Source locations of earthquake-related EM pulses derived from their arrival directions measured at two observation sites

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In order to find source locations of earthquake-related EM pulses on real-time basis, we have been preparing to set the second observation site as a counterpart of the base station at Kyoto Sangyo University. The second observation site was established at Nyumata, Misugi-cho, Tsu-shi, Mie Prefecture, where exists one of earthquake observatories of Nagoya University. On December 24, 2006, after test measurements of its detection system for one month, we started simultaneous observations of earth-origin EM pulses at the both sites, Kyoto (KSU: 35.04 N, 135.45 E), and Misugi (MSG: 34.28N, 136.18E).

During seven days from December 25 to 31, we detected 115 EM pulses at KSU and 113 at MSG. These pulses were concentrated during night times of 3 days from December 26 to 28. Among these EM pulses, only nine source locations were identified. Two of their locations were pointed to Nan-kai trough and to the Taiwan island at 20:27:55.289 JST and 20:53:35.256 JST of December 25, respectively. About 25 hour later, an EM pulse was detected at 21:34:54.915 JST of December 26 just when an earthquake of M6.0 occurred at the depth of 40 km of 21.8 N, 120.6 N, where is close to the Taiwan island. Therefore its pulse was a co-seismic excitation although its source location was far from the epicenter of the earthquake. Since, even after the earthquake, source locations of some EM pulses were pointed in the Nankai trough, these nine EM pulses would be generated in a wide area by the movements of the Philippine plate.

Through an analysis of many EM pulse data detected at the both observation sites on stormy day, we found a remarkable point that almost arrival direction lines of EM pulses detected at the both sites had no cross point with each other. This means that electromagnetic field vectors of their pulses detected in each bore-hole might be interfered by the lightning currents flowing along the ground surface, and be deformed from those of EM propagation mode. By using the present analysis method, we can select earth-origin EM pulses only from detected pulses including lightning ones, and can find their source locations.

Anyway, a multiple observation network consisting of sites equipped by the present detection system can clearly identify source location of earth-origin EM pulses, and can monitor the dynamical stress imposed onto earth plates by means of detections of electromagnetic pulses.