

## The 2011 Tohoku-oki Earthquake: Total Recovery of the Slip Deficit Accumulated in a Basement Asperity

HASHIMOTO, Chihiro<sup>1\*</sup>, NODA, Akemi<sup>2</sup>, MATSU'URA, Mitsuhiro<sup>3</sup>

<sup>1</sup>Graduate School of Environmental Studies, Nagoya University, <sup>2</sup>Kozo Keikaku Engineering Inc., <sup>3</sup>Institute of Statistical Mathematics

The Mw9.0 off northeast Japan (Tohoku-oki) earthquake occurred on March 11th of 2011 at the interface between the North American (NA) and Pacific (PA) plates. The occurrence of interplate earthquakes can be regarded as the sudden release of tectonic stress accumulated by the interseismic gradual increase of slip deficit in source regions. To obtain precise slip-deficit rate distribution on the NA-PA plate interface, Hashimoto et al. (2009) have analyzed GPS velocity data for the interseismic calm period of 1996-2000 with a unified inversion formula for Bayesian models with direct and indirect prior information (Matsu'ura et al. 2007). In this analysis, however, the updip limit of the model region is set to 4 km on the basis of geohydro-chemical studies for the strength of subduction zone plate boundaries, and so the inversion result might be biased especially in the shallow part of the plate interface. In the present study, to obtain unbiased slip-deficit rate distribution, we reanalyzed the same interseismic GPS velocity data with the same inversion procedure but without setting any updip limit of the model region. The result of the inversion analysis clearly shows the existence of five remarkable slip-deficit zones distributed on the NA-PA plate interface along the southern Kuril-Japan trench. We also analyzed coseismic GPS displacement data for the Tohoku-oki earthquake with the same inversion method, and obtained the bimodal distribution of coseismic slip spreading over the southern two, Miyagi-oki and Fukushima-oki, interseismic slip-deficit zones. The maximum slip is 32 m for the Miyagi-oki slip-deficit zone but only 7 m for the Fukushima-oki slip-deficit zone. The extraordinarily large coseismic slip in the Miyagi-oki slip-deficit zone, where ordinarily large earthquakes with about 3 m coseismic slips have repeated every 40 years in the past two centuries, suggests the total rupture of a 300-km-long basement asperity underlying much smaller-scale local asperities.

Keywords: the 2011 Tohoku-oki earthquake, GPS data inversion, interseismic slip deficit, coseismic slip, basement asperity