INCORPORATION OF EXTENDED-SOURCE EFFECTS IN TORO ET AL. (1997) EQUATIONS

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by

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Functional form of EPRI (1993)-Toro et al. (1997) equations

$$\ln Y = C_1 + C_2(M-6) + C_3(M-6)^2 - C_4 \ln R_M - (C_5 - C_4) \max\left[\ln\left(\frac{R_M}{100}\right), 0\right] - C_6 R_M + \varepsilon_e + \varepsilon_a$$

$$R_M = \sqrt{R^2 + C_7^2}$$

with C_7=6.9 - 11 km

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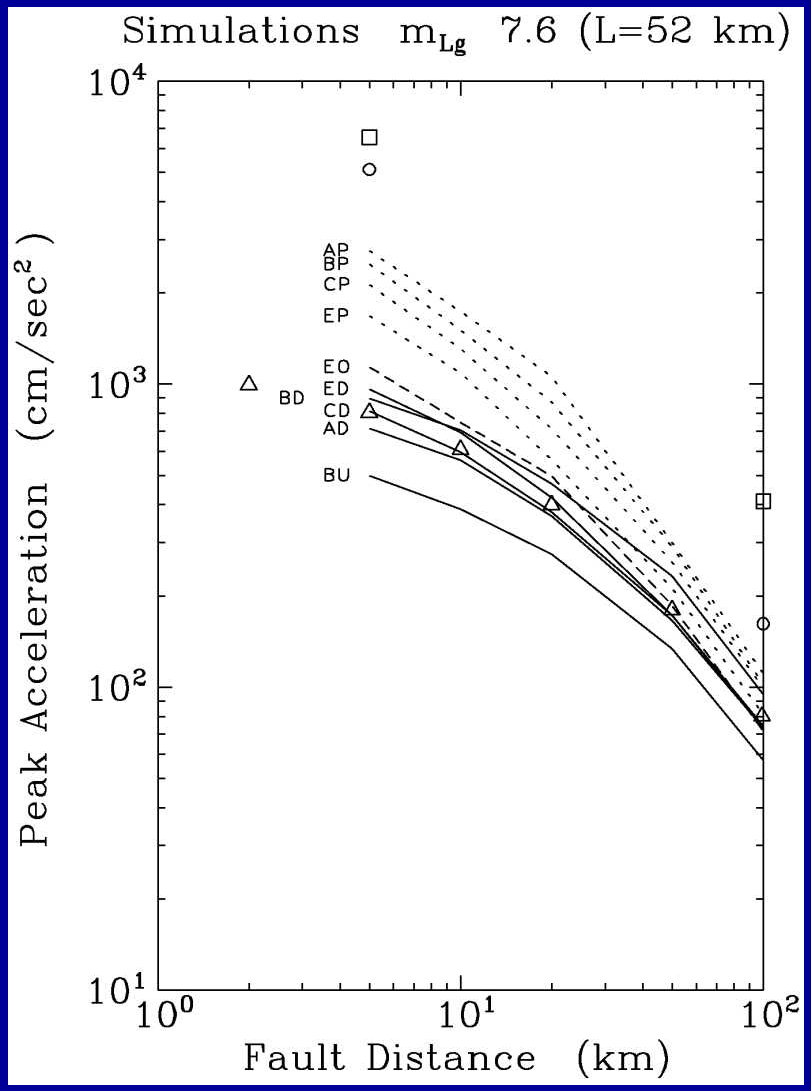
2 approaches for extended-source effects

