

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
import seaborn as sns
####question: 怎么把 dataframe 的全部数据打印出来? (太多行或太多列时)
```

#1.1

```
#read the tsv file
Sig_Eqs = pd.read_csv("earthquakes-2025-10-29_21-11-27_+0800.tsv",sep = '\t')
Sig_Eqs.head(10)

# choose the column ' Total Deaths' to compute the total number of deaths
Sig_Eqs1 = Sig_Eqs[['Country','Total Deaths']]

#sorted the number group by countries
Sig_Eqs1.groupby(['Country']).sum().sort_values('Total Deaths',ascending = False).head(10)
```

Total Deaths	
Country	
CHINA	2106524.0
TURKEY	1008863.0
IRAN	761654.0
SYRIA	487726.0
ITALY	423280.0
HAITI	323782.0
JAPAN	319443.0
AZERBAIJAN	319251.0
INDONESIA	282838.0
ARMENIA	189000.0

#1.2

```
#Plot the trend group by year
Sig_Eqs2 = Sig_Eqs[['Mag','Year']]
Sig_Eqs2.loc[Sig_Eqs2['Mag'] > 6.0]
```

```

Sig_Eqs2.groupby(['Year']).count().plot()
plt.show()

#view recent data
Sig_Eqs2.groupby(['Year']).count().tail(40)

#trend: below about 500 B.C. there is hardly any data. 公元前 500 年以后，记载的年平均 6 级以上地震数非常缓慢地波动上升，在 1900 年以前，仍保持在 10 次/年以下的数量，  

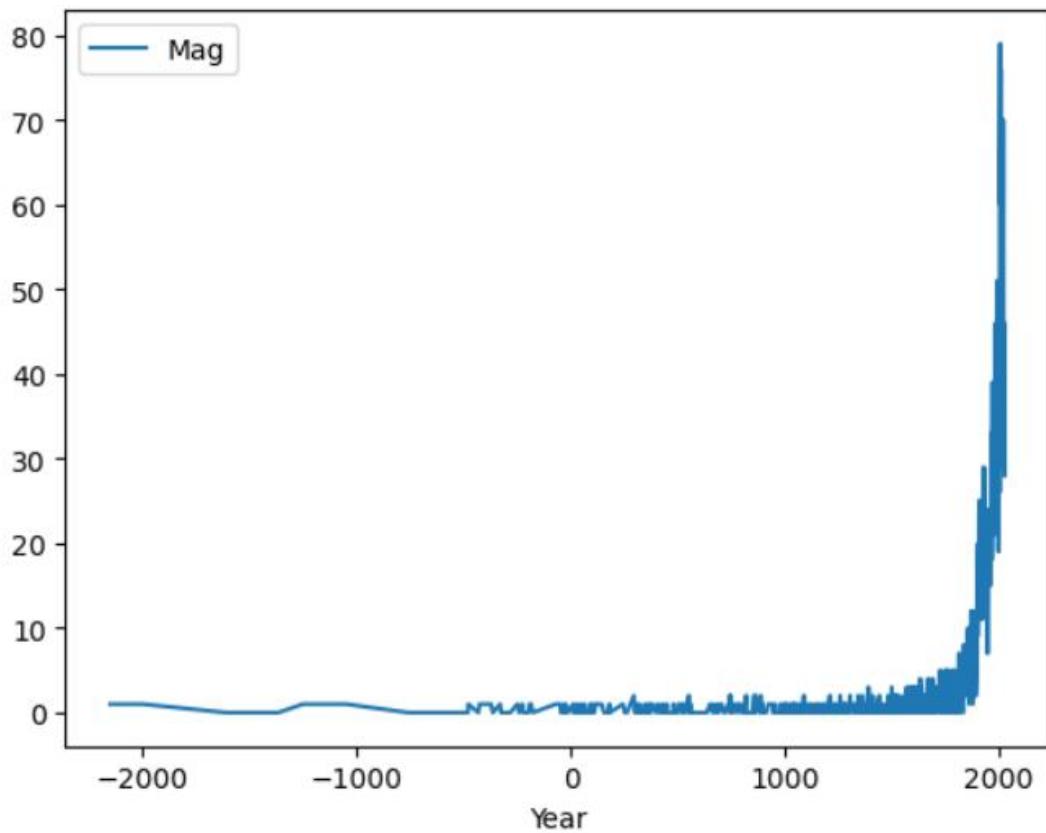
#在 1900 年左右以后，呈现非常陡峭的指数型上升，2010 年前后（2002-2019 年）达到顶峰，  

