

## 作业2

November 8, 2023

```
[2]: import pandas as pd
import matplotlib.pyplot as plt

Sig_Eqs = pd.read_csv(r"D:\Jupyter Notebook\earthquakes-2023-11-07.tsv",
    ↪delimiter='\t')

total_deaths_by_country = Sig_Eqs.groupby('Country').sum()['Deaths'].
    ↪sort_values(ascending=False)
top_ten_countries_deaths = total_deaths_by_country.head(10)
print("Top ten countries by total earthquake-related deaths:")
print(top_ten_countries_deaths)
```

Top ten countries by total earthquake-related deaths:

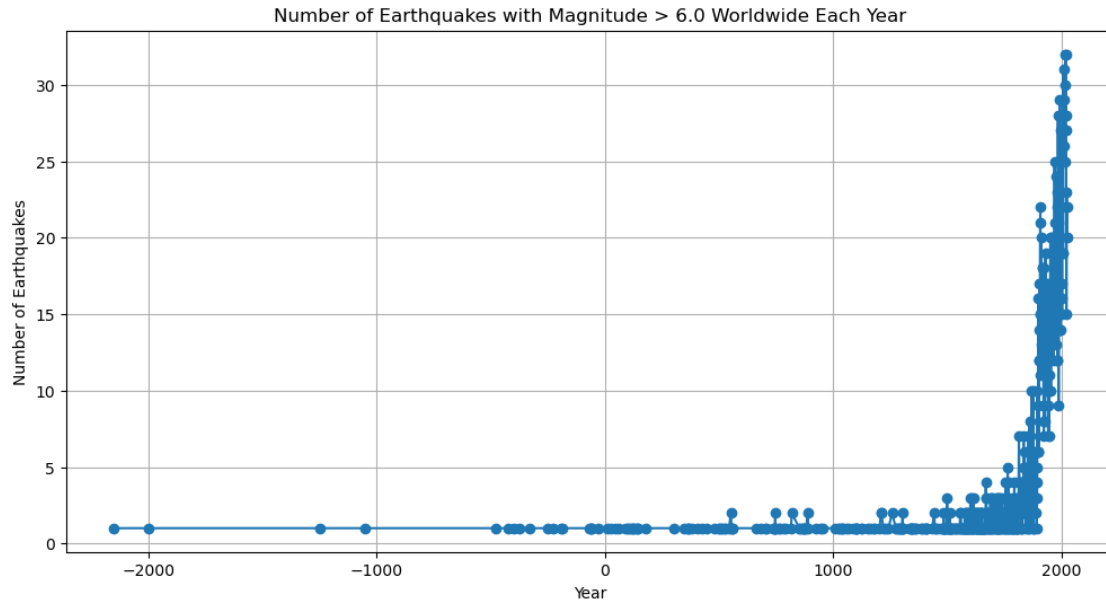
Country	
CHINA	2075045.0
TURKEY	1188881.0
IRAN	1011449.0
ITALY	498478.0
SYRIA	439224.0
HAITI	323478.0
AZERBAIJAN	317219.0
JAPAN	279085.0
ARMENIA	191890.0
PAKISTAN	145083.0

Name: Deaths, dtype: float64

```
[3]: large_earthquakes = Sig_Eqs[Sig_Eqs['Mag'] > 6.0]

earthquakes_per_year = large_earthquakes['Year'].value_counts().sort_index()

plt.figure(figsize=(12, 6))
earthquakes_per_year.plot(kind='line', marker='o', linestyle='--')
plt.title("Number of Earthquakes with Magnitude > 6.0 Worldwide Each Year")
plt.xlabel("Year")
plt.ylabel("Number of Earthquakes")
plt.grid(True)
plt.show()
```



```
[4]: def CountEq_LargestEq(data, country):
    country_data = data[data['Country'] == country]

    total_earthquakes = len(country_data)

    if total_earthquakes > 0:
        largest_earthquake = country_data[country_data['Mag'] ==
        ↪country_data['Mag'].max()]
        if not largest_earthquake.empty:
            largest_earthquake_year = largest_earthquake['Year'].values[0]

            if not pd.isna(largest_earthquake['Mo'].values[0]) and not pd.
            ↪isna(largest_earthquake['Dy'].values[0]):
                largest_earthquake_month = int(largest_earthquake['Mo'].
                ↪values[0])
                largest_earthquake_day = int(largest_earthquake['Dy'].values[0])
                largest_earthquake_date =
                ↪f"{largest_earthquake_year}-{largest_earthquake_month:
                ↪02d}-{largest_earthquake_day:02d}"
            else:
                largest_earthquake_date = "Date Unknown"
        else:
            largest_earthquake_date = "Date Unknown"
    else:
        largest_earthquake_date = None
```

```

    return total_earthquakes, largest_earthquake_date

unique_countries = Sig_Eqs['Country'].unique()

results = {}

for country in unique_countries:
    total_earthquakes, largest_earthquake_date = CountEq_LargestEq(Sig_Eqs,
↪country)
    results[country] = {'Total Earthquakes': total_earthquakes, 'Date of
↪Largest Earthquake': largest_earthquake_date}

sorted_results = sorted(results.items(), key=lambda x: x[1]['Total
↪Earthquakes'], reverse=True)

print("1.3 Total number of earthquakes and date of the largest earthquake by
↪country:")
for country, result in sorted_results:
    print(f"Country: {country}, Total Earthquakes: {result['Total
↪Earthquakes']}, Date of Largest Earthquake: {result['Date of Largest
↪Earthquake']}")

