

Application a trans-dimensional inversion to slip-deficit rate estimation along Nankai Trough

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A large number of studies have been made on the estimation of the slip-deficit rate distribution on the plate boundary between the Philippine Sea plate and the Amur plate along the Nankai Trough (e.g., Ito and Hashimoto 2004; Yoshioka and Matsuoka 2013; Yokota et al. 2016; Noda et al. 2017, SSJ). However, because they used a smoothing constraint to obtain stable and physically reasonable solutions, the estimated solutions were largely affected by a smoothing constraint. Dettmer et al. (2014) and Kubo et al. (2017, JpGU) have developed a trans-dimensional source inversion method which estimates the dimension of model parameters as well as values of model parameters. One advantage of this approach is to obtain a fault slip distribution without the effect of a smoothing constraint. In this study, we apply the trans-dimensional inversion approach to the estimation of the slip-deficit rate distribution along the Nankai Trough to understand how the use of a smoothing constraint affects the solution.

We use displacement rates at GEONET stations in southwest Japan from March 2005 to February 2011, which was provided by Noda et al. (2017, SSJ). To obtain a slip-deficit rate distribution from the geodetic data, we employ a trans-dimensional source inversion methodology suggested by Kubo et al. (2017, JpGU). In this methodology, the spatial distribution of slip-deficit rates is modeled by a variable number of Voronoi cells. Unknown parameters are the number of Voronoi cells, the locations of Voronoi cells, and values of slip-deficit rate at Voronoi cells. To obtain the posterior distribution of the unknown parameters, we employ the reversible jump Markov chain Monte Carlo method (e.g., Green 1995) using the parallel tempering algorithm (e.g., Sambridge 2013). An assumed geometric model of the upper interface of the Philippine Sea plate is based on CAMP Standard Model Version 1.0 (Hashimoto et al., 2004) and is divided into several subfaults. A rake angle at each subfault is set so that the slip direction is consistent with the subduction direction (e.g., Sella et al. 2003). For Green's functions, we adopt the concept of back-slip proposed by Savage (1983), and calculate the theoretical static displacements caused by a unit slip on each subfault assuming a homogeneous elastic half-space (Okada 1992).

The preliminary results show that a zone with high slip-deficit rate is found in the coastal region along the Nankai Trough.

Keywords: Trans-dimensional inversion, slip-deficit rate, Nankai Trough