PressureTransducer

November 23, 2015

Import required libraries:

```
In [85]: import matplotlib.pyplot as plt
         import pandas as pd
         from IPython.core.display import HTML
         import numpy as np
         import scipy as sp
         %matplotlib inline
```

A little function that converts kPa to height of water column in cm:

```
In [86]: def kPa_to_cm(kPa):
             cm = kPa * 10.2
             return cm
```

Read in the temperature time-series data, look at the first few rows. The column headers are sensor serial numbers

```
In [87]: temp = pd.read_csv('temp.csv',sep=',',  parse_dates=[[0,1]])
         temp.head()
```

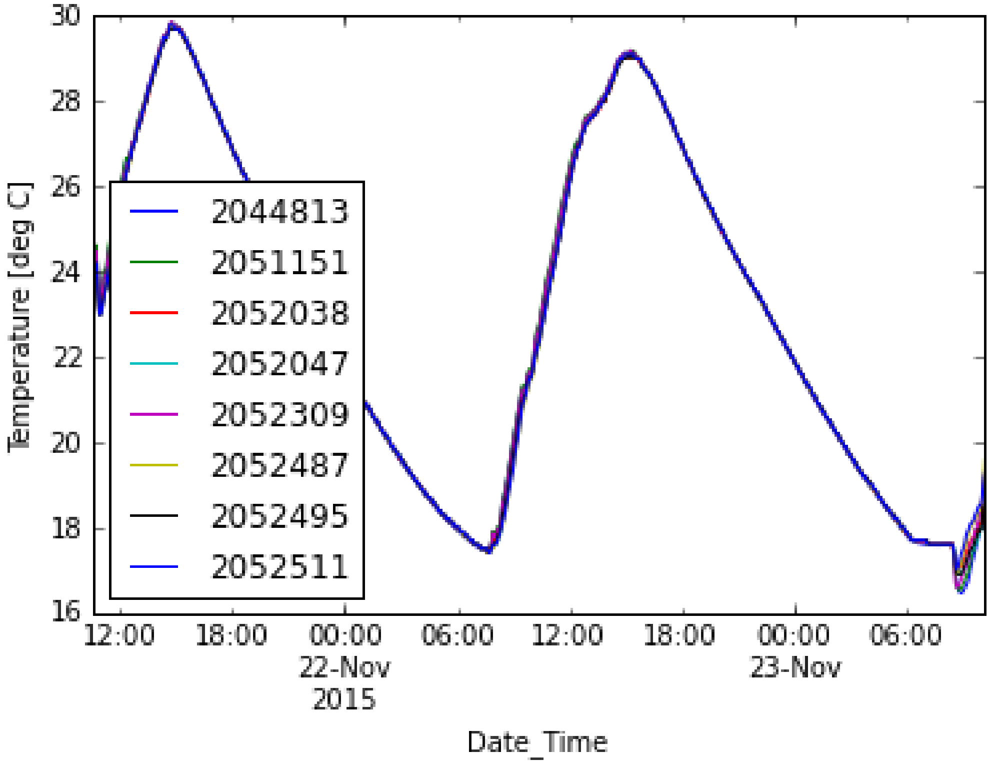
```
Out[87]:             Date_Time  2050012  2044813  2051151  2052038  2052047  2052309  \
         0 2015-11-21 10:30:00   24.000   24.700   24.524     23.5     23.8   24.533
         1 2015-11-21 10:35:00   23.633   24.192   24.173     23.8     24.0   23.982
         2 2015-11-21 10:40:00   24.250   24.346   24.482     23.9     24.0   24.312
         3 2015-11-21 10:45:00   24.453   24.504   24.628     24.2     24.2   24.492
         4 2015-11-21 10:50:00   23.636   23.659   23.734     23.5     23.6   23.683

            2052487  2052495  2052511  Actual Water Level (cm)
         0     23.7     23.7     23.6                      NaN
         1     23.5     23.6     23.7                      NaN
         2     23.9     24.0     24.0                      NaN
         3     24.1     24.2     24.2                      NaN
         4     23.5     23.5     23.6                      NaN
```