```

1.3 Total number of earthquakes and date of the largest earthquake by country:

Country: CHINA, Total Earthquakes: 620, Date of Largest Earthquake: 1668.0-07-25

Country: JAPAN, Total Earthquakes: 414, Date of Largest Earthquake: 2011.0-03-11

Country: INDONESIA, Total Earthquakes: 411, Date of Largest Earthquake: 2004.0-12-26

Country: IRAN, Total Earthquakes: 384, Date of Largest Earthquake: 856.0-12-22

Country: TURKEY, Total Earthquakes: 335, Date of Largest Earthquake: 1939.0-12-26

Country: ITALY, Total Earthquakes: 331, Date of Largest Earthquake: 1915.0-01-13

Country: USA, Total Earthquakes: 276, Date of Largest Earthquake: 1964.0-03-28

Country: GREECE, Total Earthquakes: 270, Date of Largest Earthquake: 365.0-07-21

Country: PHILIPPINES, Total Earthquakes: 224, Date of Largest Earthquake: 1897.0-09-21

Country: MEXICO, Total Earthquakes: 209, Date of Largest Earthquake: 1899.0-01-24

Country: CHILE, Total Earthquakes: 198, Date of Largest Earthquake: 1960.0-05-22

Country: PERU, Total Earthquakes: 190, Date of Largest Earthquake: 1716.0-02-06

Country: RUSSIA, Total Earthquakes: 152, Date of Largest Earthquake: 1952.0-11-04

Country: PAPUA NEW GUINEA, Total Earthquakes: 101, Date of Largest Earthquake: 1919.0-05-06

Country: INDIA, Total Earthquakes: 100, Date of Largest Earthquake: 1950.0-08-15

Country: TAIWAN, Total Earthquakes: 100, Date of Largest Earthquake: 1920.0-06-05

Country: COLOMBIA, Total Earthquakes: 80, Date of Largest Earthquake:

1826.0-06-18  
Country: NEW ZEALAND, Total Earthquakes: 71, Date of Largest Earthquake: Date Unknown  
Country: ECUADOR, Total Earthquakes: 68, Date of Largest Earthquake: 1906.0-01-31  
Country: AFGHANISTAN, Total Earthquakes: 66, Date of Largest Earthquake: 1909.0-07-07  
Country: VENEZUELA, Total Earthquakes: 66, Date of Largest Earthquake: 1894.0-04-29  
Country: SOLOMON ISLANDS, Total Earthquakes: 62, Date of Largest Earthquake: 1977.0-04-21  
Country: ALGERIA, Total Earthquakes: 57, Date of Largest Earthquake: 1980.0-10-10  
Country: ALBANIA, Total Earthquakes: 56, Date of Largest Earthquake: 1893.0-06-14  
Country: VANUATU, Total Earthquakes: 54, Date of Largest Earthquake: 1913.0-10-14  
Country: PAKISTAN, Total Earthquakes: 53, Date of Largest Earthquake: 1945.0-11-27  
Country: CROATIA, Total Earthquakes: 53, Date of Largest Earthquake: 1667.0-04-06  
Country: FRANCE, Total Earthquakes: 43, Date of Largest Earthquake: 1817.0-03-11  
Country: USA TERRITORY, Total Earthquakes: 40, Date of Largest Earthquake: 1902.0-09-22  
Country: GUATEMALA, Total Earthquakes: 39, Date of Largest Earthquake: 1942.0-08-06  
Country: NICARAGUA, Total Earthquakes: 39, Date of Largest Earthquake: 1898.0-04-29  
Country: EL SALVADOR, Total Earthquakes: 38, Date of Largest Earthquake: 1915.0-09-07  
Country: COSTA RICA, Total Earthquakes: 36, Date of Largest Earthquake: 1950.0-10-05  
Country: SPAIN, Total Earthquakes: 34, Date of Largest Earthquake: 881.0-05-26  
Country: MYANMAR (BURMA), Total Earthquakes: 34, Date of Largest Earthquake: 1912.0-05-23  
Country: SYRIA, Total Earthquakes: 33, Date of Largest Earthquake: 1202.0-05-20  
Country: SWITZERLAND, Total Earthquakes: 31, Date of Largest Earthquake: 1601.0-09-18  
Country: PORTUGAL, Total Earthquakes: 28, Date of Largest Earthquake: Date Unknown  
Country: AZORES (PORTUGAL), Total Earthquakes: 27, Date of Largest Earthquake: 1968.0-02-28  
Country: TAJIKISTAN, Total Earthquakes: 27, Date of Largest Earthquake: 1907.0-10-21  
Country: NEW CALEDONIA, Total Earthquakes: 25, Date of Largest Earthquake: 1875.0-03-28  
Country: ISRAEL, Total Earthquakes: 24, Date of Largest Earthquake: -31.0-09-02  
Country: IRAQ, Total Earthquakes: 24, Date of Largest Earthquake: 1864.0-12-02

