35th General Assembly of the
European Seismological Commission

4-10 September 2016   Trieste

Construction of 3D Shear-wave Velocity Model for Ilan Basin, Taiwan, using Microtremor H/V Spectral Ratio Modeling

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The Ilan basin, belonging to the southwestern extension of the Okinawa Trough back-arc basin, is located in north-eastern Taiwan. This basin is filled with unconsolidated Quaternary alluvium covering on the Miocene basement. The seismicity is extremely high around this basin because of the subduction. The obvious seismic site-effect would amplify and extend the incident seismic waves and result in earthquake disasters. A detailed 3D shear-wave velocity model reflecting the real and complex seismic site-effect is necessary for the ground motion simulation and prediction of the Ilan basin. A dense microtremor survey of over 300 sites has been conducted to evaluate the detail site response all over the Ilan plain by using the horizontal-to-vertical (H/V) spectral ratio analysis in the previous study. This microtremor H/V spectral ratio data is modeled to estimate the shallow S-wave velocity profiles using the GAhask method, which combines the Thomson–Haskell propagator matrix theoretical transfer function with the Genetic Algorithm, in this study. The numerous microtremor data provide enough information to figure the shear-wave velocity and thickness of the strata of the basin. Finally, a combined 3D shear-wave velocity model of the Ilan basin was constructed. The Miocene basement we estimated shows good correlation with the existing seismic reflection and other geophysical data. The 3D model also provides detail information of the complex shallow structure which is comparable with the seismic site-effect of the Ilan basin.