Assignment 02

In [31]:

```
# packages
import pandas as pd
import math
import matplotlib.pyplot as plt
```

1.Significant earthquakes since 2150 B.C.

In [32]:

```
Sig_Eqs = pd.read_csv('earthquakes-2022-10-23_16-40-15_+0800.tsv',sep = '\t')
Sig_Eqs
```

Out[32]:

	Search Parameters	Year	Mo	Dy	Hr	Mn	Sec	Tsu	Vol	Country	...	T Mis
0	NaN	-2150.0	NaN	NaN	NaN	NaN	0.0	NaN	NaN	JORDAN	...	
1	NaN	-2000.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	TURKMENISTAN	...	
2	NaN	-2000.0	NaN	NaN	NaN	NaN	NaN	1.0	NaN	SYRIA	...	
3	NaN	-1610.0	NaN	NaN	NaN	NaN	NaN	3.0	1351.0	GREECE	...	
4	NaN	-1566.0	NaN	NaN	NaN	NaN	0.0	NaN	NaN	ISRAEL	...	
...	...	...	...	...	...	...	...	...	...	...	...	
6333	NaN	2022.0	5.0	26.0	12.0	2.0	20.0	NaN	NaN	PERU	...	
6334	NaN	2022.0	6.0	9.0	17.0	28.0	37.0	NaN	NaN	CHINA	...	
6335	NaN	2022.0	7.0	12.0	23.0	36.0	11.0	NaN	NaN	PERU	...	
6336	NaN	2022.0	10.0	5.0	0.0	21.0	29.0	NaN	NaN	IRAN	...	
6337	[]	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	

6338 rows × 48 columns

1.1 Compute the total number of deaths caused by earthquakes since 2150 B.C. in each country, and then print the top 20 countries along with the total number of deaths.

In [33]:

```
# Total number of deaths caused by earthquakes since 2150 B.C. in each country
Sig_Eqs.groupby('Country').sum().sort_values('Total Deaths'
                        ,ascending = False)[['Total Deaths']]
```

Out[33]:

Country	Total Deaths
CHINA	2041903.0
TURKEY	927459.0
IRAN	758647.0
SYRIA	437700.0
ITALY	422678.0
...	...
PALAU	0.0
SAINT VINCENT AND THE GRENADINES	0.0
SAUDI ARABIA	0.0
SIERRA LEONE	0.0
ZAMBIA	0.0

156 rows × 1 columns

In [34]:

```
#  The top 20 countries along with the total number of deaths.
Sig_Eqs.groupby('Country').sum().sort_values('Total Deaths'
                         ,ascending = False)[['Total Deaths']].head(20)
```

Out[34]:

	Total Deaths
Country	
CHINA	2041903.0
TURKEY	927459.0
IRAN	758647.0
SYRIA	437700.0
ITALY	422678.0
JAPAN	355140.0
HAITI	323772.0
AZERBAIJAN	310119.0
INDONESIA	282153.0
ARMENIA	189000.0
PAKISTAN	143712.0
ECUADOR	134428.0
TURKMENISTAN	110412.0
PERU	96161.0
PORTUGAL	82531.0
GREECE	80271.0
IRAQ	70200.0
CHILE	70174.0
INDIA	62396.0
TAIWAN	57705.0

1.2 Compute the total number of earthquakes with magnitude larger than 3.0 (use column Ms as the magnitude) worldwide each year, and then plot the time series. Do you observe any trend? Explain why or why not?

In [35]:

```
#  Total number of earthquakes with magnitude larger than 3.0
#  Worldwide TOTAL.
print(      len(Sig_Eqs['Ms'][Sig_Eqs['Ms']>3])
      ==    Sig_Eqs.loc[Sig_Eqs['Ms']>3].groupby(['Year']).count()['Ms'].sum()     )

print(len(Sig_Eqs['Ms'][Sig_Eqs['Ms']>3]))

print(Sig_Eqs.loc[Sig_Eqs['Ms']>3].groupby(['Year']).count()['Ms'].sum())
```

```
True
2984
2984
```

In [36]:

```
# Total number of earthquakes with magnitude
# larger than 3.0 worldwide each year
Sig_Eqs.loc[Sig_Eqs['Ms']>3].groupby(['Year']).count()[['Ms']]
```

Out[36]:

	Ms
Year	
-2000.0	1
-479.0	1
-426.0	1
-400.0	1
-373.0	1
...	...
2011.0	30
2012.0	34
2013.0	20
2017.0	1
2019.0	1

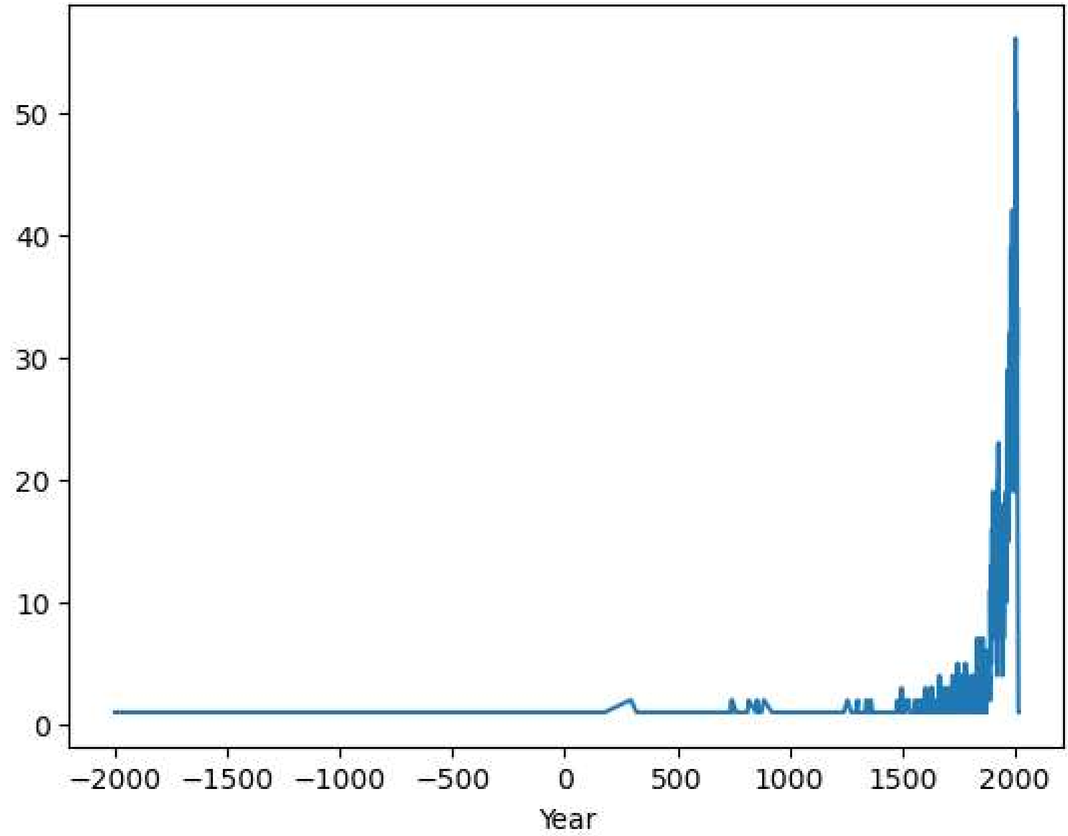
494 rows × 1 columns

In [37]:

```
# Plot
Sig_Eqs.loc[Sig_Eqs['Ms']>3].groupby(['Year']).count()['Ms'].plot()
```

Out[37]:

```
<AxesSubplot:xlabel='Year'>
```



Earthquake happens more frequently especially during recent 500 years.

