1. Data Cleaning and EDA with Time Series Data

In [8]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import random
```

In [2]:
```
# importing additional libraries
```

1.1 Load and clean the data

In [9]:
```
dataframe_raw = pd.read_csv("Weather prediction data.txt", delimiter = ",")
```

In [4]:
```
print(type(dataframe_raw))
```

```
<class 'pandas.core.frame.DataFrame'>
```

In [11]:
```
# Add a new column to the data frame with the desired values
# dataframe_raw['temperature_pred'] = 7.77
dataframe_raw['temperature_pred'] = [random.uniform(5,8) for _ in range(len(dataframe_raw))]

# Save the updated data frame to a new CSV file
dataframe_raw.to_csv('Weather prediction data temp_pred.csv', index=False)
```

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

Out[5]:

	Date	Time	Temperature	Air Pressure	Humidity
0	01-10-1996	00:00:00	10.5	996.2	80.0
1	01-10-1996	01:00:00	10.1	995.9	82.0
2	01-10-1996	02:00:00	10.2	995.3	81.0
3	01-10-1996	03:00:00	11.9	995.8	75.0
4	01-10-1996	04:00:00	13.0	995.5	70.0

In [6]:
```
dataframe_raw.describe()
```

Out[6]:

	Temperature	Air Pressure	Humidity
count	206179.000000	206179.000000	206179.000000
mean	7.776598	1012.189222	76.605193
std	8.406977	11.370530	17.845848
min	-24.700000	954.900000	12.000000
25%	1.400000	1005.200000	65.000000
50%	7.400000	1012.600000	81.000000
75%	14.400000	1019.700000	91.000000
max	31.400000	1051.600000	100.000000

In [7]:
```
dataframe_raw.dtypes
```

Out[7]:
```
Date             object
Time             object
Temperature     float64
Air Pressure    float64
Humidity        float64
dtype: object
```

In [8]:
```
#making a copy of the raw data so that we can go back and refer to it later

dataframe = dataframe_raw.copy()
```

In [9]:
```
#Combining the ‘Date’ and ‘Time’ columns into a column called ‘Datetime’ and converting it into a datetime datatype.

dataframe['Datetime'] = (dataframe['Date'].apply(str)+" "+ dataframe['Time'].apply(str))
```

In [10]:
```
dataframe.head()
```

Out[10]:

	Date	Time	Temperature	Air Pressure	Humidity	Datetime
0	01-10-1996	00:00:00	10.5	996.2	80.0	01-10-1996 00:00:00
1	01-10-1996	01:00:00	10.1	995.9	82.0	01-10-1996 01:00:00
2	01-10-1996	02:00:00	10.2	995.3	81.0	01-10-1996 02:00:00
3	01-10-1996	03:00:00	11.9	995.8	75.0	01-10-1996 03:00:00
4	01-10-1996	04:00:00	13.0	995.5	70.0	01-10-1996 04:00:00

In [11]:
```
# formatting the 'Datetime' column

dataframe['Datetime'] = pd.to_datetime(dataframe['Datetime'], format = "%d-%m-%Y %H:%M:%S")
```

In [12]:
```
# using the pd.to_numeric function to convert the rest of the columns

dataframe[dataframe.columns[2:-1]] = dataframe[dataframe.columns[2:-1]].apply(pd.to_numeric, errors ='coerce')
```

In [13]:
```
# using the Datetime column to turn the Date and Time columns into date and time dtypes.

