Mobile/Real-Time Seafloor Seismic Observation System

Hiroko Sugioka[1], Katsuyoshi Kawaguchi[1], Kenji Hirata[2], Hitoshi Mikada[1], Kiyoshi Suyehiro[1]

[1] JAMSTEC, [2] USGS

Submarine cabled observation system to monitor the earthquakes is a powerful tool for observation and has been maintained for a longtime since the 1970's. Although submarine cabled observations can realize both long-term and real-time deep seafloor observations, they are defective in mobility.

We, Japan Marine Science and Technology Center (JAMSTEC), designed an adaptable observation system with a concept to realize mobile observations. The submarine cabled observation system, which is deployed off Kushiro-Tokachi, Hokkaido, in 1999, has two expandable interfaces (depth = 2100, 3786 m) for the adaptable observation systems. In July 2001, the first of the adaptable observation systems (depth =2100 m) was deployed to be installed a broadband seismometer (3-component GURALP CMG-1T system). The real-time seismic data has successfully been recorded for about 4.5 months.

The basic development concept of the adaptable observation system is mobile. All this setup can be done using a towed vehicle and ROV. No cable ship is required. The main cable system has two expandable interfaces named branch multiplexer (B-MUX). This system consists of a B-MUX, a Joint Multiplexer (J-MUX), a fiber cable, a battery pack and a sensor package. The B-MUX branches the main optical-fiber line and allows to install J-MUX at the end of the branched line. The J-MUX is a hub for adaptable observatories, which can be accept up to 4 satellite stations extending up to 10 km distance away.

Our mobile observation system provides an opportunity to extend existing seafloor observation network, and that any geo-scientific instruments can be connected by setting up their interfaces under a common serial connection rule.

First of all, a broadband seismometer (3-component GURALP CMG-1T system) was installed at the forearc in the Kuril-Trench-Arc system at a water depth of 2133 m in July 2001. Real-time seismic data are being successfully acquired at 100 Hz sampling rate. The system has an advantage which the sensor control signals can be transmitted from the land station and are demultiplexed and distributed by the telemetry unit to the each interface through the B-MUX. The battery pack can be the sensor system for about 4.5 months.

Several large teleseismic earthquake (larger than magnitude 6.5) and many small local earthquake were recorded with high S/N. The prominent microseism peak at 0.2 Hz divides into long- and short- period quiet bands. The longer period band between 0.003 and 0.1 Hz provides a low-noise window for the detection of long-period waves. We detected some continuous signals in this low-noise window in quiescent period.