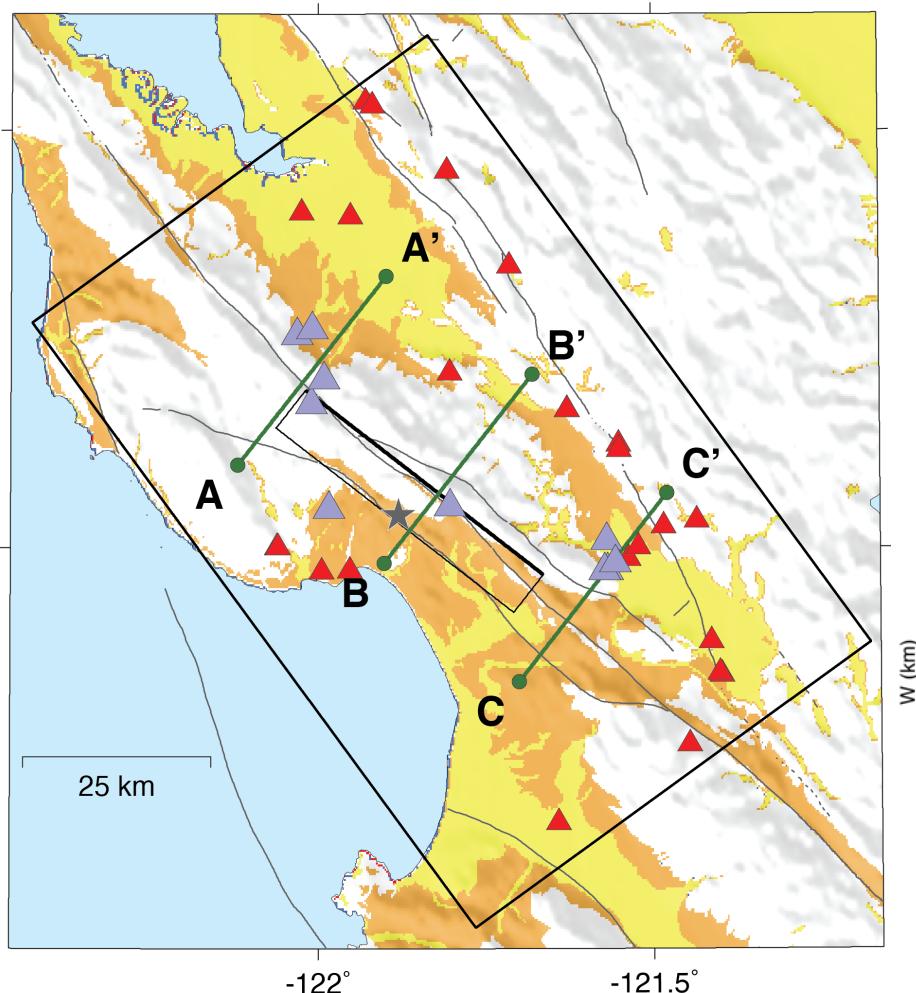


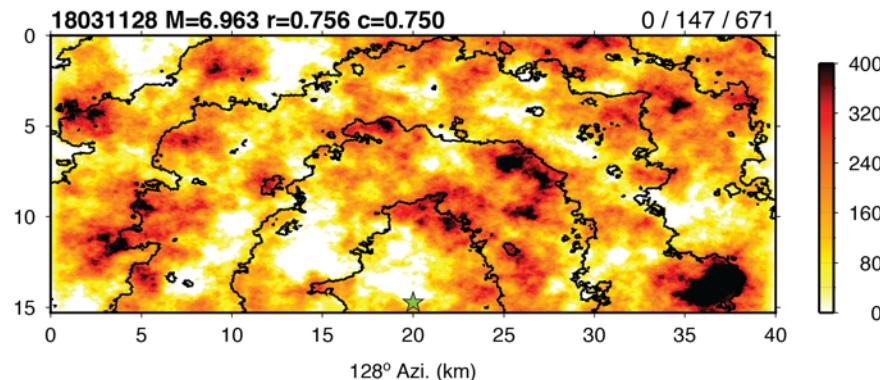
3D Modeling of Loma Prieta EQ (up to 4 Hz)

Robert Graves, U.S. Geological Survey, Pasadena



Model Parameters:

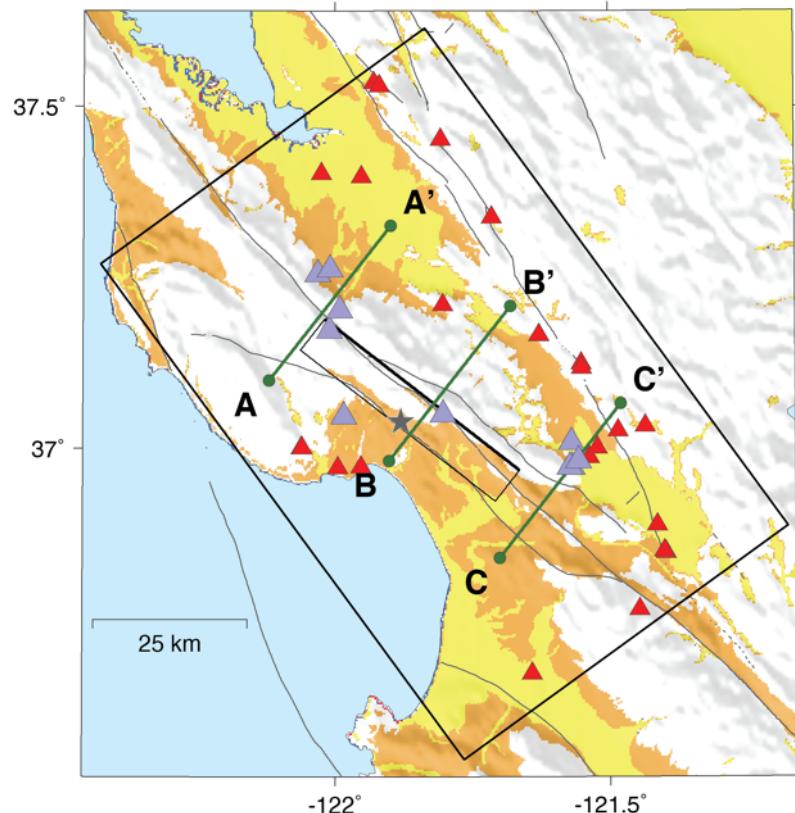
- 65 km x 100 km x 40 km (08.3.0)
 - Grid spacing = 20 m
 - Minimum Vs = 400 m/s
 - Highest frequency = 4 Hz
- 34 stations within 40 km
- Finite-fault rupture from GP15.4



