

SEISM plans: GMSV using SDOF oscillators

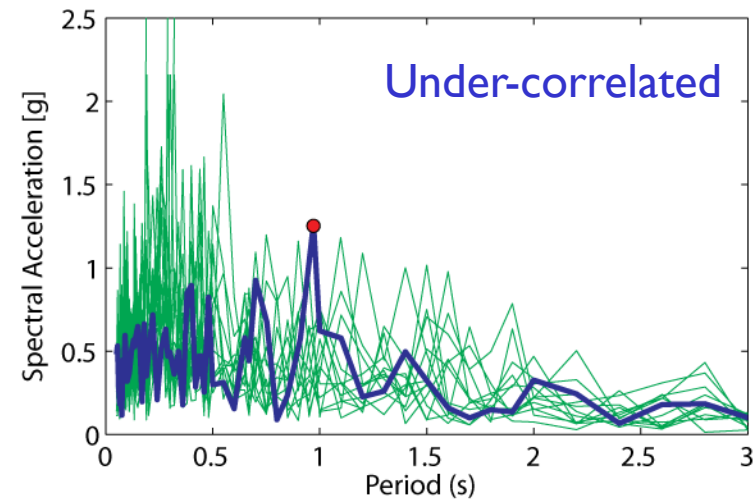
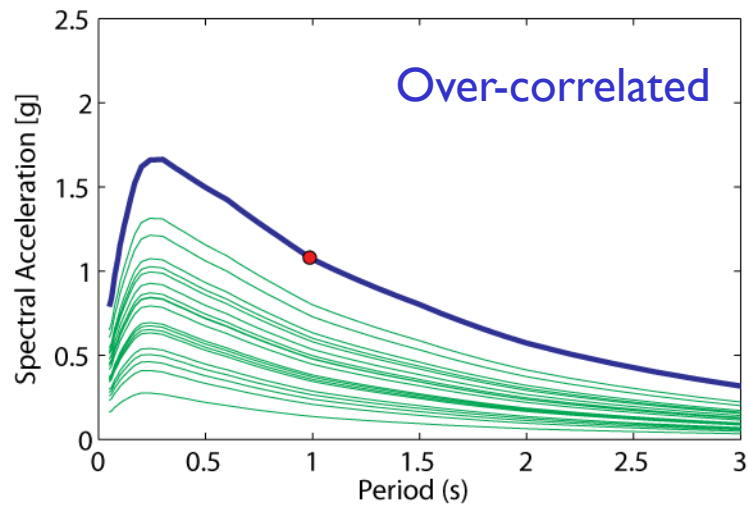
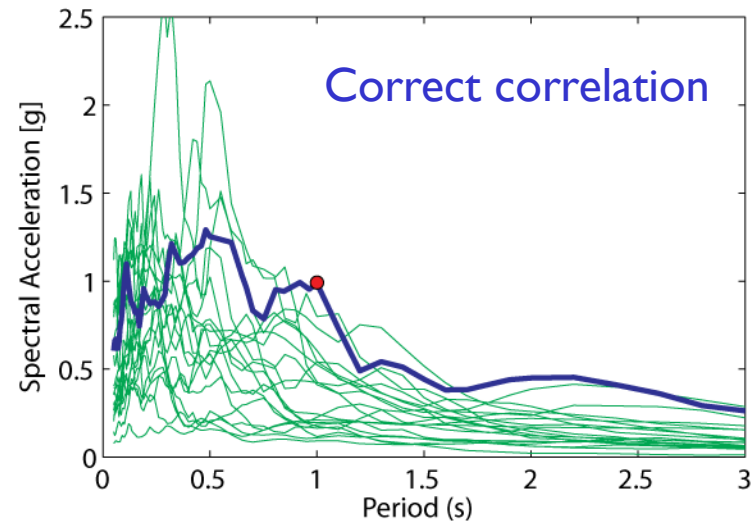
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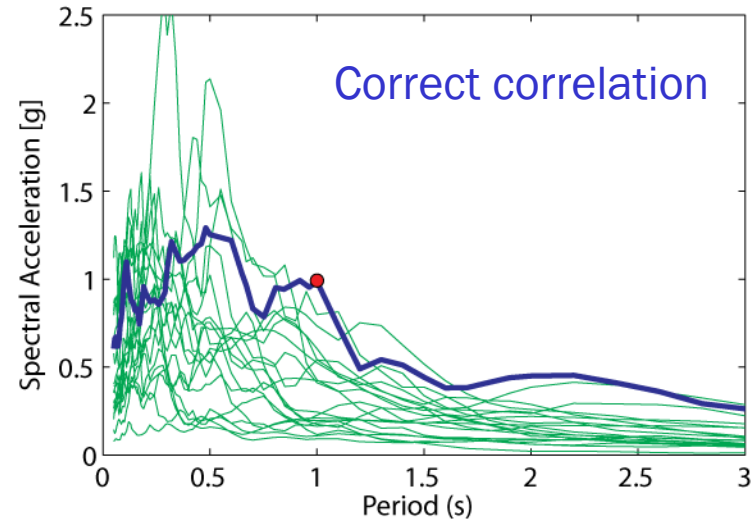
Spectral correlations

Hypothetical response spectra having the same means and standard deviations.

