

## P-wave detection of the deep low-frequency earthquakes (LFE) using a 3-D array

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Tono Research Institute of Earthquake Science (TRIES) installed a seismic array station at Shimoyama in Tokai area. This array station (SMY) has 6 high-sensitive seismographs with three components in a triangle area with about 100 m sides. Geological Survey of Japan (AIST) also installed a seismic array station of 3 borehole-type instruments with high-sensitive seismographs at three depths of 50m, 200m, and 600m in Shimoyama. We use all of those seismographs to be as a Three Dimensional array (3-D array). Using the 3-D array, we observed a remarkable activity of deep low-frequency earthquakes (LFE) occurring in Tokai area from February 5th to 12th in 2009. Most of the records of LFE show complicated as like as noise or tremor.

Using those complicated LFE records, we tried to research how to detect especially P-waves of LFE events. Before analyzing LFE records, we researched the records of a regular earthquake of which hypocenter was as the followings,

2009, 7/27, 09h44m19.58s, Lat: N35.018, Long:137.270, Depth:41.5km, M:4.0 ( JMA)

Its epicenter distance is 8.4 km at SMY. Using a semblance method, we obtained the following results.

1. Apparent velocity of P-wave propagating from a depth of 600 m to the ground surface is estimated to be 4.5 ? 6.0 km/s using vertical component record.
2. Apparent velocity of S-wave propagating from a depth of 600 m to the ground surface is estimated to be 2.2 ? 3.0 km/s using horizontal component record.
3. Reflected P-wave was also detected using the apparent velocity in the result of 1.

Not only semblance parameter but also a new parameter was calculated for detecting P-wave.

The new parameter is composed of correlation and amplitude of multi-channel records.

Using the method and result for the regular earthquake, we researched the vertical component records of LFE occurring during the period from 17h33m to 34m (JST), February 7, 2009. We identified six or seven direct P-waves in 10 seconds. It means that our method is useful for studying the physics of the source mechanism of LFE.

Keywords: deep low-frequency earthquakes, 3-D array, P-waves, semblance