PEER Ground Motion Database for the Next Generation Attenuation Model for Shallow Crustal Earthquakes in Active Tectonic Regions (NGA-W2)

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Outline

- Characteristics of the updated database
- New RotDnn spectra
- PEER Processing
- Overview of Flatfiles
- Summary

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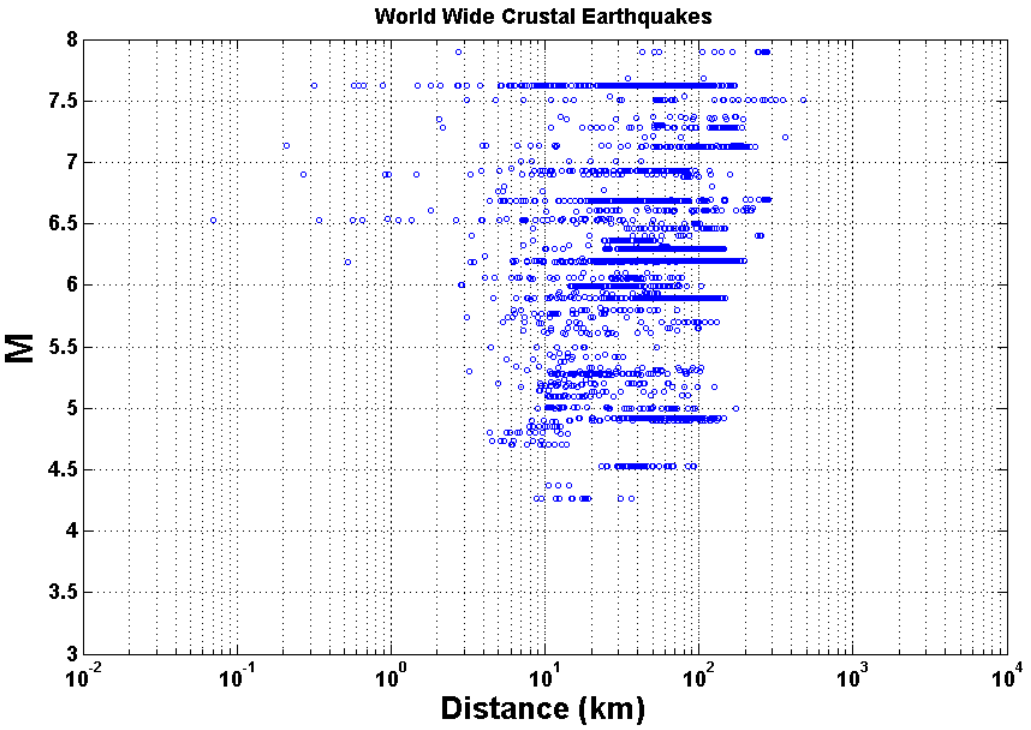
World Wide Crustal Earthquakes

- 2003 – PEER released a uniform processed GM database of free field stations during NGA W1 project



