MeteoCH.output

March 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 = 27
```

[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}.")
```

```
27
The label of weather station Zürich / Fluntern is SMA.
```

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	400.000000	400.000000	398.000000	400.000000	400.000000	400.000000	
mean	147.342500	0.232500	61.595477	953.745750	2.258000	336.097500	
std	104.950019	1.046988	32.900272	7.154824	4.789283	282.604789	
min	6.000000	0.000000	0.000000	923.200000	0.000000	0.000000	
25%	57.000000	0.000000	33.000000	950.300000	0.000000	60.000000	
50%	124.000000	0.000000	67.000000	954.250000	0.000000	309.500000	
75%	222.000000	0.000000	92.000000	957.925000	2.200000	588.000000	
max	362.000000	8.000000	100.000000	970.700000	34.500000	855.000000	

	tre200d0	tre200dn	tre200dx	ure200d0
count	400.000000	400.000000	400.000000	400.000000
mean	10.880000	7.065000	15.312250	72.491500
std	7.521915	6.579746	8.859707	14.570046
min	-5.900000	-7.700000	-4.400000	37.800000
25%	5.100000	2.000000	8.200000	61.400000
50%	10.600000	6.700000	15.100000	74.450000
75%	17.125000	12.925000	22.025000	84.500000
max	27.500000	20.800000	34.700000	97.700000

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

```
400 observations from 2022-01-25 00:00:00 to 2023-02-28 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

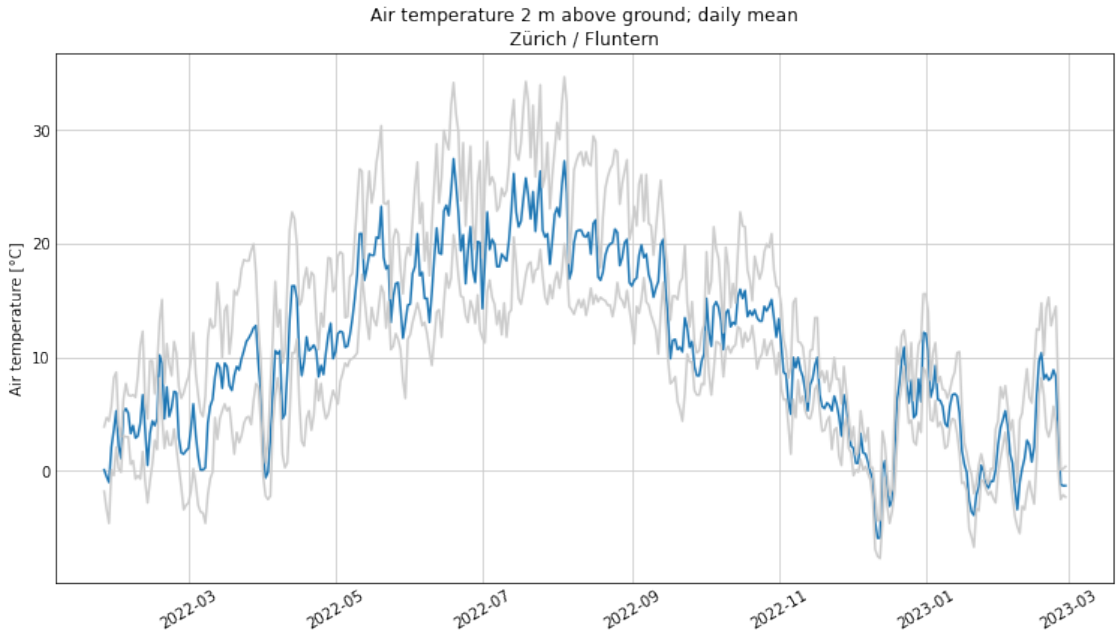
[10]:
```
import matplotlib.pyplot as plt
plt.style.use('_mpl-gallery')
fswidth = 10
fsheight = 5
```

[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()
```



