Depth-dependent periodic change in the interplate coupling at NE Japan inferred from spatial gradient of velocity field

*Takeshi Iinuma[1]

1.Japan Agency for Marine-Earth Science and Technology

Surface velocity field of an island arc based on terrestrial GNSS observations includes the effect of the interplate coupling between the overriding continental plate to which the island arc belongs and oceanic plate that is subducting from a trench or a trough. In the Japanese Islands, many studies have been carried out to estimate the distribution of interplate coupling using the surface velocity fields based on the GNSS observations with a dense nationwide observation array [e.g., *Ito et al.*, 1999, 2000; *Mazzoti et al.*, 2000; *Nishimura et al.*, 2004; *Suwa et al.*, 2006; *Hashimoto et al.*, 2009; *Loveless and Meade*, 2010]. However, especially in northeast Japan, it is difficult to resolve the distribution of the interplate coupling along the direction normal to the Japan Trench based on the terrestrial geodetic data, because the trench where the subduction starts is too far (> 200 km) from the land. The spatial change in the degree of coupling is also hard to detect accurately far off the Pacific coast.
Uchida et al. [2016] revealed that the interplate coupling between the subducting Pacific and overriding continental plates at the northeast Japan subduction zone periodically changes with the repeat intervals from 1 to 6 years based on the analyses of the small repeating earthquakes and of surface displacement rate field. They applied a geodetic data processing for monitoring the spatio-temporal variation of interplate coupling with calculating the spatial gradient of the surface horizontal velocity field within belt-like zones that are taken along the direction perpendicular to the trench axis. Temporal change in the interplate coupling is detected with shifting the one-year time window in which the surface velocity field is estimated by one week, and spatial variation along the trench-parallel direction is deduced with shifting the latitude of the belt-like zone whose width is 60 km by 0.1 degree. They suggested that the gradient of the horizontal surface velocity depends mainly on the strength of the interplate coupling in shallow portion of the offshore plate interface, while it is still difficult to resolve the distribution of coupling zone on the plate interface and to estimate the temporal change in the degree of coupling in a quantitative manner.
The results of *Uchida et al.* [2016] with respect to the small repeating earthquakes implies that the spatial variation of repeating period of the slow slip on the plate interface depends on the depth, that is, the slow slip occurs with shorter recurrence interval at the deep portion than that at the shallow portion along each profile perpendicular to the trench. In this study, I examined the depth dependency of the repeating period of the slow slip on the plate interface by comparing the predominant periods of the temporal changes in the horizontal and vertical gradients of surface velocity field. *Iinuma et al.* [2010, 114th Meeting of the Geodetic Society of Japan] revealed that the sign of the vertical velocity gradient indicates the presence or absence of interplate coupling at deeper (>50 km) regions of the plate interface beneath the land. It means that the spatial gradient of the vertical velocity field is sensitive to the change in the interplate coupling at the deep portion, while the horizontal component is sensitive to the interplate coupling change at the shallow portion. The result of the examination shows that the predominant period of the temporal change in the vertical velocity gradient is shorter than that in the horizontal component at the most profiles. I will performing comprehensive numerical tests to examine the sensitivities of the spatial gradients of horizontal and vertical velocity fields to the interplate coupling at various depth ranges, and report the quantitative evaluation of the depth dependency of the cycle

of the periodic change in the interplate coupling.

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