TAO, Vol. 17, No. 1, 179-202, March 2006

A Review of the Source Parameters of the 1999 M_s7.6 Chi-Chi, Taiwan, Earthquake

Jeen-Hwa Wang[1,*]

(Manuscript received 3 January 2005, in final form 5 December 2005)

ABSTRACT

An M_s7.6 Chi-Chi earthquake, which ruptured the Chelungpu fault, struck central Taiwan on 20 September 1999 at 17:47 p.m. GMT. Observed data and inversion results lead to the estimated values of source parameters of the earthquake based on distinct methods for measurement or inversion. In this study, the values of several source parameters, including the surface ruptures, displacements 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), strained energy (ΔE), seismic radiation energy (E_s), etc are reviewed. In addition, the observed source scaling law is also taken into account. Results show remarkable differences in source properties between the northern and southern segments of the Chelungpu fault.

(Key words: Chi-Chi earthquake, Source parameter)

1. INTRODUCTION

Earthquake rupture processes are examples of the physics of complexity. Stress exerted by regional tectonics increases with time. When such a stress reaches the breaking strength, i.e., the static frictional stress of the fault zone, the frictional stress decreases with either velocity or displacement (cf. Wang 1996, 2002), and then the fault breaks, thus generating an earthquake. The frictional force in the fault plane and the coupling between the plates and the fault zone can resist the motions of the fault plane, and the stress in the fault zone then drops to

[1] Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan, ROC

[*] *Corresponding author address:* Dr. Jeen-Hwa Wang, Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan, ROC; E-mail: jhwang@earth.sinica.edu.tw