Geometry of Pacific plate in Kuril-Japan trench zones estimated from earthquake distribution and seismic structures using OBSs

Masanao Shinohara[1]; Tomoaki Yamada[2]; Asako Kuwano[3]; Kazuo Nakahigashi[3]; Kimihiro Mochizuki[4]; Toshihiko Kanazawa[5]; Shinichiro Amamiya[6]; Yoshio Murai[7]; Yuya Machida[8]; Tetsuo Takanami[9]; Ryosuke Azuma[10]; Ryota Hino[10]; Toshinori Sato[11]

[1] ERI, Univ. Tokyo; [2] ERI, Univ. of Tokyo; [3] ERI; [4] EOC, ERI, Univ. of Tokyo; [5] ERI, Tokyo Univ; [6] ISV, Hokkaido University; [7] Institute of Seismology and Volcanology, Hokkaido Univ.; [8] ISV; [9] ISV, Hokkaido Univ; [10] RCPEV, Graduate School of Sci., Tohoku Univ.; [11] Chiba Univ.

The seismicity of the Japan arc region is as high as that observed in other areas of subduction of oceanic plates. The Japan Trench and Kuril Trench are plate convergent zones where the Pacific Plate is subducting below the Japan island. Associated with the plate convergence, many earthquakes occur beneath landward slopes of the Japan Trench and the Kuril Trench. Such earthquakes are considered to occur mainly at plate boundary between the Pacific plate and the landward plate in landward slope of the Kuril trench and the Japan trench. Therefore, to obtain precise hypocenter distribution of earthquakes occurring in the regions is essential to estimate geometry of the plate boundary. For several years, we performed dense seafloor earthquake observation using Ocean Bottom Seismometers (OBSs) in this region, including the aftershock observation of the 2003 Tokachi-oki earthquakes which is large interplate earthquake around the Japan island arc. In the region off Nemuro, dense seafloor observation was carried out from 2005 to 2006 for one year using the Long-Term OBSs. In the region off Aomori, we performed the same type of a seafloor earthquake observation from 2004 to 2007. As a result, we obtained the precise hypocenter distribution from the region off Nemuro to the region off Aomori, and the hypocenter distribution of huge number of earthquakes enables us to estimate the geometry of the plate boundary. Additionally, seismic surveys using OBSs and controlled source were carried out in this region, and the seismic structures from marine surveys are useful as references of the position of the plate boundary. From these data, we estimated the geometry of the subducing Pacific plate from the trench to the coast of Hokkaido and the northern Tohoku Japan. The Pacific plate starts to subduct with a small angle in the whole study area. The subducting angle of the Pacific plate rapidly increases where the plate reaches a depth of 30 km. Off the Erimo cape, the subducting Pacific plate has a very small dip angle until a depth of 30km, where it is known that no large earthquake occurs. Comparing between asperities which were obtained from seismic records of large earthquakes and the obtained plate boundary geometry, it is inferred that a spatial spread of asperities of large earthquakes is related to a shape of the plate boundary.