冯汇然, 12231095, Assignment 02, Due: 11/08 19:00

1. Significant earthquakes since 2150 B.C.

The Significant Earthquake Database contains information on destructive earthquakes from 2150 B.C. to the present. On the top left corner, select all columns and download the entire significant earthquake data file in `.tsv` format by clicking the `Download TSV` File button. Click the variable name for more information. Read the file (e.g., `earthquakes-2023-10-24_16-20-01_+0800.tsv`) as an object and name it `Sig_Eqs`.

1.1 [5 points] Compute the total number of deaths caused by earthquakes since 2150 B.C. in each country, and then print the top ten countries along with the total number of deaths.

1.2 [10 points] Compute the total number of earthquakes with magnitude larger than `6.0` (use column `Mag` as the magnitude) worldwide each year, and then plot the time series. Do you observe any trend? Explain why or why not?

1.3 [10 points] Write a function `CountEq_LargestEq` that returns both (1) the total number of earthquakes since 2150 B.C. in a given country AND (2) the date of the largest earthquake ever happened in this country. Apply `CountEq_LargestEq` to every country in the file, report your results in a descending order.

ANS. 1.1

In [1]:

```python
import pandas as pd
import numpy as np
import matplotlib as plt
```

In [2]:

```python
# Read the earthquake data into a DataFrame
Sig_Eqs = pd.read_table('earthquakes-2023-11-01_21-34-03_+0800.tsv')

# Drop the useless index and column
Sig_Eqs = Sig_Eqs.drop(index=0, columns='Search Parameters')

# Show the index, columns, and values in this 'tsv' table
Sig_Eqs
```

Out[2]:

	Id	Year	Mo	Dy	Hr	Mn	Sec	Tsu	Vol	Country	...	Total Missing	De
1	1.0	-2150.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	JORDAN	...	NaN	
2	2.0	-2000.0	NaN	NaN	NaN	NaN	NaN	1.0	NaN	SYRIA	...	NaN	

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3	3.0	-2000.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	TURKMENISTAN	...	NaN
4	5877.0	-1610.0	NaN	NaN	NaN	NaN	NaN	3.0	1351.0	GREECE	...	NaN
5	8.0	-1566.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	ISRAEL	...	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
6394	10708.0	2023.0	10.0	7.0	6.0	41.0	3.0	NaN	NaN	AFGHANISTAN	...	NaN
6395	10711.0	2023.0	10.0	7.0	8.0	40.0	13.0	NaN	NaN	PAPUA NEW GUINEA	...	NaN
6396	10709.0	2023.0	10.0	8.0	20.0	25.0	23.0	5891.0	NaN	JAPAN	...	NaN
6397	10710.0	2023.0	10.0	11.0	0.0	41.0	56.0	NaN	NaN	AFGHANISTAN	...	NaN
6398	10712.0	2023.0	10.0	15.0	3.0	36.0	0.0	NaN	NaN	AFGHANISTAN	...	NaN

6398 rows × 48 columns

In [3]:

```
# 'Total Deaths' - Total Number of Deaths from the Earthquake and secondary effects (eg Tsunami)

# groupby('Country'): Group by Country
# .sum().sort_values(...): Sum the 'Total Deaths' of all countries, and output them in descending order
# .head(): output the first 10 lines of 'Total Deaths'
Sig_Eqs.groupby('Country').sum().sort_values('Total Deaths',ascending=0)[['Total Deaths']].head(10)
```

Out[3]:

	Total Deaths
Country	
CHINA	2041929.0
TURKEY	995648.0
IRAN	758650.0
SYRIA	437700.0
ITALY	422679.0
JAPAN	356083.0
HAITI	323776.0
AZERBAIJAN	310119.0
INDONESIA	282819.0
ARMENIA	189000.0

In [4]:

```
# 'Deaths'- Number of Deaths from the Earthquake

# groupby('Country'): Group by Country
# .sum().sort_values(...): Sum the 'Deaths' of all countries, and output them in descending order
```

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```
# Finally, output the first 10 lines of 'Deaths'
Sig_Eqs.groupby('Country').sum().sort_values('Deaths',ascending=
[['Deaths']].head(10)
```

Out[4]:

	Deaths
Country	
CHINA	2075045.0
TURKEY	1188881.0
IRAN	1011449.0
ITALY	498478.0
SYRIA	439224.0
HAITI	323478.0
AZERBAIJAN	317219.0
JAPAN	279085.0
ARMENIA	191890.0
PAKISTAN	145083.0

ANS. 1.2

In [5]:

```
# Add a new column named 'count'
Sig_Eqs['count'] = np.zeros(Sig_Eqs.index.shape)

# Define a custom function that checks if 'Mag' is greater than
6
def update_count(row):
    if row['Mag'] > 6:
        return 1
    else:
        return 0

