

MeteoCH.output

August 6, 2023

1 Meteoschweiz

1.1 Cleanup and required imports

```
[1]: # conda install -c conda-forge pandas matplotlib jupyter pyyaml papermill
      ↪nbconvert pandoc ipynbname
      # 'Soft' reset: Only clears your namespace, leaving history intact.
      %reset -sf
      import pandas as pd
      from datetime import datetime
      import matplotlib.cbook
```

1.2 Available weather stations

```
[2]: url = 'https://data.geo.admin.ch'
      path = 'ch.meteoschweiz.klima/nbcn-tageswerte'
      wsurl = url + '/' + path + '/' + 'liste-download-nbcn-d.csv'
      ws = pd.read_csv(wsurl, sep=";", header=0, encoding = "ISO-8859-1").dropna()
      ws.drop(['WIGOS-ID', 'CoordinatesE', 'CoordinatesN', 'URL Previous years',
              ↪(verified data)',
              'URL Current year'], axis=1)
```

```
[2]:
```

	Station	station/location	Data since	\
0	Altdorf	ALT	01.01.1864	
1	Andermatt	ANT	01.01.1864	
2	Basel / Binningen	BAS	01.01.1755	
3	Bern / Zollikofen	BER	01.01.1864	
4	La Chaux-de-Fonds	CDF	01.01.1900	
5	Château-d'Oex	CHD	01.01.1879	
6	Chaumont	CHM	01.01.1864	
7	Davos	DAV	01.01.1864	
8	Elm	ELM	01.02.1878	
9	Engelberg	ENG	01.01.1864	
10	Grächen	GRC	01.01.1864	
11	Grimsel Hospiz	GRH	01.01.1932	
12	Col du Grand St-Bernard	GSB	01.01.1818	
13	Genève / Cointrin	GVE	01.01.1753	
14	Jungfrauoch	JUN	01.01.1933	

15	Lugano	LUG	01.01.1864
16	Luzern	LUZ	01.01.1864
17	Meiringen	MER	01.07.1889
18	Neuchâtel	NEU	01.01.1864
19	Locarno / Monti	OTL	01.12.1882
20	Payerne	PAY	01.08.1964
21	Bad Ragaz	RAG	01.06.1870
22	Säntis	SAE	01.01.1864
23	Samedan	SAM	01.01.1864
24	S. Bernardino	SBE	01.01.1864
25	Segl-Maria	SIA	01.12.1863
26	Sion	SIO	01.01.1864
27	Zürich / Fluntern	SMA	01.01.1864
28	St. Gallen	STG	01.01.1864

	Station height m. a. sea level	Latitude	Longitude \
0	438.0	46.887069	8.621894
1	1438.0	46.630914	8.580553
2	316.0	47.541142	7.583525
3	553.0	46.990744	7.464061
4	1017.0	47.082947	6.792314
5	1028.0	46.479819	7.139656
6	1136.0	47.049169	6.978825
7	1594.0	46.812969	9.843558
8	958.0	46.923747	9.175350
9	1036.0	46.821639	8.410514
10	1605.0	46.195314	7.836822
11	1980.0	46.571689	8.333256
12	2472.0	45.869092	7.170683
13	411.0	46.247519	6.127742
14	3571.0	46.547556	7.985444
15	273.0	46.004217	8.960322
16	454.0	47.036439	8.301022
17	589.0	46.732222	8.169247
18	485.0	47.000067	6.953297
19	367.0	46.172256	8.787494
20	490.0	46.811581	6.942469
21	497.0	47.016631	9.502594
22	2501.0	47.249447	9.343469
23	1709.0	46.526247	9.879469
24	1639.0	46.463542	9.184700
25	1804.0	46.432331	9.762325
26	482.0	46.218650	7.330203
27	556.0	47.377925	8.565742
28	776.0	47.425475	9.398528

