Slow slips on the plate boundary along the Nankai Trough

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Geographical Survey Institute operates a nationwide GPS array named GEONET, which continuously observes dairy positions of about 1000 points on the Japan islands. Most of those stations accumulate their position data over 5 years. From these observations, the following interesting results are obtained: (1) a steady state deformation of the Japan islands, especially the existence of the strain rate concentration zone; (2) interplate coupling between continental plate and subducting plate; (3) coseismic and postseismic deformation, especially the finding of afterslip lasting over 1 year following the large interplate earthquake; (4) monitoring a time variation of magma intrusion in active volcanic area; (5) the findings of slow slip events which last about 1 year without radiation of seismic wave.

Slow slip events, which had been never observed until the operation of the GEONET, are believed as aseismic or quasi-static slips which occurred at depth, whose detailed source processes are detected for the first time on the field observations. Kawasaki and Okada (2001) consider that these slow events as a nucleation process before dynamic rupture of an earthquake, and then they propose a possibility that such events may be appricable to a short term earthquake prediction. On the other hand, one can see such slow events as an end member of earthquake phenomena, as in the sense that Beroza and Jordan (1990) classified deformation events by characteristic rupture velocity. I believe that to consider which aspect is more essential is helpful not only for realization of earthquake prediction, but also for restricting the processes which obey the earthquake generation. For this reason, the purpose of this study is to explore the relation between slow slip events and earthquakes, comparing the spatial positions of the slow slipped regions and the source areas of the great subduction zone earthquakes.

I analyze the daily position data of GEONET provided by GSI to retrieve slip distributions for the following two slow slips: (1) 1997 Bungo Channel (Hirose et al., 1999; Ozawa et al., 2001), which is located in southwest Japan, and (2) 2001 Tokai district, central Japan. At first, after selecting the reference station, I subtract the component of steady state movement due to the plate motions, coseismic displacements of large earthquakes, and annual component from original time series data to retrieve the displacements due to slow slips. After that, I estimate the slip distribution on the subducting plate interface by using the inversion method of Yabuki and Matsu'ura (1992).

Estimated slip distributions for above two slow events summarized as follows: **1997 Bungo Channel event:** (1) afterslip following the two 1996 Hyuganada earthquakes (both $M_w = 6.7$) did not propagate into the source region of the slow event; (2) slow slipped area is located on the lateral transition region of interplate coupling strength; (3) this area coincides with down dip extent of the rupture zone of the Nankaido earthquake, which corresponds to a transition zone proposed by Hyndman et al. (1995); (4) also corresponds to a seismic gap which was pointed out by Ishikawa (1995). **2001 Tokai event:** (1) Slow slipped region corresponds partly to a no slip region estimated from strong motion data (Kikuchi et al, 1999), as well as a region where 1.5 m of slip is detected using tsunami data (beneath the Atsumi peninsula; Tanioka and Satake, 2001); (2) large slip region is located on the downdip extent of the proposed source area of the future Tokai earthquake (Matsumura, 1997).

The common feature in the location of the two slow slips is that the slips may occur in a transition region of interplate coupling. It is suggested that a slow slip may begin in a transition zone, whereas an earthquake nucleation which grows to a large earthquake cannot start (Hyndman et al., 1995). Probably a slow slip event may occur on an area where strength is weak and frictional resistive force is relatively small with lower effective shear stress. If these conditions are the case, a slow slip may continue for long time duration.

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