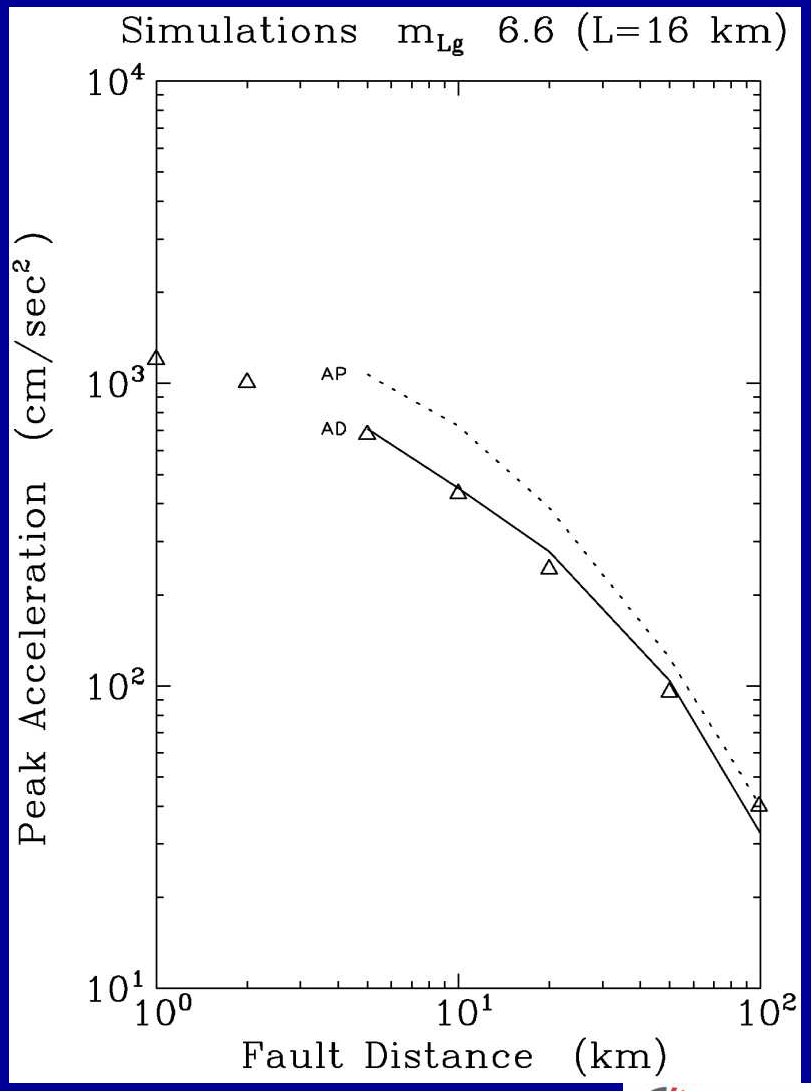
- Extended-Source Modeling Approach (REI's Paducah, 1992 study). Used extended-source simulations to quantify saturation effect
- Empirical Approach (Silva and Darragh). Uses Atkinson and Silva's (1997) observation: factor of 2 reduction in pt-source stress drop between M 5.5 and 7.5

Modeling Approach

- Documented in 1993 REI Paducah report and in EPRI TR-100410 (1992); Similar to Beresnev-Atkinson (1999).
- Heavily influenced by Herrmann's and Jost's work of that time (source-size scaling, tapering, etc.). Basic assumptions:
  - Rupture plane is sub-divided into rectangular portions, each associated with a sub-event
  - Uniform distribution of moment, except for tapering at ends
  - Vary rupture velocity, hypocentral location, tapering, site location
  - Each sub-event generates a stochastic pulse
  - 1/R geometric attenuation for each sub-event

Modeling Approach





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Functional forms

Modeling:

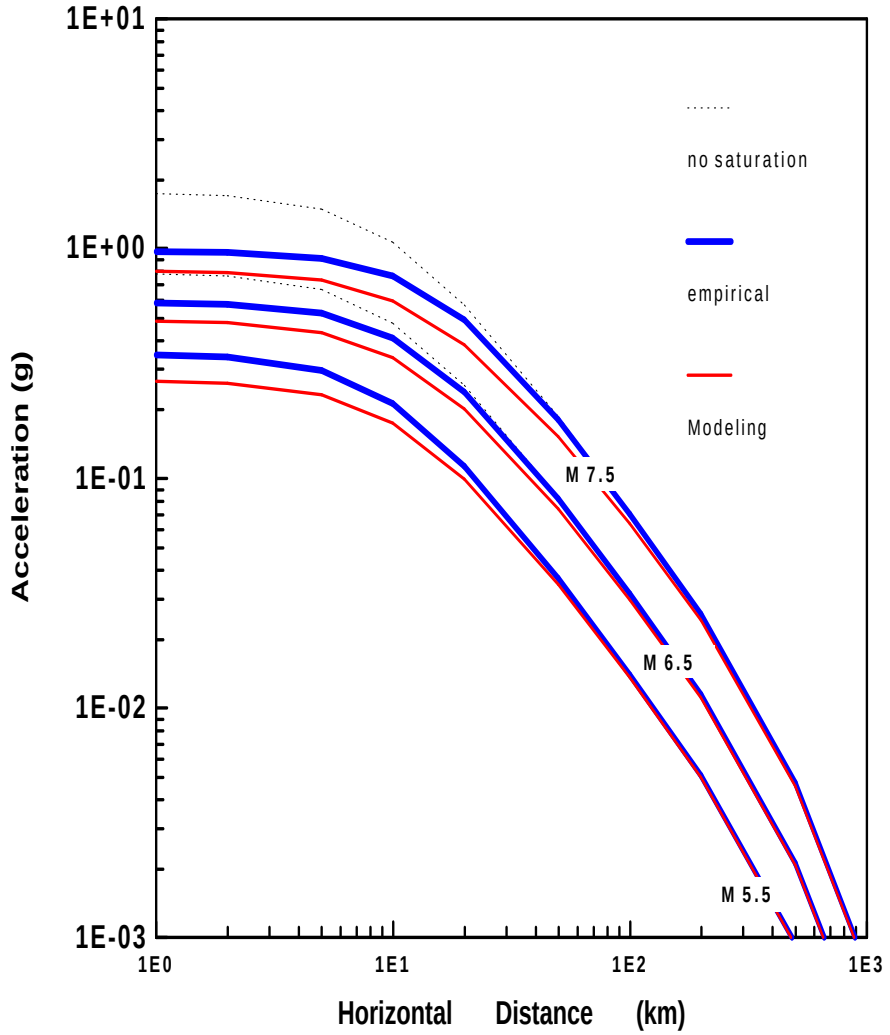
$$R_M = R_{\text{rupture}} + 0.006\exp(m_b)$$

