Geophysical Research Abstracts
Vol. 12, EGU2010-7525, 2010
EGU General Assembly 2010

Do earthquakes generate EM signals?

Christina Walter, Stephen Onacha, Peter Malin, Eylon Shalev, and Alan Lucas
Institute of Earth Science and Engineering, University of Auckland, Private Bag 92019 Auckland, New Zealand

In recent years there has been significant interest in the seismoelectric effect which is the conversion of acoustic energy into electromagnetic energy. At the onset of the earthquake and at layer interfaces, it is postulated that the seismoelectric signal propagates at the speed of light and thus travels much faster than the acoustic wave. The focus has mainly been to use this method as a tool of predicting earthquakes. Our main objective is to study the possibility of using the seismoelectric effect to determine the origin time of an earthquake, establish an accurate velocity model and accurately locate microearthquakes. Another aspect of this research is to evaluate the possibility of detecting porous zones where seismic activity is postulated to generate fluid movement through porous medium. The displacement of pore fluid relative to the porous medium solid grains generates electromagnetic signals.

The Institute of Earth Science and Engineering (IESE) has installed electromagnetic coils in 3 different areas to investigate the seismoelectric effect. Two of the research areas (Krafla in Iceland and Wairakei in New Zealand) are in active geothermal fields where high microearthquake activity has been recorded. The other area of research is at the site of the San Andreas Fault Observatory at Depth (SAFOD) at Parkfield area on the active San Andreas Fault which is associated with repeating earthquakes. In the Wairakei and Parkfield cases a single borehole electromagnetic coil close to borehole seismometers has been used whereas in the Krafla study area, 3 borehole electromagnetic coils coupled to borehole seismometers have been used.

The technical difficulties of working in the borehole environment mean that some of these deployments had a short life span. Nevertheless in all cases data was gathered and is being analysed. At the SAFOD site, the electromagnetic coil recorded seismoelectric signals very close to a magnitude 2 earthquake. In the Wairakei and Krafla study areas, large swarms of earthquakes were located very close to the electromagnetic coils.

This abstract focuses on the data from the Wairakei area. Preliminary data analysis has been carried out by band pass filtering and removing of the harmonics of the 50 Hz power line frequency. The initial results clearly show that electromagnetic signals accompany the seismic P and S waves (coseismic signal). Further data analysis involves the extraction of the seismoelectric signal generated at the onset of the earthquake and at interfaces from the coseismic signal and other 'noise' sources. This processing step exhibits a major challenge in seismoelectric data processing. Unlike in other studies we measured the EM field and the seismic field at one location. Therefore the seismoelectric wave travelling at the speed of light cannot be determined as easily in the arrival times as when an array of coils is used. This makes the determination of the origin time much more difficult. Hence other processing techniques need to be explored.