

Mid-term continuous seismic data acquisition using short-span seismometer array at defunct Hourai Town, Aichi and ACROSS analysis

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A team in Nagoya University has been working on developing Accurately-Controlled Routinely-Operated Signal System (ACROSS) in order to monitor variations in the subsurface properties. Continuous transmission of a controlled seismic signal from the seismic ACROSS source and observation of the reflected waves from a plate boundary enable us to delineate the crustal structure in the region and to monitor the state of the plate boundary. A preliminary experiment in the active seismic observation started in 2005 in Tokai region (Kasahara et al, 2005). A seismic line was deployed in Aichi and Shizuoka Pref. at the distance from 40 to 70 km from the ACROSS source in Tono mine, Toki, Gifu Pref. The line is parallel to the 2001 Tokai-Hokuriku exploration (Iidaka, 2003).

We deployed a short-span seismometer array in the Aichi Prefectural Forest Park in defunct Hourai Town (presently Shinshiro City) in eastern Aichi, which is located in the middle of the seismic line. There are several reasons for the choice of the site suitable for the seismic observation. Hi-Net station (N.HOUH) is also located in the park. The array, composed of 12 stations, is about 2 km wide in NS and 1 km wide in EW. Three components of seismometers (L22D) were deployed at each station and the signals were recorded using LS7000. The data were stored in 2GB CF card that has a capability of storing 3 weeks of continuous seismic data. A battery and a solar panel were used for power supply. The experiment started from November, 2004. Since the array was deployed in a mountain area, frequent power failure due to low sunshine rate suffered us during winter time. A good data acquisition was achieved in the spring. In summer, however, tree leaves covering the solar panels sometimes prevented generating enough powers. The experiment terminated at the end of September, 2005.

The seismic ACROSS source at Toki has been operated to generate FM signal from 10 to 20 Hz in 50 seconds of period during the continuous observation. The rotation direction was reverted every one hour so that 6 components of the transfer function (propagation characteristics of wave) would be obtained by data processing. After one or two weeks of data stacking, signals with a good S/N ratio were obtained using the surface seismometers, which is comparable to the data of the Hi-Net station deployed in a borehole. The transfer function clearly shows the P-wave, S-wave and their after-phases, having good correlation with the Hi-net data. A semblance analysis was applied to the array data to estimate the azimuth, dip of the wave propagation of each phase and the apparent slowness. The continuous record contains a number of earthquakes that can be used to estimate the velocity structure beneath the array.

An activity of low-frequency tremors in Tokai region from July 20 to 23, 2005 was reported (e.g. JMA and NIED). The noise level of our record raised at the same period. The fact that the noise signal shows good correlations among the seismic records of the array station indicates that the signals are actually low frequency tremors. We would expect the time variation of the transfer function of ACROSS signal has some relation to the activity of the tremors.

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