Climate region Canton

0	Central Alpine north slope	UR
1	Central Alpine north slope	UR
2	Eastern Jura	BL
3	Central plateau	BE
4	Western Jura	NE
5	Western Alpine north slope	VD
6	Western Jura	NE
7	Northern and central Grisons	GR
8	Eastern Alpine north slope	GL
9	Central Alpine north slope	OW
10	Valais	VS
11	Western Alpine north slope	BE
12	Alpine south side	VS
13	Western plateau	GE
14	Western Alpine north slope	VS
15	Alpine south side	TI
16	Central plateau	LU
17	Western Alpine north slope	BE
18	Western plateau	NE
19	Alpine south side	TI
20	Western plateau	VD
21	Northern and central Grisons	SG
22	Eastern Alpine north slope	AI
23	Engadine	GR
24	Alpine south side	GR
25	Engadine	GR
26	Valais	VS
27	North-eastern plateau	ZH
28	North-eastern plateau	SG

1.3 Specific weather station

```
[3]: # Define the default parameters and tag the cell accordingly
wsno = -1 # default -1 selects the last index, 2 sets BAS weather station
#
# Calling syntax from shell:
#
# time for i in {0..28}; do \
#   papermill MeteoCH.ipynb \
#   MeteoCH.output.ipynb \
#   -p wsno $i; done
#
# The time command at the beginning of the call may be omitted.
```

```
[4]: # Parameters
wsno = 16
```

```
[5]: wstation = ws['Station'].tolist()[wsno]
print(wsno)
ws[ws.Station==wstation]
label = ws[ws.Station==wstation]['station/location'].to_string()[::-1][0:3][::-1]
print(f"The label of weather station {wstation} is {label}.")
```

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The label of weather station Luzern is LUZ.

1.4 Current online observations

```
[6]: maxrows = 400 # displayed number of past days
filenm = "nbcn-daily_"
ext="csv"
currurl = url + "/" + path + "/" + filenm + label + "_current." + ext
prevurl = url + "/" + path + "/" + filenm + label + "_previous." + ext
cf = pd.read_csv(currurl, sep=";", index_col='date', converters={'date':pd.
    to_datetime}).drop(['station/location'], axis=1) #, engine='pyarrow')
for col in cf.columns:
    cf[col] = pd.to_numeric(cf[col], errors='coerce')
pf = pd.read_csv(prevurl, sep=";", index_col='date', converters={'date':pd.
    to_datetime}).drop(['station/location'], axis=1) #, engine='pyarrow')
for col in pf.columns:
    pf[col] = pd.to_numeric(pf[col], errors='coerce')
df = pd.concat([pf, cf], axis=0).tail(maxrows)
```

1.5 Summary statistics

```
[7]: df.describe()
```

```
[7]:
```

	gre000d0	hto000d0	nto000d0	prestad0	rre150d0	sre000d0	\
count	400.000000	399.000000	0.0	400.000000	400.000000	400.000000	
mean	147.877500	0.210526	NaN	964.415250	3.452750	295.267500	
std	103.791711	0.930116	NaN	6.549131	7.663787	274.919056	
min	6.000000	0.000000	NaN	935.100000	0.000000	0.000000	
25%	55.500000	0.000000	NaN	961.400000	0.000000	24.000000	
50%	127.000000	0.000000	NaN	964.450000	0.000000	218.500000	
75%	232.250000	0.000000	NaN	967.825000	3.550000	502.250000	
max	358.000000	8.000000	NaN	983.300000	55.200000	885.000000	

	tre200d0	tre200dn	tre200dx	ure200d0
count	400.000000	400.000000	400.000000	400.000000
mean	12.288500	8.18675	16.823250	74.690750
std	7.474083	6.57617	8.877082	12.252056
min	-5.400000	-8.70000	-3.300000	37.400000
25%	6.375000	2.77500	9.425000	66.400000

50%	12.300000	8.95000	16.800000	76.150000
75%	19.200000	13.92500	24.925000	85.125000
max	26.400000	19.90000	35.500000	95.600000

```
[8]: (rows, cols) = df.shape
print(f"{rows} observations from {min(df.index)} to {max(df.index)}.")
```

400 observations from 2022-07-01 00:00:00 to 2023-08-04 00:00:00.