The melting of glaciers reduces its pressure on earth crust leading active movements. Global warming results in melting of glaciers.

1.3 Write a function CountEq_LargestEq that returns (1) the total number of earthquakes since 2150 B.C. in a given country AND (2) date and location 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.

In [38]:

```
# Groupby Country and count ALL records.
Sig_EqsGRPB = Sig_Eqs.groupby('Country').count()

# For a earthquake, it must have a when and where.
# So the year counts and earthquakes number have the same value.
Sig_EqsGRPB['Count'] = Sig_EqsGRPB['Year']

# return the earthquake counts
def CountEq(country):
    return Sig_EqsGRPB.loc['%s'%(country)]['Count']

def CountEq_LargestEq(country):
    # Find the largest Magnitude of earthquake for the given country.
    LargestEqMsValue = Sig_Eqs[['Country','Ms']].groupby('Country').max()['Ms'][country]

    # If 'Ms' data is missing. Just show Earthquake Number
    if pd.isna(LargestEqMsValue):
        Sig_Eqs1_3 = Sig_Eqs[(Sig_Eqs['Country']==country)]

        # Create a new dataframe as output.
        Sig_Eqs1_3R = Sig_Eqs1_3[['Year','Mo','Dy','Country','Location Name','Ms']].groupby

        # set Earthquake_Number
        Sig_Eqs1_3R['Earthquake_Number'] = CountEq(country)

        return Sig_Eqs1_3R

    # Find the row with largest Magnitude.
    Sig_Eqs1_3 = Sig_Eqs[(Sig_Eqs['Ms']==LargestEqMsValue) & (Sig_Eqs['Country']==country)]

    # Create a new dataframe as output.
    Sig_Eqs1_3R = Sig_Eqs1_3[['Year','Mo','Dy','Country','Location Name','Ms']].groupby('Co

    # set Earthquake_Number
    Sig_Eqs1_3R['Earthquake_Number'] = CountEq(country)

    return Sig_Eqs1_3R

# Function test
#print(CountEq_LargestEq('CHINA'))
CountEq_LargestEq('ZAMBIA')
```

Out[38]:

	Year	Mo	Dy	Location Name	Ms	Earthquake_Number
Country						
ZAMBIA	2017.0	2.0	24.0	ZAMBIA: KAPUTA	NaN	1

In [39]:

```
# Country List
Country_List = Sig_Eqs.groupby('Country').count().index

# Create a new dataframe
result = CountEq_LargestEq(Country_List[0])

# Connect countries
for i in range(1,156):
    result = pd.concat([result,CountEq_LargestEq(Country_List[i])])

# Show dataframe
result.sort_values('Ms',ascending = False)
```

Out[39]:

	Year	Mo	Dy	Location Name	Ms	Earthquake_Number
Country						
USA	1957.0	3.0	9.0	ALASKA	9.1	271
INDONESIA	2004.0	12.0	26.0	INDONESIA: SUMATRA: ACEH: OFF WEST COAST	8.8	405
INDIA	1897.0	6.0	12.0	INDIA: ASSAM; BANGLADESH	8.7	99
CHILE	1730.0	7.0	8.0	CHILE: VALPARAISO	8.7	198
PHILIPPINES	1897.0	9.0	21.0	PHILIPPINES: MINDANAO, ZAMBOANGA, SULU, ISABELA	8.7	222
...	...	...	...	...	...	...
SRI LANKA	1882.0	1.0	NaN	SRI LANKA: TRINCOMALEE	NaN	1
SWITZERLAND	2006.0	12.0	29.0	SWITZERLAND: HAUT-VALAIS	NaN	31
TOGO	1933.0	5.0	19.0	TOGO: GOLD COAST	NaN	2
URUGUAY	1888.0	6.0	5.0	URUGUAY: COLOGNE	NaN	1
ZAMBIA	2017.0	2.0	24.0	ZAMBIA: KAPUTA	NaN	1

156 rows × 6 columns

In [40]:

```
# The last 20 countries.
result.sort_values('Ms',ascending = False).tail(20)
```

Out[40]:

Country	Year	Mo	Dy	Location Name	Ms	Earthquake_Number
COMOROS	2018.0	5.0	15.0	COMOROS: MAYOTTE	NaN	1
COTE D'IVOIRE	1889.0	2.0	11.0	COTE D'IVOIRE: BAIBU	NaN	2
CZECH REPUBLIC	2008.0	11.0	22.0	CZECH REPUBLIC: KARVINA	NaN	1
FRENCH GUIANA	1885.0	8.0	4.0	FRENCH GUIANA: CAYENNE	NaN	2
GRENADA	1822.0	12.0	1.0	GRENADA	NaN	1
HUNGARY	2006.0	12.0	31.0	HUNGARY: PISHKOL'T, ERENDREYD, DENGELEG	NaN	5
IRELAND	1490.0	NaN	NaN	IRELAND: SLIGO, MAYO	NaN	1
KIRIBATI	1905.0	6.0	30.0	KIRIBATI: PHOENIX ISLANDS	NaN	1
LEBANON	2008.0	11.0	25.0	LEBANON: TARABULUS (TRIPPOLES)	NaN	14
MADAGASCAR	2017.0	1.0	11.0	MADAGASCAR: ANTSIRABE	NaN	1
MONTSERRAT	1897.0	4.0	25.0	MONTSERRAT	NaN	1
SAINT LUCIA	1906.0	10.0	16.0	SAINT LUCIA: CASTRIES	NaN	2
SAINT VINCENT AND THE GRENADINES	1844.0	8.0	30.0	SAINT VINCENT: KINGSTOWN	NaN	1
SIERRA LEONE	1795.0	5.0	20.0	SIERRA LEONE	NaN	1
SLOVAKIA	2004.0	6.0	15.0	SLOVAKIA: ZILINA	NaN	3
SRI LANKA	1882.0	1.0	NaN	SRI LANKA: TRINCOMALEE	NaN	1
SWITZERLAND	2006.0	12.0	29.0	SWITZERLAND: HAUT-VALAIS	NaN	31
TOGO	1933.0	5.0	19.0	TOGO: GOLD COAST	NaN	2
URUGUAY	1888.0	6.0	5.0	URUGUAY: COLOGNE	NaN	1
ZAMBIA	2017.0	2.0	24.0	ZAMBIA: KAPUTA	NaN	1

2. Air temperature in Shenzhen during the past 25 years

In [41]:

```
Air_T = pd.read_csv('Baoan_Weather_1998_2022.csv',low_memory=False)
```

