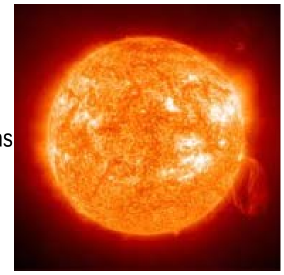
QuakeFinder Leading the Quest for Quake Forecasting

NEWSLETTER
Third Quarter, 2013

How do we minimize false alarms?

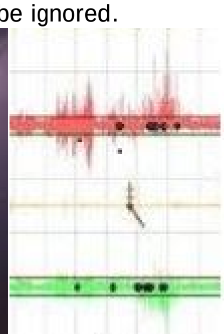


As we sort through huge amounts of pre-earthquake electromagnetic data, we see many mysterious signals. How do we identify both natural and man-made noise signals to distinguish them from the earthquake signals?

Our magnetometers can detect ***solar storm noise*** composed of micro pulsations lasting 1-300 seconds. Since they have a regular oscillation waveform, we are able to filter out these low frequency noise signals.

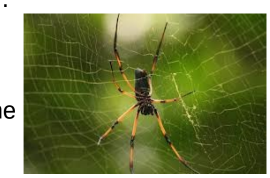
Then we look for **man-made noise (i.e.** lawn mower rotating blade, pump impeller, etc.). Most man-made noise is oscillatory so our process identifies and ignores oscillations that last for more than 10 seconds. Our system looks for singular pulses that last from 0.1 to 10 seconds, so any continuous oscillation that lasts more than 10 seconds is ignored.

Next, we look for ***earthquake generated "unipolar magnetic pulse waveforms"***. These single pulses are higher on one side than on the other, shaped almost like a single human heartbeat. The amplitude of these unipolar pulses must also be larger than a site-specific threshold value in order to be counted. This threshold is set to be 2 to 3 times the average site signal level allowing ***normal background noise*** to be ignored.

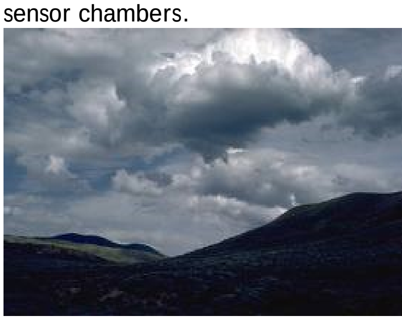


Lightning Generated Pulses

Lightning is another "unipolar signal" that looks like earthquake pulses. These noise pulses must be identified and ignored. To discriminate lightning pulses, we use data from EarthNetworks, a company that monitors lightning strikes. If a specific lightning strike is close to our site, and the lightning pulse time coincides with the time o f a magnetometer pulse, then that pulse is ignored. Tuning of this lightning algorithm was the major activity over the last quarter, and the resulting new pulse counts should be much more accurate.



Air Ionization is another earthquake indicator that we monitor at each site. However, noise in the ion data can also be a problem. If the ion sensor plates of our devices are dirty or contaminated by bugs, or if high humidity is present, then it can cause false readings. Each site has a humidity sensor, so we can detect moisture and filter the data when high humidity is present. In addition, we have now coated the sensor's electronic boards with silicone to eliminate dirt and moisture from reaching the electronics. We also have installed fine mesh screens to block bugs from the entering the sensor chambers.



Finally, the ***Infra Red*** (IR) monitoring from the GOES weather satellite is used to look for a third set of pre-quake signals, but dense clouds and fog can contaminate the IR data. The University of Colorado is helping us generate filters that identify and eliminate clouds/fog contamination.

Our ability to identify and eliminate all these "contaminants" from the data has dramatically improved our analyses, and allows us to more effectively reduce false alarms. As we integrate all these various analyses, we acknowledge that we are not done yet. We continue to develop new insights during the search for earthquakes in our data.

The world needs warning. Reliable earthquake forecasts will someday save lives.

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QuakeFinder is a humanitarian R&D project supported primarily by Stellar Solutions. Our goal, based on sound scientific theory and practice, is to create a system for short-term (days to weeks) forecasting of major earthquakes.