Press Releases

January 8, 2014
JAMSTEC

A New Ocean Bottom Tsunameter Based on the Ocean Dynamo Effect

1. Overview

Dr. Hiroko Sugioka and her colleagues at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC; Asahiko Taira, President), working in cooperation with the Earthquake Research Institute of the University of Tokyo, succeeded in detecting the tsunami generated by the February 27 in 2010 Chile earthquake by using an electromagnetic field observation network composed of nine ocean bottom electro-magnetometers (OBEMs). This achievement demonstrated the validity of the tsunami-induced electromagnetic field theory for the first time in the world. Based on the theory substantiated by this observation, the researchers have also reported a number of accomplishments including the determination of impulsive tsunami source, which are considered to cause tsunami strengthening, associated with the 2011 off the Pacific coast of Tohoku Earthquake. They are also working on research and development of higher-precision submarine tsunami observation devices aimed at improving tsunami arrival forecasting.

These research results have been published in the Nature Publishing Group's online scientific journal *Scientific Reports* on January 8, 2014 (Japan time).

Title:Tsunami: Ocean Dynamo Generator
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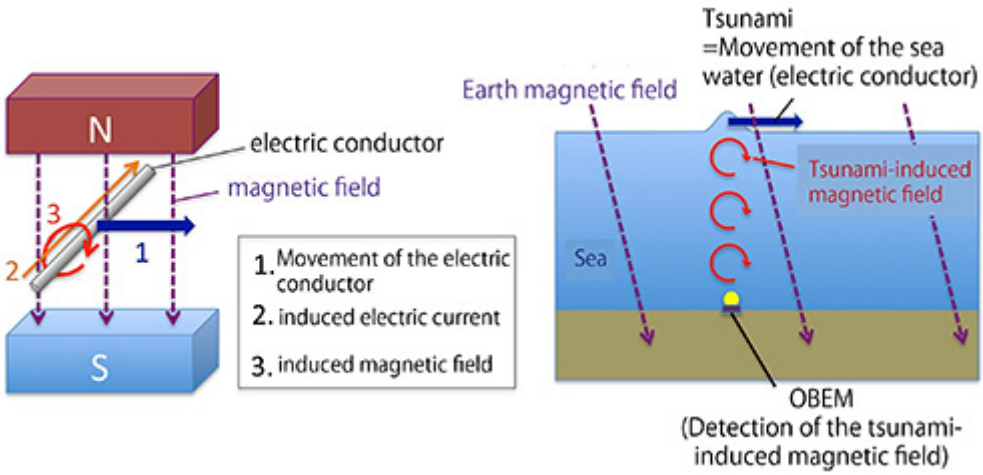

Figure 1. Principle of the oceanic dynamo effect. When a conductor moves in a magnetic field, electricity flows through the conductor, generating a secondary magnetic field in the process (left). On the earth, the magnetic field in the figure on the left corresponds to the planet's magnetic field and the conductor corresponds to seawater. An induced magnetic field is generated in the case of a tsunami as well; it is possible to detect this secondary magnetic field by using an ocean bottom electro-magnetometer (OBEM).

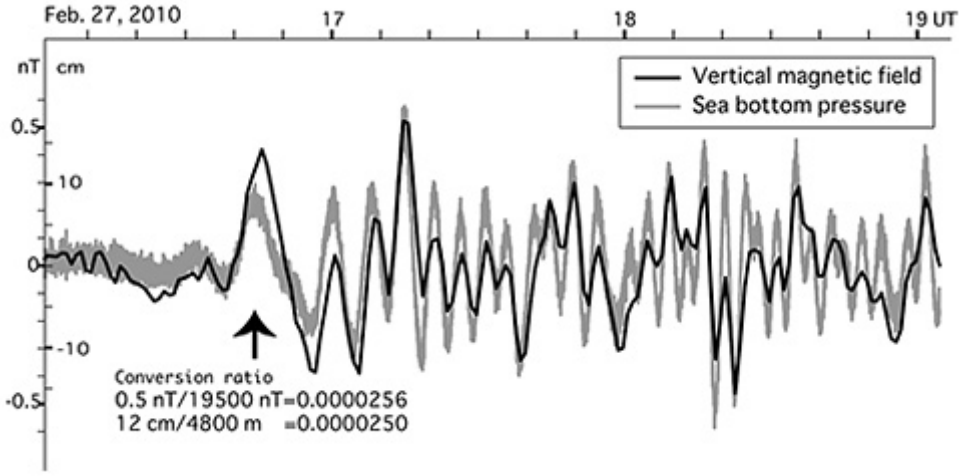

Figure 2. Record of the ocean bottom electromagnetic field fluctuation vertical component and the ocean bottom water pressure fluctuation at the time of the tsunami generated by the 2010 Chile earthquake at the same place. The amplitude of the tsunami's first wave (arrow) is in good agreement with the theoretical estimate.