达到 60 次/年上下，并在近几年有所下降，在 28-46 次/年上下浮动。  

#原因：古代特别是公元前知识不普及，对地震记载少，流传下来的记载也少，仅有少数特别大的地震记载流传下来。近代以来，观测评估地震和区域间信息记载和传输的能力都提高后，  

#记载下来的地震数显著上升。

```



```
# 1.3
```

```

Sig_Eqs3 = Sig_Eqs[['Year','Country','Mag']]
Sig_Eqs4 = Sig_Eqs3.groupby(['Country'])
Sig_Eqs5 = Sig_Eqs4.count()
Sig_Eqs6 = Sig_Eqs4.max('Mag')

def CountEq_LargestEq(country):

```

```

a = Sig_Eqs5['Year'].loc[ country ]
b = Sig_Eqs6['Year'].loc[ country ]

#result="The total number of earthquakes since 2150 B.C. is "+str(a)+", the date of the
largest earthquake ever happened in "+country+" is in "+str(b)+" ."
#print(result)
return(country, a, b)

```

```

CountEq_LargestEq('CHINA')
#CountEq_LargestEq("CHINA")

('CHINA', np.int64(623), np.float64(2025.0))

```

#整理创建我们想要的数组

```

Sig_Eqs7 = Sig_Eqs5[['Year']]
Sig_Eqs7['Total Number'] = Sig_Eqs5[['Year']]
Sig_Eqs7['Year'] = Sig_Eqs6['Year']
Sig_Eqs7 = Sig_Eqs7.reset_index()
Sig_Eqs7

```

	Country	Year	Total Number
0	AFGHANISTAN	2025.0	68
1	ALBANIA	2024.0	56
2	ALGERIA	2021.0	57
3	ANTARCTICA	2025.0	6
4	ANTIGUA AND BARBUDA	1974.0	3
...	...	...	...
153	VENEZUELA	2018.0	65
154	VIETNAM	2020.0	6
155	WALLIS AND FUTUNA (FRENCH TERRITORY)	1993.0	1
156	YEMEN	1991.0	10
157	ZAMBIA	2017.0	1

#没有运行函数，直接写出来了

```

#Apply to every country in the file, report results in a descending order
Sig_Eqs8 = Sig_Eqs7.sort_values('Total Number', ascending = False)

```

Sig\_Eqs8

		Country	Year	Total Number
28		CHINA	2025.0	623
71		JAPAN	2025.0	424
64		INDONESIA	2025.0	421
65		IRAN	2024.0	388
142		TURKEY	2025.0	358
...		...	...	...
129		SRI LANKA	1882.0	1
136		TASMAN SEA	1892.0	1
130		SUDAN	1993.0	1
155	WALLIS AND FUTUNA (FRENCH TERRITORY)		1993.0	1
157		ZAMBIA	2017.0	1

#函数循环没写出来

#Apply CountEq\_LargestEq to every country in the file, report results in a descending order

```
#data = []
```

```
#for index in range(len(Sig_Eqs7)):
```

```
#    #j = CountEq_LargestEq(Sig_Eqs7['Country'])
#    data.append(j)
#    #data = data + Sig_Eqs7.iloc[index]
```

```
#data = np.array([j])
#print(data)
```

```
# 2.1

# read the hourly weather data
# 对于字段内部含有逗号的 csv 文件, 这里使用 delimiter=None 让 Pandas 自动推断分隔符,
engine='python' 使用 Python 引擎, 适合处理复杂的分隔符。
#source
https://geek-docs.com/pandas/pandas-questions/591_pandas_retrieve_delimiter_inferred_by_re
ad_csv_in_pandas.html

sz = pd.read_csv("2281305.csv", delimiter = None, engine = 'python')

