Time Series-Live

November 6, 2018

1 Time Series

As an example of time series we will be looking at weather data which is easily obtained. The data set we will look at is from the Global Historical Climatology Network (GHCN): 2005-2015 New York Region

The data comes from http://www.ncdc.noaa.gov/cdo-web/datasets

Air Temperature: (tenths of degrees Celsius) * MNTM - Monthly mean temperature * MMNT - Monthly Mean minimum temperature * MMXT - Monthly Mean maximum temperature * EMNT - Extreme minimum daily temperature * EMXT - Extreme maximum daily temperature

Precipitation: (tenths of mm) * TPCP - Total precipitation * EMXP - Extreme maximum daily precipitation

Snow: (mm) * TSNW - Total snow fall * MXSD - Maximum snow depth

Note that one of the great strengths of Pandas is time series. Pandas is particularly helpful. If your version is not

```
In [1]: import pandas as pd
        pd.__version__
```

```
Out[1]: '0.23.4'
```

```
In [2]: ghcn = pd.read_csv('https://raw.githubusercontent.com/story645/ams_tutorials/master/da
```

```
In [3]: ghcn.head()
```

```
In [4]: ghcn.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1625 entries, 0 to 1624
Data columns (total 11 columns):
STATION_NAME    1625 non-null object
DATE            1625 non-null int64
EMXP            1625 non-null int64
MXSD            1625 non-null int64
TPCP            1625 non-null int64
TSNW            1625 non-null int64
EMXT            1625 non-null int64
EMNT            1625 non-null int64
MMXT            1625 non-null int64
```

```
MMNT            1625 non-null int64
MNTM            1625 non-null int64
dtypes: int64(10), object(1)
memory usage: 139.7+ KB
```

```
In [5]: ghcn.columns
```

```
Out[5]: Index(['STATION_NAME', 'DATE', 'EMXP', 'MXSD', 'TPCP', 'TSNW', 'EMXT', 'EMNT',
               'MMXT', 'MMNT', 'MNTM'],
              dtype='object')
```

```
In [6]: ghcn[['MMNT','TSNW']][5:15:2]
```

```
In [7]: ghcn.loc[5:15:2,'TSNW':'MNTM']
```

```
In [8]: ghcn.iloc[5:15:2,5:10]
```

```
In [9]: ghcn['MMNT'].min(),ghcn['MMNT'].max(),ghcn['MMNT'].mean()
```

```
Out[9]: (-9999, 239, -2825.9304615384617)
```

```
In [10]: import numpy as np
         np.__version__
```

```
Out[10]: '1.15.3'
```

```
In [11]: ghcn.replace(-9999,np.nan,inplace=True)
```

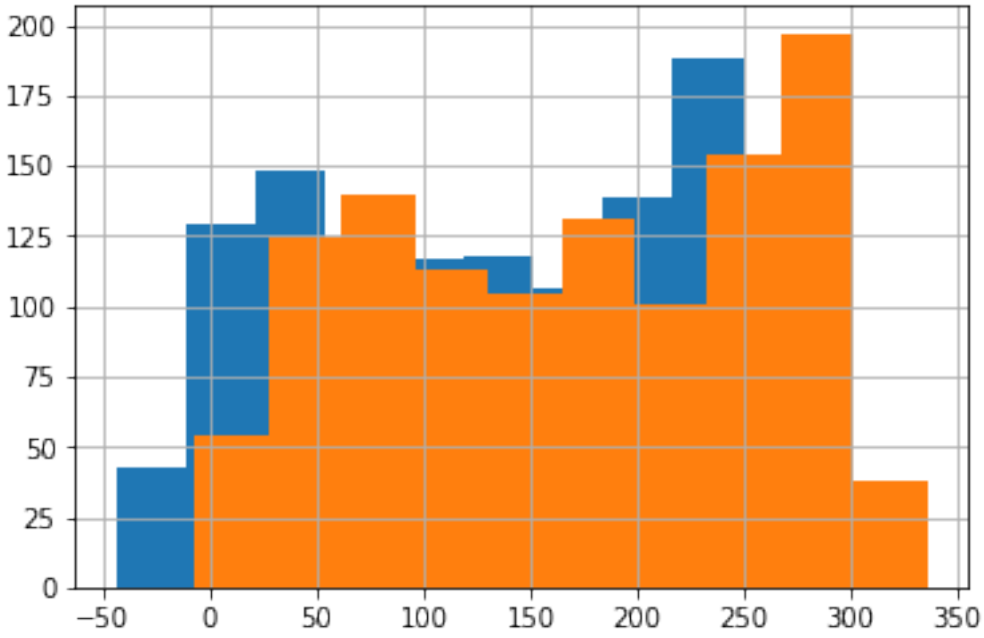
```
In [12]: ghcn.describe()
```

```
In [13]: ghcn['TPCP'].describe()
```

