Assessing suitable days: rainless days

In [1]:

```
import matplotlib
import numpy as np
import matplotlib.dates as mdates
import matplotlib.pyplot as plt
#%matplotlib notebook
%matplotlib inline
import csv
import bisect
import datetime
from scipy import interpolate
from matplotlib.dates import DateFormatter

# User defined functions
from load_precip_irrad_from_csv import *
```

Remarks:

- **HSLU pyranometer data** is avaiable from 2017 01.01 to 2018 01.03
- **Images from sky-cameras** range from 2017 11.17 to 2018 11.13

- **Camera 1** worked from 2017 02.11 to 2018 11.13
  - SW version 1 from 2017 01.01 to 2018 04.02
  - SW version 2 from 2018 04.03 to 2018 10.08
  - SW version 3 from 2018 10.09 to 2018 11.13

- **Camera 2** worked from 2017 02.11 to 2018 11.13
  - SW version 1 from 2018 01.09 to 2018 04.03
  - SW version 2 from 2018 04.03 to 2018 06.10
  - SW version 3 from 2018 11.12 to 2018 11.14

Import Precipitation

In [2]:

```
luz_precip = r'../weather_data/precipitation_luz_2017_2018.csv'

df_precip = process_LUZ_Precip(luz_precip)
df_precip.set_index(df_precip.datetime, inplace=True)
s_precip = df_precip['rka150d0']       # daily precipitaion in mm

#df_precip.head(n=2)
```

Import sunshine duration, relative to the absolute possible daily sum

In [3]:

```
dur_csv = r'../weather_data/sunshine_duration_2017_2018.csv'

df_rel_insol = process_LUZ_dur(dur_csv)
df_rel_insol.set_index(df_rel_insol.datetime, inplace=True)
df_rel_insol['sremaxdv'] = pd.to_numeric(df_rel_insol['sremaxdv'], errors='coerc
e')
s_rel_insol = df_rel_insol['sremaxdv']           # in percent
```

Precipitation and overlayed insolination 2017 from 11-01 to 12-31 near Lucern at Long: 8°18' Lat: 47°02'

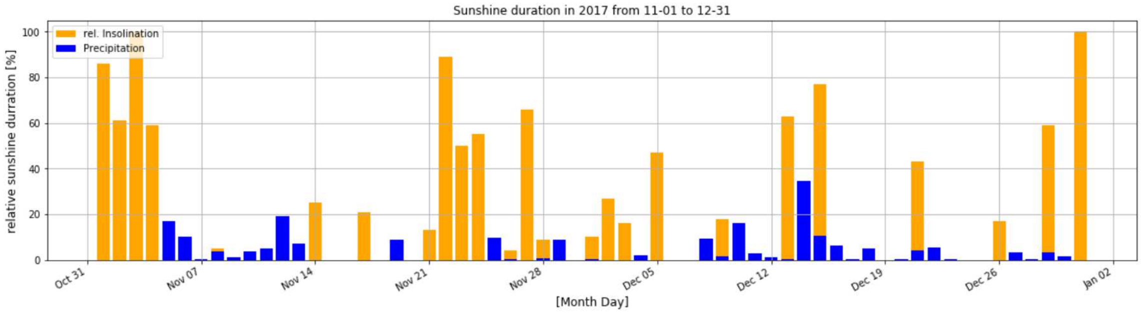
```
In [4]: year  = '2017-'
        s_day = '11-01' # beginning of observation
        e_day = '12-31' # end of observation
        start = year + s_day
        end   = year + e_day

        s_precip_17 = s_precip.loc[start:end]
        s_rel_insol_17 = s_rel_insol.loc[start:end]

        fig, ax = plt.subplots(figsize=(20,5))
        ax.bar(s_rel_insol_17.index, s_rel_insol_17.values, label='rel. Insolination', c
        olor= 'orange')
        ax.bar(s_precip_17.index, s_precip_17.values, label='Precipitation', color= 'blu
        e')

        ax.set_xlabel('[Month Day]', fontsize=12)
        ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
        ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_da
        y,e_day))
        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()
```



