

## HSLU Pyranometer Data

Remarks: HSLU pyranometer data is available from 2017 01.01 to 2018 01.03

```
In [39]: import matplotlib
import numpy as np
import matplotlib.dates as mdates
import matplotlib.pyplot as plt
%matplotlib inline
import csv
import bisect
import datetime
from scipy import interpolate
from matplotlib.dates import DateFormatter

# User defined functions
from load_data_from_csv import *
```

### Set observation time and date

```
In [40]: start = '2017-01-01 07:00:00' # beginning and
end      = '2018-01-03 21:00:00' # end of observation
```

### Import Data from Weather station at Luzern Switzerland

```
In [41]: luz_csv = r'../weather_data/irradiation_luz_2017_2018.csv'

df = process_LUZ(luz_csv)
df.set_index(df.datetime, inplace=True)
df_lu = df['gre000z0'] # 10 min mean in W/m²
lu_rad = df_lu.loc[start:end] # set distinct observation day
#lu_rad.head(n=2)
```

### Import Data from Weather station at Lucerne University of Applied Sciences and Arts, Switzerland (HSLU) for 2017

```
In [42]: hslu_csv = r'../weather_data/CH_LU_Horw_HSLU_SolarIrradiation_2017.csv'

df = process_HSLU(hslu_csv)
df.set_index(df.datetime, inplace=True)
df_hslu17 = df['GHI_Avg'] # 1 min mean in W/m²
hslu_rad17 = df_hslu17.loc[start:end] # set distinct observation day
#hslu_rad.head(n=2)
```

### Import Data from Weather station at Lucerne University of Applied Sciences and Arts, Switzerland (HSLU) for 2018

```
In [43]: hslu_csv = r'../weather_data/CH_LU_Horw_HSLU_SolarIrradiation_2018.csv'

df = process_HSLU(hslu_csv)
df.set_index(df.datetime, inplace=True)
df_hslu18 = df['GHI_Avg'] # 1 min mean in W/m²
hslu_rad18 = df_hslu18.loc[start:end] # set distinct observation day
#hslu_rad.head(n=2)
```

### Load irradiance data for McClear model

```
In [44]: soda_csv = r'../weather_data/irradiation_soda_2017_2018_1min.csv'

df = process_SODA(soda_csv)
df_soda = df['Clear sky GHI']*60 # given in units of Wh/m²
mc_rad = df_soda.loc[start:end] # set distinct observation day
#mc_rad.head(n=2)
```