In [42]:

```
# Functions for filter the data

# sign to get '+' or '-'
def sign(TMP):
    return TMP[0]

# tens to get number in ten units position
def tens(TMP):
    return TMP[2]

# one to get number in one units position
def one(TMP):
    return TMP[3]

# point to get the number after the dot'.'
def point(TMP):
    return TMP[4]

# tmprat to get temperature in number
def tmprat(sign, tens, one, point):
    temp = int(tens)*10 + int(one) + int(point) * 0.1
    if sign =='+' :
        return temp
    else:
        return 0-temp

# quality to get quality of the data
def quality(TMP):
    return TMP[6]

# get the year
def AIRtoYear(DATE):
    return DATE.split('T')[0].split('-')[0]

# get the month
def AIRtoMonth(DATE):
    return DATE.split('T')[0].split('-')[1]
```

In [43]:

```
# Filter Process

# Create a new column to store Temperature number.
Air_T['Temperature'] = Air_T.apply(lambda col: tmprat(sign(col['TMP']),
                                                      tens(col['TMP']),
                                                      one(col['TMP']),
                                                      point(col['TMP'])), axis=1)

# Create a new column to store Temperature data Quality.
Air_T['Quality'] = Air_T.apply(lambda col: quality(col['TMP']),axis=1)


# Clean data.
Air_T_Drop = Air_T.drop(index=Air_T[Air_T['Temperature'] == 99.9].index)

# Introduce a new date year-month.
Air_T_Drop['NEW_DATE'] = Air_T_Drop.apply(lambda col: AIRtoYear(col['DATE'])
                                          + '-'+ AIRtoMonth(col['DATE']),axis=1)
```

In [44]:

```
# Filtered Dataframe
Air_T_Drop
```

Out[44]:

	STATION	DATE	SOURCE	REPORT_TYPE	CALL_SIGN	QUALITY_CONTROL	A
0	59493099999	1998-01-01T00:00:00	4	SY-MT	ZGSZ	V020	06,0000,9
1	59493099999	1998-01-01T01:00:00	4	FM-15	ZGSZ	V020	N
2	59493099999	1998-01-01T02:00:00	4	FM-15	ZGSZ	V020	N
3	59493099999	1998-01-01T03:00:00	4	SY-MT	ZGSZ	V020	N
4	59493099999	1998-01-01T04:00:00	4	FM-15	ZGSZ	V020	N
...	...	...	...	...	...	...	
235669	59493099999	2022-10-10T20:00:00	4	FM-15	99999	V020	N
235670	59493099999	2022-10-10T21:00:00	4	FM-12	99999	V020	06,0000,9
235671	59493099999	2022-10-10T21:00:00	4	FM-15	99999	V020	N
235672	59493099999	2022-10-10T22:00:00	4	FM-15	99999	V020	N
235673	59493099999	2022-10-10T23:00:00	4	FM-15	99999	V020	N

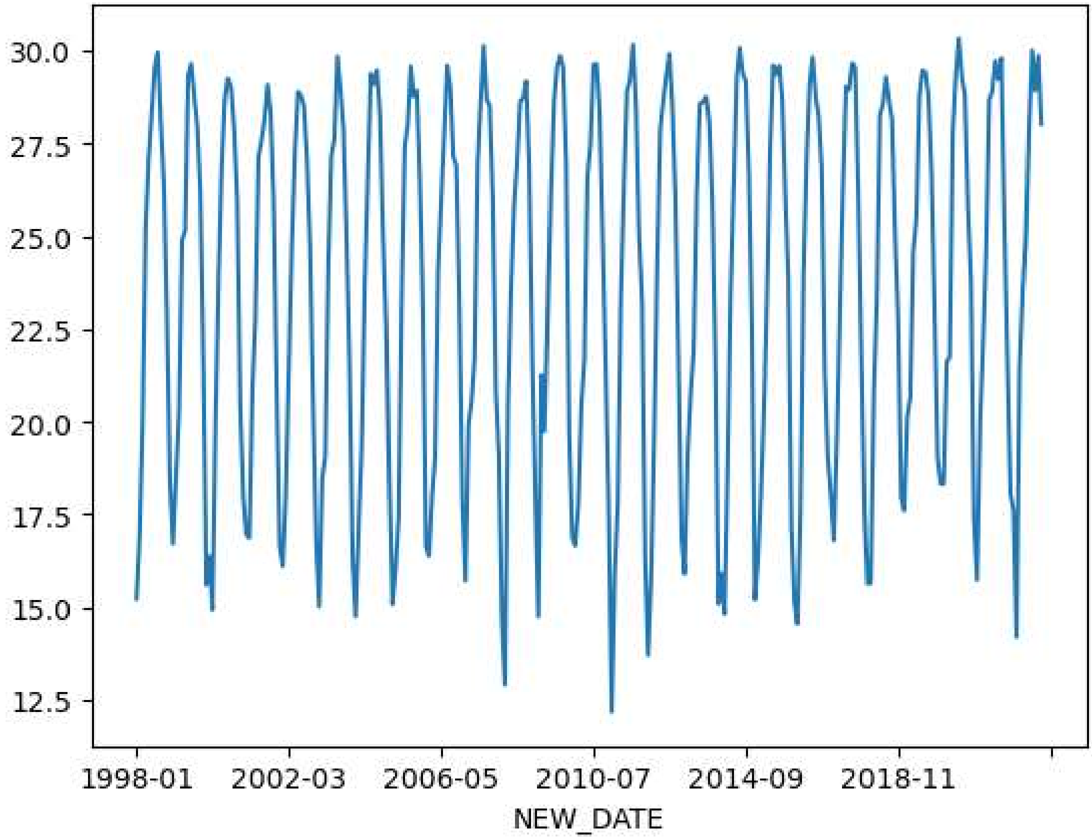
234877 rows × 57 columns

In [45]:

```
# Monthly averaged air temperature against the observation time.
Air_T_Drop.groupby('NEW_DATE').mean()['Temperature'].plot()
```

Out[45]:

```
<AxesSubplot:xlabel='NEW_DATE'>
```



There is a tiny increasing trend.

3.Global collection of hurricanes

In [46]:

```
df = pd.read_csv('ibtracs.ALL.list.v04r00.csv',
                 usecols=range(17), # the rest cols are useless.
                 skiprows=[1, 2], # first two rows are instructions.
                 parse_dates=['ISO_TIME'], # Transform TIME format. dataframe timeseries fo
                 na_values=['NOT_NAMED', 'NAME'])
                #,low_memory=False)
```

```
C:\Users\92341\AppData\Local\Temp\ipykernel_5296\288363062.py:1: Dt
ypeWarning: Columns (5) have mixed types. Specify dtype option on i
mport or set low_memory=False.
  df = pd.read_csv('ibtracs.ALL.list.v04r00.csv',
```

In [47]:

```
df
```

Out[47]:

	SID	SEASON	NUMBER	BASIN	SUBBASIN	NAME	ISO_TIME	NATURE	LAT	
0	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 06:00:00	NR	10.8709	79
1	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 09:00:00	NR	10.8431	79
2	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 12:00:00	NR	10.8188	78
3	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 15:00:00	NR	10.8000	78
4	1842298N11080	1842	1	NI	AS	NaN	1842-10-25 18:00:00	NR	10.7884	77
...	...	...	...	...	...	...	...	...	...	
707171	2022284N16268	2022	79	NaN	GM	KARL	2022-10-12 21:00:00	TS	22.2799	-94
707172	2022284N16268	2022	79	NaN	GM	KARL	2022-10-13 00:00:00	TS	22.4000	-94
707173	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 12:00:00	NR	15.2000	151
707174	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 15:00:00	NR	15.0500	151
707175	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 18:00:00	NR	14.9000	151

707176 rows × 17 columns

3.1Group the data on Storm Identifie (SID), report names (NAME) of the 10 largest hurricanes according to wind speed (WMO_WIND).

