Dislocation and Stress Drop of a Normal Fault Earthquake Controlled by Inhomogeneous Stress Field

Yongen Cai[1], Yijie Zhou[2]

[1]*Department of Geophysics, Peking University, Beijing, China,100871*

[2]*Department of Petroleum Engineering, Texas A&M University, USA*

A new finite element model in consideration of inhomogeneous stress field is introduced to study the dislocation of a normal fault with thickness and its displacement and stress fields. New results reveal: 1) The maximum dislocation of the fault is at its lower part instead of its top and the maximum shear stress drop and the maximum dislocation on the fault are not at the same location; 2) The maximum horizontal and vertical displacements on the ground surface are not at the fault, but at a distance away from it; 3) The maximum shear stress drop and the maximum shear dislocation in the fault do not take place at the same location; 4) Near the ground surface, the dislocation of the normal fault lead to two Coulomb failure regions in which the successive normal faults may develop and one non-failure region in which no normal fault exists. Therefore complex normal fault system could be regarded as the results of lots of failure events of the successive normal faults.

These results are apparently different from those of the seismic dislocation theory in semi-infinite space, in which the effects of the inhomogeneous stress field and the thickness of the fault on the displacement and stress fields are not considered.

Keywords: new FEM; normal fault; thickness; inhomogeneous stress field.