dataframe['Date'] = dataframe['Datetime'].dt.date
dataframe['Time'] = dataframe['Datetime'].dt.time
```

In [14]:
```
dataframe.dtypes
```

Out[14]:
```
Date                    object
Time                    object
Temperature            float64
Air Pressure           float64
Humidity               float64
Datetime        datetime64[ns]
dtype: object
```

In [15]:
```
# Date and Time columns are still of type “object”

dataframe.Date[0]
```

Out[15]:
```
datetime.date(1996, 10, 1)
```

In [16]:
```
dataframe.Time[0]
```

Out[16]:
```
datetime.time(0, 0)
```

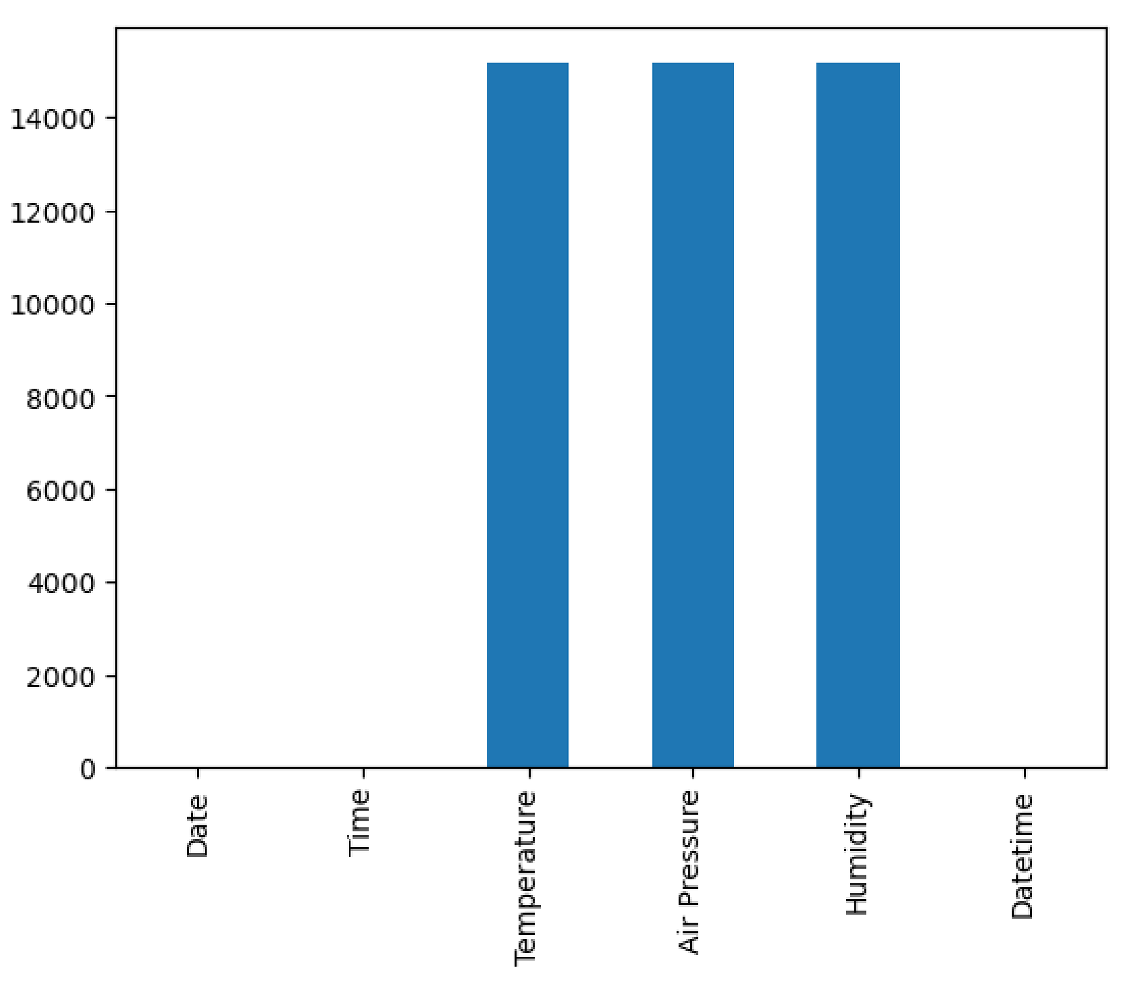
In [17]:
```
#Looking at the describe() results

