Sompi Event Analysis of the Transfer Functions Obtained by a Long-Term Test of EM-ACROSS

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Accurately Controlled Routinely Operated Signal System (ACROSS) aims at obtaining static and time-varying physical states of underground structures by using an artificial source signal (e.g., elastic or electromagnetic wave) accurately controlled in amplitude and phase. A long-term seismic and electromagnetic ACROSS observation has been executed for more than one year at Tono test field, and transfer functions between the transmitter and receivers are obtained with a high signal-to-noise ratio (SNR).

The purpose of the present study is to examine the applicability of the Sompi event analysis method to electromagnetic transfer functions acquired in the low frequency diffusion wave range by means of ACROSS technology. The transfer function used in the present analysis is obtained at 13 frequencies between 35.0 and 372.5Hz. A set of receivers is installed on the ground surface at a distance of ~700m from a current dipole transmitter with a moment of ~400Am. In this area, the tertiary sediments of ~100 Ohm-m with a thickness of ~100m is overlying the granite basement of ~10000 Ohm-m, so that information of reflected wave from this surface of unconformity is expected to be contained in the transfer functions in addition to that of direct wave from the source to receiver, even though the spatial scale of the structure is smaller than the wave length and the wave is of diffusion in nature.

A wave element with a group velocity of ~1000km/sec is successfully detected by applying the Sompi event analysis method to electromagnetic ACROSS transfer functions obtained by an observation for 10000sec, whereas no positive evidence of reflected wave has come out yet. The major reason is interpreted as the lack of the SNR in data due to the small dipole moment of the transmitter and/or the short stacking period of time. Additional factors to be discussed are (1) the trade-off between the frequency range and precision in the Sompi event analysis method for dispersive wave, and (2) the trade-off between the number of spectral lines for data acquisition and amplitude of transmission signal under the constraint of constant transmitter power. We discuss on these subjects in the presentation.