Delamination of the Izu-Bonin island arc beneath the Tanzawa mountains

Shin'ichiro Kamiya[1]; Atsuki Kubo[2]; Yoji Kobayashi[3]

[1] IFREE, JAMSTEC; [2] NIED; [3] Tsukuba Unv.

Introduction

The Pacific and Philippine Sea plates subduct in and around the Japanese islands. The Philippine Sea plate is descending from the Sagami trough in the eastern side of the Izu peninsula and from the Suruga and Nankai troughs in the western side of the peninsula. Just in the northern side of the peninsula, the Izu-Bonin island arc and the Honshu arc collide with each other. We have discussed various geophysical phenomena based on the subduction-collision system. So, it is very important for the detailed tectonic discussion around the northern tip of the Izu-Bonin island arc that we understand where and how the Philippine Sea plate and the Honshu arc convergent. Moreover, from the geological study in the convergence region between the Izu-Bonin and Honshu arcs, the total amount of the Izu-Bonin island arc crust indicates that a part of the crust is delaminated and subducted into the mantle region. It is very important that we understand the lower crust delamination of the island arc for the discussion of the formation of continental crust.

Seismic Tomography

Kamiya and Kobayashi (2004) revealed P- and S-wave seismic velocity structures beneath the Kanto-Tokai district, central Japan using arrival time data from the catalog by the National Research Institute for Earth Science and Disaster Prevention (NIED). The seismic network operated by NIED is very dense, especially in and around the Izu peninsula. Moreover, seismicity beneath this region is very active, e.g., shallow events, events along the descending Philippine Sea plate and the Pacific plate. Therefore, the tomographic image estimated from these data shows high resolution and high reliability. So, we discuss tectonics around the Izu convergent region from the estimated velocity structures by Kamiya and Kobayashi (2004).

Results

Figure 1 shows the vertical profiles of the estimate P- and S-wave velocity structures in the direction of NNW-SSE beneath the Tanzawa mountains. We find almost horizontal high velocity anomaly region in the south of a latitude of 35.5N just beneath the Tanzawa mountains. Suddenly the dip angle become larger at that point and the high velocity region seems to subduct deeper. Therefore we realize that the Philippine Sea plate is moving almost horizontally to a latitude of 35.5N and suddenly starts to subduct deeper just beneath the Tanzawa mountains. We also find a low velocity layer just above the descending high velocity Philippine Sea plate. This region shows the Poisson's ratio about 0.25. These images seem to indicate a possibility that the low velocity region is composed of the oceanic crust. This might be showing the lower crust delamination of the Izu-Bonin island arc.

Future Works

In order to understand the tectonics around the convergent region between Izu-Bonin island arc and Honshu arc, e.g., whether the lower crust of the Izu-Bonin arc is delaminated or not, we need more detailed seismic velocity structures. Although Kamiya and Kobayashi (2004) adopted about 10km grid intervals, we can estimate smaller grid intervals velocity models, to a grid interval about 5km, with the same data set that they used. This is because that the station network used by them is very dense and the seismicity is very active around this region as mentioned above. However, we need active source seismic experiments to reveal much finer seismic velocity structures for more detailed discussion.

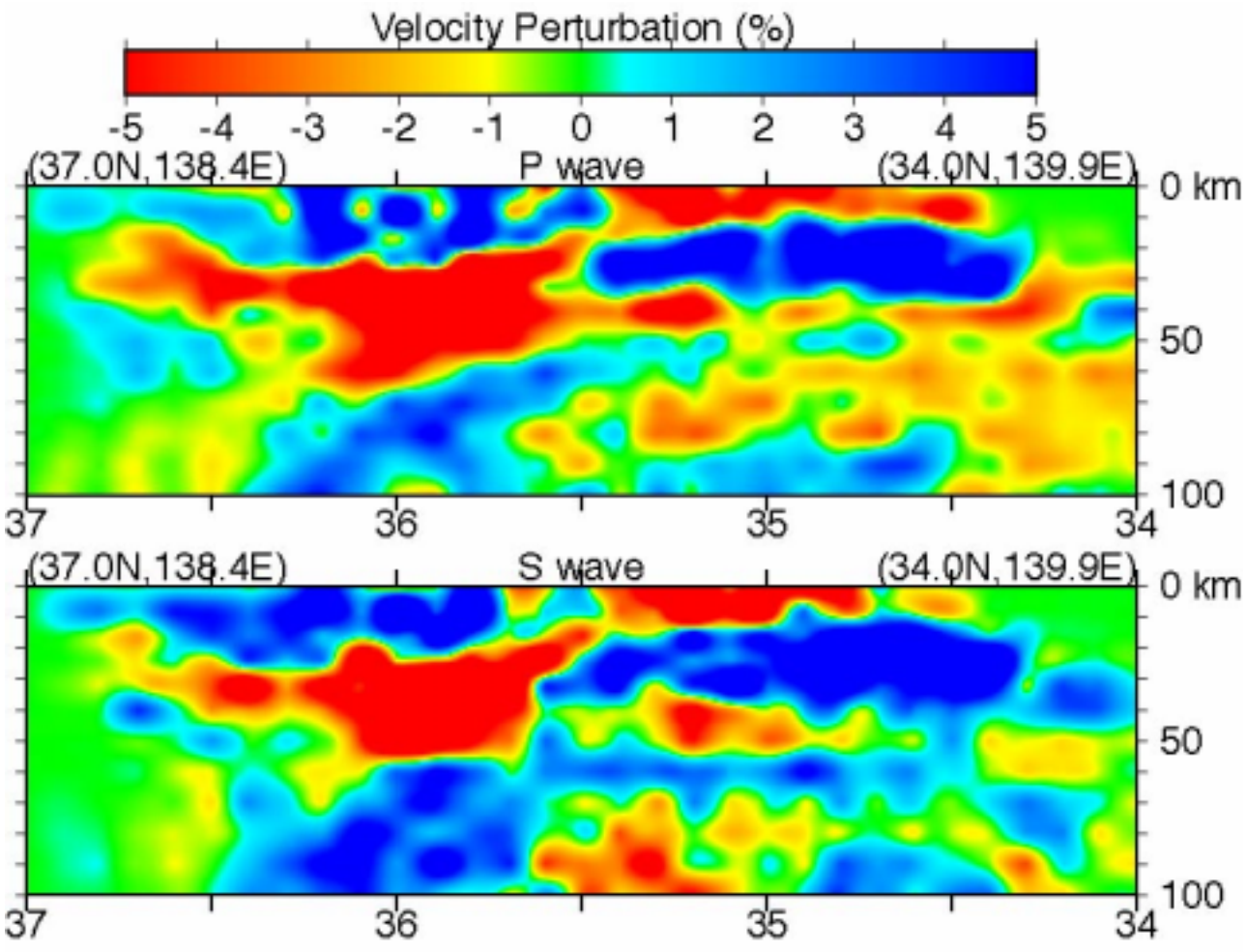

図1. 丹沢山地の下を横切る速度構造断面図

Figure 1. Vertical profiles of the seismic velocity structures estimated by Kamiya and Kobayashi (2004)