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2014 Boso slow slip

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Introduction

The GPS network detected transient crustal deformation on the Boso peninsula in 1996, 2002, 2007, and 2011. The detected transient displacements subsided for approximately 10 days. Rupture process and slip area are similar among the past four Boso SSE. The recurrence intervals of Boso SSE are 6.4, 4.9, 4.2 years from 1996. Under this circumstance, the anticipated slow slip event started from January 1 2014. This recurrence interval of 2.2 years is the shortest one compared with the previous 4 slow slip events. In this research, we estimate spatio-temporal evolution of the 2014 Boso slow slip and compare it with those in 1996, 2002, 2007, 2011.

Data and analytical procedure

Trend and annual components which are estimated for the period between 2009 and 2011 are removed from the raw time series. The detrended crustal deformation in 2014 shows southeastward movments with 1 cm maximum movement in the Pacific coastal area.

We employed time dependent inversion to the detrended crustal deformation associated with the 2014 Boso SSEs. We used EW, NS, and UD components of crustal deformation at approximately 40 GPS sites relative to Yasato station. The plate geometry of the upper surface of the Philippine Sea plate is based on Nakajima and Hasegawa [2006]. The fault geometry is composed on the B-spline and slip on the fault is also composed of superposition of B-spline function. As a boundary condition, we set 0 slip on the edge of the fault geometry.

Results and Discussion

The results show that the slow slip started offshore of the Boso peninsula and expanded to the south over time. The estimated moment magnitudes are 6.4, while those area 6.4 in 1996, 6.5 in 2002, 6.5 in 2007 and 6.6 in 2011. The 2014 Boso SSE ruptured an area similar to those of the four Boso SSEs. The recurrence interval is 6.4 year from 1996 to 2002 events, 4.9 years from 2002 to 2007 events, 4.3 year from 2007 to 2011, and 2.2 years from 2011 to 2014 events. The five events do not seem to be slip predictable nor time predictable. Though the 2011 event shows the largest magnitude among four cases, recurrence interval from 2007 event is the shortest. We cannot rule out a possibility that the Tohoku earthquake may have affected the occurrence of the 2011 event. In fact, dCFF increased near the rupture area of the Boso peninsula from the Tohoku earthquake [Hirose et al. 2012]. However, it remains unclear the reason why recurrence interval change drastically from 4.2 to 2.2 years for the 2011 and 2014 events, since dCFF does not change so much from 2011 and 2014. Another interpretation of shortening of recurrence interval is based on a scenario proposed by several simuylation studies in which recurrence interval of slow slip events become shorter as occurrence of large earthquake nears. If this is the case, it is quite important to monitor crustal deformation on and around the Boso peininsula..

Keywords: Boso peninsula, slow slip