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Static Stress Transfer and Aftershock Triggering by the 1999 Chi-Chi Earthquake in Taiwan

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ABSTRACT

The static stress changes caused by the Chi-Chi mainshock with M_L=7.3 were analyzed with an elastic dislocation model in a homogenous half-space. The results show that most aftershocks in the fold-and-thrust belt might best be interpreted as the re-activation of pre-existing thrust faults triggered by the mainshock. Strike-slip motions near the terminations of the Chelungpu fault are also likely to have been enhanced by the static stress transfer. The Chukou fault, on the other hand, fell in a stress shadow; as a result, few aftershocks occurred there.

The Chia-Yi earthquake sequence which occurred a month after the Chi-Chi earthquake turns out to have been an exception in this study. No evidence of static stress enhancement was found in that area. Unless the large aftershocks which followed the Chi-Chi earthquake altered the stress field and promoted failure, the time lag of the Chia-Yi earthquake might well be attributed to the influence of a stress shadow.

(key words: Chi-Chi earthquake, Coulomb failure stress, Static stress changes)

1. INTRODUCTION

Taiwan is located at the active convergent boundary between the Eurasian and Philippine Sea plates. Collision of the two plates have frequently induced many large earthquakes and caused serious damage especially in eastern, northwestern and southwestern Taiwan. Compared to these highly vulnerable areas, central Taiwan, on the other hand, had been relatively inactive in terms of seismicity until 21 September, 1999 (local time), when a major earthquake with local magnitude of 7.3 struck the Taichung-Nantou area killing more than 2,500 people. In many places, this strong shock lasted more than 40 seconds and more than 980 gal. ground acceleration was experienced. With the mainshock, the Chelungpu fault, a reactive thrust fault, extending nearly 77 km in the North-south (NS) direction, ruptured the ground with a maxi-

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