3D Simulation of Dynamic Response of a Heterogeneous Earth for Earthquake Forecasting

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Deformation of the earth due to such as tides, self-rotation and its variation is normally calculated using the analytical solution with some simplified assumptions, such as the Earth is a perfect sphere of continuous media. This paper proposes an alternative way, in which a 3D heterogeneous whole-earth involves the critical discontinuity in the lithosphere (i.e. plate boundaries), to calculate the related deformation by using our in-house finite element code ESyS_Crustal. The preliminary results indicate: (1) for tidal deformation: the discontinuity could have different effects on the tidal deformation in the local zone around the fault, but almost no effects on both the locations far from the fault and the global deformation amplitude of the Earth. The localized tidal deformation amplitude seems to depend much on the relative orientation between the fault strike direction and the loading direction (i.e. the location of the Moon) and the physical property of the fault; (2) for self-rotation induced deformation, the heterogeneity of the earth (i.e. plate boundaries, lithosphere thickness and topography) has significant but different effects on the global deformation/rotation of the earth at the different conditions. This would improve our understanding of deformation/rotation of a real earth and global earthquake forecasting.