Strong motions and estimation of the sursurface soil structure for the 2018 Hualien earthquake in Taiwan

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The 2018 Hualien earthquake occurred around 23:50, February 6, 2018 (local time). The depth of the event was about 10 km and the moment magnitude was 6.4 (USGS). Crustal deformation in the Hualien basin was clearly observed in the InSAR image (e.g., GSI 2018, Hashimoto 2018). The rupture propagated along the Milun fault from north to south and the northern part of the Longitudinal Valley fault was also ruptured. Particularly, the discontinuity of the interference fringes at the Milun fault was clear on the InSAR image.

In Hualien city, the middle-rise four buildings collapsed during the earthquake, due to the collapse of the pillars at the first floor. They were located at the place where discontinuous fringes were observed in the InSAR images. There is a possibility that the discontinuous displacements or ground motions in the vicinity of the fault affect on the damage of the buildings (NARlabs 2018).

In order to understand the cause of building damage in Hualien city and the heterogeneous subsurface soil structure in the Hualien basin, we performed microtremor array measurement on October 20-26, 2018. We performed the measurement at every 100-200 m along the EW section of the basin. At each measurement point, we used 5 seismometers to obtain the phase-velocity dispersion curves at the shallow subsurface structure. In total, we measured microtremors at 64 observation points and obtained the phase-velocity dispersion curves and H/V spectra.

Our profile shows that the peak of the H/V spectra is about 1-2 Hz along the measurement line, which probably corresponds to the basement at the depth of 50-100m. The average Vs at the depth of 10-30m is about 200-400 m/s. There is a clear difference between the east and west side of the Milun fault: at the west side of the fault, there is a soft soil deposit on the shallow surface (10m) with the average Vs less than 200m/s. At the east side of the fault, the soft layer with the Vs<400m/s is very thin. Therefore, we estimated the engineering bedrock of the west side of the Milun fault is deeper than the east side. This difference of the basin thickness is consistent with the movement of the Milun fault during the 2018 Hualien earthquake estimated from the InSAR image.

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