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-Induced Electromagnetic Fields in the Ocean

Electric and magnetic (EM) fields are generated within ocean currents moving through the earth's magnetic field, and tsunami flows are also considered to generate EM fields in the ocean although its signal levels are very low. Recent advances in high precision measurements of EM fields enabled the seafloor measurements of the tsunami signals. In order to extract useful information from the offshore measurements of tsunami EM signals and utilize them for the tsunami warning at coast, we need an appropriate theory which relate the EM signals observed at seafloor to tsunami parameters. Results of the theoretical examination demonstrate that the observations of the three components of the magnetic field and the two horizontal components of the electric field at a single seafloor station can reveals, (1) variations of the sea level change associated with tsunami flows, (2) propagation direction of tsunami waves, (3) frequency dependence of phase velocity of tsunami propagation, and (4) frequency dependence of apparent electrical conductivities observed at seafloor. We will show that these theoretical relations are verified by the results of the first simultaneous observation of the 2010 Chilean earthquake tsunami and applicable to the 2011 Tohoku earthquake tsunami.

Primary author: SUGIOKA, Hiroko (Kobe University)

Presenter: SUGIOKA, Hiroko (Kobe University)

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