### HSLU pyranometer measurements vs. pyranometer measurements from Allmend Lucern : 2017 11.17 to 2018 01.03

```
In [45]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

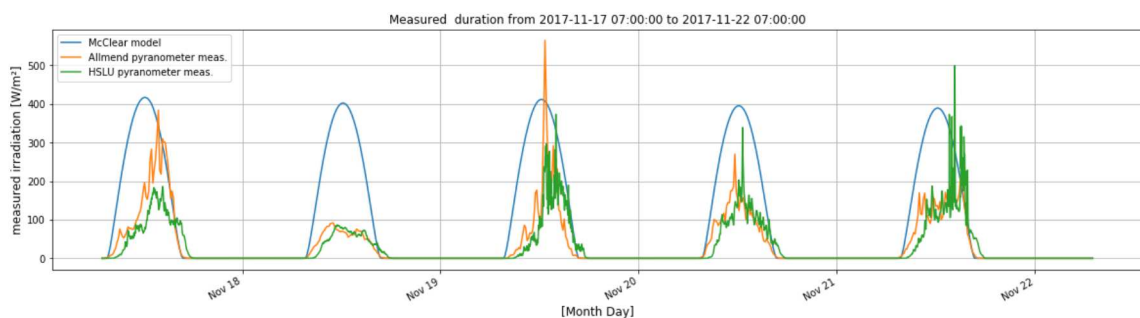
start = '2017-11-17 07:00:00' # beginning
end = '2017-11-22 07:00:00' # ending

lu_rad = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McCclear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()
```



```

In [46]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-11-22 07:00:00' # beginning
end    = '2017-11-27 07:00:00' # ending

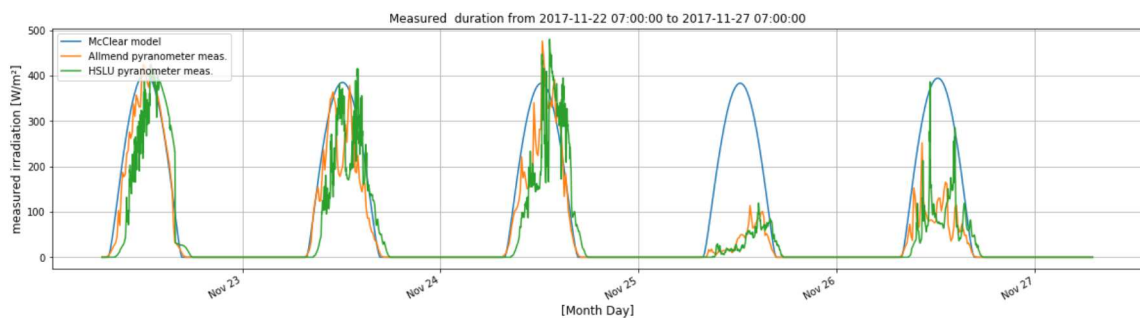
lu_rad    = df_lu.loc[start:end]
hslu_rad  = df_hslu17.loc[start:end]
mc_rad    = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [47]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-11-27 07:00:00' # beginning
end    = '2017-12-02 07:00:00' # ending

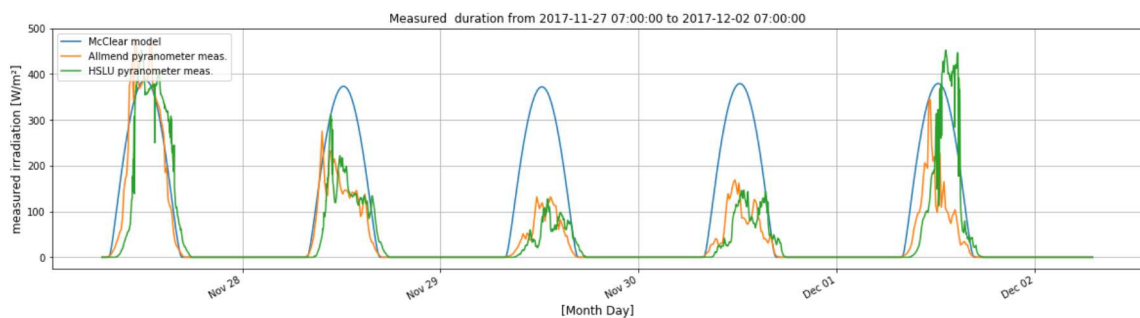
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [48]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-12-02 07:00:00' # beginning
end    = '2017-12-07 07:00:00' # ending

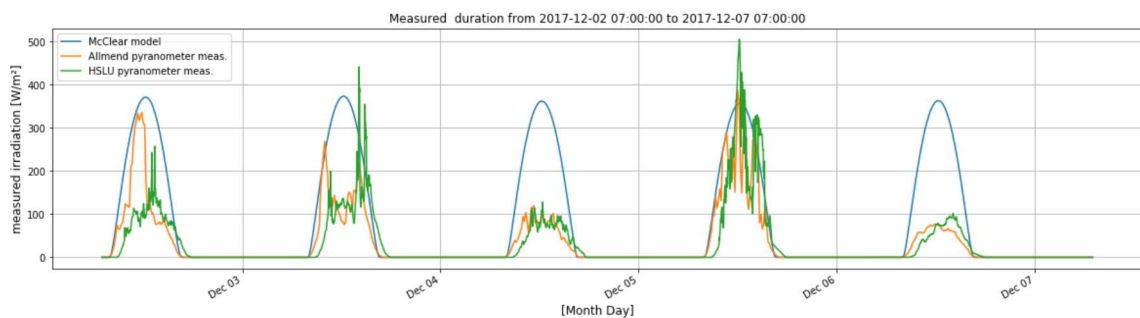
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [49]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-12-07 07:00:00' # beginning
end    = '2017-12-12 07:00:00' # ending

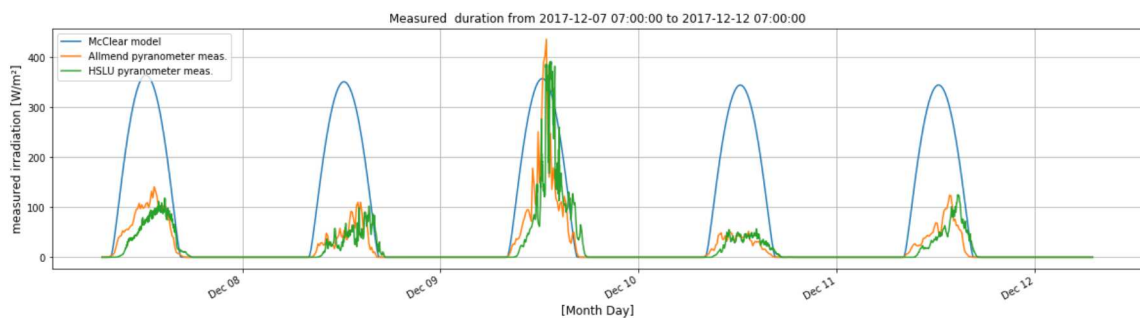
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [50]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-12-12 07:00:00' # beginning
end    = '2017-12-17 07:00:00' # ending

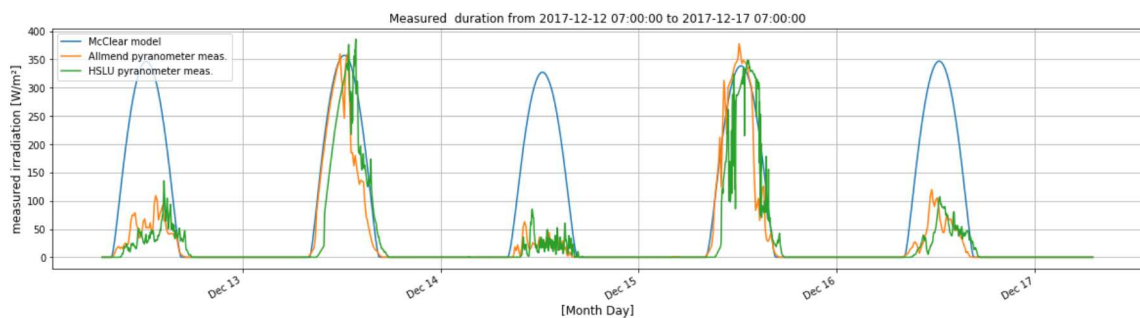
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [51]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-12-17 07:00:00' # beginning
end    = '2017-12-22 07:00:00' # ending

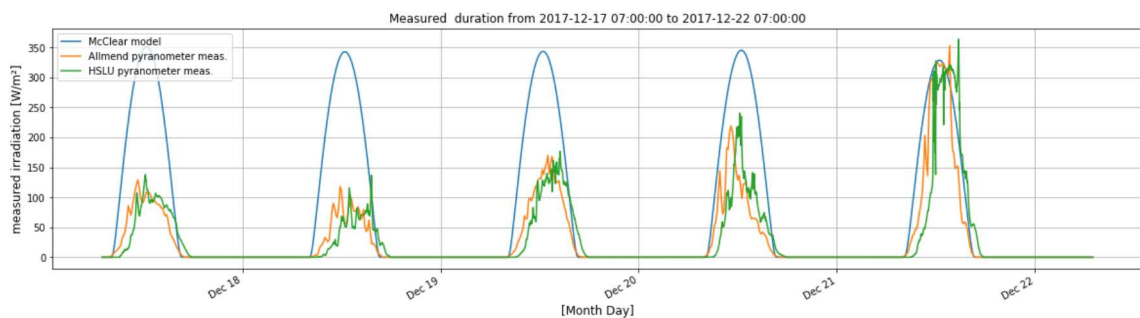
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```





