1. Significant earthquakes since 2150 B.C.

In [2]:

```
import pandas as pd
import matplotlib.pyplot as plt
Sig_Eqs = pd.read_csv("earthquakes-2022-10-25_09-17-48_+0800.tsv", delimiter = '\t')
Sig_Eqs.head()
```

Out[2]:

	Search Parameters	Year	Mo	Dy	Hr	Mn	Sec	Tsu	Vol	Country	...	Tota Missing
0	[]	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN
1	NaN	-2150.0	NaN	NaN	NaN	NaN	0.0	NaN	NaN	JORDAN	...	NaN
2	NaN	-2000.0	NaN	NaN	NaN	NaN	NaN	1.0	NaN	SYRIA	...	NaN
3	NaN	-2000.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	TURKMENISTAN	...	NaN
4	NaN	-1610.0	NaN	NaN	NaN	NaN	NaN	3.0	1351.0	GREECE	...	NaN

5 rows × 48 columns

In [3]:

```
# 1.1
Sig_Eqs.groupby(['Country'])['Total Deaths'].sum().sort_values(ascending=False)[0:20]
```

Out[3]:

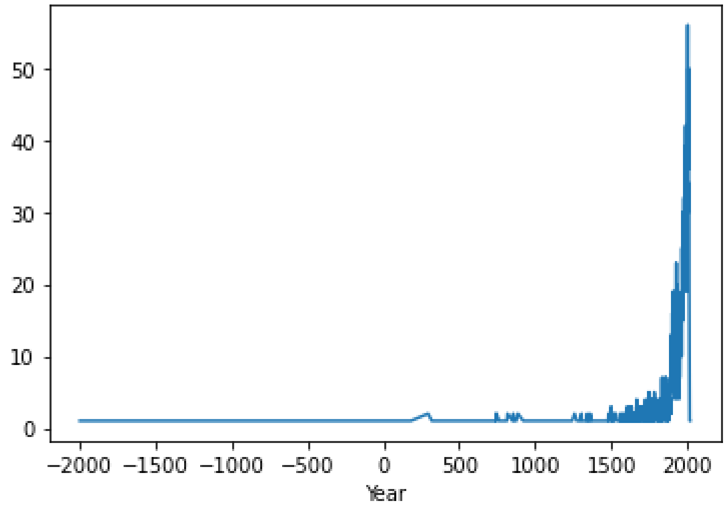
```
Country
CHINA           2041903.0
TURKEY           927459.0
IRAN             758647.0
SYRIA            437700.0
ITALY            422678.0
JAPAN            355140.0
HAITI            323772.0
AZERBAIJAN       310119.0
INDONESIA        282153.0
ARMENIA          189000.0
PAKISTAN         143712.0
ECUADOR          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
Name: Total Deaths, dtype: float64
```

In [4]:

```
# 1.2
pl1=Sig_Eqs.loc[Sig_Eqs[’Ms’]>3.0].groupby([’Year’])[’Ms’].count()
pl1
pl1.plot(x=’year’,y=’Ms’)
```

Out[4]:

```
<AxesSubplot:xlabel=’Year’>
```



The number of earthquakes has gradually increased since the distant period. Melting ice causes the Earth's crust to be pushed by magma beneath it, increasing plate movement.

In [8]:

```python
# 1.3
y1=Sig_Eqs.groupby(['Country'])['Year'].count()
y2=Sig_Eqs.groupby(['Country'])['Ms'].max()
country=[]
number=[]
Ms=[]
date=[]
location=[]

for (Country),group in Sig_Eqs[Sig_Eqs['Ms']>0].groupby('Country'):
    country.append(Country)
# country=Sig_Eqs['Country'].unique()
country
def CountEq_LargestEq(country):
    for i in country:
        y3=y1[i]
        number.append(y3)
        y4=y2[i]
        Ms.append(y4)
        y5=Sig_Eqs.loc[(Sig_Eqs['Ms']==y4) & (Sig_Eqs['Country']==i)]['Year']
        date.append(y5)
        y6=Sig_Eqs[(Sig_Eqs['Country']==i) & (Sig_Eqs['Ms']==y4)]['Location Name']
        location.append(y6)
    df = pd.DataFrame({'Country':country, 'Ms':Ms, 'Total_number':number, 'date':date, 'locatio
    df = df.sort_values('Ms',ascending=False)
    return df

CountEq_LargestEq(country)
```

Out[8]:

	Country	Ms	Total_number	date	location
121	USA	9.1	271	3746 1957.0 Name: Year, dtype: float64	3746 ALASKA Name: Location Name, dtype: object
51	INDONESIA	8.8	405	5327 2004.0 Name: Year, dtype: float64	5327 INDONESIA: SUMATRA: ACEH: OFF WEST ...
49	INDIA	8.7	99	2458 1897.0 Name: Year, dtype: float64	2458 INDIA: ASSAM; BANGLADESH Name: Locati...
20	CHILE	8.7	198	1169 1730.0 Name: Year, dtype: float64	1169 CHILE: VALPARAISO Name: Location Name...
89	PHILIPPINES	8.7	222	2465 1897.0 Name: Year, dtype: float64	2465 PHILIPPINES: MINDANAO, ZAMBOANGA, SUL...
...	...	...	...	...	...
77	NETHERLANDS	5.2	3	4824 1992.0 Name: Year, dtype: float64	4824 THE NETHERLANDS: ROERMOND; GERMANY: BO...
106	SUDAN	5.1	1	4861 1993.0 Name: Year, dtype: float64	4861 SUDAN: KHARTOUM Name: Location Name, ...
94	RWANDA	4.9	5	5528 2008.0 Name: Year, dtype: float64	5528 RWANDA: GISENYI Name: Location Name, ...
17	BRAZIL	4.8	7	4624 1986.0 Name: Year, dtype: float64	4624 BRAZIL: JOAO CAMARA, NATAL Name: Loca...
90	POLAND	3.1	7	6200 2019.0 Name: Year, dtype: float64	6200 POLAND: KATOWICE Name: Location Name,...

129 rows × 5 columns

2. Air temperature in Shenzhen during the past 25 years

In [131]:

```
import numpy as
Air_tmp=pd.read_csv("Baoan_Weather_1998_2022.csv")
```

```
C:\Users\wd\AppData\Local\Temp\ipykernel_16276\3387724967.py:2: DtypeWarning: Column
s (4,8,9,10,11,14,15,24,25,27,29,31,34,37,38,40,41,45,49,50) have mixed types. Speci
fy dtype option on import or set low_memory=False.
  Air_tmp=pd.read_csv("Baoan_Weather_1998_2022.csv")
```

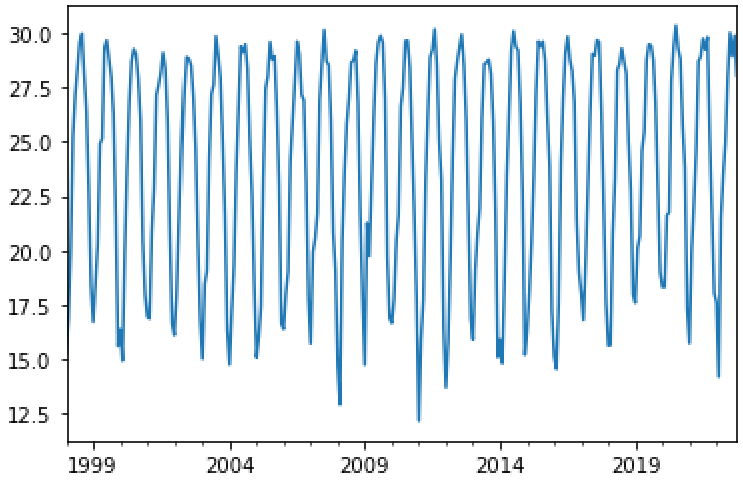
Report: 比例因子为10，TMP列数据逗号前前四位数除以比例因子即为温度，逗号后一位数代表观测空气温度的质量。

In [134]:

```
AT_new =Air_tmp.loc[:,['DATE','TMP']]
for i in range(len(AT_new)):
    AT_new.iloc[i,1] = int(AT_new['TMP'][i][1:5])
ap = AT_new['TMP'].values
ap[ap==9999] = np.nan
ap = ap/10
AT_new['TMP'] = ap
AT_new['DATE'] = pd.to_datetime(AT_new['DATE'])
AT_new.rename(index = AT_new['DATE'],inplace=True)
AT_new.resample('M').mean()['TMP'].plot()###参考陈禹凡
```