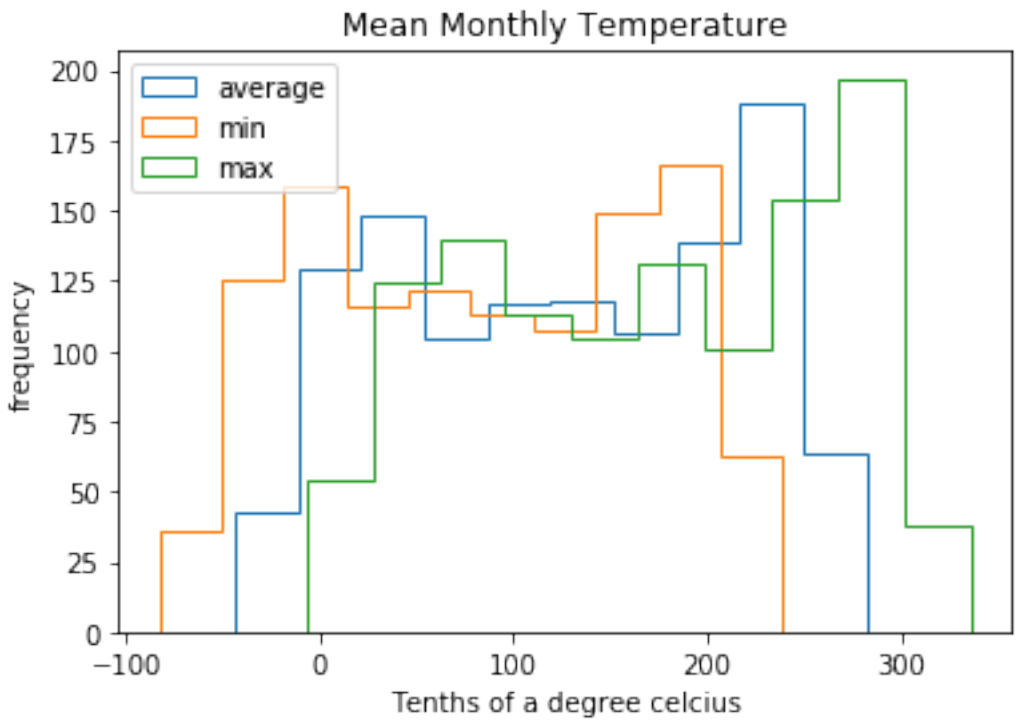
```
Out[13]: count    1622.000000
         mean      977.469174
         std       665.199628
         min         0.000000
         25%       553.000000
         50%       880.500000
         75%      1250.000000
         max      4813.000000
         Name: TPCP, dtype: float64
```

```
In [14]: %matplotlib inline
         ghcn['MNTM'].hist()
         ghcn['MMXT'].hist()
```

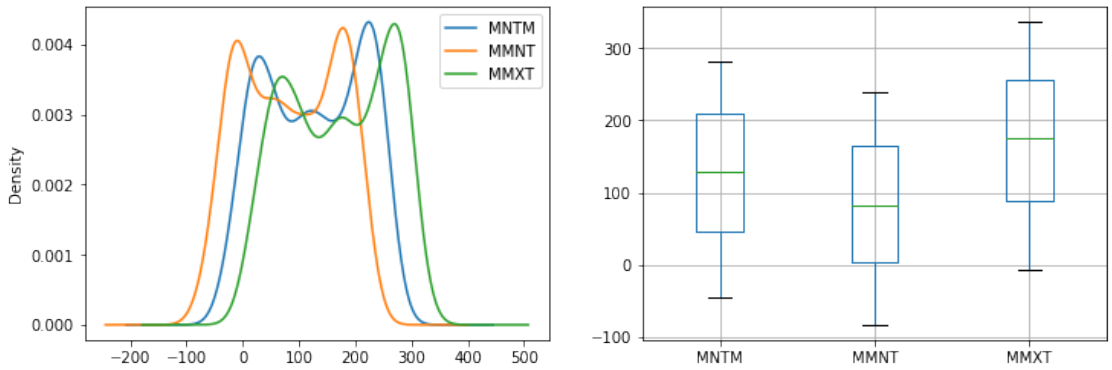
```
Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x11ce9e908>
```




```
In [15]: import matplotlib.pyplot as plt

In [16]: %magic help

In [17]: fig, ax = plt.subplots()
         _ = ghcn['MNTM'].hist(histtype='step', ax=ax, label='average')
         _ = ghcn['MMNT'].hist(histtype='step', ax=ax, label='min')
         _ = ghcn['MMXT'].hist(histtype='step', ax=ax, label='max')
         _ = ax.legend(loc='upper left')
         _ = ax.set_title("Mean Monthly Temperature")
         _ = ax.set_xlabel('Tenths of a degree celcius')
         ax.set_ylabel('frequency')
         ax.grid(False)
```