In [48]:

```
# Sort by wind speed.
df3_1 = df.groupby('NAME').max().sort_values('WMO_WIND',ascending=False)
```

```
C:\Users\92341\AppData\Local\Temp\ipykernel_5296\3256089426.py:2: F
utureWarning: Dropping invalid columns in DataFrameGroupBy.max is d
eprecated. In a future version, a TypeError will be raised. Before
calling .max, select only columns which should be valid for the fun
ction.
  df3_1 = df.groupby('NAME').max().sort_values('WMO_WIND',ascending
=False)
```

In [49]:

```
# 10 largest hurricanes according to wind speed
df3_1[['WMO_WIND']].head(10)
```

Out[49]:

NAME	WMO_WIND
DENISE	95
ELINE:LEONE	95
MAHA	95
EARL	95
EASY	95
ED	95
MAEMI	95
MABEL	95
MA-ON	95
EDNA	95

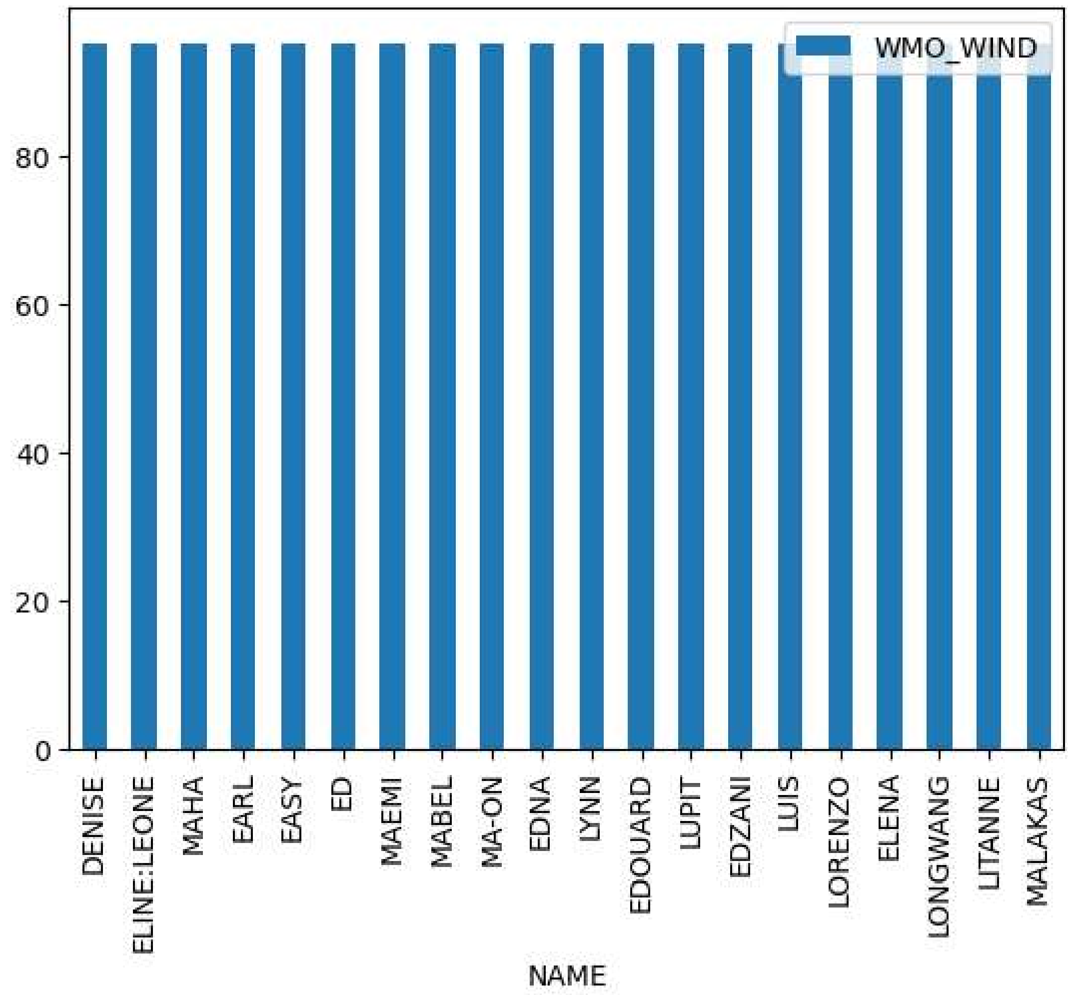
3.2 Make a bar chart of the wind speed (WMO_WIND) of the 20 strongest-wind hurricanes.

In [50]:

```
# 20 strongest-wind hurricanes.
def3_1plot = df3_1[['WMO_WIND']].head(20)

# To number
def3_1plot['WMO_WIND'] = pd.to_numeric(def3_1plot['WMO_WIND'])

# Plot
def3_1plot.plot(kind = 'bar')
```

Out[50]:

<AxesSubplot:xlabel='NAME'>



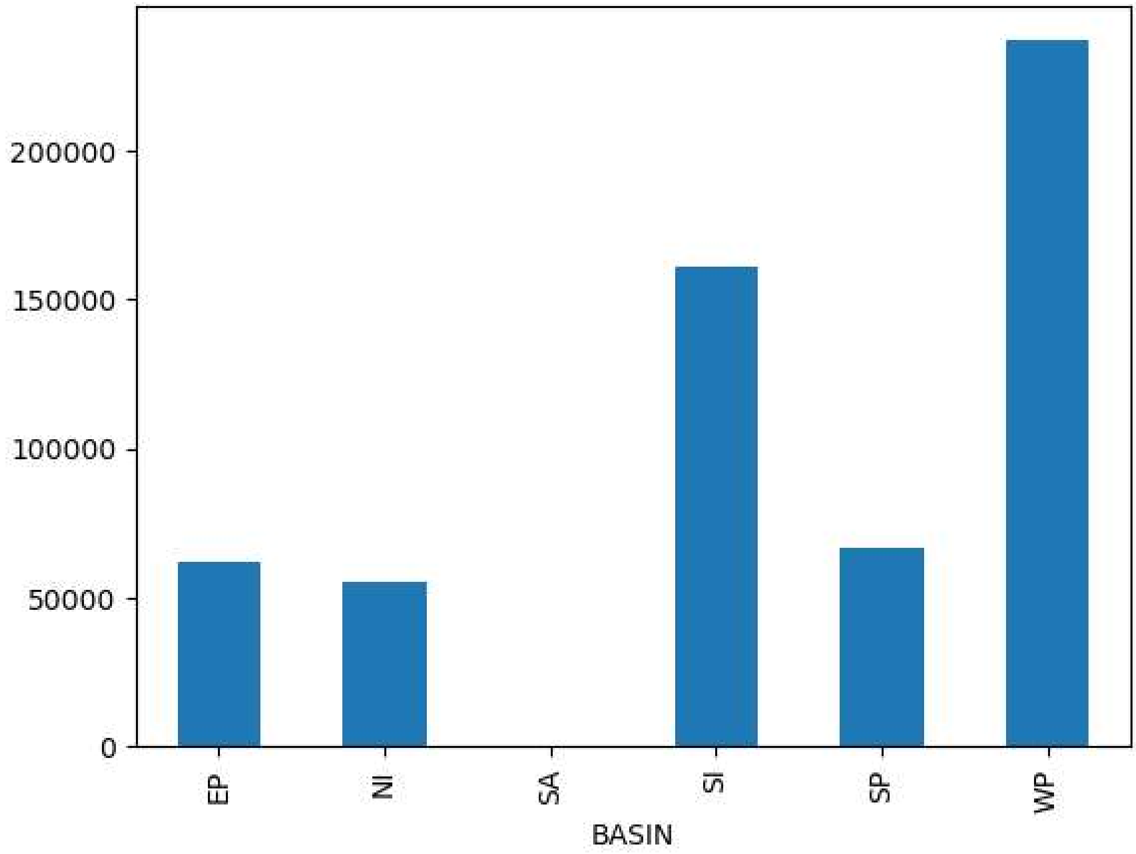
3.3 Plot the count of all datapoints by Basin as a bar chart.

