Construction of the shallow shear-wave velocity model in Taiwan

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Taiwan is an ongoing orogeny induced by complex arc-continent collisions between the Philippine Sea plate and the Eurasian plate with high seismicity. It is an essential issue to clearly understand the characteristics of the earthquake strong motion for reducing and preventing the earthquake hazard in Taiwan. Although there are many 3D velocity models presented by using seismic tomography for waveform simulation, a complete and detail shallow velocity model, which is necessary to consider the seismic site-effect of strong motion, is still inexistent in Taiwan. This study is systematically studying on shallow shear-wave velocities to construct a high- resolution substructure model for Taiwan.

National Center for Researching on Earthquake Engineering (NCREE) has collected high-quality near-surface data by drilling at 483 stations of Taiwan Strong Motion Instrumentation Program (TSMIP) since 2000. These data provide good references and constraints from the ground surface to the depth of tens of meters. Therefore, this study focuses on the shear-wave velocity model within the depths of about two kilometers to provide the structural information of engineering and seismological bedrocks. There are three major methods used in this study. By taking advantage of the well-distributed TSMIP stations and numerous earthquake records in Taiwan, a receiver function analysis of strong-motion acceleration seismogram is applied to estimate shallow shear-wave velocity profiles for TSMIP stations. Compared with the receiver function analysis, the other two methods respectively use microtremor data of array and single-station measurements. About 150 microtremor array measurements have been conducted and analyzed using Rayleigh-wave inversion technique. Furthermore, a dense microtremor survey of over 3000 sites has been conducted to evaluate the detail site response all over Taiwan by using the horizontal-to-vertical (H/V) spectral ratio analysis. The microtremor H/V spectral ratio data of all sites can be modeled to provide detail shear-wave velocity information. A combined shallow shear-wave velocity model for Taiwan is expected to be constructed based on the results of the above methods and other existing data. It will be a great benefit to improving ground motion simulation and prediction.