Mpournias_meteorological_station_02

October 3, 2017

1 Post-processing of the meteorological data

Here we look at the set of measurements obtained from the meteorological station of Mpournias.

Mpournias is part of Ampelos mountain and has a maximum height of 778 m. It is located at the southern part of Samos, south of Pyrgos. It's lithology consists of marble and gneiss. It's heighest tops are of 778 and 765 m. And the lowest are Marini (593m) and Profitis Elias (517 m).

Meteorological station's coordinates
in EGSA 87
in WGS 84
Height

```
In [1]: import pandas as pd
        import matplotlib.pyplot as plt
        plt.style.use('seaborn-bright')
        %matplotlib inline
        data = pd.read_csv ('mpournias_new.csv',
                            header=0,
                            decimal=',',
                            parse_dates={'Datetime': ['Day', 'Time']})
        pat = '(?P<day>\d{2})-(?P<month>\d{2})-(?P<year>\d{4}) (?P<hour>\d{1,2}):(?P<minute>\d
        data['Datetime'] = pd.to_datetime(data['Datetime'].str.extract(pat, expand=True))
        data = data.set_index('Datetime')
        data.head(n=10)
```

Out[1]:

Datetime	Ta	RH	Rain	LW	Bat.	WS	WD
2001-01-27 11:00:00	2.1	0	0.0	0	0.0	0.0	12.5
2001-01-27 12:00:00	3.1	0	0.4	0	0.0	0.0	12.5
2001-01-27 17:00:00	8.1	90	27.2	0	0.0	0.0	0.0
2001-01-27 18:00:00	8.0	92	0.0	0	3.0	0.0	12.5
2001-01-27 19:00:00	7.9	92	0.0	0	3.0	0.0	12.5
2001-01-27 20:00:00	7.7	94	0.0	13	3.3	0.0	12.5
2001-01-27 21:00:00	7.7	99	0.0	0	2.8	0.0	12.5
2001-01-27 22:00:00	7.5	99	0.0	0	2.1	0.0	12.5
2001-01-27 23:00:00	7.8	99	0.0	0	3.1	0.0	12.5

```
2001-01-28 00:00:00  7.8  99   0.0   0   2.5  0.0  12.5
```

1.0.1 Legend

Symbol	Explanation	Unit
Ta	Air Temperature	řC
RH	Relative Humidity	%
Rain	Height of rainfall	mm
LW	Leaf Wetness	Hours
Bat.	Battery	Volt
WS	Wind Velocity	m/s
WD	Wind Direction	ř

Mpournias dataset has the following counts per year:

```
In [2]: # Count the number of measurements per year
        !grep -Po '20\d\d' mpournias_new.csv | sort | uniq -c
```

```
   8121 2001
   3271 2002
   4622 2006
   8760 2007
   8784 2008
   8760 2009
   5843 2010
```

