Pressure Transducer Bench Test

November 23, 2015

Here I look at some of the data generated from Solinst Levelogger Pressure transducers, which will be installed in the wells and stream gauges at Sagehorn.

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]:

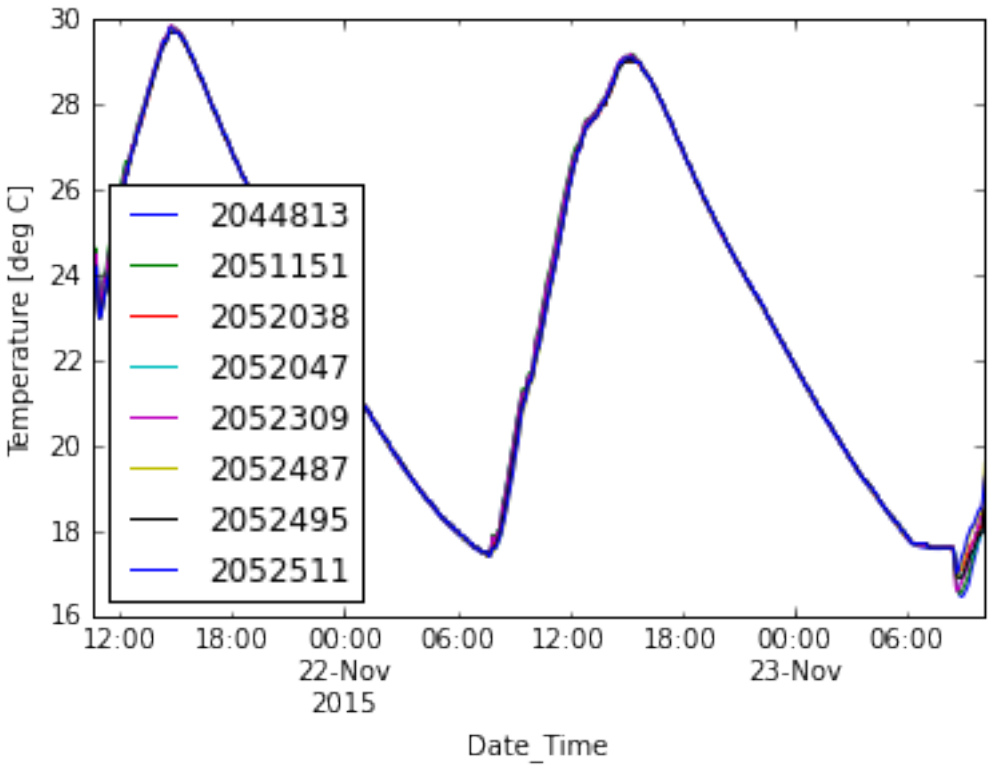
	Date_Time	2050012	2044813	2051151	2052038	2052047	2052309	\
0	2015-11-21 10:30:00	24.000	24.700	24.524	23.5	23.8	24.533	
1	2015-11-21 10:35:00	23.633	24.192	24.173	23.8	24.0	23.982	
2	2015-11-21 10:40:00	24.250	24.346	24.482	23.9	24.0	24.312	
3	2015-11-21 10:45:00	24.453	24.504	24.628	24.2	24.2	24.492	
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	2052487	2052495	2052511
0	2015-11-21 10:30:00	100.643	100.828	100.740	100.718	100.699	100.664	100.650	100.705	100.688
1	2015-11-21 10:35:00	100.629	100.826	100.726	100.711	100.659	100.646	100.619	100.705	100.690
2	2015-11-21 10:40:00	101.679	101.910	101.887	101.770	101.718	101.731	101.696	101.735	101.769
3	2015-11-21 10:45:00	101.729	101.895	101.842	101.771	101.720	101.783	101.685	101.693	101.767
4	2015-11-21 10:50:00	102.601	102.837	102.792	102.661	102.611	102.652	102.571	102.629	102.676

