Seismic explosion survey around slow events in the Tokai region

Tomotake Ueno[1]; Tetsuya Takeda[1]; Kazushige Obara[1]; Youichi Asano[1]; Yoshikatsu Haryu[2]

[1] NIED; [2] NIED/ADEP

The mega-thrust earthquakes have occurred at the plate boundary of the Philippine Sea plate (PHS) in the Tokai region. In Japan, since seismic and diastrophism observation networks were installed and kept in good condition, recently, a series of slow events at the plate boundary are resolving. Tremor, very low frequency earthquakes, and short term slow slip events in the slow events occur at the depth of 30-40 km. While, the long term slow slip event, which had been occurred for approximately five years from 2000, occurred at the depth between the active area of the other slow events and the anticipated source region of the mega-thrust earthquake. The short term slow slip events, long term slow slip events and mega-thrust earthquake seem to occur separately. In order to investigate the relationship between separate occurrence of above events and structure in the vicinity of the plate boundary, we conducted the seismic explosion survey at the Tokai region in 2008.

On December 10 and 11 in 2008, six explosive sources (500 kg) were fired. These waves were recorded, of which the sampling rate was 100 Hz. We used three components and vertical seismometers whose natural frequencies were mainly 2 Hz. The number of recorders was 440. These recorders were deployed on the four profiles of which the total length was approximately 280 km. The intervals of each seismometer were 550 - 650 m. One explosive source was located at the northern edge of this survey (southern Nagano Pref.) and it was common source of two lines (East and West lines). A shape of East and West lines looks like an inverse V character, and they were on the anticipated source region of the mega-thrust earthquakes (E line) and the active area of the slow events (W line).

We successfully obtained high quality waveform records in each seismic section. In West line located over the region of a series of the slow events, clear reflection phases were obtained. As a consequence of ray-tracing with simple velocity model, one of them probably reflected around the plate boundary of PHS. On the other hand, reflection phases were obscure in East line located over the anticipated source region of the mega-thrust earthquake. Despite of the common shot point in the northern edge of West and East lines, clear and unclear reflection phases appear at the region of the slow events and the anticipated source region of the mega-thrust earthquakes, respectively. In West line, the reflection phases gradually decrease toward the south region at which the long term slow slip occurred.

The regional feature of the reflection intensity in the plate boundary seems to correspond to the separate source regions of the slow events and the mega-thrust earthquake. Since the reflection intensity suggested the impedance contrast of the plate boundary, the regional feature of the reflection intensity may be the key to the separate occurrence of the slip phenomena in the subduction zone.