- SCEC allocation on Blue Waters
 - about 9 hours wall clock
 - 24,576 cores

Shear wave velocity cross-sections

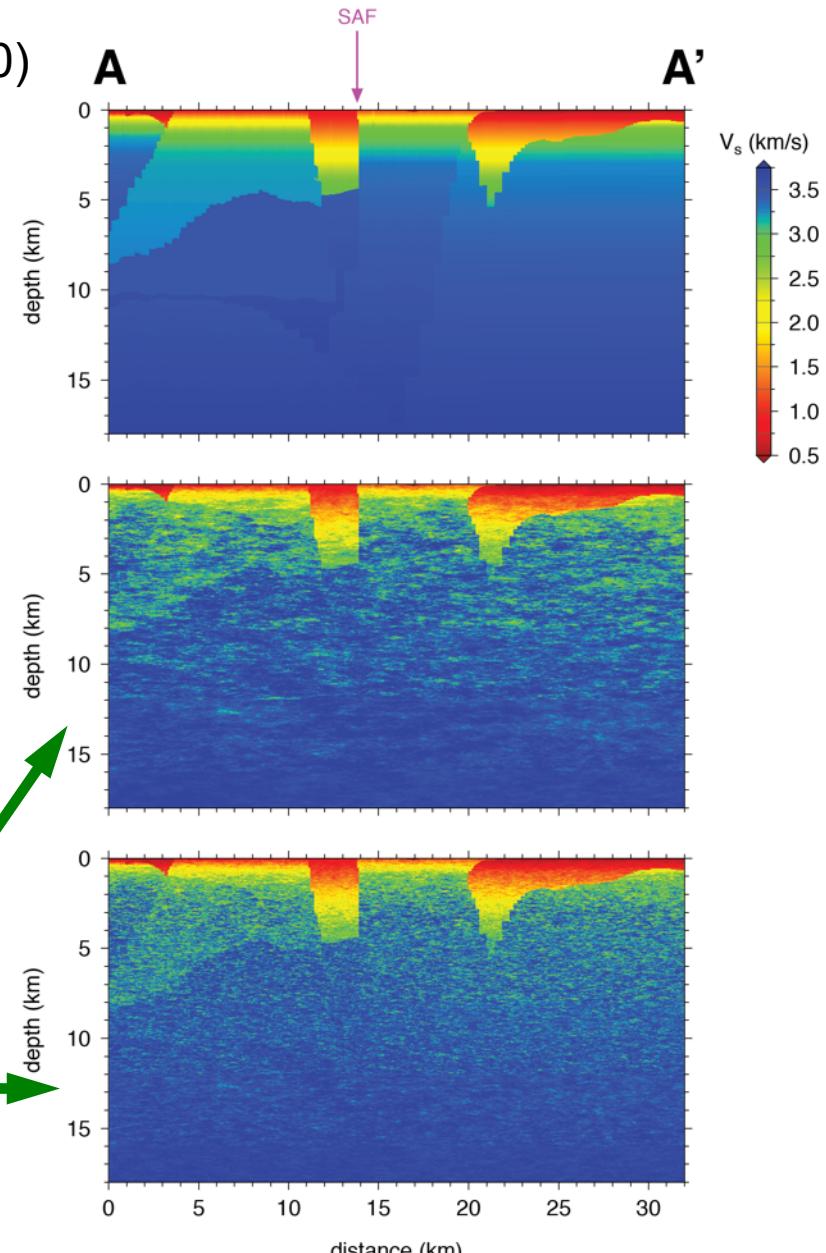
- 3D Bay Area Model (08.3.0)
- Mesh created with SCEC UCVM (15.10.0)



Velocity Perturbation Models-

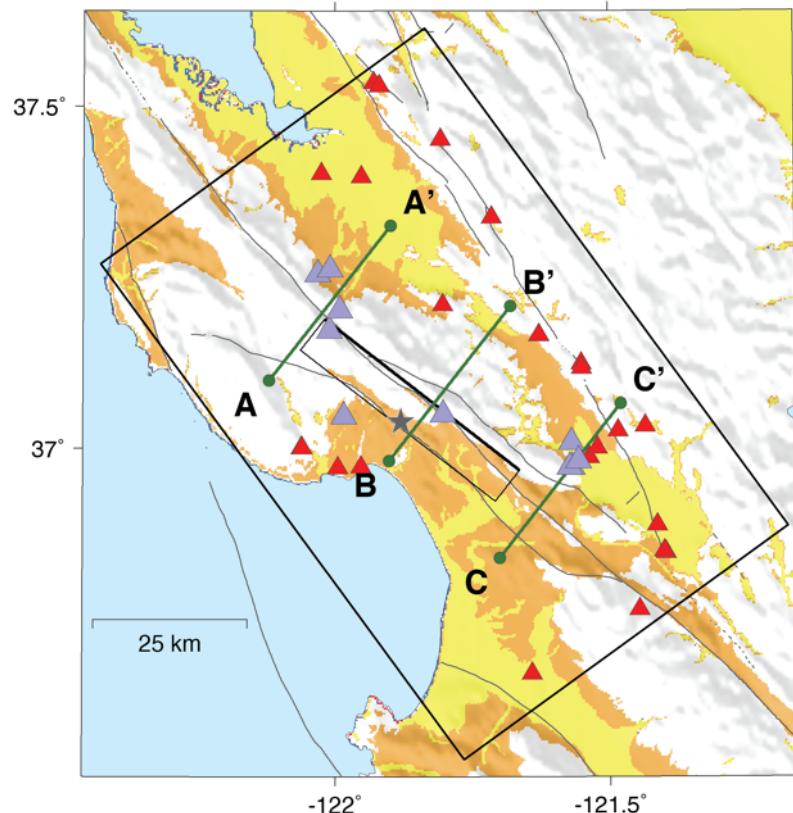
P1: $H_c = 5 \text{ km}$, $V_c = 1 \text{ km}$, $\sigma = 10\%$

