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Observation of seafloor crustal movement using the seafloor acoustic ranging on Kumano-nada

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Along the Nankai Trough, where the Philippine Sea plate subducts under southeastern Japan with a convergence rate of about 40 mm/yr, large interplate thrust earthquakes of magnitude 8 class have occurred repeatedly with recurrence intervals of 100-150 years. About 60 years have passed since the last earthquakes happened in 1944 and 1946. Therefore it is important to monitor the tectonic activities in the Nankai Trough. Since most of the source region of the earthquakes is located beneath the ocean, an observation system is necessary in the offshore source region. We developed a seafloor acoustic ranging system to continuously monitor the seafloor crustal movement. We aim to monitor the activity in the splay faults in the rupture area of the Tonankai earthquake in the Nankai subduction zone. Slips along the active splay faults may be an important mechanism that releases the elastic strain caused by relative plate motion.

We carried out two experiments, a short term (one day) and a long term (four month) experiments, to estimate the repeatability of acoustic measurements of this system. We deployed four PXPs (precision acoustic transponders) with about 600 m (M2-S1 baseline) and 920 m (M2-S2 base line) spacing in the long-term experiment. The standard deviation in acoustic measurements was about 1 cm on each baseline.

In September 2008 we carried out an observation to monitor an active splay faults on Kumano-Nada prism slope. We recovered them in August 2010 to get data of acoustic measurements for 6 month and pressure measurements for 18 month. In March 2009, very low frequency earthquake activity near the experiment area was observed by OBSs which was deployed by JAMSTEC (Obana et al, 2010) and ERI, Univ, of Tokyo (Nakahigashi et al. (2010)). The standard deviation in acoustic measurements was about 1 cm on each baseline. We didn't observe the change of baselines in this system. Therefore we have an assumption that there was no crustal movement that exceeds the detection sensitivity in this event. And we estimated the detection sensitivity of this system on the location of this observation. This results show that this system need more than M5 due to get the dislocation, which is 1cm on this location.

Keywords: seafloor geodesy, seafloor crustal movement, kumano-nada