A new ocean bottom cabled seismometer system for a high resolution earthquake monitoring

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An ocean bottom cabled seismometer (OBCS) is the best solution for a monitoring of an offshore earthquake activity. We developed a new OBCS for a high resolution earthquake monitoring in a seismogenic zone where big or huge earthquakes have occurred repeatedly. The newly developed OBCS adopts the latest Information and Communication Technologies (ICT) and IP (Internet Protocol). ICT has enabled the new OBCS to become more compact and less expensive, and enabled IP access and the upgrade of OBCS for the flexibility and expandability of measurements. The new ICT-based OBCS has also been carefully designed to meet high reliability, as ICT redundancy technologies have been adopted. Researchers can change the network configuration when one OBCS node fails, so that the other OBCS nodes will still be able to continue the reporting of measurement data.

A new OBCS system has 40 CS nodes (cabled seismometer nodes) with a spacing of 20 km. Each node equips a tsunami meter. The seismometer is a conventional force balance accelerometer (JA-5, Japan Aviation Electronics Industry, Ltd.), which is a single axial type. The JA-5 accelerometer has been used for the ocean bottom cable systems of ERI, and JAMSTEC. Each output of three accelerometers (X, Y, Z components) is synchronously digitized by 24 bit sigma-delta A/D converters with a sampling rate of 1 kHz. A GPS clock signal from the landing stations is input to the digitizer, i.e., not through Linux, so that accurate 0.1 ms time stamping is performed using 100% hardware. Consolidated studies for packing of the CS have also been performed, because the size of the CS is a critical issue for minimization of the costs. There are only 5 boards; Linux, clock and 3 digitizers, for the CS, and the board is approximately 7x7 cm^2. The size of the CS is 13 cm in diameter and 50 cm long, which is almost equal to that of a 2L plastic drink bottle. Compared to the existing OBCS, which has a 22 cm diameter and is 150 cm long, this is a remarkable reduction in size. The compact new OBCS is, of course, not expensive for installation. The new compact OBCS will introduce new applications for measurement that have not been possible so far. Portable measurement is now possible. Specific cable ships requiring high operation costs are no longer necessary; therefore, the compact OBCS can be used in a portable and timely fashion, for the monitoring of aftershocks when large earthquakes occur.

The first deployment of our new OBCS system is scheduled in 2010. 4 CSs will be deployed at 6 km spacing on the seafloor off Niigata Prefecture.