Temporal variation of S-wave revealed by the continuous transmission experiments of the seismic ACROSS

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We have started the routine transmission of the accurately controlled elastic wave signals by the seismic ACROSS transmitter at Tono mine (Tokishi, Gifu) from Oct. 2002, and the continuous observation has been executed for more than one year, in order to complete the active and continuous monitoring system for the Earth's interior by seismic waves. The transmitted signals have been observed by Hi-net or the original seismic arrays. In the vicinity of the transmitter, observation by seismometers in the underground gallery at the Tono mine has been executed to investigate mainly the transmitting characteristics. This report reviews results of the transmissions and observations at Tono mine, and discusses the stability of the transmitted signals and temporal variations of observed signals.

First, we analyzed observation data of the second experiment (Nov.19.2002-Dec.02.2002), which is relatively wideband transmission, to separate seismic phases. Because the rotating direction of eccentric mass is switched every 1-hour, we have a set of radial and transverse excitations towards any of stations by summing up the source signals of normal and reverse rotations with appropriate phase shift. Then we can get a set of 6 transfer functions; three responses; radial (r), transverse (t) and vertical (v) for two excitations; radial (R) and transverse (T). By transforming these transfer functions in frequency domain into time-series data, we found significant direct SH-waves and SV-waves in Tr-component and Rv-component respectively. Direct P-waves and multiple reflection S-waves between the earth's surface and the top of the granitic basement at about -125m G.L. (Toki Granite) were found, too. Velocities of the direct SH-wave and SV-wave are estimated to 1250m/s and 1080m/s respectively by using travel time measured from the peak of envelop of time-series data.

Next, we analyzed observations data of the forth experiment (Apr.15.2003-), and investigated temporal variations of transfer functions synthesized to linear excitation every 1hour. These transfer functions in frequency domain and time domain slightly change in correlation with precipitation and atmospheric temperature. Temporal variations of later phases are considerably larger than that of the direct S-wave (less than 0.5ms in terms of travel time). We attribute temporal variations of later phases to variation of complex reflection coefficient of earth's surface by rainfall.