AOGS 2005

Study on the source rupture process of Ms 7.9 earthquake in the border area of China, Russia and Mongolia on Sep.27 2003

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We estimated the moment tensor of the Ms 7.9 earthquake in the boarder area of China, Russia and Mongolia occurred on Sep.27 2003 firstly, by using the far field waveform inversion method of Kikuchi and from digital teleseismic P-wave seismograms recorded by long-period seismograph stations of the global seismic network. Our result shows that the strike of P axis is 359°, the plunge 2°; the strike of T axis is 90°, the plunge 20°. Considering the aftershock distribution and the fault orientations around the epicenter area, we propose that the 7.9 earthquake occurred on a fault plane with the strike of 127° , the dip of 79oand the rake of 27°. The nearly vertical generate-fault moved along the strike, only with a small part of thrust component. This result is consistent with the orientation of tectonic faults in Altai and western Mongolia region.

After obtained the focal mechanism, we further inversed its rupture process, obtained its source time function and the temporal-spatial distribution of slip on the fault plane. Our inversion result indicates that the rupture mainly occurred on the shallow area of 110km long and 30km wide on the fault plane, the maximum slip doesn't lie in the initial rupture area, and the area of slip greater than 0.5m lies within 35km deep middle-crust. There are two areas of slip obviously larger than 0.5m. One is 60km long and 0~15km deep, shallower than the initial rupture point, lying in the east-southern area to the epicenter. The maximum slip on this area is 3.6m. The other one locates to the west of the initial rupture point, 20km long and 20~30km deep. The maximum slip on this area is 2.1m. The total rupture duration is about 37s, the scalar moment tensor is M_0=0.97×10^{20}N· m, moment magnitude M_w=7.6.

We notice that when the rupture propagated towards northwestern direction and closed to the area around the Ms7.3 aftershock, which occurred on Oct.1, 2003, the displacement decreased rapidly. This may indicate that the rupture was stopped by barrier. The consistence of spatial distribution of slip on the fault plane with the distribution of aftershocks also support that the rupture is a heterogeneous process owing to presence of barriers. We suggest that the phenomenon that the slip distribution of the main shock on the fault plane associates with the location of strong aftershock may be meaningful to predict the location of strong aftershock.

Keywords: Ms 7.9 earthquake; moment tensor; source rupture process; temporal-spatial distribution of slip; location of strong aftershock;