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微動アレイ観測による大崎市古川地区の浅層地盤構造の推定
Estimation for velocity structure of shallow sediments using microtremor array observation in Furukawa, Japan

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On March 11, 2011, the Tohoku earthquake (Mw 9.0) brought the large ground motion and tsunami in the eastern part of mainland Japan. As a result, many buildings were seriously damaged and many people were killed. Furukawa of Miyagi prefecture is one of the most seriously damaged areas by the earthquake ground motion. The anomaly of the damage distribution was observed in this area. It is considered that the anomaly caused by difference in ground motion characteristics, and especially shallow ground structure affects ground motion characteristics. To identify the characteristics, some observations have been carried out in Furukawa, for example, very dense seismic array observations (Goto ea al., 2012) and so on. The observation covers 2?3km^2 area by 23 sensors and provides the relative information on depth to ground basement. However, it is still difficult to determine the absolute values of the depth to the basement.

In order to clarify the shallow ground structure in the area, the array observation of microtremors was carried out from December 13 to 16, 2014. The three components seismometer was adopted, that is, moving-coil type velocity sensor with the natural frequency of 2 Hz. We set three arrays in the north-western area of Furukawa station, which were the equilateral triangle arrays with radii of 2.9 m to 45 m.

The microtremor data were analyzed by the spatial auto-correlation (SPAC) method (aki, 1957). In the surface layer of ground, the shear-wave velocity is approximately 100 m/s at all the sites and the depth is 10 or 15 m. Also, the depth to the ground basement is around 35 m at all the sites. On the other hand, the differences of the ground properties are found in middle layers. It, however, is difficult to recognize the differences on the horizontal-to-vertical spectral ratios (H/V), because of the similarity of the predominant frequencies.

The estimated S-wave velocity structures suggest that the properties of middle layers affect to the anomaly of damage distribution. This means that the impedance ratio between middle layer and basement plays the important roles to the amplification of the ground motions in this area.
Keywords: microtremor, velocity structure, array observation, Furukawa, ground motion, spatial auto-correlation method