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Electromagnetic responses associated with earthquakes

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On September 5, 2004, an earthquake sequence involving both foreshock and aftershocks was occurred at the southeastern offshore of the Kii Peninsula in Japan. Our MT(magnetotelluric) survey, which was carried out in Jeju island, Korea for geothermal exploration, just happened to record anomalous responses related to the foreshock (magnitude 6.9) and the main shock (magnitude 7.4) at two measurement sites (Figure 1). The significant electromagnetic waves, which were recorded about 5 minutes after earthquake occurrences, appear to be synchronized with the seismic surface waves with dispersion. The EM signals have the frequency band of about 0.05 to 0.3 Hz and, in the view of MT theory, the apparent resistivity increases and phase converges on zero-phase, that means the electric and magnetic fields have the same phase. The analysis of direction property, however, shows the differences in directions of EM wave propagation at two sites. This result may mean that either the sources of EM waves are very close to the MT measurement sites or the co-seismic responses are severely affected by the local geologic structures. Our further study reveals that the observed co-seismic signals are not produced at the earthquake source, but rather due to local effects arose near MT sites by passing seismic waves.

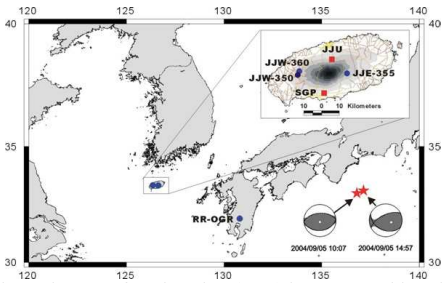

Figure 1. The map showing epicenter of earthquakes (stars) in Japan, and location of MT measurements (circles) and seismological observatory sites (squares) in Jeju island, Korea.