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Estimation of source, path and site parameters using generalized inversion technique based on empirical reference site

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In this study, strong motion data recorded from 2008 to 2015 is used to estimate the source spectra, the quality factor and the site responses of the Longmen Shan region. Because no station site meets the criteria of hard-rock reference site, an empirical reference site condition constructed from regional average site amplification function and station-specific high-frequency attenuation parameters are used in generalized inversion technique (GIT), and it has been firstly validated by comparing with classical GIT method. A high-frequency attenuation phenomenon is observed in source spectra of some 2008 Wenchuan and 2013 Lushan aftershocks with M_S $\geq$4.7. The stress parameters ($\Delta\sigma$) of 143 earthquakes are varying from 0.3 to 27.4 MPa with an average value of 2.4 MPa. Moreover, the average $\Delta\sigma$ of aftershocks occurred within one month is 1.6 MPa, and that of earthquakes occurred during other periods is 3.0 MPa. Because the attenuation characteristics of different tectonic units have been confirmed to be significantly different, the Longmen Shan region are divided into mountainous and basin region, and the quality factor is obtained as $Q(f) = 264f^{0.75}$ and $Q(f)$=$223f^{1.01}$, respectively. Site responses of 83 strong motion station sites are also obtained. The station sites are categorized into site class A, B and C based on the taxonomy of the Next Generation Attenuation, although all of these sites are classified as site class II according to Chinese classification. The result indicates that the peak amplification levels of the three site classes are similar; the peak amplification platforms, however, are tend to develop toward a broader frequency range as the sites become softer. Finally, the Wenchuan mainshock are simulated based on these parameters by applying stochastic finite-fault simulation method. The result shows that the simulated 5%-damped response spectra of acceleration and peak ground acceleration are agree well with the observations.