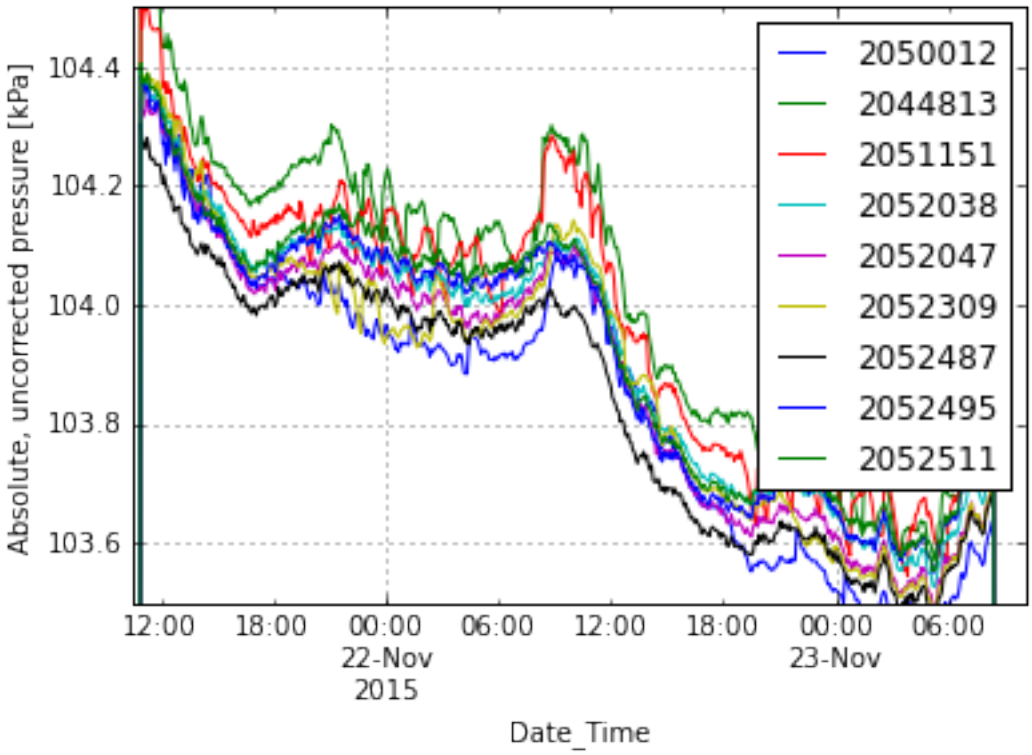
The pressure jumps up when I drop them in water, then decreases steadily, due to a combination of both evaporation (the water column dropped about 1.4 cm over the weekend) and also atmospheric pressure variations. The sensors were dangling at slightly different depths from string (+/- 1 cm from eachother), 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>
```

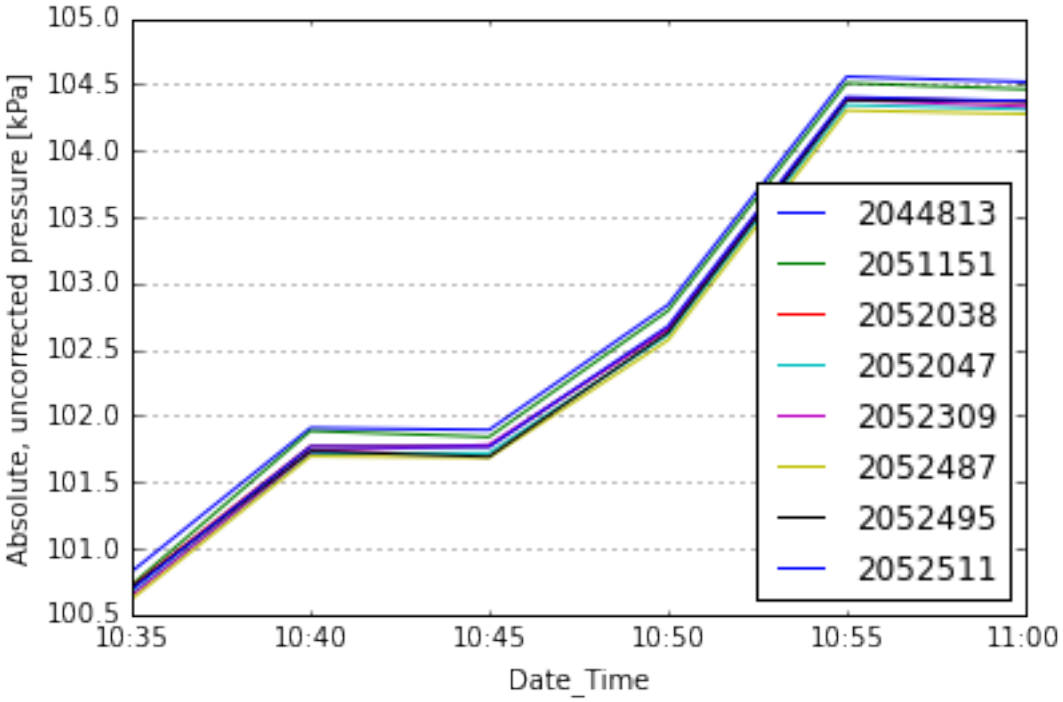


I can't figure out how to explain the finer scale wiggles in the time-series data. Sampling interval = 5 mins. The window was open in 273, and I don't think the heater was coming on because the temperature profiles are so smooth.

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 [94]:
```
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, uncorrected pressure [kPa]")
plt.grid(True)
```


105.0
104.5
104.0
103.5
103.0
102.5
102.0
101.5
101.0
100.5
Absolute, uncorrected pressure [kPa]
10:35
10:40
10:45
10:50
10:55
11:00
Date_Time
2044813
2051151
2052038
2052047
2052309
2052487
2052495
2052511

In [ ]: