# Microtremor Array Surveys in the Yatsushiro Plain, Kumamoto

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The Yatsushiro plain, Kumamoto is located between the Hinagu fault and the Ariake Sea. The bedrock of the Yatsushiro plain is mostly made of the Ryoke belt (Early Cretaceous Higo Metamorphic rocks, Higo Plutonic rocks, Early to Middle Permian Ryuhozan Group) and Kurosegawa belt. Late Cretaceous sedimentary rocks (e.g., Mifune Group and Himenoura Group), terrace deposits, pyroclastic flow deposits, and alluvium overlay the bedrock (e.g., Hase *et al.*, 2008). Two thirds of the plain are reclaimed lands by drainage constructed in about 360 years between Keicho and Showa eras.

The sub-theme #3 of the Comprehensive Research Project for the Major Active Faults Related to the 2016 Kumamoto Earthquake by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) is working on developing a three-dimensional seismic velocity structure model in the Yatsushiro plain for improvement of strong motion prediction for future earthquakes along the Futagawa-Hinagu fault system. The microtremor array surveys are conducted in the Yatsushiro plain as a part of this research project.

Microtremor array observation was conducted on August 25-29, 2017 at 22 sites within the Yatsushiro plain. Additional observation including new sites was conducted on November 20-22, 2017. We conducted 5 to 6 sets of array observation changing the array radius from 494-642 m to 3-10 m. The distance between array sites was approximately 3 to 4 km. We analyzed these observed microtremor records together with microtremor array data at permanent strong motion stations in February 2017. In total, we have conducted and analyzed microtremor array observation at 33 sites in Yatsushiro city, Hikawa town, Uki city, and Misato town. The sensors used in those observations are Tokyo-Sokushin SE-321 (5V/(cm/s)), Tokyo-Sokushin VSE-15D6 (10V/(cm/s)), and Akashi SMAR-6A3P (1.1V/G with amplification by 5000). The microtremor at four or seven sensors within an array were recorded by Hakusan LS-8800 or LS-7000XT with GPS time synchronization.

The vertical component of microtremor was analyzed by SPAC method to obtain dispersion curve of phase velocity. We obtained the phase velocity at each arrays site in the frequency range higher than about 0.3-0.4 Hz. The phase velocity in higher frequency (> 5 Hz) ranges from 90 to 130 m/s in most part of reclaimed lands and alluvium area along the Kuma River. The array sites in reclaimed land of the Gunchiku district show relatively higher phase velocity (145-160 m/s) in the same frequency range. The sites near the Yatsushiro castle, Kagami and Matsubase districts have higher phase velocities compared to reclaimed lands in frequencies higher than about 1 Hz. These results imply spatial variability or heterogeneity of S-wave velocities in shallow part of sedimentary layers in the plain. The phase velocity in low frequency is 2-3 km/s at most sites. Thus, we have succeeded in obtaining dispersion curves having information on velocity structure from the bedrock to superficial layers.

Theoretical dispersion curve of the Rayleigh wave based on J-SHIS V2 (Fujiwara *et al.*, 2012) gives systematically higher phase velocities than observed phase velocities at most sites. On the other hand, another nation-wide velocity structure model JIVSM (Koketsu *et al.*, 2012) gives better results. With using

 

these phase velocity dispersion curves together with other geophysical and geological exploration results, a three-dimensional seismic velocity structure model will be developed in this project.

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Keywords: Yatsushiro plain, microtremor array survey, seismic velocity structure model

 