Insolination and overlayed precipitation in 2017: 9.30 - 10.31

In [5]:

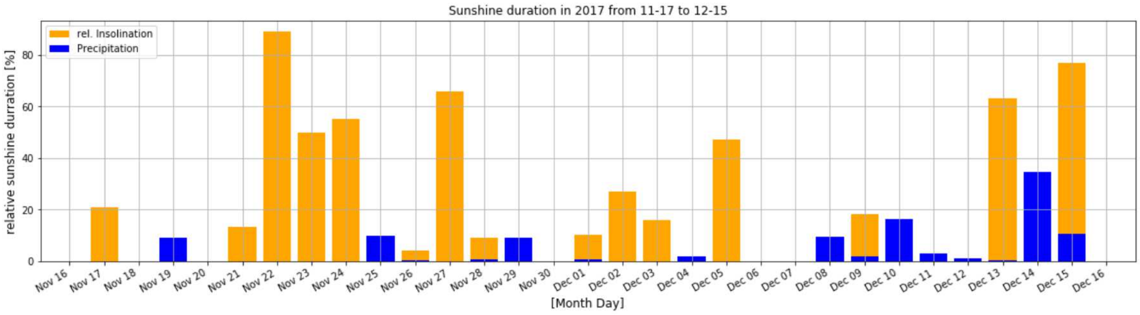
```
year  = '2017-'
s_day = '11-17' # beginning of observation
e_day = '12-15' # end of observation
start = year + s_day
end   = year + e_day

s_precip_17 = s_precip.loc[start:end]
s_rel_insol_17 = s_rel_insol.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.bar(s_rel_insol_17.index, s_rel_insol_17.values, label='rel. Insolination', color= 'orange')
ax.bar(s_precip_17.index, s_precip_17.values, label='Precipitation', color= 'blue')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_day,e_day))
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()
```



Detail view 2018 January to March

Remark: Time span where pyranometer data from HSLU is avaiable in 2018: from 1.01 to 3.01

In [6]:

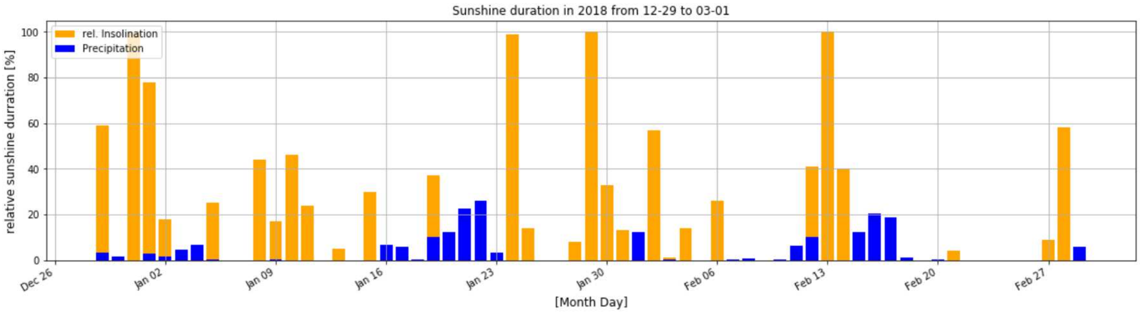
```
year1  = '2017-'
year2  = '2018-'
s_day = '12-29' # beginning of observation
e_day = '03-01' # end of observation
start = year1 + s_day
end   = year2 + e_day

s_precip_18 = s_precip.loc[start:end]
s_rel_insol_18 = s_rel_insol.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.bar(s_rel_insol_18.index, s_rel_insol_18.values, label='rel. Insolination', c
olor= 'orange')
ax.bar(s_precip_18.index, s_precip_18.values, label='Precipitation', color= 'blu
e')

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
ax.set_title('Sunshine duration in {} from {} to {}'.format(year2.strip('-'),s_d
ay,e_day))
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()
```



