Distribution of Sp conversion interface in the Onikobe area

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1. Introduction

In the Onikobe area of the northern part of Miyagi, the Onikobe earthquake occurred in August, 1996. After this earthquake seismic observations by densely distributed stations such as the Onikobe temporal aftershock observation and the Tohoku Sekiryou mountains joint observation were carried out.

In the waveforms obtained by these observations, remarkable phases which were predominant in the vertical component between the initial P and the initial S waves were recognized as Obara et al.(1997) pointed out. The time between this phase and the direct S wave (S-Sp time) at each station was almost constant irrespective of hypocentral distance. Therefore, these phases were interpreted as Sp converted waves, and the conversion interface was located between a source and a station.

Since S-Sp time is mostly determined by depth of the conversion interface, the location of conversion interface can be estimated by inversion analysis of the S-Sp time.

In this study, we used S-Sp times obtained by observations mentioned above and estimated distribution of Sp conversion interface in the Onikobe area.

2. Method

Waveforms of 49 stations were examined and 20 stations with more than three S-Sp time data were used. The conversion interface was estimated as follows.

Arrival times of the S and Sp converted waves were picked with sufficient accuracy from the observed waves after band-pass filtering (5-15Hz). Furthermore we displayed the particle motion of Sp wave and picked the arrival time of UD motion. Thus the observed S-Sp times (Tobs) were obtained. The S-Sp time ranged for 0.13s-0.98s.

The model assumed was a two-layer structure. Calculated traveltime differences (Tcal) were obtained using the bending method, and the parameters (depth, strike, dip) of a conversion interface were obtained using the least-squares method so that the rms residual(Tobs-Tcal)becomes the minimum. Referring to the 3-D seismic velocity structure by Nakajima and Hasegawa (2003), we assigned Vp = 4.73 km/s and Vs = 2.72 km/s to the upper layer, and Vs = 3.30 km/s to the lower layer.

3. Result

Around Onikobe caldera and Mukaimachi caldera, the Sp conversion interfaces in the caldera were deep compared to the surrounding regions. The deepest part, 2.1 km below the sea level, existed beneath the Onikobe caldera. Depth distribution of the interface corresponds with that of the basement estimated by gravity investigation of Komazawa and Murata(1988). Therefore, around the Onikobe caldera, the Sp conversion interface can be interpreted as the basement of the pre-Neogene. The depth of interface in the caldera was a little deep(hundreds of meters) as compared with the depth of the basement by Komazawa and Murata(1988). The borehole data by NEDO showed that the upper part of the basement rock was crushed. Seismic waves may be converted near the bottom of the crushed part.

In and around the Sanzugawa caldera, northern part of the study region, Sp conversion interface of 2.0 to 3.5 km deep was estimated in the area around Mt. Kabutoyama - Mt. Okumaemori. This area is covered with the tuff layer exceeding 1000m in thickness, and basement depth is not known. The estimated Sp conversion interface may give the depth to the basement of this area. However, because the number of stations is not enough in this area, the further examination using more data is required.