#using datetime_is_numeric = True to get statistics on the datetime column

desc = dataframe.describe(datetime_is_numeric = True)

#forcing the printout not to use scientific notation

desc[desc.columns[:-1]] = desc[desc.columns[:-1]].apply(lambda x: x.apply("{0:.4f}".format))

desc
```

Out[17]:

	Temperature	Air Pressure	Humidity	Datetime
count	206179.0000	206179.0000	206179.0000	221352
mean	7.7766	1012.1892	76.6052	2009-05-17 11:30:00
min	-24.7000	954.9000	12.0000	1996-10-01 00:00:00
25%	1.4000	1005.2000	65.0000	2003-01-23 17:45:00
50%	7.4000	1012.6000	81.0000	2009-05-17 11:30:00
75%	14.4000	1019.7000	91.0000	2015-09-09 05:15:00
max	31.4000	1051.6000	100.0000	2021-12-31 23:00:00
std	8.4070	11.3705	17.8458	NaN

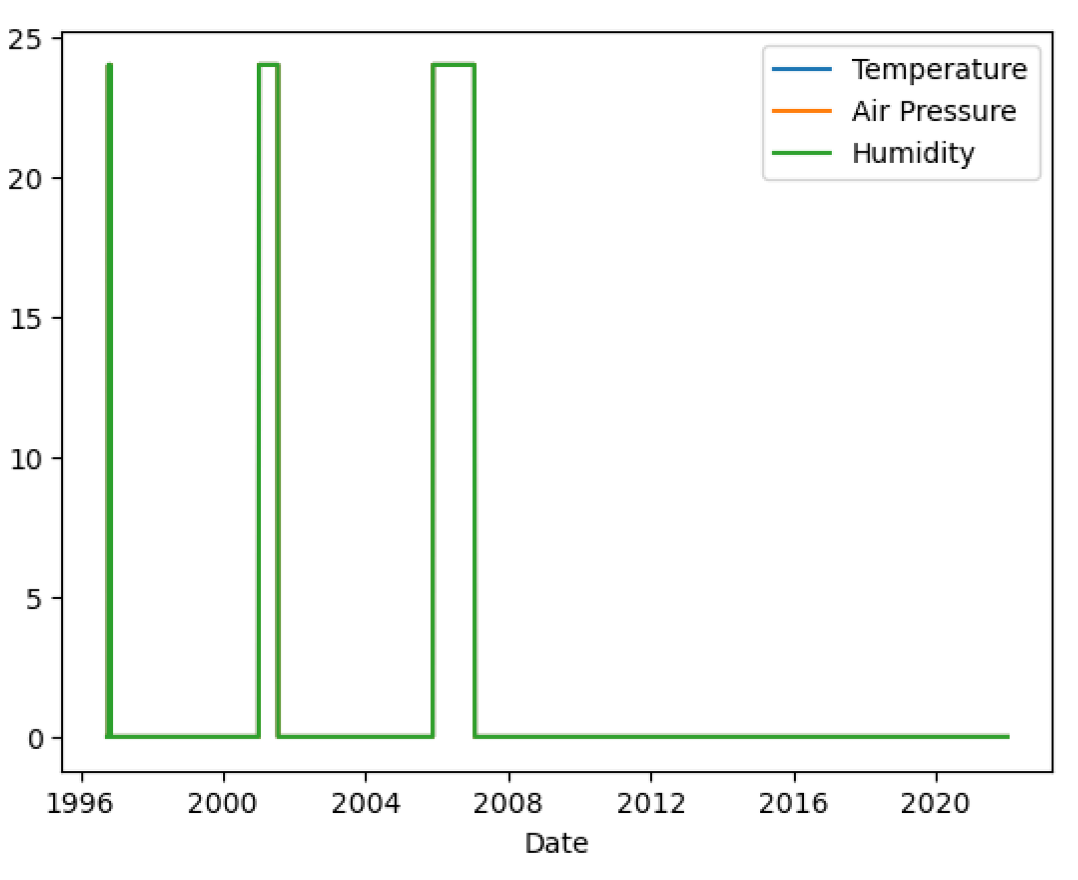
In [18]:
```
#visualizing the missing data

