Can Earthquakes be Predicted?

Neala Creasy, an undergraduate student in geophysics, is researching a new method in earthquake prediction at the United States Geological Survey in Menlo Park, California in collaboration with Stanford University. The ability to predict large, destructive earthquakes is one of the most desired skills amongst earth scientists. In 1989 the Loma Prieta earthquake (magnitude 7.1) devastated the San Francisco bay area in California by killing 63 people, motivating the rush for scientists to study a new technique in earthquake prediction. The graph below was produced soon after the Loma Prieta earthquake. There was an increase in magnetic field activity 2 weeks and 3 hours prior to the earthquake. This unusual magnetic signal sparked a debate into whether large earthquakes can disrupt the Earth’s natural magnetic field, usually remaining constant over a short period of time. To some scientists, these fluctuations in the Earth’s magnetic field may have been a precursor to the 1989 earthquake. Over the past 20 years, scientists have been studying these fluctuations in the Earth’s magnetic and electric fields in order to replicate these results for other earthquakes. Neala is in the process of installing EM stations along major fault lines to measure these small changes in the Earth’s electromagnetic field.

The goal of Neala’s work is to help render these stations permanent and find cheaper methods installing these stations. By building cheaper stations and streamlining installation, more electromagnetic stations can be installed in the bay area in order to increase the likelihood of “seeing” an earthquake precursor. The equipment being currently used for the sites are top of the line yet very expensive. Neala in the next month will be comparing a new system (which is about a third of the cost) to the expensive, current system to see if the new system is as good as or better than the current system. The new system is a completely independent design created in order to withstand lightening, compact the system, and make the entire EM station more efficient. Therefore, by installing more stations, it may be possible to prove or disprove the existence of earthquake precursors by having more stations in strategic locations along the San Andreas Fault system.

The main concern with this research is that there is not always a precursor before an earthquake. Sometimes, the opposite occurs where fluctuations in the magnetic and electric fields are not followed by an earthquake. There are many limitations and factors that influence an appearance of a precursor. Local geology, atmospheric and solar disruptions can influence the electromagnetic signal, causing deceptive signals that may appear as precursors. In addition, if an electromagnetic precursor existed for an earthquake, the current stations may not “see” the precursor depending on the location, depth, and magnitude of the earthquake.
Currently, the new system has been confronted with telemetry issues and the test is being postponed to the fall.