利用航照相關性和庫倫應力轉移探討初鄉活動斷層在集集地震的同震活動性

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摘要

初鄉斷層位於台灣西部麓山帶車籠埔斷層與雙冬斷層之間，呈東北-西南走向的活動斷層，西南側併入車籠埔斷層，東北側向雙冬斷層延伸。1999 年台灣中部的集集地震，車籠埔斷層沿線形成約 100 公里的地表破裂，根據同震地表 GPS 資料顯示，跨初鄉斷層的地表同震位移方向有顯著差異，然而未有報導指出初鄉斷層跡沿線有同震的地表變形。根據台灣機率式地震危害度分析，指出初鄉斷層在未來 50 年內有高達 37%的機率發生規模 6 的地震，為了解初鄉斷層再活動風險，本研究前期主要探討初鄉斷層於 1999 年集集地震的同震活動性。使用在 1999 年集集地震前、後之歷史航照影像，以 Micmac 軟體建置初鄉斷層於集集攔河堰地區的歷史數值地表模型與正射影像，透過像素關聯分析，試圖了解初鄉斷層於 1999 年地震時可能伴隨的同震地表破裂或變形；藉由地表 GPS 觀測到的同震位移，配合彈性半無限空間錯位模型，依據前人研究建立車籠埔斷層幾何形貌，模擬集集地震在車籠埔斷層面上的滑移量分布。建立地質構造剖面探討初鄉斷層的幾何型態及構造特性，並利用庫倫應力轉移模型，計算集集地震對於初鄉斷層的應力影響，評估初鄉斷層是否有同震觸發可能性，藉以了解初鄉斷層的可能活動性。

關鍵字：初鄉斷層、錯移模型、庫倫應力

Determination of Chi-Chi coseismic activation of the Chusiang active fault using aerial image correlation and Coulomb stress transfer

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Abstract

The Chusiang fault in the Taiwan western foothills is located between the Chelungpu fault and the Shuangtung fault. It strikes northeast to southwest, extending northeastwards to the Shuangtung fault and southwestwards merging into the Chelungpu fault. During the 1999 Chi-Chi earthquake, the surface rupture of the Chelungpu fault extended over 100 km. The coseismic GPS data shows that the horizontal displacement direction has changed significantly after passing through the Chusiang fault. However, there are no reports of coseismic surface deformation along the Chusiang fault trace. According to Taiwan's Probabilistic Seismic Hazard Analysis, it points out that there is a 37% chance of a magnitude 6 earthquake caused by the Chusiang fault in the next 50 years. In order to understand the risk of the Chusiang fault reactivation, the early stage of this study discusses the coseismic activity of the Chusiang fault during the 1999 Chi-Chi earthquake. This study uses the historical aerial images before and after the 1999 Chi-Chi earthquake and the Micmac software to build the historical digital surface model (DSM) and orthophoto of the Chusiang fault close to the Chi-Chi weir. Through pixel correlation analysis, this study tries to understand the possible coseismic surface rupture or deformation of the Chusiang fault during the 1999 earthquake. Using the coseismic displacement observed by the surface GPS, combined with the elastic semi-infinite spatial dislocation model, the geometric shape of the Chelungpu fault was established. This is based on previous research to simulate the slip distribution of the Chi-Chi earthquake on the Chelungpu fault, and establishs a geological structural profile to explore the geometry and structural characterristics of the Chusiang fault. The Coulomb stress transfer model will be used to calculate the stress effect on the Chusiang fault. To understand the Chusiang fault activity, this study evaluates whether the Chusiang fault has the possibility of coseismic triggering.

Keywords: Chusiang fault, dislocation model, Coulomb stress