dataframe.isna().sum().plot.bar()
```

Out[18]:
```
<AxesSubplot:>
```



In [19]:
```
dataframe_na = dataframe.drop('Date', axis = 1).isna().groupby(dataframe.Date, sort = False).sum().reset_index()
dataframe_na.plot(x='Date', y=dataframe_na.columns[2:-1])
```

Out[19]:
```
<AxesSubplot:xlabel='Date'>
```



In [20]:
```
#cleaning up the missing data

dataframe = dataframe.dropna()
```

In [21]:
```
#using  datetime_is_numeric = True to get statistics on the datetime column

desc = dataframe.describe(datetime_is_numeric = True)

#forcing the printout not to use scientific notation

desc[desc.columns[:-1]] = desc[desc.columns[:-1]].apply(lambda x: x.apply("{0:.4f}".format))

desc
```

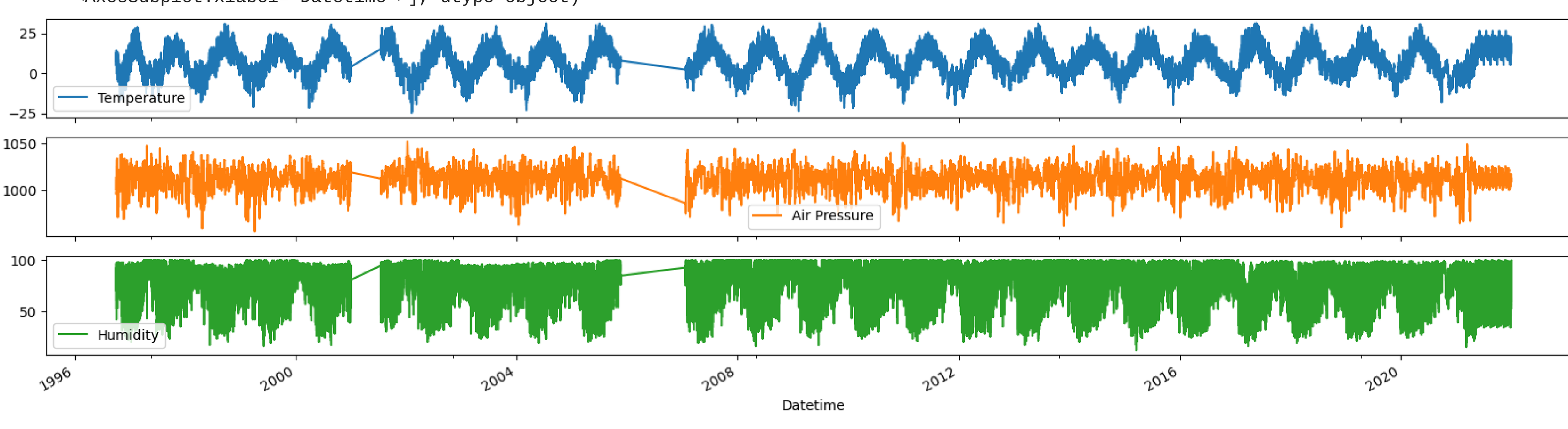
Out[21]:

	Temperature	Air Pressure	Humidity	Datetime
count	206179.0000	206179.0000	206179.0000	206179
mean	7.7766	1012.1892	76.6052	2009-09-19 21:13:44.627144448
min	-24.7000	954.9000	12.0000	1996-10-01 00:00:00
25%	1.4000	1005.2000	65.0000	2003-03-12 09:30:00
50%	7.4000	1012.6000	81.0000	2010-03-29 14:00:00
75%	14.4000	1019.7000	91.0000	2016-02-14 06:30:00
max	31.4000	1051.6000	100.0000	2021-12-31 23:00:00
std	8.4070	11.3705	17.8458	NaN

Visualizing the data

In [22]:
```
#for visualization of the data building the line chart here

