SCEC

CyberShake Validation – Part 2

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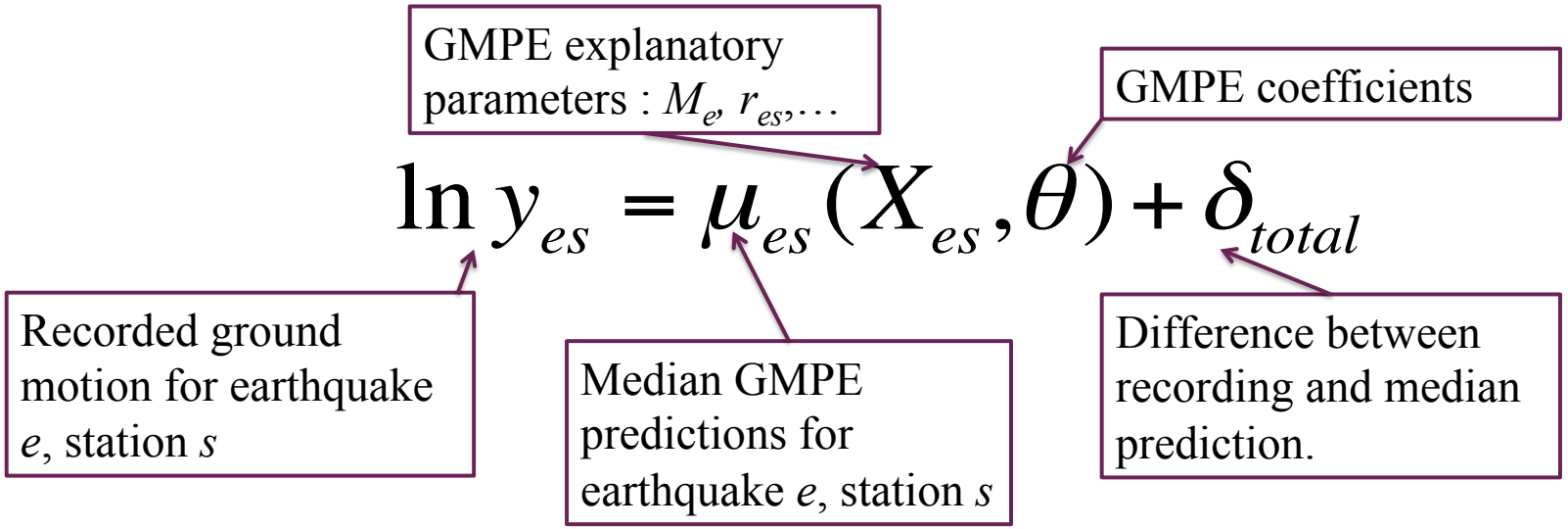
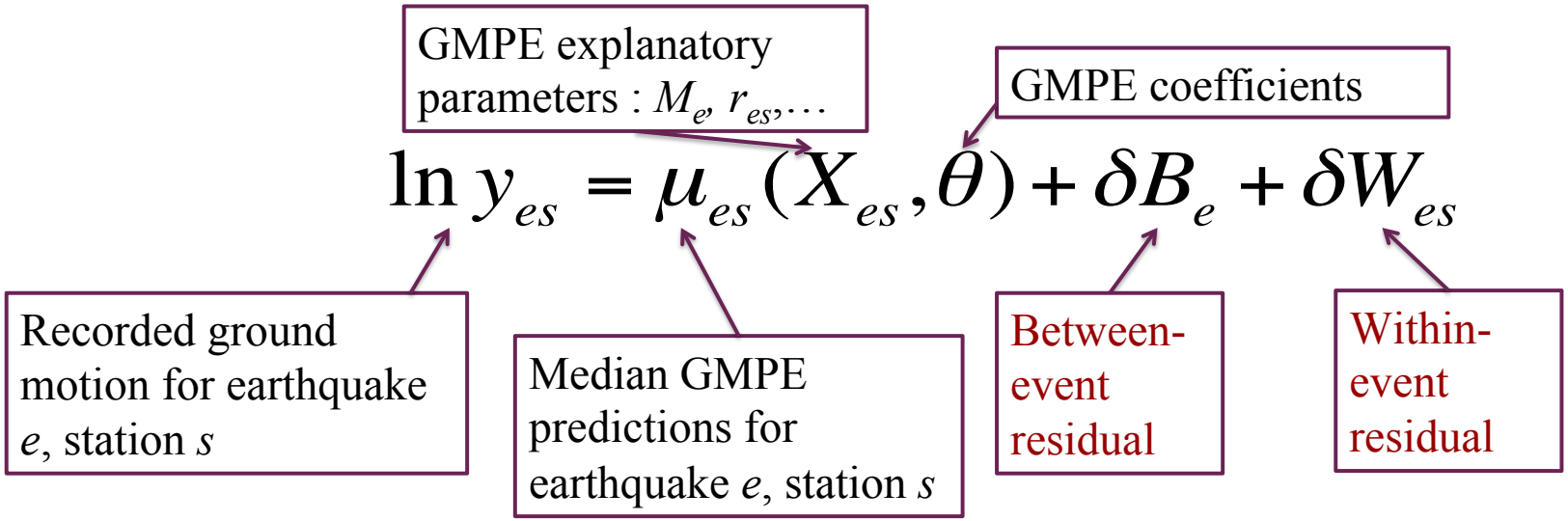
Residuals analysis