Country: TONGA, Total Earthquakes: 24, Date of Largest Earthquake: 1919.0-04-30  
Country: AUSTRALIA, Total Earthquakes: 24, Date of Largest Earthquake: 1989.0-05-23  
Country: PANAMA, Total Earthquakes: 23, Date of Largest Earthquake: 1882.0-09-07  
Country: SLOVENIA, Total Earthquakes: 22, Date of Largest Earthquake: 1511.0-03-26  
Country: SOUTH KOREA, Total Earthquakes: 21, Date of Largest Earthquake: 1643.0-07-25  
Country: MOROCCO, Total Earthquakes: 21, Date of Largest Earthquake: 2023.0-09-08  
Country: ARGENTINA, Total Earthquakes: 21, Date of Largest Earthquake: 1944.0-01-15  
Country: KERMADEC ISLANDS (NEW ZEALAND), Total Earthquakes: 21, Date of Largest Earthquake: 1986.0-10-20  
Country: NEPAL, Total Earthquakes: 20, Date of Largest Earthquake: 1505.0-06-06  
Country: CANADA, Total Earthquakes: 20, Date of Largest Earthquake: 1949.0-08-22  
Country: HAITI, Total Earthquakes: 20, Date of Largest Earthquake: 1842.0-05-07  
Country: JAMAICA, Total Earthquakes: 19, Date of Largest Earthquake: 1899.0-06-14  
Country: FIJI, Total Earthquakes: 19, Date of Largest Earthquake: 1919.0-01-01  
Country: BULGARIA, Total Earthquakes: 18, Date of Largest Earthquake: 1904.0-04-04  
Country: DOMINICAN REPUBLIC, Total Earthquakes: 18, Date of Largest Earthquake: 1946.0-08-04  
Country: ICELAND, Total Earthquakes: 17, Date of Largest Earthquake: 1912.0-05-06  
Country: BANGLADESH, Total Earthquakes: 17, Date of Largest Earthquake: 1918.0-07-08  
Country: AZERBAIJAN, Total Earthquakes: 16, Date of Largest Earthquake: Date Unknown  
Country: EGYPT, Total Earthquakes: 15, Date of Largest Earthquake: 1995.0-11-22  
Country: GEORGIA, Total Earthquakes: 15, Date of Largest Earthquake: 1905.0-10-21  
Country: SERBIA, Total Earthquakes: 15, Date of Largest Earthquake: 1922.0-03-24  
Country: ROMANIA, Total Earthquakes: 15, Date of Largest Earthquake: 1977.0-03-04  
Country: LEBANON, Total Earthquakes: 14, Date of Largest Earthquake: 551.0-07-09  
Country: KYRGYZSTAN, Total Earthquakes: 14, Date of Largest Earthquake: 1946.0-11-02  
Country: UK, Total Earthquakes: 14, Date of Largest Earthquake: 1580.0-04-06  
Country: UZBEKISTAN, Total Earthquakes: 14, Date of Largest Earthquake: 1976.0-04-08  
Country: CUBA, Total Earthquakes: 14, Date of Largest Earthquake: 2020.0-01-28  
Country: SOUTH AFRICA, Total Earthquakes: 14, Date of Largest Earthquake: 1942.0-11-10  
Country: ARMENIA, Total Earthquakes: 13, Date of Largest Earthquake: 1988.0-12-07  
Country: HONDURAS, Total Earthquakes: 13, Date of Largest Earthquake:

