

Monitoring for Plate Coupling Using Accurately Controlled Source System (ACROSS)

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Detectability of temporal changes in reflected wave from the boundary of subducting plates in Tokai district with active sources are studied. Based on rock experiments the change in the intensity of reflection wave can be caused by change in coupling between subducting and overriding plates. ACROSS system, which is designed to detect temporal variation of seismic propagation property, is planned to be used to monitor the change in the coupling in the Tokai district, Japan. The following technical issues should be overcome to monitor the returned signal from boundaries of subducting plates. (1) Long term operation of the source. (2) Detection of temporal change. (3) Accurate estimation of source functions and their temporal change. (4) Increase of signal-to-noise ratio with source and receiver array. First two issues have already been overcome. We have already succeeded a long-term operation experiment with the ACROSS system in Awaji, Japan. The operation was carried out for 15 months with only minor troubles. In the experiment we developed a technique to monitor the temporal change of travel time with a resolution of several tens of microseconds. The third issue can be solved by deploying seismometers around the source to monitor the wavefield that is emitted by the source. Source and receiver array improve the signal-to-noise ratio by phased array procedure. We also estimate the efficiency of the reflected wave detection using ACROSS system by examining the data of seismic exploration experiment by blasts that were carried out above subducting plate in Tokai district. Clear reflection from the surface of the Philippine Sea plate is observed in the waveform. Assuming that the ACROSS source is installed at the same place as the blast source, the detectability of temporal variation of reflection wave is revealed to be excellent. The resolution will be better than 1% in amplitude and 0.1 millisecond in travel time for the stacking of one week using three-unit source and ten-elements receiver arrays. Following the encouraging result we made a 10-month monitoring test of ACROSS signal at Tokai district with 12-element seismic array that is deployed in the region where massive volcanic rock is exposed. Though the distance from the source is 50 km we can detect some later phases with good signal-to-noise ratio. Beginning from 2006 we will make an extended experiment to monitor the reflection from subducting plate boundary in Tokai region with three ACROSS sources with a collaboration of Meteorological Research Institute, Shizuoka University and Japan Atomic Energy Agency.