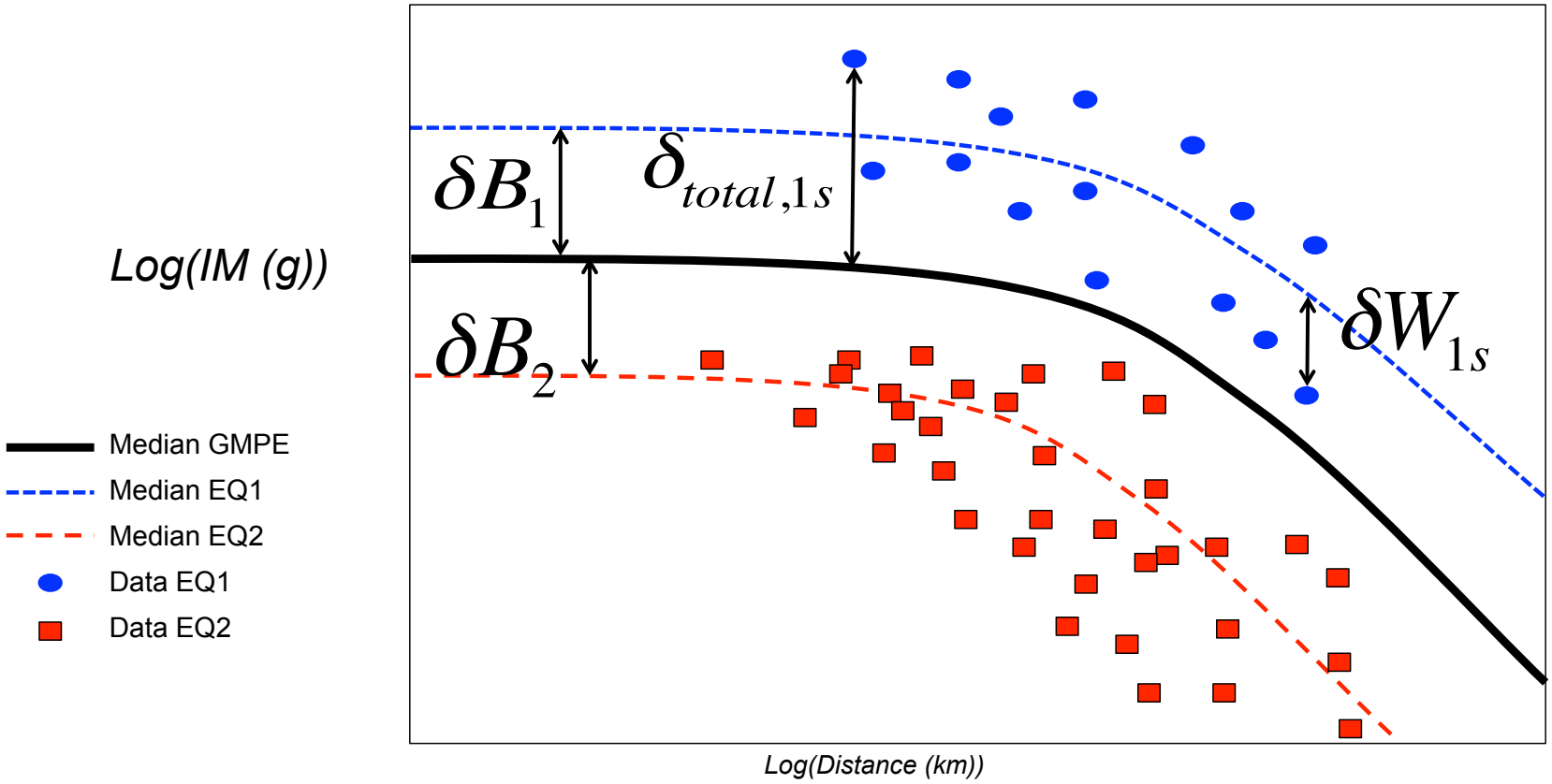
Total residuals

$$\delta_{total} = \left[\ln y_{es}\right]_{REC} - \left[\ln \mu_{es}\right]_{GMPE}$$

