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A New Method For Computing Global Postseismic Deformation in a SNRVEI Earth

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We introduce a new method by which to compute global postseismic deformation in a selfgravitating, spherically symmetric, non-rotating, viscoelastic and isotropic (SNRVEI) Earth model. Previous methods are based on too simplified Earth models that neglect compressibility and/or the continuous variation of the radial structure of Earth. This is because the previous mode summation techniques cannot avoid intrinsic numerical difficulties caused by the innumerable modes that appear in a realistic Earth model that considers such effects. In contrast, the proposed method enables both of these effects to be taken into account simultaneously. We carry out numerical inverse Laplace integration, which allows evaluation of the contribution from all of the innumerable modes of the realistic Earth model. Using this method, a complete set of Green's functions is obtained, including functions of the time variation of the displacement, gravity change, and the geoid height change at the surface for strike-slip, dip-slip, horizontal and vertical tensile point dislocations. As an Earth model, we employ the Preliminary Reference Earth Model (PREM) and a continuously varying viscosity profile. We further elucidate the effects of fine layering and compressibility on the postseismic deformation rate for large earthquakes (Mw 8). The result shows that the difference between the earth model employed in this study and those used in the previous studies is detectable with modern observational techniques such as GPS. This means that there is a possibility that we should re-examine a role of viscoelastic relaxation as a mechanism of postseismic deformation. As an example, we apply the method to the postseismic deformation due to the 2003 Tokachi-Oki Earthquake (Mw = 8.0) and show that the observed postseismic deformation can be explained by viscoelastic relaxation. This serves as counterevidence against the results which explain the variation purely by afterslip. In conclusion, the effects which have been neglected so far should be considered for theory to meet observational accuracy.