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Imaging of liquefaction features using Ground Penetrating Radar in Pohang, South Korea

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This study utilizes Ground Penetrating Radar (GPR) data to examine the disturbance of subsurface structure, which had been caused by liquefaction resulting from the magnitude 5.4 earthquake on 15 November 2017, South Korea. Soil liquefaction was observed for the first time in Korea. Liquefaction occurs when saturated sandy soil is subjected to a large shock like earthquake, which rearranges sand particles and results in excessive pressure of pore water. At this time, the effective stress and shear resistance of the soil layers become diminished and hence the ground behaves like a liquid. During liquefaction, therefore, the secondary damage like ground subsidence or building collapse can follow. We collected the GPR data using the pulseEKKO PRO 100 MHz GPR system, 27 days after the Pohang earthquake. The GPR survey was designed as a grid consisted of three 400 m long east-west lines with 50 m spacing and five 100 m long north-south lines with 100 m spacing. The measurement locations were determined from the GPS readings. For the post-processing, we applied a de-wow filter to remove low-frequency noise, bandpass filter to remove the frequency contents outside the main frequency range of the used antennas, and Spreading and Exponential Calibrated Compensation (SEC2) filter to compensate for the damping effect of waveform with respect to time. However, the near-surface geology of the study area consists of a mud-dominant layer at the top and sand-dominant layer at the bottom. Thus, the GPR penetration was not deep enough to image the sand-dominant layers (> 3 m depth), which appear to be the source of sand volcano observed along the surface. Nonetheless, the GPR data could visualize the evidence of the soil liquefaction from the disturbed upper silty mud layer characterized by a sharp discontinuity in the substrate. In order to enhance the subsurface image, we apply a Double-Sided Sliding Paraboloid (DSSP) technique to remove background noise and correct the given data for DC-shift and wow noise. Here we present the preliminary results from the GPR data collected at the earthquake-induced liquefaction site, which can be improved by advanced signal processing techniques.