1856.0-08-04  
Country: UKRAINE, Total Earthquakes: 12, Date of Largest Earthquake: Date Unknown  
Country: MACEDONIA, Total Earthquakes: 12, Date of Largest Earthquake: 1979.0-05-24  
Country: TURKMENISTAN, Total Earthquakes: 11, Date of Largest Earthquake: 1895.0-07-08  
Country: BOSNIA-HERZEGOVINA, Total Earthquakes: 11, Date of Largest Earthquake: 1969.0-10-27  
Country: KAZAKHSTAN, Total Earthquakes: 10, Date of Largest Earthquake: 1889.0-07-11  
Country: YEMEN, Total Earthquakes: 10, Date of Largest Earthquake: 1982.0-12-13  
Country: MONTENEGRO, Total Earthquakes: 10, Date of Largest Earthquake: 1979.0-04-15  
Country: MARTINIQUE, Total Earthquakes: 10, Date of Largest Earthquake: 1906.0-12-03  
Country: TUNISIA, Total Earthquakes: 9, Date of Largest Earthquake: 1957.0-02-20  
Country: GERMANY, Total Earthquakes: 9, Date of Largest Earthquake: 1978.0-09-03  
Country: ETHIOPIA, Total Earthquakes: 9, Date of Largest Earthquake: 1906.0-08-25  
Country: GUADELOUPE, Total Earthquakes: 9, Date of Largest Earthquake: 1843.0-02-08  
Country: TRINIDAD AND TOBAGO, Total Earthquakes: 8, Date of Largest Earthquake: 1888.0-01-10  
Country: TANZANIA, Total Earthquakes: 8, Date of Largest Earthquake: 1910.0-12-13  
Country: SAMOA, Total Earthquakes: 8, Date of Largest Earthquake: 1917.0-06-26  
Country: BRAZIL, Total Earthquakes: 8, Date of Largest Earthquake: 1963.0-11-09  
Country: CYPRUS, Total Earthquakes: 7, Date of Largest Earthquake: 1953.0-09-10  
Country: AUSTRIA, Total Earthquakes: 7, Date of Largest Earthquake: 1590.0-09-15  
Country: CONGO, Total Earthquakes: 7, Date of Largest Earthquake: 1992.0-09-11  
Country: SOUTH GEORGIA AND THE SOUTH SANDWICH ISLANDS, Total Earthquakes: 7, Date of Largest Earthquake: 1929.0-06-27  
Country: POLAND, Total Earthquakes: 7, Date of Largest Earthquake: 2004.0-09-21  
Country: NORTH KOREA, Total Earthquakes: 6, Date of Largest Earthquake: 1518.0-07-02  
Country: ERITREA, Total Earthquakes: 6, Date of Largest Earthquake: 1875.0-11-02  
Country: ATLANTIC OCEAN, Total Earthquakes: 6, Date of Largest Earthquake: 1941.0-11-25  
Country: BOLIVIA, Total Earthquakes: 6, Date of Largest Earthquake: 1994.0-06-09  
Country: MONGOLIA, Total Earthquakes: 6, Date of Largest Earthquake: 1905.0-07-09  
Country: JORDAN, Total Earthquakes: 5, Date of Largest Earthquake: Date Unknown  
Country: GHANA, Total Earthquakes: 5, Date of Largest Earthquake: 1862.0-07-10  
Country: HUNGARY, Total Earthquakes: 5, Date of Largest Earthquake: 1834.0-10-15  
Country: VIETNAM, Total Earthquakes: 5, Date of Largest Earthquake: 1935.0-11-01  
Country: ANTARCTICA, Total Earthquakes: 5, Date of Largest Earthquake: 1998.0-03-25

