MeteoCH.output

September 3, 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	Jungfraujoch	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 \                  # ...or /dev/null
#   -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}.")
```

```
16
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	400.000000	0.0	400.000000	400.000000	400.000000	
mean	141.787500	0.210000	NaN	964.197750	3.506000	282.262500	
std	98.291354	0.929009	NaN	6.494553	7.860415	265.389256	
min	6.000000	0.000000	NaN	935.100000	0.000000	0.000000	
25%	53.000000	0.000000	NaN	961.200000	0.000000	21.500000	
50%	123.000000	0.000000	NaN	964.300000	0.100000	212.000000	
75%	225.000000	0.000000	NaN	967.500000	3.425000	490.750000	
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	12.203250	8.175250	16.712250	75.399250
std	7.441994	6.600335	8.853119	11.593928
min	-5.400000	-8.700000	-3.300000	37.400000
25%	6.375000	2.775000	9.425000	67.450000

```
50%     12.250000    8.950000   16.750000   76.450000
75%     18.825000   13.700000   24.700000   85.325000
max     26.400000   20.500000   35.500000   95.600000
```

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

```
400 observations from 2022-07-29 00:00:00 to 2023-09-01 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/m²                          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

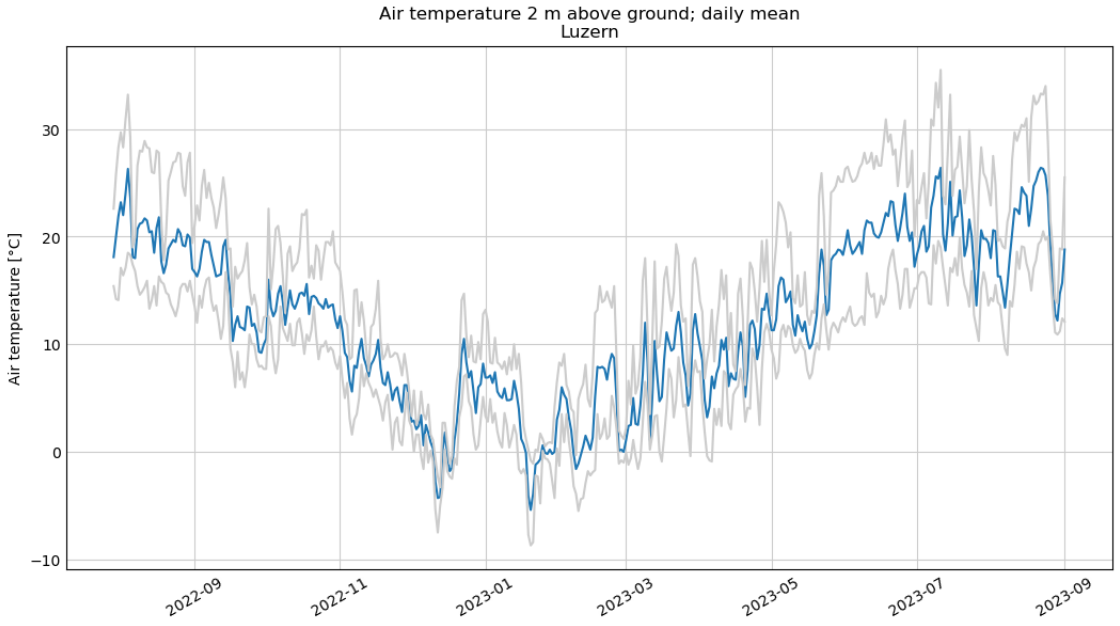
[10]:
```
import matplotlib.pyplot as plt
plt.style.use('_mpl-gallery')
fswidth = 10
fsheight = 5
```

[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()
```



