

Interplate coupling and SSE in the Tokai region after 1981 using leveling data

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The long-term SSE in the Tokai region, central Japan, from mid-2000 to mid-2005 [Suito and Ozawa (2009)], had continued five years, which was much longer than other SSEs around the world [e.g. Schwartz and Rokosky (2007)]. After the termination of the SSE in 2005, no obvious long-term SSE has been detected and that makes difficult to discuss a recurrence interval of the events. In order to reveal whether the event repeats or not, and if it repeats, in order to clarify the interval and a temporal and spatial change of the interplate coupling and the slow slip, I analyzed a leveling data before the era of GEONET.

Various types of geodetic observations have been conducted in the Tokai region and there are some previous works about the temporal change of the crustal deformation using the data of these observations. For example, Kimata and Yamauchi (1998) analyzed EDM data and Kobayashi and Yoshida (2004) analyzed tidal data to detect irregular feature in the crustal deformation. In this study, I analyzed leveling data in the Tokai region from 1981 to 1999 and reveal spatially the temporal change of the vertical deformation velocity. Leveling observations have been conducted four times a year along the route from Kakegawa City to the Omaezaki Cape and once a year along the others around the Omaezaki Cape. I used all the data from these observations and inferred two-year-averaged vertical deformation rate using the time-dependent network adjustment [Fujii (1991)]. The estimated error of the rate is about 2 mm/yr, which is twice as much as the error of GNSS vertical data in this region [Ochi and Kato (2013)]. Comparing with the other geodetic data, the biggest advantage of the leveling data is that it can produce a spatial view of the crustal deformation with small error.

From the results of the analysis, two patterns of the crustal deformation that may correspond to existence and non-existence of the SSE appear alternately. The pattern that resembles that of in the 2000-05 was detected around 1982-83, 1988-90 and 1997. The duration of the event in 1982-83 is shorter than that of 1988-90, which is again shorter than that of 2000. Summing up these results, it is clear that there are various durations in the SSEs. In addition, if the small event in 1997 is taken into account, small and large events occur alternately and the intervals after the large event may tend to get longer. However, as the 1997 event is temporally close to the large long-term SSE after 2000, the SSE would affect the analysis of 1997 data and it should be considered further.

I also inferred the temporal change of the interplate coupling and slow slip using the results. In order to overcome the lack of temporal resolution, I fixed the distribution center of the slow slip to the same place by the results by Ochi and Kato (2013), the northwestern part of the Lake Hamana with the depth around 30-40 km. According to the forward modeling, the pattern of the crustal deformation in the 1982-83 and 1988-90 require somewhat smaller amount of SSE. On the other hand, the interplate coupling beneath the Omaezaki Cape constantly continues whether the SSE occurs or not.

Keywords: leveling data, interplate coupling, slow slip event, the Tokai region