# Apply the custom function to each row of the 'Sig_Eqs'
DataFrame and update the 'count' column
Sig_Eqs['count'] = Sig_Eqs.apply(update_count, axis=1)
Sig_Eqs
```

Out[5]:

	Id	Year	Mo	Dy	Hr	Mn	Sec	Tsu	Vol	Country	...	Total Missing Description
1	1.0	-2150.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	JORDAN	...	NaN
2	2.0	-2000.0	NaN	NaN	NaN	NaN	NaN	1.0	NaN	SYRIA	...	NaN
3	3.0	-2000.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	TURKMENISTAN	...	NaN
						NaN	NaN	3.0	1351.0	GREECE	...	NaN

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5	8.0	-1566.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	ISRAEL	...	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
6394	10708.0	2023.0	10.0	7.0	6.0	41.0	3.0	NaN	NaN	AFGHANISTAN	...	NaN
6395	10711.0	2023.0	10.0	7.0	8.0	40.0	13.0	NaN	NaN	PAPUA NEW GUINEA	...	NaN
6396	10709.0	2023.0	10.0	8.0	20.0	25.0	23.0	5891.0	NaN	JAPAN	...	NaN
6397	10710.0	2023.0	10.0	11.0	0.0	41.0	56.0	NaN	NaN	AFGHANISTAN	...	NaN
6398	10712.0	2023.0	10.0	15.0	3.0	36.0	0.0	NaN	NaN	AFGHANISTAN	...	NaN

6398 rows × 49 columns

In [6]:

```
# Determine the year scale to show
yearly_counts = Sig_Eqs.groupby('Year').sum()['count']
years = yearly_counts.index
x_values = list(range(len(years)))

# Determine the year to display every 50 years
x_ticks = [x for x in x_values if x % 50 == 0]
x_labels = [years[x] for x in x_ticks]

# Create a bar chart
ax = yearly_counts.plot(kind='bar',
                        grid=True,
                        title='The total number of earthquakes with magnitude larger than 6.0 worldwide each year',
                        xlabel='Year',
                        ylabel='Count',
                        figsize=(10,3),
                        color='r')
ax.set_xticks(x_ticks)
ax.set_xticklabels(x_labels, rotation=45)
```

Out[6]:

```
[Text(0, 0, '-2150.0'),
 Text(50, 0, '27.0'),
 Text(100, 0, '348.0'),
 Text(150, 0, '565.0'),
 Text(200, 0, '845.0'),
 Text(250, 0, '1008.0'),
 Text(300, 0, '1143.0'),
 Text(350, 0, '1286.0'),
 Text(400, 0, '1375.0'),
 Text(450, 0, '1478.0'),
 Text(500, 0, '1545.0'),
 Text(550, 0, '1606.0'),
 Text(600, 0, '1661.0'),
 Text(650, 0, '1714.0'),
 Text(700, 0, '1767.0'),
```

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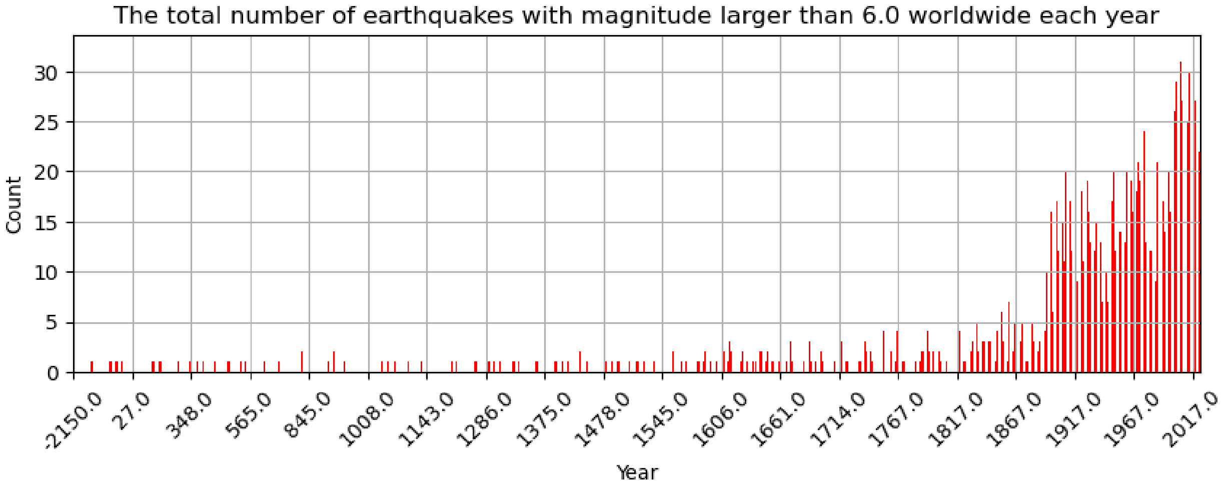
```
Text(800, 0, '1867.0'),
Text(850, 0, '1917.0'),
Text(900, 0, '1967.0'),
Text(950, 0, '2017.0')]
```



Explaination: The total number of earthquakes with magnitude larger than 6.0 worldwide each year is `steady` from 2150 B.C. to 1817 A.D., and is `increasing` from 1817 A.D. to now.

ANS. 1.3

In [7]:

```python
# Add a column named 'Date', which is like '2023-10-15 3:36:0.0'
# The number '99' means 'NA'
Sig_Eqs['Date'] = Sig_Eqs['Year'].astype(int).astype(str) + '-' + \

