

Hypocenter distribution around the 2011 Tohoku-Oki earthquake by using Ocean Bottom Seismographic data

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A megathrust earthquake (M9.0), the 2011 off the Pacific coast of Tohoku earthquake (the 2011 Tohoku-Oki earthquake), occurred on Mar. 11, 2011 along the Japan Trench subduction zone. Its hypocenter and the area of major moment release are located in the Miyagi-Oki region, middle part of the Japan Trench area, where large interplate earthquake (M7.5) have repeatedly occurred at about 40 years intervals. Since 2002, we have repeatedly deployed and retrieved pop-up type Ocean Bottom Seismometers (OBSs) to monitor the seismicity in the region. By using this OBS network, we could observe a sequence of the foreshocks, the mainshock and aftershocks of the 2011 Tohoku-Oki earthquake in their close vicinity.

Suzuki et al. (2012) relocated these hypocenters by using OBSs data. Although OBSs deployed in the area observed the series of earthquakes and their data provided with improved image of the hypocenter distribution, they relocated only early aftershocks occurred until 21 May 2011. In this presentation, we will report the aftershock distribution relocated by including the OBS data recovered in 2012 from the off-Miyagi region where large (> 10 m) coseismic slip occurred at the 2011 Tohoku-Oki earthquake.

The mainshock hypocenter was relocated slightly westward from that reported by Japan Meteorological Agency (JMA), placing it near the intersection between the plate boundary and the Moho of the overriding plate. The foreshock seismicity mainly occurred on the trenchward side of the mainshock hypocenter, where the Pacific slab contacts the island arc crust. The foreshocks were initially activated at the up-dip limit of the seismogenic zone ~30 km trenchward of the largest foreshock (M 7.3, two days before the mainshock). After the M-7.3 earthquake, intense interplate seismicity, accompanied by epicenters migrating toward the mainshock hypocenter, was observed. The focal depth distribution changed significantly in response to the M-9 mainshock. Earthquakes along the plate boundary were almost non-existent in the area of huge coseismic slip, whereas earthquakes off the boundary increased in numbers in both the upper and the lower plates, including intensive aftershock activities of intraplate earthquakes with magnitude more than 7.

Keywords: Tohoku-Oki earthquake, OBS, Miyagi-Oki, seismicity