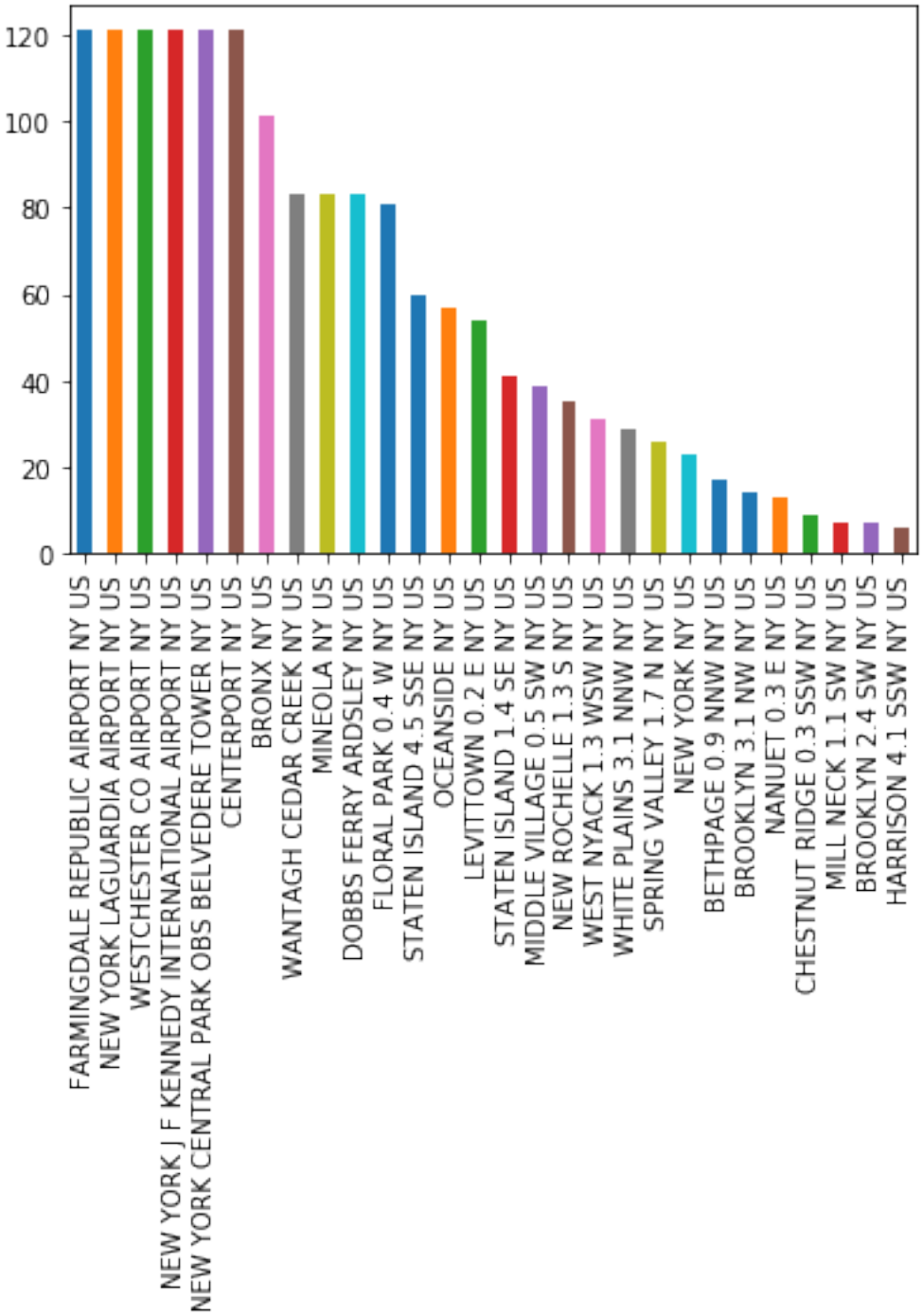



```
In [18]: fig, (ax1, ax2) = plt.subplots(figsize=(12,4), ncols=2)
         _ = ghcn[['MNTM','MMNT','MMXT']].plot.kde(ax=ax1)
         _ = ghcn[['MNTM','MMNT','MMXT']].boxplot(ax=ax2)
```

