R003-08
Zoom meeting A ：11/3 AM2 (10:45-12:30)
11:00-11:15

Simulation of tsunami-generated electromagnetic fields for the 2009 Samoa and 2010 Chile earthquakes

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The motion of seawater by oceanic waves, such as tsunamis, in the geomagnetic field can generate induced electromagnetic (EM) fields. The tsunami-generated EM field can be observed by the ocean bottom electromagnetometer (OBEM) (e.g., Toh et al., 2011). Numerical simulation of the tsunami-generated EM field can help us to estimate the arrival time, amplitude (e.g., Minami et al., 2015) and propagation direction (e.g., Lin et al., 2019) of tsunamis. Previous studies on the tsunami-generated EM field simulation have not been done for great epicentral distances due mainly to weak signals contained in observed EM data. Fortunately, in the geophysical observations on the French Polynesian seafloor in the Pacific Ocean (TIARES Project: Suetsugu et al., 2012), they observed significant EM fields by tsunamis of the 2009 Samoa (Mw 8.1) and the 2010 Chile (Mw 8.8) earthquakes. We, therefore, will compare the observed data and the simulation of tsunami-generated EM fields by these two tsunamis.

The array of OBEMs by TIARES Project was settled at 4000m-5000m depth of seafloor from February 2009 to December 2010. During the observation period, the OBEMs recorded the 2009 Samoa and 2010 Chile tsunamis by three-component magnetometers with 1min sampling. The tsunamis passed over the TIARES area after 5 hours and 10 hours from each onset of the tsunamigenic earthquakes. As shown by the Kp index (<1+: Bartels, 1957), external fields were quiet on both Sep 29, 2009 and Feb 27, 2010. As a result, the tsunami-generated vertical magnetic component has high signal-to-noise ratios and show similar waveforms with seafloor pressure signals. A wavelet analysis of the observed tsunami-generated magnetic fields revealed that the main period range was 5 to 16min in Samoa event and 6 to 30min in Chile event, while both amplitudes were approximately 0.5nT.

Tsunami-generated EM fields were computed by the three-dimensional time-domain finite element tsunami simulation code (Minami et al., 2017). This code has been applied to calculation of the 2011 Tohoku tsunami-generated EM field. We used JAGURS (Baba et al. 2015), a kinetic tsunami simulation code based on the Boussinesq dispersion wave, to obtain tsunami horizontal velocity field for long distance propagation. We confirmed the suitability of JAGURS simulation by comparing the sea-level change observed by two DART (Bernard et al., 2010) stations (DART 32412 and DART 51406) in the eastern Pacific. Then, we calculated the tsunami-generated EM field at the array of OBEMs with realistic bathymetry and a high-resolution mesh. In the presentation, we will further discuss possible causes for the difference between the simulation and observation.