MeteoCH.output

April 2, 2023

1 Meteoschweiz

1.1 Current meteorological observations

[1]:
```
# '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(['URL Previous years (verified data)', 'URL Current year'], axis=1)
```

[2]:

	Station	station/location	WIGOS-ID	Data since	\
0	Altdorf	ALT	0-20000-0-06672	01.01.1864	
1	Andermatt	ANT	0-20000-0-06695	01.01.1864	
2	Basel / Binningen	BAS	0-20000-0-06601	01.01.1755	
3	Bern / Zollikofen	BER	0-20000-0-06631	01.01.1864	
4	La Chaux-de-Fonds	CDF	0-20000-0-06612	01.01.1900	
5	Château-d'Oex	CHD	0-20000-0-06627	01.01.1879	
6	Chaumont	CHM	0-20000-0-06608	01.01.1864	
7	Davos	DAV	0-20000-0-06784	01.01.1864	
8	Elm	ELM	0-20000-0-06682	01.02.1878	
9	Engelberg	ENG	0-20000-0-06655	01.01.1864	
10	Grächen	GRC	0-20000-0-06728	01.01.1864	
11	Grimsel Hospiz	GRH	0-20000-0-06744	01.01.1932	
12	Col du Grand St-Bernard	GSB	0-20000-0-06717	01.01.1818	
13	Genève / Cointrin	GVE	0-20000-0-06700	01.01.1753	
14	Jungfraujoch	JUN	0-20000-0-06730	01.01.1933	
15	Lugano	LUG	0-20000-0-06770	01.01.1864	
16	Luzern	LUZ	0-20000-0-06650	01.01.1864	
17	Meiringen	MER	0-20000-0-06637	01.07.1889	

18	Neuchâtel	NEU	0-20000-0-06604	01.01.1864
19	Locarno / Monti	OTL	0-20000-0-06760	01.12.1882
20	Payerne	PAY	0-20000-0-06610	01.08.1964
21	Bad Ragaz	RAG	0-20000-0-06686	01.06.1870
22	Säntis	SAE	0-20000-0-06680	01.01.1864
23	Samedan	SAM	0-20000-0-06792	01.01.1864
24	S. Bernardino	SBE	0-20000-0-06783	01.01.1864
25	Segl-Maria	SIA	0-20000-0-06779	01.12.1863
26	Sion	SIO	0-20000-0-06720	01.01.1864
27	Zürich / Fluntern	SMA	0-20000-0-06660	01.01.1864
28	St. Gallen	STG	0-20000-0-06681	01.01.1864

	Station height m. a. sea level	CoordinatesE	CoordinatesN	Latitude	\
0	438.0	2690181.0	1193564.0	46.887069	
1	1438.0	2687445.0	1165044.0	46.630914	
2	316.0	2610909.0	1265612.0	47.541142	
3	553.0	2601934.0	1204410.0	46.990744	
4	1017.0	2550919.0	1214862.0	47.082947	
5	1028.0	2577040.0	1147655.0	46.479819	
6	1136.0	2565060.0	1211007.0	47.049169	
7	1594.0	2783519.0	1187459.0	46.812969	
8	958.0	2732266.0	1198425.0	46.923747	
9	1036.0	2674162.0	1186069.0	46.821639	
10	1605.0	2630738.0	1116062.0	46.195314	
11	1980.0	2668583.0	1158215.0	46.571689	
12	2472.0	2579191.0	1079754.0	45.869092	
13	411.0	2498904.0	1122632.0	46.247519	
14	3571.0	2641939.0	1155287.0	46.547556	
15	273.0	2717874.0	1095883.0	46.004217	
16	454.0	2665545.0	1209850.0	47.036439	
17	589.0	2655844.0	1175930.0	46.732222	
18	485.0	2563087.0	1205560.0	47.000067	
19	367.0	2704167.0	1114316.0	46.172256	
20	490.0	2562131.0	1184612.0	46.811581	
21	497.0	2756911.0	1209351.0	47.016631	
22	2501.0	2744188.0	1234920.0	47.249447	
23	1709.0	2787251.0	1155685.0	46.526247	
24	1639.0	2734116.0	1147294.0	46.463542	
25	1804.0	2778576.0	1144976.0	46.432331	
26	482.0	2591633.0	1118584.0	46.218650	
27	556.0	2685118.0	1248066.0	47.377925	
28	776.0	2747866.0	1254588.0	47.425475	