P2: $H_c = 1 \text{ km}$, $V_c = 0.2 \text{ km}$, $\sigma = 10\%$



Shear wave velocity cross-sections

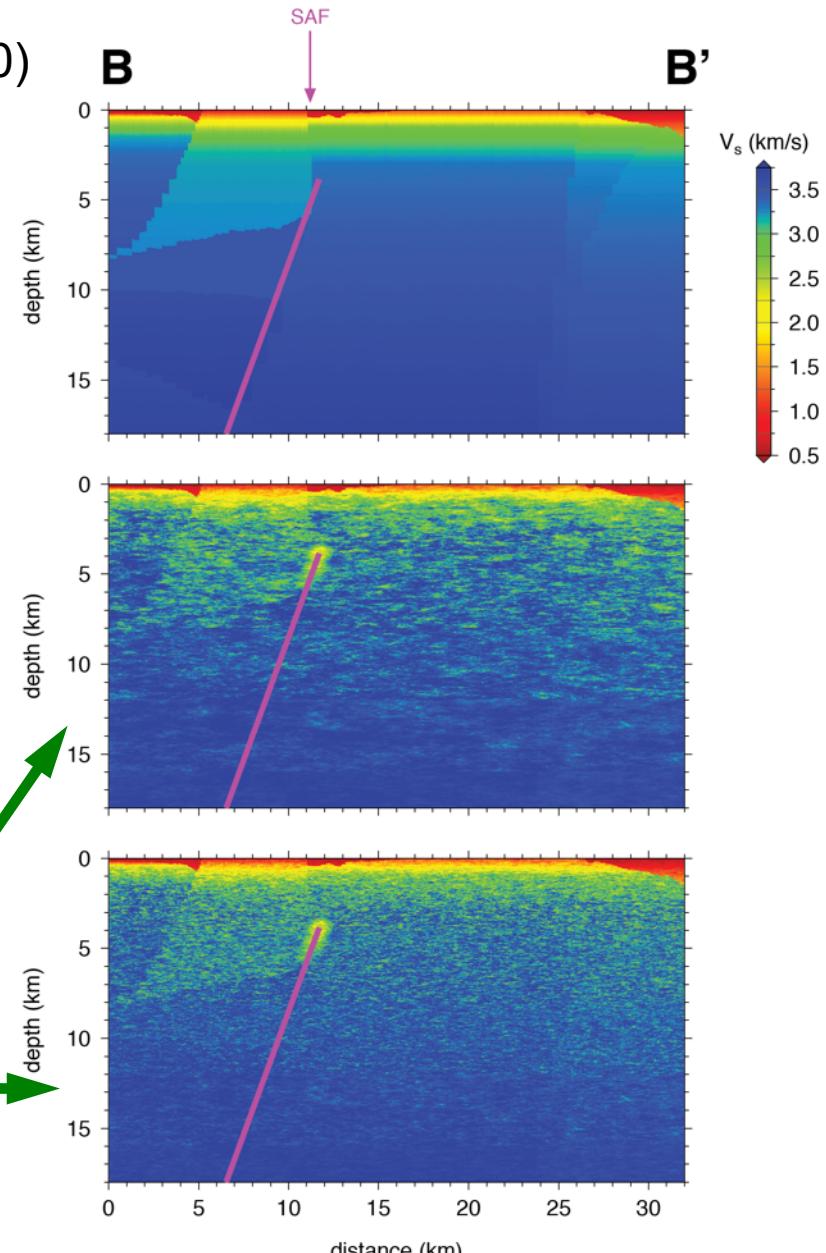
- 3D Bay Area Model (08.3.0)
- Mesh created with SCEC UCVM (15.10.0)



Velocity Perturbation Models-

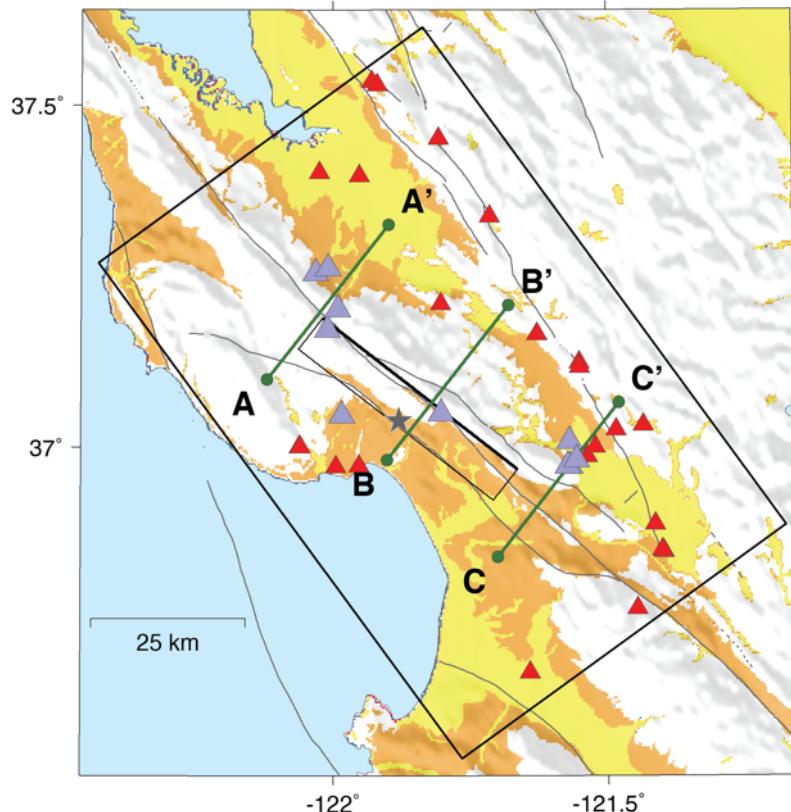
P1: $H_c = 5 \text{ km}$, $V_c = 1 \text{ km}$, $\sigma = 10\%$