In [51]:

```
# Plot the count of all datapoints by Basin as a bar chart.
df.groupby('BASIN').count()['SID'].plot(kind='bar')
```

Out[51]:

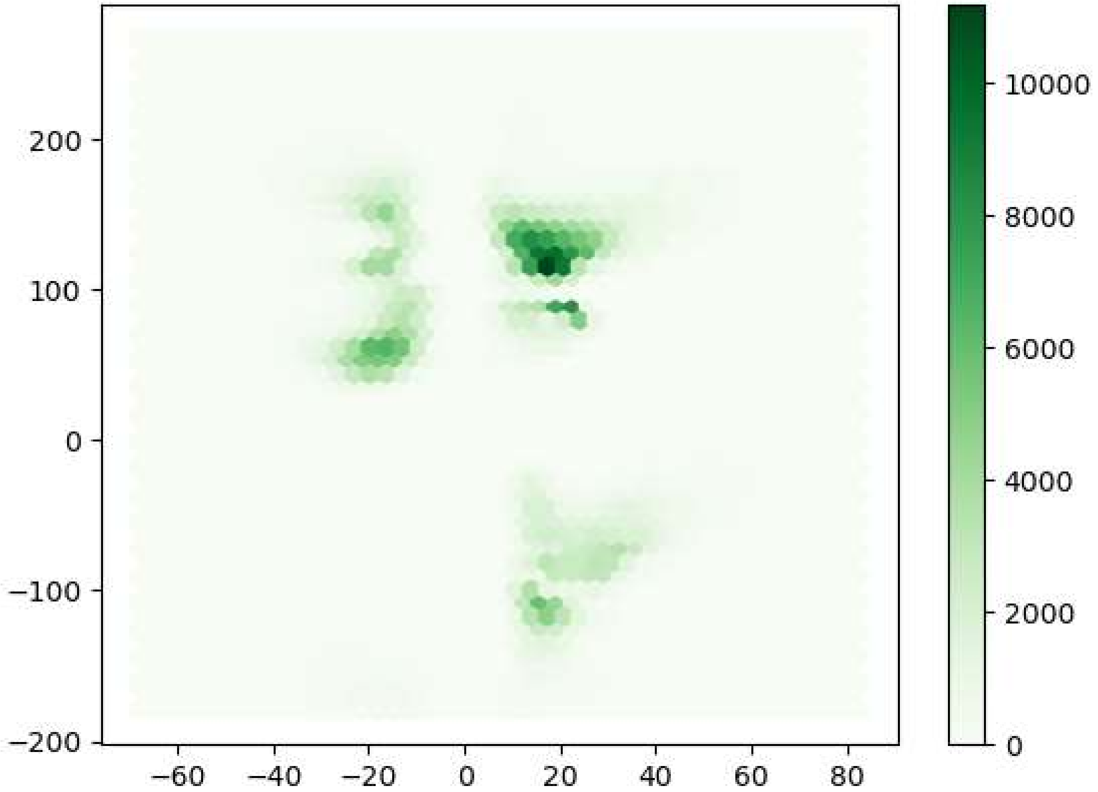
<AxesSubplot:xlabel='BASIN'>



3.4 Make a hexbin plot of the location of datapoints in Latitude and Longitude.

In [52]:

```
# Hex plot
Hex = plt.hexbin(df['LAT'], df['LON'], gridsize = 45,cmap ='Greens')

# color bar
cb = plt.colorbar(Hex)

# show plot
plt.show()
```



3.5 Find Typhoon Mangkhut (from 2018) and plot its track as a scatter plot.

In [53]:

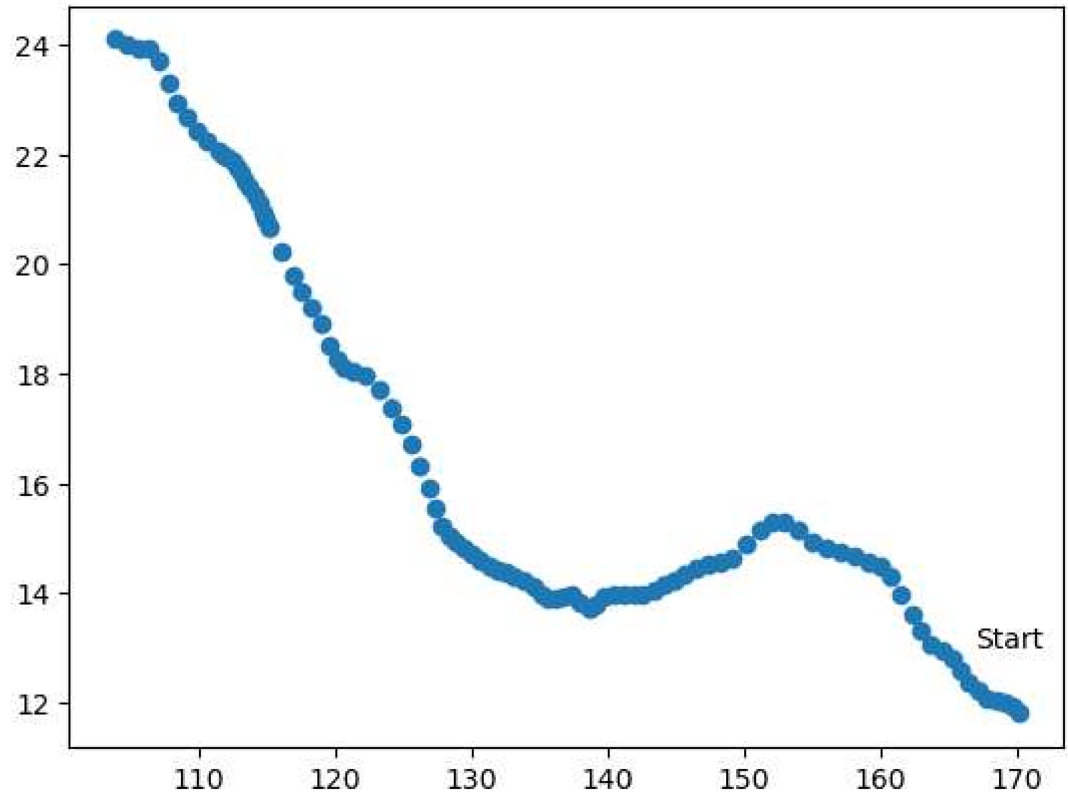
```
# to plot track, find its longitude and latitude.
lat3_5 = df.loc[ (df['NAME']=='MANGKHUT') & (df['SEASON'] == 2018)]['LAT']
lon3_5 = df.loc[ (df['NAME']=='MANGKHUT') & (df['SEASON'] == 2018)]['LON']
```

