

Rupture process of the 2022 M_w 7.0 Chihshang, Taiwan earthquake

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According to the report by Central Weather Bureau (CWB) of Taiwan, the M_L 6.83 Chihshang, Taiwan earthquake occurred at 06:44:15 (UTC) on September 18, 2022. The epicenter is in Chihshang town, Taitung County, Taiwan. The reported focal mechanism by different organizations are: CWB (205°, 61.3°, 46.6°); GCMT (201°, 61°, 30°) and USGS (203°, 69°, 25°), indicating a west-dipping direction that is different from the known east-dipping LVF.

To investigate the rupture process of the Chihshang earthquake, we used strong motion waveforms of 14 stations, geodetic data of 36 GNSS stations (Figure 1), and P -wave waveforms of 31 teleseismic stations to perform a joint source inversion. We adopted a two-segment source fault model (Figure 1), which consists of a west-dipping segment and an east-dipping segment. The west-dipping segment (strike: 198°, dip: 60°) is generally consistent with the focal mechanism and the east-dipping segment (strike: 18°, dip: 60°) represents the longitudinal valley fault (LVF). The inversion results showed that the rupture of the mainshock originated from the hypocenter and then it propagated on the west-dipping segment at a speed of 3.2 km/s, and meanwhile it triggered the slip on the east-dipping segment. The rupture lasted about 30 s, releasing a total seismic moment of 5.4×10^{19} N·m, corresponding to an M_w of 7.1. The surface projection of the total slip distribution is shown in Figure 1. The large slips of 3 or 4 meters occurred in the shallow part (< 10 km), which is close to the Yuli fault, on the west-dipping segment; while the small slips of 1 or 2 meters occurred at very shallow part (< 5 km), which is close to the northern end of the Chihshang fault, on the east-dipping LVF.

In conclusion, the rupture process of the Chihshang earthquake demonstrated the existence of a west-dipping fault in southeast Taiwan, which might be part of the west-dipping Central Range Fault (CRF), and the east-dipping LVF was also triggered with small slips during this earthquake.

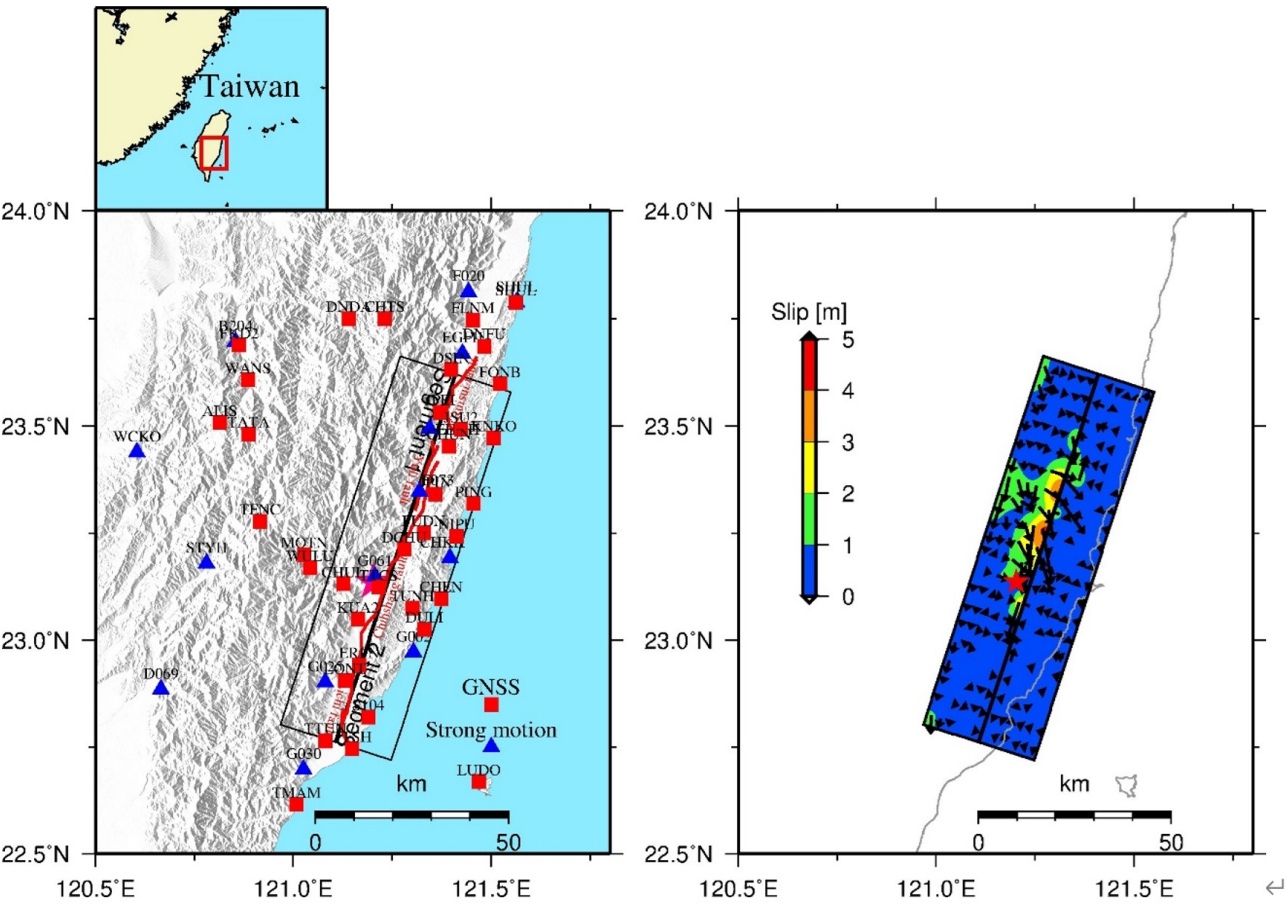


Figure 1. Source region map of the 2022 Chihshang, Taiwan earthquake and surface projection of total slip distribution.