Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SSS035-05 Room:IC Time:May 23 17:30-17:45

Source area of the outer-rise normal-faulting earthquake off the east of Chichi-jima Island in December 2010

Koichiro Obana[1*], Tsutomu Takahashi[1], Shuichi Kodaira[1], Yuka Kaiho[1], Mikiya Yamashita[1], Takeshi Sato[1], Tetsuo No[1], Naoto Noguchi[1]

[1]JAMSTEC

A M7.4 earthquake occurred off the east of Chichi-jima Island, Bonin Islands, Japan, at 2:19, December 22, 2010 (JST). This earthquake is an outer-rise normal-faulting earthquake occurred within the Pacific plate. According to Japan Meteorological Agency (JMA), the associated tsunami was observed along the Pacific coast of Japan in southern part of northeast Japan and from southern part of Kanto to Okinawa. Outer-rise normal-faulting earthquakes, such as the 1933 Sanriku Earthquake (M8.1), could cause devastating damage by large tsunamis. Furthermore, the earthquakes occurred on September 2009 near the Tonga trench are considered that an outer-rise normal-faulting earthquake and an interplate subduction thrust earthquake occurred at almost the same time and place (Beavan et al, 2010; Lay et al., 2010). Outer-rise earthquakes and interplate subduction thrust earthquakes have cause-and-effect relations between each other. Precise location and shape of fault are necessary to understand mechanism of outer-rise normal-faulting earthquakes. However, the outer-rise earthquakes occur far away from coast. Hence, it is difficult to obtain accurate hypocenter locations of aftershocks. Especially for the earthquake off the east of Chichi-jima Island in December 2010, there is limited number of island seismic stations near the hypocenter. Offshore observations are necessary to obtain accurate aftershock distributions.

R/V Kairei of Japan Agency for Marine-Earth Science and Technology (JAMSTEC) had conducted a seismic survey in Izu-Bonin area during the occurrence of the earthquake off the east of Chichi-jima Island. R/V Kairei stopped the survey temporarily and deployed one ocean bottom seismograph (OBS) in the source area on December 25, 2010, just 3 days after the occurrence of the mainshock. This OBS was recovered on January 6, 2011 during another cruise of R/V Kairei. In addition to this, R/V Kairei deployed four another OBSs in the source area. The recovered OBS succeeded to record the seismic record of aftershocks. Aftershocks were relocated using the seismic record obtained by the OBS and island seismic stations on Chichi-jima (operated by JMA and National Institute for Earth Science and Disaster Prevention) and Haha-jima (operated by JMA).

The aftershocks are located northwest to the hypocenter of the mainshock determined by USGS. Aftershocks distributed in a northwest-southeast direction, which is consistent with the mainshock focal mechanism indicating tensional axis oriented northeast-southwest. There are horst and graben structures cutting the Pacific plate by normal faults with strikes almost parallel to the plate boundary near the source area. We discuss that the source area of the outer-rise normal-faulting earthquake based on results of the offshore aftershock observations and crustal structure surveys.

Keywords: outer rise earthquake, normal fault earthquake, OBS, aftershock