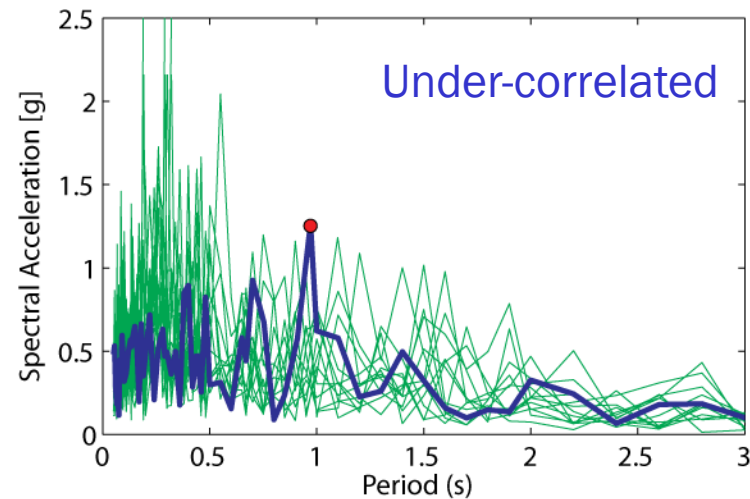
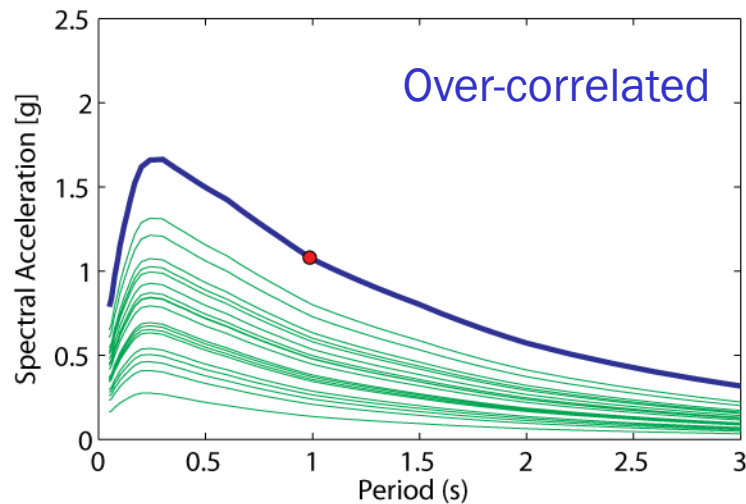


Spectral correlations are important and easily measurable

Hypothetical response spectra from ground motion simulations with a fixed M & R. All sets of spectra have the same means and standard deviations.

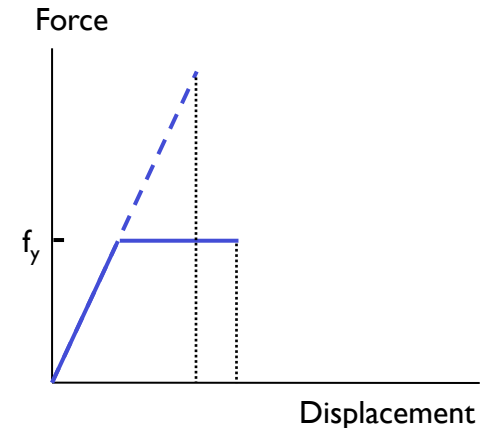


Empirical models for correlation are available, and are surprisingly stable across magnitude, distance, site condition, tectonic regime, etc.

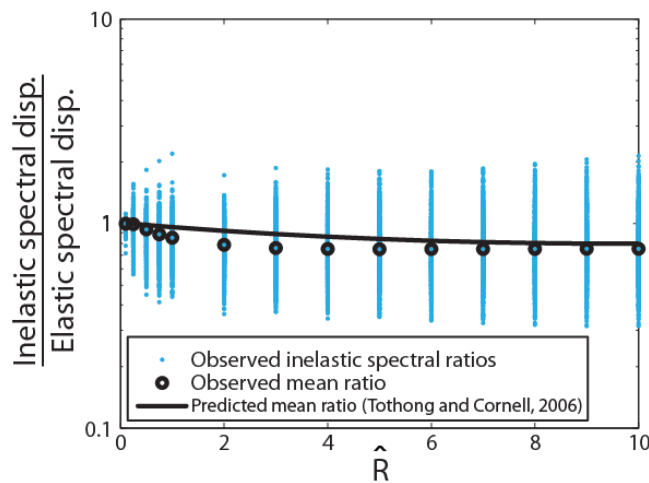


Nonlinear response spectral ratios

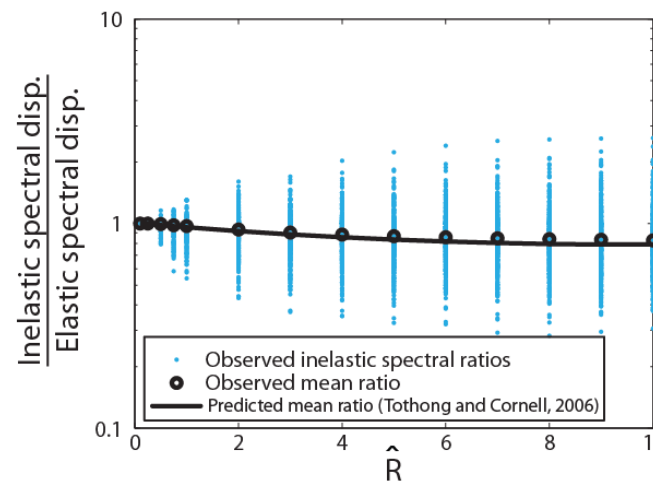
- Complimentary to elastic response spectra
- Also tied to engineering intuition
- Can still be tied to statistics of recorded ground motions
 - Predictive model available (e.g., Tothong and Cornell, 2006)
 - Relatively insensitive to most parameters besides magnitude and site nonlinearity



