

Shear-wave splitting analysis in the Iwaki region using spatial high-dense seismic array

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The elucidation of the mechanism of intraplate earthquakes is very important to mitigate the disaster. Knowledge of the stress concentration and strain accumulation to the fault is crucial to understanding the mechanism of intraplate earthquakes. A large intraplate earthquake with Mw 6.6 (Fukushima Hamadoori earthquake) occurred on April 11, 2011 in Iwaki region, south of Tohoku. This is one of the large aftershocks of The 2011 off the Pacific coast of Tohoku Earthquake (the 2011 Tohoku earthquake). The source mechanism of the Hamadoori earthquake was normal fault type. It has been considered that the stress field in this region was changed after the 2011 Tohoku earthquake. The region was very quiet before the 2011 Tohoku earthquake. The seismicity extremely increased after the 2011 Tohoku earthquake in this region. The stress field of this region was researched by the source mechanism of earthquakes (e.g., Yoshida et al., 2015). The stress field of the region seemed to be complex. The directions of the minimum stress axes were not uniform. It was easy to estimate the stress field after the 2011 Tohoku earthquake, because the seismicity becomes active in this region. However, the seismicity of this region was very low before the 2011 Tohoku earthquake. It was very difficult to declare the stress field in this region before the 2011 Tohoku earthquake. Shear-wave splitting is an ideal tool for determining the orientation of the stress field in an area. Shear-wave splitting in the crust is related to the orientation of faults or cracks, and it is thought that propagating cracks are preferentially aligned parallel to the orientation of the maximum stress axis, in turn meaning that the polarization direction should also be parallel to the maximum stress axis (Crampin, 1981). This method can also be used to determine the stress field in areas with low seismicity. We deployed 63 temporary seismic stations in this region. We researched the shear-wave splitting using the data of this temporary seismic stations.

We used the data of earthquakes occurred in 2012. The depths of earthquake are shallower than 30 km. The magnitudes of the earthquakes are larger than 2. The shear-wave splitting was researched using the spatially high dense array. In this region, the seismicity is active in the two depth ranges, which are 3-10 km (Group A) and 15-20 km (Group B). The polarization directions of the data of Group A were not uniform. The large lateral variation was found. The time-lag values are almost less than 0.2 sec. The polarization directions of Group B also suggested large lateral variation. The spatial pattern of the polarization directions of Group B was similar to that of Group A. The time difference between the data of Group A and Group B is important to know the depth variation of anisotropy. The time lag values of Group B are almost similar to those of Group A. The result suggested that the cause of the shear-wave splitting is located in the shallower part of the crust. The data was compared with those of the previous studies. Iidaka and Obara (2013) researched the shear-wave splitting in this region. The spatial distribution of the seismic stations was sparse. But, the polarization directions in this study are consistent with the data of Iidaka and Obara (2013). Iidaka and Obara (2013) studied the shear-wave splitting of the earthquake which occurred before the 2011 Tohoku earthquake. The polarization directions observed in this study were not so different from those of the earthquakes which occurred before the 2011 Tohoku earthquake. Complex structure has to be considered in this region.

Keywords: Shear-wave splitting, Stress field, Iwaki region