# 查看数据
print(sz)
-----
# 每次必须要从这步开始运行才能画图 (Why? 见 3.2)

# 使用 split 函数 根据 逗 号 将 WND 拆 分 成 多 列 , source:
https://blog.51cto.com/u_16213353/11587480

sz['WND_DIRECTION'],sz['WND_DIR_QUALITY'],sz['WND_TYPE'],sz['WND_SPEED_RATE'],sz['SPEE
S_QUALITY'] = zip(*sz['WND'].str.split(','))
sz.head()
wind =
sz[['DATE','WND_DIRECTION','WND_DIR_QUALITY','WND_TYPE','WND_SPEED_RATE','SPEES_QUA
LITY']]

#           get          month          column          #          source:
https://deepinout.com/pandas/pandas-questions/448_pandas_substring_of_an_entire_column_
in_pandas_dataframe.html
wind['Time'] = wind['DATE'].str.slice(0,7)

# Change string to timestamp
#wind['DATE'] = pd.to_datetime(wind['DATE'])
wind['Time'] = pd.to_datetime(wind['Time'])

# change the type of the wind speed data
wind['WND_SPEED_RATE'] = wind['WND_SPEED_RATE'].astype(float)
Wind
```

	DATE	WND_DIRECTION	WND_DIR_QUALITY	WND_TYPE	WND_SPEED_RATE	SPEES_QUALITY	Time
0	2010-01-02T00:00:00	040	1	N	20.0	1	2010-01-01
1	2010-01-02T01:00:00	999	9	V	10.0	1	2010-01-01
2	2010-01-02T02:00:00	999	9	C	0.0	1	2010-01-01
3	2010-01-02T03:00:00	140	1	N	10.0	1	2010-01-01
4	2010-01-02T04:00:00	300	1	N	40.0	1	2010-01-01
...	...	...	...	...	...	...	...
111979	2020-09-11T17:00:00	170	1	N	30.0	1	2020-09-01
111980	2020-09-11T18:00:00	180	1	N	40.0	1	2020-09-01
111981	2020-09-11T19:00:00	220	1	V	30.0	1	2020-09-01
111982	2020-09-11T20:00:00	260	1	N	30.0	1	2020-09-01
111983	2020-09-11T21:00:00	310	1	V	20.0	1	2020-09-01

# to see if there is missing value

```
wind.sort_values('WND_SPEED_RATE', ascending = False)
```

# remove missing data

```
wind = wind.loc[ (wind['WND_SPEED_RATE']!=9999) ]
```

# consider the scaling factor

```
wind['WND_SPEED_RATE'] = wind['WND_SPEED_RATE']/10
```

# check the data

```
wind.sort_values('WND_SPEED_RATE', ascending = False)
```

	DATE	WND_DIRECTION	WND_DIR_QUALITY	WND_TYPE	WND_SPEED_RATE	SPEES_QUALITY	Time
91004	2018-09-16 08:00:00	100	1	N	19.0	1	2018-09-01
91003	2018-09-16 07:00:00	080	1	N	19.0	1	2018-09-01
91002	2018-09-16 06:00:00	060	1	N	18.0	1	2018-09-01
91006	2018-09-16 09:00:00	120	1	N	18.0	1	2018-09-01
90999	2018-09-16 04:00:00	030	1	N	17.0	1	2018-09-01
...	...	...	...	...	...	...	...
95193	2019-02-03 18:00:00	999	9	C	0.0	1	2019-02-01
95151	2019-02-02 11:00:00	999	9	C	0.0	1	2019-02-01
95071	2019-01-30 23:00:00	999	9	C	0.0	1	2019-01-01
95001	2019-01-28 18:00:00	999	9	C	0.0	1	2019-01-01
12936	2011-06-26 22:00:00	999	9	C	0.0	1	2011-06-01

111346 rows x 7 columns

# 创建时间序列

# Reset index to have a time series

