Shallow 3D seismic structure of Izu-Ohshima volcano: Analysis of travel time data from the seismic survey in 1999

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We apply a 3D tomographic analysis to the travel time data that was obtained from the Izu-Ohshima seismic survey in 1999. We used the software of TOMOG3D (Zhao, 1992) which adopts a pseudo-bending ray trace and the LSQR solver. The initial velocity model was inferred from an averaged travel-time curve. The grid intervals are 0.02˚ (~2km) for the horizontal directions and 0.5 km for the vertical direction. The trade-off curve for the model and data variances suggests that the damping factor of 20 is appropriate. After 10 times iteration, the weighted RMS residual of 0.156 s was improved to 0.138 s, the variance reduction was about 20 %. The checkerboard resolution test indicated that the horizontal spatial resolutions of 2 and 4 km are confirmed at 0-0.5 km depths beneath the whole island and those at 1.0-2.0km depths beneath the center of the island. The resultant structure shows that the high velocity anomaly at 0 km depth locates beneath the south-east corner of the caldera and that at 1 km depth locates beneath the south-west edge of the caldera, that at 1.5 km depth elongates beneath the west rim of the caldera, that at 2 km depth distributed beneath the north of the caldera. Since the distribution of the high velocity anomaly resembles to that of positive gravity anomaly, the high velocity anomaly can be interpreted as the dense and solidified magma after intrusions and eruptions in the past. Additionally, this strong heterogeneous seismic structure showing mainly east-west asymmetry may affect the hypocenter determination for the shallow volcanic earthquakes just beneath the central part of the island.

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