

Development of a short-span strainmeter for observation of deformation associated with deep low-frequency tremors

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Crustal deformations, such as strain and tilt changes, have been observed associated with deep low-frequency tremors occurring below the Kii peninsula and Shikoku. Strain measurements by an extensometer at Kishu operated by DPRI, Kyoto University, for example, show that the closer sources with epicentral distance of 30 - 40 km, have large deformations with strain changes of 10^{-9} to 10^{-8} occurring within several days. Although the traditional extensometer observations can detect strain changes, it is difficult to make interpretations because of the limited number of stations.

An instrument that is inexpensive and is easy to install will make possible strain array observations. We designed a short-span extensometer that is 1.5 - 2 m-long measure. The measure is made from a metal with a small temperature expansion constant and hanging by a thin string at one end. A linear variable differential transformer (LVDT) is used to detect displacement. Strong coupling of the instrument to the ground is important for stable observations, so three anchor bolts fixed to the base of the instrument are cemented into a 30-cm-deep hole.

As a test example, we constructed a one component short-span extensometer and installed it in a tunnel of Donzurubou observatory, Nara prefecture. Earth tides and strain oscillation caused by a teleseismic event are clearly observed by the short-span extensometer. We expect that the crustal deformation associated with deep low-frequency tremors can be observed by an array of these short-span extensometers, that have a length of 1.5-m.