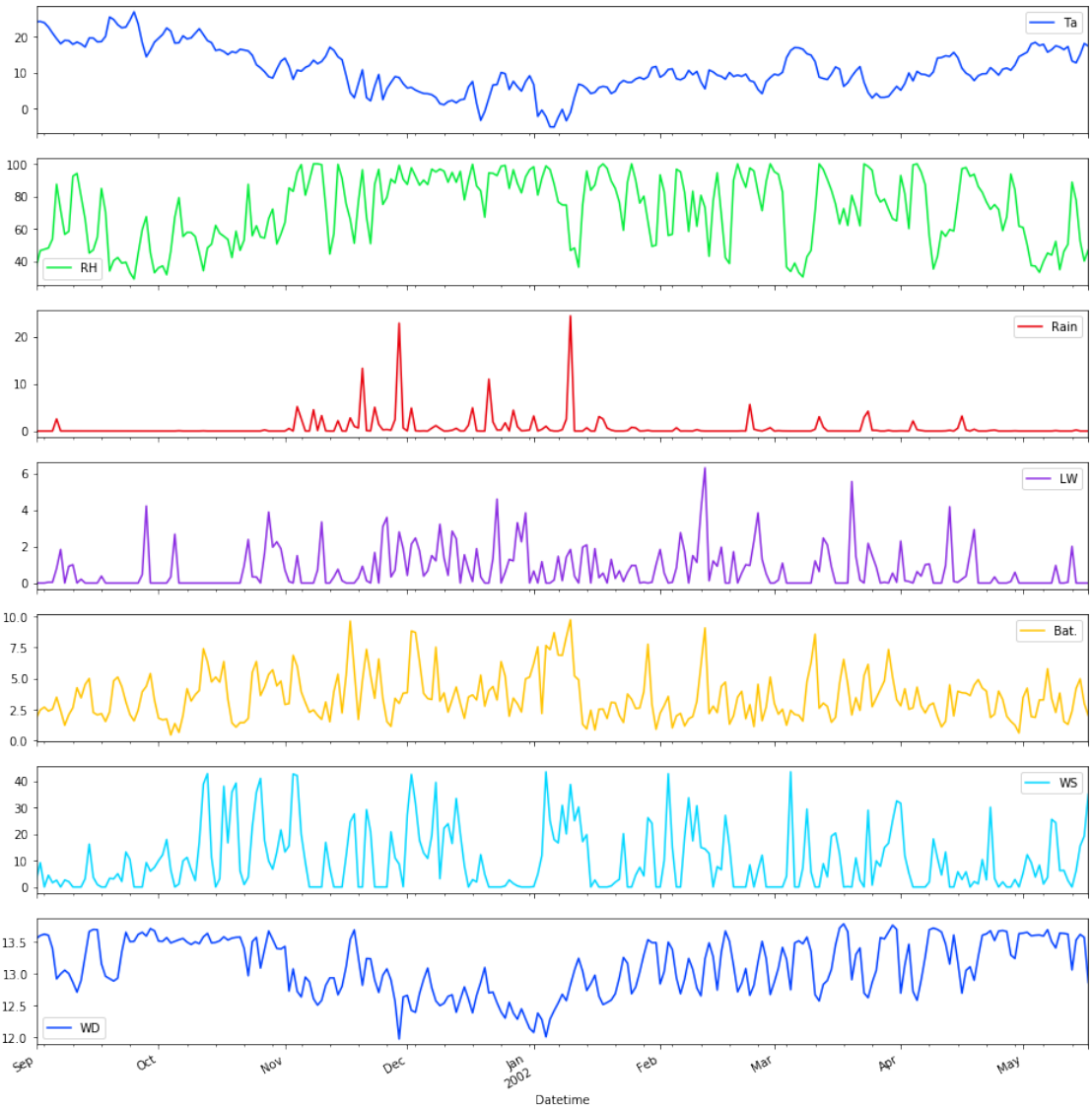
Years 2002, 2006, 2010 have incomplete data series, while years 2001 and 2007-2009 appear to have a complete dataset. The dataset of the following hydrological years will be further processed in order to check validity. Hydr. year 2001-2002 Hydr. year 2006-2007 Hydr. year 2007-2008 Hydr. year 2008-2009 Hydr. year 2009-2010

```
In [22]: # Creation of a new dataset that considers the complete hydrological years for hydrol
         data_2001_02 = pd.concat([data['2001-09-01':'2002-08-31']])
         data_2001_02.head()
```

```
Out[22]:                      Ta  RH  Rain  LW  Bat.   WS    WD
         Datetime
         2001-09-01 00:00:00  22.9  24   0.0   0   3.3  0.0  12.9
         2001-09-01 01:00:00  22.7  24   0.0   0   3.1  0.0  12.9
         2001-09-01 02:00:00  22.9  24   0.0   0   2.4  0.0  12.9
         2001-09-01 03:00:00  22.3  26   0.0   0   3.0  0.0  12.9
         2001-09-01 04:00:00  21.8  27   0.0   0   4.2  0.0  12.8
```

```
In [27]: # Figure of all parameters on a daily basis for year 2001-2002
         data_2001_02.resample('D').mean().plot(subplots=True,figsize=(16,18))
```

```
Out[27]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x7f464b26c990>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f46437a3450>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f464377d950>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f464368cd50>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f46436a7610>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4643585950>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f464350c850>], dtype=object
```




```
In [39]: data_2001_02.sum()

Out[39]: Ta       67877.1
         RH      444410.0
         Rain      4220.8
```

```
LW        4621.0
Bat.     21972.6
WS       62589.3
WD       81291.1
dtype: float64
```

