

[JJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG67] Ocean area observation to detect crustal activity under the seafloor: Present and future

convener: Kazuro Hirahara (Department of Geophysics, Earth and Planetary Sciences, Graduate School of Sciences, Kyoto University), Ryota Hino (Graduate School of Science, Tohoku University), Takane Hori (独立行政法人海洋研究開発機構・地震津波海域観測研究開発センター)

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Recent progress of seafloor observations for earthquake and crustal deformation, such as deployment of submarine cable networks of S-net and DONET, and repeated observations of GNSS/A and acoustic extensometer (direct path acoustic ranging), enable us to evaluate on-going crustal activities in the megathrust regions along the Japan trench and the Nankai trough. We review the present status and the future plans of such seafloor observations, and discuss the future directions of seafloor observation networks, especially for real-time monitoring of crustal activities. Toward these directions, we welcome papers introducing the present status of novel approaches and systems such as optical fiber, laser ranging or seafloor SAR and real-time geodetic observations using mooring buoys or wave glider, and so on. We also welcome future plans to integrate observation for the crustal activity under the seafloor with observation for ocean and climate changes.

[SCG67-P01] Practical method to determine relative orientation of horizontal components of ocean bottom seismometer in an array

*Shukei Ohyanagi¹, Kazuaki Ohta², Yoshihiro Ito², Ryota Hino³, Yusaku Ohta³, Ryosuke Azuma³, Masanao Shinohara⁴, Kimihiro Mochizuki⁴, Toshinori Sato⁵, Yoshio Murai⁶ (1. Graduate School of Science, Kyoto University, 2. Disaster Prevention Research Institute, Kyoto University, 3. Tohoku University, 4. Earthquake Research Institute, University of Tokyo, 5. Chiba University, 6. Hokkaido University)

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Japan Trench is one of typical subduction margins with fast and slow seismic activities, such as M9 Tohoku-Oki megathrust event, slow slip events [Kato et al., 2012], low frequency tremors [Ito et al., 2015] and very low frequency earthquakes [Matsuzawa et al., 2015]. To observe such offshore seismicity with high precision and resolution, we installed three arrays of ocean bottom seismometers (OBS) on offshore Fukushima prefecture near the trench axis. Each array consists of one broad band OBS, and six 1Hz short period OBSs. Those seven OBSs form triangular array with diameter of 1km, and 500m of interstation distance. Continuous observation was performed between September 2016 and October 2017.

We have processed data with beamforming, which is a method allows us to reveal azimuth and apparent velocity of incoming wave observed by an array. It has been used to detect tremors in Cascadia subduction zone [Ghosh et al., 2009; 2012] and San Jacinto Fault [Hutchison and Ghosh, 2017]. Beamforming was applied to OBS array dataset in previous study [Ohta et al., 2017, EGU]. However, only waveforms of vertical components had been used, because of unknown orientation of horizontal components due to free-fall deployment of the OBSs. Definite orientation of horizontal components can be obtained using particle motion of regional or teleseismic earthquakes [e.g., Scholz et al., 2016]. However, associated uncertainty is too large to satisfy required condition of beamforming, which is horizontal components of all seismometers in an array must oriented in a same direction. Here, we align the orientation of horizontal components of all

OBSs within each array by cross correlating observed waveforms. On each array, we pick one OBS as a reference. Horizontal components of the other OBSs in an array are rotated every 1 degree, and cross correlated with the horizontal components of the reference OBS using first several seconds of P-wave radiated from regional and local earthquakes. As a result, we obtained relative orientation where waveforms of horizontal components of the other OBSs correlate for the best with the reference OBS. We verified these orientation angles are accurate enough for beamforming through beamform of local, regional and teleseismic earthquakes.

Our method can determine relative orientation of horizontal components of OBSs in the array accurately, which is a crucial condition for any array analysis technique. Analysis of waveforms of horizontal components would be a huge advantage for study of low frequency tremors, since S-wave dominates its waveform [Obara, 2002; La Rocca et al., 2005] and thus expected to be more energetic in horizontal components rather than vertical.

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