	Longitude	Climate region	Canton
0	8.621894	Central Alpine north slope	UR
1	8.580553	Central Alpine north slope	UR
2	7.583525	Eastern Jura	BL

3	7.464061	Central plateau	BE
4	6.792314	Western Jura	NE
5	7.139656	Western Alpine north slope	VD
6	6.978825	Western Jura	NE
7	9.843558	Northern and central Grisons	GR
8	9.175350	Eastern Alpine north slope	GL
9	8.410514	Central Alpine north slope	OW
10	7.836822	Valais	VS
11	8.333256	Western Alpine north slope	BE
12	7.170683	Alpine south side	VS
13	6.127742	Western plateau	GE
14	7.985444	Western Alpine north slope	VS
15	8.960322	Alpine south side	TI
16	8.301022	Central plateau	LU
17	8.169247	Western Alpine north slope	BE
18	6.953297	Western plateau	NE
19	8.787494	Alpine south side	TI
20	6.942469	Western plateau	VD
21	9.502594	Northern and central Grisons	SG
22	9.343469	Eastern Alpine north slope	AI
23	9.879469	Engadine	GR
24	9.184700	Alpine south side	GR
25	9.762325	Engadine	GR
26	7.330203	Valais	VS
27	8.565742	North-eastern plateau	ZH
28	9.398528	North-eastern plateau	SG

1.3 Select one 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 = 4
```

[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}.")
```

```
4
The label of weather station La Chaux-de-Fonds is CDF.
```

1.4 Read online observations from selected weather station

[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 Compute summary statistics

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

[7]:

	gre000d0	hto000d0	nto000d0	prestad0	rre150d0	sre000d0	\
count	400.00000	400.000000	0.0	400.000000	400.000000	400.000000	
mean	156.98250	1.720000	NaN	901.594500	3.098500	334.605000	
std	102.39406	4.623857	NaN	6.971558	6.022497	269.131731	
min	6.00000	0.000000	NaN	871.000000	0.000000	0.000000	
25%	69.00000	0.000000	NaN	898.550000	0.000000	53.500000	
50%	143.00000	0.000000	NaN	902.550000	0.000000	317.000000	
75%	235.00000	0.000000	NaN	906.300000	3.200000	562.250000	
max	372.00000	20.000000	NaN	916.300000	40.000000	855.000000	

	tre200d0	tre200dn	tre200dx	ure200d0
count	400.000000	400.000000	400.000000	400.000000
mean	8.356250	3.119000	13.253500	73.999750
std	7.339334	6.712483	8.472133	13.501075
min	-9.000000	-15.700000	-4.800000	37.000000
25%	3.200000	-1.500000	6.975000	62.175000
50%	8.000000	3.100000	13.450000	77.350000
75%	14.725000	8.925000	20.125000	85.175000
max	24.800000	16.500000	32.000000	96.500000

