Validation and Use of 3-D simulations

• Before implementing the 3-D simulations into the building code, there should be a quantitative validation
  – Show that the 3-D simulations do better or no worse than GMPEs with basin depth terms
  – Use the current 3-D structure
• Approaches
  – Compare PSA
    • Example using cybershake1 (M. Villani)
    • Averaging –based factorization (F. Wang)
  – Compare FAS
    • Initial NGA-W2 empirical FAS models will be available July 2015
Villani (BSSA 2015)

• Data Sets
  • Use Cybershake1 results
  • Use NGA-w2 residuals I LA region
  • Mainly M3 – M5
• Limitations
  • Assumes T=3 sec residuals from small eqk capture linear path and site effects
  • Cybershake locations and NGA-W2 sites do not match
    • Used residuals from stations within 5 km of cybershake simulation sites
NGA-W2 Data Set for Southern CA

All data

Only if N>=5
Empirical Data from NGA-west2
(N>=5 per station)

1776 Recordings
307 earthquakes
Correlation of Site Terms (T=3 sec) Cybershake and Empirical Data

Empirical vs. CyberShake - $\rho = 0.63$

- ○ data
- --- y=x

\[ \delta S2S \text{ from CyberShake} \]
\[ \delta S2S \text{ from empirical} \]
Correlation of Path Effects Between CyberShake and Empirical
Repeatability of Path Effects

![Graph showing the relationship between σ and CI](image)
Moving Forward

• Could repeat Villani evaluation using new cybershake simulations
  – Easy to do

• Could use averaging-based factorization approach to compare GMPEs and 3-D simulations
  – Easy to do

• Could run 3-D simulations for the smaller earthquakes and compare FAS
  – 300 earthquakes
  – May require too much effort