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GPS
A direct method for estimating the rigid body motion of crustal blocks from GPS velocity data

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The Japanese Islands is composed of many crustal blocks (e.g., Taira, 2001). GPS array data contain information about not only rigid body motion (translation and rotation) of the crustal blocks but also intrinsic deformation due to fault slip at their boundaries. For this reason, McCaffrey (2002) proposed an inversion method to simultaneously estimate rigid block motions and fault slip rates at block boundaries from GPS velocity data. However, as demonstrated by Noda et al. (2013), rigid body motion and intrinsic deformation are separable from each other. In fact, rigid body translation and rotation are the constant parts of velocity and rotation fields, respectively, and both of them are independent of intrinsic deformation (strain). This means that we can estimate rigid block motions and fault slip rates independently of each other from GPS velocity data. In this study, we propose a direct method for estimating the rigid body translation and rotation of a crustal block from GPS velocity data with bidirectional polynomial fitting in Chebyshev form, and examine its validity through the analysis of interseismic GPS velocity data (1996-2000) in southwest Japan.

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