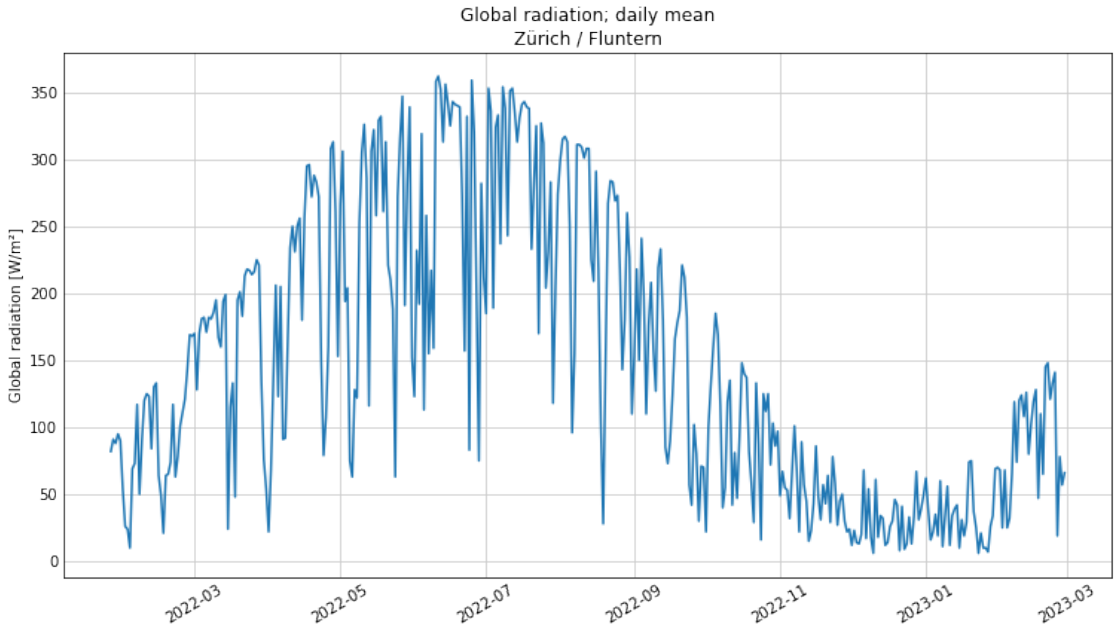
1.8 Scatter plot global radiation

[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()
```



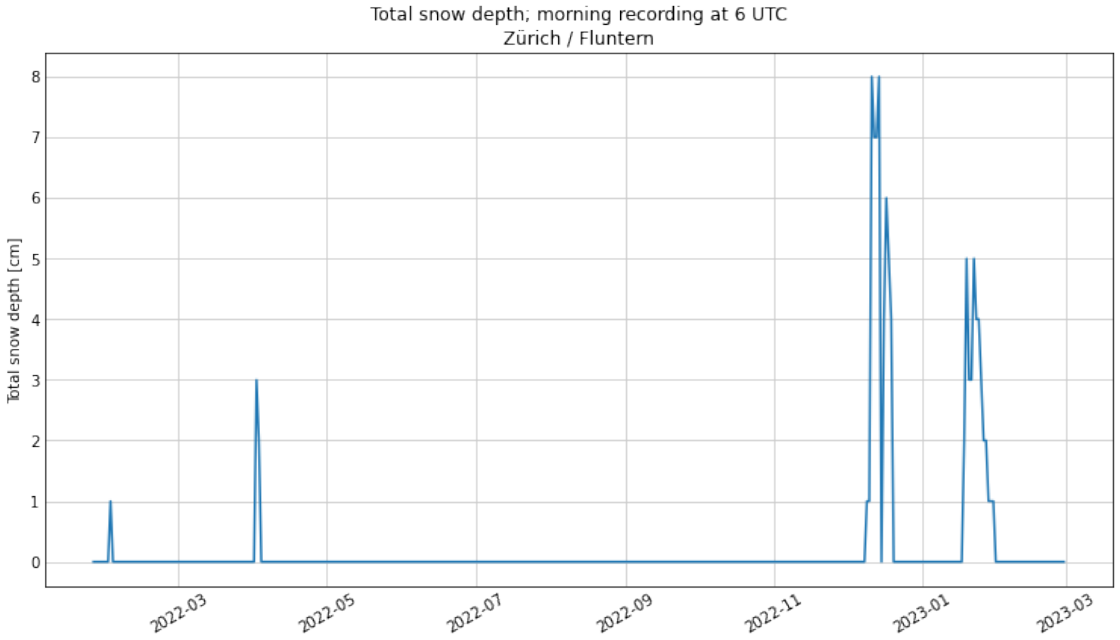
1.9 Scatter plot total snow depth

[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()
```