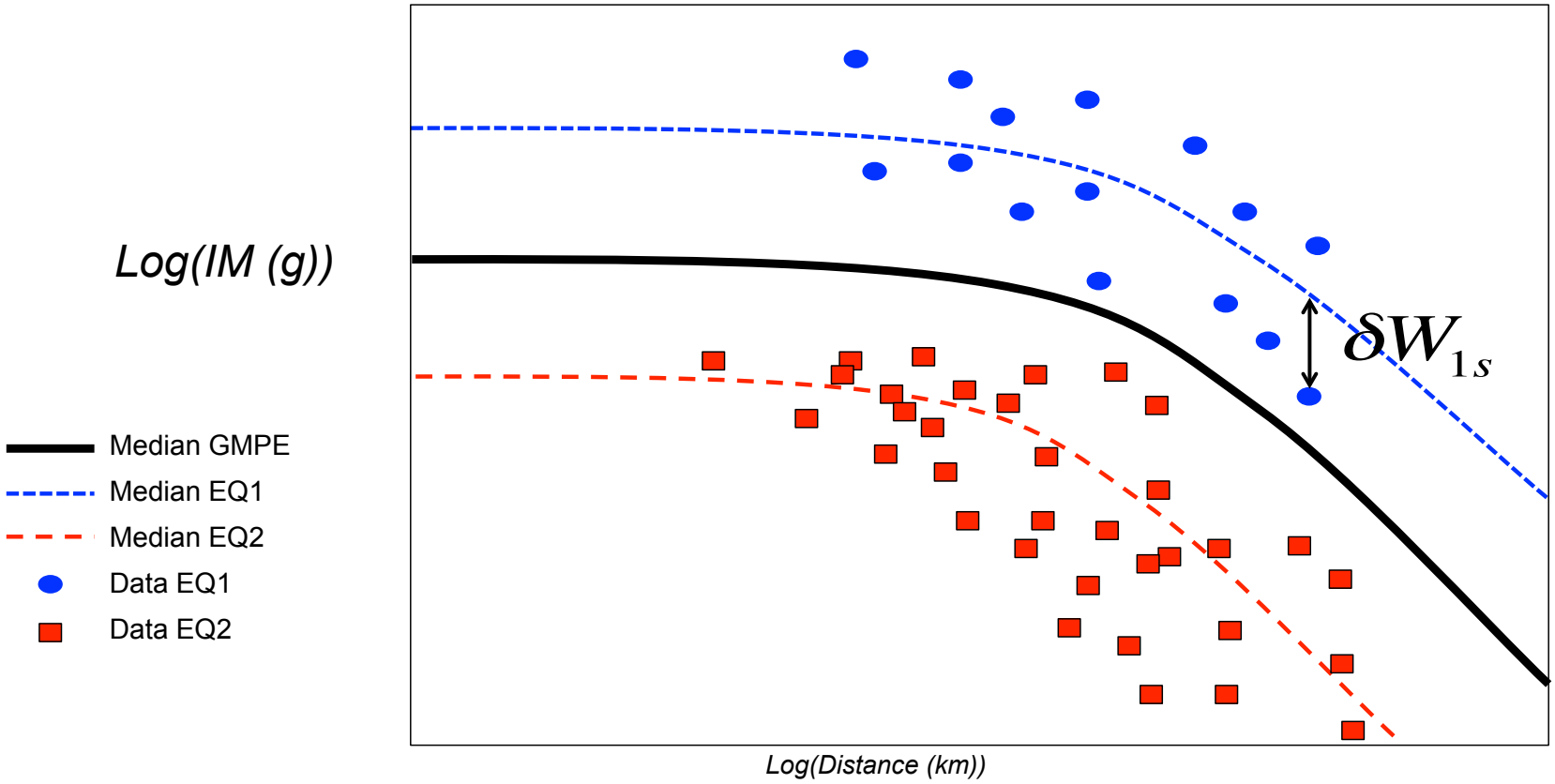
Residuals analysis - Partitioning



$$\ln y_{es} = \mu_{es}(X_{es},\theta) + \delta B_e + \delta W_{es}$$



$$\ln y_{es} = \mu_{es}(X_{es}, \theta) + \delta B_e + \delta W_{es}$$



Residuals analysis - Partitioning

$$\ln y_{es} = \mu_{es}(X_{es},\theta) + \delta B_e + \delta W_{es}$$

$$\ln y_{esr} = \mu_{esr}(X_{esr},\theta) + \delta L2L_r + \delta B_{0,er} + \delta S2S_s + \delta P2P_{sr} + \delta W_{0,esr}$$

Location term	Single-region between-event	Site term	Path term	Within-event single-path

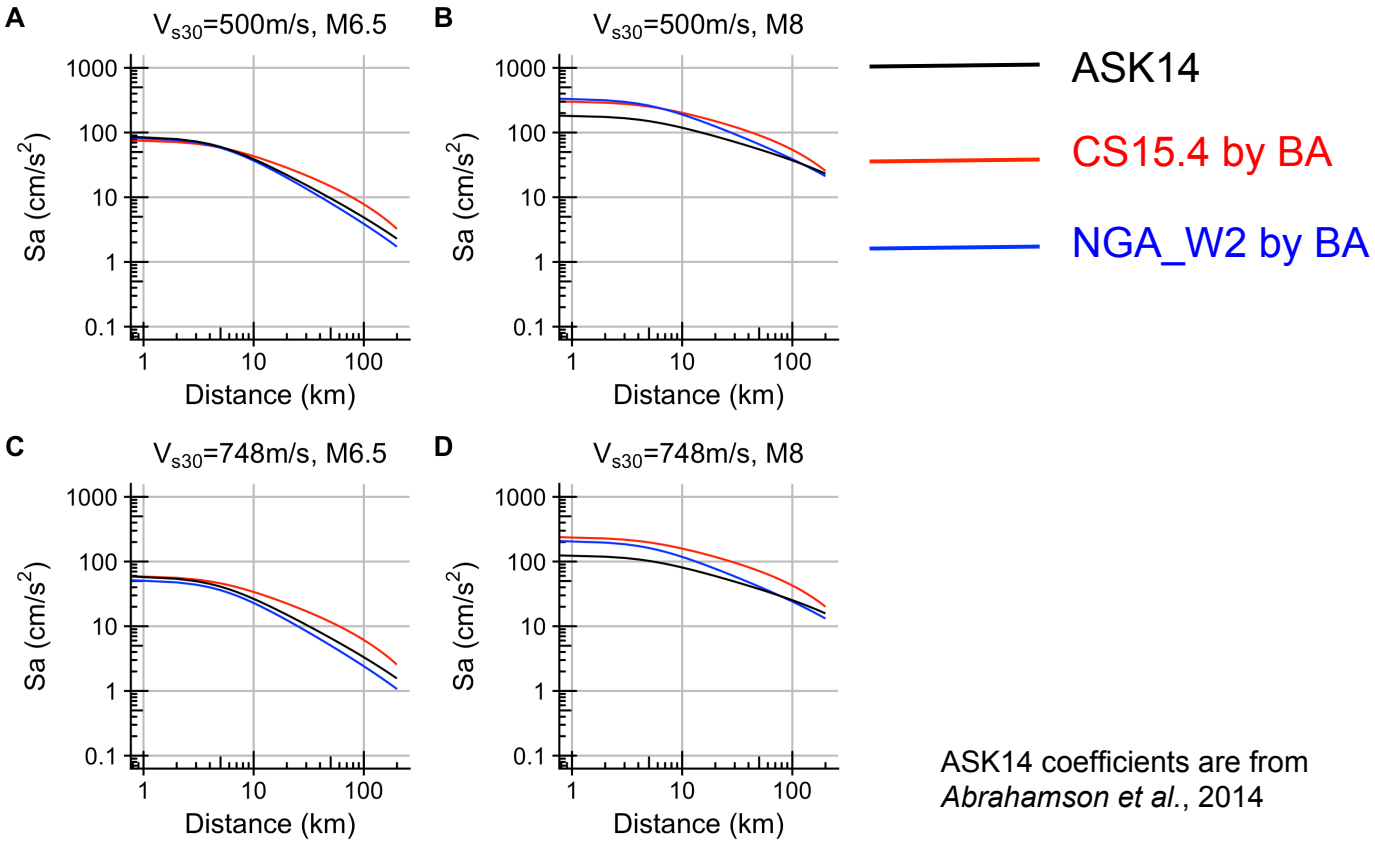
Mixed effects regression

$$\ln y_{es} = b_1 + b_2 \cdot (m-6) + b_3 \cdot (m-6)^2 + (b_4 + b_5 \cdot (m-4.5)) \cdot \ln(\sqrt{R^2 + h^2}) + b_6 \cdot R + b_7 \cdot \ln(\frac{V_{S30}}{760})$$

GMPE is modified from *Boore and Atkinson*, 2008. Hereafter referred as BA.