Detail view 2018 April to May

In [7]:

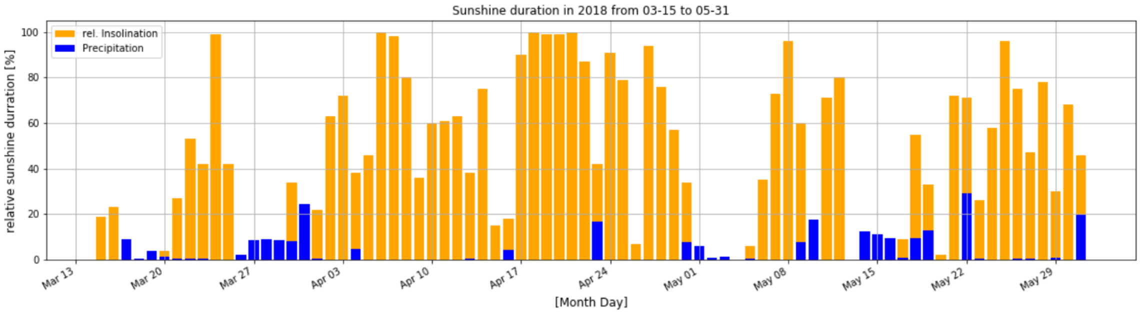
```
year  = '2018-'
s_day = '03-15' # beginning of observation
e_day = '05-31' # end of observation
start = year + s_day
end   = year + e_day

s_precip_4 = s_precip.loc[start:end]
s_rel_4 = s_rel_insol.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.bar(s_rel_4.index, s_rel_4.values, label='rel. Insolination', color= 'orange'
)
ax.bar(s_precip_4.index, s_precip_4.values, label='Precipitation', color= 'blue'
)

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_da
y,e_day))
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()
```



Detail view 2018 Jun to July

In [8]:

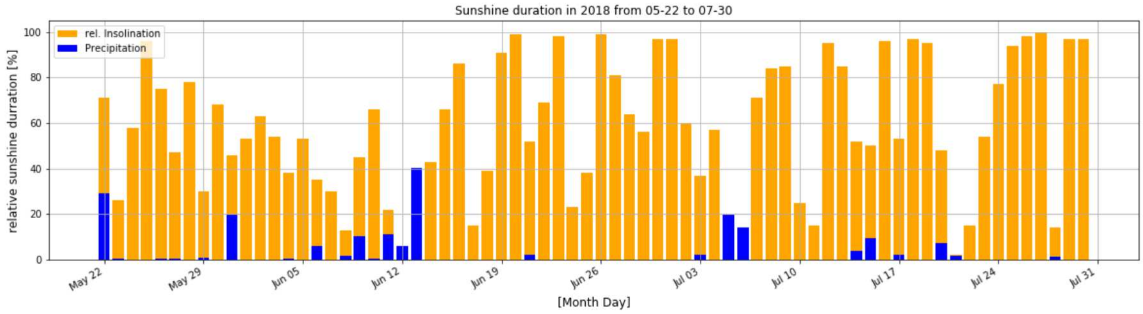
```
year  = '2018-'
s_day = '05-22' # beginning of observation
e_day = '07-30' # end of observation
start = year + s_day
end   = year + e_day

s_precip_5 = s_precip.loc[start:end]
s_rel_5 = s_rel_insol.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.bar(s_rel_5.index, s_rel_5.values, label='rel. Insolination', color= 'orange'
)
ax.bar(s_precip_5.index, s_precip_5.values, label='Precipitation', color= 'blue'
)

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_da
y,e_day))
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()
```



