Continuous observation in propagation properties of ACROSS signal using seismometer array

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Introduction

Temporal variations in the propagation properties of seismic waves around the Nojima fault have been continuously monitored using ACROSS and seismometer arrays since February 2003. The experiment will be carried over for at least five months, in which water injection experiments will be conducted in a borehole of 1800m deep at the fault. One of the purposes of this study is detecting a behavior of the injected water, which is represented by scattering strength around the water injection well. The other purposes are identifying the discontinuity and heterogeneous structures in the crust using the later phase and detecting changes in propagation properties of elastic waves corresponding to earthquake and earth tide. We are going to make a preliminary report of the result this experiment including the static crust structure and temporal variation of travel time.

Site

In Awaji Island, two ACROSS sources and seismometer arrays are deployed near the fault of 1995 Kobe earthquake. Water injection point is about 150m to north-northwest far from ACROSS sources and its depth is estimated to be about 540m. Elasitic waves generated by the ACROSS sources are received by two series of seismometer array. One is located at about 300m to northwest and the other hand is about 650m to southwest from the top of injection point. Each array consists of ten 3-component seismometers with natural frequency of 4Hz, which is made by Markproducts Inc. The seismometers are deployed in cross shaped array with separation of 10m. Two seismometers are linked to one datalogger developed by Hakusan Corp. specially for ACROSS system.

Experiment parameter and observation capability

The two ACROSS sources are designed to generate sinusoidal wave up to 35Hz and 25Hz with maximum force of 2.0x10^5N. Hereafter each source is called HF(High Frequency)and LF(Low Frequency) unit, respectively. Two rotational sources were operated simultaneously with frequency modulation to cover as wide frequency range as possible. The HF and LF units were operated with the same modulation amplitude of 2.2Hz and modulation period of 20 seconds, but with the different frequencies centered at 13Hz and 19.1Hz, respectively.

We recorded the data with the sampling frequency of 100Hz. Data are stacked 35 times and saved once an hour with a stacking interval of 100 seconds. The ACROSS sources and receiver are synchronized with GPS clock with accuracy of better than 0.1 microsecond. As the signal-to-noise ratio is more than 100 for each component in the frequency domein in this experiment, travel time resolution is estimated to be less than 10 microseconds. The experiment will be continued for about five months to compare the background signal with the scattering nature during the period water-injection experiment.