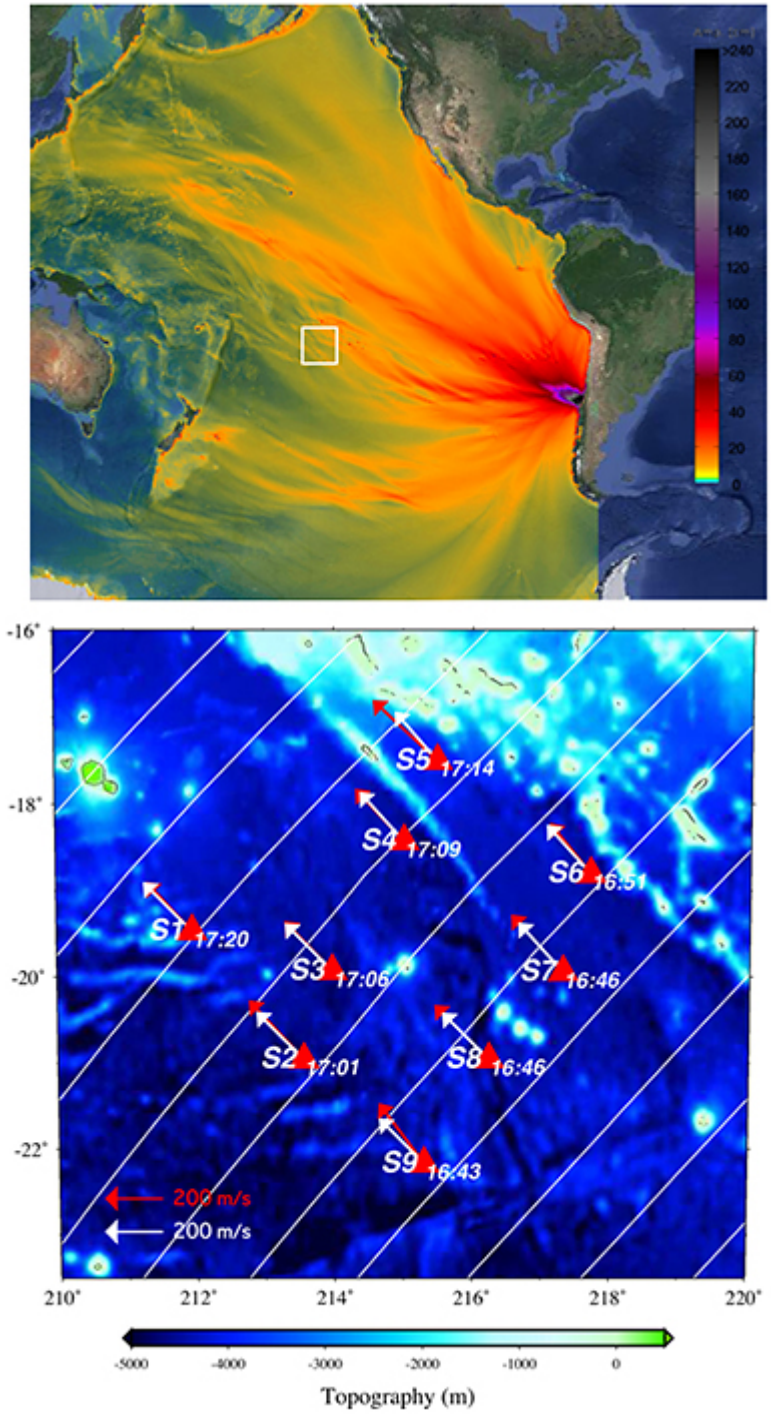

Figure 3. (Upper) Area observed with OBEM (inside the white frame). The background colors indicate the height of the Chile earthquake tsunami.
(Lower) Tsunami wave propagation vectors obtained from the ocean bottom electromagnetic field fluctuation horizontal component, observed at the time of the 2010 Chile earthquake (red arrows). The white lines are the isochronous lines of tsunami propagation obtained from the tsunami's arrival time at each observation point.

