

Estimation of site effects and Q factor using two reference sites

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Absolute site amplification and the quality factor, Q could be retrieved by modifying the method described in Iwata and Irikura (1988). Spectral ratios are conventionally estimated with respect to a reference site and by using techniques such as the Singular Value Decomposition Method (SVDM) a matrix consisting of spectral ratios of site effects and the quality factor can be solved. We modified the writing of the spectral ratios as a difference,

$$\ln [G_{ji}(f)/G_{ri}(f)] = \ln[G_{ji}(f)] - \ln[G_{ri}(f)] \quad (1)$$

where $G_{ji}(f)$ is the observed record of the i -th event at j -th site and $G_{ri}(f)$ is the corresponding record of the i -th event at the reference site, r . This allows for the solution of the site, j , and the reference site, r . However, in solving (1), there is an obvious trade-off between the sites at different frequencies. The way to avoid this is by assuming an omega-square source spectral model that is added into the matrix and will be an amplitude normalization factor for the solution of the sites.

In addition to yielding the absolute amplitude for the site effects, the way (1) is written can be also extended to include more than one reference site. This approach was tested by inverting synthetic site effects and quality factor. For the test, we used different levels of noise and were able to recover the original model.

Reference:

Iwata, T. and K. Irikura (1988). Source parameters of the 1983 Japan Sea earthquake sequence, *J. Phys. Earth.*, 36, 155-183.