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A One-body Model of the 1999 Chi-Chi, Taiwan, Earthquake

Jeen-Hwa Wang[1,*]

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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 show remarkable differences in source properties between the northern and southern segments of the Chelungpu fault. In this study, the Chelungpu fault is divided into two individual segments, and each segment is approximated by a one-body spring-slider model in the presence of friction. Results show that the simple model can interpret the differences in displacements and predominant periods between the two segments. Meanwhile, the ground surface displacement of the fault is capable of reflecting behavior of the thoroughly ruptured area, consisting of numerous different asperities, while the predominant period is able to display the oscillations of a major asperity in the fault plane. However, based on ground surface data the simple model cannot explain the differences in velocities and accelerations between the two segments.

(Key words: One-body spring-slider model, Displacement, Velocity, Acceleration, Stress drop)

1. INTRODUCTION

The M_s7.6 Chi-Chi earthquake struck central Taiwan on 20 September 1999 at 17:47 p.m. GMT (Ma et al. 1999; Shin 2000). The earthquake resulted from an over 80-kilometer-long, east-dipping thrust fault (that is, the Chelungpu fault), with a maximum vertical ground displacement of over 6 meters and with a maximum horizontal ground displacement of over 9 meters.

Since the occurrence of the Chi-Chi earthquake, numerous seismological, geophysical, geodetic, and geological observations have been made. All the results show remarkable differences in source properties between the northern and southern segments of the Chelungpu fault.

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

[*]*Corresponding author address*: Prof. Jeen-Hwa Wang, Institute of Earth Sciences, Academia Sinica, P. O. Box 1-55, Nangang, Taipei, Taiwan, ROC; E-mail: jhwang@earth.sinica.edu.tw