P2: $H_c = 1 \text{ km}$, $V_c = 0.2 \text{ km}$, $\sigma = 10\%$



Shear wave velocity cross-sections

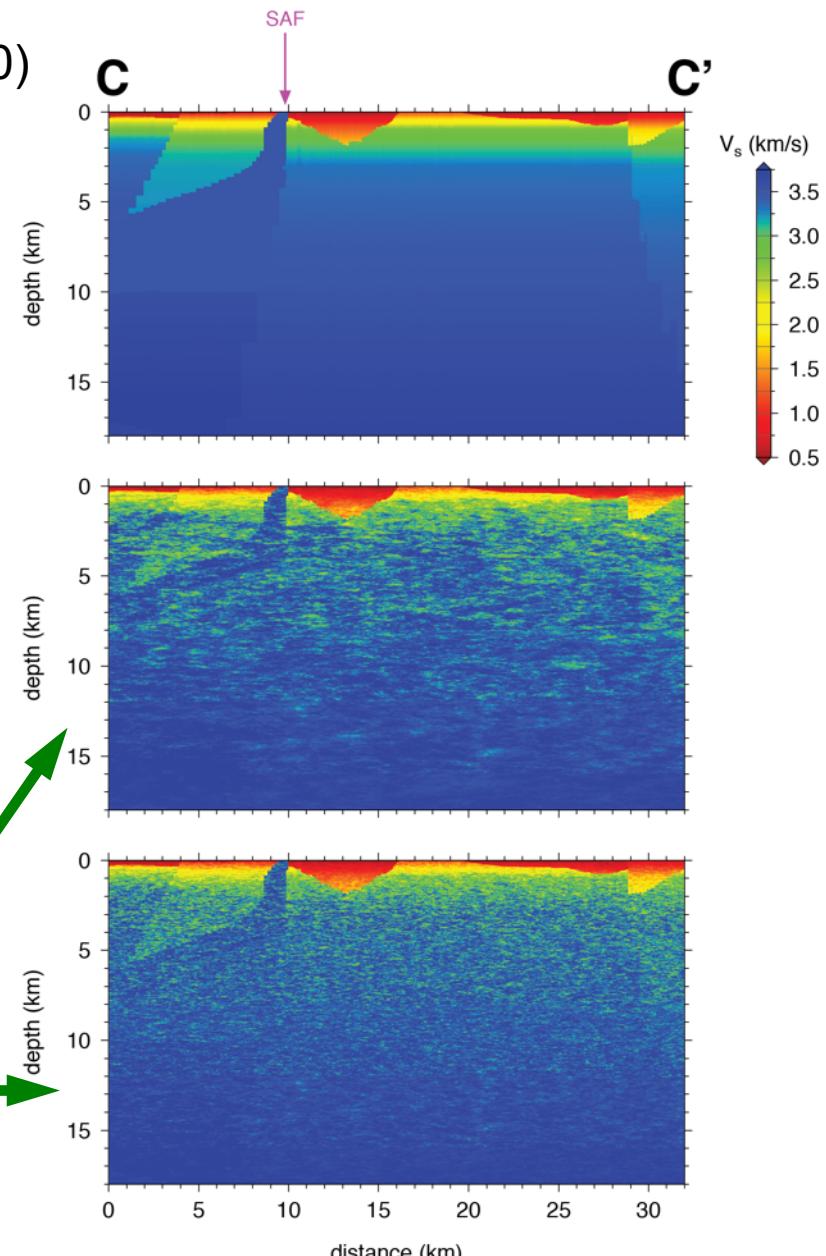
- 3D Bay Area Model (08.3.0)
- Mesh created with SCEC UCVM (15.10.0)



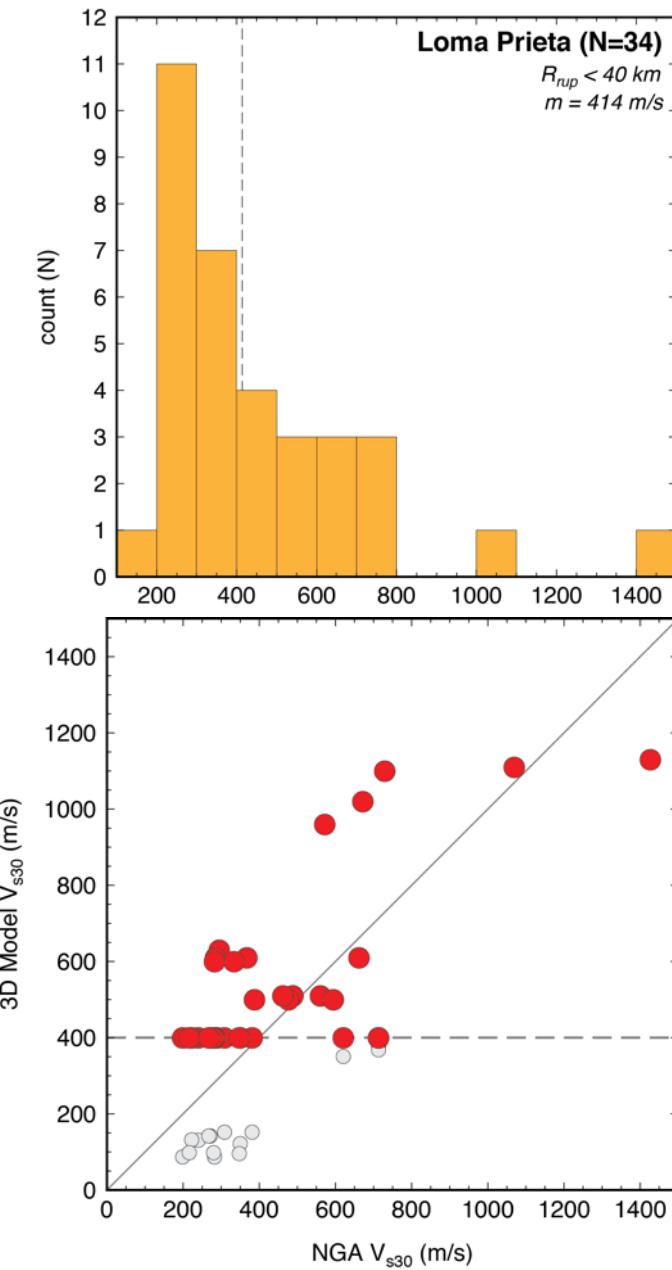
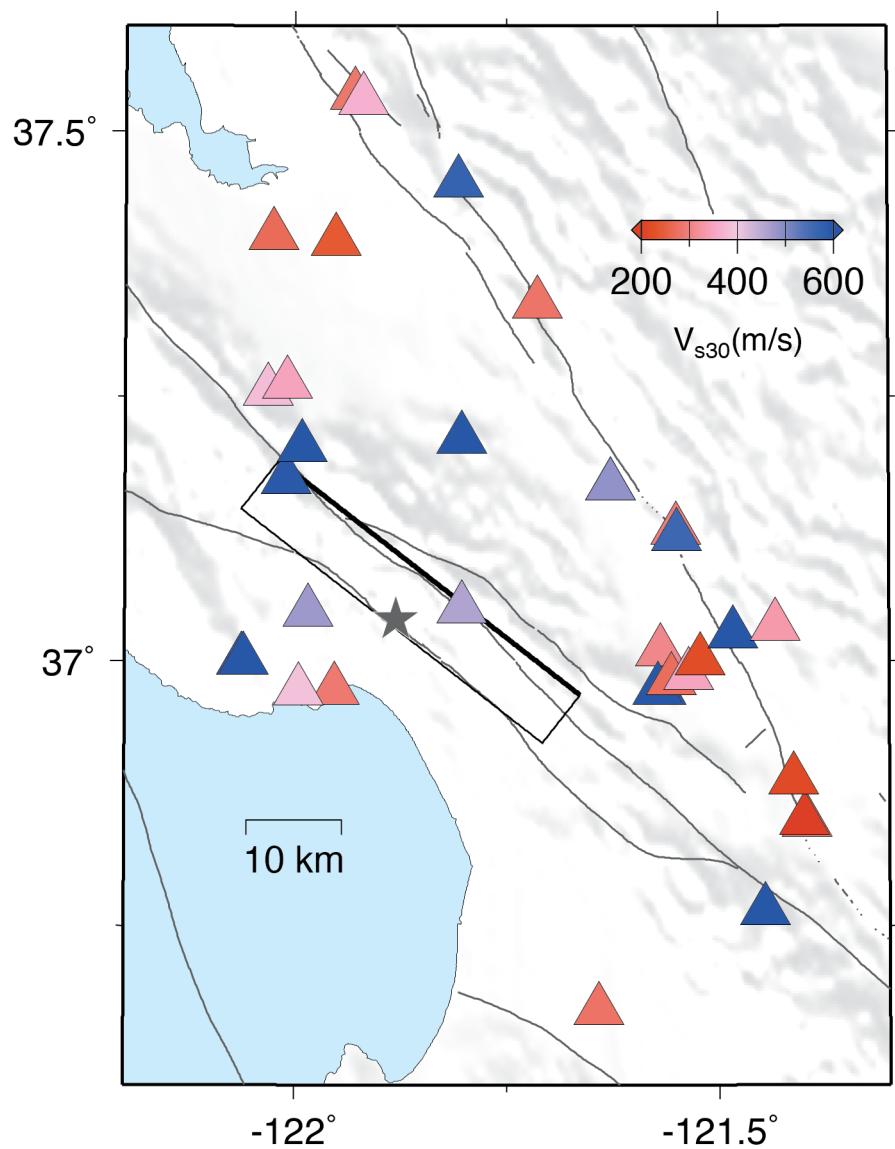
Velocity Perturbation Models-

