Oblique Subduction of the Pacific Plate along the Kuril Trench and Lateral Slip of the Forearc

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Southern part of the Kuril forearc is driven by oblique subduction of the Pacific plate at the Kuril Trench of the eastern Hokkaido. The southwestward lateral motion of the forearc sliver results in a collision with the northeast Japan arc and a formation of the Hidaka Mountains (Kimura, 1986).

In this study, we estimate motion of the southern Kuril forearc by the method proposed by McCaffrey (1992), that combines relative plate motion vectors and focal mechanisms of thrust events at the trench. At first we derive slip vectors of 11 earthquakes (Mw≥7.0) that occurred at the southern Kuril Trench in 1976-1996 from Harvard CMT catalog. Next we calculate plate motion vector of the Pacific plate relative to the North American plate at the epicenter of each event using NNR-NUVEL-1A (DeMets et al., 1994). We decompose the plate motion vector into two components: one parallel to the slip vector of the earthquake and the residual. The former contributes to strain accumulation for the occurrence of the earthquake and the latter to the permanent lateral motion of the forearc sliver.

The result shows that the southern Kuril forearc moves southwestward at a mean rate of 7mm/yr. In more detail, northeastern part of the forearc sliver moves at a faster rate of about 15mm/yr, and the rate decreases to 5mm/yr at the southwestern end of the forearc. This implies a deceleration due to a collision with the northeast Japan arc.

In southwest Japan where oblique subduction of the Philippine Sea plate is going on, relative block motion across the rear boundary of the forearc sliver has been evaluated from dense GPS velocity field (Tabei et al., 2003). In the eastern Hokkaido, strain distribution from GPS observation seems consistent with the lateral motion of the forearc sliver. However, the detail is not clear because GPS network does not cover other part of the forearc. Furthermore the rear boundary that coincides with the volcanic front is considered to form a broad shear zone, which makes more difficult to precisely determine relative block motion across the boundary. We will estimate detailed slip distribution of the southern Kuril forearc by combining GPS velocity field and focal mechanism of inland earthquakes.