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Interplate coupling detected by observed using ocean-bottom crustal deformation system

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Ryukyu trench is a major convergent plate boundary where the Philippine Sea plate is subducting at a rate of about 8 cm/yr. Large earthquakes have not been reported along the Ryukyu subduction for the last 300 years. The GPS measurements by Japan Geographical Survey Institute also show the southward motion of Ryukyu arc, which is due to extensional rifting of Okinawa Trough. Backslip by the interplate coupling between the subducting Philippine Sea plate and the overriding Eurasian plate cannot have been detected.

We have started the observation of sea floor crustal deformation to detect the inter-plate coupling in the central Ryukyu trench. The seafloor reference point was set at about 35 km landward from the axis of the Ryukyu trench. A set of three acoustic transponders has been installed on the seafloor, at a depth of about 2900m. The transponders are placed to form a triangular. Three campaign observations were carried out for the period from January 2008 to November 2009. Each epoch consists of three observation days. The RMS of travel time residuals for each campaign analysis is about 70 micro-seconds.

The result shows that the benchmark moved to northwest direction for two years at a rate of 6 cm/yr. Then we calculated the width of interplate coupling area using observed movement of the benchmark. The estimated width of interplate coupling area is 50 km from the Ryukyu trench. The interplate coupling in the central Ryukyu Trench and tsunami earthquake (which occurred 300 km southwest of our site near the Ryukyu Trench) suggest that interplate coupling occurred updip of the seismogenic zone in the Ryukyu subduction zone.

Keywords: Interplate coupling, Ocean bottom crustal deformation, subduction, Asperity, GPS, Tsunami earthquake