[JJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS14]Strong Ground Motion and Earthquake Disaster

convener:Masayuki Kuriyama(Central Research Institute of Electric Power Industry)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Strong ground motion has social impacts as it induces earthquake disasters. We solicit contribution on any seismological topics related to strong ground motion that includes, but are not limited to, source processes, wave propagation, and site effects. We also welcome contribution on earthquake related disaster mitigation.

[SSS14-P15]A study on estimations of the P-wave and S-wave velocity structure based on the diffuse wave field theory, using H/V spectral ratios of micorotremors and earthquake motions.

*Kenichi Nakano[1], Satoru Koike[1] (1.HAZAMA ANDO CORPORATION)

Keywords:Geophysical exploration, H/V spectral ratios, Diffuse wave filed theory

Nakamura (1989) and his related works suggested that H/V spectral ratios for microtremors (MHVR) is amplifications of S-wave from seismological bedrock to surface. It is called “Nakamura method”. However, his works hasn't been able to overturn the theory is that MHVRs is composed of Rayleigh waves mainly. But, the discussion of theoretical interpretations to MHVRs has not been closed yet.

Sánchez-Sesma et al. (2011) proposed the diffuse wave field theory (DWFT) for MHVRs. This is the new interpretation to MHVRs. They derived the equation which allows us to understand that MHVRs at a surface on a horizontally layered medium equals to the ratio of imaginary part of Green’s function of horizontal component and vertical component. According diffuse field concept, as a result, we only need the Green’s function what source-point and receiver-point of are same in horizontally layered medium to calculate the MHVRs by theory.

Kawase et al. (2011) applied DFWT to earthquake motions. They derived the equation proves that the H/V spectral ratios for earthquake motions (EHVR) and the ratios of transfer function of horizontal component and vertical component t from bedrock to surface in horizontal layered medium are equivalent, according to diffuse filed concept. Their study gives us the useful theory to estimate the S-wave velocity structure from earthquake motions. These studies might bring a new development to the discussion we mentioned above.

In this study, we investigate the differencies of underground structure model estimated from MHVRs and EHVRs, using microtremors and earthquake motions in the same site.

We have been operated the earthquake observation at technical research institute of our company where is located in Tsukuba city of Ibaraki prefecture in Japan, and we collected the ground motion records. We selected the ground motion records from Aug. in 2008 to Dec. 2017 in dataset for this study. The criterion of selection are seismic intensity calculated by JMA of Tennodai-station at Tsukuba city larger than or equal to 2 (Before the Tohoku earthquake (Main shock) in 2011), or larger than or equal to 3

(After the Tohoku earthquake (Main shock) in 2011), and, we sort out the records depending on the incident angle and before and after of Tohoku earthquake in 2011. After the sorting, we cut the data for 81.92s to consider the body-wave and coda-wave. We calculated the EHVRs from those. Fig.1 shows the EHVRs computated from observation records, theoritical one based on DWFT, and the MHVR estimated by Nakano &Koike (2018). These are root mean square values of horizontal components.

Next, we combined the shallow-underground structure estimated by Mori et al. (2014) and the deep-underground structure model provided by the Headquarters for Earthquake Research Promotion (HERP, 2012). We call it “Initial model”. We identified the underground structure account for EHVRs in observations, using the Hybrid Heuristic Search (HHS) as an identification method proposed by Yamanaka et al. (2007) and the Genetic Algorithm (GA). The useful identification tools of DWFT for MHVRs are provided by García-Jerez et al. (2016) thourh out the web-page (https://w3.ual.es/GruposInv/hv-inv/), we use it for identification of MHVRs. The Initial model is used in both identifications.

As a result, we found that the shapes of EHVRs are harmonious to MHVRs at around 0.25Hz (dominant frequencies), while these are not similar in around 1 -5Hz. Also we found, the amplitude at predominant frequencies of EHVRs were not changed significantly depending on incident angle, while the difference of grooves depending on incident-angle were appeared in at around 0.2Hz. Furthermore, from the identifications of EHVRs and MHVRs, we got the several underground structure models which are different especially in shallow layers. It is our next works that we study about the differencies of the models estimated by EHVRs and MHVRs.