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

```
400 observations from 2022-02-25 00:00:00 to 2023-03-31 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 Scatter plot air temperature

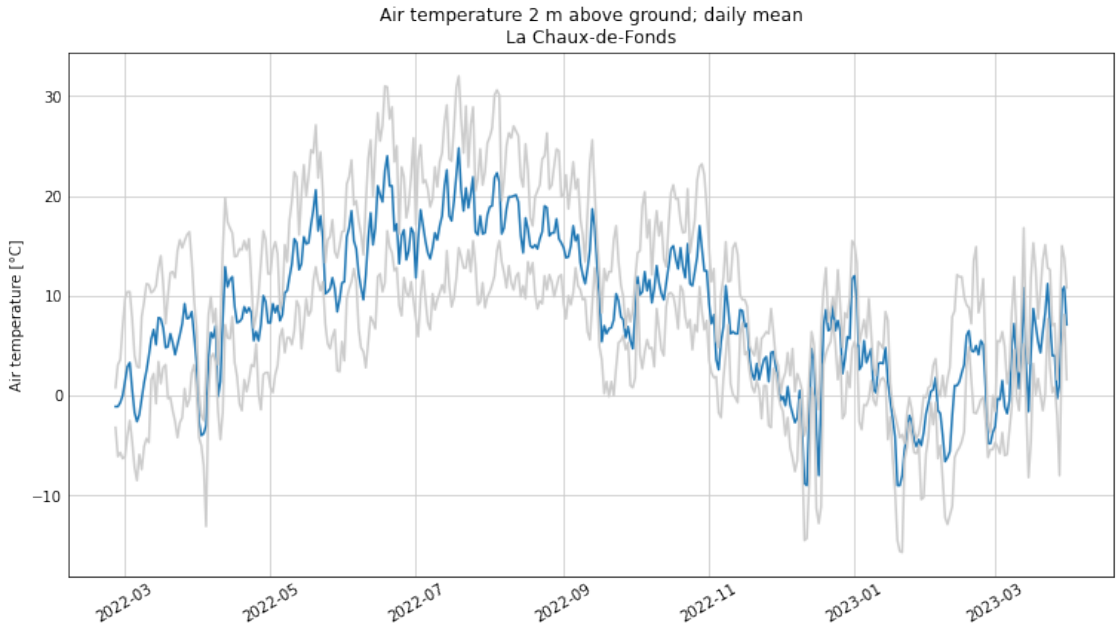
[10]:
```
import matplotlib.pyplot as plt
plt.style.use('_mpl-gallery')
fswidth = 10
fsheight = 5
```

[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()
```



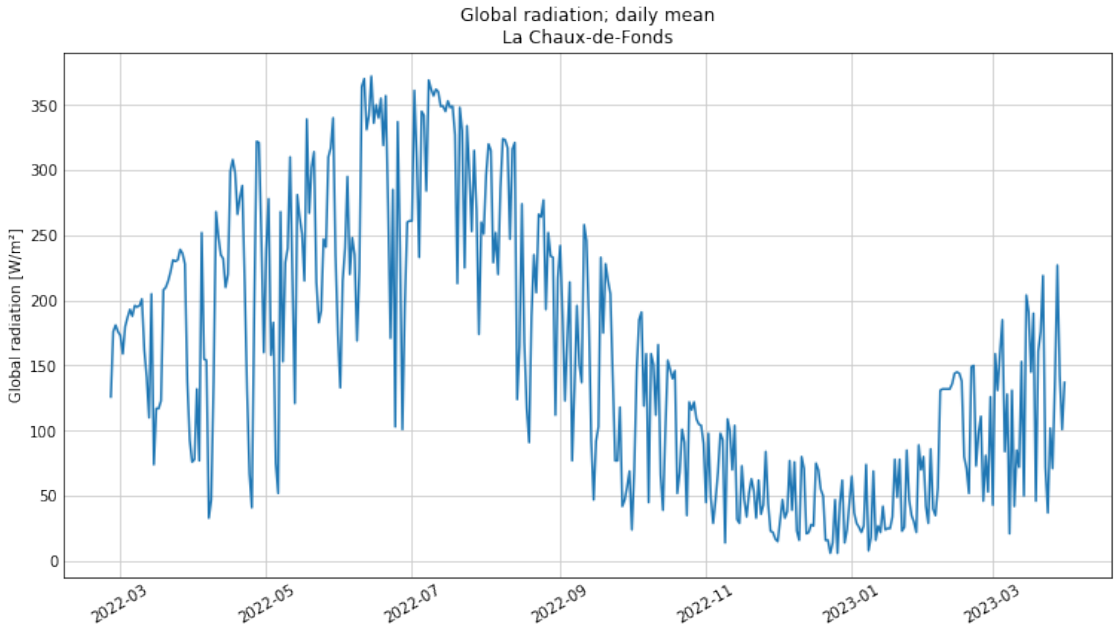
1.8 Scatter plot global radiation

[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()
```



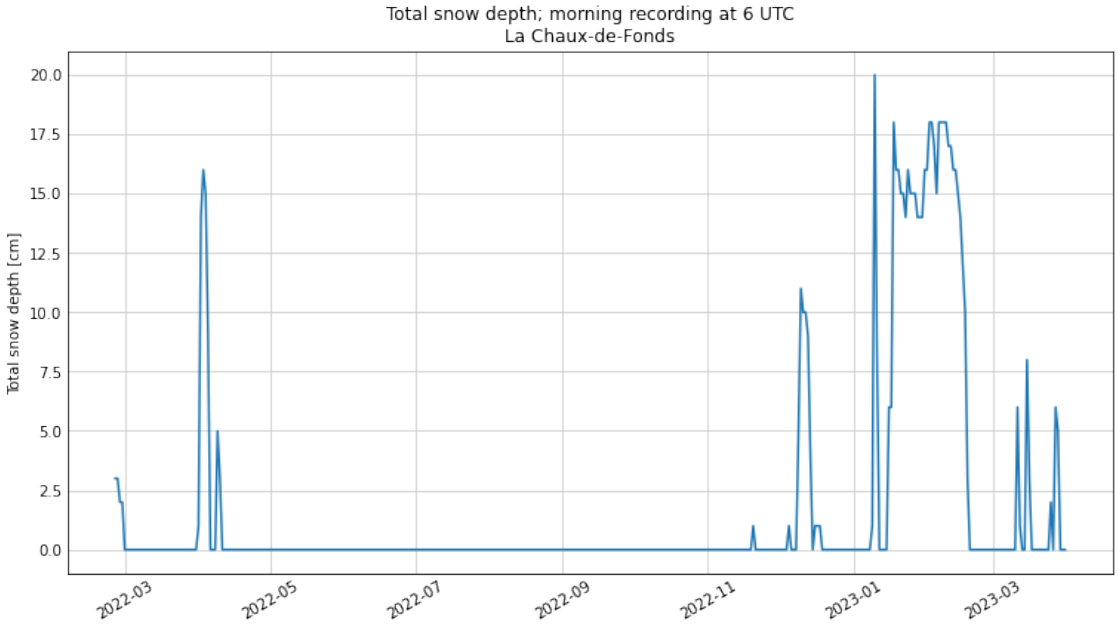
1.9 Scatter plot total snow depth

[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()
```