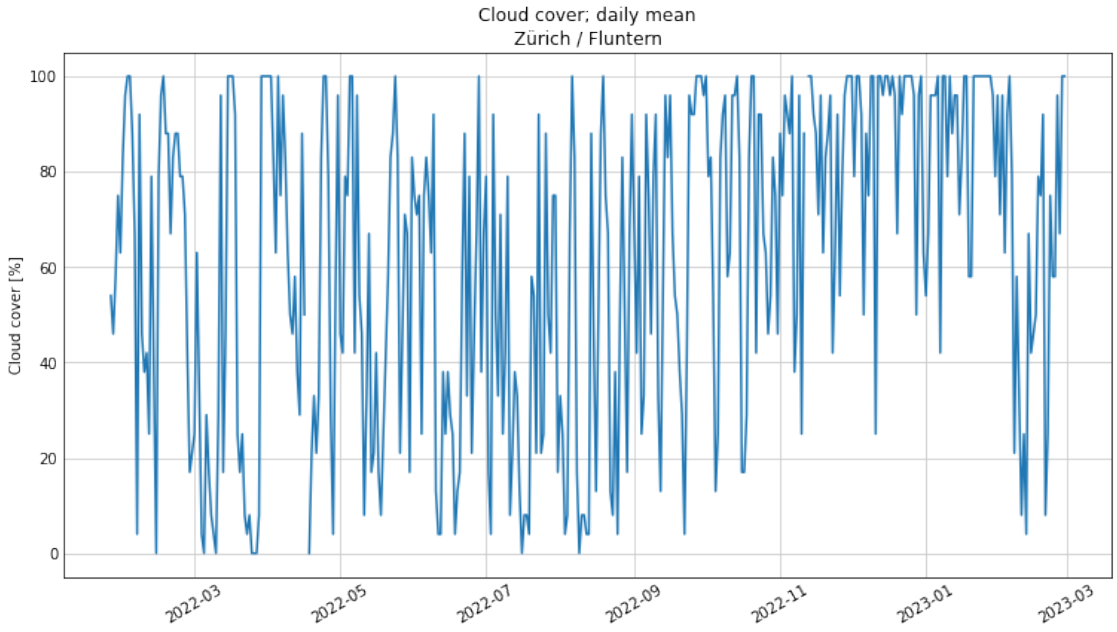
1.10 Scatter plot cloud cover

[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()
```



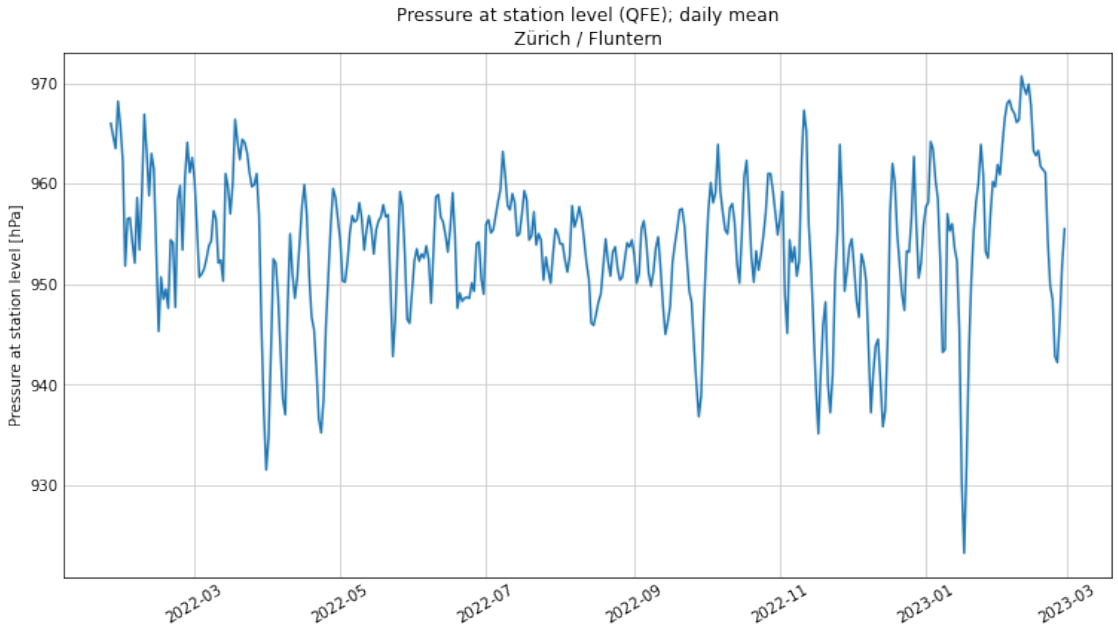
1.11 Scatter plot pressure at station level

[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()
```



