Development of Multi-component borehole instrument and wireless intelligent type strainmeter in deep boreholes.

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Large amplitude variations of strain and tilt caused by rainfall are usually observed at shallow observation sites. Instruments for crustal movement observations have high sensitivities to detect small amplitude variation. If we observe crustal deformation at the site where effects of rainfalls are not exist, we can detect small amplitude crustal variation. In order to observe crustal deformation at such site, saying it differently at deep boreholes, we have developed mult-component borehole instrument including multi-component strainmeters with high sensitivity, tiltmeters, quartz thermometers. The instrument has a diameter of 10 cm, and is 150-1000 cm long, depending on purposes and combinations of instruments taking jointly with seismometers and accelerometers on the market. The instrument installed at Izu peninsula recorded anomalous precursory and co-seismic crustal variations. The instrument installed at Tono region central Japan also recorded abnormal shearing variation before and after earthquake occurrence near the site. Volumetric type straimeter used in the Tokai region by JAM is not able to detect such an abnormal shearing variation.

It is very important to measure in-situ rock stress for the earthquake prediction study, therefore we have also developed a wireless intelligent type strain meter for in-situ rock stress measurement in deep borehole. The instrument has SRAM, RTC, MPX, CPU, A/D converter, and batteries. As the instrument has no electric cables outside, we can it in a deep borehole and take it out by overcoring for the determination of in-situ rock stress. The results coincide well with the results of hydraulic fracturing method obtained at the same borehole.