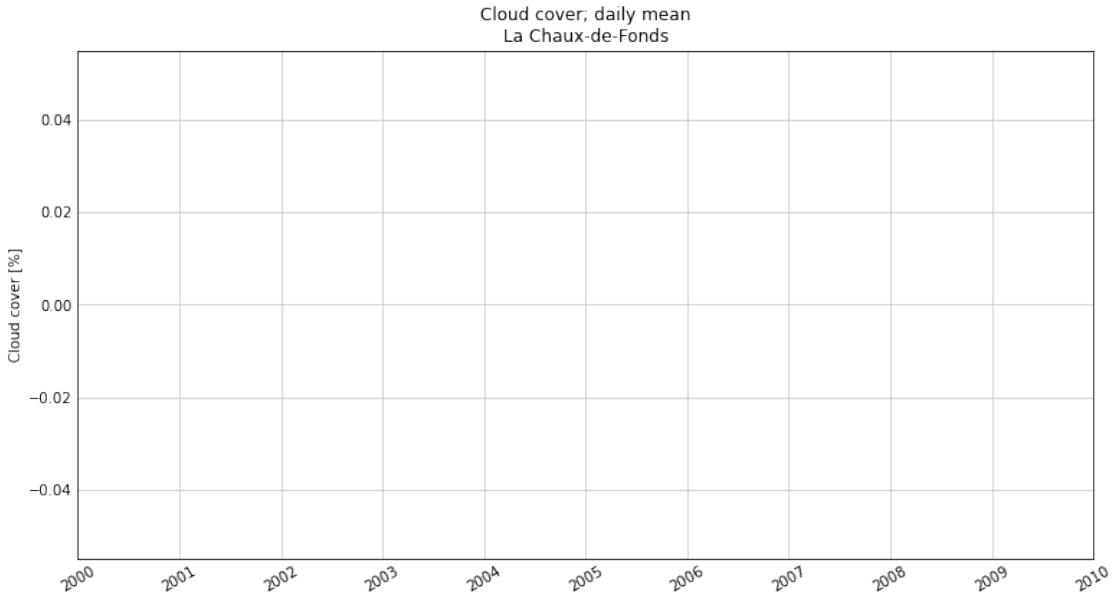
1.10 Scatter plot cloud cover

[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()
```



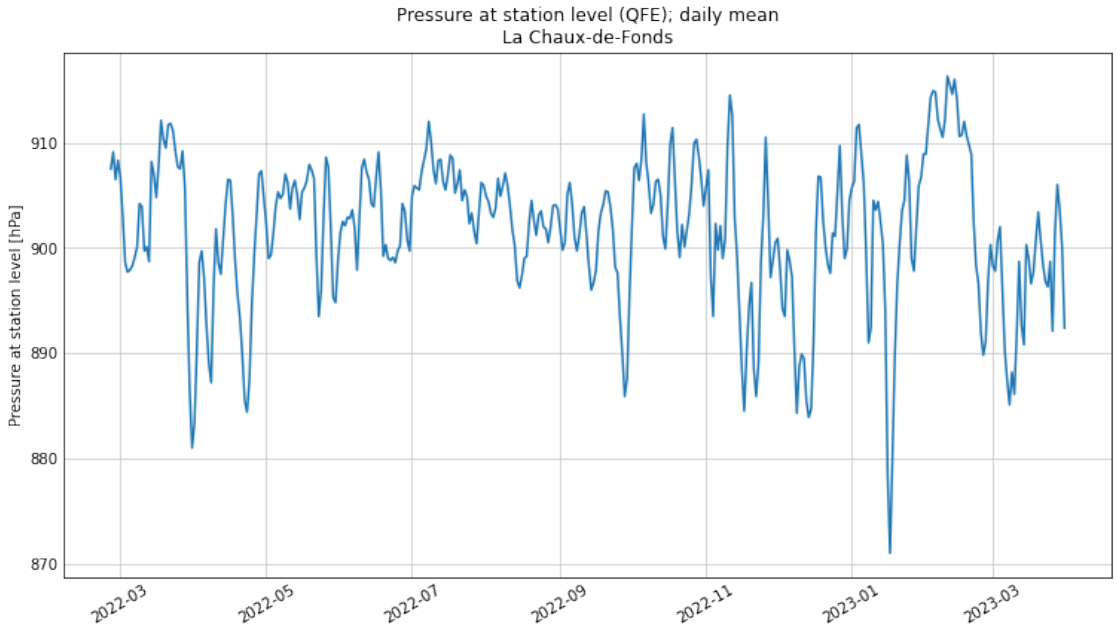
1.11 Scatter plot pressure at station level

[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()
```