dataframe.plot('Datetime', ['Temperature', 'Air Pressure', 'Humidity'], subplots = True, figsize = (20,5))
```

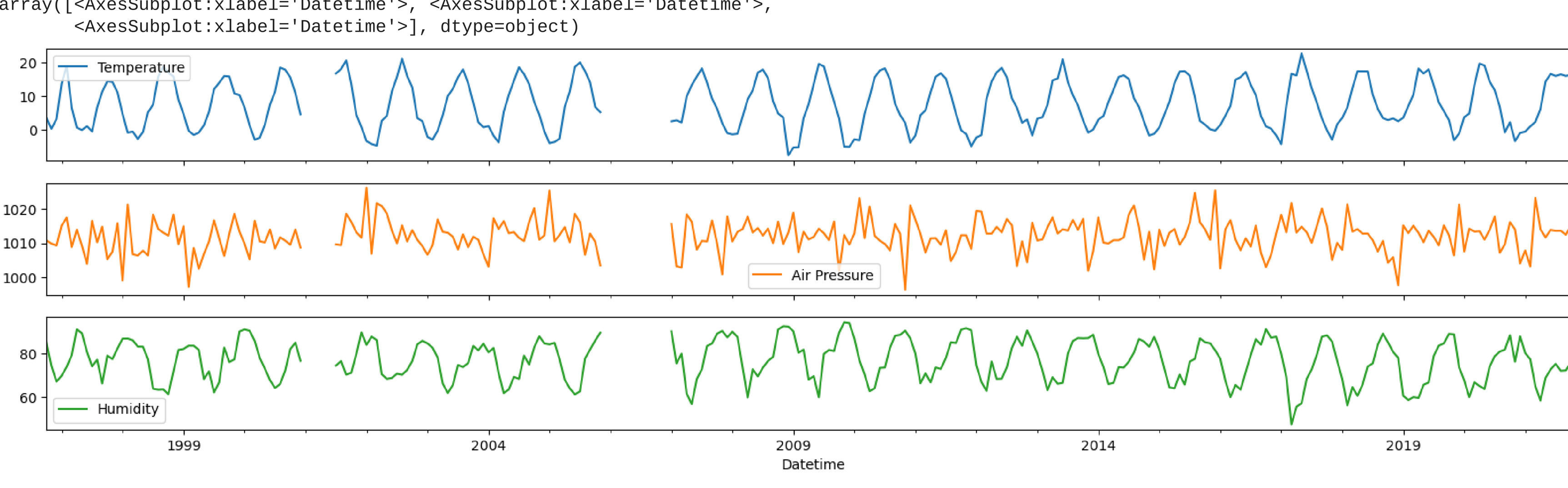
Out[22]:
```
array([<AxesSubplot:xlabel='Datetime'>, <AxesSubplot:xlabel='Datetime'>,
       <AxesSubplot:xlabel='Datetime'>], dtype=object)
```



In [23]:
```
#computing the monthly average here

dataframe_avg = dataframe.groupby(pd.Grouper(key = "Datetime", freq = "1M")).mean()
```

In [24]:
```
#building your linechart here