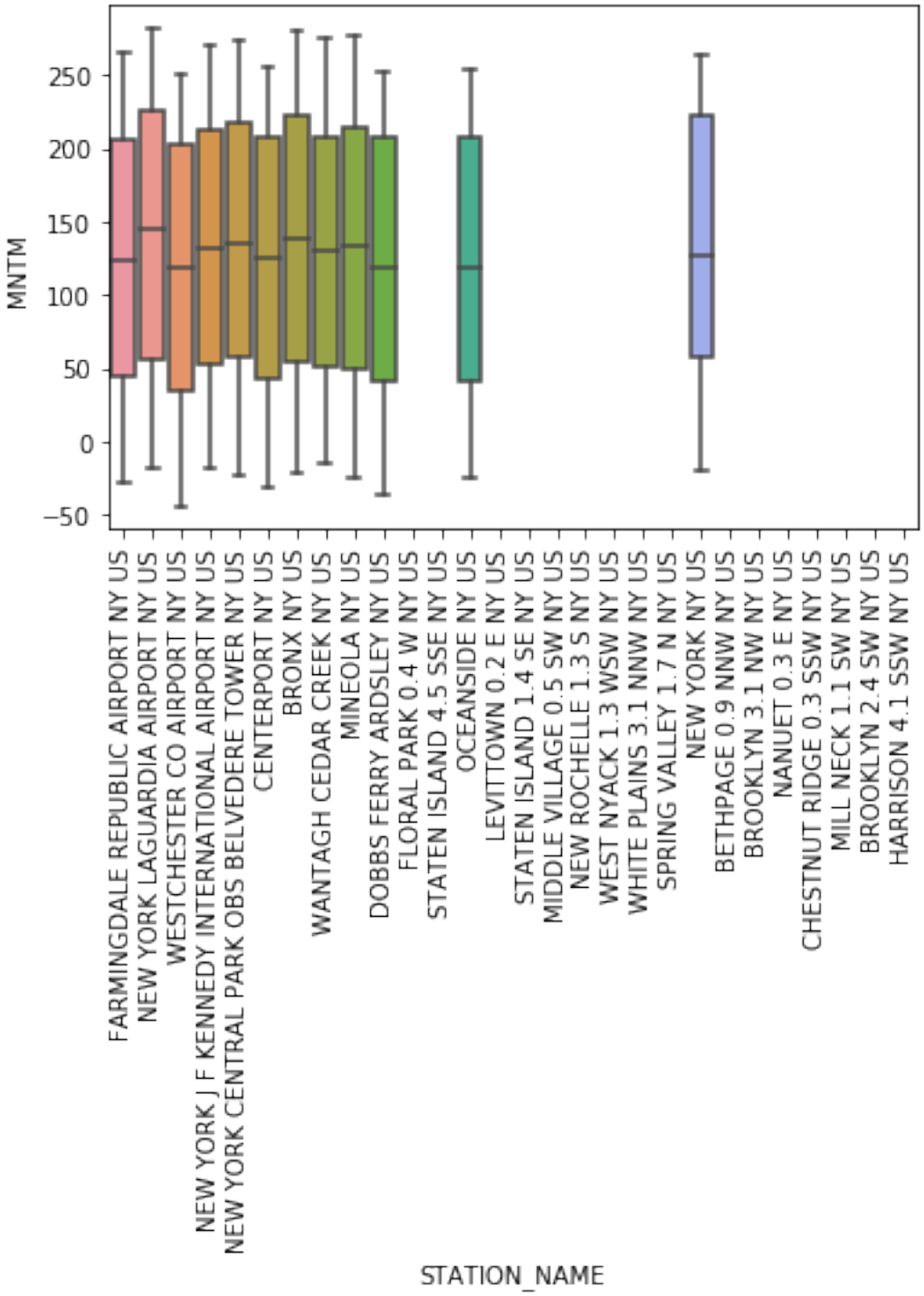



```
In [19]: ghcn.describe()

In [20]: import seaborn as sns

         ghcn['STATION_NAME'].value_counts()
```

```
Out[20]: FARMINGDALE REPUBLIC AIRPORT NY US                    121
         NEW YORK LAGUARDIA AIRPORT NY US                      121
         WESTCHESTER CO AIRPORT NY US                          121
         NEW YORK J F KENNEDY INTERNATIONAL AIRPORT NY US      121
         NEW YORK CENTRAL PARK OBS BELVEDERE TOWER NY US       121
         CENTERPORT NY US                                      121
         BRONX NY US                                           101
         WANTAGH CEDAR CREEK NY US                              83
         MINEOLA NY US                                          83
         DOBBS FERRY ARDSLEY NY US                              83
         FLORAL PARK 0.4 W NY US                                81
         STATEN ISLAND 4.5 SSE NY US                            60
         OCEANSIDE NY US                                        57
         LEVITTOWN 0.2 E NY US                                  54
         STATEN ISLAND 1.4 SE NY US                             41
         MIDDLE VILLAGE 0.5 SW NY US                            39
         NEW ROCHELLE 1.3 S NY US                               35
         WEST NYACK 1.3 WSW NY US                               31
         WHITE PLAINS 3.1 NNW NY US                             29
         SPRING VALLEY 1.7 N NY US                              26
         NEW YORK NY US                                         23
         BETHPAGE 0.9 NNW NY US                                 17
         BROOKLYN 3.1 NW NY US                                  14
         NANUET 0.3 E NY US                                     13
         CHESTNUT RIDGE 0.3 SSW NY US                            9
         MILL NECK 1.1 SW NY US                                  7
         BROOKLYN 2.4 SW NY US                                   7
         HARRISON 4.1 SSW NY US                                  6
         Name: STATION_NAME, dtype: int64

In [21]: ghcn['STATION_NAME'].value_counts().plot.bar()

Out[21]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1f35d780>
```




```
In [22]: ghcn[ghcn['STATION_NAME'].str.contains('HARRISON')]

In [23]: g=sns.boxplot(y='MNTM', x='STATION_NAME', data=ghcn,
                       order=ghcn['STATION_NAME'].value_counts().keys())
         _ = g.set_xticklabels(g.get_xticklabels(), rotation=90)
```




```
In [24]: ghcn['DATE'].head()

Out[24]: 0    20050601
         1    20050701
```

```
2    20050801
3    20050901
4    20051001
Name: DATE, dtype: int64
```

```
In [25]: ghcn['date']=pd.to_datetime(ghcn['DATE'],format='%Y%m%d')
```

```
In [26]: ghcn['date'].head()
```

```
Out[26]: 0   2005-06-01
         1   2005-07-01
         2   2005-08-01
         3   2005-09-01
         4   2005-10-01
         Name: date, dtype: datetime64[ns]
```

```
In [27]: stations = dict(list(ghcn.groupby('STATION_NAME')))
         stations.keys()
```