In [54]:

```
# longitude - x     latitude - y
plt.scatter(lon3_5,lat3_5)
# Mark the start point
plt.text(167,13,'Start')
```

Out[54]:

```
Text(167, 13, 'Start')
```



3.6 Create a filtered dataframe that contains only data since 1970 from the Western North Pacific (“WP”) and Eastern North Pacific (“EP”) Basin. Use this for the rest of the problem set.

In [55]:

```
df3_6 = df.loc[ (df['SEASON'] >= 1970) & (  (df['BASIN']=='WP')  |  (df['BASIN'] =='EP')  )
df3_6
```

Out[55]:

	SID	SEASON	NUMBER	BASIN	SUBBASIN	NAME	ISO_TIME	NATURE	LAT	
350393	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 00:00:00	TS	7.00000	1
350394	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 03:00:00	TS	7.24752	1
350395	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 06:00:00	TS	7.50000	1
350396	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 09:00:00	TS	7.75747	1
350397	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 12:00:00	TS	8.00000	1
...	...	...	...	...	...	...	...	...	...	
707084	2022275N10316	2022	76	EP	MM	JULIA	2022-10-10 15:00:00	TS	13.99570	-
707085	2022275N10316	2022	76	EP	MM	JULIA	2022-10-10 18:00:00	NR	14.50000	-
707173	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 12:00:00	NR	15.20000	1
707174	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 15:00:00	NR	15.05000	1
707175	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 18:00:00	NR	14.90000	1

176352 rows × 17 columns

3.7 Plot the number of datapoints per day.

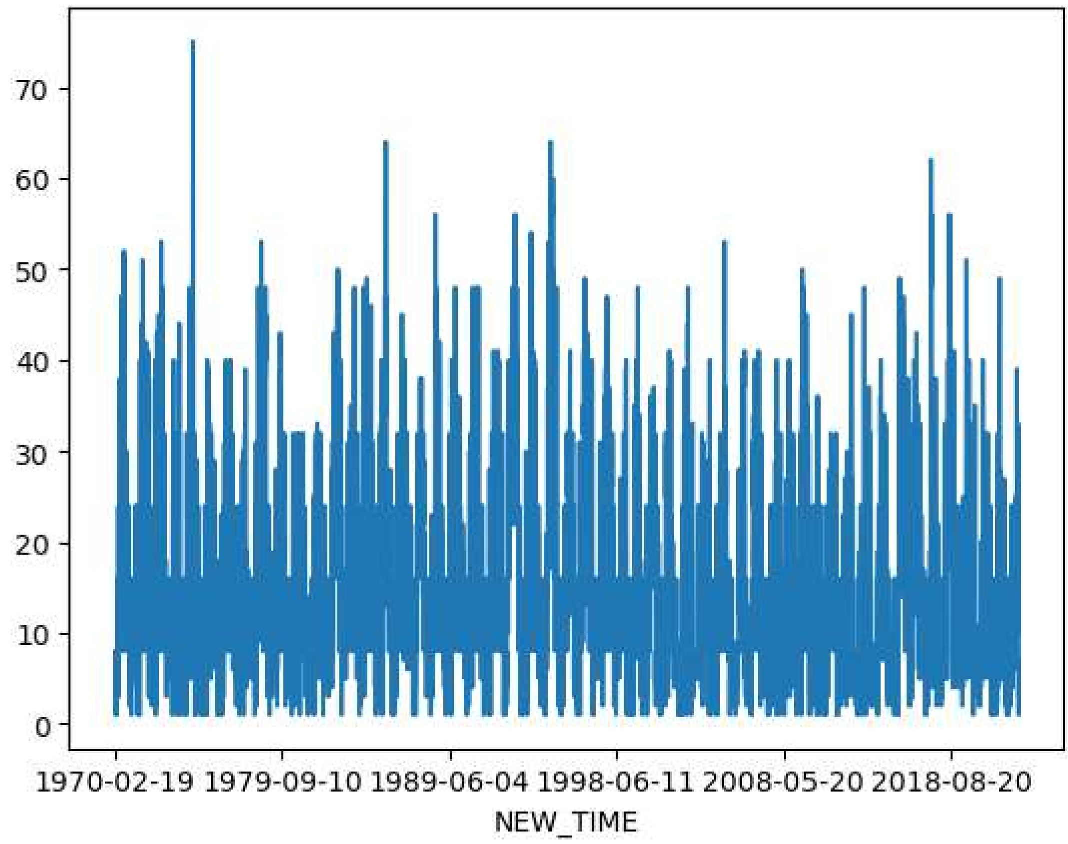
In [56]:

```
# dataframe timeseries to string time
df3_6['NEW_TIME'] = df3_6['ISO_TIME'].dt.strftime('%Y-%m-%d')

#Plot
df3_6.groupby('NEW_TIME').count()['SID'].plot()
```

```
C:\Users\92341\AppData\Local\Temp\ipykernel_5296\4007816809.py:2: S
ettingWithCopyWarning:
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/pan
das-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-
copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/index
ing.html#returning-a-view-versus-a-copy)
  df3_6['NEW_TIME'] = df3_6['ISO_TIME'].dt.strftime('%Y-%m-%d')
```

Out[56]:

```
<AxesSubplot:xlabel='NEW_TIME'>
```



3.8 Calculate the climatology of datapoint counts as a function of day of year. The day of year is the sequential day number starting with day 1 on January 1st.