1.6 Description of observed parameters

```
[9]: from urllib.request import urlopen
from io import BytesIO
from zipfile import ZipFile

zip_url = url + "/" + path + "/" + "data.zip"
plist = [] # parameter
ulist = [] # unit
dlist = [] # description

with urlopen(zip_url) as f:
    with BytesIO(f.read()) as b, ZipFile(b) as myzipfile:
        rf = myzipfile.open('1_how-to-download-nbcn-d.txt')
        blines = rf.readlines()
        rf.close()
        for i in range(14, 25):
            line = blines[i].decode('unicode-escape').rstrip('\r\n')
            plist.append(line[0:21].strip())
            ulist.append(line[21:38].strip())
            dlist.append(line[38:].strip('\n'))

# list of lists instead of list of tuples
##zipped = zip(plist[1:], ulist[1:], dlist[1:])
list_of_lists = [list(tup) for tup in zip(plist[1:], ulist[1:], dlist[1:])]
cols = [plist[0], ulist[0], dlist[0]]

par = pd.DataFrame(list_of_lists, columns = cols)
print(par)
```

	Parameter	Einheit	Beschreibung
0	gre000d0	W/m ²	Globalstrahlung; Tagesmittel
1	hto000d0	cm	Gesamtschneehöhe; Morgenmessung von 6 UTC
2	nto000d0	%	Gesamtbewölkung; Tagesmittel
3	prestad0	hPa	Luftdruck auf Stationshöhe (QFE); Tagesmittel
4	rre150d0	mm	Niederschlag; Tagessumme 6 UTC - 6 UTC Folgetag
5	sre000d0	min	Sonnenscheindauer; Tagessumme
6	tre200d0	°C	Lufttemperatur 2 m über Boden; Tagesmittel
7	tre200dn	°C	Lufttemperatur 2 m über Boden; Tagesminimum

```
8 tre200dx      °C      Lufttemperatur 2 m über Boden; Tagesmaximum
9 ure200d0      %      Relative Luftfeuchtigkeit 2 m über Boden; Tage...
```