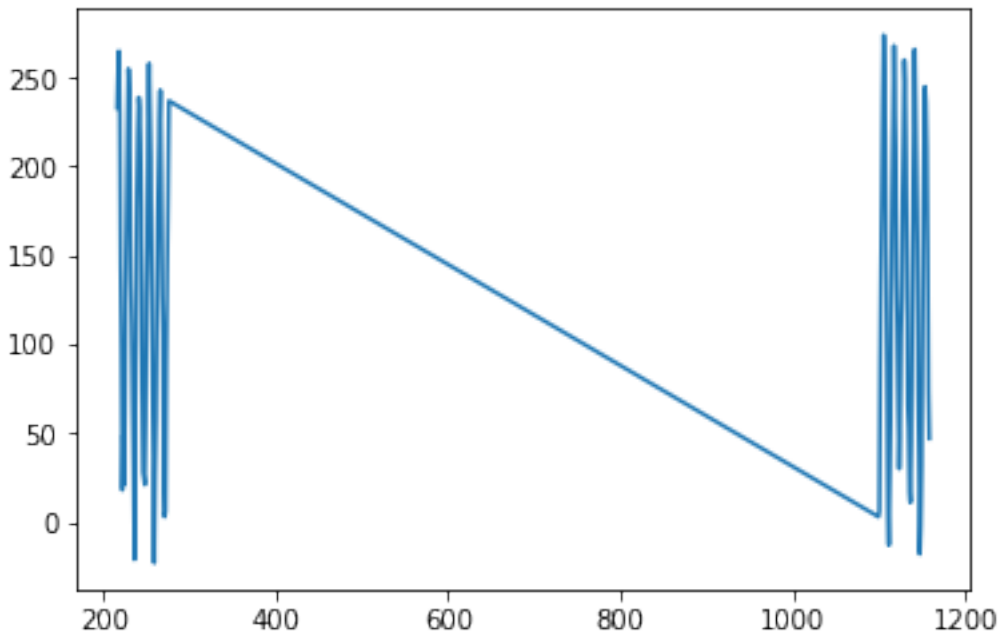
```
Out[27]: dict_keys(['BETHPAGE 0.9 NNW NY US', 'BRONX NY US', 'BROOKLYN 2.4 SW NY US', 'BROOKLYI
```

```
In [28]: cpd = stations['NEW YORK CENTRAL PARK OBS BELVEDERE TOWER NY US']
```

```
In [29]: cpd.head()
```

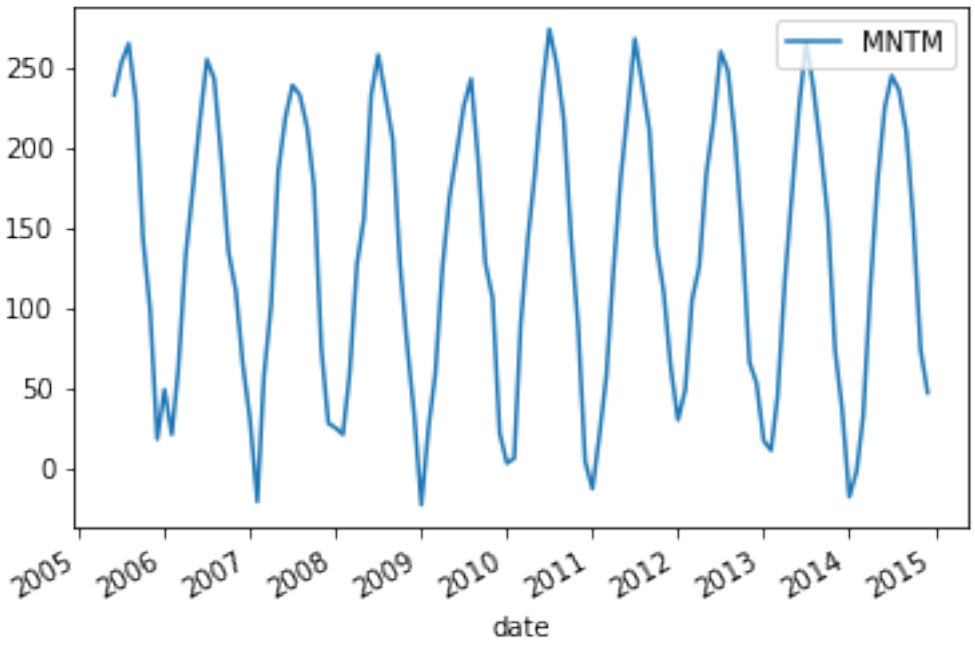
```
In [30]: cpd['MNTM'].plot()
```

```
Out[30]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1f69aa90>
```

