Coseismic and Postseismic Velocity Changes caused by the 2016 Mw 6.5 Meinong, Taiwan Earthquake using Ambient Seismic Noise

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Abstract

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 17 high 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 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 December 2016. We found coseismic velocity drops of about 0.463% mostly in 0.5 to 1 Hz at the north of the Hsinhua fault and 0.206% at the south part, however postseismic velocity variation differs between these two regions. The time series of velocity change presented a non-recovery trend at the north area, however the south 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 3D velocity model displays low velocity in the alluvial plain, but indicates high velocity in the north of the Hsinhua fault. During the six months of the postseismic period, based on the GPS observations in the Hsinhua fault area, the block south of the fault continuously moved ~30 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 permeability, corresponding to soil liquefaction. 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. Apparently, the Hsinhua fault acts as a barrier blocked the afterslip south of the fault.

Key words: Ambient seismic noise, Surface wave tomography, 2016 Meinong earthquake.