1.7 Air temperature

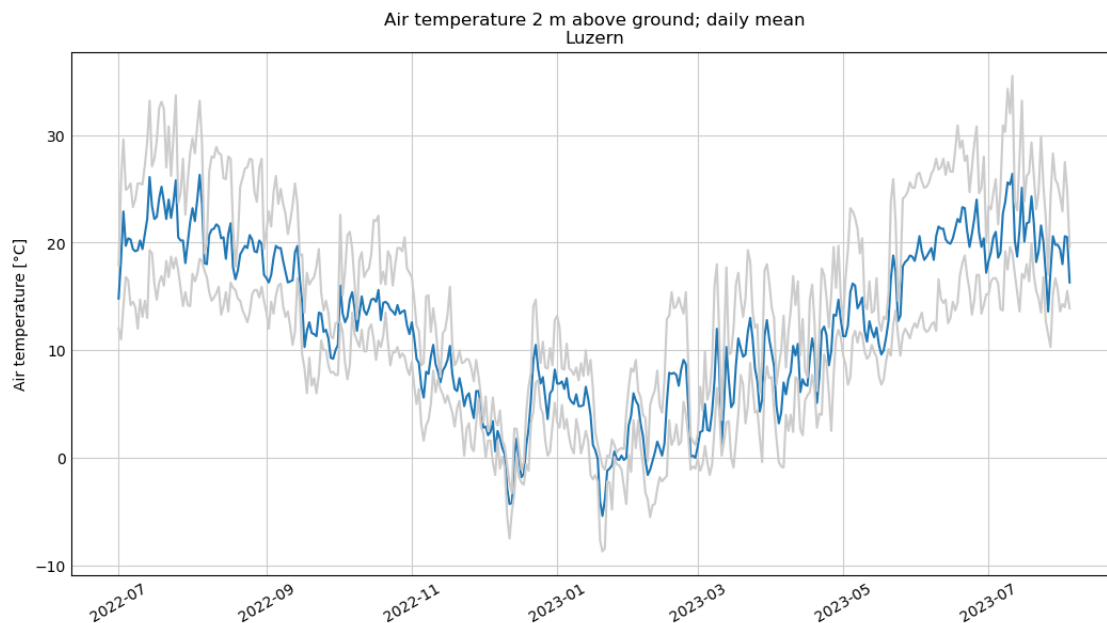
```
[10]: import matplotlib.pyplot as plt
plt.style.use('_mpl-gallery')
fswidth = 10
fsheight = 5
```

```
[11]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.tre200d0)
axs.plot(df.index, df.tre200dn, color='0.8')
axs.plot(df.index, df.tre200dx, color='0.8')
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')
#axs.grid(which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Air temperature [°C]')
plt.title('Air temperature 2 m above ground; daily mean\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



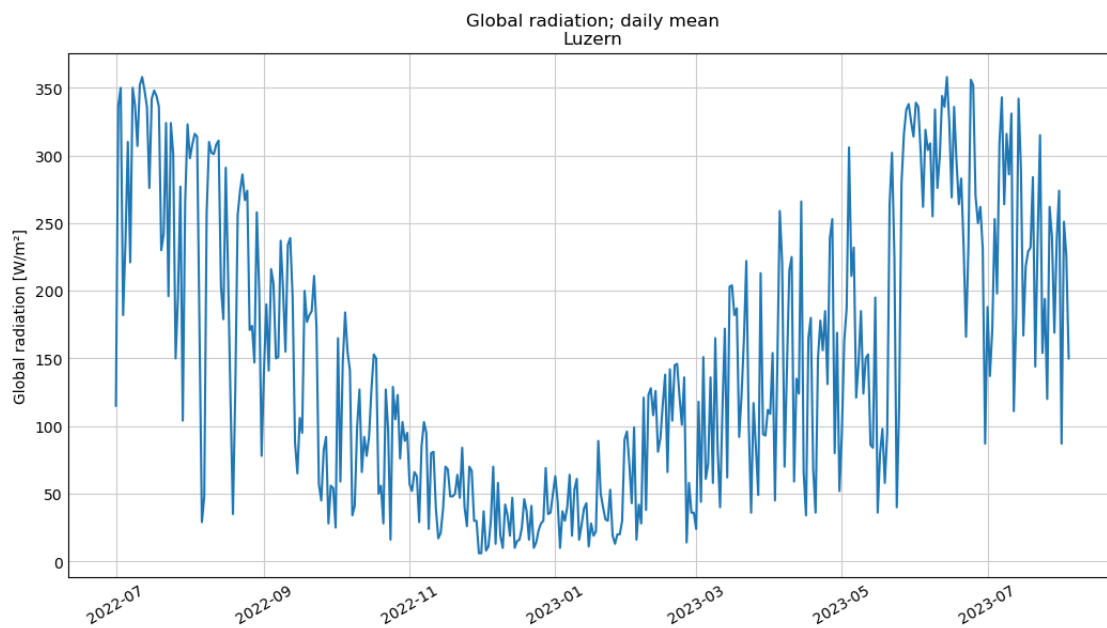
1.8 Global radiation

```
[12]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.gre000d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Global radiation [W/m²]')
plt.title('Global radiation; daily mean\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



