

The observation and analysis of ACROSS signals by seismic networks (Part I) The detection of seismic signals by JMA and Hi-net

Hiroshi Ueno[1], Yasuhiro Yoshida[2], Hidetoshi Matsuoka[3], Yuzo Ishikawa[4], Takahiro Kunitomo[5], Mineo Kumazawa[6]

[1] SVD/JMA, [2] MRI, [3] Japan Meteorological Agency, [4] Meteorological Res. Inst., [5] JNC, [6] Tono, JNC

The present work is aiming at the study on the optimum designing of 'The Active Underground Monitoring System of Japanese Islands' by using ACROSS on the basis of experimental data and their analysis. The ACROSS (Accurately Controlled Routinely Operated Signal System) is an active exploration method for the underground by continuous operation for the long period of time to reach the very high S/N by data stacking in obtaining the temporal variation of accurate transfer function between the signal transmitters and receivers. Broadcasting station of seismic ACROSS signals has started the test operation at Tono Mine since October 2002, after the extensive developmental works (mostly by JNC and Nagoya Univ.) started right after the Southern Hyogo Prefecture Earthquake, 1995 (M_j= 7.3). The transmitted seismic waves were detected by many observation sites of regional seismic networks up to 100 km as expected from the preliminary survey ('Earthquake Frontier Research for Terrestrial Subsurface' Report, 2001).

Here we show only the result from the first test, in which a 11 day broadcasting is made for a simple sinusoid of 25 Hz with amplitude of $9.6 \times 10^4 \text{N}$ and FM signal in the range $18.52 \pm 0.5 \text{Hz}$ with amplitude of $1.0 \times 10^5 - 1.1 \times 10^5 \text{N}$. The sets of continuous records in regional seismic networks (JMA and Hi-net) are segmented into 100 sec sequences, and they are stacked for the whole time period of observation to reduce the noise. We have surely confirmed the arrival of signals with level as low as $10^{-2} - 10^{-3}$ microkine in velocity amplitude up to the epicentral distance of 100km. Close examination of the observed results yields interesting underground features reflecting the regional peculiarity, e.g., (1) the amplitude of the 25Hz signal is larger by several times for the sensors installed on the earth surface (JMA) than that of Hi-net installed in borehole, and (2) there are such sites that FM signals show larger amplitude than 25 Hz sinusoid, whereas each of their spectral lines is substantially smaller in transmitted amplitude. The more elaborate data analysis is being made and further broadcasting and observation works are being continued, so that more interesting results will be reported at the session.

As exemplified above, we have started such and much systematic survey on the regional peculiarity of signal amplitude and the nature of noise as a function of frequency. Undoubtedly it would provide us with the important information demanded by the optimum designing of active underground monitoring system to detect remotely the structure-sensitive behaviors of deep seismogenic horizon.