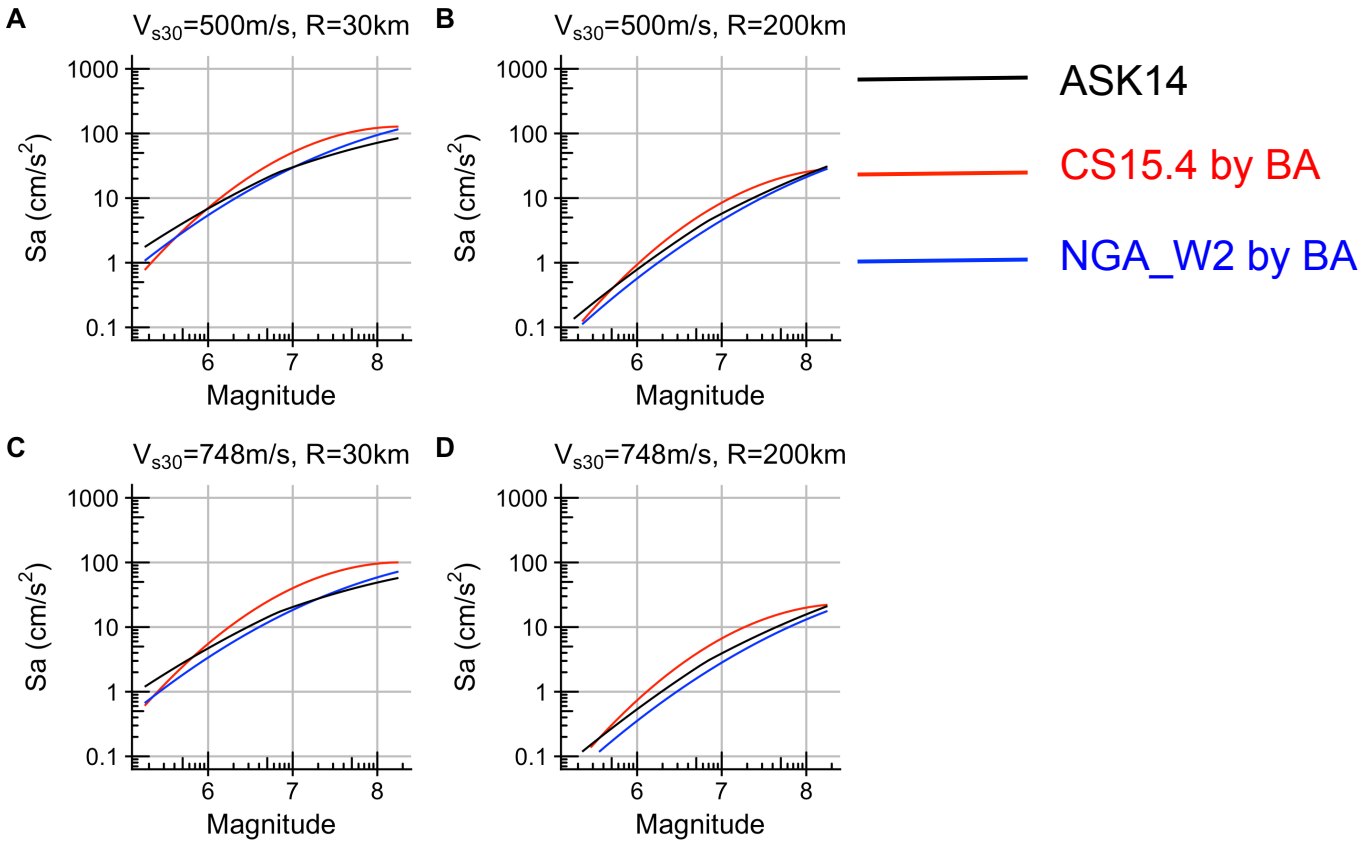
T=3s	Number	b_1	b_2	b_3	b_4	b_5	b_6	b_7	h
CyberShake (CS) 15.4	~10^8	4.02	2.13	-0.55	-0.82	0.12	0.00	-0.60	4.47
NGA_W2 in southern California	2691	4.87	1.28	-0.27	-1.36	0.20	0.00	-1.18	4.86