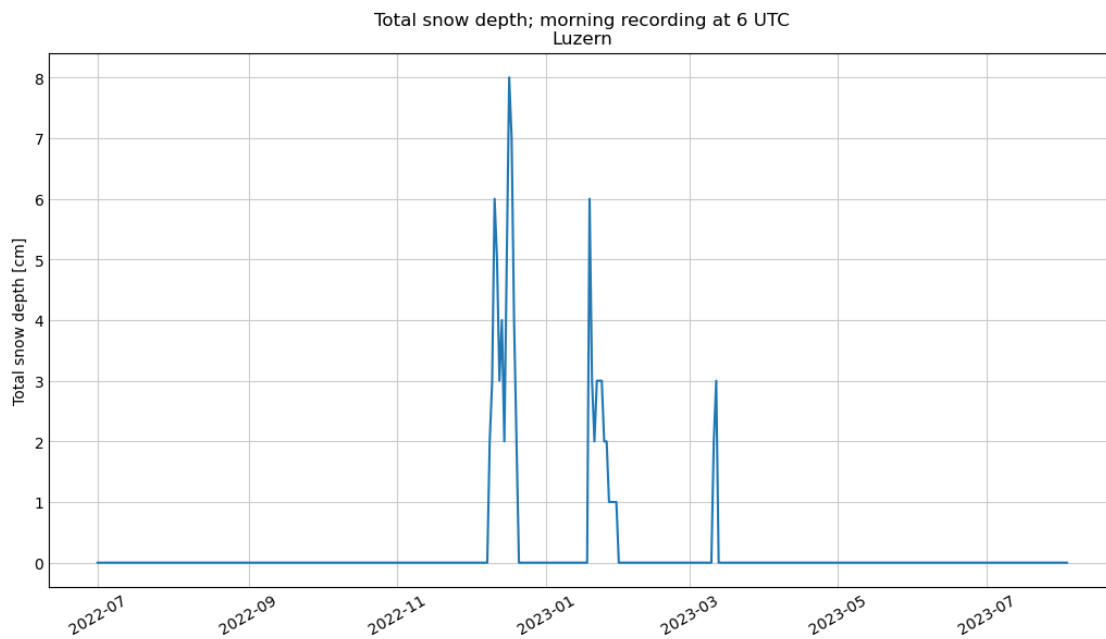
1.9 Total snow depth

```
[13]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.hto000d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Total snow depth [cm]')
plt.title('Total snow depth; morning recording at 6 UTC\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



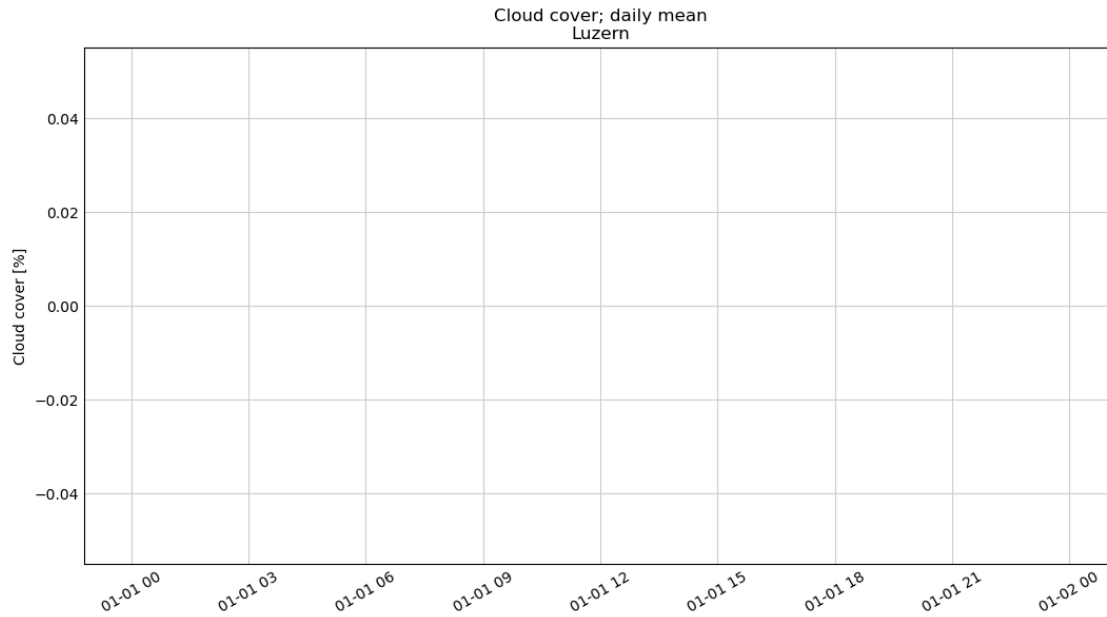
1.10 Cloud cover

