A new cable system for a dense ocean-bottom seismic network

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The Pacific plate and the Philippine Sea plate subduct beneath the Japan Islands along ocean trenches of the Kuril Trench, the Japan Trench and the Nankai Trough, which locate off the east coast of Japan. M8-class damaging submarine earthquakes occurred repeatedly at almost regular intervals at the subduction plate boundaries. Plate subducting causes repetitive occurrences of damaging earthquakes in Japan. Therefore the monitoring of seismic activities in the focal region of the damaging earthquakes is very important for earthquake forecasting.

We have developed a new long-term ocean bottom seismometer (LT-OBS), which has an ability to record seismic signals continuously over one-year period. The LT-OBS is the most effective instrument to study seismic activities in the sea by a dense seismic network on the sea floor. However, OBS does not provide earthquake data in real time. Ocean bottom cable systems (OBCS) can optimize a real-time earthquake monitoring in the focal region of the damaging earthquakes. We have designed a new cost effective OBCS, jointly with engineers of various fields such as communication engineering, ocean engineering, metrology, electronics, and mechanical engineering.

A main specification of a stationary type OBCS is as follows,

1. Landing Station: two place; both stations have power-feeding units for redundancy
2. Sensor: 40 of Seismometers and 3 of Tsunami sensors
3. Sensor interval: 20km for dense observation
4. Cable length: 900km
5. Dual Ring structured network of Ethernet switch for fault-tolerant and redundancy
6. Smaller sized OBCS housing for lower cost and easy handling onboard.
7. Delivery accuracy of time stamp: more than 0.1ms by PTP
8. Operational life: 20 years

Authors will discuss new cost effective OBCS in detail in a paper, especially, new network structure for the OBCS, high precision time stamping, and high reliable analog signal digitizer interface design.