

Preliminary results of long-term and real-time observation of electromagnetic fields on the ocean floor in Sagami Bay

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Water in the crust is believed to play an important role on generation of earthquakes and magma. Measurement of electromagnetic (EM) fields is one of promising methods which would provide key information on the water. The existing EM data in sea areas are, however, not sufficient for clarifying the distribution, movement and state of the water. We have therefore developed a long-term and real-time observation system of the EM fields on the seafloor using a submarine cable since 2000. The objectives of this study are to develop that instrument and to investigate changes of the EM fields associated with the crustal deformation and the deep-sea environment.

In January, 2005, we successfully connected an ocean bottom electromagnetometer (OBEM) with the Real-Time Deep Sea Floor Observatory off Hatsushima Island in Sagami Bay, Japan. The installation was carried out by a remotely operated vehicle, the Hyper Dolphin, and its support vessel, the Natsushima, during the NT05-01 cruise. The observatory was established at a depth of 1174 m in the area of numerous giant white clams by JAMSTEC in 1993. Linked the land station by optical fiber cable, it has monitored the state of the organism population, ground and water temperature, the occurrence of earthquakes, and water turbidity in real time.

The OBEM measures two horizontal components of electric field and three components of magnetic field with a sampling rate of 1, 2, 4 or 8 Hz. This system allows us to make continuous observations of the EM fields on the seafloor as with ones on land. It is operating properly as of February 6, 2006. To our knowledge, it is the first time that the EM fields in the deep-sea have been measured with such a high sampling rate for more than one year. Observed data of the magnetic field clearly show daily variations of the geomagnetic field and geomagnetic storms. Some variations of the electric field suggest changes of bottom current. Spectra of the EM data also indicate tidal components such as S2 and M2. Although vibrational changes of the magnetic field were observed when some earthquakes occurred in the eastern part of Japan, they are probably explained by vibrations of the magnetometer due to seismic waves.

The south Kanto area including Sagami Bay is tectonically active because the Philippine Sea plate is subducting beneath the North American plate at the Sagami Trough and the Izu Peninsula is colliding with the Honshu Arc. That new measurement could provide valuable information on the crustal deformation, the mechanism of the occurrence of earthquakes, the development of the earthquake disaster prevention system and the environmental changes of the deep-sea. We will here present the outline of the EM field observation system and preliminary results of the measurement.