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The Suruga-Bay earthquake of August 11, 2009, as seen from dense GPS observation network in the Tokai district, Japan

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A moderate size (M6.4) earthquake occurred in the Suruga-bay, central Japan, on 11 August 2009, adjacent to the hypothetical source area of the predicted M8 class "Tokai earthquake", which people believe to occur in the near future. The August 2009 earthquake threw a serious question if the earthquake triggers the "Tokai earthquake" or not. In order to evaluate stress transfer to the source region due to the earthquake, we estimated Coulomb Failure Function (CFF) on the source region due to the earthquake.
In order to monitor crustal activity in the area, a lot of geophysical investigations have been conducted. The Japanese University Consortium for GPS Research (JUNCO) has established a dense GPS array in the Tokai region, to monitor the crustal deformation in this area. We deployed more than 50 permanent sites in this region adding to the GEONET GPS network that has been operated by the Geographical Survey Institute of Japan (GSI). The observation started in around 2003, which is in the middle of the 2000-2005 slow event that occurred in the west of the hypothetical source area of Tokai earthquake. In addition to GPS, leveling surveys have been conducted frequently in the region. Only one month before the 2009 August earthquake, a leveling survey was conducted in the region by GSI. Leveling surveys were repeated just after the earthquake, which provided us with unprecedented accurate co-seismic vertical motions due to the earthquake.
The recent Suruga-Bay earthquake in August 2009 provided us a good oppotunity to examine if this earthquake accelerated or decelerated the generation of the "predicted" Tokai earthquake, using these abundant and accurate data. First, 30 second sampling GPS data and leveling data were used to derive the co-seismic fault model. Reflecting somewhat complicated rupture process revealed by seismic wave and aftershock distribution analysis, we required two fault segments model for the earthquake. Then, the estimated fault model was used to estimate changes of CFF on a curved plate interface, on which hypothetical "Tokai earthquake" is placed, that was modeled by paved triangular elements. Results suggest that the CFF change is in the order of 0.1MPa and positive and negative area of CFF change is closely neighbored on the plate interface. Significantly affected area for the Tokai earthquake is limited only in a small area nearby the hypocentral region of the Tokai earthquake, so that the effect of the recent earthquake to the Tokai earthquake might be limited.
In addition to the static analysis above, we analyzed 1Hz GPS data to derive co-seismic ground vibration in the area due to the earthquake. Since 2008, nine stations of the JUJNCO network started logging data with 1Hz sampling interval with real-time telemetry. Site position at every second was estimated using both GIPSY/OASIS and RTNet softwares. The results are consistent each other and detected seismic vibration of about 9 centimeters in amplitude at Sumiyoshi site, which is located about 20km WSW from the epicenter. Other nearby sites also recorded significant seismic waves. These high-rate records may facilitate to seismic record analysis to reveal the rupture propagation process as well as static displacements.
Finally, longer term crustal deformation is investigated to monitor if post-seismic or triggered slow events is taking place on or surrounding region of the hypothetical Tokai earthquake interface.