Crustal Movement in Nansei Islands, Inferred From GPS Data

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The Okinawa Trough is a backarc basin currently opening behind the Nansei Islands where the Philippine Sea Plate subducts beneath the Eurasia plate. We analyze the continuous rotation and strain rate in the Nansei Islands using GPS data by GSI. We calculated the rotation and strain rates in the Nansei Islands from the observed continuous GPS data during 1996 to 2001. The rotation and strain rate are computed on the surface of a sphere. We choose the Shanghai GPS station as the reference site and its velocity is fixed. Thus we calculate the velocities of all other stations.

Since we assume the whole of Nansei Islands as a block, large velocity residuals are appeared in the Amami and Yaeyama areas. Then we divide the Nansei Islands into three blocks and compute the rotation and strain rates. Location and accuracy of block boundary are determined using AIC.

The GPS analysis gives a picture of the deformation of Nansei Islands described below.

The Nansei Islands behaves as three blocks: Amami-Oshima area (Amami block), Okinawa island to Miyako island area (Okinawa-Miyako block), and Ishigaki island to Yonaguni island area (Yaeyama block). Principal strain rate and axis in the Amami block are 84 nstrain/yr compression NW-SE and 23 nstrain/yr extension NE-SW, respectively. Principal strain rate and axis in the Okinawa-Miyako block are 28 nstrain/yr extension E-W and 20 nstrain/yr extension N-S, respectively. Principal strain rate and axis in the Yaeyama block are 57 nstrain/yr compression NW-SE and 20 nstrain/yr extension NE-SW, respectively.

Deformation of Nansei Islands is arc-parallel extension. This is consistent with active fault analysis in the Okinawa Island and Miyako Island.

Regional arc-perpendicular compression strain in the Amami block would be caused by the collision of Amami ridge.

Shear strain has dominated in the Yaeyama block. Since the Yaeyama block moves southward and coupling is weak in the Ryukyu Trench, the shear strain may not be caused by the oblique subduction of the Philippine Sea plate. Large extension rate of southwestern Okinawa trough (Yonaguni Graben) would cause the deformation of Yaeyama block.