Seafloor Crustal Deformation Measurement at the Nanseisyoto Trench

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The occurrence potential of subduction-zone earthquakes has never been evaluated for the Nanseisyoto Trench because characteristics of earthquake occurrence remain obscure. In addition, Nakamura [2009] pointed out that the 1771 Yaeyama Tsunami, Southern Ryukyu Islands, Japan, was caused by subduction earthquake along the Nanseisyoto Trench; and it is necessary to understand the interplate coupling along the Nanseisyoto Trench. Although geodetic data are useful to grasp interplate coupling, it is difficult to deduce interplate coupling along the Nanseisyoto Trench only from the GPS network data on the Ryukyu islands because the trenchward motion of the Ryukyu Arc that is associated with the active backarc spreading along the Okinawa Trough. Nakamura [2011] measured seafloor crustal deformation at site RKA to the southeast of the Okinawa Island; and reported a full-coupling region beneath RKA with widths of about 50 km. In this study, we installed a new site RKB, in 2011. The site RKB is located about 70 km northeast of RKA and 53 km from the Nanseisyoto Trench axis. The water depth at RKB is about 2200 m. We performed seafloor crustal deformation observation four times in 2001, 2012, 2014, and 2015, using R/V Tonanmaru of Okinawa Prefectural Fisheries Research and Extension Center.
The four-years measurement revealed a site velocity at RKB, 6+/-22 mm/yr to the south and 2+/-26 mm/yr to the east with respect to GEONET Kamitsushima station on the Amurian Plate. The velocity is significantly different from that at RKA, 35+/-23 mm/yr to the north and 30+/-19 mm/yr to the west Nakamura [2011], indicating difference in interplate coupling beneath the two sites. The crustal deformation field along the Ryukyu Arc is affected by the backarc spreading along the Okinawa Trough [Nishimura et al., 2004], slow-slip events [Nishimura, 2014], and back-slip caused by the interplate coupling. The back-slip rate at RKB is calculated at 24+/-25 mm/yr in a northwest direction relative to stable Amurian Plate, resulting 0-20 % of interplate coupling rate beneath RKB from a forward modeling. The low coupling rate is consistent to an active strain release events, such as slow-slip events, very low frequency earthquakes [Tu et al., 2010], and trust-type earthquakes, around RKB. Our observation demonstrates less strain accumulation caused by plate convergence, in the hanging wall side at RKB. We plan to install a new site on the seafloor about 90 km southwest of RKA site in 2016.
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