On Precision of S-wave Velocity Structure Determined by the Spatial Auto-Correlation Method

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To estimate shear wave velocity structure, several methods have been used, by active control sources, such as PS logging, reflection/ Refraction surveys. These methods are generally high cost and meet sometimes difficulties to apply in urban area. The array observation of microtremors provides a good estimate of the shear wave velocity structure by surface wave inversion with relatively low cost. The efficiency of the Spatial Auto-Correlation method has mostly been verified for deep underground structures. However, a few investigations have been applied for shallow structures, therefore, we are necessary to verify an accuracy and/or reliability of this method, in order to export in the field of earthquake engineering. To do this, we carried out array observations of microtremors at 5 sites and compared the results to the data of PS logging. We also compared the results with the optimum S-wave velocity structures determined by the spectral ratio of the surface to down-hole earthquake records and got reasonable agreement.

This method estimates average shear wave velocity structure in the array space. We postulated, for simplicity, that shear wave velocity increases gradually with depth. The approximation of fitting to the observed dispersion means an equivalent shear wave velocity structure in case high velocity layers included between a surface layer and a half-space. It is certainly difficult to estimate details of the boundaries of layer, however, the site amplification and dominant period are well assessed by this method. The agreement was obtained in the lower frequency than 5 Hz. We can conclude that the SPAC method has enough precision to apply for engineering purposes with the same level as that of PS logging data. We also examined that the SPAC method works well for deep underground structure rather than shallow structure.

The observable wave length (L) by this method were larger than 3.5R and smaller than 11R in average with a set of circular array consisted of a center and regular triangle of radius R. We recommend a variation by three times of radius for quick coverage of dispersion for wide frequency range.