In [40]:
```
data_2001_02.describe()
```

Out[40]:

	Ta	RH	Rain	LW	Bat.
count	6198.000000	6198.000000	6198.000000	6198.000000	6198.000000
mean	10.951452	71.702162	0.680994	0.745563	3.545111
std	6.512553	22.899822	4.936647	3.151025	2.410417
min	-6.200000	15.000000	0.000000	0.000000	0.000000
25%	6.700000	52.000000	0.000000	0.000000	1.700000
50%	10.000000	75.000000	0.000000	0.000000	3.100000
75%	15.800000	93.000000	0.000000	0.000000	4.900000
max	29.700000	100.000000	128.000000	24.000000	15.300000

	WS	WD
count	6198.000000	6198.000000
mean	10.098306	13.115699
std	19.152636	0.830568
min	0.000000	0.000000
25%	0.000000	12.700000
50%	0.000000	12.800000
75%	9.500000	13.200000
max	70.000000	15.500000

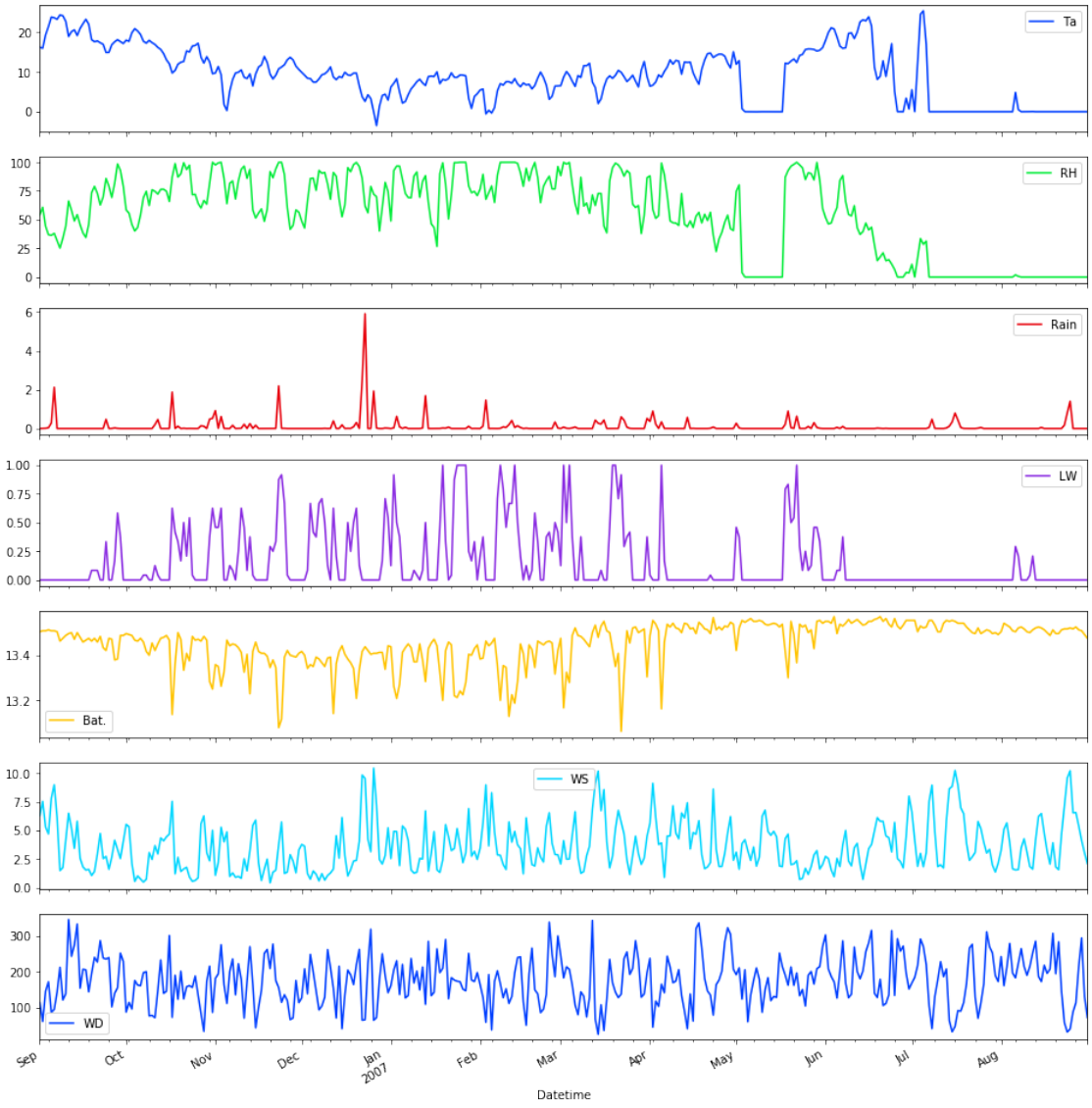
In [23]:
```
data_2006_07 = pd.concat([data['2006-09-01':'2007-08-31']])
data_2006_07.head()
```

