Hydroacoustic signals from tsunamigenic earthquakes acquired by CTBT IMS hydrophone triplets

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The present study focuses on the hydroacoustic recordings observed by the CTBT’ s International Monitoring System (IMS) hydroacoustic hydrophone stations during tsunamigenic earthquakes. The IMS hydroacoustic network consists of 6 hydrophone stations and 5 T-phase stations (near-shore seismometers) around the world. Each hydrophone station consists of two triplets except for HA01 Cape Leeuwin, Australia that has only one triplet. The hydrophones are suspended in the water column, at a depth near the SOFAR channel axis, and form an approximately equilateral triangle with each side 2 kilometers long. This arrangement makes it possible to estimate the bearing of incoming hydroacoustic signals by using a technique similar to seismic array analysis. In this study, hydroacoustic recordings from the 2011 Tohoku earthquake in Japan (data received at HA11 Wake Island) and from the 2015 earthquake in Chile (data received at HA03 Juan Fernández Islands) are analyzed. T-phase signals associated with these two tsunamigenic earthquakes are processed using a three-step technique similar to seismic F-K analysis. As a result, the bearings of T-phase signals acquired by hydrophones are resolved uniquely with no spatial aliasing. Subsequently, the hydrophone triplet data are processed for tsunami detection. The de-convolution of the hydrophone triplet data using the extrapolated frequency-amplitude-phase (FAP) response of the hydrophones makes it possible to clearly identify dispersive signals which correspond to the theoretical curves associated with the group velocity of surface gravity waves. Although further examination is needed in order to quantify the amplitude of tsunami signals, this work shows that the CTBT’ s IMS hydrophone triplets have the potential to detect tsunami signals.

Keywords: hydrophone triplet, T-phase, tsunami

