Geophysical Research Abstracts
Vol. 21, EGU2019-4599, 2019
EGU General Assembly 2019

A Study of Site Effect Using Borehole Seismic Network in Taiwan

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Since the inception of 62 borehole seismic arrays deployed by Central Weather Bureau (CWB) in Taiwan until the end of 2018, a large quantity of strong-motion records have been accumulated from frequently occurring earthquakes around Taiwan, which provide an opportunity to understand the site effects (e.g., amplification) caused by the subsurface materials. Each borehole array includes two force balance accelerometers, one at the surface and other at a depth of a few ten-to-hundred (30-492) meters, as well as one broadband seismometer is below the borehole accelerometer. In general, the background seismic noise level are lower at the borehole stations than surface stations, facilitating to detect microseismicity. For a few earthquakes, the seismograms recorded by the borehole stations are smaller than surface stations due to the different geological conditions. The resulting of site-specific spectral decay parameter κ_0 (Kappa value) has been derived by our pervious study, and relative higher κ_0 could be observed at surface station, indicating a strong attenuation effect. In this study, we used 147 earthquakes with local magnitude (M_L) > 4.0 to investigate the site amplification at materials between downhole and surface stations. Result shows the amplification factors ranging from 1.1 to 10, provide additional parameter to understand the site effect. These amplification factors have a strong relationship with Vs30 (the average S-wave velocity of the top 30 m of strata), showing the linear correlation coefficient of -0.6. Furthermore, we conduct a series investigation of borehole-based and surface-based M_L values for a purpose of providing the comprehensive earthquake catalog and additional seismic records to study earthquake early warning.