P1: $H_c = 5 \text{ km}$, $V_c = 1 \text{ km}$, $\sigma = 10\%$

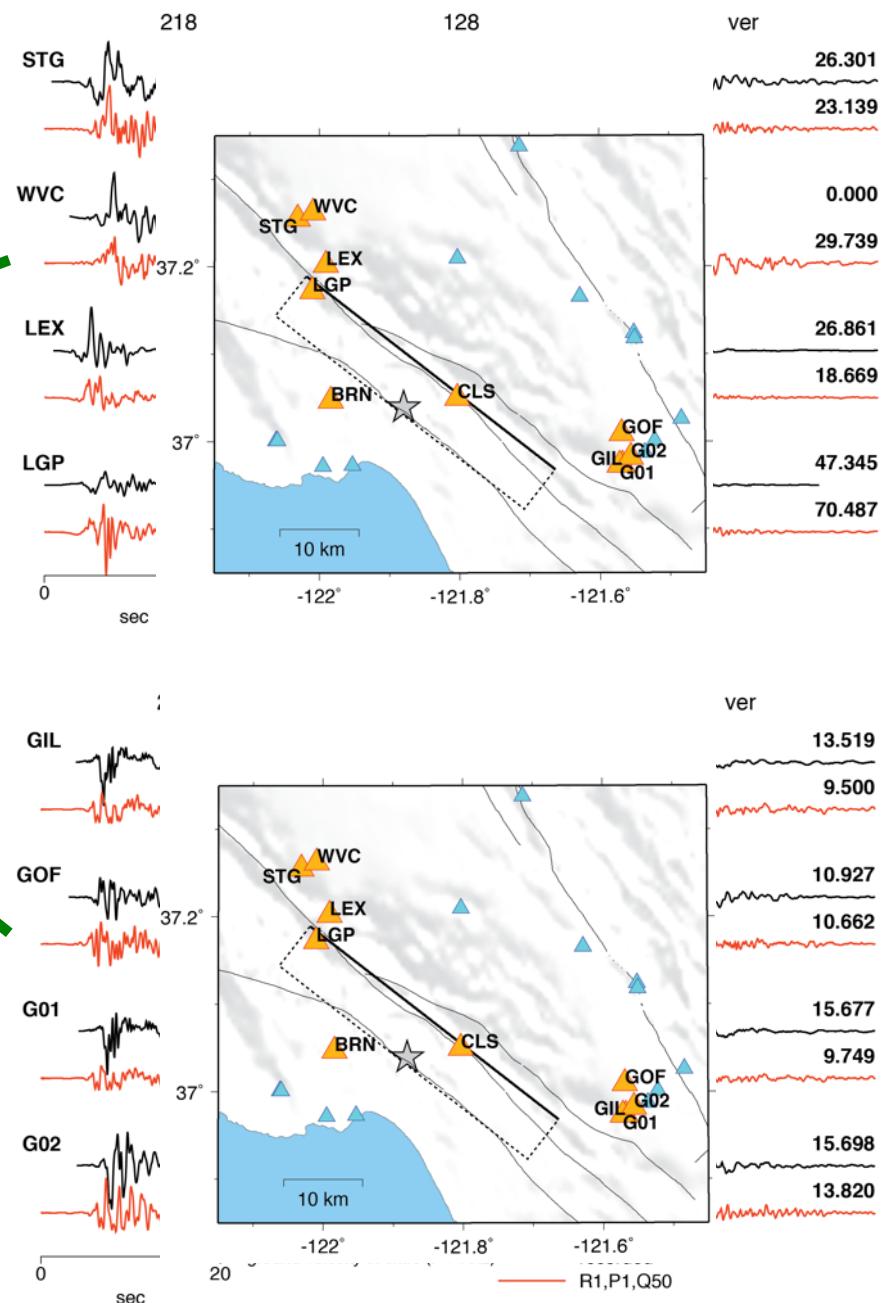
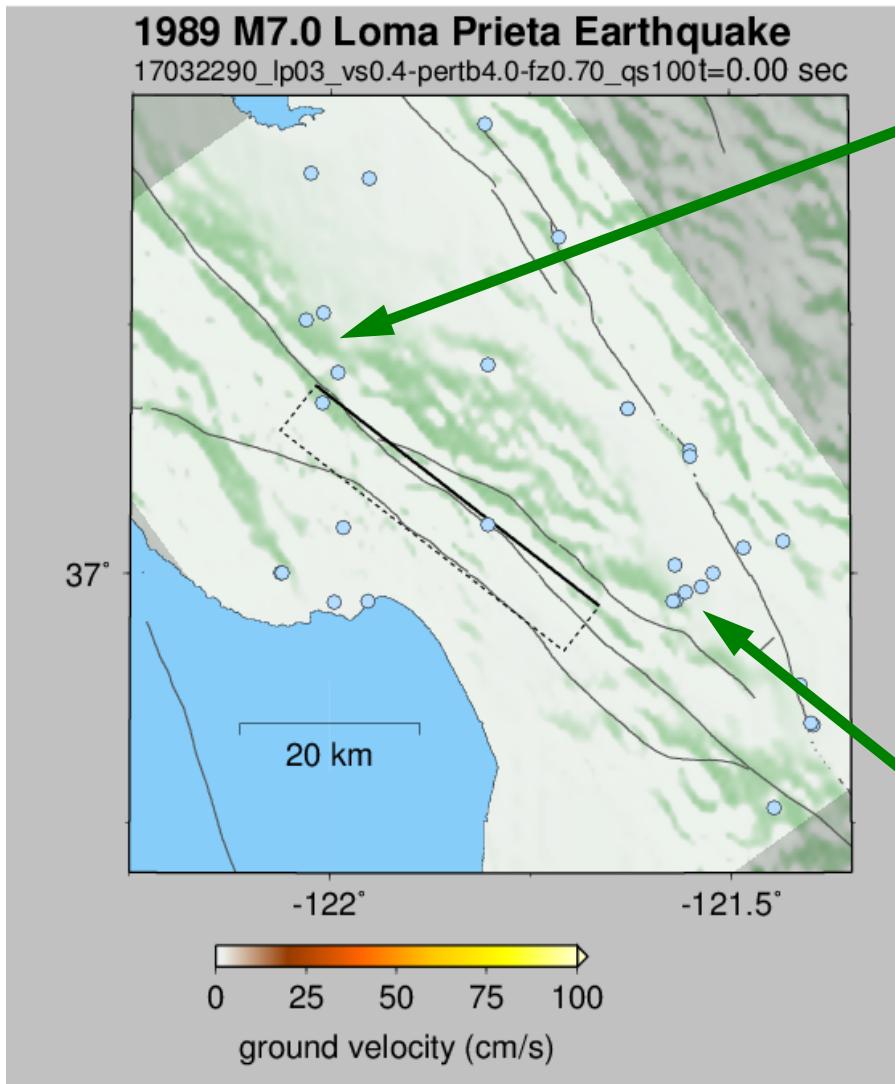
P2: $H_c = 1 \text{ km}$, $V_c = 0.2 \text{ km}$, $\sigma = 10\%$