```
[14]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df. nto000d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Cloud cover [%]')
plt.title('Cloud cover; daily mean\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```

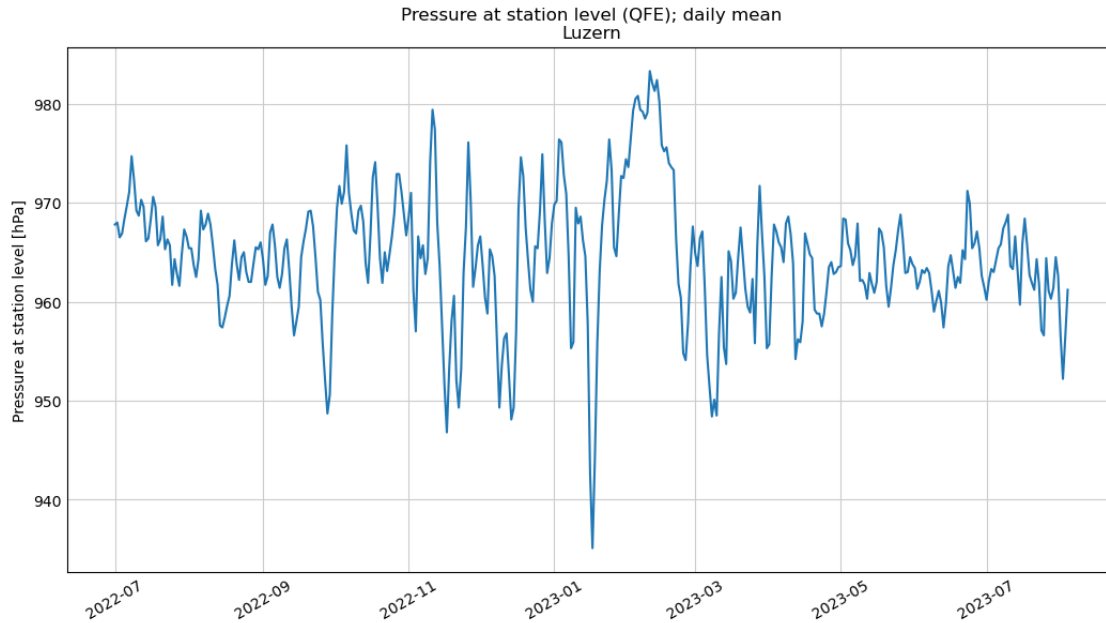
1.11 Pressure at station level

```
[15]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.prestad0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Pressure at station level [hPa]')
plt.title('Pressure at station level (QFE); daily mean\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



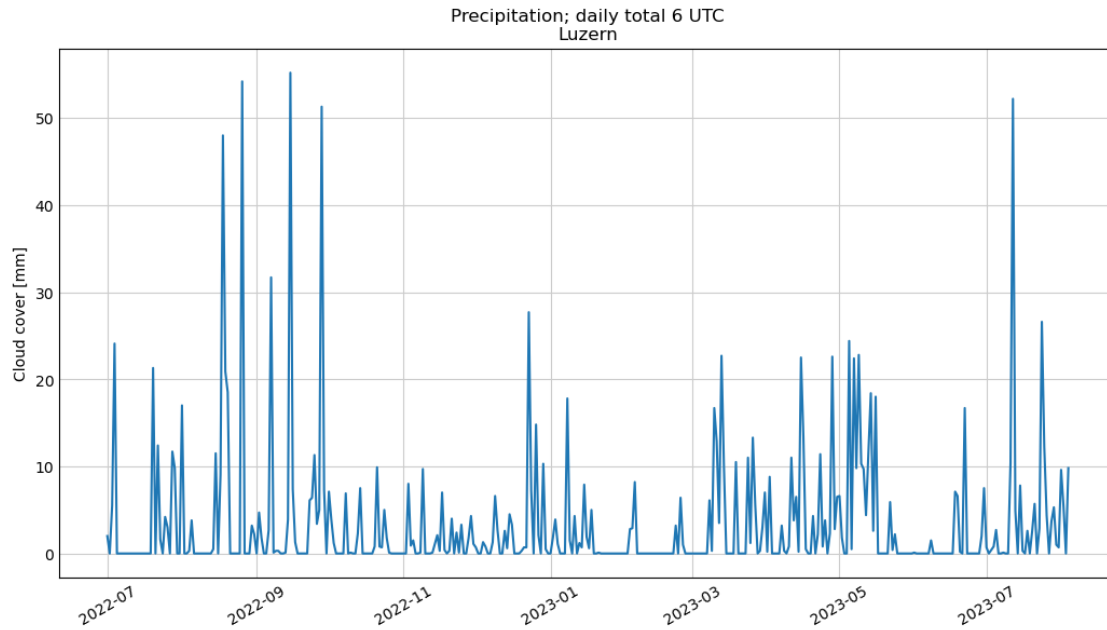
1.12 Precipitation