In [57]:

```
#df3_6.iloc[0,17].split('-')[0]
df3_6.iloc[0,17]
df3_6.iloc[0,17].split('-')
```

Out[57]:

```
['1970', '02', '19']
```

In [58]:

```
# determine the leap year
def isleap(year):
    return ( ( int(year)%400==0) | (  ( int(year)%100!=0) & ( int(year)%4==0)  ) )

# Days of each month
days = [31,28,31,30,31,30,31,31,30,31,30,31]

# Day of year
def day_of_year(date):
    # split data string: '1970-02-19'
    # we got datearray = ['1970', '02', '19']
    datearray = date.split('-')

    #year month day
    year = int(datearray[0])
    month = int(datearray[1])
    day = int(datearray[2])

    # Modify
    if ( (isleap(year)) & ( month >2 )):
        day += 1

    # Compute day
    for i in range(month - 1):
        day += days[i]
    return day
```

In [59]:

```
# Create a new column DAY_OF_YEAR
df3_6['DAY_OF_YEAR'] = df3_6.apply(lambda col: day_of_year(col['NEW_TIME']), axis=1)

# counts
#df3_6.groupby('DAY_OF_YEAR').count()

# Climatology
Count_Mean = df3_6.groupby('DAY_OF_YEAR').count()['SID'].mean()
Count_Mean
```

```
C:\Users\92341\AppData\Local\Temp\ipykernel_5296\2798588327.py:2: S
ettingWithCopyWarning:
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/pan
das-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-
copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/index
ing.html#returning-a-view-versus-a-copy)
  df3_6['DAY_OF_YEAR'] = df3_6.apply(lambda col: day_of_year(col['N
EW_TIME']), axis=1)
```

Out[59]:

```
481.8360655737705
```

3.9 Calculate the anomaly of daily counts from the climatology.

In [60]:

```
# Create a new dataframe 'climatology'
df3_9 = df3_6.groupby('DAY_OF_YEAR').count()[['SID']]

# Rename the column
df3_9.columns = ['counts']

# Two columns: 'counts' 'anomaly'
df3_9['anomaly'] = df3_9['counts'] - Count_Mean

df3_9
```

Out[60]:

DAY_OF_YEAR	counts	anomaly
1	83	-398.836066
2	72	-409.836066
3	74	-407.836066
4	93	-388.836066
5	105	-376.836066
...	...	...
362	158	-323.836066
363	132	-349.836066
364	104	-377.836066
365	93	-388.836066
366	13	-468.836066

366 rows × 2 columns

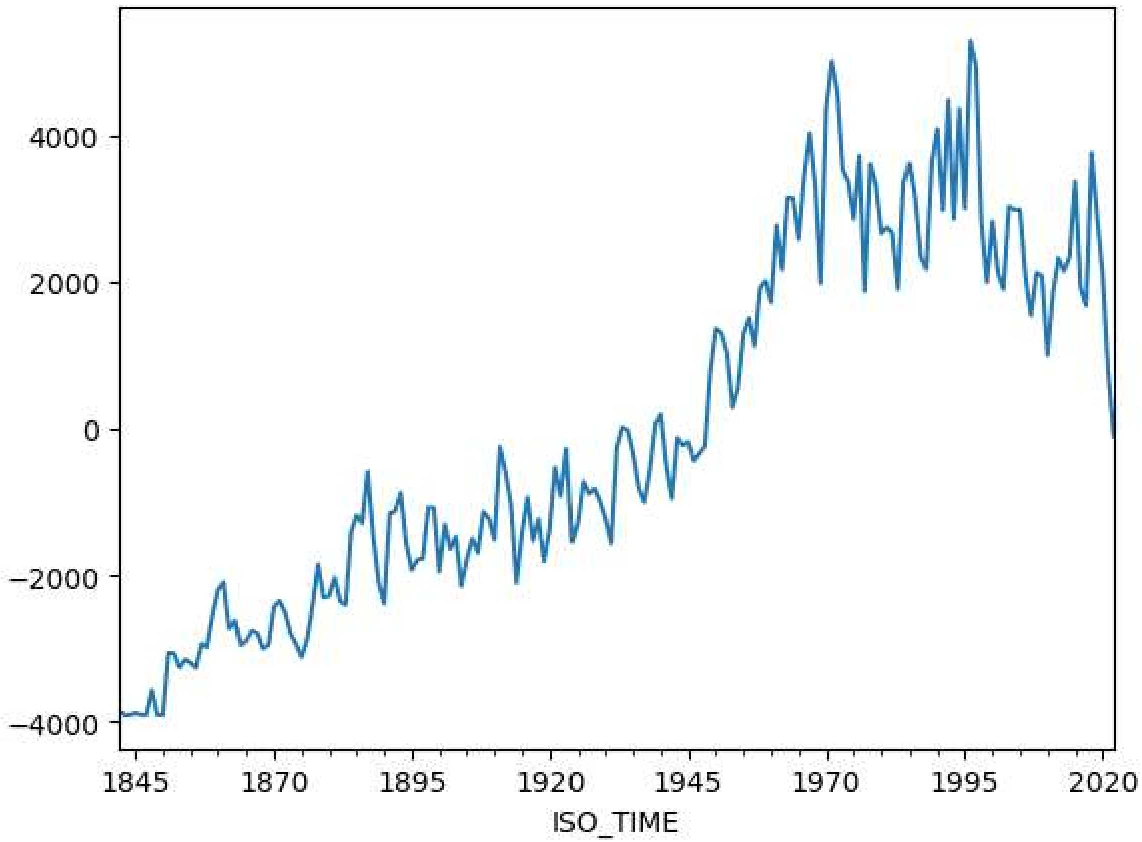
3.10 Resample the anomaly timeseries at annual resolution and plot. So which years stand out as having anomalous hurricane activity?

In [61]:

```
# Resample by year.
resample_by_year = df.resample('Y',on = 'ISO_TIME').count()

# Anomaly
resample_by_year['anomaly'] = resample_by_year['SID'] - resample_by_year['SID'].mean()

# Plot Anomaly
resample_by_year['anomaly'].plot()
```

Out[61]:

```
<AxesSubplot:xlabel='ISO_TIME'>
```



In [62]:

```
resample_by_year.sort_values('anomaly',ascending = False)
# year 1996
```

Out[62]:

	SID	SEASON	NUMBER	BASIN	SUBBASIN	NAME	ISO_TIME	NATURE	LAT	LON	WMO_WIN
ISO_TIME											
1996-12-31	9189	9189	9189	8128	8389	7443	9189	9189	9189	9189	918
1971-12-31	8911	8911	8911	7737	8147	7417	8911	8911	8911	8911	891
1997-12-31	8854	8854	8854	8456	8489	7703	8854	8854	8854	8854	885
1972-12-31	8503	8503	8503	7764	7808	6991	8503	8503	8503	8503	850
1992-12-31	8389	8389	8389	7860	7883	7276	8389	8389	8389	8389	838
...	...	...	...	...	...	...	...	...	...	...	..
1850-12-31	0	0	0	0	0	0	0	0	0	0	
1849-12-31	0	0	0	0	0	0	0	0	0	0	
1847-12-31	0	0	0	0	0	0	0	0	0	0	
1846-12-31	0	0	0	0	0	0	0	0	0	0	
1844-12-31	0	0	0	0	0	0	0	0	0	0	

181 rows × 18 columns

4. Dew point temperature in Yibin from 2000 to 2021.

In [63]:

```
# Dew point temperature in Yibin from 2000 to 2021.
df4 = pd.read_csv('3122650.csv',parse_dates=['DATE'])
```

4.1 Load the csv, XLS, or XLSX file, and clean possible data points with missing values or bad quality.

In [64]:

```
# Data Clean
df4_drop = df4.drop( index = df4.loc[ df4['DEW'] == '+9999,9' ].index )


# Create a new column to store DEW Temperature.
df4_drop['DEW_Temperature'] = df4_drop.apply(lambda col: tmprat(sign(col['DEW']),
                                                     tens(col['DEW']),
                                                     one(col['DEW']),
                                                     point(col['DEW'])), axis=1)

# Create a new column to store Temperature data Quality.
df4_drop['Quality'] = df4_drop.apply(lambda col: quality(col['DEW']),axis=1)

df4_drop
```

