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The Source Properties of the 1999 Ms7.6 Chi-Chi, Taiwan, Earthquake

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The Ms7.6 Chi-Chi earthquake, which ruptured the Chelungpu fault, struck central Taiwan on 20 September 1999 at 17:47 p.m. GMT. This large thrust-faulting earthquake produced serious damage in several urban cities, including the City of Taipei, which is about 150 km far away from the epicenter. The source, path, and site effects are three important factors in affecting the spatial pattern and degree of damage. In this work, only the source effect is taken into account. Direct observations and inversion from the recorded data lead to the estimates of source parameters and the inference of rupture processes of the event. Results show remarkable differences in near-fault ground motions between the northern and southern segments of the fault.

Several source parameters, including the surface ruptures, slip distribution with the average displacement on the fault plane, peak ground velocity (PGV), peak ground acceleration (PGA), predominant frequency (f_o), corner frequency (f_c), spectral level (Ω_o), seismic moment (M_o), static stress drop ($\Delta\sigma_s$), dynamic stress drop ($\Delta\sigma_d$), rupture velocity (V_R), characteristic slip displacement, strain energy (ΔE), seismic radiation energy (E_s), fracture energy (E_g), and frictional energy (E_f) are reviewed. In addition, the spatial distribution of the frequency associated with the peak ground motions and long-term behavior of events rupturing the fault obtained from trenching are also taken into account.