dataframe_avg.plot(y=['Temperature', 'Air Pressure', 'Humidity'], use_index = True, subplots = True, figsize = (20,5))
```

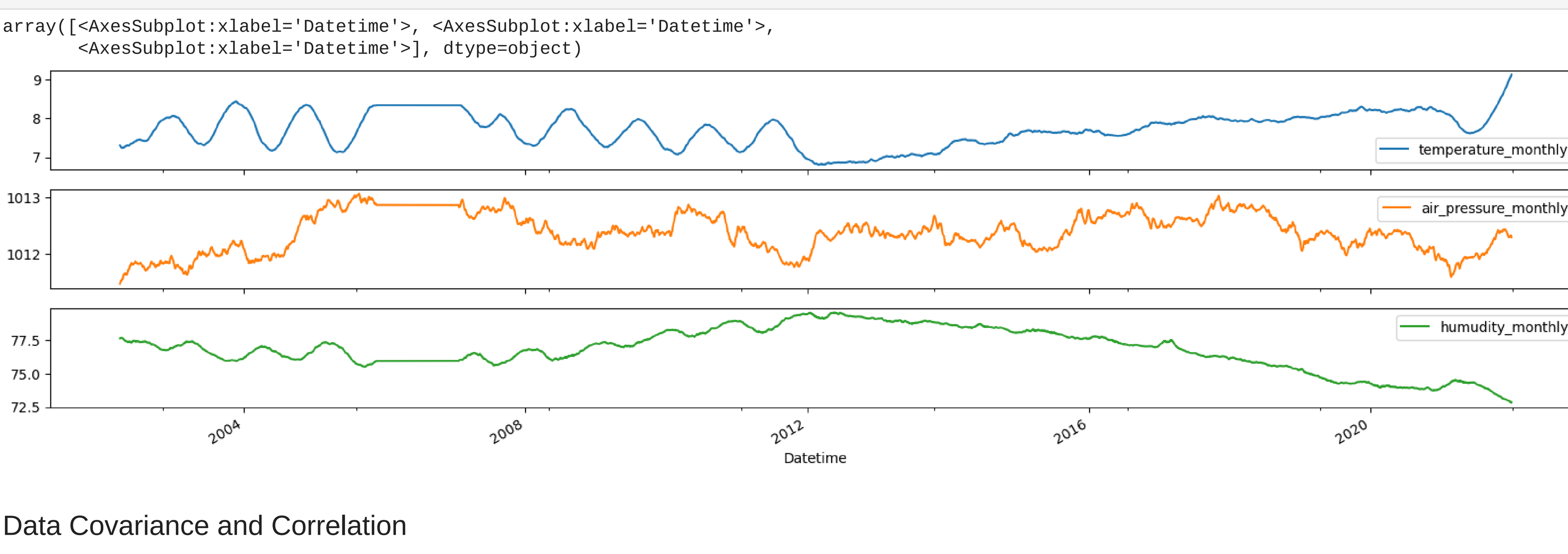
Out[24]:
```
array([<AxesSubplot:xlabel='Datetime'>, <AxesSubplot:xlabel='Datetime'>,
       <AxesSubplot:xlabel='Datetime'>], dtype=object)
```



In [25]:
```
#computing your moving average here