Out[64]:

	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	DATE	SOURCE	REPORT_TYPE	C
0	56492099999	YIBIN, CH	28.8	104.6	342	2000-01-02 00:00:00	4	FM-12	
1	56492099999	YIBIN, CH	28.8	104.6	342	2000-01-02 03:00:00	4	FM-12	
2	56492099999	YIBIN, CH	28.8	104.6	342	2000-01-02 06:00:00	4	FM-12	
3	56492099999	YIBIN, CH	28.8	104.6	342	2000-01-02 09:00:00	4	FM-12	
4	56492099999	YIBIN, CH	28.8	104.6	342	2000-01-02 12:00:00	4	FM-12	
...	...	...	...	...	...	...	...	...	
63896	56492099999	YIBIN, CH	28.8	104.6	342	2021-12-31 06:00:00	4	FM-12	
63897	56492099999	YIBIN, CH	28.8	104.6	342	2021-12-31 09:00:00	4	FM-12	
63898	56492099999	YIBIN, CH	28.8	104.6	342	2021-12-31 12:00:00	4	FM-12	
63899	56492099999	YIBIN, CH	28.8	104.6	342	2021-12-31 15:00:00	4	FM-12	
63900	56492099999	YIBIN, CH	28.8	104.6	342	2021-12-31 18:00:00	4	FM-12	

63566 rows × 13 columns

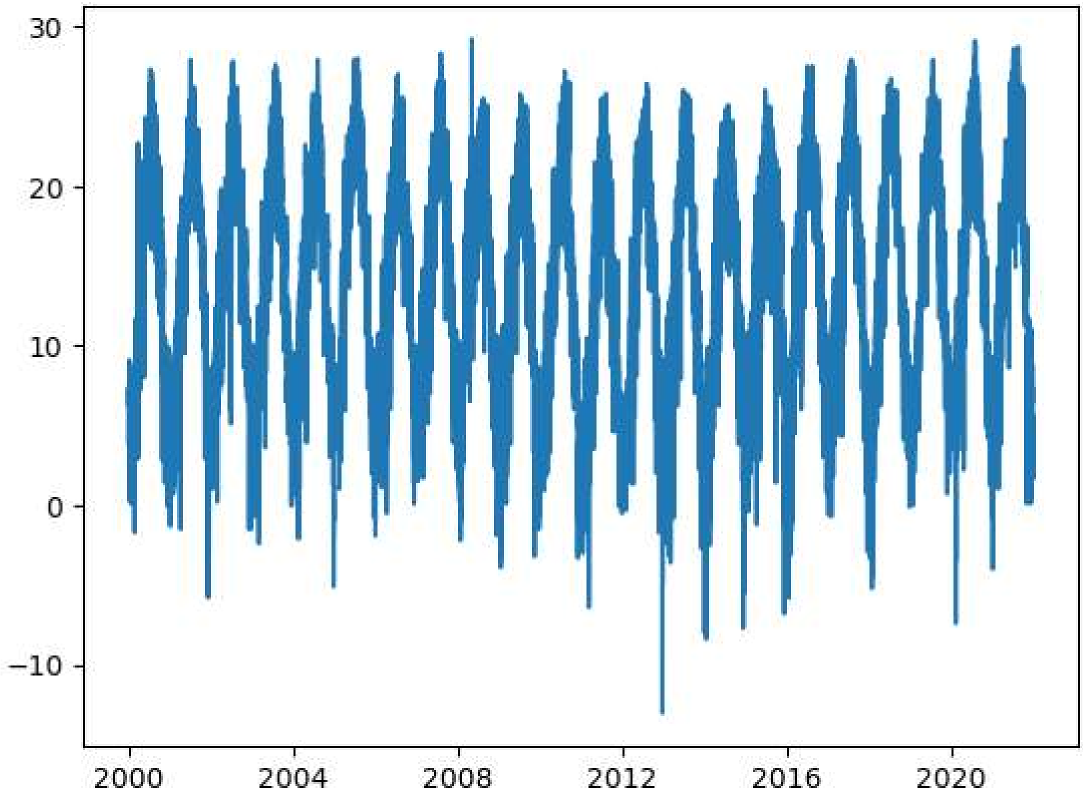
4.2 Plot the time series of a certain variable.

In [65]:

```
# Time series of DEW_Temperature
plt.plot(df4_drop['DATE'],df4_drop['DEW_Temperature'])
```

Out[65]:

```
[&lt;matplotlib.lines.Line2D at 0x29a036bb910&gt;]
```



4.3 Conduct at least 5 simple statistical checks with the variable, and report your findings.

In [76]:

```
# Resample by Month
df4_drop_resampleM = df4_drop.resample('M',on = 'DATE',label = 'right').mean()
#df4_drop_resampleM
```

In [77]:

```
df4_drop_resampleM.sort_values('DEW_Temperature').head(1)
# Lowest Monthly DEW_Temperature appeared in 2011.01
```

Out[77]:

	STATION	LATITUDE	LONGITUDE	ELEVATION	SOURCE	CALL_SIGN	DEW_Temperature	
DATE								
2011-01-31	5.649210e+10	28.8	104.6	342.0	4.0	99999.0	1.232389	10.

In [78]:

```
df4_drop_resampleM.sort_values('DEW_Temperature').tail(1)
# Highest Monthly DEW_Temperature appeared in 2005.017
```

Out[78]:

	STATION	LATITUDE	LONGITUDE	ELEVATION	SOURCE	CALL_SIGN	DEW_Temperature	
DATE								
2005-07-31	5.649210e+10	28.8	104.6	342.0	4.0	99999.0	24.57541	10.

In [79]:

```
df4_drop_resampleQ = df4_drop.resample('Q',on = 'DATE',label = 'right').mean()
#df4_drop_resampleQ
```

In [80]:

```
df4_drop_resampleQ.sort_values('DEW_Temperature').head(1)
# Lowest Seasonal DEW_Temperature appeared in 2011 First Season (Spring maybe?)
```

Out[80]:

	STATION	LATITUDE	LONGITUDE	ELEVATION	SOURCE	CALL_SIGN	DEW_Temperature	
DATE								
2011-03-31	5.649210e+10	28.8	104.6	342.0	4.0	99999.0	3.723538	10.

In [81]:

```
df4_drop_resampleQ.sort_values('DEW_Temperature').tail(1)
# Highest Seasonal DEW_Temperature appeared in 2017 Third Season(Fall maybe?)
```

Out[81]:

DATE	STATION	LATITUDE	LONGITUDE	ELEVATION	SOURCE	CALL_SIGN	DEW_Temperature	
2017-09-30	5.649210e+10	28.8	104.6	342.0	4.0	99999.0	22.861255	10.

In [82]:

```
# Create a new column for hour
df4_drop['HOUR'] = df4_drop['DATE'].dt.hour

# Dew point Temperature in a day.
df4_drop.groupby('HOUR').mean()['DEW_Temperature'].plot()

# 5 clock got lowest dew point temperature in a day
# 2 clock got highest dew point temperature in a day
```

Out[82]:

<AxesSubplot:xlabel='HOUR'>