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A fault slip model of the 2016 Meinong, Taiwan, earthquake from near-source strong motion and high-rate GPS waveforms

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The 6 February 2016 MW 6.5 Meinong earthquake (03:57:26.1 local time) occurred at about 30 km ESE of the Tainan city with a focal depth of 14.6 km. It is a mid-crust moderate-sized event, however, produced widespread strong shaking in the 30-km-away Tainan city and caused about 10 buildings collapsed and 117 death. Furthermore, the earthquake created a 20 x 10 km2 dome-shaped structure with a maximum uplift of ∼13 cm in between the epicenter and the Tainan city. We collected 81 50-Hz GPS and 130 strong motion data recorded within 60 km epicentral distances. High-rate GPS data are processed with GIPSY 6.4 and the calculated GPS displacement wavefield record section shows 40-60 cm Peak Ground Displacement (PGD) concentrated at 25-30 km WNW of the epicenter. The large PGDs correspond to 65-85 cm/sec PGV, which are significantly larger than the near-fault ground motion collected from moderate-sized earthquakes occurred worldwide. To investigate the source properties of the causative fault, considering the azimuthal coverage and data quality, we selected waveform data from 10 50-Hz GPS stations and 10 free-field 200-Hz strong motion stations to invert for the finite source parameters using the non-negative least squares approach. A bandpass filter of 0.05-0.5 Hz is applied to both high-rate GPS data and strong motion data, with sampling rate of 0.1 sec. The fault plane parameters (strike 281 degrees, dip 24 degrees) derived from Global Centroid Moment Tensor (CMT) are used in the finite fault inversion. The results of our joint GPS and strong motion data inversion indicates two major slip patches. The first large-slip patch occurred just below the hypocenter propagating westward at a 15-25 km depth range. The second high-slip patch appeared at 5-10 km depth slipping westward under the western side of the erected structure shown by InSAR image. These two large-slip patches appeared to devoid of aftershock seismicity, which concentrated mainly at the low-slip zones.