

The Ocean Bottom Seismometers for Long-term Seafloor Observations

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Earthquake Research Institute, University of Tokyo, Japan has developed the three types of the ocean bottom seismometer to address long-term seafloor seismic observations.

1. The long-term broadband ocean-bottom seismometer, Type I (360 s - 0.05 s)

The long-term broadband ocean-bottom seismometer of Type I (BB-OBS) records seismic signals in the period of 360 s - 0.05 s continuously for over 400 days with using the Guralp broadband sensors of CMG-1T and CMG-3T. The BB-OBS digital recorder (HDDR) manages on power on/off, locking/unlocking of pendulum and mass centering of the CMG sensors via a serial link. We developed the active-controlled leveling system that adjusts a tilt of a broadband sensor body within one degree during a seafloor observation. The default frequency of sensor leveling is one time per a day. The HDDR recorder samples seismic signals at 128 Hz using a 22-bit ADC and records the digitized data continuously on the four 2.5-inch hard disks. The CMG sensors that is mounted on the leveling system, the HDDR recorder, the acoustic transponder and lithium batteries are contained in one 65-cm diameter sphere that is made of titanium alloy. The acoustic transponder for the BB-OBS has the functions of data transmission, interrogation and anchor releasing. The acoustic data transmission is very effective to a long-term seafloor observation to know the status of the function of the seafloor instruments and to change the observation parameters remotely from a surface ship. The anchor is attached at several places outside the sphere to controls the attitude of the BB-OBS during its descending and ascending. Acoustic commands from a surface ship activate a forced electric corrosion of the two thin titanium plates that connect the BB-OBS main frame and the anchor. At an instance when the thin plates are fully dissolved, the BB-OBS main frame releases the anchor and begins to ascend to the sea surface.

2. The long-term broadband ocean-bottom seismometer, Type II (30 s - 0.05 s)

PMD three-component sensor is installed to the OBS to observe seismic signals of the period of 30 s - 0.05 s. The HDDR recorder, the PMD sensors, the acoustic transponder and lithium batteries are contained in a titanium sphere of 50-cm diameter. Seismic signals are continuously recorded for 1 - 1.5 y periods.

3. The long-term ocean-bottom seismometer (1 s - 0.05 s)

Lennartz three-component 1-Hz sensor is installed to the OBS. The active-controlled leveling system that has a similar mechanism with the BB-OBS leveling system adjusts the attitude of the 1Hz sensor. Seismic signals are continuously recorded for 1 - 1.5 y periods.