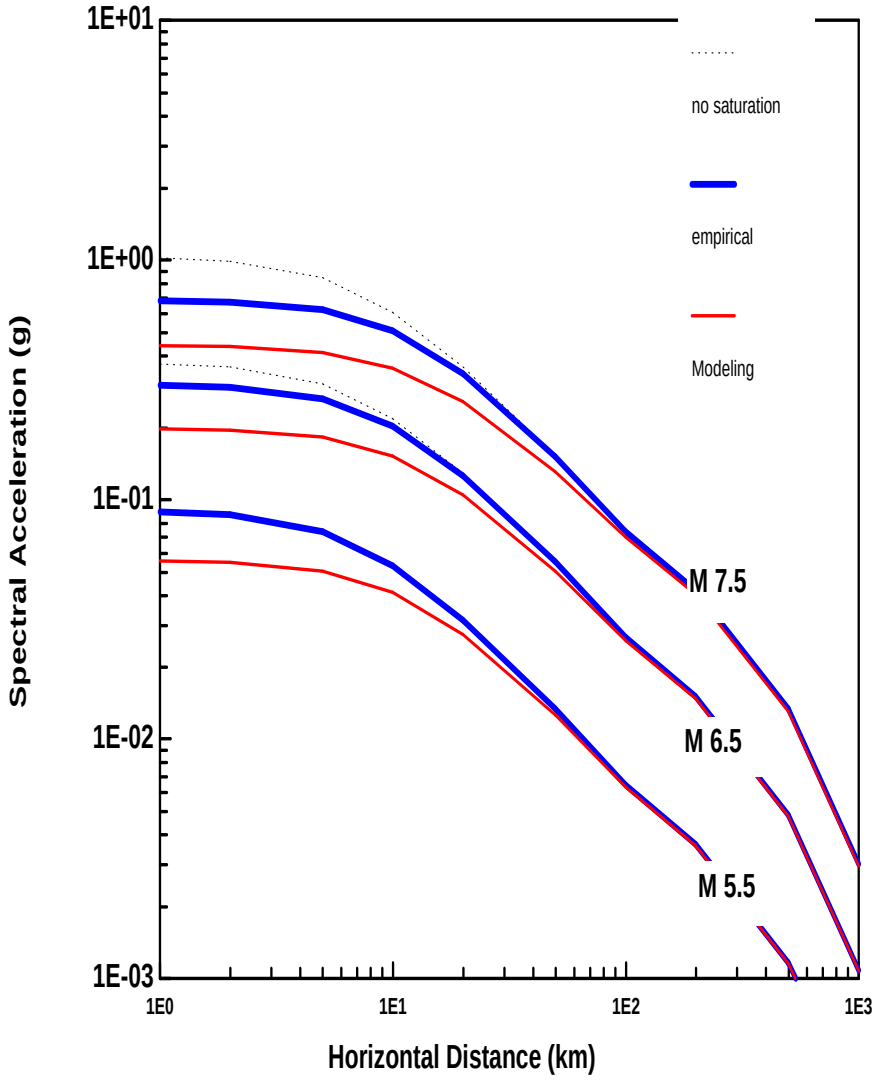
$$R_M = R_{\text{rupture}} + 0.089\exp(0.5\mathbf{M})$$

(do not include depth-dependent sigma)

Empirical:

$$R_M = \sqrt{R_{JB}{}^2 + C_7{}^2[\exp(-1.25 + 0.227\mathbf{M})]^2}$$


Attenuation Equations for Faults
Peak Ground Acceleration
1E+01
1E+00
1E-01
1E-02
1E-03
Acceleration (g)
no saturation
empirical
Modeling
M 7.5
M 6.5
M 5.5
1E0
1E1
1E2
1E3
Horizontal Distance (km)


Attenuation Equations for Faults
1-Hz Spectral Acceleration
1E+01
1E+00
1E-01
1E-02
1E-03
Spectral Acceleration (g)
no saturation
empirical
Modeling
M 7.5
M 6.5
M 5.5
1E0
1E1
1E2
1E3
Horizontal Distance (km)