S-wave reflectors below the earthquake swarm in the Yonezawa-Kitakata area, NE Japan

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Studies about distinct S wave reflectors around volcanic regions and inland earthquake faults has been reported for decades. In the NE Japan, S wave reflectors was interpreted as fluid which was dehydrated from melt [e.g., Hasegawa et al., 2005]. In addition, it is pointed out that crustal fluid may be involved in the mechanism of inland earthquake occurrence, and further understanding of the crustal fluid is necessary.

Also in the Yonezawa - Kitakata area, NE Japan, earthquake swarm occurred 7 days after the 2011 off the Pacific coast of Tohoku Earthquake because frictional strengths were estimated to have changed due to fluid diffusion [e.g., Okada et al., 2015]. In the previous studies (e.g., JpGU 2019 Meeting), we have obtained the spatial distribution of the S wave reflectors in Yonezawa - Kitakata area. We used data from the permanent stations by Hi-net and the temporary seismic network deployed by Group of the aftershock observations of 2011 off the Pacific coast of Tohoku Earthquake. We used the hypocenters determined by the Double Difference method using the temporary observation data. First, we carefully picked the travel time of the S wave reflected wave manually. Next, using the travel time, the strike/dip and the position of the reflection point were obtained by the image station method [e.g., Horiuchi et al., 1988]. As a result, the reflectors were located at the depth of 10 - 20 km below the focal area of the swarm.

The internal structure of the S-wave reflector is important for interpreting the origin of seismic reflector. In order to estimate the internal structure of the S-wave reflector, we calculated the spectral amplitude ratio of the reflected S wave to the direct S wave. Each time window sets from -0.1 s to 0.53 s based on the arrival time. The sampling frequency is 100Hz. The station used in this analysis is N.YNZH station deployed by Hi-net. The peak frequency of the obtained spectral amplitude ratio was confirmed at about 3-5 Hz, and the secondary peak could be seen at a multiple of that frequency. This characteristic of spectral amplitude ratio could be explained by a model of thin layer with low seismic velocity as shown by Umino et al., (2002). This result suggests that localized fluid exist below the focal area. Accordingly, it can be interpreted that earthquake swarm occurred due to the presence of fluid around the epicenter.

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