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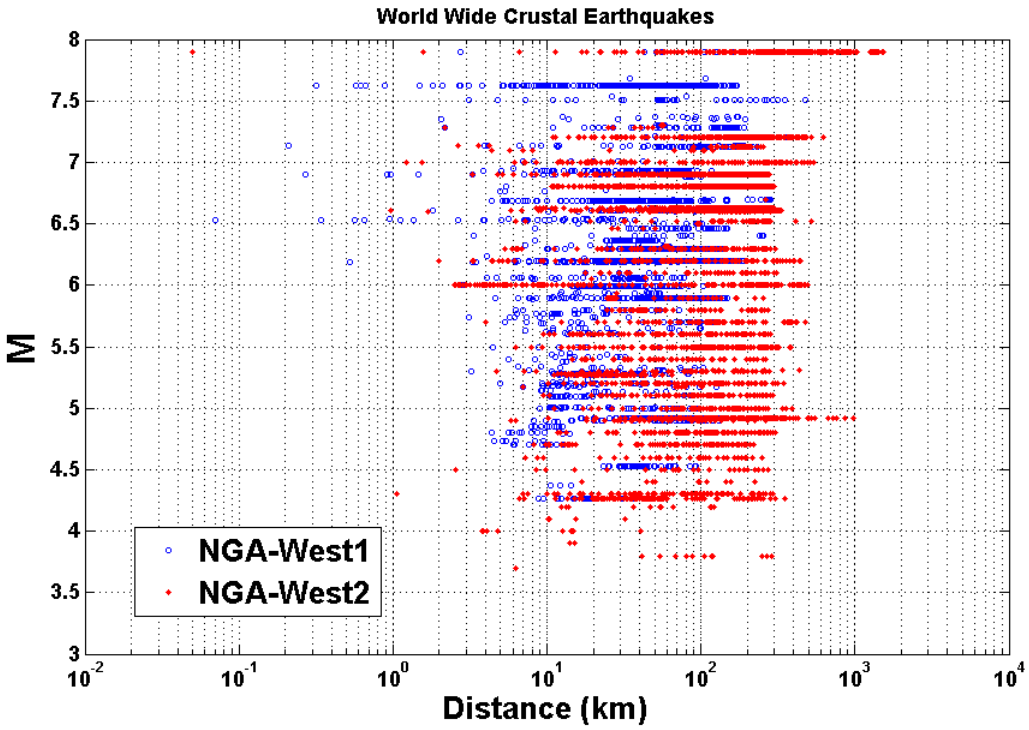
World Wide Crustal Earthquakes

- 2003 – PEER released a uniform processed GM database of free field stations during NGA W1 project