Out[134]:

```
<AxesSubplot:>
```



年平均气温呈现季节规律性，8月气温达到峰值，明显季风气候。

3. Global collection of hurricanes

In [120]:

```
import pandas as pd
import matplotlib.pyplot as plt
df = pd.read_csv('ibtracs.ALL.list.v04r00.csv',
                 usecols=range(17),
                 skiprows=[1, 1],
                 parse_dates=['ISO_TIME'],
                 na_values=['NOT_NAMED', 'NAME',' '])###参考陈禹凡同学，将空值转换为NA
df.head()
```

```
C:\Users\wd\AppData\Local\Temp\ipykernel_16276\725947886.py:3: DtypeWarning: Columns
(5,12) have mixed types. Specify dtype option on import or set low_memory=False.
  df = pd.read_csv('ibtracs.ALL.list.v04r00.csv',
```

Out[120]:

	SID	SEASON	NUMBER	BASIN	SUBBASIN	NAME	ISO_TIME	NATURE	LAT
0	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 03:00:00	NR	10.900
1	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 06:00:00	NR	10.870
2	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 09:00:00	NR	10.843
3	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 12:00:00	NR	10.818
4	1842298N11080	1842	1	NI	BB	NaN	1842-10-25 15:00:00	NR	10.800

In [2]:

```
# 3.1
select_cols=[’SID’,’NAME’,’WMO_WIND’]
df1=df[select_cols]
df1.head()
df1[’WMO_WIND’].max()
df1.groupby([’SID’,’NAME’]).max().sort_values([’WMO_WIND’],ascending=False)[0:10]
#求出风速最大值为95，但是源文件里最大为185,后来发现是读取数据时没有将空值转换为NA值,参考陈禹凡
```

Out[2]:

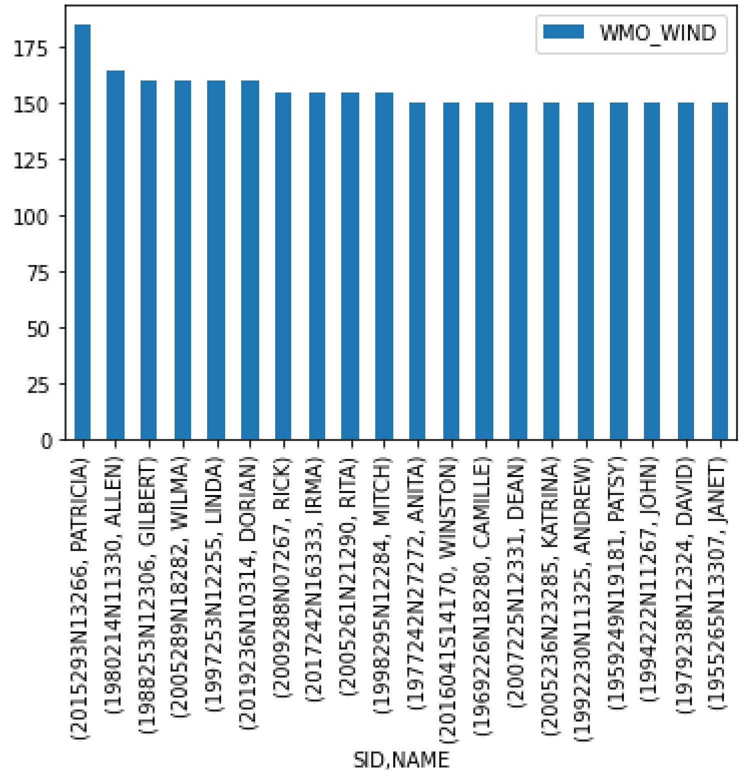
		WMO_WIND
SID	**NAME**	
2015293N13266	**PATRICIA**	185.0
1980214N11330	**ALLEN**	165.0
1988253N12306	**GILBERT**	160.0
2005289N18282	**WILMA**	160.0
1997253N12255	**LINDA**	160.0
2019236N10314	**DORIAN**	160.0
2009288N07267	**RICK**	155.0
2017242N16333	**IRMA**	155.0
2005261N21290	**RITA**	155.0
1998295N12284	**MITCH**	155.0

In [9]:

```
# 3.2
df2=df1.groupby(['SID','NAME']).max().sort_values(['WMO_WIND'],ascending=False)[0:20]
df2.plot(kind='bar')
# plt.bar(df2['SID'],df2['WMO_WIND'])
```