Country: RWANDA, Total Earthquakes: 5, Date of Largest Earthquake: 2015.0-08-07  
Country: BHUTAN, Total Earthquakes: 5, Date of Largest Earthquake: 2009.0-09-21  
Country: THAILAND, Total Earthquakes: 4, Date of Largest Earthquake: 2014.0-05-05  
Country: MICRONESIA, FED. STATES OF, Total Earthquakes: 4, Date of Largest Earthquake: 1911.0-08-16  
Country: UGANDA, Total Earthquakes: 4, Date of Largest Earthquake: 1912.0-07-09  
Country: MALAWI, Total Earthquakes: 4, Date of Largest Earthquake: 1989.0-03-10  
Country: SLOVAKIA, Total Earthquakes: 3, Date of Largest Earthquake: 2004.0-01-10  
Country: ANTIGUA AND BARBUDA, Total Earthquakes: 3, Date of Largest Earthquake: 1690.0-04-16  
Country: SOUTH SUDAN, Total Earthquakes: 3, Date of Largest Earthquake: 1990.0-05-20  
Country: KENYA, Total Earthquakes: 3, Date of Largest Earthquake: 1928.0-01-06  
Country: INDIAN OCEAN, Total Earthquakes: 3, Date of Largest Earthquake: 1928.0-03-09  
Country: MALAYSIA, Total Earthquakes: 3, Date of Largest Earthquake: 1976.0-07-26  
Country: NETHERLANDS, Total Earthquakes: 3, Date of Largest Earthquake: 1992.0-04-13  
Country: SAUDI ARABIA, Total Earthquakes: 3, Date of Largest Earthquake: 2009.0-05-19  
Country: MOZAMBIQUE, Total Earthquakes: 3, Date of Largest Earthquake: 2006.0-02-22  
Country: FRENCH GUIANA, Total Earthquakes: 2, Date of Largest Earthquake: 1885.0-08-04  
Country: SAINT LUCIA, Total Earthquakes: 2, Date of Largest Earthquake: Date Unknown  
Country: TOGO, Total Earthquakes: 2, Date of Largest Earthquake: Date Unknown  
Country: CANARY ISLANDS, Total Earthquakes: 2, Date of Largest Earthquake: Date Unknown  
Country: UK TERRITORY, Total Earthquakes: 2, Date of Largest Earthquake: 1983.0-11-30  
Country: COTE D'IVOIRE, Total Earthquakes: 2, Date of Largest Earthquake: 1879.0-02-11  
Country: SOLOMON SEA, Total Earthquakes: 2, Date of Largest Earthquake: 1895.0-03-06  
Country: CAMEROON, Total Earthquakes: 2, Date of Largest Earthquake: 1945.0-09-12  
Country: PACIFIC OCEAN, Total Earthquakes: 2, Date of Largest Earthquake: 1932.0-11-02  
Country: LAOS, Total Earthquakes: 2, Date of Largest Earthquake: 2007.0-05-16  
Country: IRELAND, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown  
Country: SIERRA LEONE, Total Earthquakes: 1, Date of Largest Earthquake: 1795.0-05-20  
Country: NORWAY, Total Earthquakes: 1, Date of Largest Earthquake: 1819.0-08-31  
Country: GRENADA, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: BARBADOS, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: SAINT VINCENT AND THE GRENADINES, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: FRENCH POLYNESIA, Total Earthquakes: 1, Date of Largest Earthquake: 1848.0-07-12

Country: BRITISH VIRGIN ISLANDS, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: SRI LANKA, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: URUGUAY, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: MONTSEERRAT, Total Earthquakes: 1, Date of Largest Earthquake: Date Unknown

Country: KIRIBATI, Total Earthquakes: 1, Date of Largest Earthquake: 1905.0-06-30

Country: PALAU, Total Earthquakes: 1, Date of Largest Earthquake: 1914.0-10-23

Country: CENTRAL AFRICAN REPUBLIC, Total Earthquakes: 1, Date of Largest Earthquake: 1921.0-09-16

Country: LIBYA, Total Earthquakes: 1, Date of Largest Earthquake: 1963.0-02-21

Country: GABON, Total Earthquakes: 1, Date of Largest Earthquake: 1974.0-09-23

Country: BELGIUM, Total Earthquakes: 1, Date of Largest Earthquake: 1983.0-11-08

Country: GUINEA, Total Earthquakes: 1, Date of Largest Earthquake: 1983.0-12-22

Country: DJIBOUTI, Total Earthquakes: 1, Date of Largest Earthquake: 1989.0-08-20

Country: BERING SEA, Total Earthquakes: 1, Date of Largest Earthquake: 1991.0-02-21

Country: WALLIS AND FUTUNA (FRENCH TERRITORY), Total Earthquakes: 1, Date of Largest Earthquake: 1993.0-03-12

Country: SUDAN, Total Earthquakes: 1, Date of Largest Earthquake: 1993.0-08-01

Country: BURUNDI, Total Earthquakes: 1, Date of Largest Earthquake: 2004.0-02-24

Country: CZECH REPUBLIC, Total Earthquakes: 1, Date of Largest Earthquake: 2008.0-11-22

