Continuous monitoring of the shallow subseafloor resisitivity using controlled current source

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For disaster prevention, environmental preservation and natural resource management, technological development for the subseafloor monitoring is required for the detection of physical condition change in the subseafloor environment. The movement of ground water, gas and oil, whose electrical resistivity values are different from the normal sediment, can be monitored by observation of resistivity changes with the seafloor instruments. In order to monitor resistivity changes in the deep part below the seafloor accurately, degree of resistivity changes near the seafloor should be identified at first. In this study, we monitor the shallow subseafloor resistivity by using controlled current source.

We used data acquired by the off-Toyohashi submarine cable and the seafloor sensors placed at the water depth of about 1300 meters. The artificially controlled electric current with variable amplitude is transmitted from the sea earth at the end of the cable with a period of 120 seconds. Then, the ocean-bottom electrometers, attached at the end of cable and located within 10-40m far from the sea earth, receive the electric potential signals. All dataset are transmitted to the land in real-time.

We applied the pole-dipole DC resistivity method to the analysis of our data, and obtained the apparent resistivity changes during one month in 2008. After the analysis, we found the periodical change of apparent resistivity with period of approximately 14 days. The predicted resistivity changes derived from the seawater temperature variations observed on the seafloor is too small to explain the observed variations. Therefore, the observed apparent resistivity change is caused by the subseafloor resistivity change.

The period of the apparent resistivity change is similar to that of the lunar tide, so we suggest that the resistivity change is possibly related to seafloor pressure changes due to tidal height changes.