```
In [52]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

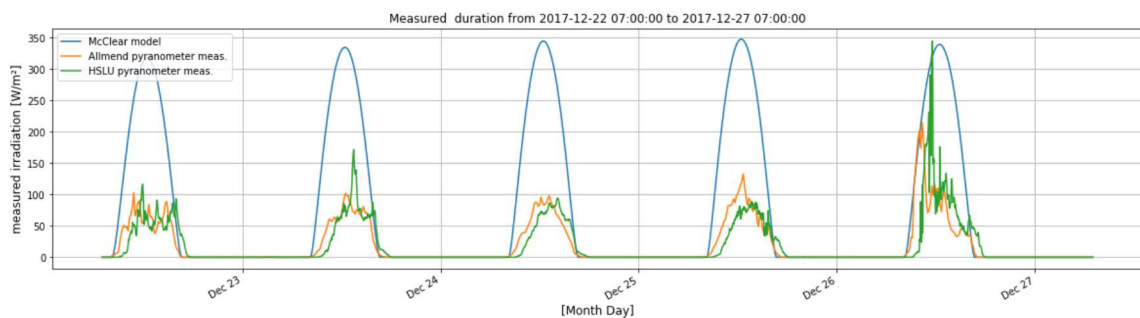
start = '2017-12-22 07:00:00' # beginning
end    = '2017-12-27 07:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()
```



```

In [53]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2017-12-27 07:00:00' # beginning
end    = '2017-12-31 07:00:00' # ending

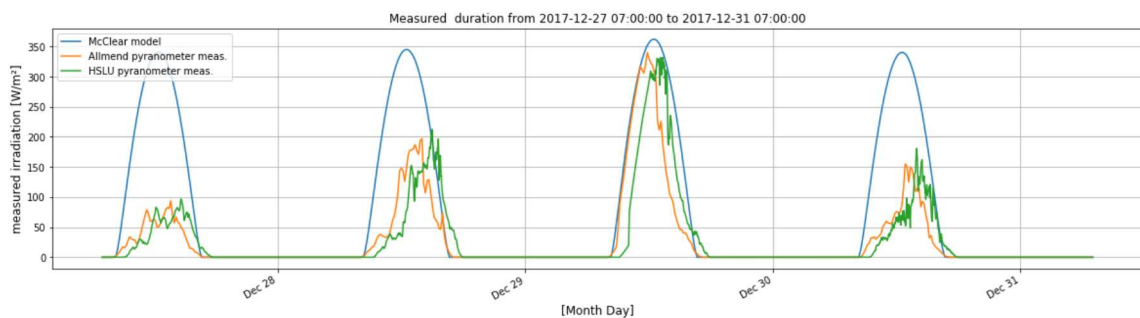
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu17.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [54]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-01-01 07:00:00' # beginning
end    = '2018-01-06 07:00:00' # ending