Country: MADAGASCAR, Total Earthquakes: 1, Date of Largest Earthquake: 2017.0-01-11

Country: ZAMBIA, Total Earthquakes: 1, Date of Largest Earthquake: 2017.0-02-24

Country: COMOROS, Total Earthquakes: 1, Date of Largest Earthquake: 2018.0-05-15

Country: nan, Total Earthquakes: 0, Date of Largest Earthquake: None

```
[9]: import pandas as pd
import matplotlib.pyplot as plt

data = pd.read_csv("2281305.csv")

data['Wind_Speed'] = data['WND'].str.split(',').str[3].astype(float) / 10.0

data['Year_Month'] = pd.to_datetime(data['DATE']).dt.to_period('M')
```



```

data = data[(data['Wind_Speed'] != 999.9) & (data['WND'].str.split(',').str[1]_
↵ == '1')]

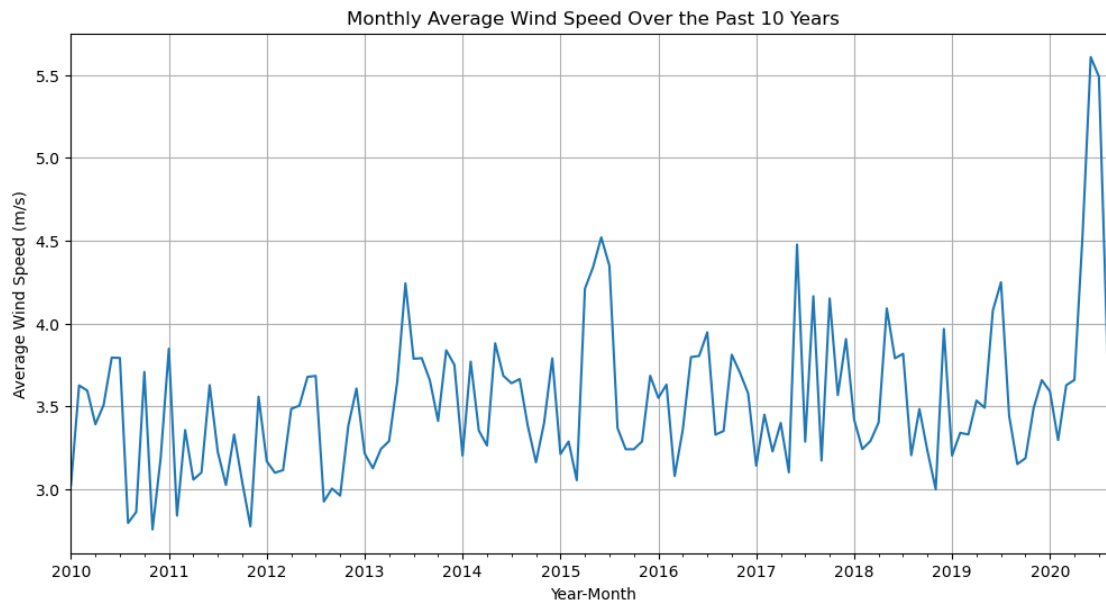
monthly_avg_wind_speed = data.groupby('Year_Month')['Wind_Speed'].mean()

plt.figure(figsize=(12, 6))
monthly_avg_wind_speed.plot()
plt.title("Monthly Average Wind Speed Over the Past 10 Years")
plt.xlabel("Year-Month")
plt.ylabel("Average Wind Speed (m/s)")
plt.grid(True)
plt.show()

```

C:\Users\jiaji\AppData\Local\Temp\ipykernel\_5588\505290023.py:5: DtypeWarning: Columns (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.

```
data = pd.read_csv("2281305.csv")
```



```

[10]: import pandas as pd
import matplotlib.pyplot as plt

df = pd.read_excel("3510102.xlsx")
df = df.dropna()
df['DATE'] = pd.to_datetime(df['DATE'], format='%Y-%m-%d')
df['PRCP'] = df['PRCP'] * 25.4
df['YearMonth'] = df['DATE'].dt.to_period('M')
monthly_avg = df.groupby('YearMonth')['PRCP'].mean()

