Present-day movement of the forearc sliver along the southern Kuril arc

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Geological observations indicate that the forearc sliver along the southern Kuril arc has been migrating southwestward and colliding against the northeastern Japan forearc at the Hidaka Mountains in Hokkaido since the late Miocene. The rate of the sliver motion is estimated at about 5 mm/y geologically. In order to determine the present-day motion of the forearc sliver, we investigated the crustal deformation derived from GPS data in recent years. We constructed a model which might represent the crustal deformation due to both the slip deficit (backslip) on the upper boundary of the descending Pacific plate and the motion of the forearc sliver. The deformation due to the latter was represented by the tensile dislocation on vertical faults along the Hidaka Mountains and the shear dislocation on vertical faults along the volcanic front in the eastern Hokkaido. In inverting the observed crustal velocities for the model parameters, we set the direction of the backslip free in one case. In the other case we fixed the direction of the backslip according to the global plate model and also constrained the motion of the forearc sliver following the oblique convergence model proposed by Fitch (1972). The free inversion showed that there is a trade-off between the rate of forearc motion and the direction of backslip beneath the forearc sliver, thus being difficult to determine the motion of forearc sliver reliably. The constrained inversion resulted in an estimate of almost zero rate of the forearc motion, suggesting that the model is too simplistic to detect the subtle deformation associated with the forearc sliver. Also the inversion resulting from these two extreme cases shows us the limitation of the presently-available GPS data. In terms of the present model, the motion of the forearc sliver would be best retrieved using a number of GPS stations close to the boundaries of the forearc sliver, which is not sufficiently provided by the present data.