# THE MID CRUSTAL REFLECTOR DETECTED BY VSP METHOD AND SEISMICITY IN IWAKI AREA, NORTHEASTERN JAPAN

Takashi Iidaka1, Yuta Usuda1, Eiji Kurashimo1, Shin'ichi Sakai1, Toshihiro Igarashi1, Kazushige Obara1, Aitaro Kato1, Tetsuya Takeda2, and Shigeki Nakagawa1

[1] Earthquake Research Institute, University of Tokyo, [2] National Research Institute for Earth Science and Disaster Resilience

The Tohoku-Oki earthquake occurred on March 11, 2011. The seismicity in Japan changed after the earthquake. The seismicity increased in some areas. The seismicity decreased areas also exist. It has been considered that the change of the seismicity is related to the change of the stress field caused by the large slip at the plate boundary. The Iwaki area, northeastern part of Japan, is one of the areas that the seismicity changed. The seismicity in this area increased drastically. Before the 2011 Tohoku-Oki earthquake, the seismicity was very low. But, the seismicity increased after the Tohoku-Oki earthquake. The cause of the changes of seismicity was not clear. It is very important to survey the crustal structure in order to understand the mechanism of the seismicity in this region. The characteristics of the seismicity of the area are following. The earthquakes occurred within a triangle area. The size of the one side of the triangle was around 50 km. The crustal seismicity in the area divided into two depth ranges. The depths of shallower group are less than 15 km. The depth range of the other group is 15–25 km.

A temporary dense seismic array (63 seismometers) has been deployed to know the seismicity and mechanism in this area. The clear two later phases were detected. From the particle motion analysis of these phases, the later phases were S- waves. The both of the phases are identified as the S reflected S waves at the boundaries below the source. Usuda (Master thesis 2018) studied the crustal structure using this data. The crustal structure was obtained using a reversed VSP (Vertical Seismic Profile) method. The origins of the two phases are the reflected wave from reflectors with depths of 15- 20 km and about 30 km. The reflector with the depth of about 30 km is consistent with the depth of Moho boundary in this area. The reflector with depth of 15-20 km is a reflected phase at the boundary located in middle of crust. The location of the boundary of the middle of the crust was consistent with that of seismic activity area inside the crust. The amplitude of the reflected wave was very large. It was expected that the reflected wave was caused by the reflector with fluid.

We researched the relationship between the seismicity in this area and location of the mid-crustal reflector. In this area, seismicity was very low before the Tohoku-Oki earthquake. The seismicity increases from March, 11, 2011. The seismicity started at the southern part the reflector. The seismicity increased in and around reflector area from Mar., 11 to Apr. 10, 2011. At the northern part of the reflector, a relatively low-seismicity area appeared. On Apr., 11, 2011, the Hamadori earthquake (Mw 6.6) occurred in the low-seismicity area. We suppose that there is some relationship between the seismicity of the area and reflector. If the reflector is caused by the crustal fluid, the increase of the seismicity in Iwaki area might be related to the crustal fluid. The outline of reflector obtained by Usuda (2018) is related to the location of the temporally seismic stations. In Iwaki region, the earthquakes are located at the north of the reflector. We researched the waveforms at the seismic stations located in north of the reflector. The later phase with large amplitude was found at the seismic stations. We found the reflector at the north of the reflector obtained by Usuda (2018). The seismicity in Iwaki area will be related to the crustal fluid.