Out[9]:

```
<AxesSubplot:xlabel='SID,NAME'>
```

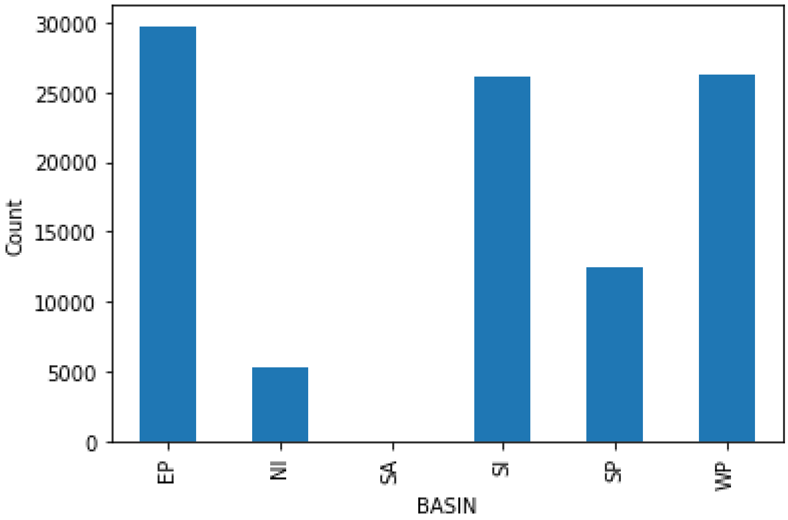


In [3]:

```
# 3.3
df.groupby("BASIN")['WMO_WIND'].count().plot(kind='bar')
plt.ylabel('Count')
```

Out[3]:

```
Text(0, 0.5, 'Count')
```

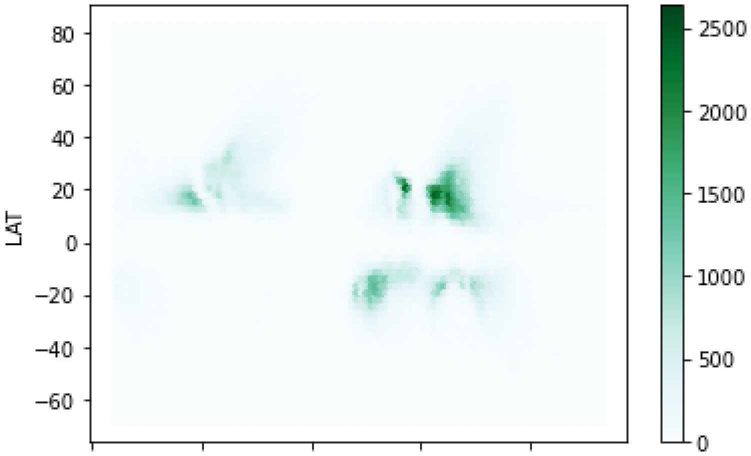


In [4]:

```
# 3.4
df.plot.hexbin(x='LON',y='LAT')
```

Out[4]:

```
<AxesSubplot:xlabel='LON', ylabel='LAT'>
```



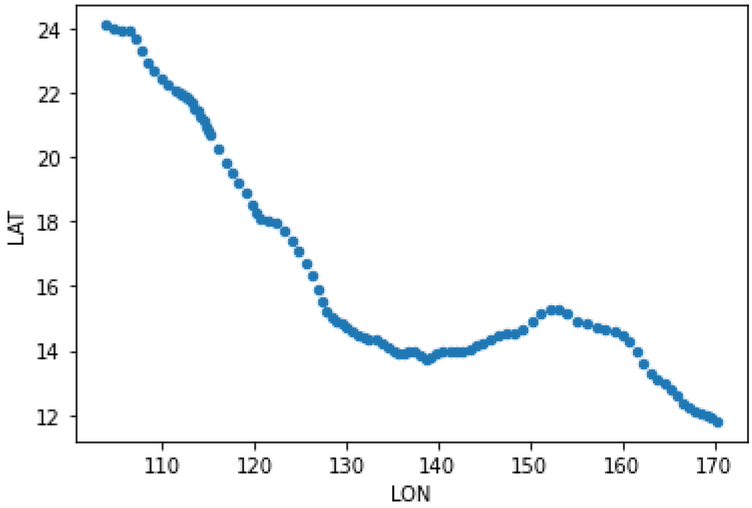
In [5]:

```
# 3.5
df3=df.loc[(df['NAME']=='MANGKHUT') & (df['SEASON']==2018)]
df3.head()
df3.plot.scatter(x='LON', y='LAT')

```

Out[5]:

```
<AxesSubplot:xlabel='LON', ylabel='LAT'>
```



In [7]:

```
# 3.6
df_new=df[((df['BASIN']=='EP')|(df['BASIN']=='WP')) & (df['SEASON']>=1970)]#将or改为|可运行结
df_new
```

