

The Influence on the Regional Crustal Deformation and Stress Field of the Wenchuan M_s 8.0 Earthquake

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The long-term impact of coseismic and post-earthquake effects on the crustal deformation field, stress field, fault activity status, and seismic hazard in the surrounding area had attracted more and more attention from the international academic community and had become a hot topic for research in the past two decades. As the first high-angle reversed type 8-magnitude earthquake that occurred in the mainland since the instrument records, the occurrence of the M 8.0 Wenchuan earthquake on May 12, 2008 not only caused serious casualties and economic losses, but also had a continuous and significant impact on the regional tectonic deformation and fault stress accumulation. Carrying out related coseismic and postseismic researches on the Wenchuan earthquake not only favor to understand the rupture characteristics of the earthquake, but also has great significance on analyzing the change of regional crustal deformation and stress field and estimating the future seismic hazards of main active faults. Therefore, we took the Wenchuan earthquake as the research object, based on the dislocation theory and the viscoelastic constitutive relation, carried out the research on the changes of regional deformation field and stress field caused by coseismic dislocation and viscoelastic relaxation of the earthquake. Firstly, we constructed a 3D model of the seismogenic faults of the Wenchuan earthquake by means of comprehensive multidisciplinary data, together with the inversion using multiple coseismic observations, the coseismic slip distribution of the Wenchuan earthquake was obtained. And then, based on the constitutive relation of Burgers' viscoelastic body, with GPS time series as the constraints, with the distribution of coseismic slip in the Wenchuan earthquake as the initial condition, and with the help of finite element numerical simulation, the optimal short-term and long-term effective viscous coefficient of each block in both sides of the Longmenshan fault zone were determined. Finally, the regional deformation field changes caused by coseismic dislocations and viscoelastic relaxation was analyzed, and the earthquake risk of the surrounding active faults in the future was discussed based on the Coulomb stress change.

Keywords: Wenchuan earthquake, crustal deformation, stress evolution, coseismic slip, viscoelastic relaxation, finite element simulation