Broadband seismometer for a long-term observation on the sea floor

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Abstract. A new broadband seismometer for a long-term observation on the sea floor was developed for the OHP network. The outline of the sesimometer, LT-VBB OBS, are shown.

1 Introduction

The most important item of the Ocean Hemisphere Project (OHP) is to construct the broadband seismic observation network (OHP seismic network) in the western Pacific. OHP seismic network covers the western Pacific at a station spacing of 1000 km - 2000 km with linking seafloor observatories to on-land and island observatories. The network will help increase the resolution of tomographic studies of the Earth's interior, which have revolutionized understanding of mantle dynamics and structure. Moreover, it will allow more precise studies of the large-scale seismic structure, as well as better resolution of earthquake locations, mechanisms and earthquake generation processes at the plate boundaries in the western Pacific.

LT-VBB OBS, a long-term broadband ocean-bottom seismometer, was developed for the OHP seismic network to fill a large gap in the existing observation net on the seafloor.

2 Outline of the LT-VBB OBS

LT-VBB OBS has a broadband velocity sensor (CMG-1T : Guralp, UK) covering a period from 3 mHz (333 s) to 50 Hz in order to observe a teleseismic waves which contain the information on the structure of deep earth interior along their propagating paths. The sensor output is digitized by ADC (20bit, 128Hz) and is recorded continuously on the four 2.5-inch SCSI disks with 5-Mbyte buffer memory during the preset time-window of observation. LT-VBB OBS is a free-fall and self pop-up type OBS. The exterior view and the releasing system of an anchor were designed similar to our compact and reliable OBS with a short period sensor of 4.5 Hz.

The transducer of the acoustic transponder, the releasing mechanism of an anchor, radio beacon and flasher are equipped outside the titanium sphere of 65 cm diameter which can be deployed to the water depth of 6,000 m. The recorder, sensor, batteries and transponder electronics are contained inside the sphere. The acoustic command from a surface ship activates the releasing mechanism of an anchor utilizing forced electric corrosion of thin titanium plates. The observation period is designed for 400 days.

3 Observations in the sea

In August 1999, we deployed a long-term broadband ocean bottom seismometer (LT-VBB OBS1) in the northwest Pacific near the WP-2 site prior to the installation of a borehole observatory at the site. We successfully recovered the LT-VBB OBS1 (Photo 1) in May 2000 after the 9-month observation as the first mobile ocean-bottom seismic observatory of the OHP network.

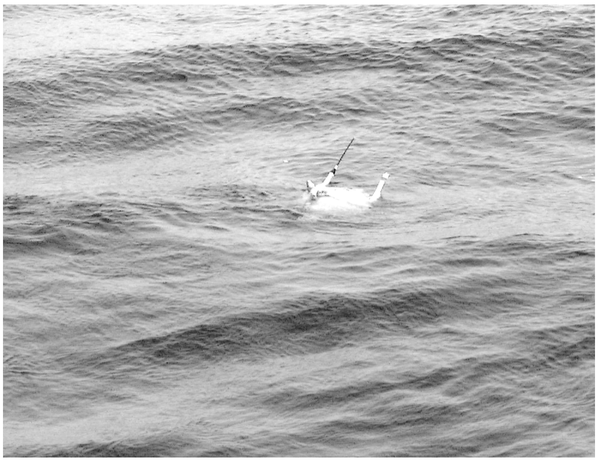

Photo 1. LT-VBB OBS1 at the sea surface.

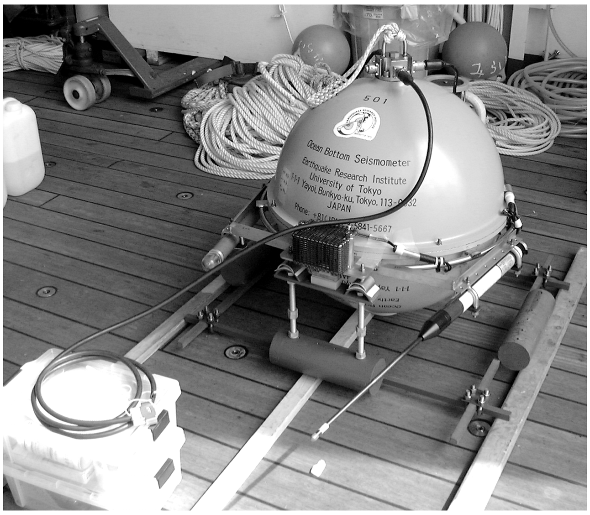

Photo 2. LT-VBB OBS3 on the deck.

After the recovery, we deployed another OBS (LT-VBB OBS3, Photo 2) at the same site near WP-2 and successfully recovered in November 2000 after the 6-month observation. As the second observatory, LT-VBB OBS2 was deployed off Sanriku in September 1999 and was also successfully recovered after the observation of about 50 days.

4 Specifications of LT-VBB OBS for 400 days observation

Sensor:	CMG-1T, analog feedback velocity output (3200V/m/s) , 3 components (Vertical / NS / EW), wide frequency band (3m~50Hz, -3dB), low power consumption (0.3W), active leveling mechanism (±20 degrees, check every day), flux-gate compass with tilt-meter.
Recorder:	HDDR-2B (modified), amplifier gain (-6dB), LPF (30Hz, -24dB/oct.), continuous recording (128 Hz sampling), ADC (20 bits, ±2.5V), media (2.5-inch SCSI HDD, 6.5GB x 4), TCXO (±0.5ppm), two serial ports for sensor and acoustic transponder.