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Performance evaluation of the borehole volume strainmeter installed in Nankai Trough

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Long term in situ monitoring of seismic activity, slow slip event, and pore fluid behavior around mega earthquake zone is important for understanding the processes of earthquake generation and strain accumulation. During IODP Exp 332 in December 2010, we have successfully installed borehole volume strainmeter in Nankai Trough for the long term monitoring of mega earthquake zone. Assessing the strain response caused by several externally applied stresses is a crucial step toward evaluating and interpreting the strain data. Especially, in order to detect strain change based on the regional stress field, it is important to verify the performance by comparing with the theory model after removed the effect of the environmental factors. In this study, we installed borehole volume strainmeter which is same type as installed in Nankai Trough, into the 216 mm OD borehole with depth of about 21m in Kamioka mine (Hida city, Gifu) and started the pressure and long term evaluation tests for evaluating the strainmeter performance. Collected strain data showed the drift (about -520 nstrain/day) which can be explained by the temperature change of silicone oil inside strainmeter and the other effect. The drift corrected data clearly showed the earth tidal strain change and corresponds with areal strain change predicted by the earth tidal model. 0.2 - 0.4 Hz microseisms (amplitude 0.15 nstrain) and earthquake with magnitude 5.3 (amplitude 0.38 nstrain) were recorded in the strain data, corresponding with microseisms (amplitude 140 nrad.(X), 180 nrad.(Y)) and earthquake (amplitude 650 nrad.(X), 1350 nrad.(Y)) recorded in tiltmeter installed next to the strainmeter. And the coherency between strain and tilt data was 0.6 - 0.7 at 0.2 - 0.4 Hz (microseisms) and about 0.8 at 0.5 - 1 Hz (earthquake). Further, in order to evaluate strain change associated with pore pressure change, we have conducted the pressure test by pressurizing the bottom of the borehole. As a result, the strain value decreased after the pressurizing (dilatation) and then increased with gradual pressure decay (compression), which may be caused by the opening effect of the borehole wall around the bottom. But the additional test was required to explain relation between strain and pressure change. In this presentation, we will present the performance evaluation of the borehole volume strainmeter installed in Nankai Trough using the strain data collected and will be collected.

Keywords: Tonankai eathquake, Nankai Trough, strain measurement, slow slip, crustal deformation, Kamioka mine