AOGS 2005

The January 26, 2001, Gujarat, India, M_S7.8 Earthquake: Rupture Process and Predicted Ground Motion

XU LISHENG, Gao Mentan, Chen Yuntai
Institute of Geophysics, CEA, Beijing, 100081

On January 26, 2001, there occurred a large earthquake in Gujarat, India, whose magnitude was estimated to be M_S7.8. The earthquake caused little surface dislocations but only some cracks in fields and roads. However, it generated strong ground motion that was felt even at long distances, resulted in huge losses of lives and properties in a wide range. The depth of the earthquake was estimated to be 20~26 km. We inverted the long-period waveform data from stations across the world for rupture process and calculated the near-source ground motion caused by the inverted faulting model. The moment tensor inversion suggested that the strike, dip and rake of the seismogenic fault were determined to be 92º, 58º and 62º, respectively; and that the seismic moment released was 3.5×10^{20} Nm, accordingly, the moment magnitude M_W was 7.6. The analysis of the STFs suggested that the earthquake was nearly a single event with the duration time of 19s, starting rapidly and ending slowly. The image of temporal-spatial distribution of the slip on the fault plane indicated that the maximum slip amplitude on the fault plane was about 7m. The maximum dress drop was 30MPa, and the average one over the whole rupture area was 7MPa. The rupture area was about 85km long in the strike direction and about 60km wide in the down-dip direction, which was correspondent to 51km deep in the depth direction. The rupture propagated 50km eastwards and 35km westwards. The main portion of the rupture area, which has the slip amplitude greater than 0.5m, was roughly of the shape of an ellipse with the major axis oriented in the slip direction of the fault. The eastern portion of the rupture area above the initiation point was larger than the western portion below the initiation point, which was indicative of the asymmetrical rupture. In other words, the earthquake was of asymmetrical bilateral rupture and the rupture from west to east and from down to up was dominant. The rupture propagation velocity over the whole rupture process was estimated to be 3.3km/s. The ground motion near the fault, which covers the area of intensity VIII, was calculated using the inverted kinematical faulting model. The calculation indicated that the feature of disaster distribution or the intensity geometry could be well explained by the predicted ground motion.

Keywords: Strong ground motion ,earthquake disasters, Source process, Large earthquake