A tentative investigation to detect past activities of deep low-frequency tremor from the paper recording of the Kanto-Tokai observation network for crustal observation

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In the Nankai region, episodes of deep low frequency tremor recur at the intervals of several months. The activity of tremor is detected and monitored by NIED, using Hi-net seismic data. However, other recordings are required to reveal the activity before 2000, as the Hi-net data is available after Oct. 2000. NIED operated the Kanto-Tokai observation network for crustal observation (Okada et al., 2000) from 1979. Seismic stations of this network gradually increased after 1979. Continuous data of vertical component of seismograms has been stored as paper recordings in NIED. At first, we examined whether the recordings are useful to reveal past activities of deep low-frequency tremor. Then, we scanned paper image, and examined the setting to convert the paper recordings, as the paper recordings now causes a trouble in the storing space. Short-term slow slip events (SSEs) in the Tokai region from 1984 are detected and reported by Kobayashi et al. (2006), using a tiltmeter. We checked the recording around the period of the reported SSEs, and found signals dominant in several Hz with the amplitude of several hundreds of nm/s at some stations (e.g., SMY, KSH, and TOE) in the Tokai region. This is characteristic to the deep low-frequency tremor detected from Hi-net data. For example, the signal is found in SMY, from 13 to 16, Aug., 1984, from 4 to 5, Dec., 1986, and from 8 to 10, May, 1987, while SSEs are reported from 13 to 14, Aug., 1984, from 3 to 4, Dec. 1986, and from 8 to 10, May, 1987, respectively. The several-days difference of the activities between tremor and SSE may be attributed to the spatial migration of tremor and SSE, as the SMY station is about 20 km north from the tiltmeter station. We examined the digitization of paper recordings. We need to choose appropriate settings (e.g., resolution) in the conversion to image files. Paper feeding speed is 4 mm/s and amplitude of 336 nm/s is scaled to 1 mm on the paper of the recording of SMY. If the resolution is 300dpi, one pixel is about 0.085 mm. This means that temporal resolution is about 47 samples/s, and minimum resolution of velocity is about 28 nm/s. This is sufficient to recognize low frequency tremor. We note that this value is not common in this network, as the settings are different at each station. In terms of color, even the black and white color is sufficient, as the outline of pen is clear. It takes five minutes to convert images of 1 day. As the observation at SMY started from May 1980, it takes more than 600 hours to convert 20-years data. Much work is required to convert all of paper recordings, as the number of stations is 66 even in 1985, while this data is significant and cannot be replaced.

Keywords: deep low-frequency tremor, paper recording, slow slip event

