Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG67-02 Room:201A Time:May 25 09:15-09:30

Systematic Errors in the Inversion Analysis of GPS Data to Estimate Interseismic Slip-deficit Rates at Plate Interfaces

NODA, Akemi[1*], MATSU'URA, Mitsuhiro[2]

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

Through GPS measurements we can determine the current coordinates of observation points in a geodetic reference frame. To estimate interseismic slip-deficits at plate interfaces, we usually analyze GPS displacement data, that is to say the difference between the current and previous coordinates of observation points. However, the GPS displacement data contain not only intrinsic deformation but also the rigid body translation and block rotation due to intraplate inelastic deformation, which cannot be explained by interplate slip-deficit models based on elastic dislocation theory. In the inversion analysis of interseismic GPS data, unlike coseismic GPS data, we cannot ignore the theoretically unexplainable coherent noise (systematic errors), because they will seriously bias the inversion results. If the intraplate inelastic deformation is caused by fault slip at well-defined block boundaries as in the case of southwest Japan, we can apply the method of simultaneous GPS velocity data inversion for block rotations and block-boundary slip rates, proposed by McCaffrey (2002). In the case of central Japan, however, the cause of intraplate inelastic deformation is the brittle fracture and/or plastic flow at a number of defects spreading over indefinite tectonic zones (Sagiya et al. 2000, Noda & Matsu'ura 2010). So, we cannot apply the method of simultaneous GPS velocity data inversion. Another and more effective way to remove the rigid body translation and block rotation from GPS array data is to transform observed horizontal displacement vectors into average strain tensors for individual triangles composed of adjacent GPS stations. Applying an inversion formula based on Bayesian statistical inference theory (Matsu'ura et al., 2007) to the GPS strain data, we can obtain unbiased slip-deficit rate distribution. In this talk, we show the theoretical basis for the use of the average strains instead of horizontal displacement data, and demonstrate the applicability of the method of GPS strain data inversion through the analysis of interseismic GPS velocity data (1996-2000) in the Japan region (Hashimoto et al. 2009, Hashimoto et al. 2012, Noda et al. 2012), where the North American, Pacific, Philippine Sea, and Eurasian plates are interacting with each other in a complicated way.

Keywords: Systematic errors, Inverse problem, GPS data, Interseismic slip deficit