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Geodetic observation and modeling of viscoelastic relaxation

Yoshiyuki Tanaka[1*]

[1]Earthquake Research Institute, University of Tokyo

Mantle rheology has been inferred from geodtic observation data of post-seismic deformation. In this presentation, how to construct post-seismic viscoelastic relaxation models to be compared with geodetic data have been illustrated with some examples. Practical problems in computations in previous models due to non-linear rheology, compressibility, sphericity of the Earth and self-gravitation are explained. Separation from afterslip also precludes us from inferring mantle rheology. As an example of solving these problems, a method based on a self-gravitating spherical Earth model is presented, which incorporates GRACE satellite gravity observation data. This method is applied to the 2004 Sumatra earthquake, and it is shown that both afterslip and viscoelastic are included in the gravity data. By applying such a method to the 2011 Tohoku earthquake, mantle rheology beneath the Tohoku region can be determined.

Keywords: viscoelastic relaxation, post-seismic deformation, crustal deformation, satellite gravity, earthquake cycle