Crustal structure beneath Taiwan estimated from local and regional earthquakes

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1. Introduction

In the northeastern area of Taiwan, Philippine Sea Plate is subducting northward, and in the southern area of Taiwan, Eurasian Plate is subducting eastward. These two plates are colliding each other beneath Taiwan. About mountain building mechanism, there are two representative theories, that is, a thin-skinned model (Suppe, 1981) and a collision model (Wu, 1997). These models have not been resolved yet by well constrained dataset. We have analyzed the shape of Moho using teleseismic events.from 2001.3 to 2001.5. It was difficult to estimate a crustal structure only from the teleseismic events. The purpose of the present research is to estimate the crustal structure using local and regional earthquakes.

2. Observation

Fifty-five three-component seismographs (1Hz) were installed at intervals of 2-3km along a line crossing central Taiwan, near 23 degree 45 minute N, in the east-west direction. Sampling frequency was 100Hz. Observation was held continuously for two months.

3. Data

During the period of the observation, 208 earthquakes, whose magnitudes were more than 3.0, were recorded near Taiwan (20-27 degree N, 119-124 degree E). There were two earthquakes at the center of the line, one on the westward extension, and three on the eastward extension. We analyzed these six earthquakes. Two at the center of the line were about 10 km deep, others were from 20 to 35 km, hypocenter of which were reported by CWB. In the waveform record, we could see clear later phases. One of the later phases is thought to be the reflection wave from Moho.

4. Analysis

We obtained apparent velocities of the direct P waves based on the past-up waveform record reduced by 6.0km/s. Characters are listed below:

(1)Earthquakes east off Taiwan have an apparent velocity of more than 13.4 km/s with an epicentral range of 15-30 km, 6.0 km/s with an epicentral range of 30-45 km, 8.7 km/s with an epicentral range of 45-65 km, 6.0 km/s with an epicentral range of 65-80 km, and 7.2 km/s with an epicentral range of 80-135 km.

(2)Earthquakes beneath the central range have an apparent velocity of 5.5 km/s with an epicentral range of 0-40 km, 8.3 km/s with an epicentral range of 40-50 km, and 5.2 km/s with an epicentral range of 50-60 km.

(3)An earthquake west off Taiwan have an apparent velocity of slightly less than 6.0 km/s with an epicentral range of 160-180 km, 8.6 km/s with an epicentral range of 180-200 km, and 5.7 km/s with an epicentral range of 200-215 km.

Next we calculated the apparent velocities using a ray tracing method based on the model obtained from the refraction survey (Yeh et al., 1998). For the central and eastern earthquakes, calculated apparent velocities could roughly explain the tendency of the observation. For the western earthquakes, however, an apparent velocity of Central Range became about 7 km/s, which was different from observation. From this time on we will modify the preliminary model to explain those differences.