Out[23]:

Datetime	Ta	RH	Rain	LW	Bat.	WS	WD
2006-09-01 00:00:00	15.8	80	0.0	0	13.0	3.8	337.4
2006-09-01 01:00:00	15.3	79	0.0	0	13.0	2.3	29.1
2006-09-01 02:00:00	15.3	71	0.0	0	13.0	6.9	30.1
2006-09-01 03:00:00	14.9	68	0.0	0	12.9	7.8	34.4
2006-09-01 04:00:00	14.1	62	0.0	0	12.9	6.0	23.2

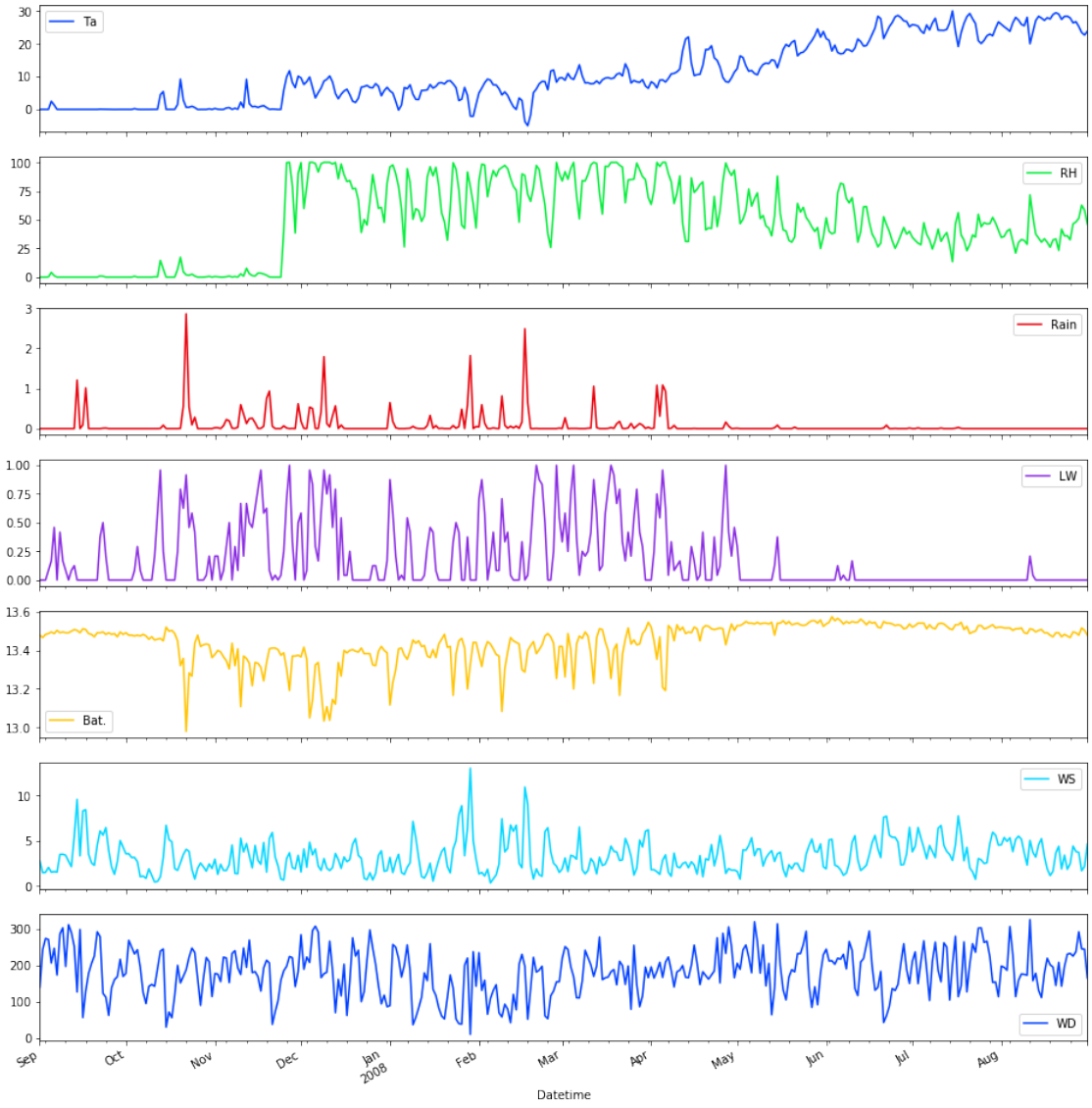
In [28]:
```
# Figure of all parameters on a daily basis for hydrological year 2006-2007
data_2006_07.resample('D').mean().plot(subplots=True,figsize=(16,18))
```