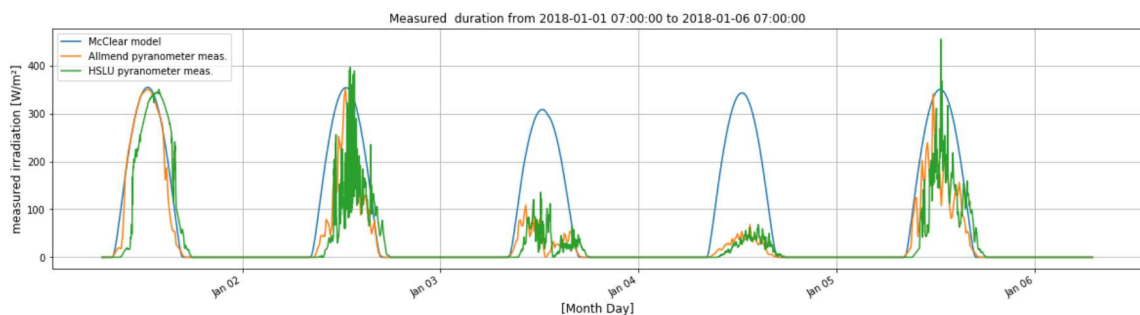
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [55]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-01-06 07:00:00' # beginning
end    = '2018-01-11 07:00:00' # ending

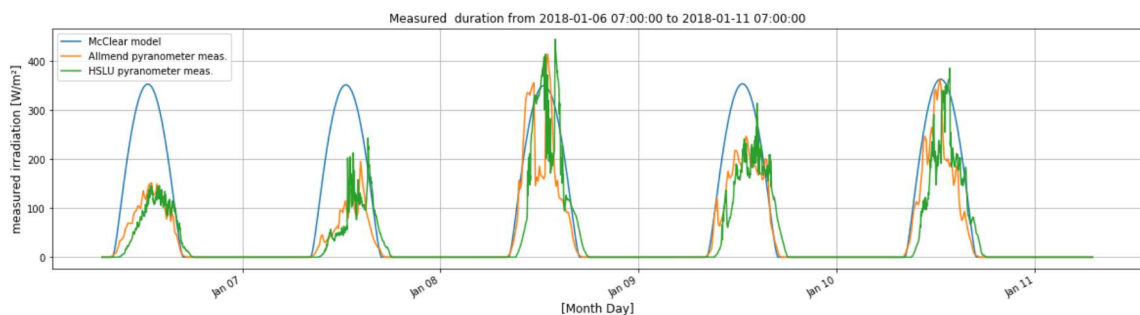
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```
In [56]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

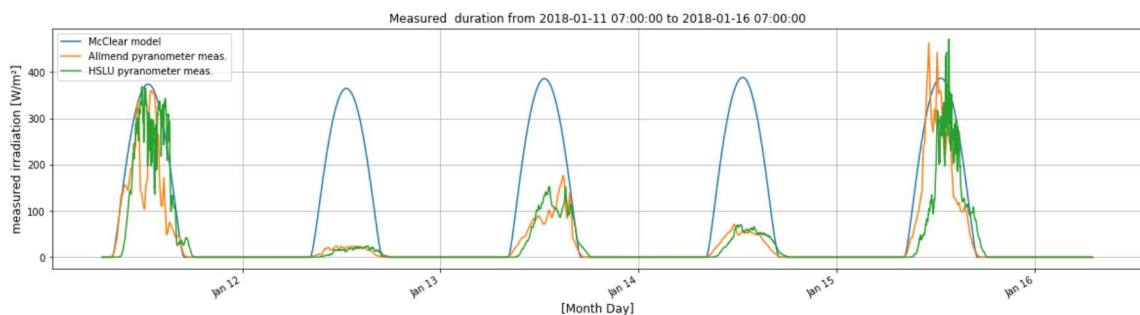
start = '2018-01-11 07:00:00' # beginning
end    = '2018-01-16 07:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()
```



```

In [57]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-01-16 07:00:00' # beginning
end    = '2018-01-21 07:00:00' # ending

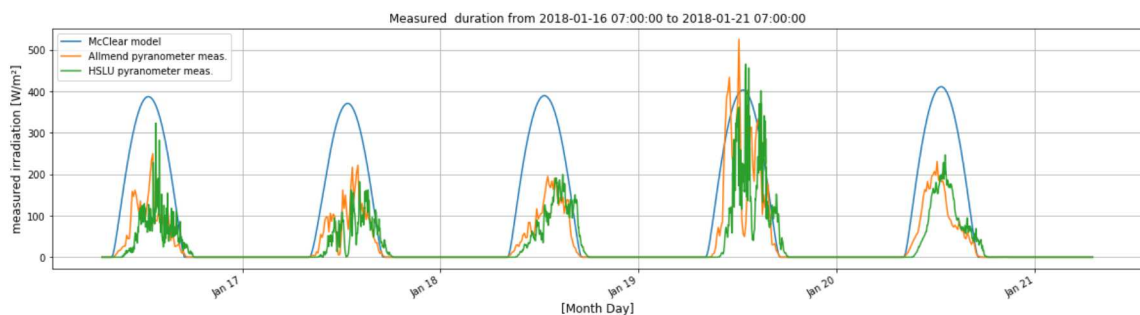
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [58]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-01-21 07:00:00' # beginning
end    = '2018-01-26 07:00:00' # ending

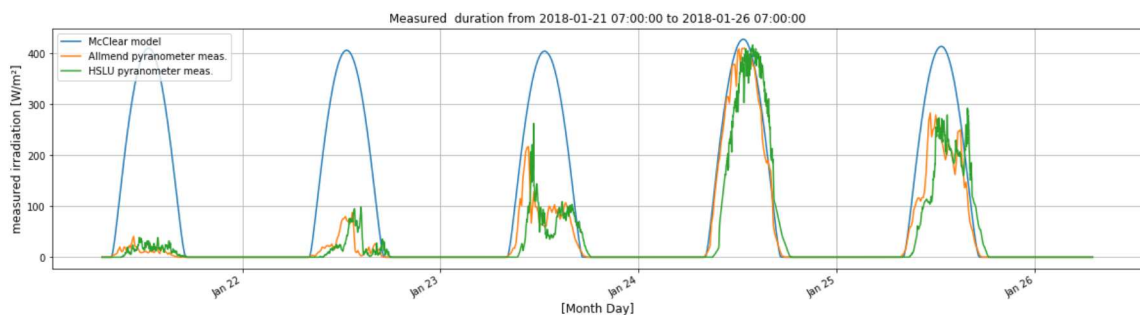
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```
In [59]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

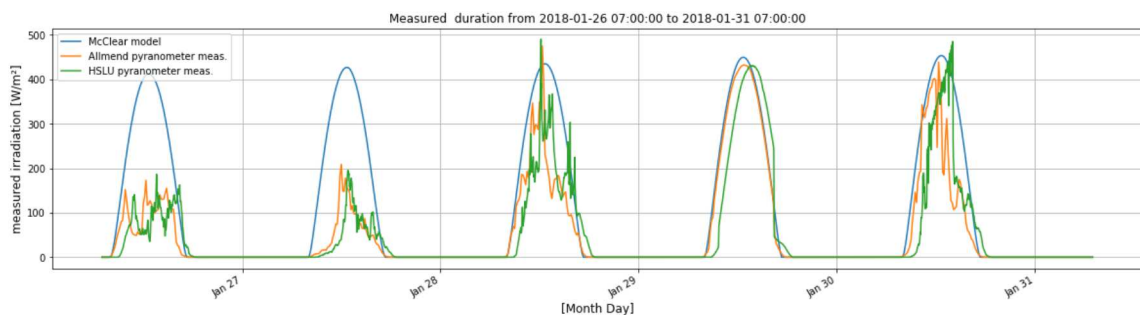
start = '2018-01-26 07:00:00' # beginning
end    = '2018-01-31 07:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()
```





```

In [60]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-01-31 07:00:00' # beginning
end    = '2018-02-05 07:00:00' # ending

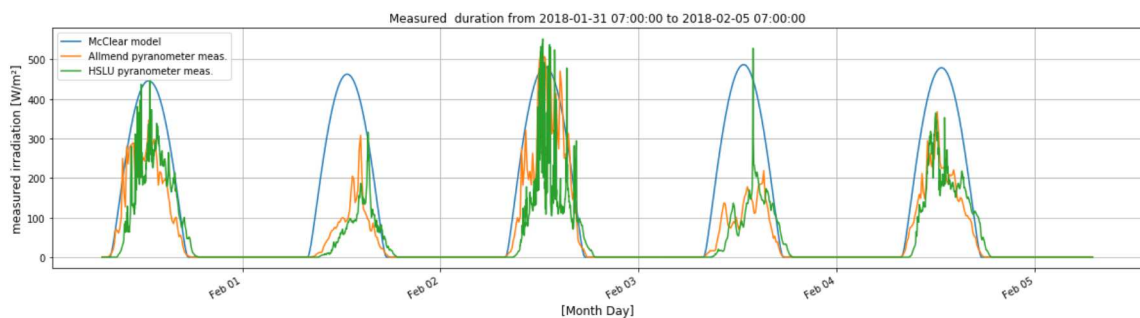
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [61]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-05 07:00:00' # beginning
end    = '2018-02-10 07:00:00' # ending

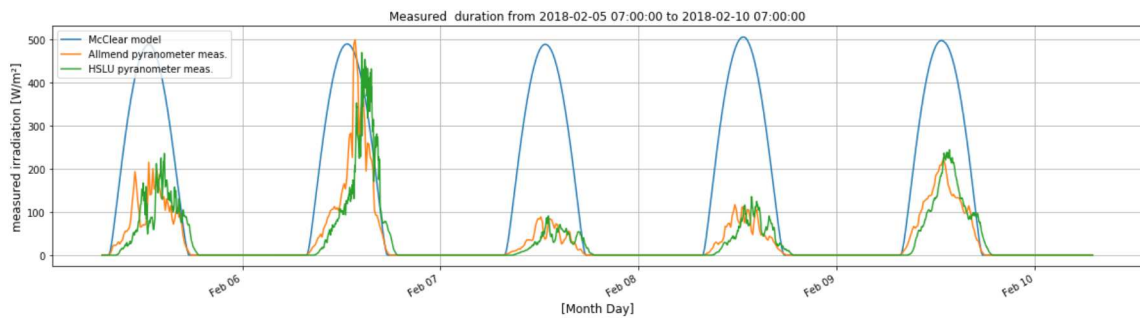
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [62]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-10 07:00:00' # beginning
end    = '2018-02-15 07:00:00' # ending

