Global Co-seismic Deformations Caused by 2004 Sumatra Earthquake (Mw9.1) and Spherical Curvature Effect of the Earth

Wenke Sun[1]; Guangyu Fu[2]

[1] ERI, Univ Tokyo; [2] ERI, Tokyo Univ

The 2004 Sumatra-Andaman earthquake (Mw 9.1, Ammon et al., 2005) caused a global deformation which can be detected by GPS, strain meter (Araya, personal communication) and even satellite gravity mission (GRACE, http://photojournal.jpl.nasa.gov /catalog/PIA03625). In order to interpret the observed geodetic and geophysical changes, a spherical dislocation theory is considered to be necessary to model/inverse the fracture fault and to calculate the co-seismic deformations over the earth surface. At the same time, the earthquake provides a chance to investigate global co-seismic deformations and observe the effects of spherical curvature and layered structure of the earth.

In this study, the global deformations (displacement, gravity and geoid changes) are first calculated based on spherical dislocation theory (Sun and Okubo, 1993; Sun et al., 1996) and the seismic wave derived earth model (Ammon et al., 2005). In order to consider the slip distribution on fault plane, the segment-summation scheme (Fu and Sun, 2004) is used. The results can be used as theoretical references for related studies for interpreting observed deformations, especially in the far filed.

Then, a comparison study is made by considering a spherical earth mode and a half-space model. A dislocation theory for a spherical earth model is considered to be necessary because the effects of the earth curvature and layer structure must be taken into account. Theoretically, they can produce big error if the spherical curvature and layer structure are not considered (Sun and Okubo, 2002). The Sumatra earth provides a chance to prove the theory, if the above results are compared with that calculated by the theory for a half-space model (Okada, 1985).

Finally, the possible application of the results of this study is also mentioned.