Seismic observations using ocean bottom seismometer arrays off-shore Miyagi, northeast Japan

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Japan Trench is one of the most important subduction zones when discussing the occurrence condition of slow earthquakes. Although recent studies have identified some slow slip events (SSEs) and tectonic tremors in the shallow part of the Japan Trench subduction zone (Kato et al., 2012; Ito et al., 2013; Ito et al., 2015), the existing observation is still very limited because of the sparse seismic network. For the aim of examining detailed activities of shallow seismicity including tectonic tremors, we deployed ocean bottom seismometer (OBS) arrays near the trench. In this study, we analyze 6 months observed array data to show the fundamental performances of installed arrays.
We installed three OBS arrays (AoA1-3) at interval of about 20km near the trench where the anticipated slip area of SSEs and the high coseismic slip area are overlapped. Each array consists of 5 stations spacing about 500m. The station at the center of array has a broad-band OBS and other 4 stations have a short-period OBS, respectively. While the observation is now going on with replacing of the OBSs, the first observation of AoA has been performed for 6 months from the 28 October 2014. Data from all stations have been successfully recovered on May 2015.
For each array data, we conduct a coherence analysis using the moving-window correlation technique to detect coherent signals and estimate their incoming directions (e.g. Fletcher et al., 2006). For every 4s time window, the optimum azimuth and apparent velocity are measured by maximizing the average cross correlation of all pairs of seismograms within an array with an assumption of plane waves.
We successfully detect many coherent signals. The number of signals detected simultaneously by all arrays is about 2,500 in the entire observation period, which includes regional and distant earthquakes or artificial signals like airgun shooting. About 1,000 signals correspond to the regional events in the earthquake catalog of the Japan Meteorological Agency (JMA). For corresponding events the azimuths estimated by two arrays (AoA2, AoA3) are almost consistent with azimuths from JMA epicenters, whereas the azimuths estimated by AoA1 are inconsistent and strongly biased to the specific direction of about 90 degrees, which is probably due to site effects. We also show detected tremor-like signals, though their origins are still uncertain at this time.
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