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Seafloor crustal deformation at the Kumano Basin and along the Nankai Trough

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Our research group performs monitoring of sea-floor crustal deformation with the GPS/acoustic system at four sites (KMN, KMC, KMS, and KME) on the Kumano Basin. We have already measured 16, 6, 20, and 10 times at KMN (from 2005), KMC (from 2012), KMS (from 2004), and KME (from 2008) sites, respectively. The battery at KME site ran out in the previous year, and we cannot continue to measure at the site. The research vessel we used is Asama of Mie Prefecture Fisheries Research Institute.

We carried out correction of travel-times of acoustic ranging wave and removal of incorrect results of KGPS positioning and ship's attitude measurement before the benchmark position analysis for improving data quality before deriving site velocities. We also fix a correction parameter, related to the relative position of GPS antenna and transducer, at an averaged value for the benchmark position (weight center) determination.

We obtained the horizontal site velocities from linear trends of the time series of benchmark position through the robust estimation method (Tukey's Biweight estimation), adopting REVEL model for the plate motion. The steady horizontal site velocities with relative to the Amurian Plate are: 45+/-2 mm/yr in N78+/-5W direction (KMN), 46+/-5 mm/yr in N75+/-4W (KMS), and 32+/-12 mm/yr in N69+/-21W (KME). These results show no significant difference in the site velocities at the three sites. We installed two different benchmarks on the same weight center position at KMS site. The horizontal site velocity of the other set of benchmark has no significant difference compared to the above-mentioned one at KMS site, which shows high precision of our system.

During the 2011 Tohoku earthquake, it is estimated that the large slip of 40-50 m on the plate interface immediately adjacent to the trench axis. It is, therefore, essential to measure the slip deficit also at the same region along the Nankai Trough. For this reason, we installed a new site, TCA and TOA, on the seafloor 15 and 35 km from the trough axis, respectively. We have already measured four times at the two new sites. A transducer is equipped at the bottom of the research vessels we used, Shinsei Maru and Kaiyo Maru No.3, and we can perform acoustic ranging for distances more than 6,000 m above 5 knot. Now we are carrying out the benchmark position analysis, with checking the effect on the benchmark positioning of sound speed structure in the sea, as well as the data quality of KGPS.