```

```

annual_avg = monthly_avg.groupby(monthly_avg.index.year).mean()
annual_avg.index = pd.to_datetime(annual_avg.index, format='%Y')
plt.figure(figsize=(12, 6))
plt.subplot(211)
monthly_avg.plot(kind='line', marker='o', linestyle='-', label='Monthly Average')
plt.title("Guangzhou Monthly Average Rainfall (1970-2023)")
plt.xlabel("Year-Month")
plt.ylabel("Average Rainfall (mm)")
plt.grid(True)
plt.legend()

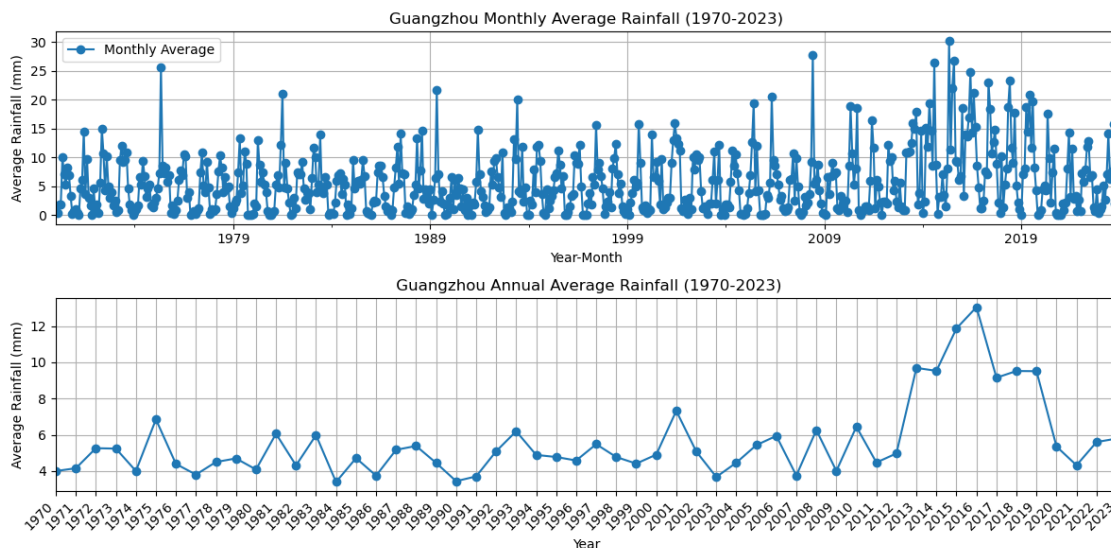
plt.subplot(212)
annual_avg.plot(kind='line', marker='o', linestyle='-', label='Annual Average')
plt.title("Guangzhou Annual Average Rainfall (1970-2023)")
plt.xlabel("Year")
plt.ylabel("Average Rainfall (mm)")

years = annual_avg.index.year
plt.xticks(range(len(years)), years)
plt.xticks(rotation=45, ha='right')
plt.grid(True)

plt.tight_layout()
plt.show()