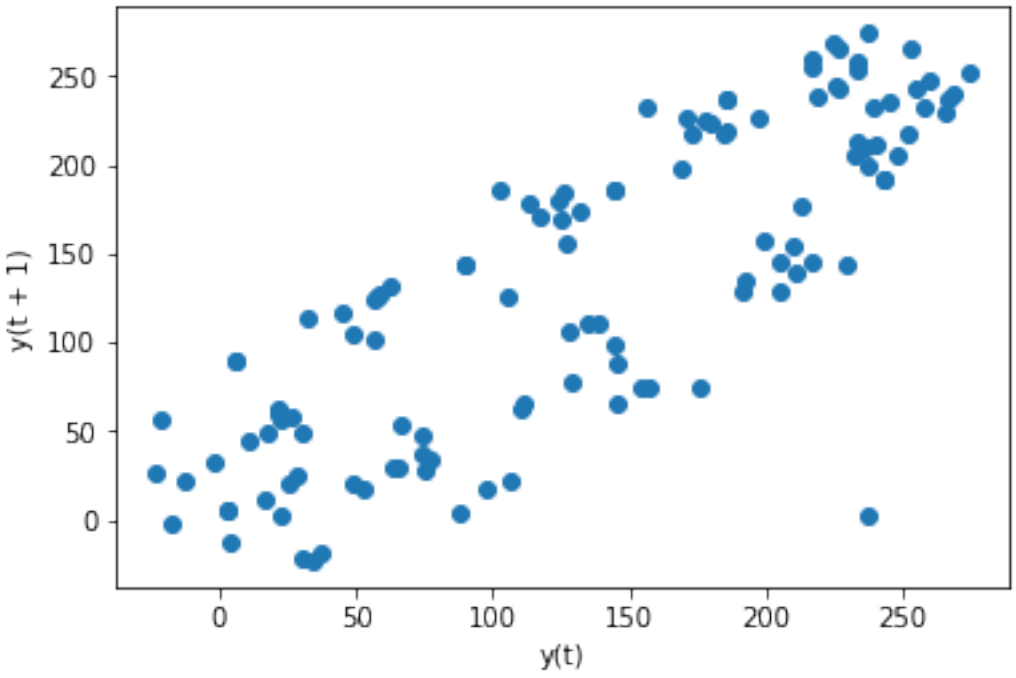


```
In [31]: cpd = cpd[['MNTM','date']].set_index('date')
```

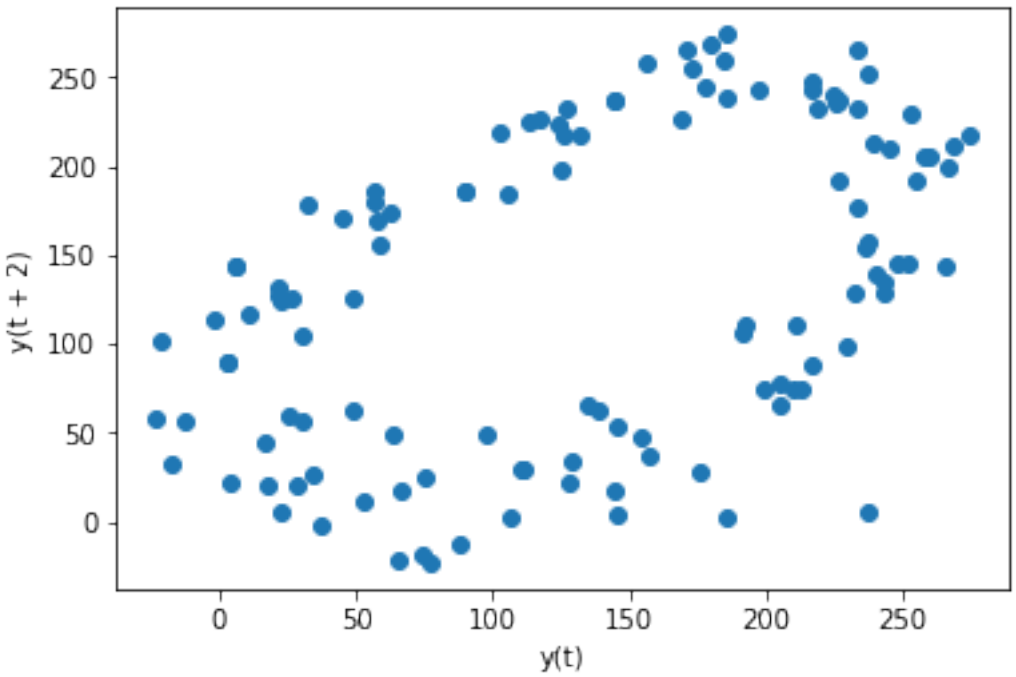
```
In [32]: _=cpd.plot()
```



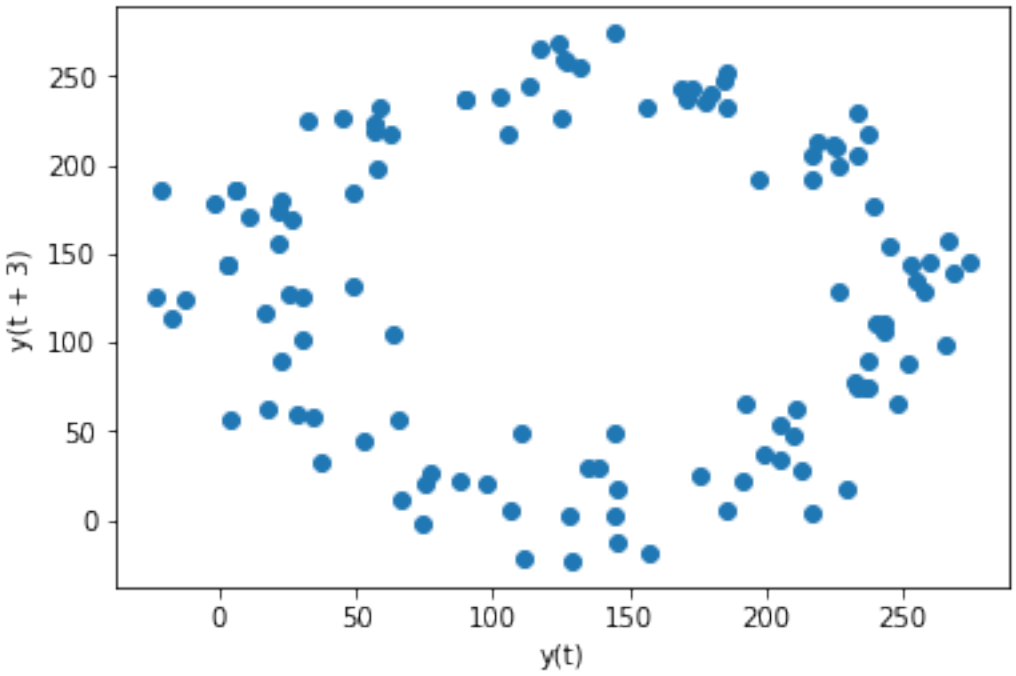

```
In [33]: _= pd.plotting.lag_plot(cpd['MNTM'],lag=1)
```



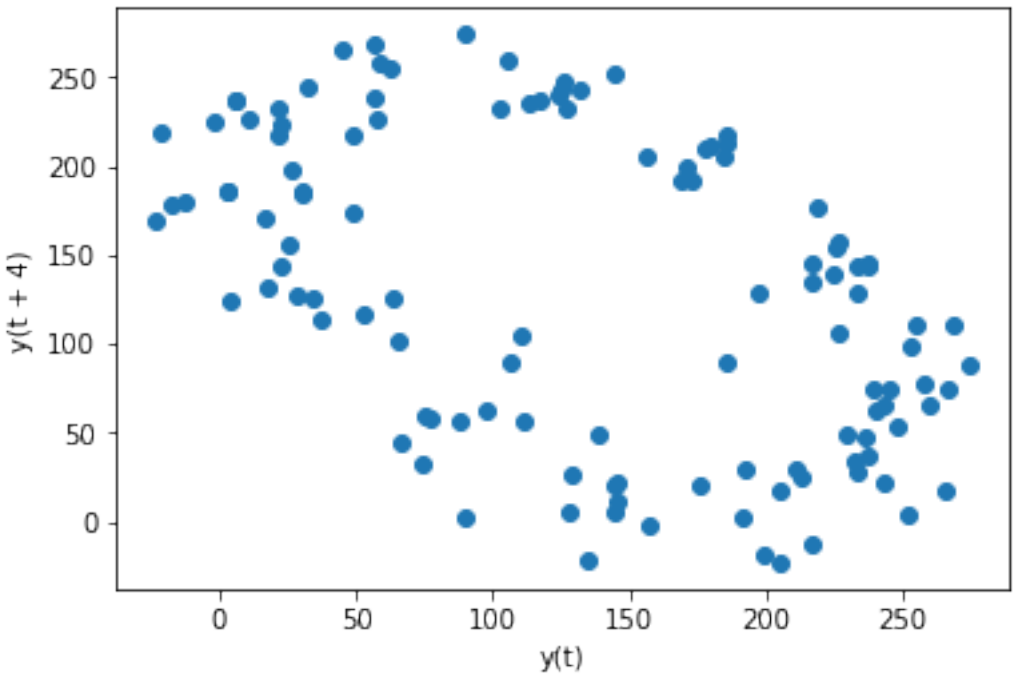
In [34]: _= pd.plotting.lag_plot(cpd['MNTM'],lag=2)