- 2012 – NGA W2 added significant events up to 11/2011



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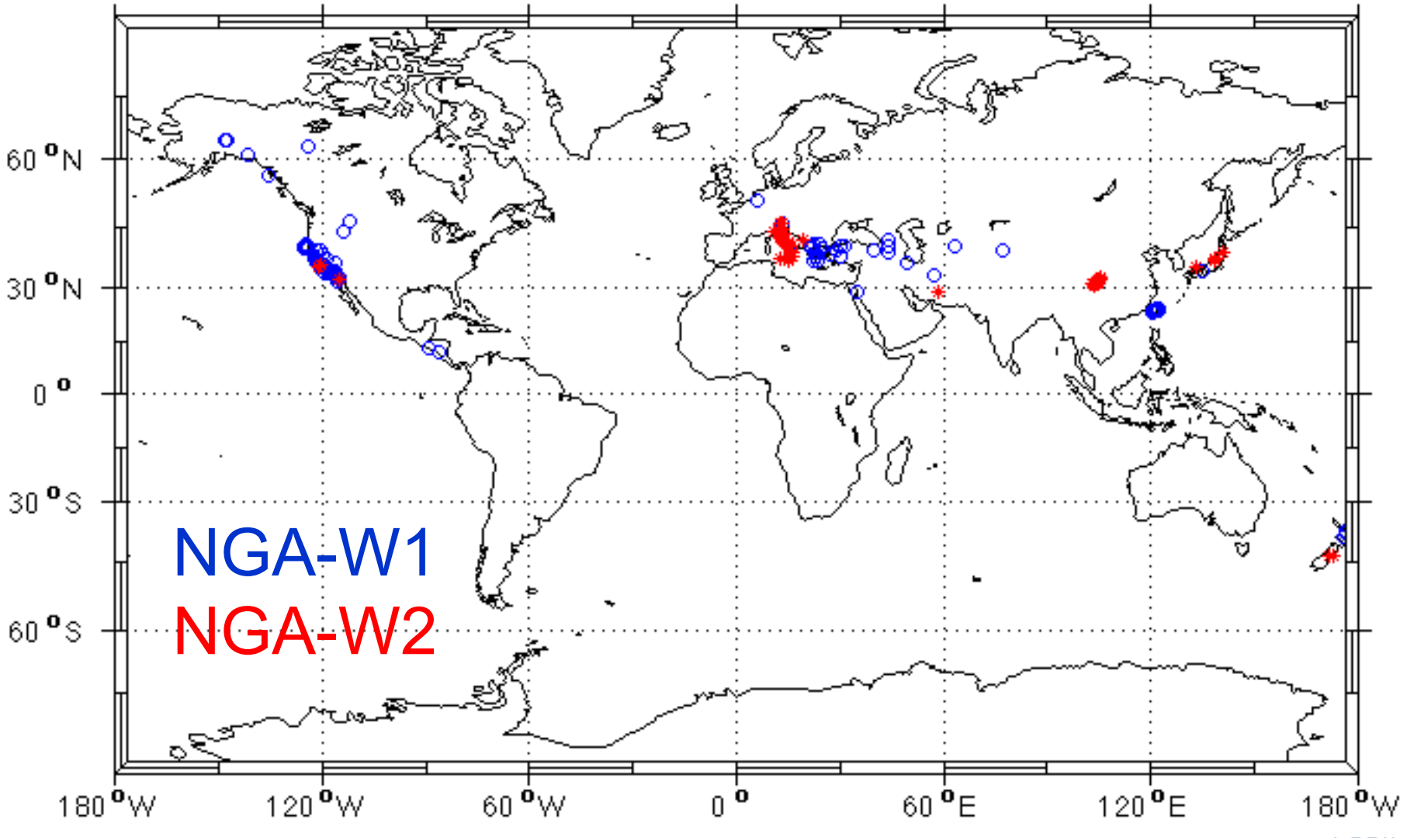
NGA W2 World Wide Event Locations