Site Characterization (V_{s30})

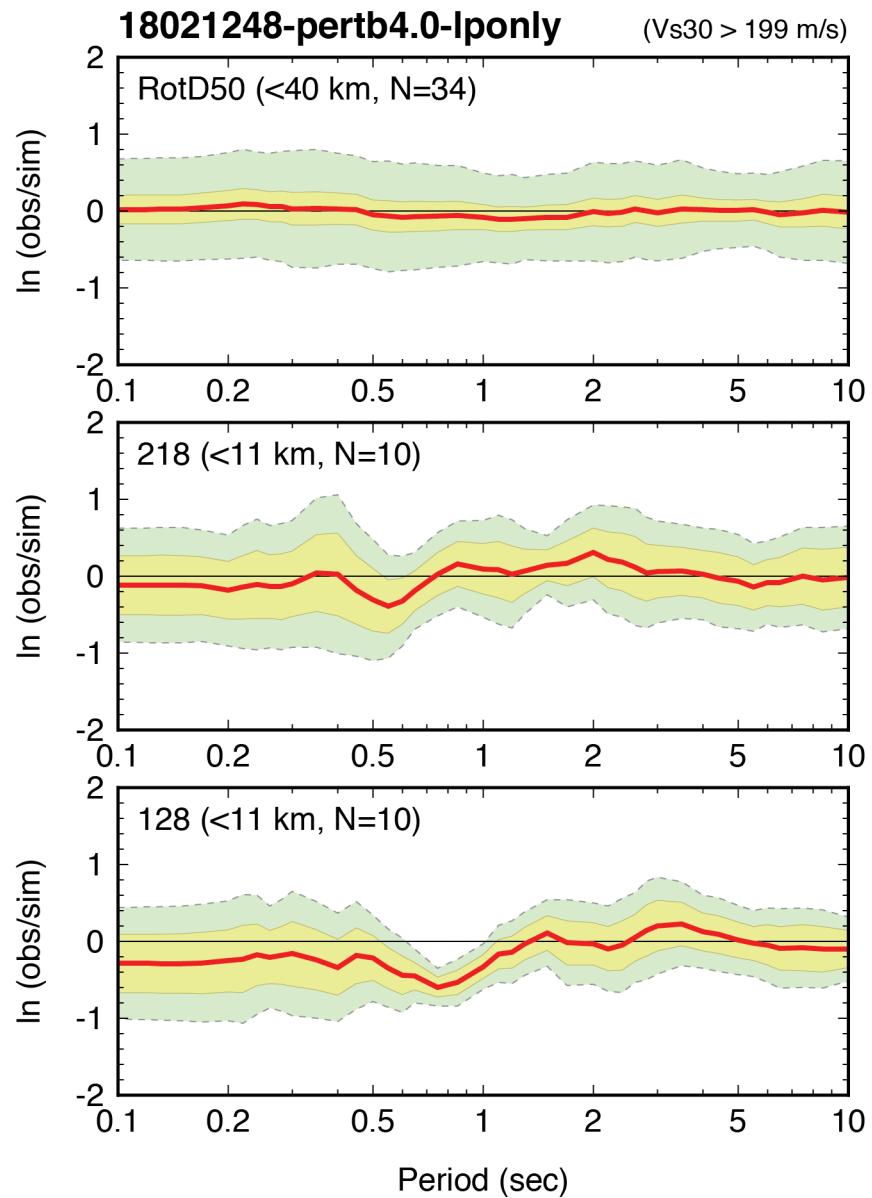
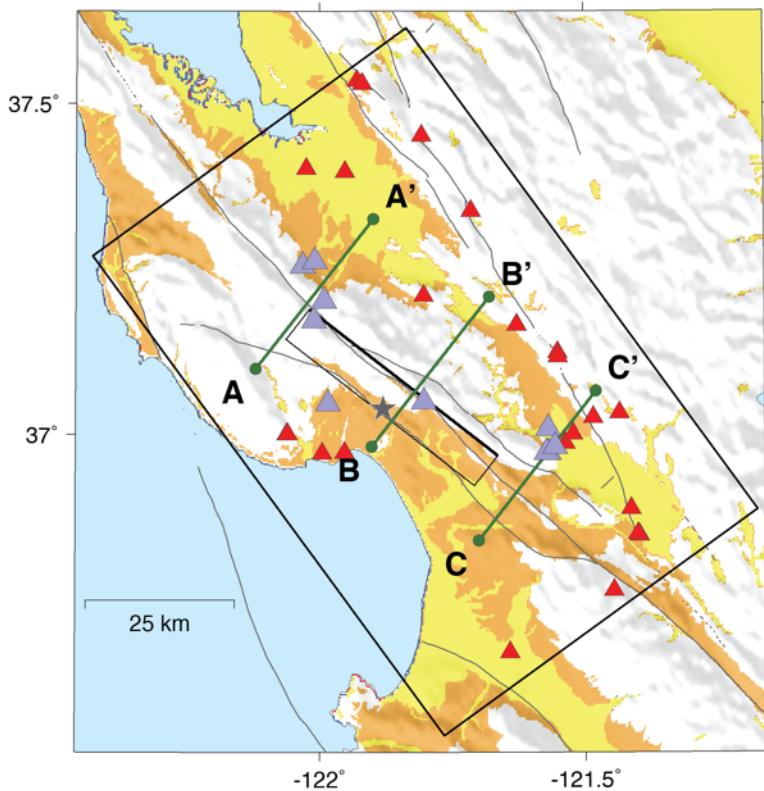


