

Continuous Electromagnetic Observation on the Seafloor for Monitoring the Earth

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Continuous electromagnetic (EM) observation is useful for understanding crustal deformation and earthquakes. Three EM phenomena related to the crustal deformation are described theoretically and observed on land: geomagnetic variation by the tectonomagnetic effect, self-potential field by the electrokinetic effect and resistivity variation by porosity and permeability change due to the stress variation. Those phenomena will be observed on the seafloor close to the trench, where the mega-earthquake occurs repeatedly. Here, we introduce new techniques for marine EM observations, and discuss a future plan for off-shore monitoring of the crust around the Tokai mega-earthquake region by using two submarine cables. Four new geophysical tools have been developed and used in various marine environments: continuous EM monitoring on the seafloor, self-potential observation near hydrothermal vents, geoelectric field measurement with a 10-km long cable and controlled EM survey by using a long cable behind the deep tow system. These new techniques will be combined to the Tokai submarine cables and allow us to observe unknown EM phenomena useful to constrain the crustal condition before/at/after the earthquake.