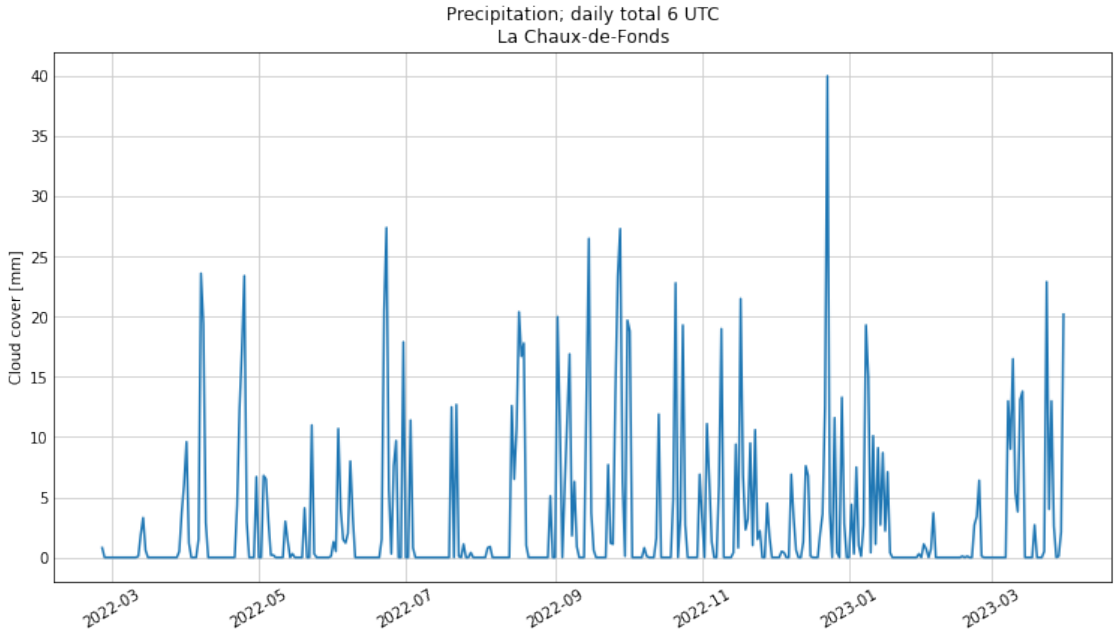
[16]:
```
## Scatter plot cloud cover
```

