Geometrical spreading factor of layered half spaces and attenuation relation

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As many strong motion seismometers (K-NET, KiK-net) almost uniformly distributed, the data shows deviation from proposed attenuation functions (Horike & Otani,2001, Midorikawa,2001). Many formulas of the attenuation relation have a form of logA = aM - logX - bX + c(A:maximum ground motion, M:magnitude, X:hypocentral distance). The term of -logX means that the geometrical spreading factor is reciprocal of hypocentral distance.

In this study, we calculate maximum amplitude attenuation of geometrical spreading factor using the green function (Hisada,1994). The parameters of Vp and Vp are after Ichikawa and Mochizuki(1971). Q-values are set as large enough value, 1000, for each layer. Area of calculation is 0-100km in depth, and 0-400km in epicentral distance. Directions of Sources are X,Y and Z-component, and Ricker wavelet of 3 s are adopted in each directions simultaneously. Amplitude of observation points calculated as root mean square of X and Y-component.

The result shows the slopes of attenuation are larger than the 1/X slope. Next, we obtained the function of geometrical spreading factor as follows,

logA = aM - log(GSF)- bX + c
log(GFS)=j logX+k
j = -0.015 h - 1 (h 0--50km)
j = -1.75 (h 50km--)
k = 0.035 h (h 0--50km)
k = 1.75 (h 50km--)

The calculated PGA using the above function are consistent with the K-NET PGA data.