

Three-dimensional velocity structure near Miyake-jima and Kozu-shima Island from travel time analyses (2)

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A seismic swarm started under Miyake-jima Island from June 26th, 2000 and was related to the eruption of Miyake-jima Island. It spread toward the northwestern ocean region from Miyake-jima Island, in which huge number of earthquakes occurred. We estimated 3-D V_p , V_s and V_p/V_s models in the ocean region applying a seismic tomography method to both of the arrival time data obtained by ocean bottom seismometers and the land ones.

In order to understand both of the spatial and temporal changes of this activity, we repeatedly conducted and recovered ocean bottom seismometer stations 6 times by December 20th since July second, 2000. We used the data of total 38 stations from July second to August first. These are 19 ones in ocean bottom seismometers (ERI, JHD) in about 5km interval and 19 ones (ERI, Metropolitan office, Meteorological Agency) in the land. We chose earthquakes including ocean bottom phase data. Then further more we selected data being the location error less than 0.5km and the residual of travel times less than 0.1 seconds. We inverted 70620 P- and 29937 S-wave arrival times from 3641 local earthquakes.

To handle simultaneously both of the data of seabed and the land, which have different velocity structures, we need to consider the effect right under the stations. Then, at first, we obtained the velocity structure of 1-D and the station corrections using Joint-Hypocenter-Determination method (VELEST) by Kissling et al., (1994). Next, we inverted simultaneously travel times of V_p and V_s using seismic tomography method (Matsubara et al., (2000) which improved Zhao et al., (1992)). Initial velocity model in VELEST was based on the result of refraction and reflection survey by JHD and JAMSTEC using the artificial hypocenters. V_p/V_s was assumed 1.73. We placed grids within the analysis region (34~34.4 N and 139.1~139.6 E) about 5km interval horizontally and 3, 6, 9, 12, 15, 20km depth vertically.

To know the resolution we carried out checker board testing which gave the perturbation of (+-) 10% alternately in every grid. The result showed that there was the good recovery of the pattern to 5~15km depth in the focal region where distributes for the northwest-southeast between Miyake-jima Island and Kouzu-shima Island. Then, it was proven that there was the reliability of solution in this region. The low-velocity area exists the west 5km of Miyake-jima Island. The depth is 3 ~ 14 km for V_p and 8 ~ 13 km for V_s and V_p/V_s here is about 1.9. Here, the existence of the magma is suggested, because the earthquake is little. There is also the low velocity area in west of Kouzu-shima Island. V_p/V_s is about 1.8, and the earthquake is little in here. It also implied the possibility of the existence of the magma. There is a region with high V_p/V_s (1.9) in central and near the 15km depth in the focal region. Earthquakes are occurring in the high velocity area surrounded in the low velocity. The depth is 5~15km.