

Active and passive seismic experiment during the IODP Exp. 358 deep riser drilling in the Nankai Trough, Japan

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Stress and strain should be crucial parameter to understand preparation/generation cycle of mega-thrust earthquakes which repeatedly occur along subduction zone. Recent studies suggest that seismic approach (c.f. seismic anisotropy analysis and seismic velocity monitoring) could be alternative tool to monitor stress/strain field in the seismogenic zone. The IODP Exp. 358, which includes deep riser drilling by D/V Chikyu around the IODP C0002 hole in the Nankai Trough region, is a great opportunity to observe the seismic dataset, which would be used to discuss the relationship between seismic parameters and stress field before, after and while the deep borehole drilling.

We performed a series of seismic experiments including passive and active surveys. The experiments include: 1) Seismic velocity monitoring near the C0002 hole by seismic interferometry using drilling/vessel noise. 2) Seismic anisotropy survey around the C0002 hole by air-gun circular shooting. 3) Microearthquakes and tremors monitoring to identify stress condition around the borehole. In this region, real-time borehole seismic observatory and seafloor seismic observatory, named LTBMS (Long-Term Borehole Monitoring System) and DONET (Dense Oceanfloor Network system for Earthquake and Tsunamis), have been already installed and operated. These observatories can be used as seismic receivers for this experiment. 10 OBSs (Ocean Bottom Seismometer) were additionally deployed near the C0002 hole for dense seismic observation within 10 km from the C0002 hole. 6 OBSs were deployed by R/V Yokosuka during the YK18-14 cruise. Another 4 OBSs were deployed by Chikyu's ROV (Remotely Operated Vehicle) with distances of 90 m to 300 m from the C0002 hole. These OBSs will be recovered from May to Oct. 2019. As active seismic survey, R/V Kaimei fired circular shooting line around the C0002 hole during the KM18-10 cruise. The air-gun signals were clearly observed by LTBMS seismometer and seafloor DONET seismometers. The observed data show clear seismic events which should be caused by seismic anisotropy. Since 2013 to 2016, we have performed the same survey around the C0002 hole by R/V Kairei in every year. Therefore, time-lapse discussion on seismic anisotropy should be possible by using the newly and existing dataset.

Phase analysis and beam-forming processing would be possible by using the OBS array dataset to discuss distributions of microearthquake and tremors. OBS array data can be also used for seismic interferometry analysis to discuss velocity structure monitoring during the drilling. In this presentation, we will show initial data observed by OBS if the data were available after the recovery. Also, we will show initial results of active seismic survey observed by LTBMS and DONET seismometers including time-lapse discussion on seismic anisotropy.

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