Geophysical exploration technologies on the EARS program for the assessment of the interplate earthquake generation

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A large earthquake along the subducting plate boundary is considered to occur repeatedly in the particular asperity which is the region of strongly coupled zone of two plates. The regions other than 'asperities' along the plate boundary are considered stable - quasi-stable region where slow-slip may release the strain energy caused by the oceanic plate subduction. The intensity of coupling and the heterogeneities in a particular large asperity is not possible to know at present. Although the plate-coupling state of the stable-quasi stable slip region on land can be estimated by GPS observation, the coupling of the similar region in the forearc slope is difficult to monitor because of the far distance from the GPS network on land.

We found the presence of the strong PP-wide-angle reflections from the subducting plate boundary in the aseismic forearc region in the Japan Trench. We suggested the presence of the low-Vp/ soft materials or fluid at the subducting plate boundary to generate strong seismic reflection, and it may cause the slow-slip by the lubrication due to the physical properties of materials. Similar strong PP-wide-angle reflections were also observed in the NE region of the Hamana Lake, where has also showed large aseismic slip detected by GPS. Such region can be called as 'non-asperity'. The subducting plate boundary can be classified as asperity and non-asperity. If we can map the non-asperities by intensity of PP reflectors, we can map the distribution of asperity on the plate boundary.

The EARS (Exploration of Asperities-Reflectors System) intends to integrate necessary research components. Mapping is essential components. In the geophysical exploration technologies such as 2D, 3D seismic surveys on land and off shore and wide-angle reflection-refraction survey using OBS-airguns are essential technologies to map the nature of the subducting plate boundary.

The mapping of PP reflector at the subducting plate boundary can be efficiently carried out by the OBS-airgun survey. The combination of forward modeling, tomographic inversion and synthetic seismograms has been used for the OBS-arigun data in the continental shelf survey in Japan. When the tomographic inversion is used, the careful examination is requires such as search of global minimums, selection of start model, identification of Pn, Pg, PmP and later phases. The forward modeling is also extensively used. Synthetic seismogram calculation may give theoretical supports for the resultant models.