

Short-term slow slip event with low-frequency tremor activity in southwest Japan (Nov.--Dec., 2004)

Hitoshi Hirose[1]; Kazushige Obara[1]

[1] NIED

Nonvolcanic deep low-frequency tremor, which occurs in a belt-like zone parallel to the Nankai trough, is thought to be a manifestation of a dehydration process in the subducted Philippine Sea slab [Obara, 2002]. Recently, it has been found that the short-term slow slip events (SSE) occur in correlation with the tremor activity [Obara et al., 2004]. This coupling phenomenon is one of the key factors for exploring the water and material circulation along with the subduction of oceanic plates and the effects on the generation cycle of shallower mega-thrust earthquakes.

This phenomenon is found in the Cascadia subduction zone [Rogers and Dragert, 2003] and in the western Shikoku region. On the other hand, the subduction tremor activity in southwest Japan is not limited in the western Shikoku, but in the much wider region [Obara, 2002]. Therefore, the similar coupling phenomenon is expected to occur in the other regions in the tremor belt.

In this study, we report the short-term SSE with the active tremors in Nov. and Dec., 2004 which occurred in the northern part of the Kii peninsula and the Aichi prefecture, in the Tokai region. We also report the recurrence of the episode in the western Shikoku region in Dec. 2004, after 8 month interval.

[Northern Kii peninsula episode in late November 2004]

The tremors activated around Matsusaka, northern Kii peninsula from Nov. 29, 2004. This activity lasted for a week with migration of the epicenter toward southwest. Simultaneously, the coincident tilt changes were recorded in several NIED Hi-net tiltmeter stations located in the central Mie prefecture. The tilt movement lasted for about three days and the maximum tilt change was around 0.1 micro radian. These tilt change data were inverted to estimate a slip on a simple rectangular fault in an elastic half-space [Okada, 1992]. The estimated slow slip source fault is at about 38 km in depth and has a corresponding moment magnitude of 5.8. The location of the fault is agree well with that of the tremor.

[Aichi prefecture episode in mid December 2004]

On Dec. 17, 2004, the tremor started around the Aichi prefecture and lasted for about five days. Accompanied by this tremor activity, a tilt change of approximately 0.06 micro radian in maximum was observed. The estimated SSE fault area is about 28 km deep and extends from the northern Chita peninsula to the central Nobi plain. The estimated moment magnitude is 5.8. The area of this short-term SSE does not overlap with that of the ongoing Tokai SSE [Ozawa et al., 2002]. This indicates that the source region of the short- and long-term SSE occupies a different area on the plate interface.

[Western Shikoku episode in late December 2004]

On the next day of the great Sumatra-Andaman Islands earthquake (December 26, 2004), the active tremor began in the western Shikoku and the Bungo channel regions. The main phase of the activity continued until Dec. 30, but the minor tremors remain active till Jan. 3, 2005. Correlating with this main activity, a tilt change of about 0.08 micro radian in maximum was detected. The source region of the SSE is estimated to extend from the Sada Cape peninsula to the nearby area around Hi-net Kawabe station (KWBH). The moment magnitude is estimated to be 6.0. The estimated source area roughly coincides with that of the previous episode in Apr. 2004.