Serializer lab testing (post-project)

To attempt to debug the 2Hz noise seen on the kryptons during this project, I have set up part of stn #4 in the lab:

DSM #5

CSAT #0671

GPS for timekeeping

First, I used KH2O #1133 and *saw no noise on an output voltage of about 0.21V. I blocked the optical path and saw no noise at 0.00V.*

Next, I swapped in KH2O #1394 (the actual krypton used at stn #4. *It now outputs 1.43V, but also had no noise. Also no noise when blocked and reading 0.00V.*

Next, I added the cradlepoint with a modem back into the DSM. The modem wasn't connected (due to placement in the room), so no data transfer was occurring. *Still no noise.*

That's it for now. Next steps would be:

- Move to get cell coverage

- Add 2 TRHs

- Add barometer & prop

- Add solar panels

Round 2, 9/19:

Tripod set up outside near basketball court (mostly the same)

- DSM5, CSAT0671, back to KH2O1133 (since I didn't want to risk putting 1394 outside before post-cals), GPS

- Modem on using Cradlepoint, transmitting UDP data to rt-server.eol (sp?)

- Power from solar panels

Ambient kh2ov = 0.34V. *Thought I saw some noise during one "kv", but couldn't replicate it. Bagged detector, so 0.00V and no noise.*

Final step is to add the remaining 4 sensors (2xTRH, prop, baro).

Round 3, 9/28:

Added TRH, Baro, Prop, Power mote to tripod set-up. All the same S/N as used at #4, except possibly not mote (or TRH fan)

- Some jumping, but doesn't analyze as clear 2Hz with ambient voltage ~0.38V

- Put bag back on, get 0.00V, no noise evident (spectra show a slight bump at 5Hz -- probably A/D conversion artifact)

- Replaced bag by bit of wire mesh, reduced voltage to 0.18V. Also changed mote power switch, which might have been off.

Not seeing noise here either (or data from the mote, for that matter).

The last step is to add the 2nd TRH -- not yet done. I'll also take data through tonight, to look at the signal when turbulence levels are smaller (but I don't expect the noise to appear).

Interlude: Look at spectra from old data:

CWEX11:

Looking at 2 days (1&2 Aug) of spectra, see that noise amplitude is pretty constant, freq changes a small amount (~2.2 to 2.4 Hz), ncar2 is 2 orders of magnitude (in power -- 1 order of mag in amplitude) lower than ncar4. All of these are quite consistent.

Looking at 26 Jul (when I gave the tour), I recall that all turbines were stopped due to calm winds when I arrived (~13:00). During this period, the amplitude of the noise is about a factor of 2 smaller, though at the same frequency. Other hours of this day have noise levels similar to 1&2 Aug, though I have no information as to whether the turbines were running then.

Also, look at snapshots of data from other projects:

TREX: Don't see 2Hz noise for a case when V~0.6V at night (though white digitizing noise is obvious). Noise level is much lower than seen in CWEX (so CWEX noise would show up).

dpar(start="2006 mar 30 04:00",lenmin=30)
iod = prep("kh2oV.30m#3")

PCAPS: Also no 2Hz noise for a case with V~0.6V at night. Similar comments as above.

dpar(start="2011 jan 4 4:30",lenmin=30)
iod = prep("kh2oV#7")

SUMMARY:

1. It appears that this problem was due to RF environmental factors unique to CWEX11. It is not physical since we do not see noise on the Li7500 H2O signal or any other scalar.

2. We have no way of detecting whether noise occurred on the lower-rate analog channels.

3. Since we can fix the CWEX11 data in software (FFT; filter spectra; inverse FFT), we do not need to know the source.

4. We are not sure that we will ever use the same serializers (or kryptons) again, but we should look for this noise again in any case.

5. IF we wanted to pursue this further, we could take the station to the turbine test station at NREL, though there still may not be exactly the same RF environment.

6. We should keep track of the frequency and amplitude of the noise while correcting the CWEX11 data. We also may get turbine operating parameter data (rotation speed?) from the wind farm operator. This log entry may be revisited with a check of whether these values are correlated.

Postlude:

Contrary to summary comment 2 above, I now note that noise is apparent in the PTB220's pressure signal as well. This occurs all the time at stn2 and some of the time at stns 3&4. Note that it is impossible to detect that it is 2Hz noise, since the sampling rate is 1sps. Also note that this stn 2/4 behavior is opposite that seen in kh2oV, where the noise was continuous and large at stn 4 and much less and variable at stn 2. The bottom-line conclusion probably doesn't change -- the source likely is RF and the effect on a sensor depends on some nuance of mounting and cabling.

Unfortunately, this "noise" appears to preclude the use of pressure to identify the existence of turbine wakes at the surface, though it might be possible to pull out a signal...

Addendum:

During CentNet tests at Marshal during the first half of 2012, the 2 Hz noise gradually appeared (as the krypton signal response declined?), to the point that it is quite obvious in the June-August data. Thus, I don't think we can blame the turbines after all...