Influence of spatial correlation on sigma

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Estimation of spatial correlation

\[ \varepsilon_i = \ln Sa_i(T) - \ln Sa_i(M, R_i, T, \ldots) - \eta \]

Assume stationarity and isotropy, then pool paired observations with comparable distances

PGA \( \varepsilon \)'s from the 1999 Chi-Chi earthquake

\( \varepsilon \)'s at two sites separated by a specified distance
Recent spatial correlation models of this type

- These models have no functional dependence on magnitude, azimuth, etc.
- The only potential detectable dependence: regional variation or heterogeneity in site conditions
Conditional standard deviation given nearby observation

Plan view of geometry:

Conditional standard deviation
(1 second, within-event std. dev.):

\[ \phi_{\ln S_a,\text{cond}} = \phi_{\ln S_a} \sqrt{1 - \rho^2} \]
Conditional standard deviation given nearby observation

Plan view of geometry:

Conditional standard deviation (1 second, within-event std. dev.):
Earthquake-specific correlation ranges from 2009 study

Empirical semivariogram for PGA ε’s from the 1999 Chi-Chi earthquake

Data used for 2013 study

\[ C(h) = B_1 \exp\left( -\frac{3h}{20} \right) + B_2 \exp\left( -\frac{3h}{70} \right) + B_3 \mathcal{I}_{h=0} \]

Loth and Baker (2013). “A spatial cross-correlation model of ground motion spectral accelerations at multiple periods.” EESD, 42(3).
References


