

Intensive observations using long-term ocean bottom seismometers; Cases of off-Sanriku and off-Hitachi

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Northeastern Japan is located in the Western Pacific margin, and M7 class offshore earthquakes correlated with the subducting Pacific plate have repeatedly occurred. It is one of the most well-studied subduction zones; however, accurate hypocentral distributions in the offshore area have mostly not been determined because most previous offshore seismic networks were temporally restricted and spatially regulated. For the sake of precisely understanding background seismicity in the region, we have set up 5 networks to cover almost the entire area for 5 years since 2004. In this presentation, we will introduce the intensive observations and show the preliminary results of the latest two observations in the off-Sanriku and the off-Hitachi regions.

We have had 189 pop-up and long-term type ocean bottom seismometers (LTOBSs) in total installed on the landward slopes along the Japan Trench for 5 years. In 2004, 18 LTOBSs were deployed at the northwestern part of the region. In 2005, 2006, 2007 and 2008, we deployed 30, 42, 49, 50 LTOBSs in other regions, respectively. Furthermore, we installed the other LTOBSs in the off-Miyagi and the off-Ibaraki regions, which have high potentiality for large earthquakes. Each observation period is from several months to 1 year, and the networks have covered almost all areas, adding to other experiments such as aftershock observations after large earthquakes in recent years.

The off-Sanriku region is located in the northern part of the Japan Trench subduction zone. We spaced 49 LTOBSs at approximately 20-km intervals in and around the area off-Sanriku from mid-October 2007 to late June 2008, and we have located earthquakes during the observation period after combination with routine seismic data. Almost all hypocenters we have determined are distributed into five regions: a) interplate zone, b) some areas around the turning point of subducting dip angles, c) island crust, d) lower part of double seismic zone and e) some areas below seaward from the trench. The distribution of earthquakes we have labeled as the interplate type is consistent with previous seismic surveys, and lateral variations of the focal depths along the trench axis are unnoticeable, unlike in other areas. By contrast, the hypocenter distribution around the turning point of the subducting dip angles deduced from seismic surveys shows voluminous, and it includes non-thrust type earthquakes.

The off-Hitachi region is located in the southern part of the Japan Trench subduction zone. 50-plus LTOBSs were spaced at almost the same intervals as for the off-Sanriku observation. In 2008, a large earthquake with a magnitude of 7.0 occurred on May 8 (JST) at the central part of the network just before we deployed 12 LTOBSs on May 19, and the other 38 LTOBSs were deployed a month later in late June. The LTOBSs recorded a lot of aftershocks as well as background seismicity. Furthermore, we have deployed the 5 other LTOBSs since 2007. They have enabled us to obtain sequential data sets, including the foreshocks, the mainshock and aftershocks. The distribution of the hypocenters include the large earthquakes delineates roughly a plane which is consistent with the dip angles of the subducting Pacific plate.