Average S-wave velocities of top several meters at stations of the Shindo-Joho network in western part of Aomori prefecture

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As the Shindo-Joho network governed by local government is deployed more densely than K-NET and KiK-net, studying these data is very valuable. For example, in Aomori Prefecture we have 29 K-NET stations and 18 KiK-net stations, on the other hand, we have 67 Shindo-Joho network stations (from now on, we call Shindo station). All Shindo stations are set up close on town offices, where is a center of local community. This fact emphasizes the importance of studying ground motion at the Shindo station. However, unknown ground structure is the biggest defect. We decide to estimate underground structure at Shindo station. Exactly to say, ground structure means suites of P- and S-wave velocity and thickness of a site. However, estimating such values by simple way is difficult. We consider following conditions to decide an estimating method. 1. The method should need brief time, 2. The method should be simple, 3. The results of measurements are reusable, 4. Our study starts with amplification of ground shaking intensity. Finally, we concluded that we carry out an array measurement for micro-tremor and estimate an average S-wave velocity from Rayleigh wave phase velocity. The relation between an average S-wave velocity and Rayleigh wave phase velocity is proposed by Konno and Kataoka (2001). In this report, at first we described a relation between an average S-wave velocity and Rayleigh wave phase velocity at stations where underground structures are published. Then, average velocities at Shindo stations in west part of Aomori Prefecture, named Tsugaru region, are reported.

During measurements, we adopt triangle array using four seismometers. One seismometer is placed barycenter of an equilateral triangle and others are placed apexes. Distance from the center to an apex is changed from 4 meters to 26 meters. Unit record length was 200 seconds with sampling frequency of 200 Hz. Two or three recordings are done for one size array. Phase velocities are estimated by Spatial correlation method.

At first, we estimate average S-wave velocity of top 10 to 30 meters at K-NET station AOM020 and AOM016 and KiK-net station AOMH04, using micro-tremor array data. We also calculate average S-wave velocity from published underground structure. Ratios of estimated values to calculated values vary from 0.8 to 1.0 with depth. We concluded that these errors are acceptable. Because our array measurement is close to stations bu not exact point, changing velocities of near surface layers from published values is reasonable.

Then, we carried out micro-tremor observation at thirteen Shindo stations. Phase velocities are categorized into four groups with a view to estimate average S-wave velocity. First one is an excellent result. We can estimate average S-wave velocity from phase velocity without difficultly. Next one is good one. For the third group, scattered phase velocity makes difficult to estimate average S-wave velocity. For this case, we use a semblance analysis to confirm phase velocities. For the fourth group, contribution of higher mode Rayleigh wave is stood out. Even phase velocity is under such conditions, but we keep a proposed empirical relation between phase velocity and average S-wave velocity in a short wavelength region. So that reliability of estimated values is very low. Finally we list average S-wave velocities with note of these categories. Comparing amplification factors derived from attenuation relations with estimated average S-wave velocities, and low velocity sites have higher amplification factors.