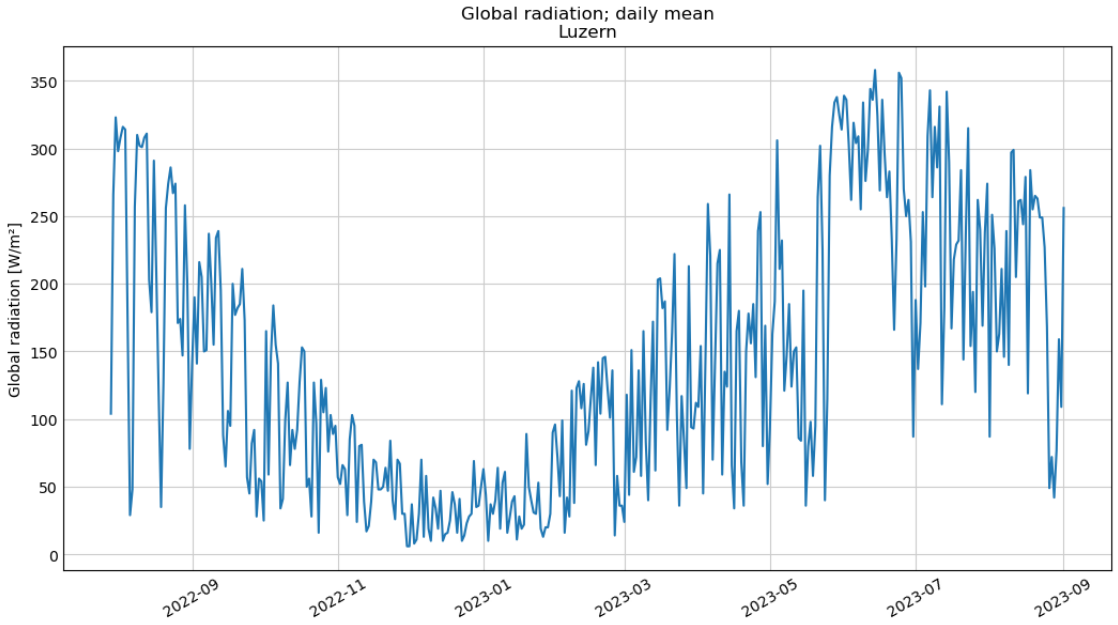
1.8 Global radiation

[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()
```



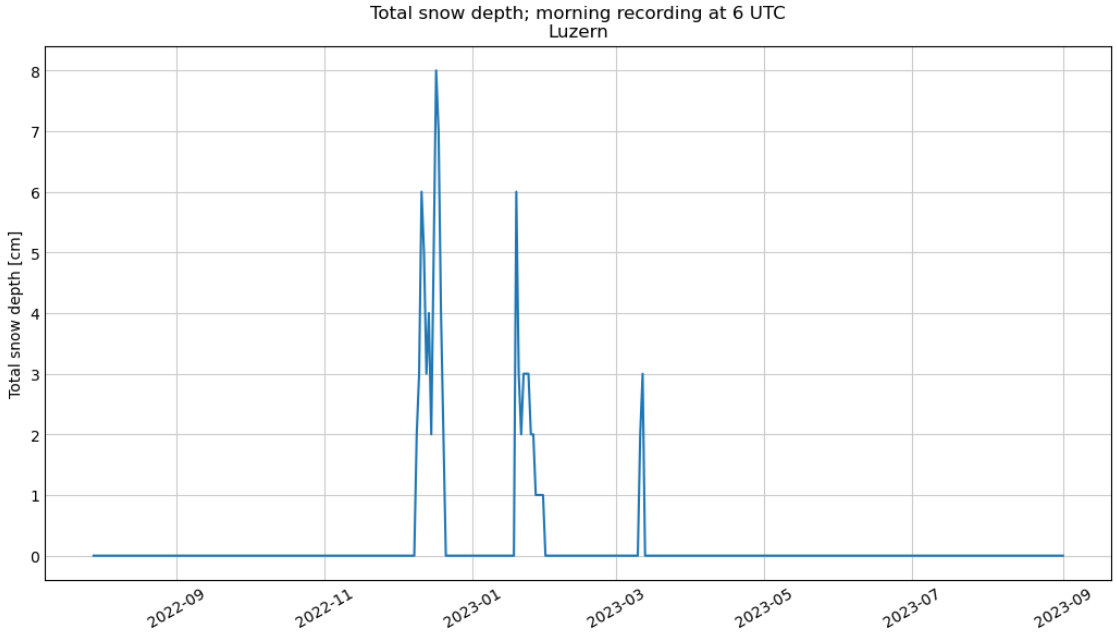
1.9 Total snow depth

[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()
```



