Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS24-P04 Room:Poster Time:May 1 18:15-19:30

Spatial distribution of earthquakes off the coast of Ibaraki and the Boso Peninsula after the 2011 Tohoku Earthquake

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The 2011 off the Pacific coast of Tohoku Earthquake occurred on March 11, 2011, off shore of the northeast Japan region. Many aftershocks occurred following the mainshock. To obtain a precise aftershock activity is important for understanding the mechanism of earthquake generation, and the recovery of plate coupling at a ruptured plate boundary. In order to study the aftershock activity, we had deployed 66 long-term ocean bottom seismometers(LTOBS) off the coast of Ibaraki and the Boso Peninsula from October 2011 to November 2012.

For hypocenter determination, we selected 1606 events whose epicenter catalog which the Japan Meteorogical Agency for hypocenter determination.P- and S- wave arrival times were manually picked using the WIN system (Urave and Tsukada, 1991).Hypocenters were determined by the maximum-likelihood estimation technique (Hirata and Matsu·ura, 1987). The hypocenter location program used in this study is based one-dimensional structure with constant Vp/Vs ratio of 1.73. Because a sedimentary layer below the sea floor generally has a large Vp/Vs value, an adjustment of the station corrections is needed. To obtain the station correction, we used the following method. First, we located the hypocenter using the P- and S-wave arrival times with the assumed station correction values for the velocity structure used. The averaged differences between observed travel time and estimated travel times (O-C times) for each station were then calculated. The averaged O-C times were added to the previous station correction values, and the hypocenters were relocated. We repeated this procedure eleven times. After this procedure, the averaged O-C times were less than 0.1 s for both the P-wave and S-wavesWe estimated 458 hypocenter locations with an error of less than 5 km in the horizontal direction and less than 3 km in depth by using LTOBS data.

Most of the hypocenter locations have a depth shallower than 40km. The earthquakes form a plane dipping landward in the study area. Comparing the hypocenter locations with crustal structures obtained by active seismic studies (e.g. Miura et al., 2003). Many events occurred along the plate boundary. We also compared the hypocenter locations with aftershock distribution of the seismic observation conducted immediately after 2011 Tohoku Earthquake (Shinohara et al., 2012). Shinohara et al., (2012) reported that the low seismicity region has seen at the shallow part of the plate interface in the off-Fukushima. On the other hand, our results showed the seismicity is not low at the same region. This difference may reflect the change of stress fields at a ruptured plate boundary.