Evaluation of groundwater level changes related to the 1946 Nankai earthquake

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The large earthquake named Nankai earthquake has repeatedly occurred in the western part of the Nankai Trough, which is the boundary between Eurasia and Philippine Sea plates and caused a severe earthquake hazard in and around the Kii Peninsula and Shikoku, which is adjacent to the western part of the Nankai Trough. The period of the occurrence time is about 100 - 200 years and the Nankai earthquake have historically recorded 9 times since 684. The latest Nankai earthquake, whose magnitude was 8.0, occurred in December 1946 and is named 1946 Nankai earthquake. The Headquarters for Earthquake Research Promotion, which is an officially responsible committee for a national policy on earthquake disaster prevention in Japan, announced that the probability of the next Nankai earthquake occurrence would be 80% within 50 years in future in 2001. So now Japanese government are being ready for observation system in and around the Kii Peninsula and Shikoku region in order to understand the Nankai earthquake and reduce the hazard of the impending one.

Groundwater level in hot springs of the Kii Peninsula and Shikoku decreased 6 times in relation to the past Nankai earthquakes. It is not clear whether those decreases started before the Nankai earthquake or not. The groundwater level at Dogo hot spring in Shikoku, where the groundwater level had repeatedly decreased in the past Nankai earthquakes, fell about 11m coseismically in the 1946 Nankai earthquake. Recent observation of the groundwater level of the Dogo hot spring by Geological Survey of Japan and Matsuyama local government shows volumetric strain sensitivity of the level is about 2 cm per 10-8 strain. Therefore the fall of 11m means about 6 x 10-6 volumetric strain change, which is close to the coseismic one estimated from the fault model of the 1946 Nankai earthquake. Therefore the other past groundwater level decrease in the hot springs, which are usually confined and sensitive to volumetric strain changes, can be explained by volumetric strain changes caused by preseismic or coseismic slip in the focal region of the Nankai earthquake.

It is important to evaluate the groundwater changes related to the 1946 Nankai earthquake in view of the groundwater level changes reflecting the seimic crustal deformation. It is because such evaluation gives us more useful information about the Nankai earthquake.