

Abstract Title:

A Strategy for Collecting and Analyzing Multiple Electromagnetic (EM) Data Sets for Pre-Earthquake Signal Investigations

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There have been a number of reports of interesting electromagnetic (EM) signals detected prior to large earthquakes, but the subsequent analyses have been hampered by the lack of enough instrumentation to cover large geographical areas, and enough data history to allow statistical analyses of the “earthquake signatures”. The EM data analysis requires that several basic questions be addressed: “What are the “normal” background signatures (both natural and man-made) for each instrument during non-earthquake days?” and “What are the statistically “unique” signatures associated with large earthquakes?” Both ground and space sensors are subjected to a wide variety of non-earthquake EM noise (Pc-1, 3, 4’s, SRS, Schumann Resonance). We first show the top-level strategy developed by QuakeFinder and our partners to collect large volumes of satellite EM data (DEMETER and QuakeSat) and ground EM data (from QuakeFinder’s CalMagNet and Berkeley’s magnetometer networks, and total electron content (TEC) data from US and Japanese GPS networks). We show a wide variety of algorithms used to identify and characterize natural and man-made EM noise, and then compare the information from multiple instrument platforms and algorithms to help discriminate between “normal” EM noise sources and potentially “earthquake-generated EM noise”. This data collection, algorithm generation, and analysis processes are evolving from a simple “post quake” analysis, to a daily ingest, data fusion, and strategy refinement at our QuakeFinder Data Center. We also recognize that there may never be enough instrumentation located at the right place and at the right time, so we also include the strategy to use multiple, portable instruments to collect and measure potential post-quake EM signals near the epicenter area.