

Seismic structure of the off-Miyagi region by airgun-OBS experiment

Ryota Hino[1], Minoru Nishino[1], Kimihiro Mochizuki[2], Kenji Uehira[3], Toshinori Sato[4], Mikako Nakamura[5], Syunichi Nakata[6], Masanao Shinohara[7], Junzo Kasahara[8]

[1] RCPEV, Tohoku Univ., [2] EOC, ERI, Univ. of Tokyo, [3] SEVO, Kyushu Univ., [4] Chiba Univ., [5] ERI, Univ of Tokyo, [6] Earth Sciences, Chiba Univ, [7] ERI, Univ. Tokyo, [8] Earthq. Res. Inst., Univ.Tokyo

In the middle part of the Japan trench subduction zone, the off-Miyagi area, large interplate earthquakes with $M \sim 7$ is known to regularly recur with about 40 years interval. The most recent event occurred 25 years ago (the 1978 Miyagi-Oki earthquake $M7.4$) and the Japanese government evaluated that the next large earthquake may occur within 20 years from now with over 80 % possibility. Most of the past large events in this area, including the 1978 earthquake, did not rupture the shallow (less than 20 km) part of the plate interface, although active background microseismicity is observed in the shallow thrust zone. Analyses of the historical records of the tsunami caused by the 1793 earthquake, one of the off-Miyagi series, suggest that the rupture area of the earthquake extended to the shallow part of the thrust zone and that the size of the event was much larger ($M \sim 8$) than the other earthquakes in the series.

In the northern part of the Japan trench subduction zone, we recently found a significant relation between the seismic reflection intensity of the surface of the subducting oceanic plate and the interplate seismicity along the interface; the wide-angle reflection arrivals are observed with remarkably strong amplitudes in the region of low interplate seismicity. This finding suggests that the appearances of the seismic reflections from subduction plate boundary can be a good indicator of the seismic coupling strength.

As an application of this idea to the shallow seismogenic zone of the off-Miyagi region, we made an airgun-OBS seismic experiment to observe the wide-angle reflections arrivals from the plate boundary in 2002. The surveyed area was in the trenchward extension of the rupture area of the 1978 earthquake and its size was 150 x 40 km in the strike and dip directions of the trench system, respectively. 39 OBSs were deployed in the area and a 3,400 cu airgun-array was shot along the four survey lines. The spacing of the OBS stations was 10 km and the airgun shot interval was about 150 m. The quality of the OBS record sections is good and we can trace the first arrivals up to at least offsets of 80 km. There are two groups of evident later arrivals on the record sections. Preliminary travel time analysis based on a reference structure model in this region presented by Miura et al. (2002) indicates that these later phases are wide-angle reflections from the subducting oceanic crust, which are of our most significant interest. The appearances of these later arrivals are quite different from a station to another, indicating that there seems to be a spatial variation of the reflection intensity of the plate boundary as we found in the northern part of the Japan trench.