Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS34-P07 Room:Convention Hall Time:May 23 18:15-19:30

Temporal Change of Plate Coupling and Slow Slip Events in the Tokai-Tonankai Region in Japan

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In the southwestern part of the Japanese Islands, many large earthquakes have been reported and many geodetic or seismic observations have been operated to monitor the crustal deformation due to the interplate process between subducting Philippine Sea plate and the overriding continental plate along the Suruga-Nankai trough. The precise observation provides us insight into aseismic stress releasing process such as (long-term) slow slip events (SSEs).

Although some part of accumulated stress in the hanging wall would be released by SSE, the interplate coupling always takes place in the surrounding area and affect stress accumulating process. Thus, monitoring temporal change of the interplate coupling is as important as that of aseismic events such as SSE. On the basis of this standpoint, the interplate coupling should not be treated as steady state but be inferred together with SSE.

I have done the geodetic inversion analyses for the Tokai region, which is the easternmost end of the Suruga-Nankai trough, and for the area around the Bungo Channel, which is near the westernmost part of the trough. The results of the former case are already reported (JpGU 2012, SSS32-10; Ochi and Kato, submitted). In both of the analysis, I mainly used the daily coordinate of the GPS(GNSS) data from 1996 to 2010.

In the Tokai case, the SSE occurred around the deeper edge of the distribution of the interplate coupling and the width of it in the dipping direction becomes narrower as the occurrence of the SSE. After cessation of the SSE, the distribution of the coupling does not return to the state before the SSE. Therefore, the SSE really affect the interplate coupling.

In the Bungo Channel case, on the other hand, the SSE also occurred around the edge of the distribution of the interplate coupling but had little effect on it. Therefore, the interplate states before and after the occurrence of the SSE are very similar and the interplate coupling can be regarded as the steady state in this case.

The obviously different nature between these two cases is the duration of the SSE; about five years in the Tokai case and one year in the Bungo Channel case. Considering the stress change on the plate interface, I will discuss the difference in the spatial pattern and underlying physics further.

Keywords: slow slip events, interplate coupling, GNSS