```

In [5]:

```
#checking for missing data
#there are 14 missing data in the avg_temp column

lagos_temp.isnull().sum()
```

Out[5]:

```
year         0
city         0
country      0
avg_temp    14
dtype: int64
```

In [6]:

```
#replacing missing data with mean:

for i in ['avg_temp']:
    lagos_temp[i] = lagos_temp[i].fillna(value = lagos_temp[i].mean())
```

In [7]:

```
#confirming there are no more missing data

lagos_temp.isnull().sum()
```

Out[7]:

```
year        0
city        0
country     0
avg_temp    0
dtype: int64
```

In [8]:

```
#missing data has been replaced with the mean(26.553113)
lagos_temp.head()
```

Out[8]:

	year	city	country	avg_temp
0	1849	Lagos	Nigeria	25.980000
1	1850	Lagos	Nigeria	25.870000
2	1851	Lagos	Nigeria	26.100000
3	1852	Lagos	Nigeria	26.553113
4	1853	Lagos	Nigeria	26.553113

In [9]:

```
#to calculate 20years, 100years moving average temperature

lagos_temp['20years MA_lagos (deg. C)'] = lagos_temp.avg_temp.rolling(window=20).mean()
lagos_temp['100years MA_lagos (deg. C)'] = lagos_temp.avg_temp.rolling(window=100).mean()
```

In [10]:

```
# renaming the avg_temp column to include temperature celsius unit

lagos_temp = lagos_temp.rename(columns = {'avg_temp': 'lagos_avg_temp (deg. C)'},
                               inplace = False)
```

In [11]:

```
lagos_temp.describe()
```

Out[11]:

	year	lagos_avg_temp (deg. C)	20years MA_lagos (deg. C)	100years MA_lagos (deg. C)
count	165.000000	165.000000	146.000000	66.000000
mean	1931.000000	26.553113	26.524611	26.526524
std	47.775517	0.518566	0.388154	0.159520
min	1849.000000	24.860000	25.750500	26.330936
25%	1890.000000	26.280000	26.283897	26.400832
50%	1931.000000	26.600000	26.661500	26.468500
75%	1972.000000	26.900000	26.806375	26.659150
max	2013.000000	27.790000	27.246000	26.857200

GLOBAL TEMPERATURE ANALYSIS

In [12]:

```
# reading the CSV file
global_temp = pd.read_csv('C:/Users/user/Desktop/1.coding_datascience/UDACITY NANO DEGREE d
```

In [13]:

```
#exploring the columns and some few rows

global_temp.head()
```

Out[13]:

	year	avg_temp
0	1750	8.72
1	1751	7.98
2	1752	5.78
3	1753	8.39
4	1754	8.47

In [14]:

```
# getting more information about the data

global_temp.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 266 entries, 0 to 265
Data columns (total 2 columns):
year        266 non-null int64
avg_temp    266 non-null float64
dtypes: float64(1), int64(1)
memory usage: 4.3 KB
```

In [15]:

```
#checking for missing data
#there are no missing data

global_temp.isnull().sum()
```

Out[15]:

```
year        0
avg_temp    0
dtype: int64
```

In [16]:

```
#to calculate 20years, 100years moving average temperature for global

global_temp['20years MA_global (deg. C)'] = global_temp.avg_temp.rolling(window=20).mean()

global_temp['100years MA_global (deg. C)'] = global_temp.avg_temp.rolling(window=100).mean(
```

In [17]:

```
# renaming the avg_temp column to include temperature celsius unit

global_temp = global_temp.rename(columns = {'avg_temp': 'global_avg_temp (deg. C)'},
                                 inplace = False)
```

In [18]:

