

## 纲要

- 工具：利用 Python, Pandas, Matplotlib
- 如何计算移动平均线：每八年计算一次平均值，若不足八年则以 4 年开始平均。
- 决定如何将趋势可视化的关键：在观察线图在非移动平均值时波动过于大，因此打算使用移动平均值来观察趋势。

In [1]:

```
import pandas as pd
df_city = pd.read_csv('city_data.csv')
df_city.head()
```

Out[1]:

	year	city	country	avg_temp
0	1841	Shanghai	China	14.87
1	1842	Shanghai	China	15.43
2	1843	Shanghai	China	15.53
3	1844	Shanghai	China	15.33
4	1845	Shanghai	China	15.43

In [2]:

```
df_city.describe()
```

Out[2]:

	year	avg_temp
count	173.000000	173.000000
mean	1927.000000	15.973237
std	50.084928	0.575494
min	1841.000000	14.470000
25%	1884.000000	15.600000
50%	1927.000000	15.930000
75%	1970.000000	16.230000
max	2013.000000	17.860000

In [3]:

```
df_global = pd.read_csv('global_data.csv')  
df_global.head()
```

Out[3]:

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

In [4]:

```
df_global.describe()
```

Out[4]:

	year	avg_temp
count	266.000000	266.000000
mean	1882.500000	8.369474
std	76.931788	0.584747
min	1750.000000	5.780000
25%	1816.250000	8.082500
50%	1882.500000	8.375000
75%	1948.750000	8.707500
max	2015.000000	9.830000

In [5]:

```
import matplotlib.pyplot as plt  
  
def data_comparison_visualization(X_1, X_2, Y_1, Y_2, label_name_1, label_name_2  
):  
    plt.plot(X_1, Y_1, label=label_name_1, color='orange')  
    plt.plot(X_2, Y_2, label=label_name_2, color='magenta')  
    plt.legend(loc='upper left')  
    plt.show()
```

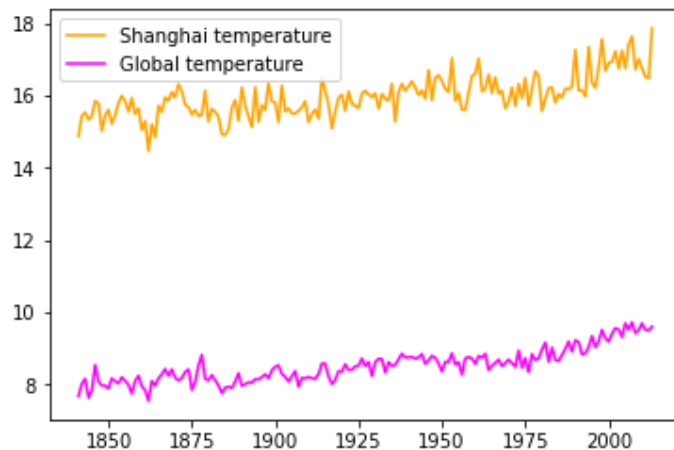
## 线图观察

- 首先，在 1841 ~ 2013 年间全球和上海的温度的趋势都是呈现上升曲线。
- 发现上海的温度比全球的平均温度高了大约 7 度。
- 线图如果是在非移动平均值时，观察到的上海温度上升趋势跟全球相比不是太明显，因此考虑使用移动平均值在观察上升曲线。
- 在以下的移动平均值线图中，可以清晰看见不论是全球或是上海的温度，在 1841 ~ 2013 年间都是稳定上升的，然后也是可以明显看出每个平均都是高了7度左右。

In [6]:

```
# for aligning city_data because of inconsistant data length
df_global = df_global[91:-2]

data_comparison_visualization(df_city.year, df_global.year, df_city.avg_temp, df_global.avg_temp, 'Shanghai temperature', 'Global temperature')
```

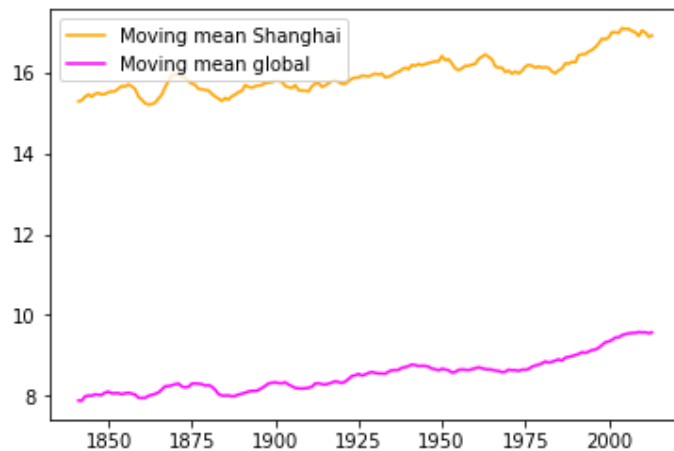


In [7]:

```
rolling_mean_city = df_city.avg_temp.rolling(window=8, center=True, min_periods=4).mean()
rolling_mean_global = df_global.avg_temp.rolling(window=8, center=True, min_periods=4).mean()
```

In [8]:

```
data_comparison_visualization(df_city.year, df_global.year, rolling_mean_city, r  
olling_mean_global, 'Moving mean Shanghai', 'Moving mean global')
```



## Reference

- Udacity tutorial materials
- Pandas official website for rolling api: <https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.rolling.html> (<https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.rolling.html>)
- Moving mean data visualization: <https://towardsdatascience.com/implementing-moving-averages-in-python-1ad28e636f9d> (<https://towardsdatascience.com/implementing-moving-averages-in-python-1ad28e636f9d>)

**Author : Wei-Chung Chen**