Simulation Results



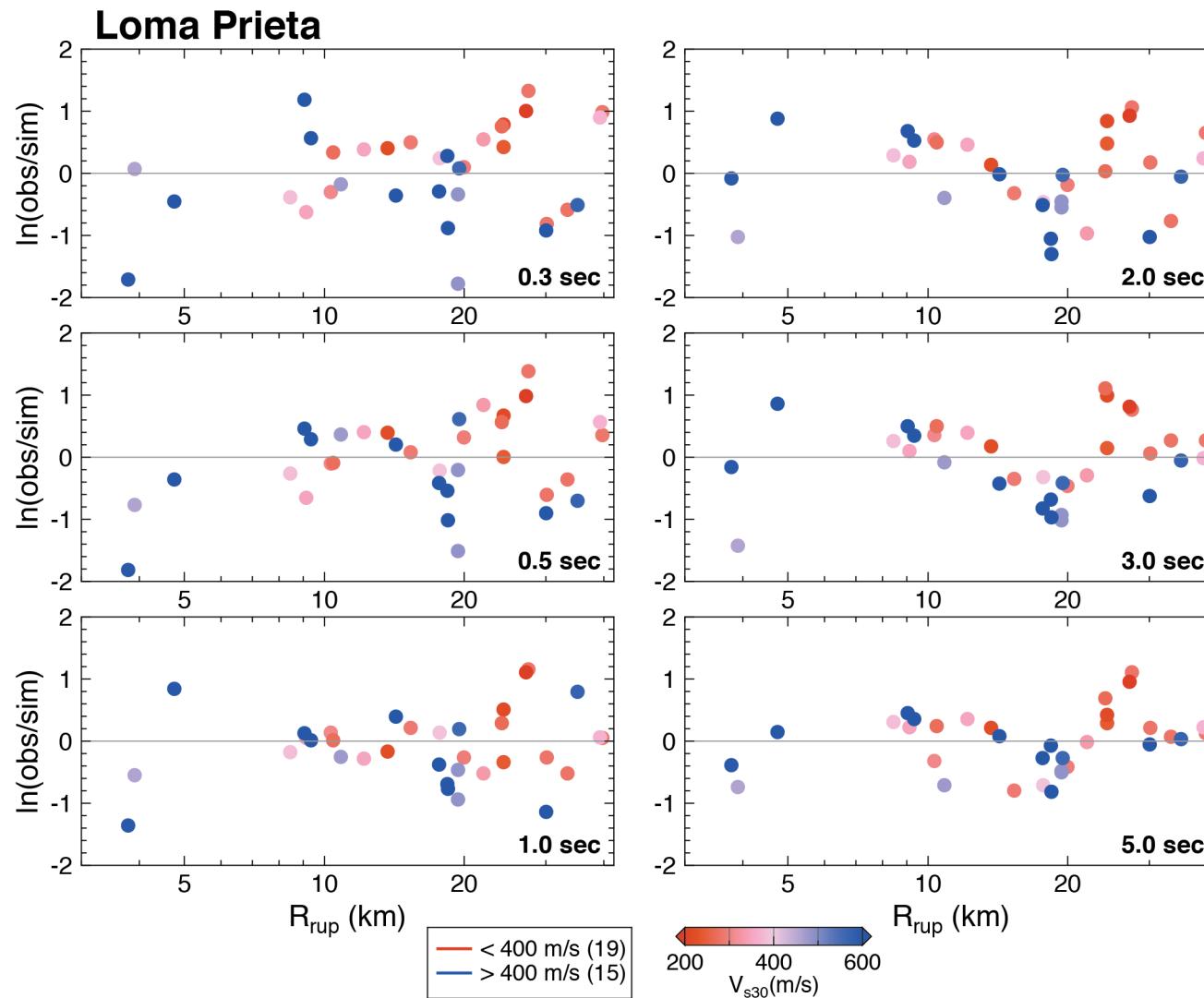
Simulation Results

Peak Spectral Acceleration Goodness-of-Fit (GoF)



