

Hydroacoustic signals detected by distributed acoustic sensing (DAS) using submarine cable

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Ship-based seismic survey was conducted close to the non-operational submarine cable in December 2019, and the DONET observatories were operational alternatively at the same region. We obtained the distributed acoustic sensing (DAS) recordings along the non-operational submarine cable down to 50 km from the landing station during the seismic survey. We examine the acquired DAS dataset together with the DONET observations to investigate the detectability of the underwater acoustic (hydroacoustic) signals. Raw data of DAS measurement is associated with the strain dimension of the fiber optic cable, while hydroacoustic signals originated from the air-gun (predominant frequency range > 1 Hz) is proportional to velocity of the source. Therefore, we process the DAS dataset so that the direct comparison with the DONET sensors can be performed. Our analysis suggests that DAS can be sensitive at the frequency range between a few of Hz and a few tens of Hz, in which the power spectral density (PSD) follows the frequency contents recorded by the DONET seismometer and pressure sensors nearby. DAS can identify ocean microseismic background noise at the appropriate frequency range, i.e. between 0.1 Hz and 0.2 Hz. However, PSD of DAS suggests that noise level is somewhat different at the frequency range less than 0.1 Hz compared to the DONET observations. Since hydroacoustic signals originated from geodynamic sources such as submarine volcanic eruptions or submarine earthquakes have predominant frequency between 1 and 10 Hz, the present unique opportunity has proved that DAS is capable to detect hydroacoustic events occurred in the ocean.

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