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Tectonics of the Izu Peninsula region deduced from GPS data -Izu microplate and back-arc spreading of the Izu arc-

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Various tectonic processes proceed around the Izu Peninsula. They include a collision of the Izu arc to the Honshu arc, subduction along the Sagami and the Suruga Troughs, and volcanic activities of Izu-oshima and Izu-Tobu volcanoes. Many models for regional tectonics are proposed there. We modeled the regional deformation observed by GPS using a block-fault model and estimated block motion of the Izu microplate and spreading rate in the Izu back-arc rift zone. We present these results focusing on the regional tectonics in and around the Izu region.

In some previous studies, regional deformation by geodetic measurements is modeled by a kinematic block-fault model, in which surface displacements are expressed by the sum of rigid block rotations and elastic deformation near boundary faults. Nishimura et al. (2007) has applied this model to GPS velocity for 1996-2000 in the Izu region. We revised their model using new block configurations and GPS data for 2007-2009. We assumed 6 distinct blocks, that is the Kanto block, the Chubu block, the Izu microplate, the Philippine Sea plate, the Izu Arc block (a Izu Islands part of the conventional Philippine Sea plate), and the Pacific plate. Four-point inflation sources represent volcanic deformation for the Mount Fuji, O-shima, Kozu-shima, and Miyake-jima volcanoes. The unknowns estimated from the GPS velocity are 42 slip-deficit rates, 18 parameters of 6 Euler vectors, and 12 parameters of 4 point sources. Inversion results suggest the Izu microplate rotates rapidly clockwise with respect to the Kanto region. The block boundary between the Izu microplate and the Izu Arc block locates between the Izu Peninsula and Izu-oshima, extending from north to south. It passes near Kozu-shima and Nii-jma toward southeast. This boundary accommodates left-lateral strike slip with a long-term slip rate of 28 mm/yr. The dike intrusion events of the Izu-Tobu volcanoes in 1997, 1998 and 2006 accompanied the largest earthquakes (M5.8-5.9) whose focal mechanisms are left-lateral strike slip with north-south strike. They are attributed to the relative block movements. The pattern of the observed GPS velocity clearly suggests this lateral movement.

The GPS data supports back-arc spreading of the Izu arc suggested by the geological and geomorphological studies. Our analysis confirms that the forearc of the Izu Islands arc has an independent motion on a rigid part of the Philippine Sea plate. The relative Euler pole is estimated to locate west of Haha-jima. The model predicts 7 and 9 mm/yr of opening west of Aoga-shima and Miyake-jima across the Izu back-arc rift zone, respectively. Slip vectors of interplate earthquakes along the Sagami Trough imply that the active spreading may extend to the Izu Peninsula region. Our result supports a hypothesis that volcanism of Izu-Tobu is related with back-arc rift of the Izu arc (Takahashi, 2004).

Keywords: Izu Peninsula, Izu microplate, back-arc spreading, GPS, block-fault model