```
wind = wind.set_index('Time')
```

```
wind
```

# Plot an averaged wind speed rate time series group by months

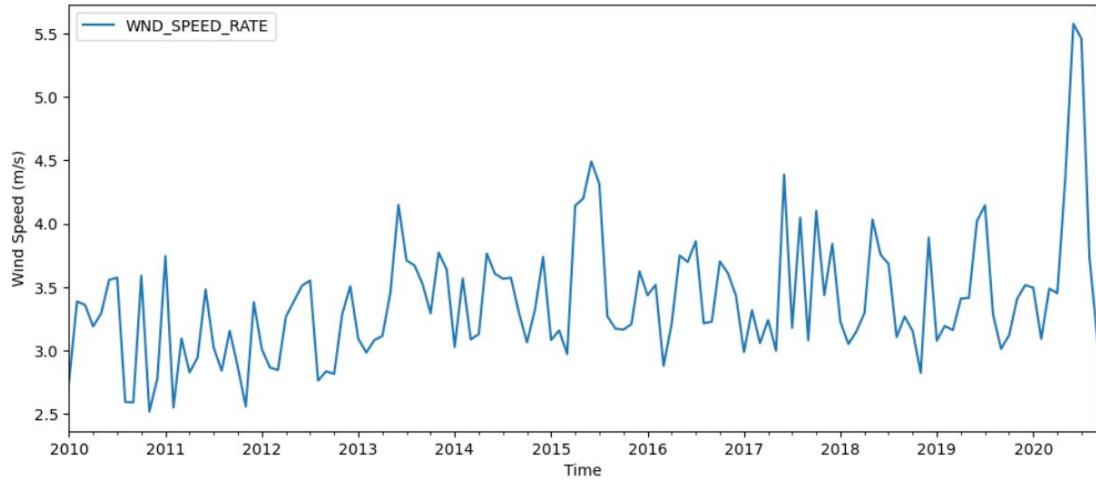
```
plot = wind.groupby(['Time']).mean(['WND_SPEED_RATE']).plot(figsize=(12, 5))
```

```
plot.set_ylabel('Wind Speed (m/s)')
```

```
plt.show()
```

#Trend: 风速有一个微弱的上升趋势

```
# 趋势线的绘制(没跑出来)
# 计算线性回归系数
#z = np.polyfit(wind['Time'].values, wind['WND_SPEED_RATE'], 1)
#p = np.poly1d(z)
# 绘制趋势线
#plt.plot(wind['Time'], p(wind['Time']), "r--", label="Trend Line")
```



### #3.1

```
#尝试过去 NCEI 上下载广州市附近站点的小时数据，不知道为什么选中站点后没有数据集

#开始选用这个数据，后来没有做
# #source: https://data.casearth.cn/dataset/5feae825819aec33049b7bd1
#引用地址： 尹君. “一带一路”沿线国家人口数据（1960-2017 年），国家青藏高原科学数
据中心,2020.doi:9dea5829-4ac0-47f3-8840-258b921c7ebc/
#read the xlsx file
#population = pd.read_excel("1960-2017 年“一带一路”沿线国家人口数据.xlsx")
#population
#remove missing point
#no missing point
#创建时间序列
#plot = wind.groupby(['Time']).mean(['WND_SPEED_RATE']).plot(figsize=(12, 5))
#plot.set_ylabel('Wind Speed (m/s)')
#plt.show()
#populationT = population.T
#populationT

#选用数据
# 孟加拉国达卡市气象站点 419230 的监测数据（2019） # source:
https://data.casearth.cn/dataset/5feae826819aec33049b7c14
# 引用地址：葛咏.孟加拉国达卡市气象站点监测数据（2016-2019）,国家青藏高原科学数据
中心,2020.doi:10.11888/Meteoro.tpdc.270311
# 来自 NCEI，包括气温、风速、露点和降水等信息

#read the csv file
data = pd.read_csv("419230-99999-2019.csv")
#data
#data.info()

# 表头解释          #https://www.czqxj.net.cn/qihou_334922
#https://blog.csdn.net/long1657/article/details/9316691
#STN---WBAN 气象站号 YEARMODA 年月日 TEMP 气温 DEWP 露点（dew point） SLP 海
平面气压（Sea level pressure） STP 本站气压(station pressure) VISIB 能见度（Visibility）
#WDSP 风向风速（wind direction ; speed） MXSPD 最大风速 (max. speed) GUST 阵风 MAX
最大 MIN 最小 PRCP 降水量 SNDP 雪深
#FRSHTT 标志当天是 1 否 0 发生了雾/雨/雪/冰雹/雷/台风

#if there is missing data
data.max()
#3 columns has 999.9
```

```
#only MXSPD has some 999.9 for missing data, the other 2 are all 999.9
data.head(10)