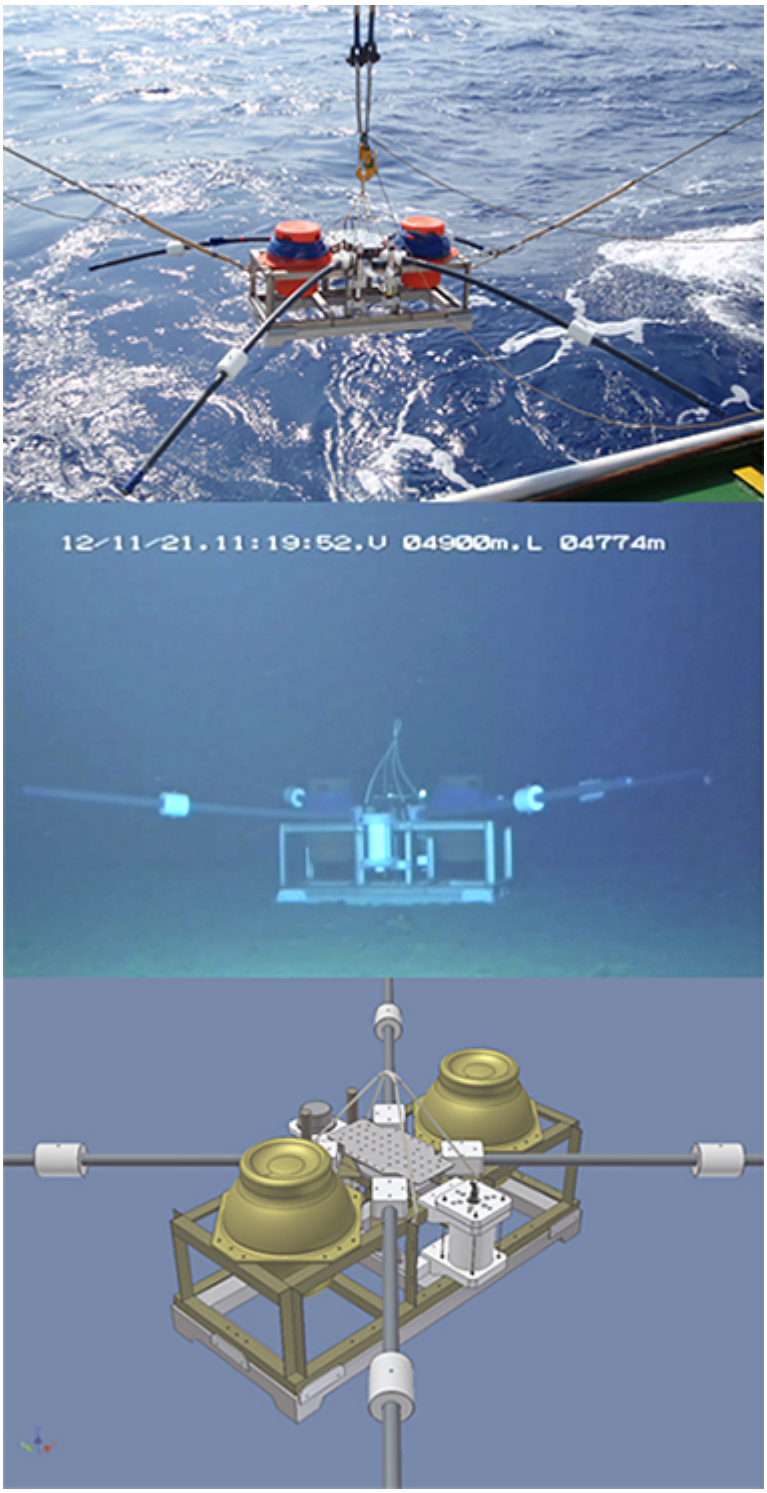

Figure 4. The newly developed vector tsunami meter. Trial observations of the ocean bottom were carried out from November 2012 to February 2013 in the Shikoku Basin. (Upper) Lowering the device into the ocean. (Center) Installing the device on the ocean bottom. The photograph was taken by the unmanned probe vehicle KAIKO 7000. (Lower) Schematic diagram.

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