Geophysical Research Abstracts
Vol. 16, EGU2014-1255, 2014
EGU General Assembly 2014

Effect of Topography anf Geological Structure in Computing Co-seismic Deformation——a Case Study of 2011 Tohoku Earthquake (Mw 9.0)

Xiaoguang Lin and Wenke Sun

Key Laboratory of Computational Geodynamics, Chinese Academy of Sciences, University of Chinese Academy of Sciences, Beijing, China (linxiaoguang09@mails.ucas.ac.cn)

A dislocation theory is usually applied in calculating co-seismic deformations. However, the dislocation is valid only for a regular geometric earth model (e.g., half-space or sphere), and the real topography and lateral heterogeneity cannot be taken into account. Therefore, co-seismic deformations for an earth model with topography or heterogeneity can be solved by a numerical technique, such as finite element method (FEM). In this study, we apply 2-D FEM in computing co-seismic deformations caused by the 2011 Tohoku-Oki earthquake (Mw9.0), to observe the effect of topography and geological structure. The results reveal that 1) the topographic effect reaches from -1.25 to 1.31 m in horizontal displacement, and from -0.89 to 0.44 m in vertical displacement; the relative effects are 26% and 55%, respectively. 2) If a layer structure and topography are considered at the same time, the effects are range from -2.73 to 0.3 m and from -0.87 to 0.48 m for horizontal and vertical displacement, respectively; the relative effects are 54% and 47%, respectively. 3) When the topography and regional tectonic structure are considered, the effects are range from -1.78 to 0.8 m and from -1.4 to 0.64 m for horizontal and vertical displacement, respectively; the corresponding relative effects are 34% and 92%, respectively. These topographic and structure effects can be detected by modern geodetic measurements, such as GPS and InSAR. Therefore, the topography and geologic structure should be considered in computing co–seismic deformations.