pressure puzzles

Okay, I've been looking at pressure data and I can't figure out some things:

1. The reference pressure is slowly ramping away from P. My best guess is that the soil surrounding the reservoir is actually cooling now that it has the space blanket on top of it, thus making the pressure go down. I believe that this is consistent with the sequence of operations (from Khuong) when the cylinder was reburied (hole dug Fri AM, old hold dug up Fri AM, cylinder moved to new hole Fri AM, pressure lines sealed & checked Sat AM, hole backfilled and space blanket added Sat AM). Although Pref is now 14mb lower than P, this is well within the 150mb range of the 202BGs, so I'm not excessively concerned. *We'll keep on monitoring this signal.*

2. I've now looked at selected pressure spectra from two periods, one in config#1 and one in config#2. The two periods have spectra that are quite similar to each other and the 3 sensors I've looked at also are similar to each other. However, these spectra are completely different than those seen in CHATS. CHATS p spectra followed f^-5/3 reasonably well from a peak more-or-less at 0.1Hz until a digitizing white noise floor at ~7Hz. The amplitude of the noise was about 2.5e-6 (mb^2).

Here, we are seeing a nice peak at about 0.02 Hz, but with a roll-off that goes more like f^-3.5 and thus intersects the noise floor (of about 2.5e-7 mb^2) at a frequency of only about 1Hz. It is gratifying that the noise floor is lower (given all the hard work on our counter boards), though I thought we would gain more than this factor of 3 (the square root of 2.5e-6/2.5e-7). The amplitude of the signal at 0.01 Hz is actually about the same as the CHATS cases but, with this sharper roll-off at high frequencies, there is a lot less energy at, say, 1 Hz.

I don't understand the sharper roll-off. At first, I thought that the low frequencies might be contaminated by tower wakes in our configuration #2, but I would have expected energy at high frequencies as well and I see the same roll-off in configuration #1 data. However, I can't see how filtering like f^2 (the approximate difference between -5/3 and -3.5) could be caused by a physical process (say, too small tubing). My best guess is that it is a signal processing artifact, though I can't imagine what. The cut-off frequency of such a filter would be about 0.1 Hz (10 s period).

I don't know at the moment what the calibration code is doing. Since the variables "pper" and "p" are almost perfectly correlated, I'm assuming that the temperature correction, if it is being applied, is quite small (at least at these frequencies). In any case, since this "filtering" appears in "pper", I'm assuming that it hasn't been introduced by post-processing.

Did anyone else look at pressure spectra before I arrived? If so, did you see similar behavior??

I might try changing the sample-side tubing on one of the transducers, in a long-shot attempt to figure this out, but otherwise I'm stumped.

I got the following replies from Tom and Gordon:

Steve:

Perhaps you have already considered the averaging of the counter board output. It is counting for approximately 0.1 second, which is applying a low-pass filter equal to sin(x)/x where x = 2/pi*f*dt/2 and dt=0.1 sec. This does not nearly correspond to the attenuation you are seeing at high frequencies. At the Nyquist frequency, 5 Hz, the attenuation is 0.637 (0.405 for the power spectrum: a rough anti-aliasing filter) and at 1 Hz the attenuation is 0.984 (0.968).

Still not much help. It is perhaps worth noting this in the logbook for future users of the pressure data.

Tom

We can alter that averaging period. It is the NumPulses parameter in the XML, currently set to 3000 for pressures and 10,000 for temperatures.

Gordon