Sig_Eqs['Mo'].fillna(99).astype(int).astype(str) + '-' + \

Sig_Eqs['Dy'].fillna(99).astype(int).astype(str) + ' ' + \

Sig_Eqs['Hr'].fillna(99).astype(int).astype(str) + ':' + \

Sig_Eqs['Mn'].fillna(99).astype(int).astype(str) + ':' + \
                  Sig_Eqs['Sec'].fillna(99).astype(str)
Sig_Eqs
```

Out[7]:

	Id	Year	Mo	Dy	Hr	Mn	Sec	Tsu	Vol	Country	...	Total Injuries	De
1	1.0	-2150.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	JORDAN	...	NaN	
2	2.0	-2000.0	NaN	NaN	NaN	NaN	NaN	1.0	NaN	SYRIA	...	NaN	
						NaN	NaN	NaN	NaN	TURKMENISTAN	...	NaN	

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4	5877.0	-1610.0	NaN	NaN	NaN	NaN	NaN	3.0	1351.0	GREECE	...	NaN
5	8.0	-1566.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	ISRAEL	...	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
6394	10708.0	2023.0	10.0	7.0	6.0	41.0	3.0	NaN	NaN	AFGHANISTAN	...	1950.0
6395	10711.0	2023.0	10.0	7.0	8.0	40.0	13.0	NaN	NaN	PAPUA NEW GUINEA	...	NaN
6396	10709.0	2023.0	10.0	8.0	20.0	25.0	23.0	5891.0	NaN	JAPAN	...	NaN
6397	10710.0	2023.0	10.0	11.0	0.0	41.0	56.0	NaN	NaN	AFGHANISTAN	...	164.0
6398	10712.0	2023.0	10.0	15.0	3.0	36.0	0.0	NaN	NaN	AFGHANISTAN	...	153.0

6398 rows × 50 columns

In [8]:

```python
def CountEq_LargestEq(country_data):
    # Calculate the total number of earthquakes in the country
    total_earthquakes = len(country_data)

    # Initialize the maximum earthquake date to 'NAN'
    largest_earthquake_date = 'NAN'

    # First, check if there is any eligible data, and then try to extract the maximum earthquake date.
    # If there is no eligible data or no maximum earthquake date, it will use the default value of "'NAN'
    if not country_data.empty:
        # Find the largest earthquake in the country
        largest_earthquake = country_data[country_data['Mag'] == country_data['Mag'].max()]

        if not largest_earthquake.empty:
            largest_earthquake_date = largest_earthquake['Date'].values[0]

    return total_earthquakes, largest_earthquake_date
```

In [9]:

```python
# Create an empty list to store the results for each country
results = []

# Iterate through unique countries in the data
unique_countries = Sig_Eqs['Country'].unique()

# Total number of contries
unique_countries.shape
```

Out[9]:

```
(157,)
```

In [10]:

```python
for country in unique_countries:
    country_data = Sig_Eqs[Sig_Eqs['Country'] == country]
    total_earthquakes, largest_earthquake_date = CountEq_LargestEq(country_data)
    results.append({'Country': country, 'Total Earthquakes': total_earthquakes, 'Largest Earthquake Date': largest_earthquake_date})
```

In [11]:

```python
# Convert the results to a DataFrame and sort by 'Total Earthquakes' in descending order
results_df = pd.DataFrame(results)
results_df = results_df.sort_values(by='Total Earthquakes', ascending=0)
results_df.head(20)
```

Out[11]:

	Country	Total Earthquakes	Largest Earthquake Date
14	CHINA	620	1668-7-25 99:99:99.0
33	JAPAN	414	2011-3-11 5:46:24.1
68	INDONESIA	411	2004-12-26 0:58:53.4
7	IRAN	384	856-12-22 99:99:99.0
9	TURKEY	335	1939-12-26 23:57:23.8
5	ITALY	331	1915-1-13 6:52:38.0
52	USA	276	1964-3-28 3:36:0.0
3	GREECE	270	365-7-21 99:99:99.0
65	PHILIPPINES	224	1897-9-21 5:12:99.0
49	MEXICO	209	1899-1-24 23:43:0.0
56	CHILE	198	1960-5-22 19:11:17.0
48	PERU	190	1716-2-6 99:99:99.0
15	RUSSIA	152	1952-11-4 16:58:27.9
85	PAPUA NEW GUINEA	101	1919-5-6 19:41:13.0
8	INDIA	100	1950-8-15 14:9:30.0

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72	TAIWAN	100	1920-6-5 4:21:35.0
62	COLOMBIA	80	1826-6-18 3:40:0.0
98	NEW ZEALAND	71	1826-99-99 99:99:99.0
59	ECUADOR	68	1906-1-31 15:36:10.0
22	AFGHANISTAN	66	1909-7-7 21:37:50.0

2. Wind speed in Shenzhen during the past 10 years

In this problem set, we will examine how wind speed changes in Shenzhen during the past `10` years, we will take a look at the hourly weather data measured at the BaoAn International Airport. The data set is from NOAA Integrated Surface Dataset. Download the file 2281305.zip, where the number `2281305` is the site ID. Extract the zip file, you should see a file named `2281305.csv`. Save the `.csv` file to your `working directory`.

Read page `8` - `9` (`POS 65-69` and `POS 70-70`) of the comprehensive user guide for the detailed format of the wind data. Explain how you filter the data in your report.

[10 points] Plot monthly averaged wind speed as a function of the observation time. Is there a trend in monthly averaged wind speed within the past `10` years?

ANS. 2

First, I open `2281305.csv` via notepad, and choose encoding to `'utf-8'` when clicking 'save as' to `2281305_new.csv`. Otherwise, there will be errors like 'utf-8' codec can't decode byte 0x9c in position 4098: invalid start byte.

In [17]:

```
# Read the wind speed data into a DataFrame
Ws_SZ = pd.read_csv('2281305_new.csv',encoding='utf-8')

# Only choose 'DATE' and 'WND'
Ws_SZ = Ws_SZ[['DATE', 'WND']]

# Split 'WND' into 'direction_angle', 'direction_quality', 'type', 'speed' and 'speed_quality'
Ws_SZ[['direction_angle', 'direction_quality', 'type', 'speed', 'speed_quality']] = Ws_SZ['WND'].str.split(',', expand=True)

# Split 'DATE' into 'yyyymm' and 'ddHHMMSS'
Ws_SZ[['yyyy', 'mm', 'ddHHMMSS']] = Ws_SZ['DATE'].str.split('-', expand=True)

# yyyy + mm
```

```
Ws_SZ['yyyymm'] = Ws_SZ['yyyy'].astype(str) + '-' +
Ws_SZ['mm'].astype(str)

# Show the Data Frame
Ws_SZ
```

```
C:\Users\dell\AppData\Local\Temp\ipykernel_19460\3690991221.py:2: DtypeWarning:
Columns (0,2,4,8,9,12,15,21,22,24,26,31,33,34) have mixed types. Specify dtype
option on import or set low_memory=False.
  Ws_SZ = pd.read_csv('2281305_new.csv',encoding='utf-8')
```

Out[17]:

	DATE	WND	direction_angle	direction_quality	type	speed	speed_quality	yyy
0	2010-01-02T00:00:00	040,1,N,0020,1	040	1	N	0020	1	201
1	2010-01-02T01:00:00	999,9,V,0010,1	999	9	V	0010	1	201
2	2010-01-02T02:00:00	999,9,C,0000,1	999	9	C	0000	1	201
3	2010-01-02T03:00:00	140,1,N,0010,1	140	1	N	0010	1	201
4	2010-01-02T04:00:00	300,1,N,0040,1	300	1	N	0040	1	201
...	...	...	...	...	...	...	...	...
112346	2020-09-11T17:00:00	170,1,N,0030,1	170	1	N	0030	1	202
112347	2020-09-11T18:00:00	180,1,N,0040,1	180	1	N	0040	1	202
112348	2020-09-11T19:00:00	220,1,V,0030,1	220	1	V	0030	1	202
112349	2020-09-11T20:00:00	260,1,N,0030,1	260	1	N	0030	1	202
112350	2020-09-11T21:00:00	310,1,V,0020,1	310	1	V	0020	1	202

112351 rows × 11 columns

In [18]:

```
## Quality control

# 1. Drop direction_angle == 999
Ws_SZ = Ws_SZ[Ws_SZ['direction_angle'] != '999']

# 2. Drop direction_quality in [2,3,6,7]
Ws_SZ = Ws_SZ[~Ws_SZ['direction_quality'].isin(['2', '3', '6',
'7'])]

# 3. Drop type == 9
Ws_SZ = Ws_SZ[Ws_SZ['type'] != '9']
```

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```
# 4. Drop speed == 9999
Ws_SZ = Ws_SZ[Ws_SZ['speed'] != '999.9']
Ws_SZ['speed'] = (Ws_SZ['speed'].astype(float))/10

# 5. Drop speed_quality in [2,3,6,7]
Ws_SZ = Ws_SZ[~Ws_SZ['speed_quality'].isin(['2', '3', '6', '7'])]

## Show
Ws_SZ
```

Out[18]:

	DATE	WND	direction_angle	direction_quality	type	speed	speed_quality	yyy
0	2010-01-02T00:00:00	040,1,N,0020,1	040	1	N	2.0	1	201
3	2010-01-02T03:00:00	140,1,N,0010,1	140	1	N	1.0	1	201
4	2010-01-02T04:00:00	300,1,N,0040,1	300	1	N	4.0	1	201
5	2010-01-02T05:00:00	320,1,N,0050,1	320	1	N	5.0	1	201
6	2010-01-02T06:00:00	270,1,N,0010,1	270	1	N	1.0	1	201
...	...	...	...	...	...	...	...	
112346	2020-09-11T17:00:00	170,1,N,0030,1	170	1	N	3.0	1	202
112347	2020-09-11T18:00:00	180,1,N,0040,1	180	1	N	4.0	1	202
112348	2020-09-11T19:00:00	220,1,V,0030,1	220	1	V	3.0	1	202
112349	2020-09-11T20:00:00	260,1,N,0030,1	260	1	N	3.0	1	202
112350	2020-09-11T21:00:00	310,1,V,0020,1	310	1	V	2.0	1	202

106029 rows × 11 columns

In [19]:

```
# Plot
Ws_SZ.groupby('yyyymm').mean()['speed'].plot(figsize=(9,3),
                                             title='Monthly Wind Speed in ShenZhen Site',
                                             ylabel='Wind Speed (m/s)',
                                             xlabel='Month',
                                             grid=True)
```

Out[19]:

```
<AxesSubplot:title={'center':'Monthly Wind Speed in ShenZhen Site'}, xlabel='Mo
```

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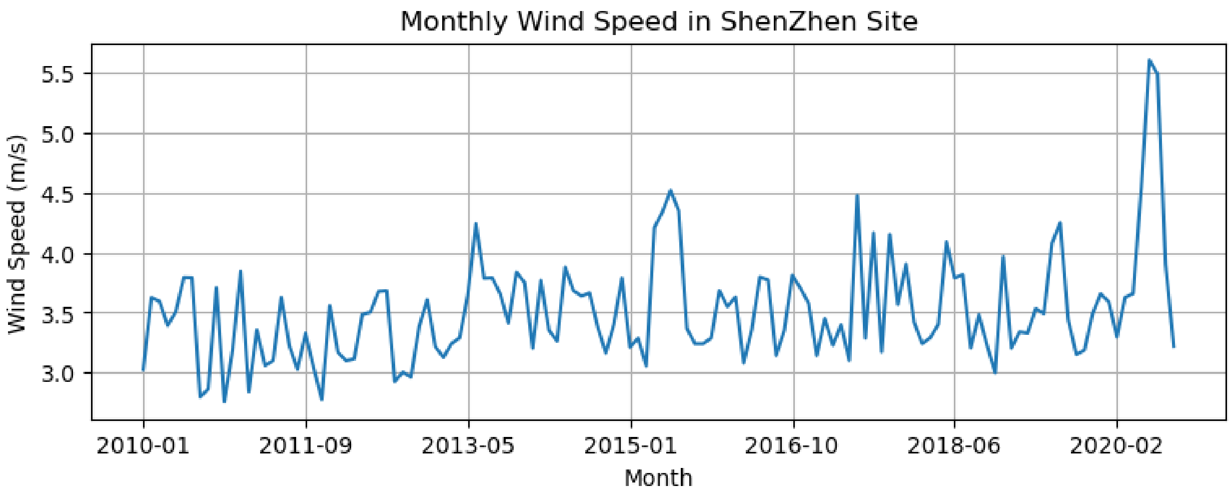

Thus, there seems an insignificant increasing trend of wind speed from 2010-10 to 2020-02 in this Shen Zhen Site, without trend significance calculation and only obtaining it through observation.

3. Explore a data set

Browse the CASEarth, National Centers for Environmental Information (NCEI), or Advanced Global Atmospheric Gases Experiment (AGAGE) website. Search and download a data set you are interested in. You are also welcome to use data from your group in this problem set. But the data set should be in `csv`, `XLS`, or `XLSX` format, and have temporal information.

3.1 [5 points] Load the csv, XLS, or XLSX file, and clean possible data points with missing values or bad quality.

3.2 [5 points] Plot the time series of a certain variable.

3.3 [5 points] Conduct at least 5 simple statistical checks with the variable, and report your findings.

ANS. 3.1

I download the csv data in hourly data in JIANGBEI CHINA, 2021 from NCEI.

In [20]:

```
# Read data as table
Jiangbei_df = pd.read_table('57516099999.csv',delimiter=',')

# Choose 5 columns
Jiangbei_df = Jiangbei_df[['DATE', 'WND', 'TMP', 'DEW', 'SLP']]

# Split 'WND' into 'direction_angle', 'direction_quality', 'type', 'speed' and 'speed_quality'
Jiangbei_df[['direction_angle', 'direction_quality', 'type', 'speed', 'speed_quality']] = Jiangbei_df['WND'].str.split(',', expand=True)
```

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```python
Jiangbei_df['speed'] =
(Jiangbei_df['speed'].astype('float'))/10
Jiangbei_df['direction_angle'] =
Jiangbei_df['direction_angle'].astype('float')

# Split 'TMP' into 'tmp_value' and 'tmp_quality'
Jiangbei_df[['tmp_value', 'tmp_quality']]  =
Jiangbei_df['TMP'].str.split(',', expand=True).astype('float')
Jiangbei_df['tmp_value'] = Jiangbei_df['tmp_value']/10

# Split 'DEW' into 'dew_value' and 'dew_quality'
Jiangbei_df[['dew_value', 'dew_quality']] =
Jiangbei_df['DEW'].str.split(',', expand=True).astype('float')
Jiangbei_df['dew_value'] = Jiangbei_df['dew_value']/10

# Split SLP into 'slp_value' and 'slp_quality'
Jiangbei_df[['slp_value', 'slp_quality']] =
Jiangbei_df['SLP'].str.split(',', expand=True).astype('float')
Jiangbei_df['slp_value'] = Jiangbei_df['slp_value']/10

# Split 'DATE' into 'yyyymmdd' and 'HHMMSS'
Jiangbei_df[['yyyymmdd', 'ddHHMMSS']] =
Jiangbei_df['DATE'].str.split('T', expand=True)