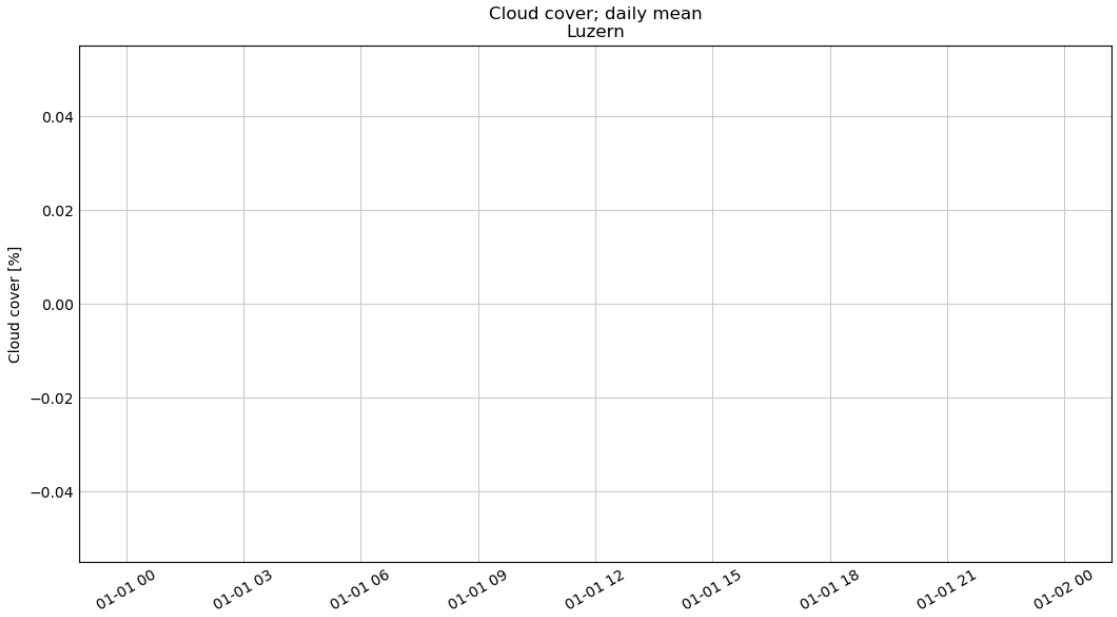
1.10 Cloud cover

[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()
```



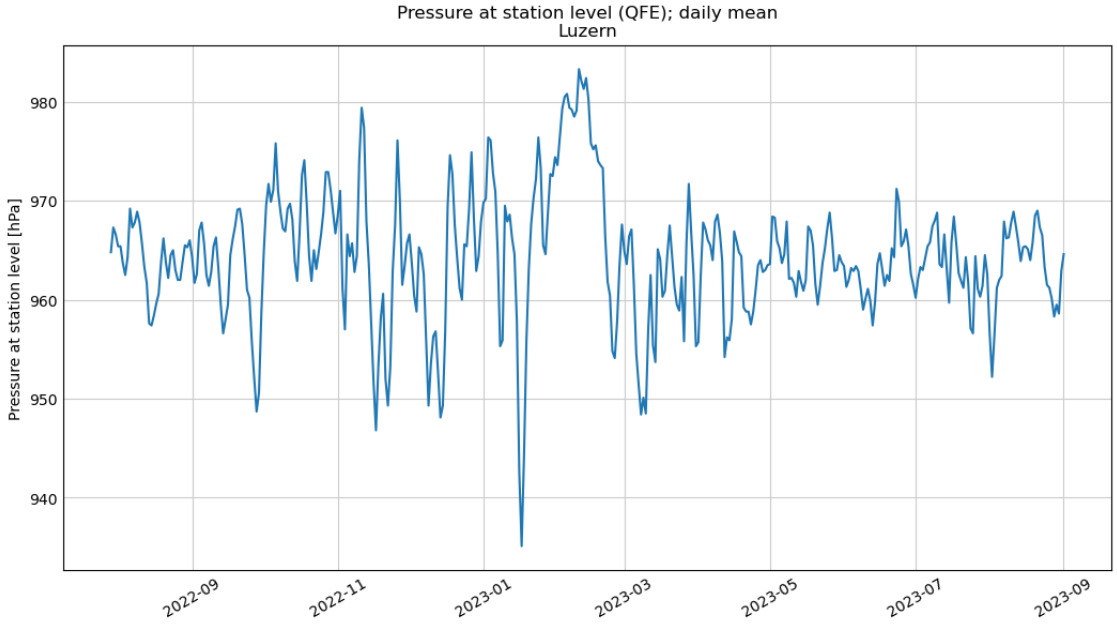
1.11 Pressure at station level

[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()
```



