

Development of a monitoring technique of anomalous crustal deformations preceding earthquakes by the application of kinematic GPS

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An anomalous vertical deformation preceding the 1944 Tonankai Earthquake was detected by leveling survey performed near Kakegawa, Japan, about 300 km away from its epicenter [Mogi (1982)]. It is hard to detect such an anomalous deformation with conventional surveys, because they cover a narrow area and cannot be frequently made. GPS has overcome these drawbacks of conventional surveys. It is important to develop a method to detect such a deformation with GPS. Now, in the Japanese Islands, the GPS observing stations, GEONET, are built at an interval of about 20 km over the whole region. At present, daily solutions are obtained by static analysis of GEONET data. Therefore we cannot observe deformations with a time constant shorter than 1 day like that in 1944. We must rely on a kinematic GPS positioning.

For that purpose, the kinematic GPS positioning is required to be as accurate as static GPS positioning, but not in the case at present. We conducted two experiments in order to resolve the error factor and improve accuracy. One is a detection experiment of the antenna that moves on a guide-rail slider. This experiment is designed to verify how much bias error between static analysis position and kinematic analysis position is, and how large the error factors could affect the solution. We made an observation of baselines with different distances between this moving antenna and surrounding sites. Consequently, it became clear that a systematic error rapidly increases as the baseline becomes longer than 50 km. In this experiment, the antenna moves rather quickly. In order to verify whether the slow slip is caught by kinematic GPS positioning, a similar experiment in which antenna moves more slowly are planned from now on. We are conducting another verification experiment of the bias error an observation point between static analysis positioning and kinematic analysis positioning using the external frequency clock in Kii peninsula, Japan. The results of experiment will be presented, too.