#remove missing data
data = data.loc[ (data['MXSPD']!=999.9) ]
Data

#3.2

#创建时间序列

# Change string to timestamp
data['YEARMODA'] = data['YEARMODA'].astype(str)
data

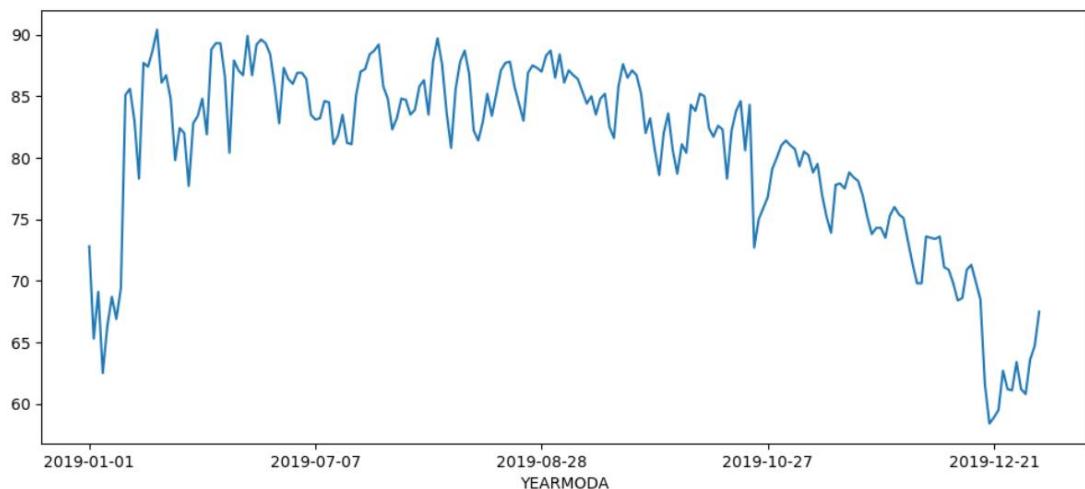
data['YEARMODA'] = data['YEARMODA'].str.slice(0,4) + '-' + data['YEARMODA'].str.slice(4,6) + "-" +
data['YEARMODA'].str.slice(6,8)
#because of 这里如果多次运行会持续添加 ‘-’，导致下一步运行失败，因此每次 debug 必须从这一步之前开始运行（第 2 题同理）
#实际：必须从上上步开始 debug why?
#data['YEARMODA'] = data['YEARMODA'].astype(str) 这一步也不行，要从这一步的上一步开始运行
pd.to_datetime(data['YEARMODA'])
data
```

#例： 创建一个温度的时间序列

```
# Reset index to have a time series
data = data.set_index('YEARMODA')
data

# Plot a simple TEMP time series
data['TEMP'].plot(figsize=(12, 5))
plt.show()

#在 1 月份时温度较低，为 65 华氏度左右，之后持续升高，在上半年达到高温，之后与其亚热带季风型气候相关，年中温度持续较高，10 月份开始下降，10 月底以后温度持续下降
#question:不均匀的时间表，如何把它变得均匀？
```



# 3.3

# 1. 年平均温度

```
data['TEMP'].mean()
```

```
np.float64(80.48578199052133)
```

#约为 80 华氏度 (26.67 摄氏度)

#2. 年降水量

#年平均降水量

```
data['PRCP'].mean()
```

```
np.float64(0.2314691943127962)
```

#约为 0.23 mm/day.

#question: 如何把格式括号 (?) 去掉?

```
data['PRCP'].sum()
```

#年总降水量约为 48mm.

#? 怎么这么低?