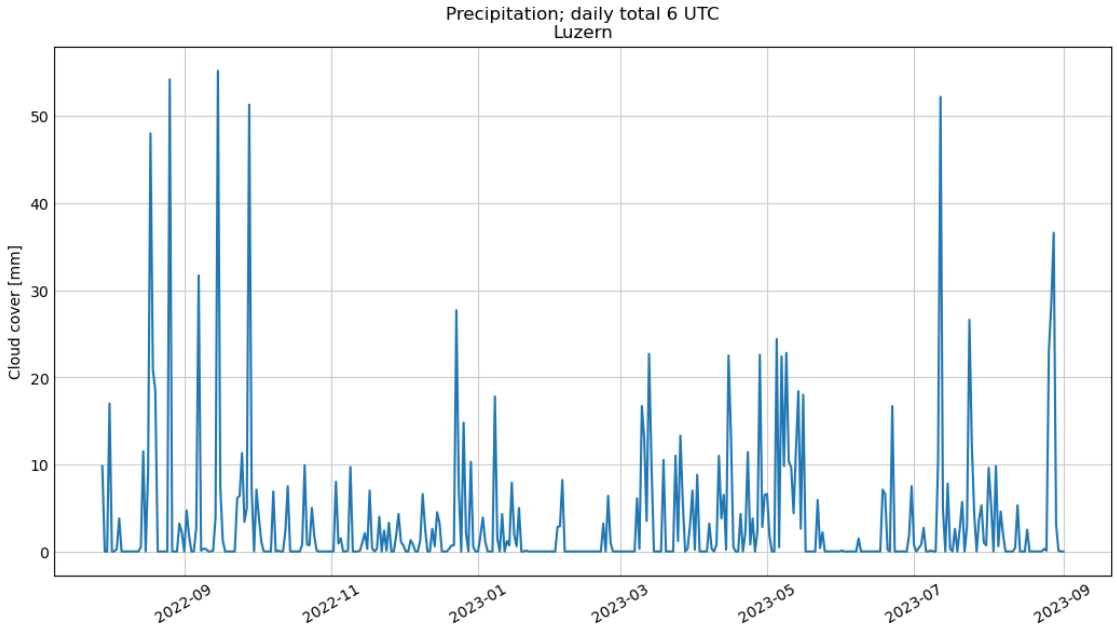
1.12 Precipitation

[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()
```



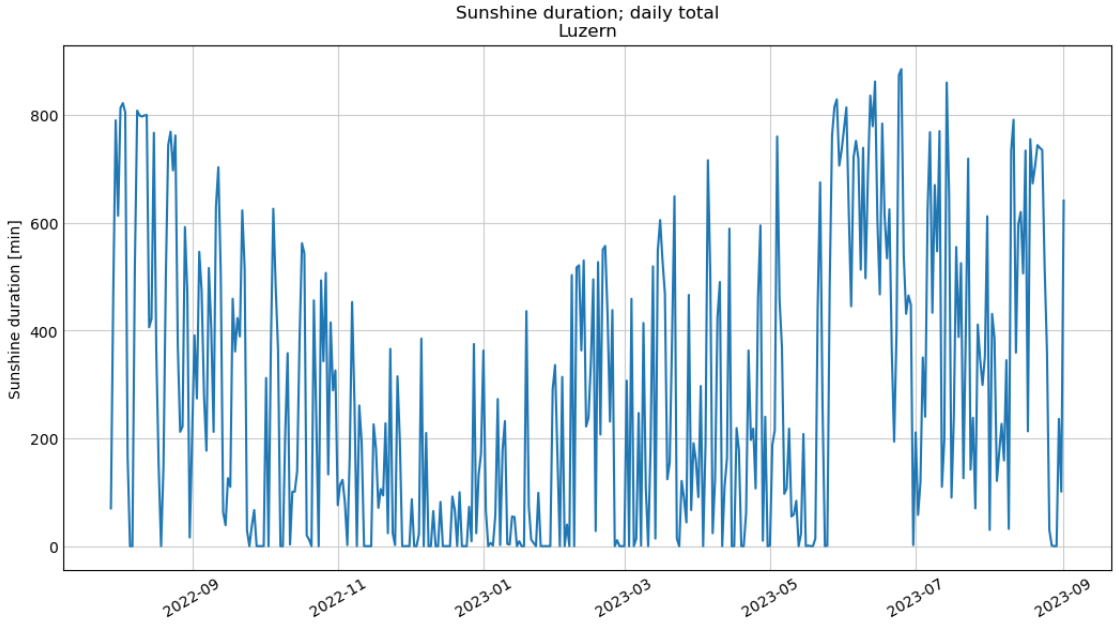
1.13 Sunshine duration

