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Geological meaning of residual velocity fields in GPS strain data inversion

Mitsuhiro Matsu'ura[1*], Akemi Noda[2]

[1]Institute of Statistical Mathematics, [2]Kozo Keikaku Engineering Inc.

Recently, we developed an inversion method to estimate unbiased interseismic slip-deficit rates at plate interfaces from observed GPS velocity data with an elastic dislocation model [1]. Observed GPS data always include rigid block translation and rotations, which cannot be explained by the elastic dislocation model. So, in this method, first we remove the rigid block translation and rotations by transforming the velocity data into the average strain rates of triangle elements composed of adjacent GPS stations, and then invert the strain rates with a unified Bayesian inversion formula [2]. We applied the method of GPS strain-rate data inversion to interseismic GPS velocity data (1996-2000) in the Kanto region, central Japan, and obtained unbiased slip-deficit rate distribution on the North American-Philippine Sea and Philippine Sea-Pacific plate interfaces. In the inversion of strain-rate data, unlike in the direct inversion of velocity data, the obtained slip-deficit rate distribution does not always explain the observed GPS velocity data well, because they will include some rigid block translation and rotations. In the present analysis, we found significant residual velocities, which should not be explained by interseismic slip deficit at plate interfaces. From theoretical consideration to rotation tensor [1], we may ascribe the residual velocities mainly to rigid body translation and rotation of tectonic blocks; that is, the south-southeastward translation of the Izu microplate, which suggests plate convergence at the incipient subduction boundaries southeast off the Izu peninsula [3], the anticlockwise rotation of the south Kanto block, and the clockwise rotation of the Tokai block.

References
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