

A short review for the development of ACROSS system in Nagoya University

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In Nagoya University a system for active monitoring was being developed. The system was named ACROSS (Accurately Controlled Routine Operated Signal System). In this talk I would like to review the process of development of ACROSS in Nagoya university for the last eight years.

Phase 1. (- 1995)

In the first stage of the ACROSS development, we pointed out some advantage of the system. The availability or possibilities of the following features are the advantage. i) Long-term continuous operation, ii) generation of accurately controlled iii) sinusoid, iv) usage of single force. We also developed the data-loggers which can stack signal with constant time interval. Sompi-method is also applied to the analysis of ACROSS system.

Based on the plan we construct a proto-type ACROSS source and operated it in the campus of Nagoya University. In this experiment we used conventional telemetry for receiver system and make a synchronization using radio. We succeeded to get a signal with sufficiently high signal-to-noise ratio.

Phase 2 (1996 - 1997)

After the Kobe earthquake in 1995 two ACROSS source for practical use are constructed at two sites, Awaji and Tono. Portable ACROSS sources are also constructed. These vibrators have been utilized for the development of ACROSS system until now. A new project started in Tono Geoscience center of PNC (now JNC = Japan Nuclear Cycle Development Institute), which promoted the development of ACROSS system. Soon after the start of the project, the source operation under accurate synchronization to GPS clock was almost established.

Phase 3 (1997-1998)

Using the ACROSS sources many experiments were carried out to assure the potential ability of ACROSS system. One of the epoch making experiment in this period was 'long-distance transmission test', in which the signal of the source at Tono were received in the telemetered seismic station in the central part of Japan. Monotone signal at 25Hz was detected at the station which locates at 100km from the source. No limitation of noise reduction by stacking has been found.

Phase 4 (1998-2000)

Several issues which have substantial problem for the practical use of ACROSS were found in this period. The most serious problem, which we are now trying hard to solve, is the instability of the source motion. Though the force (i.e. rotation) by the source are very accurately estimated using the rotation velocity, the movement (e.g. acceleration) of the source region are very much affected by the change of elastic or inelastic nature. The change in motion strongly varies the signal at receivers. Statistical methods for correction are already developed, but modeling of the source motion will be necessary for precise analysis.

Phase 5 (2000-)

We carried out an experiment at Awaji site in which ACROSS are operated for 15 months without major trouble. We also put seismometer to monitor the motion in the source region. The notable results in this experiment are the finding of the temporal change in the anisotropy using shear-wave splitting. Besides the development of the ACROSS itself, we try to analyze data for explosion experiment and vibroseis to check the applicability of ACROSS system to earthquake-prone area and active volcano.