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Coseismic and postseismic velocity changes caused by the 2016 Mw 6.5 Meinong, Taiwan earthquake using ambient seismic noise

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The 6 February 2016 MW 6.5 Meinong earthquake with a focal depth of 14.6 km produced widespread strong shaking in the 30-km-away Tainan city and caused about 10 buildings collapsed and 117 death. We collected seismic waveforms from 11 broadband stations within 40 km epicentral distances and reconstruct the Green's functions from cross-correlation function of ambient seismic noise between two stations. We first analyzed seismic data for six different frequency ranges from 0.01 to 2 Hz, which yielded time series for different station pairs from January 2014 to August 2016. Then we used an exponential model to fit the time series of velocity variation consisting of a coseismic velocity drop followed by seasonal changes and postseismic recovery. We found coseismic velocity drops of about 0.20% mostly in 0.5 to 1 Hz at the Hsinhua fault area and the region 20 km SW of the epicenter, however postseismic velocity variation differs between these two regions. The time series of velocity change presented a non-recovery trend in the Hsinhua fault area, however the SW region is indicated by a recovering trend three months after the Meinong earthquake. For the surface wave tomography results in southwestern Taiwan, the regional geological structures are recognizable in the estimated phase-velocity dispersion maps. The dispersion map in the 7.0s Rayleigh wave displays low velocity in the alluvial plain, but indicates high velocity in the north of the Hsinhua fault. The anisotropy direction changes from SSW in the south to SW in the north, which followed the strike of regional geological structure. During the three months of the postseismic period, based on the GPS observations in the Hsinhua fault area, the block south of the fault continuously moved 15 - 20 mm along the southwest direction while the north of the fault remained stationary. The Hsinhua fault is located near the boundary between the Tainan basin and the muddy continental shelf, and where the block south of the fault is on the continental slope. We suggest that the coseismic velocity drop was caused by the earthquake shaking in the soft deposited materials with increase of porosity. The shorter recovery time and thus velocity increase in the block south of the Hsinhua fault was resulted from the afterslip of the Meinong earthquake, which resulted in the stress increases and the closure of the micro-fracture. On the contrary, the Hsinhua fault acts as a barrier blocked the afterslip south of the fault.