

A proposal of the active monitoring for the deep crustal structure in the central Japan

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Active monitoring of the seismogenic zone such as the plate boundary, the deep crust and the volcanic region is effective in the assessment of the earthquake generation and the volcanic eruption. For this purpose, we require an integrated mapping and monitoring system for quantifying the time and spatial changes of underground heterogeneity.

Seismic exploration by explosive sources or seismic vibrators is mainly carried out for mapping a large-scale underground structure over several 100 km. For example, the seismic reflection experiment across the central Japan revealed the strong PxP reflection phase from the Philippine Sea plate boundary at the depth of 20-35 km and high-dip angle reflector beneath the Tokai region (Iidaka et al., 2003). We examined the seismic records used by Iidaka et al (2003), and notified several strong reflection phases identified on survey lines from the north to south beneath the central Japan region. Such phases can be explained by several reflectors scattered in the middle to lower crust at 20 km or deeper and in the wide region over 100 km long around Atera active fault system and the western area of Ontake Volcano. A mapping of the reflectors in the crust and plate boundary is also suggested by using microearthquakes (e.g., Yamawaki et al., this meeting).

On the other hand, we have proposed the monitoring observation system under the stable control for a long time period. The ACROSS (Accurately-Controlled Routinely-Operated Signal System) is an innovative technology to estimate the transfer function showing the characteristics along the propagating paths. It uses the continuous band-limited sinusoidal seismic and electromagnetic waves whose phases are accurately controlled by the GPS clock. (Kumazawa et al., 2000). In recent years, the continuous seismic ACROSS signals were successfully transmitted during two years or more (Kunitomo and Kumazawa, 2004). We also conducted the array observation in Tokai area for 9 months from Nov. 2004, toward the monitoring the physical state of plate coupling by the seismic reflections from the plate boundary and/or the crustal structures in future (Kasahara et al., 2004). We confirmed the refracted and reflected P and S waves up to nearly 75 km offset distance using one-month long stacking data (Tsuruga et al., 2005; Ikuta et al., 2005). These results encourage us for the next step toward the detection and monitoring of the temporal change of geophysical state of underground structure.

We here propose the potential of the active monitoring observation by ACROSS for the deep crustal structure, especially remarkable seismic reflectors located around the middle - lower crust in central Japan. Such reflectors were also observed in Tohoku and Kinki districts, and suggest one of the possibilities of the detachment in the lower crust and/or the bright spot which might be originated in the fluid. Under the Ontake Volcano, because the reflective layer which inclines west-southwest to 10-14 km was expected (Inamori et al, 1992), the relevance of such reflectors and volcanic underground structures (e.g., magma source) is also suggested. Therefore, more detailed structure investigation and active monitoring of such reflectors provide us the important information, considering the loading process of island arc and the seismic and volcanic activities. We will discuss about the changes of travel times and waveforms by showing the results of theoretical travel times and waveform in the variable case of the structural model.

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