Simulated ground motions



Observed ground motions



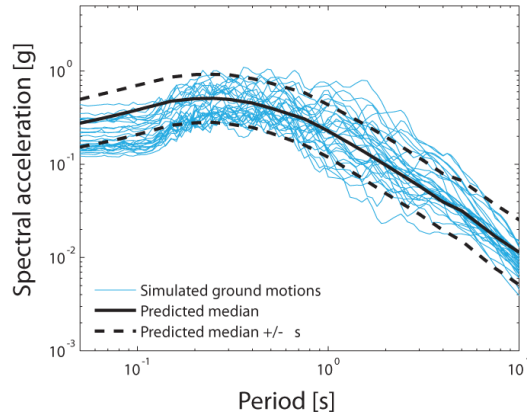
$T = 4s$

Record criteria:
 $M > 6.5$
 $V_{s30} > 300 \text{ km/s}$

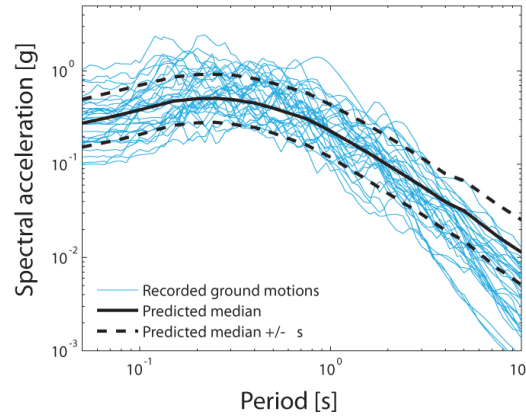
Expected level of nonlinearity

Nonlinear response spectra

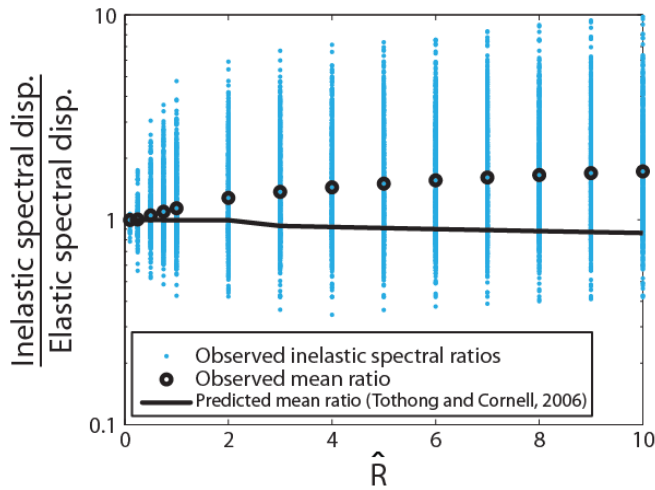
Simulated ground motions



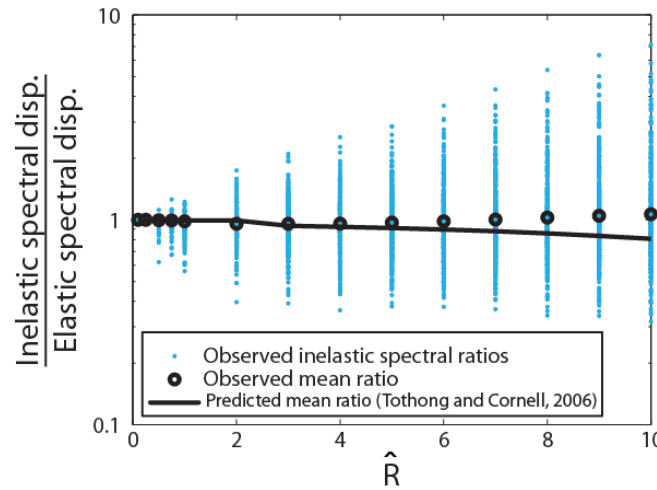
Comparable observed ground motions



Simulated ground motions



Observed ground motions

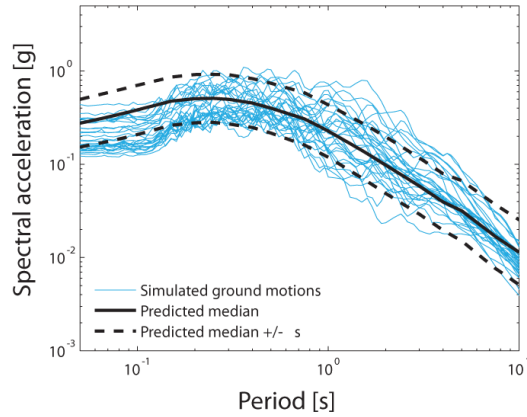


$T = 1s$

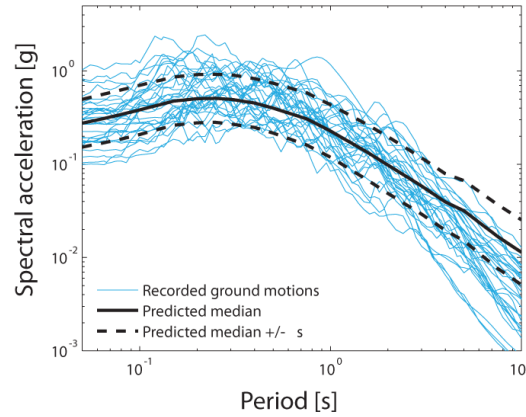
Record criteria:
 $M > 6.5$
 $V_{s30} > 300 \text{ km/s}$