Out[7]:

	SID	SEASON	NUMBER	BASIN	SUBBASIN	NAME	ISO_TIME	NATURE
350394	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 00:00:00	TS
350395	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 03:00:00	TS
350396	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 06:00:00	TS
350397	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 09:00:00	TS
350398	1970050N07151	1970	22	WP	MM	NANCY	1970-02-19 12:00:00	TS
...	...	...	...	...	...	...	...	...
707085	2022275N10316	2022	76	EP	MM	JULIA	2022-10-10 15:00:00	TS
707086	2022275N10316	2022	76	EP	MM	JULIA	2022-10-10 18:00:00	NR
707174	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 12:00:00	NR
707175	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 15:00:00	NR
707176	2022286N15151	2022	80	WP	MM	NaN	2022-10-12 18:00:00	NR

176352 rows × 17 columns

In [17]:

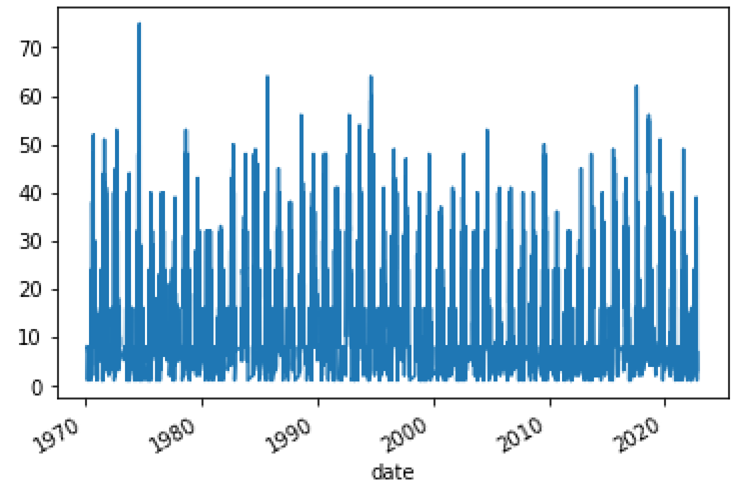
```
# 3.7
df_new.loc[:, 'date'] = pd.to_datetime(df_new['ISO_TIME'].apply(lambda x: x.strftime('%Y-%m-%d
###参考 https://blog.csdn.net/Caiqiudan/article/details/121494272 提取时间的年月日
df_new['date']
df_new1=df_new.groupby('date')['NUMBER'].count()
df_new1
df_new1.plot()
```

```
C:\Users\wd\AppData\Local\Temp\ipykernel_16276\2237416517.py:2: SettingWithCopyWarni
ng:
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/stable/u
ser_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pa
ndas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df_new.loc[:, 'date'] = pd.to_datetime(df_new['ISO_TIME'].apply(lambda x: x.strfti
me('%Y-%m-%d'))).values
```

Out[17]:

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



In [24]:

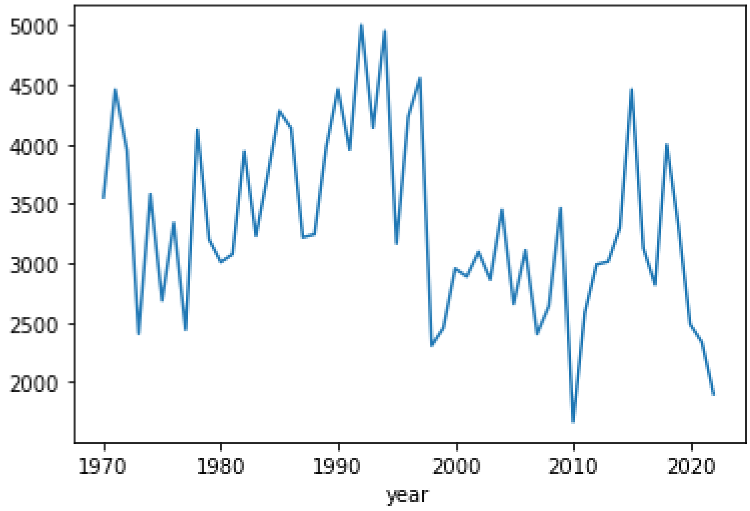
```
# 3.10
df_new['year'] = df_new['date'].dt.year
df_new_number=df_new.groupby('year')['SID'].count()
df_new_number.plot()
```

```
C:\Users\wd\AppData\Local\Temp\ipykernel_16276\1050350642.py:2: SettingWithCopyWarni
ng:
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/stable/u
ser_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pa
ndas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df_new['year'] = df_new['date'].dt.year
```

