

Long-period Seismology, by Using Strainmeters

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Abstract

The continuous observations of strain exist for the statical crustal movement, and now a large number of the stations had been installed in Japan, and observation is continuing. But, many of those records are for extremely long-term observation. And to handle the large data easily, its sampling interval was relatively long, such as 10 minutes or one hour.

On the other hand, the earthquake observation in Japan started at observation campaign of aftershock at the huge earthquake, as dynamical crustal movement, and then, thousands of continuous earthquake observation stations exist now. In case of seismic observation, duration time of an event is almost always short, so data set to handle at one time is relatively small. And the hypocenters of earthquake had to be decided more precisely, so the records of seismometers have high sampling frequency (10Hz~10kHz) from early days.

Because of the difference of such sampling frequency, strain records were not compared with seismometer's. But, recently, observation which uses the seismometer pays attention not only to short-periodic wave, but also to long-periodic wave such as the surface wave and the free harmonic oscillation. And by the development of new sensors, such as Ishii type borehole strainmeters and laser extensometers, strain observation at high frequency also became possible. And so, the observation ranges of strainmeters and seismometer were adjoined, they are overlapping now.

Our institute (Tono Research Institute of Earthquake Science, Association for the Development of Earthquake Prediction) has installed two borehole instruments, which are Ishii type multi-component borehole instruments and an improved one, within 5m distance in horizontal at Togari area, Mizunami city, Gifu prefecture. The instruments which were named TGR350 have been installed in 350m depth. And the other, which have smaller diameter named TGR165, installed in 165m depth. And the extensometers, which made by quartz tube and belong to Mizunami station (NAMZ) of Nagoya University, exist within about 100m distance in horizontal. The data of those instruments, TGR165 (horizontal:3, vertical:1, oblique:2), TGR350 (horizontal: 3), NAMZ (horizontal:3), are recorded with 1Hz sampling frequency on the same digital recorder, continuously. Moreover, we installed digital borehole strainmeters at Byoubusan in 2003 March. Byoubusan station (BYB) is located at about 6km eastward from TGR. In the BYB station, 4 horizontal, 1 vertical and 2 oblique components of strain are observed. And these are recorded with 20Hz sampling frequency, except for oblique components (10Hz). Those instruments, which are TGR165, TGR350 and BYB, are also equipped with seismometers for the earthquake observation.

In this study, I compared the waveform obtained at the time of Tokachi-oki Earthquake (2003) by various sensors, seismometers, accelerometer, borehole strainmeters and extensometers and so on. And I think about the meanings of record which have been observed by the strainmeters as dynamic changes by the earthquake.