Out[28]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x7f464803d290>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642e14450>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642ea4410>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642d89d10>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642d12bd0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642c85410>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642c0d590>], dtype=object
```




```
In [41]: data_2006_07.sum()

Out[41]: Ta        78578.9
         RH       480271.0
         Rain       1003.2
         LW         1402.0
         Bat.     117850.5
         WS        31844.4
         WD      1523160.9
         dtype: float64

In [42]: data_2006_07.describe()
```

```
Out[42]:                 Ta           RH         Rain           LW         Bat.  \
         count  8760.000000  8760.000000  8760.000000  8760.000000  8760.000000
         mean      8.970194    54.825457     0.114521     0.160046    13.453253
         std       7.221216    35.902524     0.809942     0.366669     0.534522
         min      -5.300000     0.000000     0.000000     0.000000    12.600000
         25%       1.700000    29.000000     0.000000     0.000000    13.000000
         50%       8.700000    60.000000     0.000000     0.000000    13.100000
         75%      13.800000    87.000000     0.000000     0.000000    14.100000
         max      38.300000   100.000000    19.400000     1.000000    14.200000

                        WS           WD
         count  8760.000000  8760.000000
         mean      3.635205   173.876815
         std       2.697150   124.670235
         min       0.000000     0.000000
         25%       1.500000    50.800000
         50%       3.100000   169.750000
         75%       5.200000   309.525000
         max      15.900000   360.000000

In [5]: data_2007_08 = pd.concat([data['2007-09-01':'2008-08-31']])

In [24]: data_2007_08.head()

Out[24]:                      Ta  RH  Rain  LW  Bat.   WS    WD
         Datetime
         2007-09-01 00:00:00 -0.1   0   0.0   0  13.0  4.9  13.2
         2007-09-01 01:00:00 -0.1   0   0.0   0  13.0  4.3  34.8
         2007-09-01 02:00:00 -0.1   0   0.0   0  13.0  4.6  35.8
         2007-09-01 03:00:00 -0.1   0   0.0   0  13.0  4.9  42.6
         2007-09-01 04:00:00 -0.1   0   0.0   0  13.0  4.5  46.2

In [29]: # Figure of all parameters on a daily basis for hydrological year 2007-2008
         data_2007_08.resample('D').mean().plot(subplots=True,figsize=(16,18))