Detail view 2018 August to September

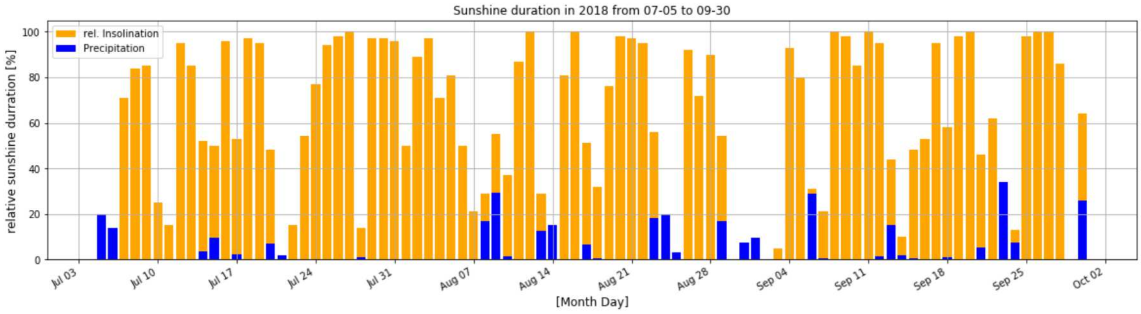
```
In [9]: year  = '2018-'
        s_day = '07-05' # beginning of observation
        e_day = '09-30' # end of observation
        start = year + s_day
        end   = year + e_day

        s_precip_6 = s_precip.loc[start:end]
        s_rel_6 = s_rel_insol.loc[start:end]

        fig, ax = plt.subplots(figsize=(20,5))
        ax.bar(s_rel_6.index, s_rel_6.values, label='rel. Insolination', color= 'orange'
        )
        ax.bar(s_precip_6.index, s_precip_6.values, label='Precipitation', color= 'blue'
        )

        ax.set_xlabel('[Month Day]', fontsize=12)
        ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
        ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_da
        y,e_day))
        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()
```



Detail view 2018 October

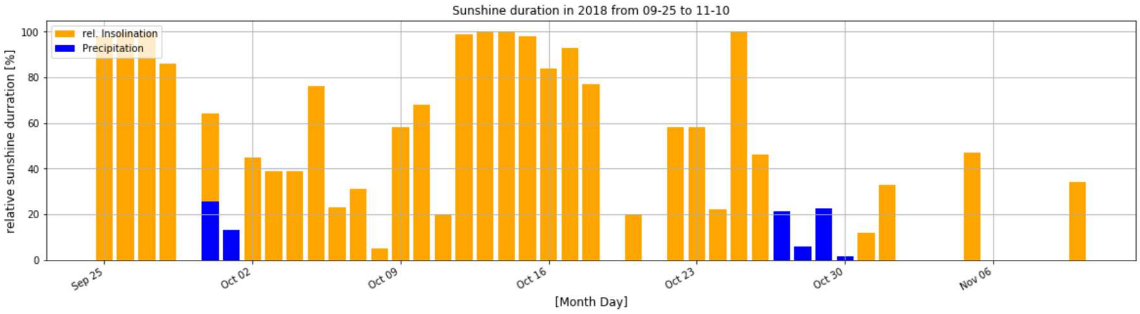
In [10]:
```
year  = '2018-'
s_day = '09-25' # beginning of observation
e_day = '11-10' # end of observation
start = year + s_day
end   = year + e_day

s_precip_7 = s_precip.loc[start:end]
s_rel_7 = s_rel_insol.loc[start:end]

fig, ax = plt.subplots(figsize=(20,5))
ax.bar(s_rel_7.index, s_rel_7.values, label='rel. Insolination', color= 'orange'
)
ax.bar(s_precip_7.index, s_precip_7.values, label='Precipitation', color= 'blue'
)

ax.set_xlabel('[Month Day]', fontsize=12)
ax.set_ylabel('relative sunshine durration [%]', fontsize=12)
ax.set_title('Sunshine duration in {} from {} to {}'.format(year.strip('-'),s_da
y,e_day))
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()
```



Longest dry periodes in 2018

21.06.2018 - 03.07.2018 -> 11 days

28.07.2018 - 08.08.2018 -> 11 days

10.02.2018 - 27.10.2018 -> 25 days