

Recent anomalous groundwater temperature and water level changes at the frontier land zone of Nanki region for impending great earthquakes at the Nankai trough

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Earthquakes are generated by the anisotropic principal stress regime in the rock medium. In the preparing process of a large earthquake, the medium would be deformed generating regions of contraction and dilatation around the nucleus of the shearing stresses. According to a hydraulic model, pore fluid flow is driven upward to the ground surface through crack systems serving as flowing pipes by high pressure pumps at a deep spot. The change in the quantity of the upwelling hot water from deep underground causes a change of groundwater temperature(Tsukuda et al., 2005).

We have 16 groundwater observation stations for temperature, and 3 stations for water level in the Tokai and Nanki regions, central and southwest Japan, respectively, where are close to the source regions of the great Nankai-trough earthquakes. This paper reports the seismological meaning of the data from Nanki region.

At stations HA and WA in Shionomisaki, Nanki region, Wakayama Prefecture, the long-term trend of the water level is rising, corresponding to the ground subsidence found by levelling and GNSS data (Kobayashi, 2013). The trend of temperature is similarly rising, suggesting contraction of the rock medium under Shionomisaki, the southernmost end of Honshu. At KZ(Kozagawa)about 15km northeast of HA or WA in the Nanki region, the temperature is monotonously falling since the observation started in 2002. However, the decreasing temperature changed to severely increase in the middle of 2015, and changed to decrease again in 2017.

As mentioned above, the deformations of the rock medium are accelerated under the regions close to the source regions of the great earthquakes at the Nankai trough. For prediction studies for the impending great earthquakes, we should start to conduct detailed and multidisciplinary observations.

Keywords: dilatation, contraction , groundwater temperature, water level, precursor, earthquake prediction