

Compact Ocean Bottom Cabled Seismic and Tsunami Observation System Using ICT and Installation Plan

SHINOHARA, Masanao^{1*} ; YAMADA, Tomoaki¹ ; SAKAI, Shin'ichi¹ ; SHIOBARA, Hajime¹ ; KANAZAWA, Toshihiko²

¹Earthquake Research Institute, University of Tokyo, ²National Research Institute for Earth Science and Disaster Prevention

The Pacific plate is subducting below the northeastern Japan islands arc. The 2011 Tohoku earthquake occurred at the plate boundary between the Pacific plate and the landward plate below landward slope of the Japan Trench. In 1996, Earthquake Research Institute (ERI), University of Tokyo had installed seismic and tsunami observation system using seafloor optical fiber in the off-Sanriku area. The continuous real-time observation has been carried out since the installation. The system observed seismic waves and tsunamis generated by the 2011 Tohoku earthquake, and the data from the system are indispensable to estimate accurate position of the source faults and the source process of the 2011 event. However, the landing station of the system was damaged by huge tsunami 30 minutes after the mainshock, and the observation is discontinued. Because the data from the real-time system on seafloor are important, we decide to restore the existing system and install newly developed Ocean Bottom Cabled Seismic and Tsunami (OBCST) observation system off Sanriku for additional observation and/or replacement of the existing system. In this paper, we present a system of the new OBCST in detail, and installation plan.

Until 2010, we had already developed and installed the new compact Ocean Bottom Cabled Seismometer (OBCS) system near Awashima-island in the Japan Sea. After the installation, the OBCS system is being operated continuously and we have continuous seismic data for more than 3 years at the present. The new OBCST system for off-Sanriku area is based on this system, and is characterized by system reliability using TCP/IP technology and down-sizing of an observation node using up-to-date electronics. The new OBCST has three accelerometers as seismic sensors. Signals from accelerometers are 24-bit digitized with a sampling rate of 1 kHz and sent to a landing station using standard TCP/IP data transmission. A precise pressure gauge is also equipped as a tsunami sensor. The tsunami data with a sampling rate of 1ms are also transmitted by TCP/IP protocol. In addition, an observation node can equipped with an external port for additional observation sensor instead of a pressure gauge. Additional sensors on seafloor are supplied the power using Power over Ethernet technology. Clock is delivered from the GPS receiver on a landing station using simple dedicated lines. In addition, clocks in observation nodes can be synchronized through TCP/IP protocol with an accuracy of 200 ns (IEEE 1588). The data will be stored on the landing station and sent to ERI in the real-time. A simple canister for tele-communication seafloor cable is adopted for the observation node, and has diameter of 26cm and length of about 1.3m. This small size of the canister has an advantage for burying the system below seafloor.

At the present, we are producing the observation nodes of the new OBCST. The new system has three observation nodes; two have three-component seismometer and a pressure gauge, one has seismometers and an external port by using the PoE technology. We have a plan to connect a pressure gauge and hydrophone via the PoE external port of the third observation node. Total length of the practical system is approximately 100 km and an interval of the observation node is about 30 km. We have a plan to install the practical system in 2015.

Keywords: Cabled ocean bottom seismometer and tsunami gauge, Sanriku, Japan Trench, seafloor observation