dataframe[['temperature_monthly', 'air_pressure_monthly', 'humudity_monthly']] = dataframe[['Temperature', 'Air Pressure', 'Humidity']].rolling(24*
```

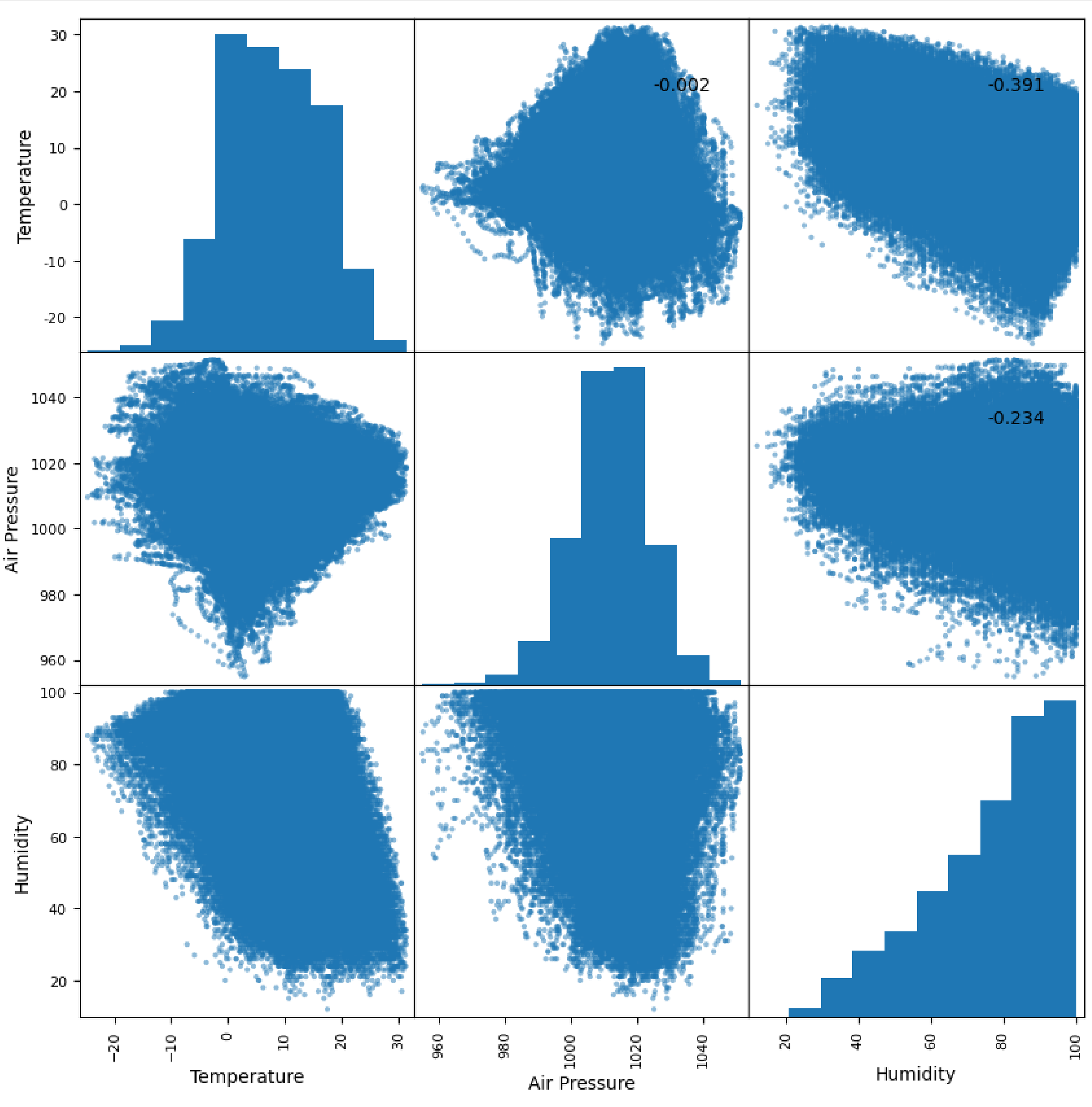
In [26]:
```
#building the line chart on the moving average

dataframe.plot('Datetime', ['temperature_monthly', 'air_pressure_monthly', 'humudity_monthly'],subplots = True, figsize = (20,5))
```

Out[26]:
```
array([<AxesSubplot:xlabel='Datetime'>, <AxesSubplot:xlabel='Datetime'>,
       <AxesSubplot:xlabel='Datetime'>], dtype=object)
```



Data Covariance and Correlation

In [27]:
```
# Correlation Matrix for the three parameters 'Temperature', 'Air Pressure', 'Humidity'

axes = pd.plotting.scatter_matrix(dataframe[['Temperature', 'Air Pressure', 'Humidity']], alpha=0.5, figsize=[10, 10])

corr = dataframe[['Temperature', 'Air Pressure', 'Humidity']].corr(method='spearman').to_numpy()

for i, j in zip(*plt.np.triu_indices_from(axes, k=1)):
    axes[i, j].annotate("%.3f" % corr[i, j], (0.8, 0.8), xycoords='axes fraction', ha='center', va='center')

plt.show()
```



In [28]:
```
#Cleaned data after the data processing and cleaning phase

dataframe.to_csv("Weather prediction cleaned data.csv")
```