Example of New World Wide Events

Earthquake Name	Year	M	N Rec	R_{RUP} (km)
Tottori, Japan	2000	6.61	414	1-333
Niigata, Japan	2004	6.63	530	8-300
Chuetsu-oki, Japan	2007	6.8	616	10-300
Iwate, Japan	2008	6.9	367	5-280

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Example of New World Wide Events

Earthquake Name	Year	M	N Rec	R_{RUP} (km)
Darfield, New Zealand	2010	7	114	1-540
Christchurch, NZ	2011	6.1	104	2-440
Wenchuan, China	2008	7.9	263	1-1500
L'Aquila, Italy	2009	6.3	48	5-230
Bam, Iran	2003	6.6	24	2-282

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Example of New World Wide Events

Earthquake Name	Year	M	N Rec	R_{RUP} (km)
El Mayor-Cucapah	2010	7.2	238	11-240
Parkfield, CA	2004	6	141	2.5-373
San Simeon, CA	2003	6.5	68	6-524

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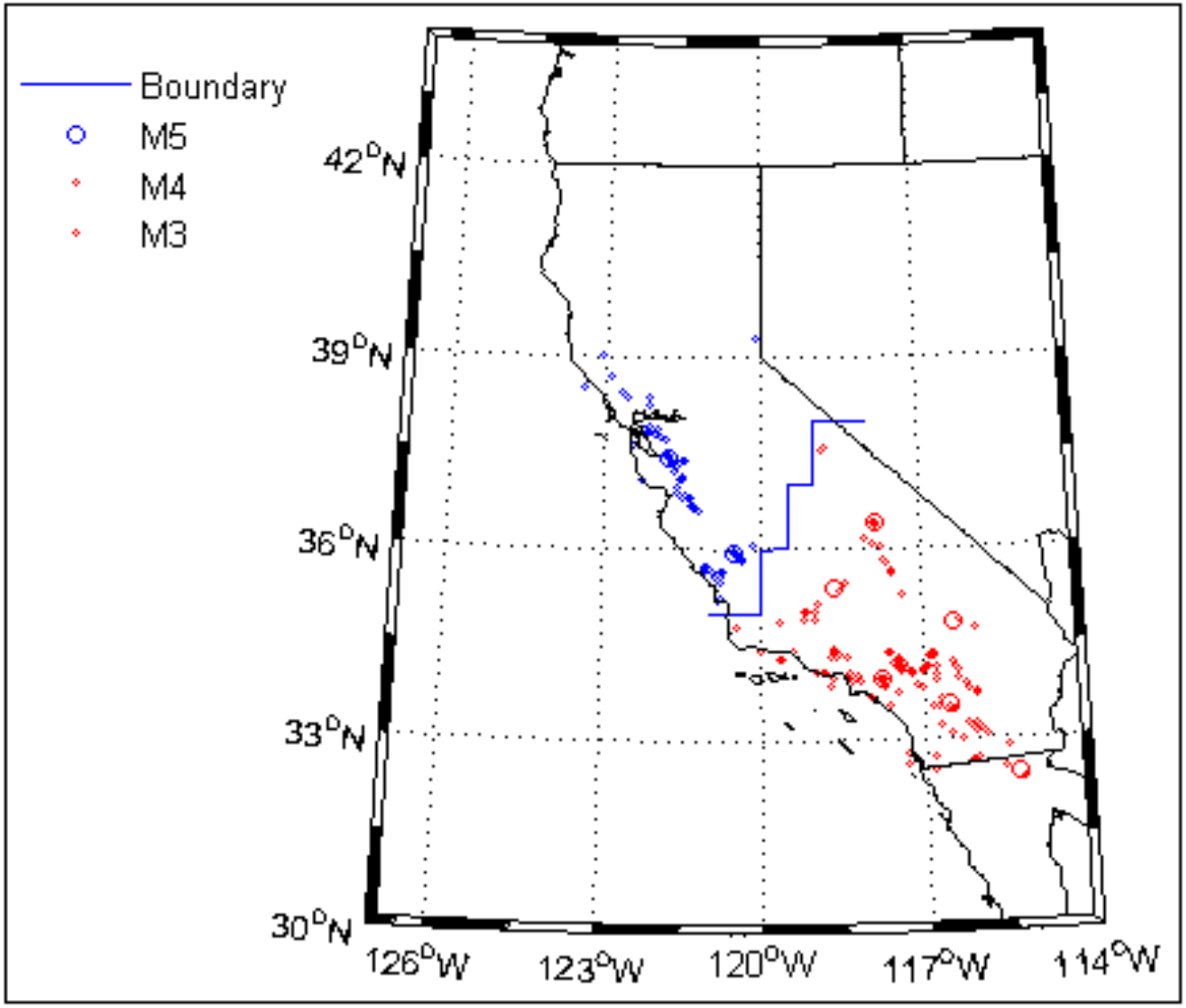
CA Small to Moderate Magnitude Events



