Slip deficit distribution at the southern Kuril Trench estimated from GPS displacement rates

Tatsuma Furuse[1]; # Takao Tabei[1]

[1] Natural Environmental Sci., Kochi Univ.

We estimate interseismic slip deficit distribution at the southern Kuril Trench using three-dimensional displacement rates from nationwide continuous GPS array. In horizontal deformation field the most dominant over Hokkaido district is a crustal shortening in the direction parallel to the convergence of the Pacific plate. On the other hand, vertical deformation field shows a contrast of uplift and subsidence across the volcanic front, the latter is roughly 1cm/yr in the forearc region. According to several previous studies (e.g. Murakami and Ozawa, 2004; Suwa et al., 2006), slip deficit of several cm/yr is required at the deeper extension of the seismogenic zone (deeper than 80km) to reproduce wide area of subsidence in the forearc. On the contrary, Heki (2004) proposed deep basal subduction erosion to interpret forearc subsidence of northeast Japan. In this study we use a popular geodetic inversion approach (Yabuki and Matsu'ura, 1992) but incorporate a negative tensile component to discuss relationship between forearc subsidence and deep basal subduction erosion. We deploy a region of 650km x 350km on the plate boundary that is determined based on earthquake hypocenter catalog by JMA, covering a depth down to 120km. GPS data used for the inversion are site displacement rates estimated from coordinate time series of the final F2 solutions during the period from January 1999 to July 2003 before the 2003 Tokachi-oki earthquake (Mw=8.1).

Inversion result without incorporating negative tensile component shows slip deficit distribution that is very similar to that of the previous studies. The maximum slip deficit area exists off the Nemuro peninsula and the second largest area southeastern off the Erimo peninsula. It is also very similar to the previous results that the slip deficit, after decayed at the depth around 60km, again increases to several cm/yr at deeper than 80km. When the negative tensile component is incorporated, slip deficit at the deeper portion is no longer significant while distribution at the shallower shows no drastic change but the distribution itself becomes smoother. The most characteristic is the distribution of the negative tensile component, which is supplementary to that of the slip deficit. Negative tensile component is nearly negligible at the shallower portion, and becomes significant at around a depth of 50km where slab dip-angle increases from 15 to 30 degrees. It reaches the maximum of 1-2cm/yr at around the depth of 80-100km. If negative tensile component is an indicator of the basal subduction erosion, it means that the erosion does not occur at the strongly coupled shallower region but it becomes significant at the loosely coupled deeper portion.