Effect of Lateral Inhomogeneous P-wave Structures in the Mantle on Computing Co-seismic Gravity Changes

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This study presents a new theory for evaluating the effects of the horizontal inhomogeneities in the mantle on computing co-seismic gravity changes. In general, the effect is caused by two factors: the increments of the real earth medium (density, and elastic parameters) from the stratified earth model in the whole Earth and the ones at the position of dislocation. Since the spherically asymmetric distributions ofthe Earth are relatively weak from stratified earth model, the two factors can be expressed mathematically by the disturbance of equilibrium equation and the variation of the internal boundary conditions. The effect of the first factor is expressed by a set of spherical harmonic coefficients (variation of Love numbers) that are volume integrations of the auxiliary solutions, co-seismic deformations for a stratified earth and the lateral disturbance of the earth model. Here the auxiliary solutions include that of tide, load and press sources for layered earth model. The effect of the second factor is obtained by comparison with two results, which are calculated respectively by using previous dislocation theories (Sun and Okubo, 1993; Okubo, 1993), with elastic parameters of either the stratified earth model or the real Earth at the position of dislocation for the source functions.

Based on above mentioned theory and the 3-D P-wave structure models internal the earth (Zhao, 2001), this paper valuates the effect of lateral inhomogeneous structure of P-waves on computing co-seismic gravity changes. The vertical displacements and potential changes calculated by layered dislocation theories (Sun and Okubo, 1993; Okubo, 1993), as well as the 3-D P-wave structures internal the earth, are assumed to the inputs. Results show that the effect of increments of P-wave structures from layered earth is small (about 1% or less), which are controlled by both the earth structures and co-seismic deformations for a stratified earth.