Out[29]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x7f46423c8e90>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642246dd0>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642319f50>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f464220c6d0>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f46421945d0>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f464217ad90>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4642081f10>], dtype=objec
```




```
In [43]: data_2007_08.sum()

Out[43]: Ta         96733.7
         RH        426902.0
         Rain        768.5
         LW         1647.0
         Bat.     118096.3
         WS        28869.6
         WD      1594701.7
         dtype: float64
```

```
In [6]: data_2008_09 = pd.concat([data['2008-09-01':'2009-08-31']])
```

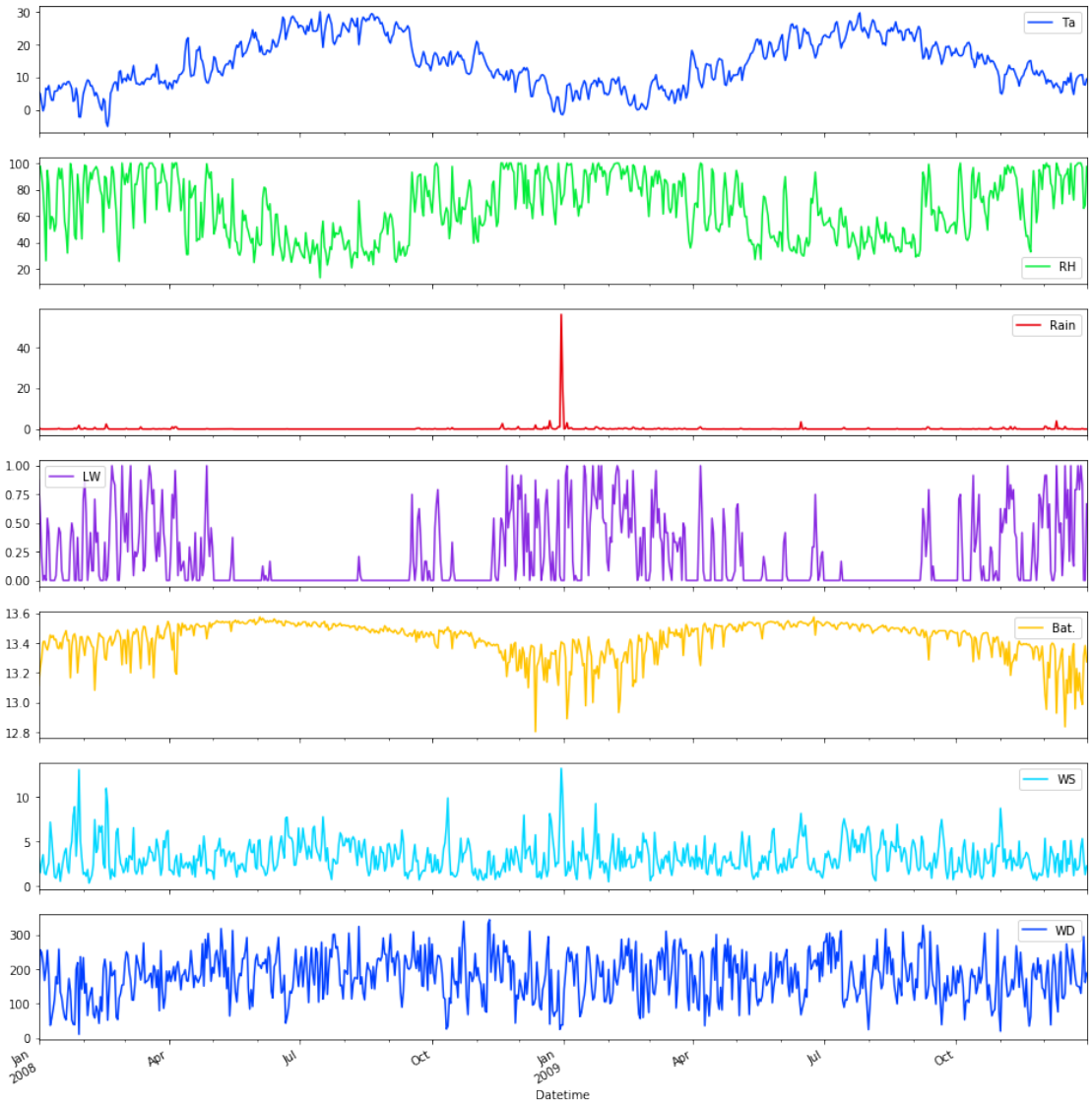
```
In [25]: data_2008_09.head()
```

Out[25]:

Datetime	Ta	RH	Rain	LW	Bat.	WS	WD
2008-01-01 00:00:00	6.8	75	0.0	0	13.0	3.5	55.2
2008-01-01 01:00:00	6.8	71	0.0	0	13.0	4.1	62.3
2008-01-01 02:00:00	6.3	72	0.0	0	12.9	4.1	77.0
2008-01-01 03:00:00	5.4	98	0.8	1	12.9	3.0	80.4
2008-01-01 04:00:00	5.8	100	0.4	1	12.9	2.1	152.2

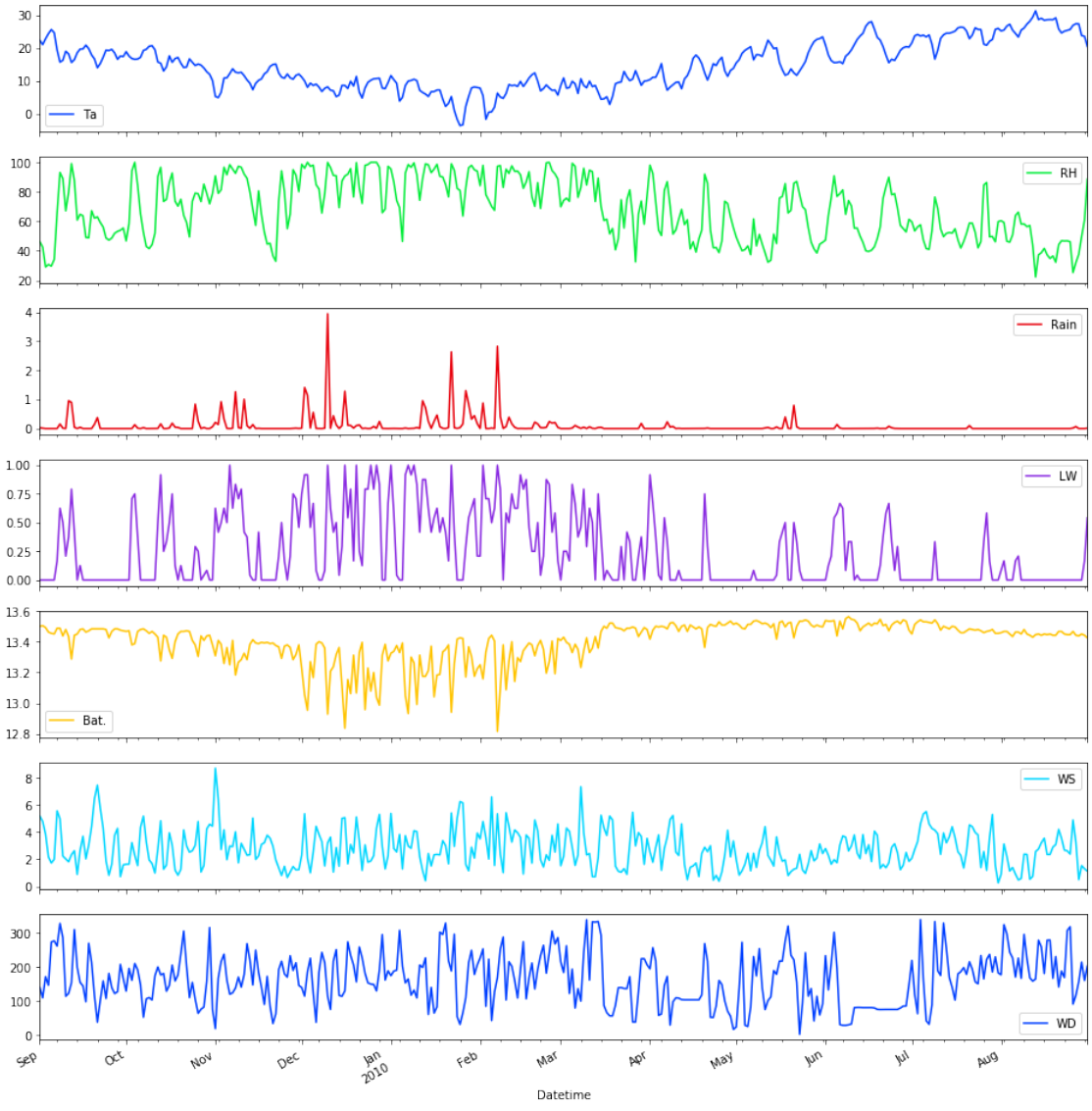
In [30]:
```
# Figure of all parameters on a daily basis for hydrological year 2008-2009
data_2008_09.resample('D').mean().plot(subplots=True,figsize=(16,18))
```

Out[30]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x7f46418b1690>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4641721610>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f46416f1790>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4641797ed0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f464165ed90>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f46415d25d0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x7f4641558750>], dtype=objec
