

Relations between structure and earthquake activity in source region of M7 earthquakes off Ibaraki Prefecture: Preliminary results

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There have not been occurrences of Magnitude 8 (M8) class large earthquakes along the Japan Trench off Boso and Ibaragi Prefecture. On the other hand, M7 class large earthquakes have occurred with a fairly constant interval of 20 years farther off toward the trench from a seismically active region approximately 60 km off the coast of Ibaragi Prefecture. The most recent earthquake of this group occurred in July 1982 with M7.0, and more than 20 years have already passed. These earthquakes are considered to have a mode of sequential occurrences of fore-main-after shocks. It has been shown from a rupture process study of the 1982 M7.0 earthquake that, assuming the constant interval of 20 years between M7 earthquakes, a relative displacement along the plate interface coincides well with the amount of slip of the earthquakes. It has then been implied that the mechanical coupling along the plate interface within the source region is nearly 100%. Relationship between mechanical coupling along the plate interface and seismic activity has been widely discussed recently. However, offshore earthquake observation had not been conducted and seismic activity in the source region of the 1982 earthquake off Ibaragi Prefecture has not been elucidated. Earthquake monitoring by on-land observatories perceived increasing earthquake activity in the source region of the 1982 earthquake. By considering this raise of earthquake activity as that of foreshocks to an expected M7 class main shock, Earthquake Research Institute of the University of Tokyo started continuous offshore observations using long-term ocean bottom seismometers (OBSs) in July 2002. The purpose of these offshore observations is to elucidate earthquake activity in the 1982 source region as well as to directly monitor a series of fore-main-after shock just above the source region.

In conjunction with the above offshore long-term observations, a seismic survey and a 1.5-months-long earthquake observation have been conducted during R/V Hakuho-Maru KH05-4 cruise in October and November 2005. The purpose of this seismic survey and earthquake observation is to understand detailed relationship between structure and earthquake activity by determining seismic velocity structure and hypocenter locations simultaneously.

Twenty-seven OBSs were deployed within the approximately 50 x 50 km source region of the M7 class earthquakes. Three airguns with a 25-liter chamber were used as artificial seismic sources. The total length of 8 profiles running parallel and perpendicular to the trench axis and 4 profiles running diagonally over the OBS grids is 572.4 km. The average shot interval is 60 s, and the average air pressure is approximately 110 atm. The total number of shots is 4915. Ship speed was held at a ground speed of 3.5 knots, and thus the average shot separation is 115 m. A newly introduced airgun shot synchronizer (Hot Shot by Real Time System co.) constrained the timing variations within ~ 1 ms.

Twenty-five out of 27 OBSs were safely recovered, and they recorded fine data about both seismic survey and earthquake observation. Preliminary results of these survey and observation will be presented.