Out[24]:

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



4. Explore a data set

In [51]:

```
# 4.1
import pandas as pd
import matplotlib.pyplot as plt
Em=pd.read_excel("em-cfc-11.xls",
                 nrows=73,
                 usecols=range(23),
                 skiprows=4)
Em.dropna(axis=1,how='all',inplace=True)
Em.columns = ['Year',
              'Annual Production', 'Annual Released',
              'Total Production', 'Total Released', 'Total Unreleased',
              'Refrigeration hermetic Sales' , 'Refrigeration hermetic Released', 'Refrigeratio
             'Refrigeration NON-hermetic Sales', 'Refrigeration NON-hermetic Released', 'Refrig
             'Blowing Agents Closed Cell Foam Sales', 'Blowing Agents Closed Cell Foam Released
             'Open Cell Foam, Aerosols & Others Sales', 'Open Cell Foam, Aerosols & Others Rele
Em
#No missing values or bad quality
```

Out[51]:

	Year	Annual Production	Annual Released	Total Production	Total Released	Total Unreleased	Refrigeration hermetic Sales	Refrigera herm Relea
0	1931	0.000000	0.000000	0.000000	0.000000	0.000000	0	
1	1932	0.000000	0.000000	0.000000	0.000000	0.000000	0	
2	1933	0.000000	0.000000	0.000000	0.000000	0.000000	0	
3	1934	0.045675	0.003825	0.045675	0.003825	0.041850	0	
4	1935	0.045675	0.007875	0.091350	0.011700	0.079650	0	
...	...	...	...	...	...	...	...	
68	1999	13.064065	48.271442	8814.381800	7867.006216	947.375584	0	
69	2000	10.048500	44.775559	8824.430300	7911.781776	912.648524	0	
70	2001	8.435665	41.129395	8832.865965	7952.911170	879.954795	0	
71	2002	6.896925	37.386376	8839.762890	7990.297546	849.465344	0	
72	2003	3.192175	34.500977	8842.955065	8024.798523	818.156542	0	

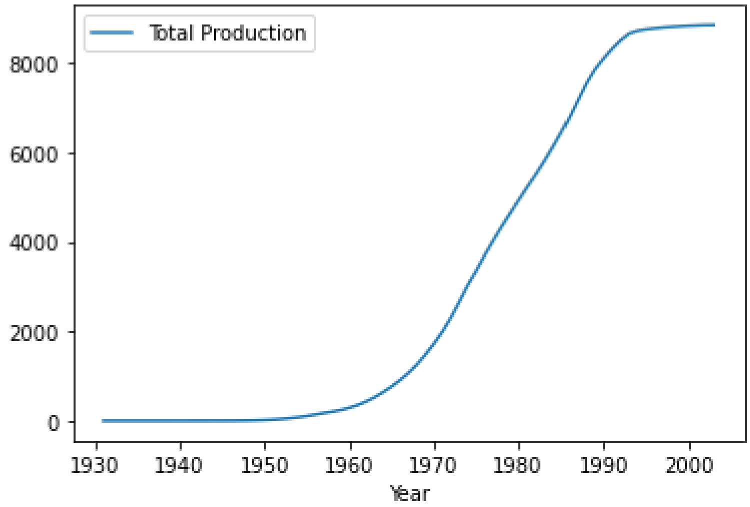
73 rows × 18 columns

In [58]:

```
# 4.2
Em.plot(x='Year',y='Total Production')
```

Out[58]:

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



In [70]:

```
# 4.3
median = Em['Total Production'].median()#中位数
mean = Em['Total Production'].mean()#平均值
var = Em['Total Production'].var()#方差
std = Em['Total Production'].std()#标准差
quantile25 = Em['Total Production'].quantile(0.25)#25%分位数
quantile75 = Em['Total Production'].quantile(0.75)#75%分位数
print(median)
print(mean)
print(var)
print(std)
print(quantile25)
print(quantile75)
```

```
1069.2284049999998
3086.5271955479457
12311926.542068858
3508.8354965812887
12.10895
6427.37991
```

年总产量平均值远大于中位数，75%分位数远大于25%分位数，这与方差大和4.2中的曲线结果相符合，表明年均

产生量大幅度增长。