# Detection of a slow slip before the anticipated Tokai earthquake using groundwater monitoring network

# Norio Matsumoto[1], Makoto Takahashi[2], Naoji Koizumi[3]

[1] AIST, [2] GSJ,AIST, [3] GSJ, AIST

In this paper we represent a detectability of a slow slip before an anticipated Tokai earthquake using groundwater-level monitoring network of National Institute of Advanced Industrial Science and Technology (AIST).

Kato and Hirasawa (1996) showed that volumetric strain due to a slow slip changes rapidly about 1 day before the anticipated Tokai earthquake simulated by a friction law. In order to detect such a change as soon as possible, we need to know usual water-level changes and responses of groundwater level to volumetric strain in advance.

Kobayashi and Matsumori (1999) defined the 'noise level' as follows for the differences of volmetric strainmeter data with 5-minute to 24-hour lag:

1. Maximum value of the differences of data with each time lag,
2. A value which appears first is taken if anomalous value comes out continuously in 2 hours.

Japan Meteorological Agency (JMA) is monitoring volumetric strain to detect anomalous data larger than the 'noise level' (Yoshida, 1999). We determine the 'noise level' of groundwater level in the Haibara observation well to detect anomalous groundwater-level changes as preseismic anomalous volumetric strain changes.

Firstly we estimate responses of the groundwater level to M2 and O1 tidal constituents, and compare response of JMA volumetric strainmeter data to these constituents in Haibara,150 m south of our well. As a result we estimated a sensitivity of groundwater level to volumetric strain is 2.2 mm/10-8 strain in the Haibara well. The sensitivity is proper because the target preseismic strain changes in about 1 day, and periods of M2 and O1 constituents (12.42 and 25.82 hours, respectively) are similar to the target changes.

Secondly we calculate differences of the residual water level with 1-, 3- and 24-hour lags, respectively, which is subtracted barometric, tidal and rain responses from original water level during the period of 1992 and 1997. The 'noise level' is determined for each difference and each data period. The 'noise level' of the water level is larger than a 'noise level' of volumetric strain observed in dry period, but is smaller than that observed in rainy period at the Haibara well. We conclude that water level is almost as large sensitivity as volumetric strainmeter to detect the anomalous strain change before the Tokai earthquake.

Furthermore, we assume that a slow slip whose magnitude is M6.0 occurs before the anticipated Tokai earthquake based on Kato and Hirasawa (1996). We investigate whether or not we can detect an anomalous water level change due to the slow slip, using the estimated volumetric strain time series and the tidal coefficient of water level (2.2 mm/10-8 strain). As a result, we expect to detect anomalous water level changes 7, 11 or 26 hours before the main shock by using difference of the residual water level with 1, 3 or 24-hour lag, respectively.