AOGS 2005

Dynamic Rupture Model of the December 26, 2004 Sumatra Earthquake from Long-period Waveform Data of Worldwide Stations

XU LI-SHENG and CHEN YUN-TAI

Institute of Geophysics, China Earthquake Administration, Beijing 100081, China

The great off west coast of northern Sumatra earthquake of December 26, 2004 and earthquake-generated tsunami in Indian Ocean caused around 300,000 casualties. For understanding the physics of earthquake and tsunami, the dynamic rupture process were studied by inverting the long-period waveform data across the world. From moment tensor inversion, the scalar seismic moment was estimated to be 5.0×10^{22}Nm (moment magnitude Mw9.1); the strikes, dips and rakes are 340º, 17º and 114º for one nodal plane and 141º, 74º and 83º for another, respectively. The aftershock distribution and existing faults indicated that the nodal plane striking 340º is causative fault. From the source time functions (STFs) retrieved, it is found that the earthquake has duration of rupture of about 450s, and consisted of mainly 3 sub-events, which occurred consecutively in the first 120s, 120s to 280s, and 280s to 450s. From the inverted slip distribution, the fault length is estimated to be around 1000km, the rupture was mainly unilateral and slip pulse propagated to strike direction. The imaged static slip distribution indicated that most of strain energy was released in a region around the hypocenter, with the maximum slip of up to 30m near the hypocenter. The snapshots of slip rate and slip show that during the rupture process both rupture velocity and slip rate on the fault plane were varying with time and location. It is shown that the complicated dynamic rupture process, especially, strong directivity of rupture, huge dimension of fault and megathrust faulting mechanism are critical for the devastating disaster.