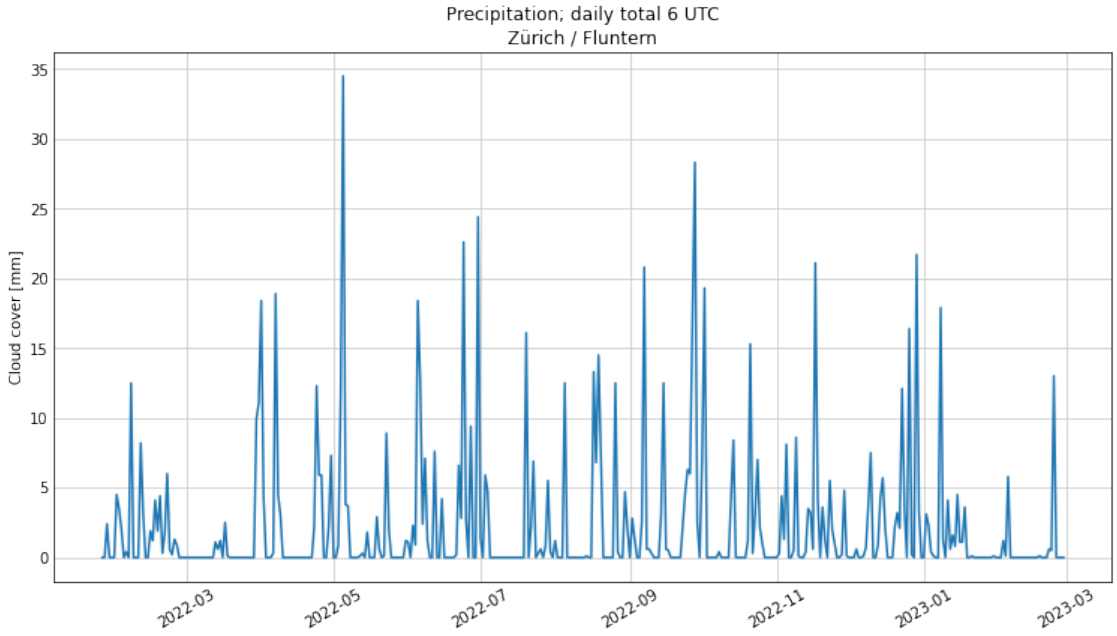
[16]:
```
## Scatter plot cloud cover
```