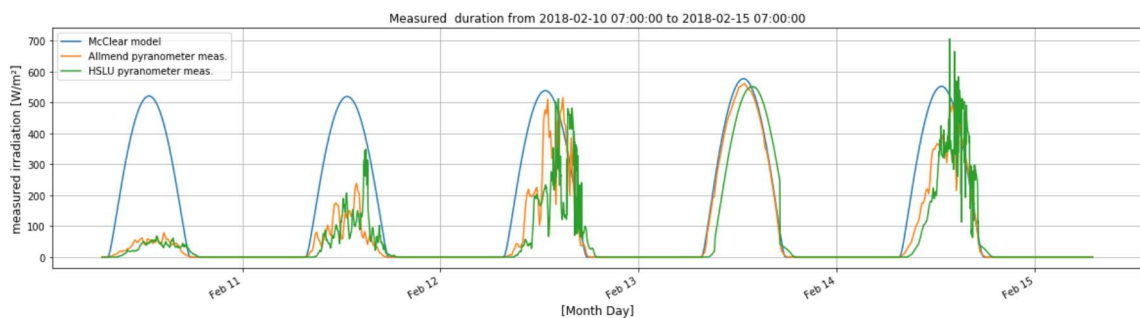
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [63]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-15 07:00:00' # beginning
end    = '2018-02-20 07:00:00' # ending

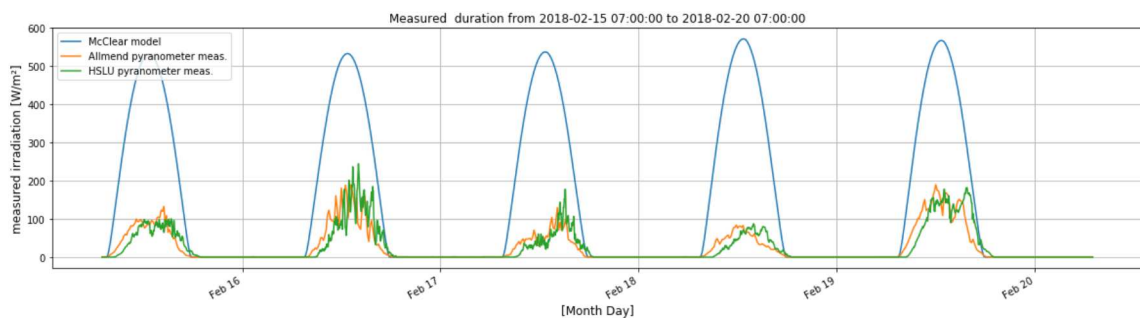
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [64]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-20 07:00:00' # beginning
end    = '2018-02-25 07:00:00' # ending

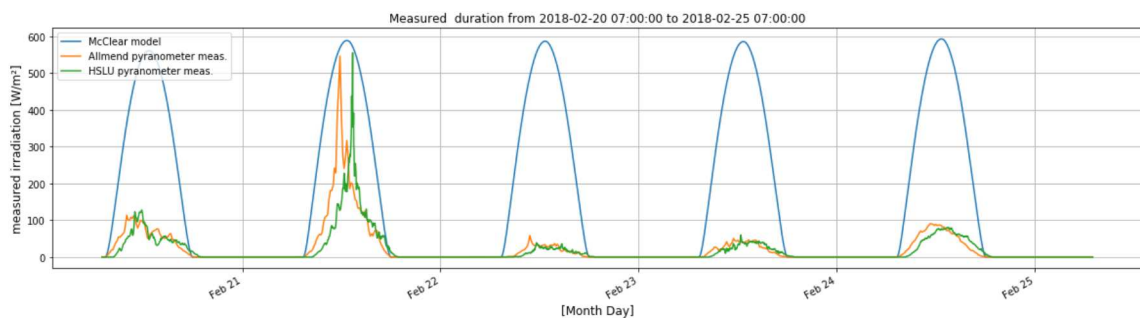
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [65]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-25 07:00:00' # beginning
end    = '2018-02-28 07:00:00' # ending

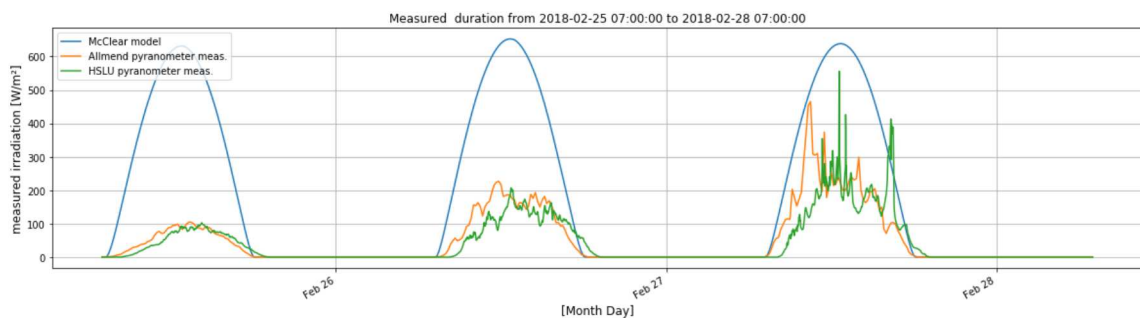
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [66]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-03-01 07:00:00' # beginning
end    = '2018-03-06 07:00:00' # ending