Plot the full time series of each sensor. It sat in the window in 273 McCone over the weekend and experienced >10 deg c temperature fluctuations!

```
In [88]: tempPlot = temp.plot("Date_Time",range(1,9,1))
         tempPlot.set_ylabel("Temperature [deg C]")
```

```
Out[88]: <matplotlib.text.Text at 0x127a0668>
```



Now, let's read in the pressure data and look at it as well. The pressure transducers are unvented and record absolute pressure in kPa (water weight + atmospheric pressure)

```
In [89]: pressure = pd.read_csv('pressure.csv',sep=',',  parse_dates=[[0,1]])
         pressure.head()
```

```
Out[89]:             Date_Time  2050012  2044813  2051151  2052038  2052047  2052309  \
         0 2015-11-21 10:30:00  100.643  100.828  100.740  100.718  100.699  100.664
         1 2015-11-21 10:35:00  100.629  100.826  100.726  100.711  100.659  100.646
         2 2015-11-21 10:40:00  101.679  101.910  101.887  101.770  101.718  101.731
         3 2015-11-21 10:45:00  101.729  101.895  101.842  101.771  101.720  101.783
         4 2015-11-21 10:50:00  102.601  102.837  102.792  102.661  102.611  102.652

            2052487  2052495  2052511
         0  100.650  100.705  100.688
         1  100.619  100.705  100.690
         2  101.696  101.735  101.769
         3  101.685  101.693  101.767
         4  102.571  102.629  102.676
```

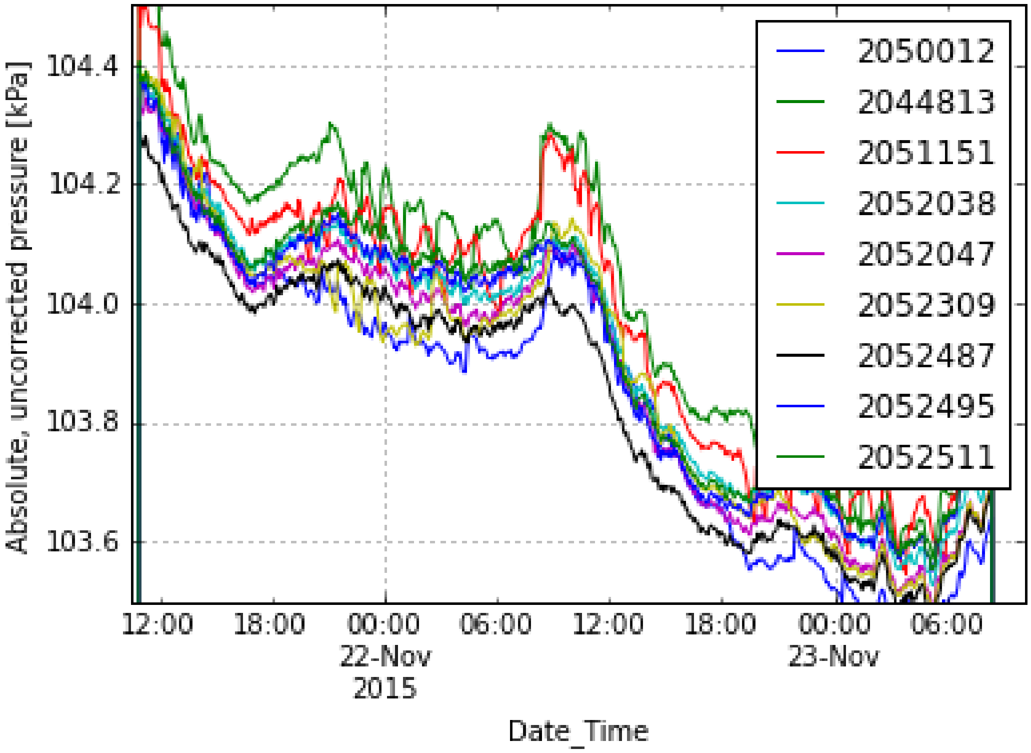
The pressure jumps up when I drop them in water, then decreases steadily, due to a combination of both evaporation (the water column dropped about 1.4 cm over the weekend) and also atmospheric pressure variations. The sensors were dangling at slightly different depths from string (+/- 1 cm from eachother), so shouldn't all plot right on top of eachother like the temperature data

```
In [90]: fig = plt.figure()
         pressurePlot = pressure.plot("Date_Time",range(0,9,1))
```

```
        pressurePlot.set_ylabel("Absolute, uncorrected pressure [kPa]")
        plt.grid(True)
        pressurePlot.set_ylim([103.5,104.5])
```

```
Out[90]: (103.5, 104.5)
```