Distance scaling

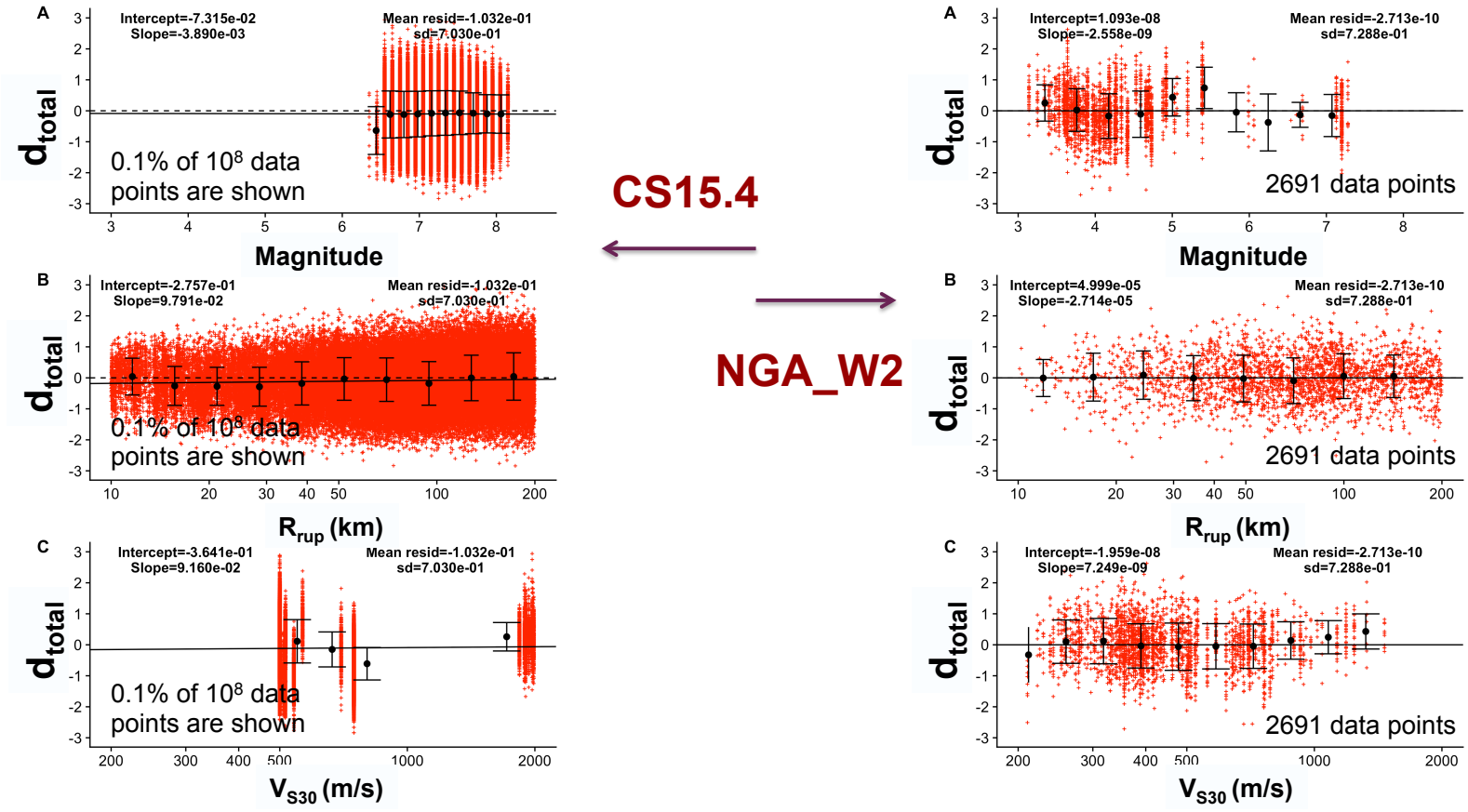


ASK14 coefficients are from *Abrahamson et al.*, 2014

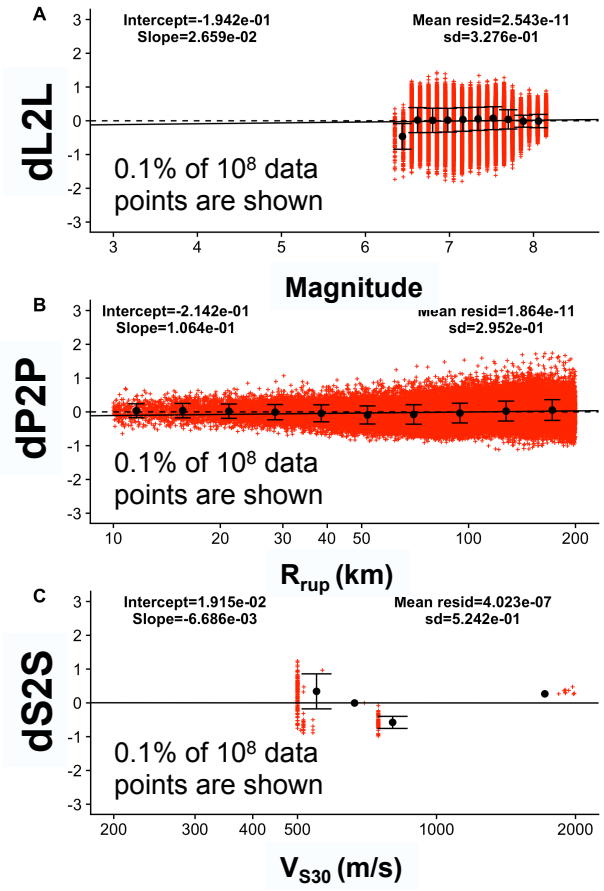
Magnitude scaling



Total residuals

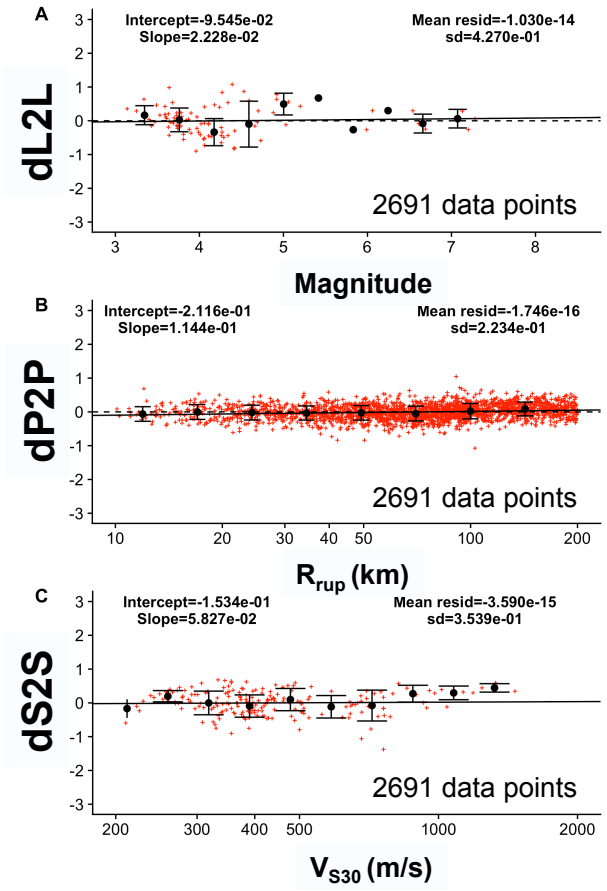


Location, site and path terms