[17]:
```
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()
```



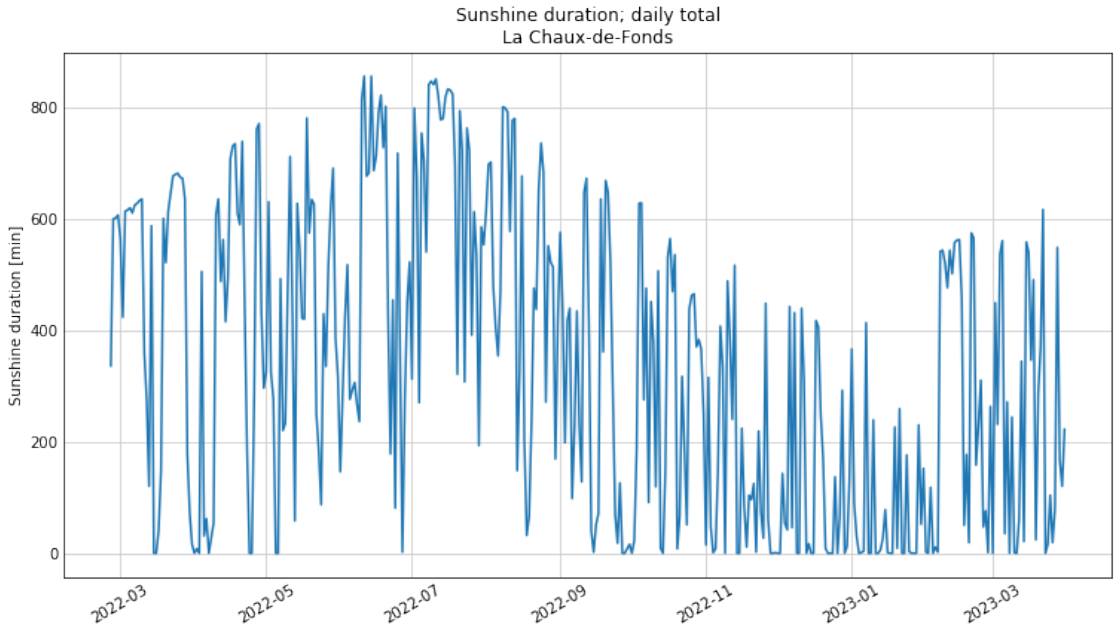
1.12 Scatter plot sunshine duration

[18]:
```
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()
```



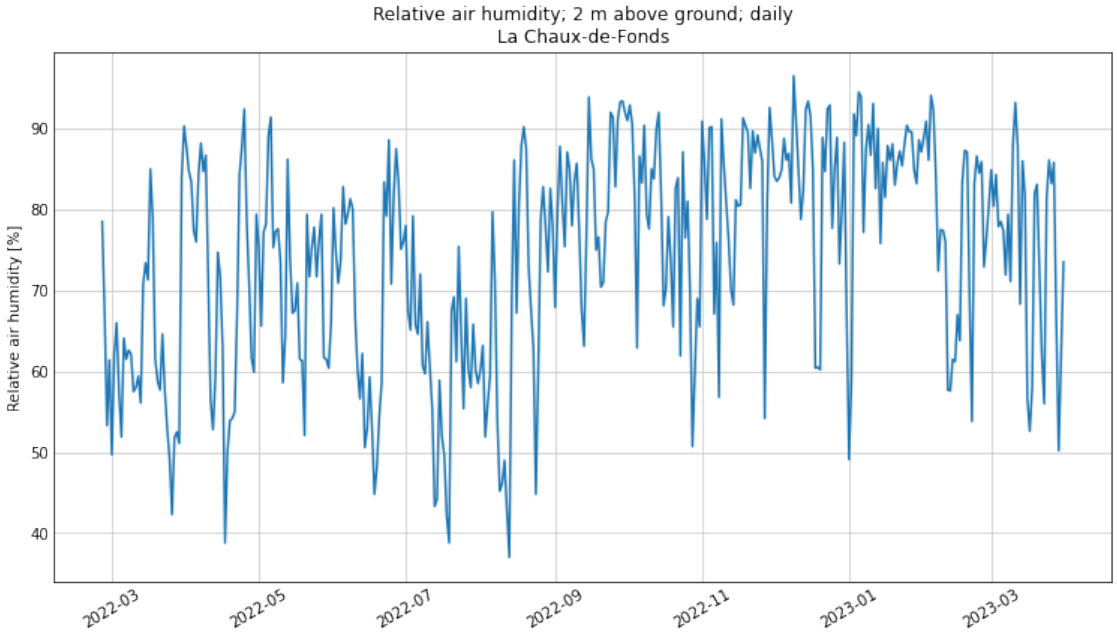
1.13 Scatter plot relative air humidity

[19]:
```
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()
```



1.14 Export as HTML Report

[ ]:
```
import os
#import ipynbname
#nb_fname = ipynbname.name()
nb_fname = 'MeteoCH' # hard-coded: import ipynbname raises an exception...
#nb_path = ipynbname.path()
#print(f"{nb_fname=}")
#print(f"{nb_path=}")

out_fname = nb_fname + ".output"
static_format = 'pdf'  # pdf or html, etc.
os.system(f'jupyter nbconvert --to {static_format} {out_fname}.ipynb')
os.system(f'mv {out_fname}.{static_format} {label}.{static_format}')
```

[ ]:
```

```