# Show
Jiangbei_df
```

Out[20]:

	DATE	WND	TMP	DEW	SLP	direction_angle	direction_quality	type
0	2021-01-01T00:00:00	320,1,N,0010,1	+0060,1	+0045,1	10319,1	320.0	1	N
1	2021-01-01T00:00:00	999,9,V,0010,1	+0050,1	+0030,1	99999,9	999.0	9	V
2	2021-01-01T01:00:00	999,9,V,0010,1	+0050,1	+0030,1	99999,9	999.0	9	V
3	2021-01-01T02:00:00	150,1,V,0020,1	+0060,1	+0040,1	99999,9	150.0	1	V
4	2021-01-01T03:00:00	310,1,N,0010,1	+0063,1	+0045,1	10318,1	310.0	1	N
...	...	...	...	...	...	...	...	...
11505	2021-12-31T20:00:00	999,9,V,0010,1	+0060,1	+0030,1	99999,9	999.0	9	V
11506	2021-12-31T21:00:00	271,1,N,0007,1	+0072,1	+0039,1	10314,1	271.0	1	N
11507	2021-12-31T21:00:00	230,1,N,0020,1	+0050,1	+0030,1	99999,9	230.0	1	N
		,1	+0030,1	99999,9		999.0	9	V

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	31T22:00:00							
11509	2021-12-31T23:00:00	150,1,N,0020,1	+0050,1	+0040,1	99999,9	150.0	1	N

11510 rows × 18 columns

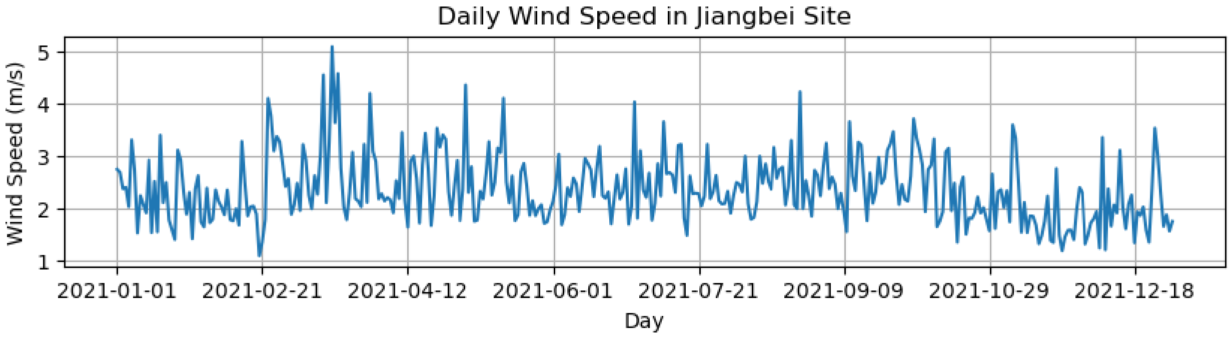
ANS. 3.2

In [21]:

```
## Quality control

# 1. Drop direction_angle == 999
Jiangbei_df = Jiangbei_df[Jiangbei_df['direction_angle'] !=
999]

# 2. Drop direction_quality in [2,3,6,7]
Jiangbei_df =
Jiangbei_df[~Jiangbei_df['direction_quality'].isin(['2', '3',
'6', '7'])]

# 3. Drop type == 9
Jiangbei_df = Jiangbei_df[Jiangbei_df['type'] != '9']

# 4. Drop speed_quality in [2,3,6,7]
Jiangbei_df =
Jiangbei_df[~Jiangbei_df['speed_quality'].isin(['2', '3', '6',
'7'])]

## Plot
Jiangbei_df.groupby('yyyymmdd').mean()['speed'].plot(figsize=
(10,2),

title='Daily Wind Speed in Jiangbei Site',

ylabel='Wind Speed (m/s)',

xlabel='Day',
                                                      grid=True)
```

Out[21]:

```
<AxesSubplot:title={'center':'Daily Wind Speed in Jiangbei Site'}, xlabel='Da
y', ylabel='Wind Speed (m/s)'>
```

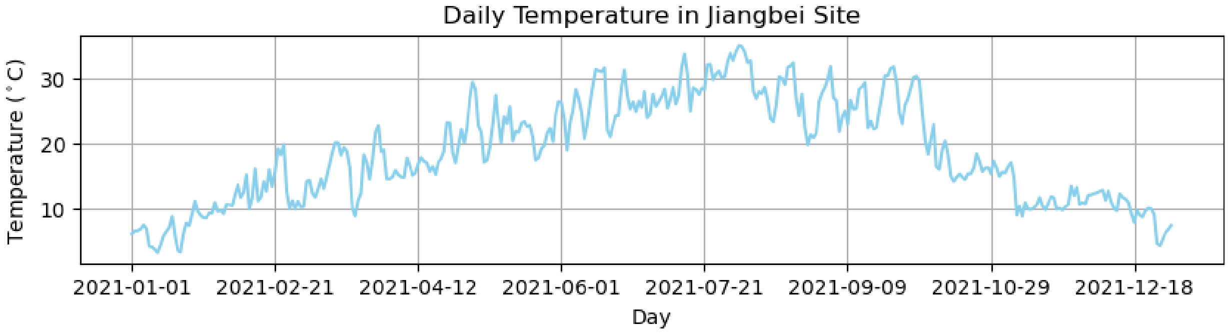


In [22]:

```
## Quality control

# Drop tmp_quality != 1
Jiangbei_df = Jiangbei_df[Jiangbei_df['tmp_quality'] == 1]

## Plot
Jiangbei_df.groupby('yyyymmdd').mean()
['tmp_value'].plot(figsize=(10,2),

title='Daily Temperature in Jiangbei Site',

ylabel=r'Temperature ($^\circ$C)',

xlabel='Day',

grid=True,

color='skyblue')
```

Out[22]:

```
<AxesSubplot:title={'center':'Daily Temperature in Jiangbei Site'}, xlabel='Da
y', ylabel='Temperature ($^\\circ$C)'>
```



In [23]:

```
## Quality control

# Drop tmp_quality != 1
Jiangbei_df = Jiangbei_df[Jiangbei_df['dew_quality'] == 1]

## Plot
Jiangbei_df.groupby('yyyymmdd').mean()
e=(10,2),
```

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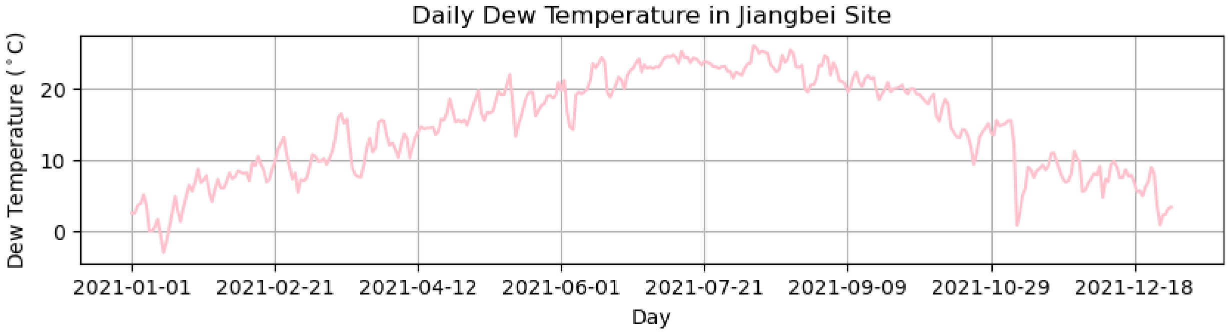
```
title='Daily Dew Temperature in Jiangbei Site',

ylabel=r'Dew Temperature ($^\circ$C)',

xlabel='Day',

grid=True,

color='pink')
```

Out[23]:

```
<AxesSubplot:title={'center':'Daily Dew Temperature in Jiangbei Site'}, xlabel
='Day', ylabel='Dew Temperature ($^\\circ$C)'>
```



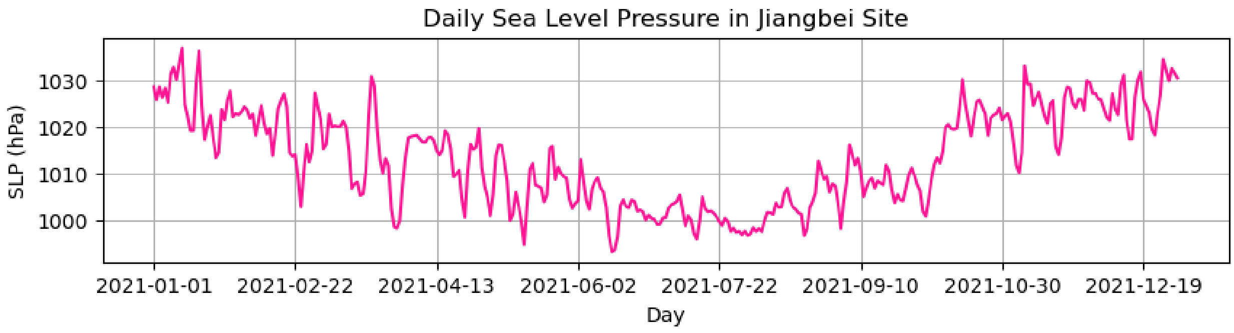
Actually, I can show tmp and dew in the same picture, but there's no time to polish my code...

In [24]:

```
## Quality control

# Drop tmp_quality != 1
Jiangbei_df = Jiangbei_df[Jiangbei_df['slp_quality'] == 1]

## Plot
Jiangbei_df.groupby('yyyymmdd').mean()
['slp_value'].plot(figsize=(10,2),

title='Daily Sea Level Pressure in Jiangbei Site',

ylabel='SLP (hPa)',

xlabel='Day',

grid=True,

color='deeppink')
```

Out[24]:

```
<AxesSubplot:title={'center':'Daily Sea Level Pressure in Jiangbei Site'}, xlab
el='Day', ylabel='SLP (hPa)'>
```



ANS. 3.3

In [25]:

```
print('In Jiangbei site, during the whole 2021, the following average values are shown:\n')

speed_mean_yyyy = Jiangbei_df['speed'].mean()
print('1. The average wind speed is','%.3f'%speed_mean_yyyy,'m/s\n')

tmp_mean_yyyy = Jiangbei_df['tmp_value'].mean()
print('2. The average temperatue is','%.3f'%tmp_mean_yyyy,'\u00b0C.')

dew_mean_yyyy = Jiangbei_df['dew_value'].mean()
print('3. The average dew point temperature is','%.3f'%dew_mean_yyyy,'\u00b0C.')
print('The temperature is close to the dew point temperature, indicating the relative humidity is high.\n')

slp_mean_yyyy = Jiangbei_df['slp_value'].mean()
print('4. The average sea level pessure is','%.3f'%slp_mean_yyyy,'hPa.')
```

```
In Jiangbei site, during the whole 2021, the following average values are show
n:

1. The average wind speed is 1.126 m/s

2. The average temperatue is 19.463 °C.
3. The average dew point temperature is 14.627 °C.
The temperature is close to the dew point temperature, indicating the relative
humidity is high.

