Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

STT055-01 Room:302 Time:May 27 08:30-08:45

Development of an artificial vibration source by use of giant magnetostrictive material

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We can obtain many information about rock bed such as modulus of elasticity, attenuation,variation of stress and so on, utilizing elastic wave propagation. If we can make an artificial vibration source which is strong and easy to handle, we can easily know information about rock bed. Therefore, we have developed an artificial vibration source by use of a giant magnetostrictive material. A giant magnetostrictive material deform by applying magnetic field and a deformation is larger than other materials. This time we employed a giant magnetostrictive material with cylinder size of 40mm diameter and 150mm length. A coil is rolled up around the material and it is installed into a cylinder type vessel that is 60mm diameter and 300mm length. The vibration source can be drove by AC 100volt and output power is about 2000kgf. And it can drive wave forms made by an oscillator.

We will present the vibration source system and some experimental results.

Keywords: artificial vibration source, giant magnetostrictive material, development, elastic wave

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STT055-02 Room:302 Time:May 27 08:45-09:00

Development of precise and longterm monitoring system of Vp with magnetostrictive transducer

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Precise and continuous monitoring of Vp can be a measure for small stress change in rock [Reasenberg and Aki, 1974]. Piezo-electric transducers were employed as a transmitter by one of the authors for such a precise measurement. Based on the Vp change in situ and pressure dependence of Vp in laboratory, stress variation of the order of hPa was estimated at Kamaishi test site. In this study, a magnetostrictive transducer is employed as a transmitter, because of higher power than piezo-electric transducers. The newly developed measurement system is set at Mizunami test site of Nagoya University. Boxcar signal of 500 Hz is continuously applied to the transmitter. The applied voltage is 1000 V and 40 V for piezo-electric transducer and magnetostrictive transducer, respectively. The length of measurement path is 20 m and 100 m for piezo-electric transducer and magnetostrictive transducer, respectively. Based on the rock properties, in the rocks of higher quality than the rock at Mizunami, such as granitic rocks, measurement path of several kilo-meters should be available with the use of magnetostrictive transducers.

Keywords: stress, Vp, magnetostrictive transducer, precise monitoring, continuous monitoring

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STT055-03 Room:302 Time:May 27 09:00-09:15

The improvement of auto-determined hypocenter location, focal mechanism and CMT-solution

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We issue hypocenter parameter of felt earthquakes immediately after earthquake occurred. And after two days, we re-issue more precise hypocenter parameter of all earthquakes occurred in and around Japan.

On the other hand, after four business days, the parameter of the mechanism solution issue.

It is effective in the disaster prevention measures to know immediately the parameter of the hypocenter and mechanism solution.

This time, we have improved the automatic determination method of the hypocenter location, focal mechanism and CMT-solution with EPOS(Earthquake and Phenomena Observation System) and REDC(Regional Earthquake information Data Center) system updating.

We plan to publish in JMA HP(in Japanese only) by following criteria in the spring of this year.

1. The publishing time: In about 30 minutes after the earthquake occurs

2. The publishing magnitude of earthquake

2-1. auto-hypocenter location:

(1) All felt earthquake

(2) JMA magnitude of earthquake which occurred inland is 1.5 and over.

(3) JMA magnitude of earthquake which occurred in sea and deep area is 4.0 and over.

2-2. auto-mechanism

(1) Focal mechanism: JMA magnitude of earthquake is 3.5 and over.

(2) CMT-solution: Moment magnitude of earthquake which occurred in and around Japan is 5.0 and over. Moment magnitude of earthquake which occurred over the world is 6.5 and over.

Keywords: AUTO hypocenter location, AUTO focal mechanism, AUTO CMT solution, EPOS, REDC

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STT055-04 Room:302 Time:May 27 09:15-09:30

Development of high quality seafloor earthquake and Tsunami observation in DONET project

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We developed seafloor cabled observatory network called Dense Ocean-floor Network for Earthquake and Tsunamis (DONET) in the rupture zone of Tonankai earthquake and around to monitor earthquakes and tsunamis as well as crustal activity in the seafloor. Observation targets of DONET are earthquakes from micro-earthquakes to large earthquake of magnitude 8 such as the last Tonankai earthquake in 1944, episodic slow slip events such known as very low frequency earthquakes, tsunami generation process in the epicenter area and so on. In DONET project, 20 seafloor observatories are planned to connect to 5 seafloor observation node with 10 km extension cables. The seafloor observation nodes are connected to a backbone submarine cable of both ends landed to supply power and communicate with each observatory. With this system of backbone cable, observation node, and extension cables, we are able to establish an observatory network much denser (10-30 km separations) than the past cabled observatories.

Each seafloor DONET observatory consists of a set of seismometers observing earthquakes and a set of pressure gauges observing earthquakes, tsunamis and slow crustal motion, as well as seafloor water thermometer intended for seafloor turbidity current monitoring. The seismometers are a set of broadband seismometer (Guralp CMG3T) and strong motion accelerometer (Metrozet TSA100-S), which support ground motion monitoring from the smallest to 4 G ground acceleration. The pressure gauges are a set of quartz pressure gauge (Paroscientific 8B7000-2), deep sea differential pressure gauge and hydrophone, which support seafloor pressure observation of much less than 1 Pa, very slow seafloor vertical movement as well as pressure wave of over a few MPa during a large earthquake in the vicinity. With the DONET seawater thermometer, seafloor water temperature can be monitored with an accuracy of 5 mK and 1 mK resolution which will be necessary to detect seafloor turbidity current.

In the DONET project, we also developed a technique to install a seismometer to avoid influences of seafloor current flowing in the seafloor. With the developed technique, the seismometers are completely buried beneath the seabed. As a result of complete burial, low frequency noise of seafloor broadband seismometer was lowered by more than 40 dB for horizontal components. With this noise reduction, we were able to clearly observe the effect of long period ocean gravity wave deforming the seabed in the period longer than 50 seconds. This ground deformation due to the long period ocean gravity wave is regarded as a noise for earthquake monitoring, but this effect may also be reduced by monitoring seafloor pressure at the same place of ground motion monitoring by the broadband seismometer. This is possible with differential pressure gauge in the DONET seafloor observatory. This is an example showing the importance of measuring both ground motion and pressure in the seafloor.

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Performance evaluation of a laser-interferometric broadband seismometer for observations in extreme environments

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We have developed a Laser-interferometric broadband seismometer for observations in extreme environments.
As such environments, the seafloor (ocean bottom borehole) and the planet (Mars investigation etc.) are so important sites from the viewpoint of seismology.
The seismic observation in ocean bottom boreholes in subduction zones is a critical way to get better comprehension of earthquake generation process and the prediction.
Also, the seismic observation on a planet (earthquakes, free oscillation) is so effective way to reveal its internal structure.

To perform valuable observations for such purpose, many superior specifications are simultaneously required for the seismometer, such as high sensitivity, broadband, maintenance-free, robustness, low noise, compact size (borehole/hand size), durability in high/low temperature, and radiation durability (cosmic ray).
As there are no seismometers on the market that have these specs, we have originally developed a laser-interferometric type broadband seismometer.
This seismometer consists of 3 sections: a laser intereferometer, a long-term pendulum, and a feedback servo electronics.
Having passed through the vibration test and the temperature test, we have made the breadboard model of this seismometer.
In this presentation, we will mainly show the details of the self-noise test and the evaluation through the test observation at Nokogiriyama observatory.

Keywords: seismometer, broadband, borehole, planet, ocean, laser