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New interpretation of crustal deformation at the Kumano Basin inferred from seafloor geodetic observation

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At the Nankai Trough, the Philippine Sea plate subducts beneath the southwest Japan at a rate of about 4-6 cm/yr, where great interplate earthquakes have repeatedly occurred every 100-200 years. A number of researchers have investigated crustal deformation caused by subduction of the Philippine Sea plate based on geodetic measurements as represented by GPS observation. However it is difficult to infer the strength of the plate coupling in offshore areas, due to the poverty of offshore geodetic data. From a viewpoint of disaster mitigation, it is important to know the upper limit of the plate locking depth. For this issue, we have conducted seafloor geodetic observation using GPS/Acoustic techniques around the Nankai Trough since 2004. From these observations, two seafloor sites, which are located about 60 and 80 km away from the deformation front of the Nankai Trough, are moving at a rate of about 6-7 cm/yr in the WNW direction with respect to the Amurian plate. However our previous study showed that calculated elastic deformation accompanied with subduction of the Philippine Sea plate around here is estimated to be about 4 cm/yr at a maximum, even if we applied back slips predicted from relative plate motion model on the plate interface at the depths of 5-40 km. This discrepancy may be caused by following two factors. The first is the observation period. Our seafloor sites velocities are estimated from time series with only a few years. Thus successive observations and data accumulation can illustrate proper sites velocities. The second factor is inhomogeneous material structures. Seafloor of the Nankai Trough is though to be covered by deformable materials such as accretionary prism especially in the vicinity of trench axis. We have calculated crustal deformation at the homogeneous elastic half-space without considering inhomogeneous material structures until now. In this study, we investigate the effects of inhomogeneous material structures on the crustal deformation field through three dimensional finite element method.