4. The average sea level pessure is 1013.628 hPa.
```

In [26]:

```
print('In Jiangbei site, during the whole 2021, the maximum values are shown:\n')

speed_max_yyyy = Jiangbei_df['speed'].max()
```

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```
speed_max_date = Jiangbei_df.at[Jiangbei_df['speed'].idxmax(),
'DATE']
print('5. The maximum wind speed','%.3f'%speed_max_yyyy,'m/s
occurred at', speed_max_date)

tmp_max_yyyy = Jiangbei_df['tmp_value'].max()
tmp_max_date =
Jiangbei_df.at[Jiangbei_df['tmp_value'].idxmax(), 'DATE']
print('6. The maximum temperatue','%.3f'%tmp_max_yyyy,'\u00b0C
occurred at', tmp_max_date)

dew_max_yyyy = Jiangbei_df['dew_value'].max()
dew_max_date =
Jiangbei_df.at[Jiangbei_df['dew_value'].idxmax(), 'DATE']
print('7. The maximum dew point
temperature','%.3f'%dew_max_yyyy,'\u00b0C occurred at',
dew_max_date)

slp_max_yyyy = Jiangbei_df['slp_value'].max()
slp_max_date =
Jiangbei_df.at[Jiangbei_df['slp_value'].idxmax(), 'DATE']
print('8. The maximum  sea level
pessure','%.3f'%slp_max_yyyy,'hPa occurred at', slp_max_date)
```

```
In Jiangbei site, during the whole 2021, the maximum values are shown:

5. The maximum wind speed 5.000 m/s occurred at 2021-05-02T15:00:00
6. The maximum temperatue 40.700 °C occurred at 2021-08-03T09:00:00
7. The maximum dew point temperature 26.600 °C occurred at 2021-08-21T15:00:00
8. The maximum  sea level pessure 1040.900 hPa occurred at 2021-01-17T03:00:00
```

In [27]:

```
# Choose 4 values!!!
NewJiangbei_df =
Jiangbei_df[['speed','direction_angle','tmp_value','dew_value','



# Make a new column
NewJiangbei_df['wind_direction'] = 'N'

# Assign wind directions
NewJiangbei_df.loc[ (NewJiangbei_df['direction_angle'] <= 135 )
& (NewJiangbei_df['direction_angle'] > 45 ), ['wind_direction']
] = 'E'
NewJiangbei_df.loc[ (NewJiangbei_df['direction_angle'] <= 225 )
& (NewJiangbei_df['direction_angle'] > 135 ),
['wind_direction'] ] = 'S'
```

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```
NewJiangbei_df.loc[ (NewJiangbei_df['direction_angle'] <= 315 )
& (NewJiangbei_df['direction_angle'] > 225 ),
['wind_direction'] ] = 'W'

NewJiangbei_df
```

```
C:\Users\dell\AppData\Local\Temp\ipykernel_19460\2920269344.py:5: SettingWithCo
pyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/sta
ble/user_guide/indexing.html#returning-a-view-versus-a-copy
  NewJiangbei_df['wind_direction'] = 'N'
```

Out[27]:

	speed	direction_angle	tmp_value	dew_value	slp_value	wind_direction
0	1.0	320.0	6.0	4.5	1031.9	N
4	1.0	310.0	6.3	4.5	1031.8	W
8	1.0	260.0	8.4	3.3	1028.2	W
12	1.0	40.0	9.9	0.2	1025.5	N
16	3.0	330.0	7.1	2.4	1027.9	N
...	...	...	...	...	...	...
11490	0.9	249.0	9.5	3.0	1027.6	W
11494	1.4	290.0	8.7	3.0	1030.1	W
11498	0.4	283.0	8.5	3.3	1031.8	W
11502	0.7	287.0	8.0	3.5	1032.1	W
11506	0.7	271.0	7.2	3.9	1031.4	W

2703 rows × 6 columns

In [28]:

```
# Group by wind_direction
NewJiangbei_df.groupby(['wind_direction']).mean()
```

Out[28]:

	speed	direction_angle	tmp_value	dew_value	slp_value
wind_direction					
E	1.109693	81.517730	22.528842	14.552719	1012.209929
N	1.119777	295.067658	19.407955	15.055093	1013.790409
S	1.242132	176.685279	20.824365	14.809645	1012.627919
W	1.114770	291.033875	17.442818	13.842005	1014.411924

The above table shows the mean wind speed, temperature, dew point temperature, sea level pressure in 4 wind direction.

In [ ]:

```

```

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