Nonlinear response spectra

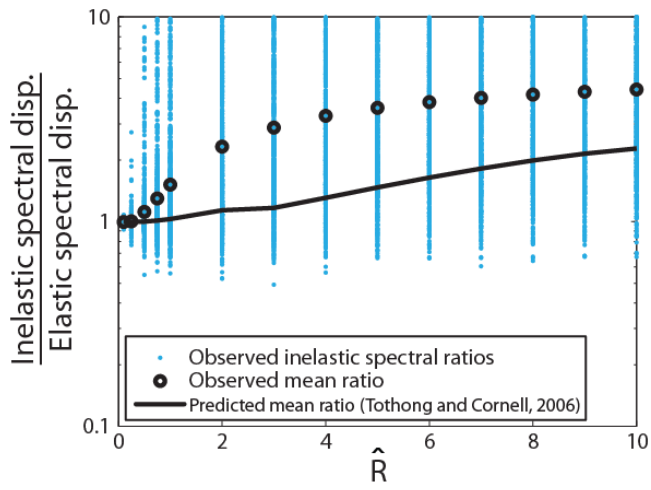
Simulated ground motions



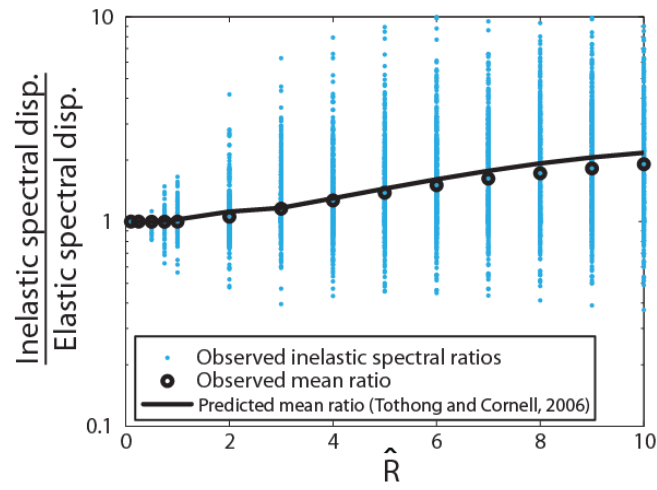
Comparable observed ground motions



Simulated ground motions



Observed ground motions

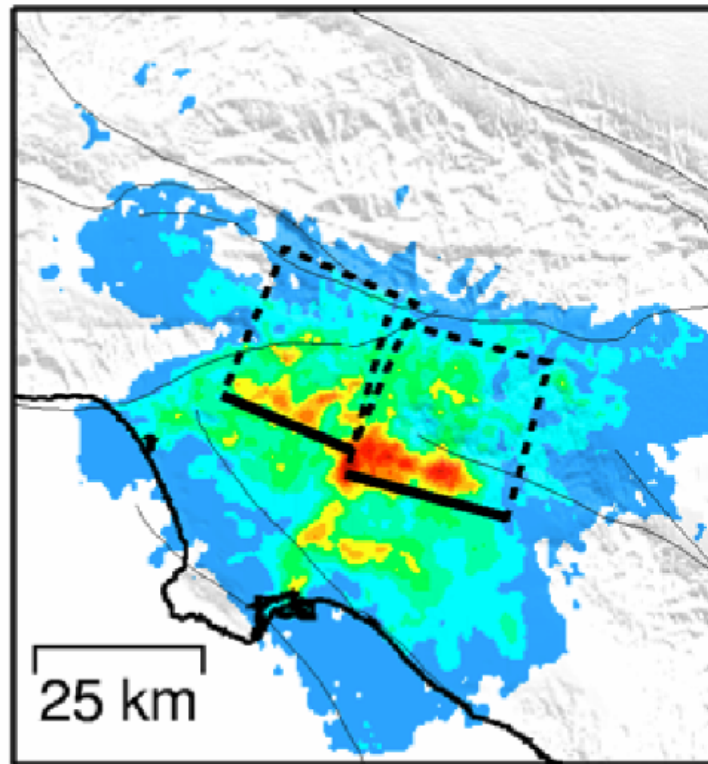


$T = 0.3s$

Record criteria:
 $M > 6.5$
 $V_{s30} > 300 \text{ km/s}$

Ground motions for illustration

Illustrative results are presented for several sets of Puente Hills broadband simulations at 648 sites in the Los Angeles region (Graves and Somerville 2006)

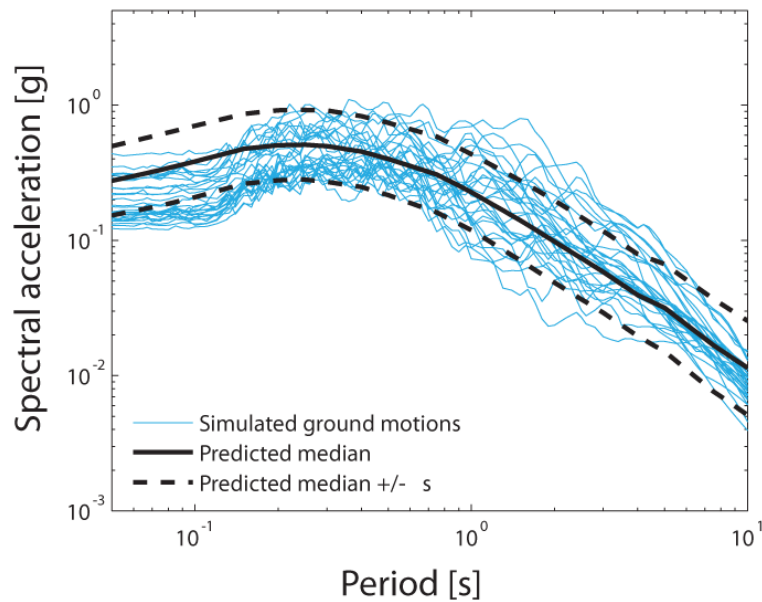


One-second elastic spectral accelerations
(from Graves and Somerville 2006)

Elastic response spectra

- Often serve as the link between seismic hazard analysis and structural response calculation.
- Basis of significant engineering intuition
- Looking at these in a statistical sense is important (means, standard deviations, and correlations)

Simulated ground motions



Comparable observed ground motions

