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Single-Station Strong Ground-Motion Relationship for North Eastern Taiwan Subduction Zone Earthquakes

Ting-Yu Yeh and Chyi-Tyi Lee

Graduate Institute of Applied Geology, National Central University, Taoyuan City, Taiwan (ting.yu830@gmail.com)

Sigma (standard deviation) of ground-motion prediction equation (GMPE) has great impact on probabilistic seismic hazard analysis (PSHA). Therefore, how to properly evaluate the sigma has been a crucial issue currently. It is very suitable for seismic-related research due to the abundant earthquake data in Taiwan. With establishing single-station GMPE, the sigma can be reduced due to eliminating the variance from site effect.

In this study, ground-motion data of subduction zone for both interface and intraslab earthquakes are obtained from the Taiwan Strong-Motion Instrumentation Program (TSMIP). A total of 174 earthquakes and 14,551 records which moment magnitude greater than 4.0 are selected to establish PGA attenuation relationship. We chose the general usage of the functional forms by reviewing of previous studies. Each candidate term in the form was tested with Taiwan data set. The final form is generally similar to the form proposed by Lin and Lee (2008), besides a quadratic magnitude term, a VS30 term and a focal mechanism term were added. The coefficients of the equation are determined through non-linear regression analysis using maximum likelihood method (MLE) and mixed-effects model.

Both regional GMPE and 44 single-station GMPEs are done in this study. The results show that intraslab earthquakes generaly predict higher PGA than that of interface earthquakes. Comparing the sigma of regional GMPE and single-station GMPEs, the single-station sigmas are smaller than the regional sigma with a reduction rate from 1.5% to 37.0%, averaging 21.7%.