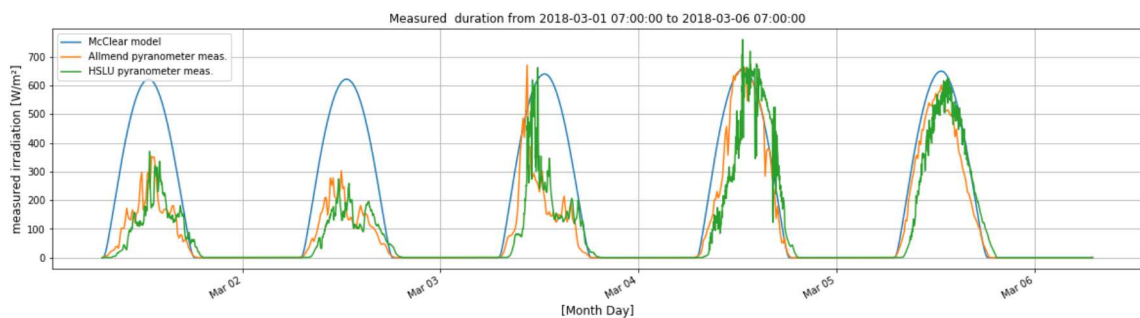
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```

In [67]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-03-06 07:00:00' # beginning
end    = '2018-03-11 07:00:00' # ending

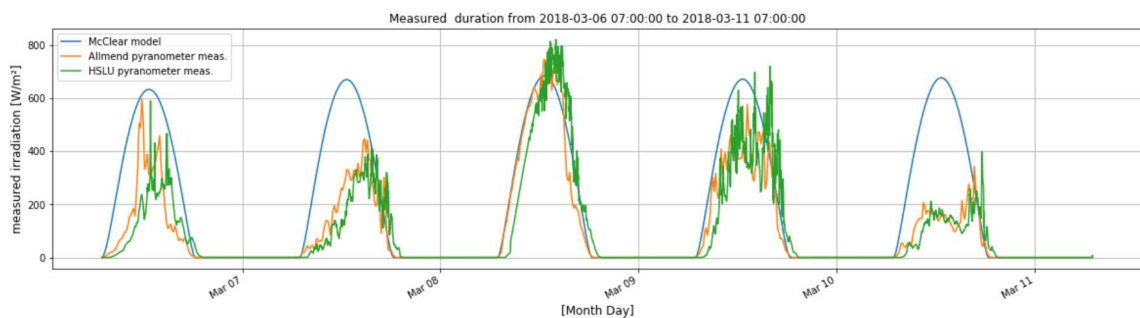
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```





```

In [68]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-03-11 07:00:00' # beginning
end    = '2018-03-17 07:00:00' # ending

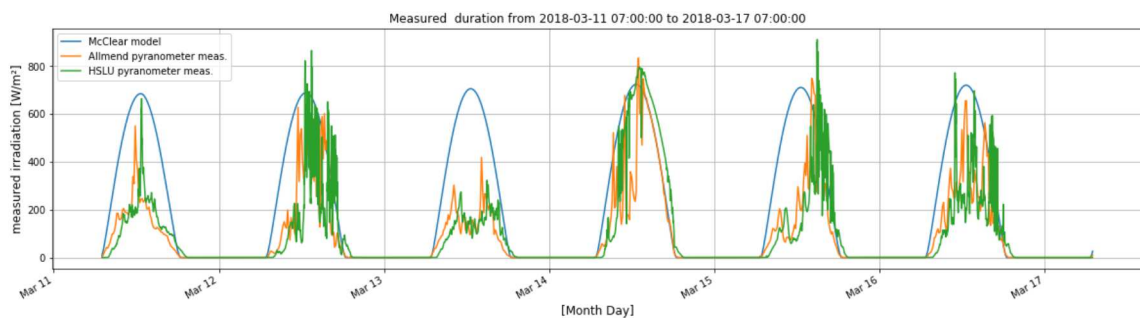
lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()

```



```
In [69]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

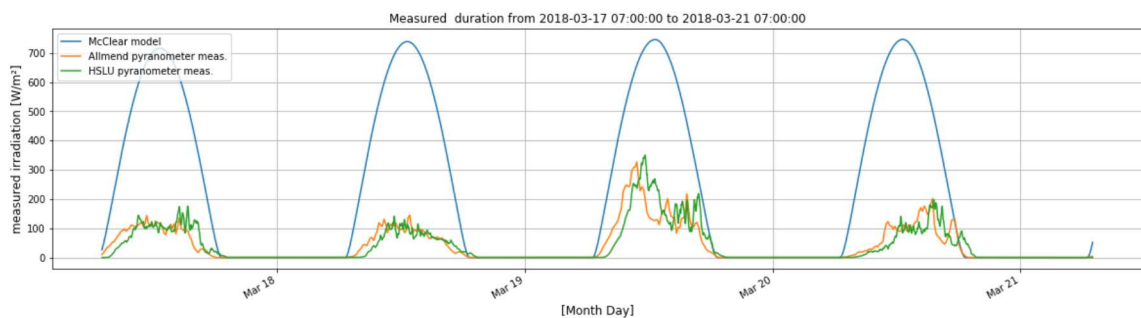
start = '2018-03-17 07:00:00' # beginning
end    = '2018-03-21 07:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.DayLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%b %d'))
fig.autofmt_xdate()
```