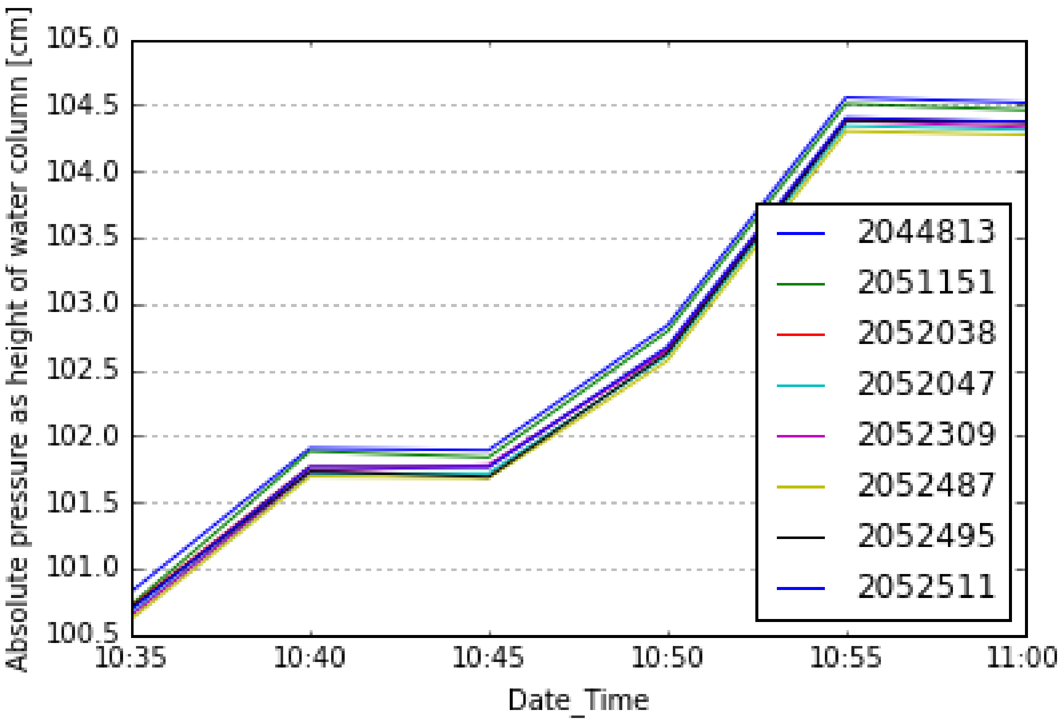
```
<matplotlib.figure.Figure at 0x11f399b0>
```



Let's look at the very start of the time series, when I added specific amounts of water: 10:37 am: added sensors to water 10:46 am: added 9.8 cm water 10:51 am: added 17.9 cm water

```
In [93]: startDateTime = pd.to_datetime('2015-11-21 10:30:00')
         stopDateTime = pd.to_datetime('2015-11-21 11:05:00')
         pressure = pressure[ (pd.to_datetime(pressure["Date_Time"]) > startDateTime) & (pd.to_datetime


         pressurePlot2 = pressure.plot("Date_Time",range(1,9,1))
         pressurePlot2.set_ylabel("Absolute pressure as height of water column [cm]")
         plt.grid(True)
```


Absolute pressure as height of water column [cm]
105.0
104.5
104.0
103.5
103.0
102.5
102.0
101.5
101.0
100.5
10:35
10:40
10:45
10:50
10:55
11:00
Date_Time
2044813
2051151
2052038
2052047
2052309
2052487
2052495
2052511

```
In [ ]:
```