```
np.float64(48.83999999999996)
```

#3. 降水量时间序列分布图

```
data['PRCP'].plot(figsize=(12, 5))
```

```
plt.show()
```

#季风性气候，剧烈变化的降水。11-12 月（冬季）降水天数明显少

#4. 风速时间序列图

#日平均风速

```
data['WDSP'].plot(figsize=(12, 5))
```

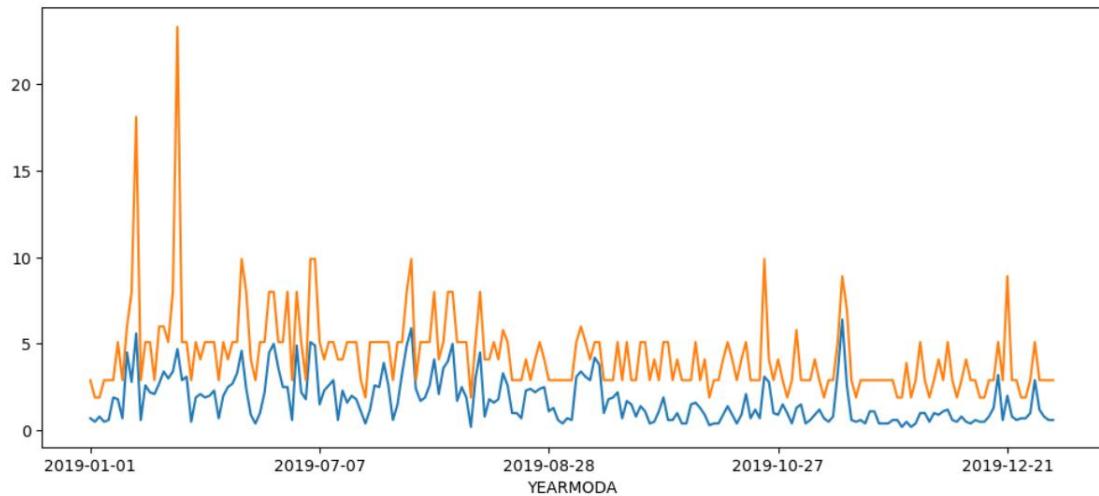
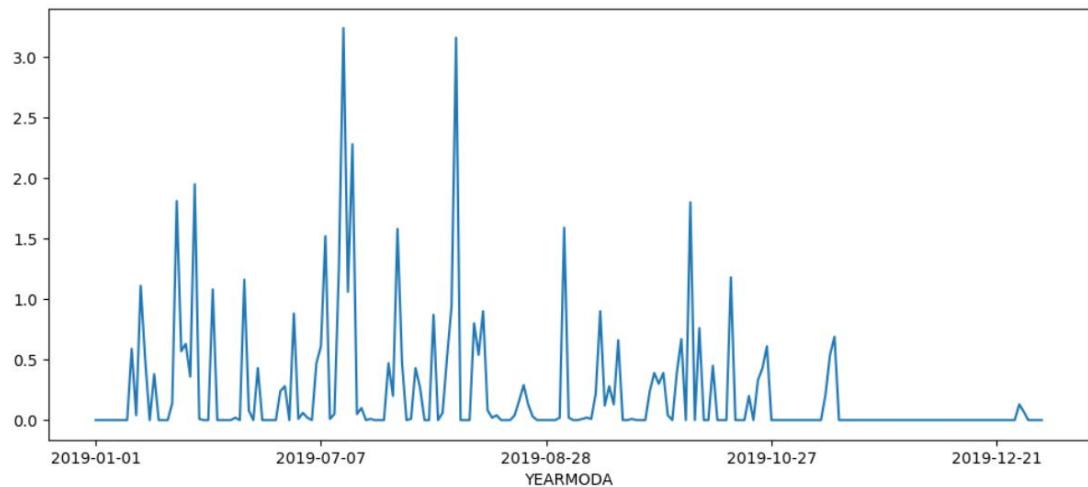
#最大风速

```

data['MXSPD'].plot(figsize=(12, 5))
plt.show()
#呈现上下两条， 趋势波动一致的折线，最大风出现在年初

#5. 当天发生了雾/雨/雪/冰雹/雷/台风的天数
a = data.count()
#共有 211 天测量数据
b = data.loc[data['FRSHTT'] != 0].count()
#99 天发生了雾/雨/雪/冰雹/雷/台风
b/a*100
#简单地做一个比率是 46.9%
#note that 这不是一个均匀的时间序列，上半年的数据很多缺失，所以这个数据几乎没意义

```



```
STN---    46.919431
WBAN      46.919431
YEAR      46.919431
MODA      46.919431
TEMP      46.919431
NTEMP     46.919431
DEWP      46.919431
NDEWP     46.919431
SLP       46.919431
NSLP      46.919431
STP       46.919431
NSTP      46.919431
VISIB     46.919431
NVISIB    46.919431
WDSP      46.919431
NWDSP     46.919431
MXSPD     46.919431
GUST      46.919431
MAX       46.919431
TMAX      46.919431
MIN       46.919431
TMIN      46.919431
PRCP      46.919431
TPRCP     46.919431
SNDP      46.919431
FRSHTT    46.919431
dtype: float64
```