[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()
```



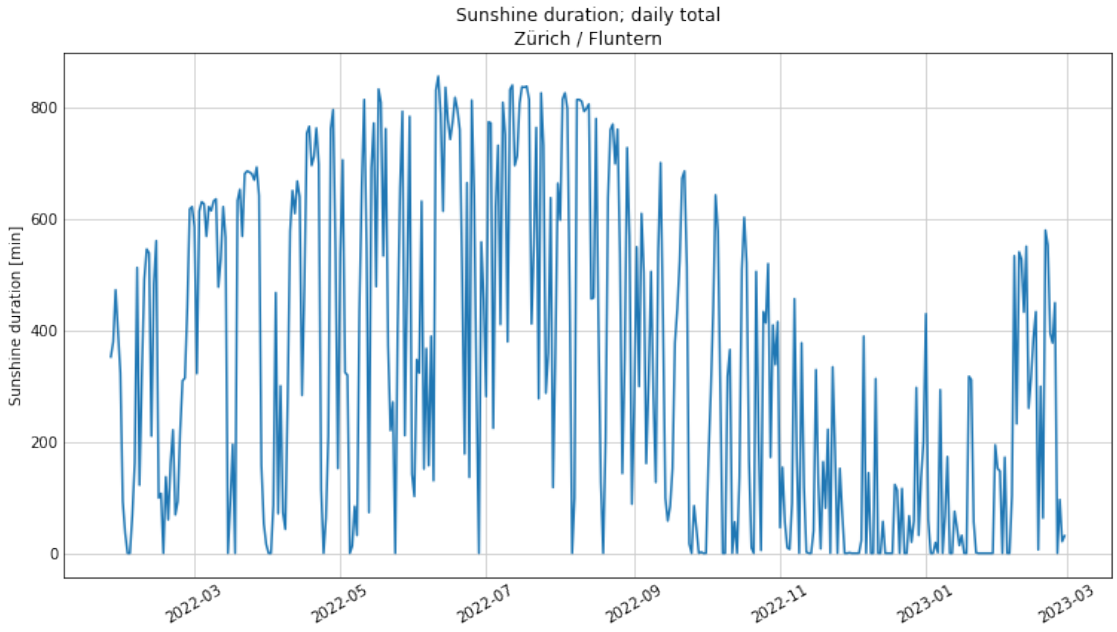
1.12 Scatter plot sunshine duration

[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()
```



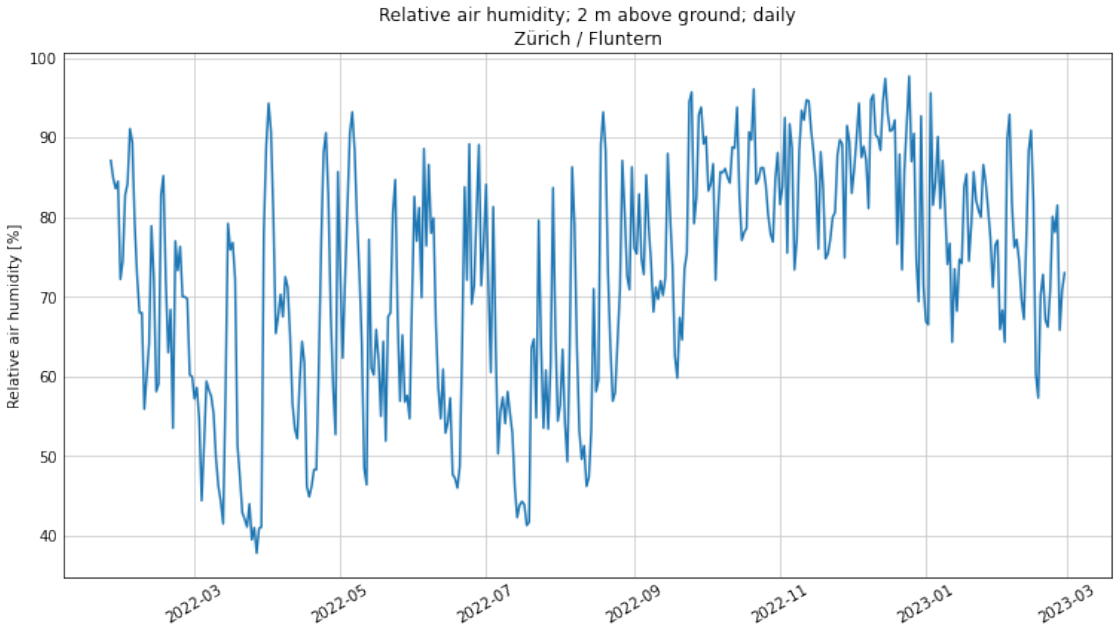
1.13 Scatter plot relative air humidity

[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}')
```

[ ]:
```

```