```
[16]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.rre150d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='--')

plt.xlabel('')
plt.ylabel('Cloud cover [mm]')
plt.title('Precipitation; daily total 6 UTC\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



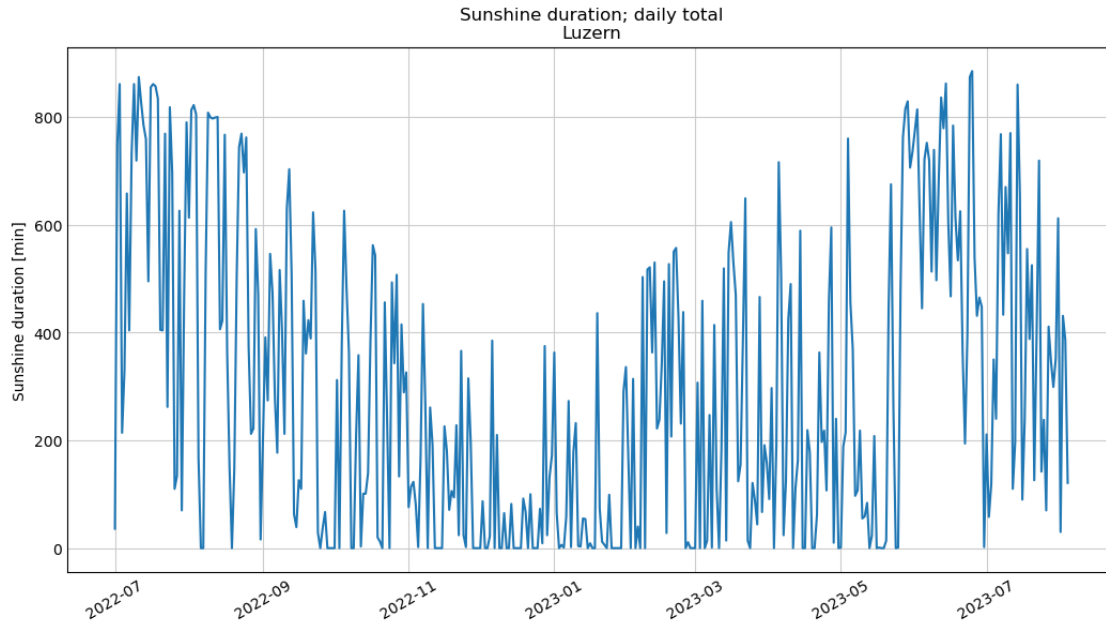
1.13 Sunshine duration

```
[17]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.sre000d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='-')

plt.xlabel('')
plt.ylabel('Sunshine duration [min]')
plt.title('Sunshine duration; daily total\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



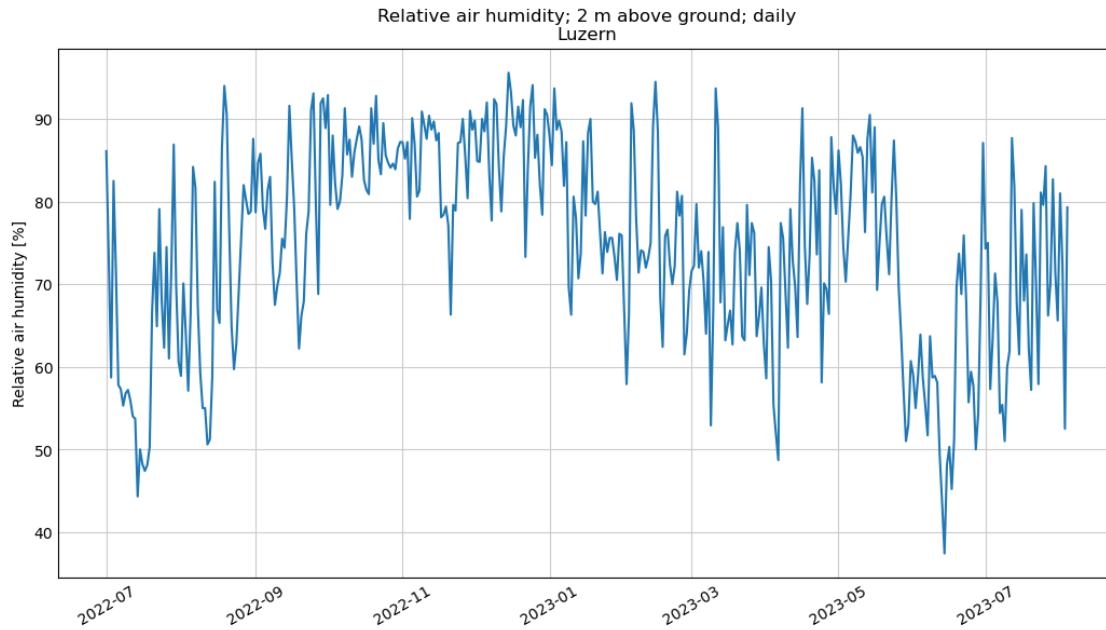
1.14 Relative air humidity

```
[18]: fig, axs = plt.subplots(figsize=(fswidth, fsheight))

axs.plot(df.index, df.ure200d0)
axs.grid(visible='visible', which='major', color='0.8', linestyle='--')

plt.xlabel('')
plt.ylabel('Relative air humidity [%]')
plt.title('Relative air humidity; 2 m above ground; daily\n' + wstation)
plt.xticks(rotation=30)

plt.show()
```



1.15 Export as PDF Report

```
[ ]: import os

# Note that this only reliably works when running a notebook in a browser.
# So it does not currently work for things like nbconvert or papermill.
#import ipynbname
nb_fname = 'MeteoCH' # hard-coded: import ipynbname raises an exception...

out_fname = nb_fname + ".output"
#out_fname = nb_fname
#label = "FOOBAR"

static_format = 'pdf' # pdf or html, etc.
os.system(f'jupyter nbconvert --to {static_format} {out_fname}.ipynb')

# Linux
os.system(f'mv {out_fname}.{static_format} {label}.{static_format}')

# Windows
#os.system(f'del {label}.{static_format}')
#os.system(f'ren {out_fname}.{static_format} {label}.{static_format}')

os.system(f'echo done {wsno}: {label}')
```