## Some excerpts from 2017 11.17 - 2018 01.03

2018 02.13

```

In [70]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-13 07:00:00' # beginning
end    = '2018-02-13 21:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

_hslu_rad = hslu_rad.shift(-57)

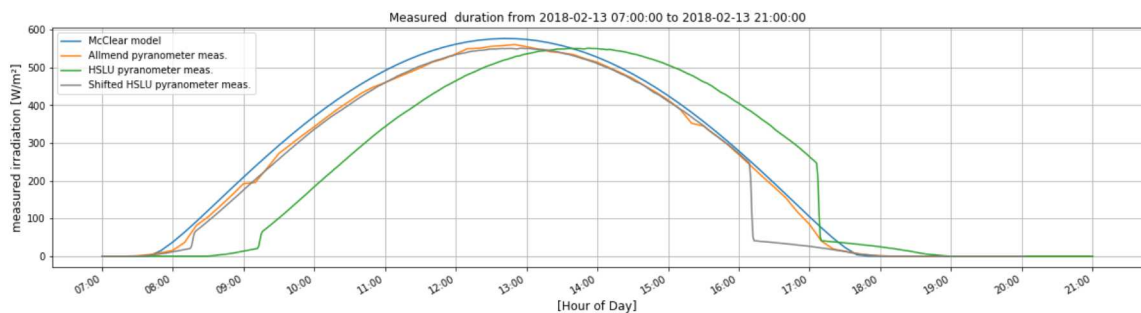
fig, ax = plt.subplots(figsize=(20,5))

ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')
ax.plot(_hslu_rad.index, _hslu_rad, label='Shifted HSLU pyranometer meas.', color
='gray')

ax.set_xlabel('[Hour of Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.HourLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%H:%M'))
fig.autofmt_xdate()

```



2018 03.12

```

In [71]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-03-12 07:00:00' # beginning
end    = '2018-03-12 21:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

_hslu_rad = hslu_rad.shift(-57) # shift in minutes

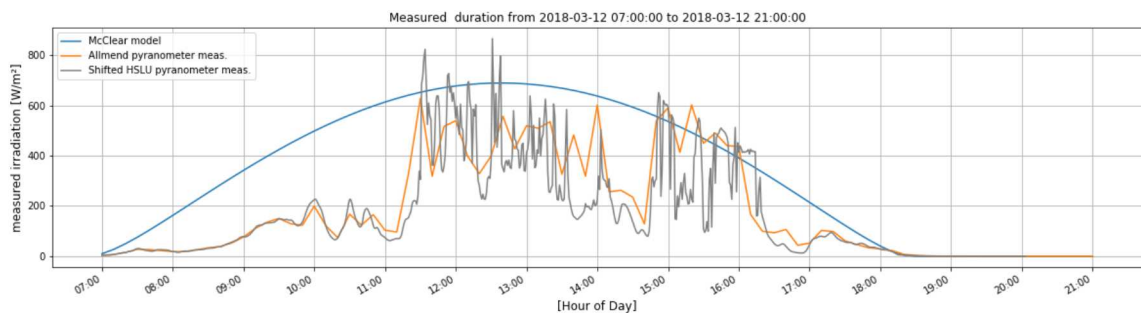
fig, ax = plt.subplots(figsize=(20,5))

ax.plot(mc_rad.index, mc_rad, label='McClear model')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.')
#ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.')
ax.plot(_hslu_rad.index, _hslu_rad, label='Shifted HSLU pyranometer meas.', color='gray')

ax.set_xlabel('[Hour of Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.HourLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%H:%M'))
fig.autofmt_xdate()

```



2018 02.27

```

In [72]: matplotlib.rcParams['timezone'] = 'Europe/Zurich'

start = '2018-02-27 07:00:00' # beginning
end    = '2018-02-27 21:00:00' # ending

lu_rad  = df_lu.loc[start:end]
hslu_rad = df_hslu18.loc[start:end]
mc_rad  = df_soda.loc[start:end]

_hslu_rad = hslu_rad.shift(-57)

fig, ax = plt.subplots(figsize=(20,5))

ax.plot(mc_rad.index, mc_rad, label='McClear model', color='blue')
ax.plot(lu_rad.index, lu_rad, label='Allmend pyranometer meas.', color='orange')
#ax.plot(hslu_rad.index, hslu_rad, label='HSLU pyranometer meas.', color='green')
ax.plot(_hslu_rad.index, _hslu_rad, label='Shifted HSLU pyranometer meas.', color='gray')

ax.set_xlabel('[Hour of Day]', fontsize=12)
ax.set_ylabel('measured irradiation [W/m²]', fontsize=12)
ax.set_title('Measured duration from {} to {}'.format(start,end))
ax.legend(loc='upper left')
ax.grid(b=None, which='major', axis='both')

#ax.xaxis.set_major_locator(mdates.WeekdayLocator())
ax.xaxis.set_major_locator(mdates.HourLocator())
ax.xaxis.set_major_formatter(mdates.DateFormatter('%H:%M'))
fig.autofmt_xdate()

```