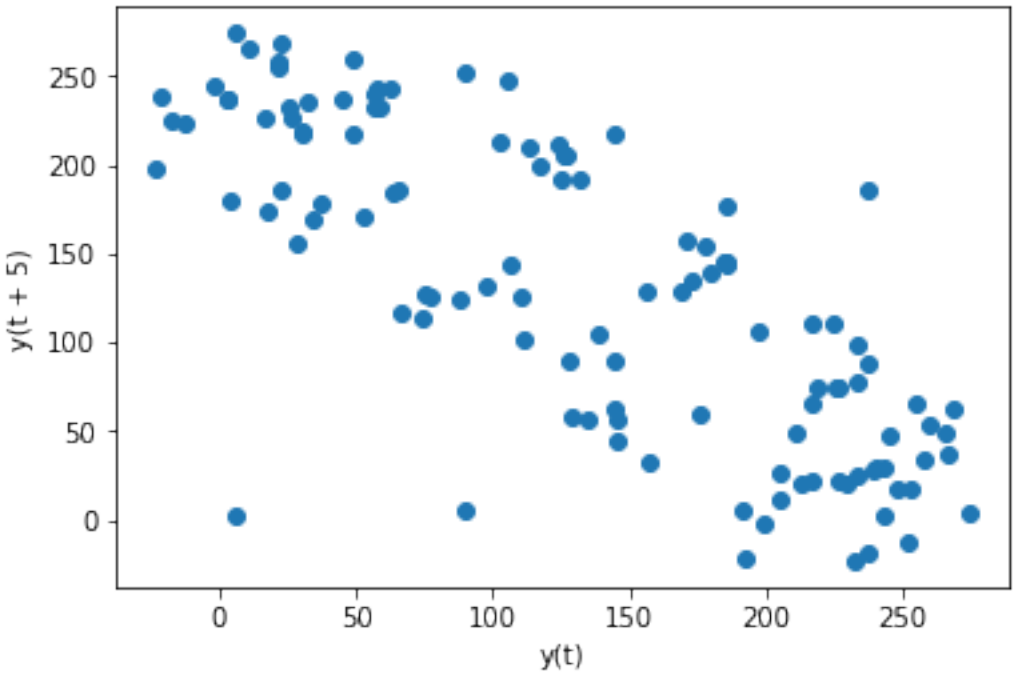
In [35]: _= pd.plotting.lag_plot(cpd['MNTM'],lag=3)



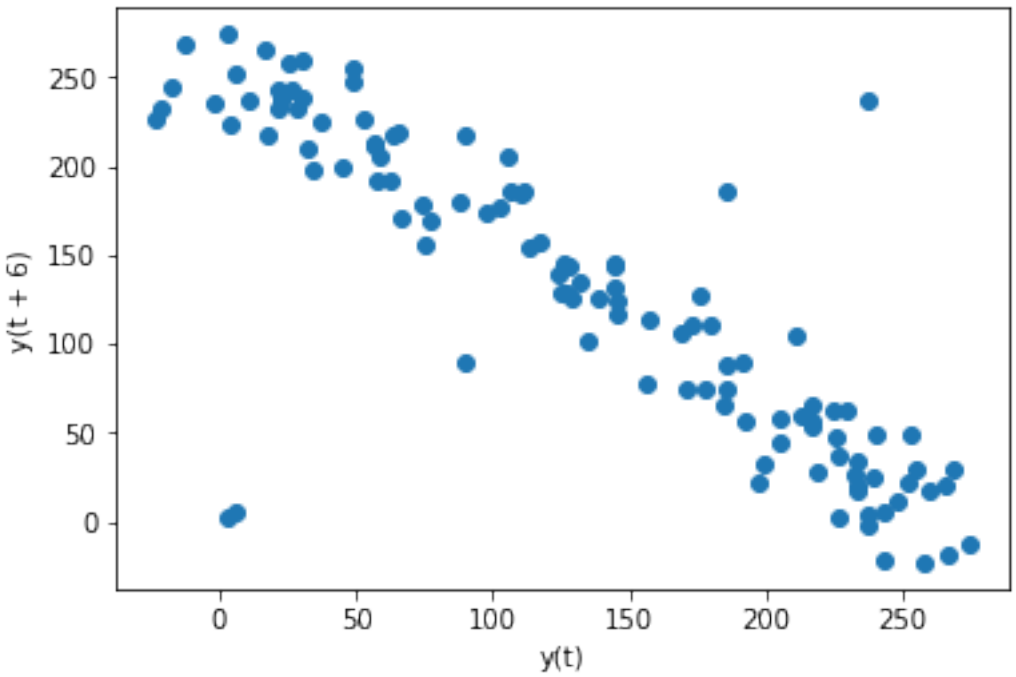
In [36]: _= pd.plotting.lag_plot(cpd['MNTM'],lag=4)



In [37]: _= pd.plotting.lag_plot(cpd['MNTM'],lag=5)



In [38]: `_= pd.plotting.lag_plot(cpd['MNTM'],lag=6)`



In [39]: `_= pd.plotting.lag_plot(cpd['MNTM'],lag=18)`