

# Measurements of arrival direction of electromagnetic pulses in the earth

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In order to elucidate a relation between movements of earth crust and excitations of electromagnetic (EM) pulses in the deep earth, we are planning to identify source locations of the excited EM pulses. As the first step for this purpose, we were constructing a system to find the arrival direction of EM pulse waves in the earth, and have accomplished it recently. The sensor system consists of a vertical electric dipole antenna with linear elements of 5 m, and two search coils of 10000 turns which are assembled horizontally-and-orthogonally with each other and whose length is restricted within 9 cm because of the narrowness of the bore-hole (10 cm in diameter) which was constructed in the campus of Kyoto Sangyo University. This sensor system can make it possible to detect a vertical component of wave electric fields and two orthogonal components of horizontal wave magnetic fields. Furthermore, we have accomplished software programs which can analyze and display the arrival direction of pulsed EM waves from their detected signals by using a personal computer. At the end of December 2003, we installed the sensor system into the bore-hole and started its continual observation.

We here introduce one of examples. At 14:49 JST of January 6, we had an earthquake with M 5.2 at 34.2 N, 137.7 E, 40 km in depth. Just at that time, the monitor system displayed the arrival direction of rather intense EM pulse wave. The displayed direction was just from the epicenter. We checked another type of display which shows time-change plots of the arrival direction of EM pulses up to that time. The plots concentrated to the same direction since January 4, and the number density of plots increased from early morning of 6. Just after the earthquake, the number density of plots decreased abruptly. However, few hours later, it increased until the midnight of January 7, and plots disappeared after 8. The trend of this situation on EM pulse detections before and after the earth quake will be worth to discuss the relation between them.

Because the newly developed direction finding system of pulsed EM waves propagating in the deep earth would become very useful tool for the study on the relation between movements of earth crust and excitations of EM waves, we would like to establish a network system to identify the source location of the EM pulse excitations.