```
global_temp.describe()
```

Out[18]:

	year	global_avg_temp (deg. C)	20years MA_global (deg. C)	100years MA_global (deg. C)
count	266.000000	266.000000	247.000000	167.000000
mean	1882.500000	8.369474	8.336142	8.255404
std	76.931788	0.584747	0.393107	0.244739
min	1750.000000	5.780000	7.621500	7.988800
25%	1816.250000	8.082500	8.080000	8.034050
50%	1882.500000	8.375000	8.243000	8.163600
75%	1948.750000	8.707500	8.644500	8.432100
max	2015.000000	9.830000	9.486000	8.838500

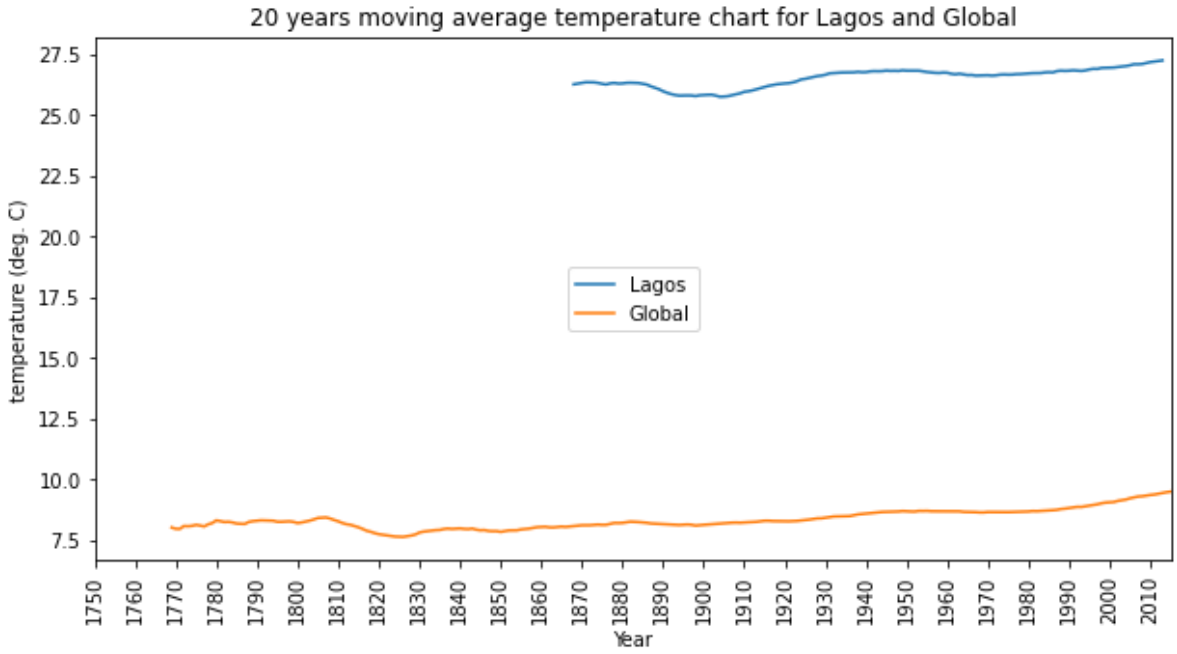
VISUALIZATIONS

In [23]:

```
# comparing lagos and global line chart in the same plot


lagos_temp.index = pd.Index(lagos_temp.year)
global_temp.index = pd.Index(global_temp.year)

lag_temp = lagos_temp[['20years MA_lagos (deg. C)']]
glob_temp = global_temp[['20years MA_global (deg. C)']]

ax = lag_temp.plot.line(figsize=(10, 5),
                        title='20 years moving average temperature chart for Lagos and Glob
glob_temp.plot.line(ax=ax)

ax.legend(["Lagos", "Global"], loc='center')
ax.set_xticks(global_temp.index[::10])
ax.set_xticklabels(global_temp.index[::10], rotation=90)
ax.set_xlabel("Year")
ax.set_ylabel("temperature (deg. C)")
```

Out[23]:

```
Text(0, 0.5, 'temperature (deg. C)')
```

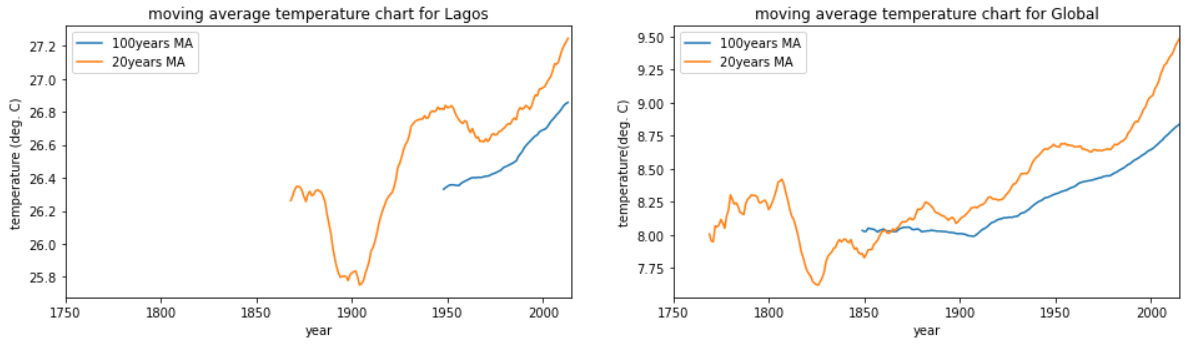


In [24]:

```
# comparing lagos and global line chart in separate plots


lagos_temp.index = pd.Index(lagos_temp.year)
global_temp.index = pd.Index(global_temp.year)

lag_temp = lagos_temp[['100years MA_lagos (deg. C)', '20years MA_lagos (deg. C)']]
glob_temp = global_temp[['100years MA_global (deg. C)', '20years MA_global (deg. C)']]



figure, axes = plt.subplots(1, 2, sharex=True)

lag_temp.plot(ax=axes[0], figsize=(16, 4),
              title='moving average temperature chart for Lagos')
glob_temp.plot(ax=axes[1], title='moving average temperature chart for Global')

axes[0].legend(["100years MA", "20years MA"], loc='upper left')
axes[1].legend(["100years MA", "20years MA"], loc='upper left')
axes[0].set_ylabel("temperature (deg. C)")
axes[1].set_ylabel("temperature(deg. C)")
```

Out[24]:

```
Text(0, 0.5, 'temperature(deg. C)')
```



OBSERVATIONS

Similarities

1. The world as well as my city is getting hotter

2. the difference in temperature fluctuates for both city and global

3. the overall trend is on the increase

4. generally, they both have positive temperature gradient

Differences

1. my city temperature is much higher than the global temperature

2. the global average temperature has a wider range (4.05 deg. C) than my city ave rage temperature (2.93 deg. C)

3. There is no temperature data for my city for years earlier than 1849

4. some temperature data where not available in my city in some years (missing dat a)

CONSIDERATIONS FOR VISUALIZATION

1. I maintaned the same scale for better comparison

2. I viewed the plots on the same chart

3. I also viewed the plots on different charts to see details of fluctuations

4. I plotted more than one moving average to help see the trends better

FINDINGS

according to (climaterealityproject.org), 1.5 degree celsius rise in temperature has been said to be danger line for global warming.

according to (climate.nasa.gov), if global Increase in temperature get to 2 degrees celsius, more than 70 percent of earth's coastlines will see sea-level rise greater than 0.66 feets resulting in increased coastal flooding, salinazation of water supplies and beach erosion among other impacts on human and ecological systems

national ocienic and atmospheric administration, one of the most immediate and obvious effect of global warming is the increase in temperature around the world. the average global temperature has increased by about 0.8 degree celsius over the past 100 years (livescience.com)

based on this data, there is global warming as temperature has risen more than 1 degree celsius in the last 100 years

FURTHER ANALYSIS

What is Correlation Coefficient?

The correlation coefficient is a statistical measure of the strength of the relationship between the relative movements of two variables. The values range between -1.0 and 1.0

In [19]:

```
lagos_global_temp = global_temp.merge(lagos_temp, on = 'year',
                                      how = 'left').drop(['city','country',],
                                                         axis=1, inplace=False)
```

In [22]:

```
lagos_global_temp.corr(method ='pearson')
```

Out[22]:

	year	global_avg_temp (deg. C)	20years MA_global (deg. C)	100years MA_global (deg. C)	lagos_avg_temp (deg. C)	20years MA_lagos (deg. C)
year	1.000000	0.622775	0.799960	0.937102	0.694096	0.818863
global_avg_temp (deg. C)	0.622775	1.000000	0.775097	0.895913	0.787121	0.794404
20years MA_global (deg. C)	0.799960	0.775097	1.000000	0.961803	0.718834	0.886210
100years MA_global (deg. C)	0.937102	0.895913	0.961803	1.000000	0.720502	0.861011
lagos_avg_temp (deg. C)	0.694096	0.787121	0.718834	0.720502	1.000000	0.778381
20years MA_lagos (deg. C)	0.818863	0.794404	0.886210	0.861011	0.778381	1.000000
100years MA_lagos (deg. C)	0.962916	0.902195	0.953753	0.993832	0.769031	0.877283

Strong Positive Correlation

There is a strong positive correlation of (0.787121) between the city average temperature and the global average temperature. it shows that an increase in temperature in my city contributes to the increase in the global temperature