```




```
In [44]: data_2008_09.sum()

Out[44]: Ta       253756.4
         RH      1153139.0
         Rain       3801.6
         LW         3596.0
         Bat.     235596.2
         WS        56863.0
         WD      3147461.7
         dtype: float64

In [46]: data_2008_09.describe()
```

```
Out[46]:                 Ta            RH          Rain            LW          Bat.  \
         count  17544.000000  17544.000000  17544.000000  17544.000000  17544.000000
         mean      14.463999     65.728397      0.216689      0.204970     13.428876
         std        7.835812     24.650429      3.036803      0.403691      0.539990
         min       -6.600000      0.000000      0.000000      0.000000     12.600000
         25%        8.400000     45.000000      0.000000      0.000000     13.000000
         50%       13.700000     65.000000      0.000000      0.000000     13.100000
         75%       20.800000     90.000000      0.000000      0.000000     14.100000
         max       34.500000    100.000000    173.000000      1.000000     14.300000

                        WS            WD
         count  17544.000000  17544.000000
         mean       3.241165    179.403882
         std        2.283120    122.091377
         min        0.000000      0.000000
         25%        1.500000     57.500000
         50%        2.800000    182.850000
         75%        4.600000    301.625000
         max       18.000000    360.000000

In [7]: data_2009_10 = pd.concat([data['2009-09-01':'2010-08-31']])

In [26]: data_2009_10.head()

Out[26]:                      Ta  RH  Rain  LW  Bat.   WS    WD
         Datetime
         2009-09-01 00:00:00  22.5  34   0.0   0  13.0  5.4  17.2
         2009-09-01 01:00:00  22.9  33   0.4   0  13.0  5.7  18.1
         2009-09-01 02:00:00  22.4  36   0.0   0  13.0  5.3  17.5
         2009-09-01 03:00:00  22.4  35   0.0   0  12.9  5.7   7.6
         2009-09-01 04:00:00  21.4  41   0.0   0  12.9  5.6   8.3

In [31]: # Figure of all parameters on a daily basis for hydrological year 2009-2010
         data_2009_10.resample('D').mean().plot(subplots=True,figsize=(16,18))

Out[31]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x7f4641c07a50>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4640fe2990>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4640fb0950>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f46410a3290>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4640f6a150>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4640ed0950>,
                <matplotlib.axes._subplots.AxesSubplot object at 0x7f4640e56ad0>], dtype=objec
```




```
In [47]: data_2009_10.sum()

Out[47]: Ta       129145.8
         RH       600583.0
         Rain        863.7
         LW         2203.0
         Bat.     117431.6
         WS        24314.4
         WD      1438811.5
         dtype: float64
```

2 Conclusion

The following data refer to the complete hydrological years.

Hydological year
2001-2002
2006-2007
2007-2008
2008-2009
2009-2010

Our sample is too limited in order to take this meteoroligical station into account.