The relationship between the location of the mid crustal reflector and seismicity in Iwaki area, northeastern Japan

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The Tohoku-Oki earthquake occurred on March 11, 2011. After the 2011 Tohoku-Oki earthquake, the seismicity in Japan changed. 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 were 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 range. The seismicity in the shallower area is 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. Usuda (Master thesis 2018) studied the crustal structure using this data. The crustal structure was studied with a reversed VSP (Vertical Seismic Profile) method. The clear two later phases were detected. One of the later phases was the reflected wave at the Moho boundary. The other phase was the reflected phase at the 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 that the relationship between the seismicity in this area and location of the mid-crustal reflector. In this area, 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 the Apr., 11, 2011, the Hamadori earthquake 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 (Master thesis 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 want to know the true size of the reflector. We researched the waveforms of the seismic stations located in the north of the reflector area. Hi-net and F-net stations were used. The later phase with large amplitude was found at the seismic stations. We found the reflector at the north of the reflector of Usuda (2018).

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