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Seismic velocity structures and relocated seismicity in the northeast area of the Izu Collision Zone

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The region of the Izu peninsula and its surroundings is located in the site of ongoing collision zone between the Izu-Bonin arc, a part of the Philippine Sea Plate (PSP), and the Japan island arc, called the Izu collision zone. The Izu collision zone gives rise to a very complex tectonics and structures. We have reported about three-dimensional seismic velocity structures inverted by seismic tomography [Nagai et al., 2008(JpGU Meeting 2008); Nagai & Tanada, 2008(7th General Assembly of ASC & SSJ 2008); Nagai et al., 2009(SSJ2009)]. In this study, we combined data sets among these studies mentioned above and added the Japan Meteorological Agency (JMA) unified catalog to invert seismic velocity structures more robustly. To discuss deeper structure and seismicity related with collision process, we relocated earthquakes using three dimensional velocity models obtained in this study.
We selected data based on the JMA unified catalog. For tomographic inversion, we selected 868 earthquakes from 2005 to 2008, which are with a magnitude of 1.5 or larger and located in and around the northeastern of Izu collision zone with a focal depth of 50 km or shallower. We selected travel time data corresponding to those earthquakes from the JMA unified catalog, the routine network in Hot Spring Research Institute and a temporary network in 2008. In total, numbers of selected absolute travel times of P- and S-waves are about 30,000 and 27,000, respectively. The method used in this study is the double-difference tomography method [Zhang and Thurber, 200 3].

Seismic velocity structures obtained in this study have resolution of 5 km or less, in northeastern part of Izu Collision zone and one of around 10 km in surrounding target region. Large scale structures are consistent with previous studies and our previous reports. Remarkable features in the results of seismic tomography are as follow.
(1)Wedge-like low-velocity body between Hakone region and Tanzawa Mountains. It corresponds to trough-filled deposits (sandstone and conglomerate), where the Izu-Bonin arc collides and accretes with the Japan island arc
(2)High-velocity anomaly under Hakone region.
(3)Kozu-Matsuda fault zone was clearly imaged as velocity boundaries between low velocity in south or southwest and high velocity in north or northeast.
(4)High-velocity body with northward dipping as subducting PSP slab.
(5)High-velocity body under the Tanzawa Mountains. It corresponds to plutonic body of tonalite (Tanzawa Tonalite) within an accreted crustal slice of the PSP. This high-velocity body is interpreted as a thrust sheet of upper/mid crust of the Izu-Bonin arc, which detached from the PSP.

From relocated seismicity using three-dimensional seismic velocity models obtained in this study and compared with them, we concluded as follow.
(a)Seismicity under the eastern part of Tanzawa Mountains is located at velocity boundary under wedge-like low-velocity body. These earthquakes are interpreted as interplate seismicity, which

was suggested from focal mechanisms among them.
(b)Seismicity under the western part of Tanzawa Mountains is located inside of high-velocity body, interpreted as subducting Philippine Sea plate. These earthquakes are interpreted as intraplate seismicity. No interplate earthquake occurs.

Difference of seismicity between eastern and western parts under Tanzawa Mountains was most remarkable result of this study. Difference of seismic velocity structures is also indicated, such as a variation of thickness of low-velocity body around source region under Tanzawa Mountains. These results and interpretation gives us new seismic constraints to understand the process of the Izu collision zone.

Keywords: Izu Collision Zone, Seismic tomography, Relocated seismicity