```

C:\Users\jiaji\anaconda3\Lib\site-packages\openpyxl\styles\stylesheet.py:226: UserWarning: Workbook contains no default style, apply openpyxl's default warn("Workbook contains no default style, apply openpyxl's default")



```
[11]: max_month = monthly_avg.idxmax()
min_month = monthly_avg.idxmin()

max_year = annual_avg.idxmax().year
min_year = annual_avg.idxmin().year

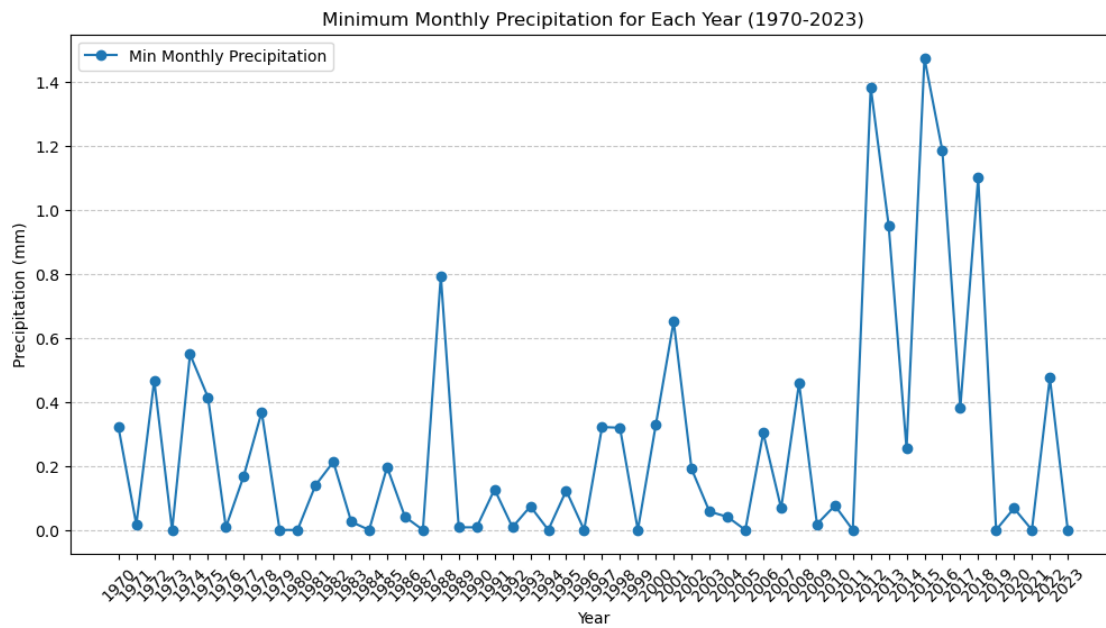
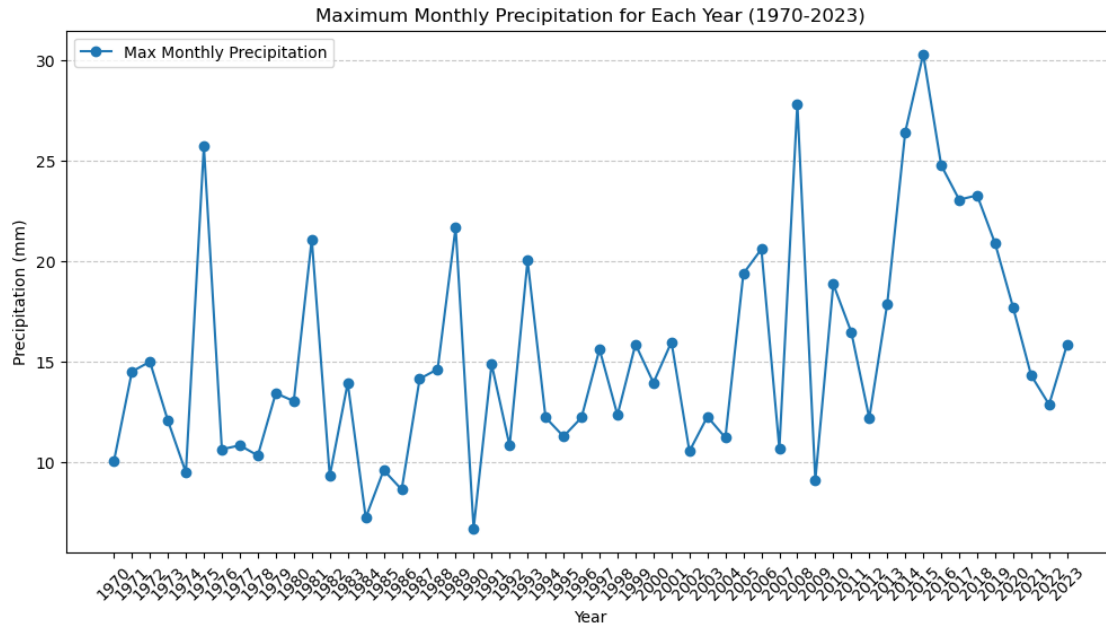
print(f"Month with the highest average precipitation: {max_month.strftime('%B %Y')}")
print(f"Month with the lowest average precipitation: {min_month.strftime('%B %Y')}")
print(f"Year with the highest average precipitation: {max_year}")
print(f"Year with the lowest average precipitation: {min_year}")
```

Month with the highest average precipitation: May 2015  
Month with the lowest average precipitation: December 1973  
Year with the highest average precipitation: 2016  
Year with the lowest average precipitation: 1984

```
[18]: min_monthly_precip = monthly_avg.groupby(monthly_avg.index.year).min()
max_monthly_precip = monthly_avg.groupby(monthly_avg.index.year).max()

plt.figure(figsize=(12, 6))
plt.plot(max_monthly_precip.index, max_monthly_precip, label='Max Monthly Precipitation', marker='o', linestyle='-')
plt.title("Maximum Monthly Precipitation for Each Year (1970-2023)")
plt.xlabel("Year")
plt.ylabel("Precipitation (mm)")
plt.xticks(max_monthly_precip.index, rotation=45)
plt.legend()
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()

plt.figure(figsize=(12, 6))
plt.plot(min_monthly_precip.index, min_monthly_precip, label='Min Monthly Precipitation', marker='o', linestyle='-')
plt.title("Minimum Monthly Precipitation for Each Year (1970-2023)")
plt.xlabel("Year")
plt.ylabel("Precipitation (mm)")
plt.xticks(min_monthly_precip.index, rotation=45)
plt.legend()
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



[ ]: