

Electromagnetic waves radiated from the ground

TSUTSUI, Minoru^{1*}

¹Kyoto Sangyo University

We have been observing electromagnetic (EM) pluses excited by earthquakes. Recently we have confirmed that the detected EM waves were co-seismic ones which were readily generated by piezo-electric effect in earth crusts by vibrations of seismic waves [1]. In order to inspect behaviors of the excited EM pulse, we prepared two sensor systems consisting of tri-axial magnetic search coils. One was inserted into a deep bore hole of 100 m in depth and another was installed on the ground. When an earthquake (M2.7) occurred at just below (at the depth of 11 km) the EM observation site, we simultaneously captured waveforms of an EM pulse in the borehole and on the ground. From the waveforms of magnetic north-south and east-west components detect by the both sensor systems, we obtained their wave polarizations in horizontal plane. Their results are shown in Figure 1. As shown in the figure, the wave above the ground shows elliptic polarization whereas that in the earth shows linear polarization. This means that the wave was propagating from the deep earth to the air region passing through the ground surface which is interface of two media with different refractive indices. We found that almost all of seismic waves can excite EM waves, and they were radiated out of the ground surface. This is a reason why co-seismic signals were often detected by MT method.

[1] Minoru Tsutsui, Behaviors of Electromagnetic Waves Directly Excited by Earthquakes, IEEE Geoscience and Remote Sensing Letters, Vol. 11, No. 11, pp. 1961-1965, 2014.

[2] M. Tsutsui, T. Nakatani, M. Kamitani and T. Nagao, Polarization and propagation property of electromagnetic pulses in the earth, in Proc. IGARSS, 2011, pp. 838-841.

Keywords: observation of electromagnetic pulses, polarization analysis, radiation from the ground