[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()
```



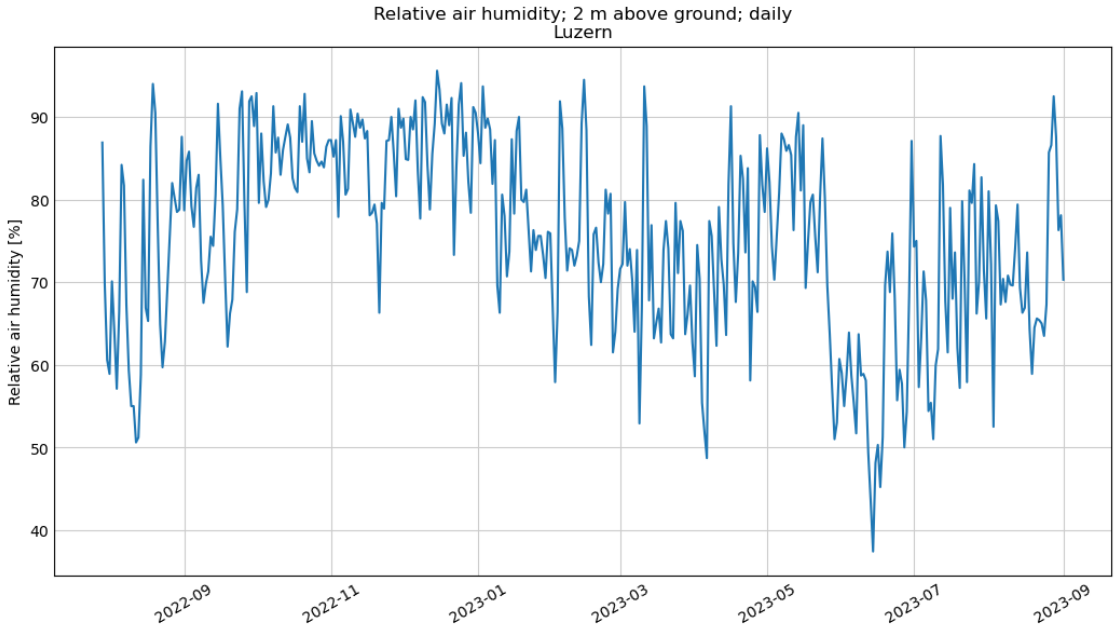
1.14 Relative air humidity

[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}')
```