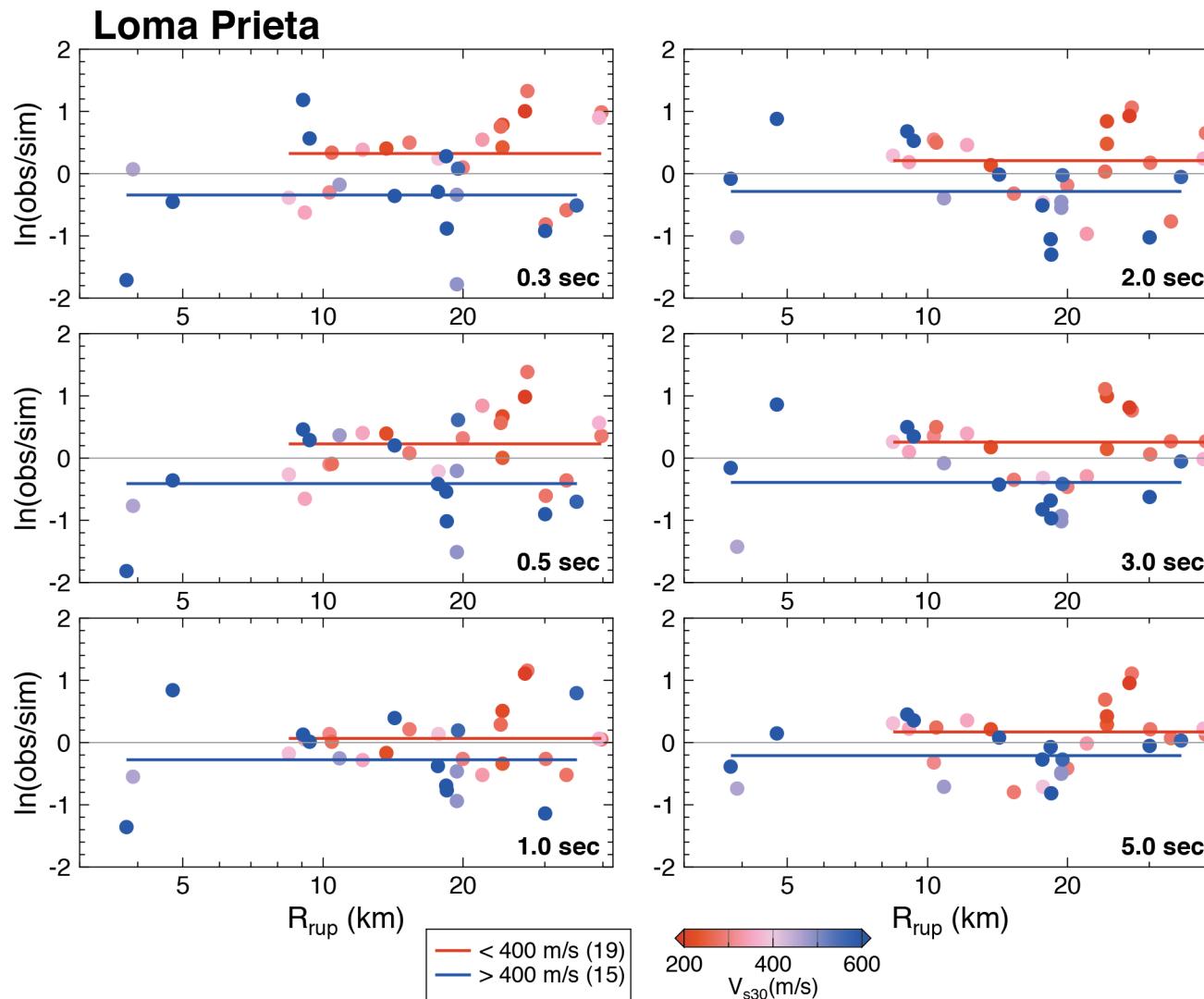
Simulation Results

Peak Spectral Acceleration (*RotD50*) Residuals



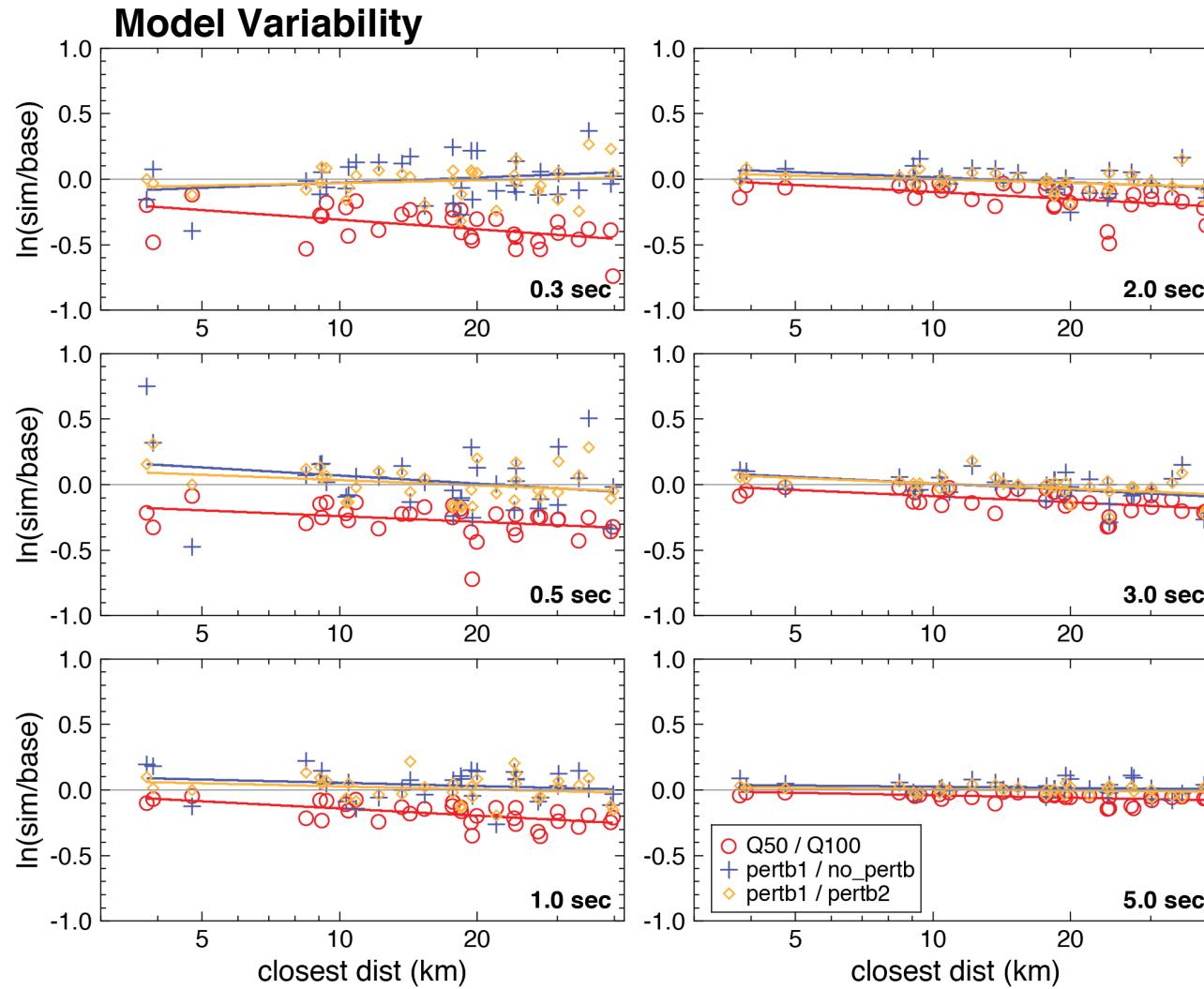
Simulation Results

Peak Spectral Acceleration (*RotD50*) Residuals



Simulation Results

Peak Spectral Acceleration (RotD50) Residuals



$Q_{50}: Q_s = 50 \times V_s \text{ (km/s)}, Q_p = 2 \times Q_s$
frequency independent

Summary / Recommendations

- **Fault bounded material boundaries create strong wave guide effects:**
 - How well constrained (e.g., alternatives)?
 - Velocity contrast?
 - Depth extent?
- **Characterizing near surface media:**
 - Consistency with other data (e.g., NGA Vs30)?
 - Higher resolution needed?
 - Correlation with deeper media?
- **Attenuation:**
 - Constraints on quality factor (Q)?
 - Small-scale media variability?
- **Key factor in validation is using “simpler” events**