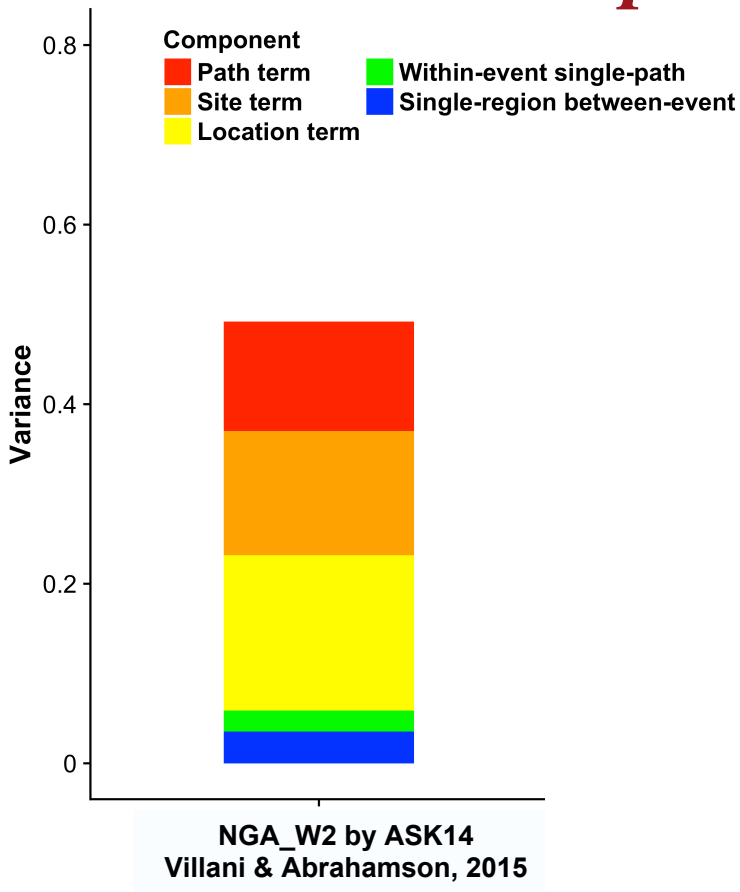


CS15.4

NGA_W2



Residual partitioning



Conclusions

- CyberShake shows general agreement with ground motion data and existing models;
  - Similar median trend
  - Similar variance partitioning

- At single site, CyberShake generates a lot data points, which allow us to dig deeper into the source of variability;

- Validation of CyberShake is still ongoing on multiple fronts.
  - Correlation among site terms between two datasets
  - Evaluate the importance of assumptions in source modeling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