

```
In [1]: import pandas as pd
import numpy as np
```

```
In [2]: df = pd.read_csv('FINAL_DATA.CSV', sep =",", index_col = "MESS_DATUM")
df
```

```
Out [2]:          1590  5733  13670
```

MESS_DATUM			
1941-01-01	0.0	NaN	NaN
1941-01-02	0.0	NaN	NaN
1941-01-03	0.2	NaN	NaN
1941-01-04	0.3	NaN	NaN
1941-01-05	0.0	NaN	NaN
...
2022-12-27	0.3	2.1	0.9
2022-12-28	8.7	3.9	6.0
2022-12-29	1.6	0.5	3.0
2022-12-30	7.2	20.1	3.3
2022-12-31	0.0	0.1	0.2

29220 rows × 3 columns

```
In [3]: start = '2018-01-01'
end = '2022-12-31'
df_5_years = df.loc[start:end]
df_5_years
```

```
Out [3]:          1590  5733  13670
```

MESS_DATUM			
2018-01-01	6.3	5.9	5.0
2018-01-02	12.7	16.2	12.3
2018-01-03	5.6	6.5	3.1
2018-01-04	3.0	2.6	2.4
2018-01-05	0.0	2.3	0.0
...
2022-12-27	0.3	2.1	0.9
2022-12-28	8.7	3.9	6.0
2022-12-29	1.6	0.5	3.0
2022-12-30	7.2	20.1	3.3
2022-12-31	0.0	0.1	0.2

1826 rows × 3 columns

```
In [4]: if pd.api.types.is_datetime64_any_dtype(df_5_years.index):
        print('yes')
        else:
        print('No')
```

No

```
In [5]: pd.options.mode.chained_assignment = None
df_5_years.index = pd.to_datetime(df_5_years.index)
df_5_years['Year'] = df_5_years.index.year
df_5_years['Month'] = df_5_years.index.month
#df_5_years['Total_precip'] = df_5_years['1590'] + df_5_years['5733'] + df_5_year
df_5_years
```

```
Out [5]:
```

	1590	5733	13670	Year	Month
MESS_DATUM					
2018-01-01	6.3	5.9	5.0	2018	1
2018-01-02	12.7	16.2	12.3	2018	1
2018-01-03	5.6	6.5	3.1	2018	1
2018-01-04	3.0	2.6	2.4	2018	1
2018-01-05	0.0	2.3	0.0	2018	1
...
2022-12-27	0.3	2.1	0.9	2022	12
2022-12-28	8.7	3.9	6.0	2022	12
2022-12-29	1.6	0.5	3.0	2022	12
2022-12-30	7.2	20.1	3.3	2022	12
2022-12-31	0.0	0.1	0.2	2022	12

1826 rows × 5 columns

```
In [6]: df_5_years['Total_Precipitation'] = df_5_years[['1590', '5733', '13670']].sum
df_5_years.head()
```

```
Out [6]:
```

	1590	5733	13670	Year	Month	Total_Precipitation
MESS_DATUM						
2018-01-01	6.3	5.9	5.0	2018	1	17.2
2018-01-02	12.7	16.2	12.3	2018	1	41.2
2018-01-03	5.6	6.5	3.1	2018	1	15.2
2018-01-04	3.0	2.6	2.4	2018	1	8.0
2018-01-05	0.0	2.3	0.0	2018	1	2.3

```
In [7]: #Monthly = df_5_years.groupby(['Year', 'Month'])['Total_Precipitation'].idxmax
#df_Monthly = df_5_years.loc[Monthly]
#df_Monthly
```

```
In [8]: #most = df_Monthly.groupby(['Year'])['Total_Precipitation'].idxmax()
#df_most = df_Monthly.loc[most]
#df_most
```

```
In [9]: monthly_accumulated = df_5_years['Total_Precipitation'].resample('M').sum()
df_5_years['Monthly_Accumulated'] = monthly_accumulated
df_5_years.head()
```

```
Out[9]:
```

	1590	5733	13670	Year	Month	Total_Precipitation	Monthly_Accumulated
MESS_DATUM							
2018-01-01	6.3	5.9	5.0	2018	1	17.2	NaN
2018-01-02	12.7	16.2	12.3	2018	1	41.2	NaN
2018-01-03	5.6	6.5	3.1	2018	1	15.2	NaN
2018-01-04	3.0	2.6	2.4	2018	1	8.0	NaN
2018-01-05	0.0	2.3	0.0	2018	1	2.3	NaN

```
In [10]: Monthly = df_5_years.groupby(['Year', 'Month'])['Monthly_Accumulated'].idxmax()
df_Monthly = df_5_years.loc[Monthly]
df_Monthly.head()
```

```
Out[10]:
```

	1590	5733	13670	Year	Month	Total_Precipitation	Monthly_Accumulated
MESS_DATUM							
2018-01-31	5.1	11.2	6.0	2018	1	22.3	235.5
2018-02-28	0.0	0.0	0.0	2018	2	0.0	44.4
2018-03-31	4.8	2.6	0.9	2018	3	8.3	149.8
2018-04-30	4.4	4.9	4.7	2018	4	14.0	161.5
2018-05-31	0.0	0.0	0.0	2018	5	0.0	111.6

```
In [11]: most_precip_month = df_Monthly.groupby(['Year'])['Monthly_Accumulated'].idxmax()
df_most_precip_month = df_Monthly.loc[most_precip_month]
df_most_precip_month
```

```
Out[11]:
```

	1590	5733	13670	Year	Month	Total_Precipitation	Monthly_Accumulated
MESS_DATUM							
2018-12-31	0.3	0.0	0.0	2018	12	0.3	315.2
2019-10-31	0.0	0.0	0.0	2019	10	0.0	317.5
2020-02-29	1.4	1.5	1.1	2020	2	4.0	433.5
2021-06-30	2.2	2.1	1.5	2021	6	5.8	343.8
2022-09-30	6.3	6.4	10.0	2022	9	22.7	343.1

```
In [13]: df_match = pd.DataFrame()
for year, month in zip(df_most_precip_month['Year'], df_most_precip_month['Mo
mask = (df_5_years.index.year == year) & (df_5_years.index.month == month
```

```
df_match = pd.concat([df_match, df_5_years[mask]])

GH_roof_area = 7.1*4.1 #m^2
df_match['vol_water(m^3)'] = GH_roof_area * (df_match["Total_Precipitation"] /
avg_daily_precip = df_match.groupby(['Year', 'Month'])['vol_water(m^3)'].mean(
avg_daily_precip

all_avg = avg_daily_precip.mean()
all_avg
print(f'The daily average precipitation of 3 stations is {all_avg:.4f} m^3')
print(f'The daily average precipitation of 3 stations is {all_avg*1000:.1f} L

The daily average precipitation of 3 stations is 0.3392 m^3
The daily average precipitation of 3 stations is 339.2 Liters
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