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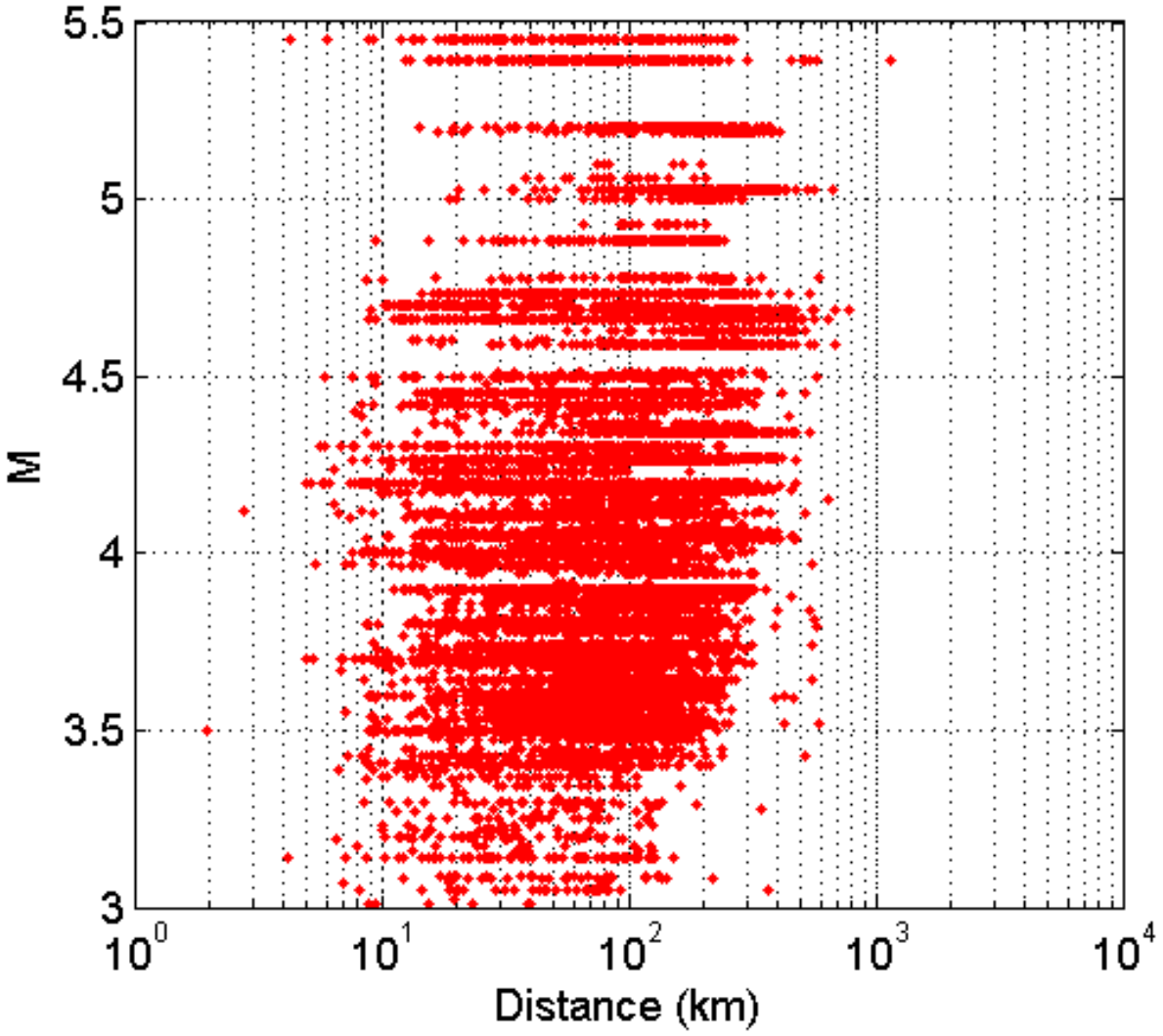
CA Small to Moderate Magnitude Events



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CA Small to Moderate Magnitude Events

- 264 events: 10,789 3-component rec.
- M 3 to 5.5
- 4 data providers: USGS, BDSN, CIT, CGS
- Broadband seismometer and accelerometer
- Motivation: multiple events recorded at same site, single station sigma, updating M scaling of GMPE's, contrast Central vs S. CA ground motion

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Comparison of NGA Databases

- New RotDnn spectra
- 11 damping levels
- Periods up to 20 sec

Data Set	# Eqk	# Rec	Sa Type	Damping	Periods (sec)
NGA	173	3551	AR, GMRotI50	5%	0.01 - 10
NGA W2	610	~19400	AR, GMRotI50, RotDnn	0.5-30%	0.01 - 20

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RotDnn

- Combine two orthogonal components to create a rotated time series over 0-180˚ rotation angles
- Calculate response spectra at each rotation angle
- Three fractiles, the minimum (nn = 00), mean (**nn = 50**), and the maximum (nn = 100) spectral amplitude are considered in the NGA-West2 project.

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RotDnn

- Motivation: Building code community using the maximum component
- Comparison of RotD50 and GMRotI50 is presented in Boore (2010)

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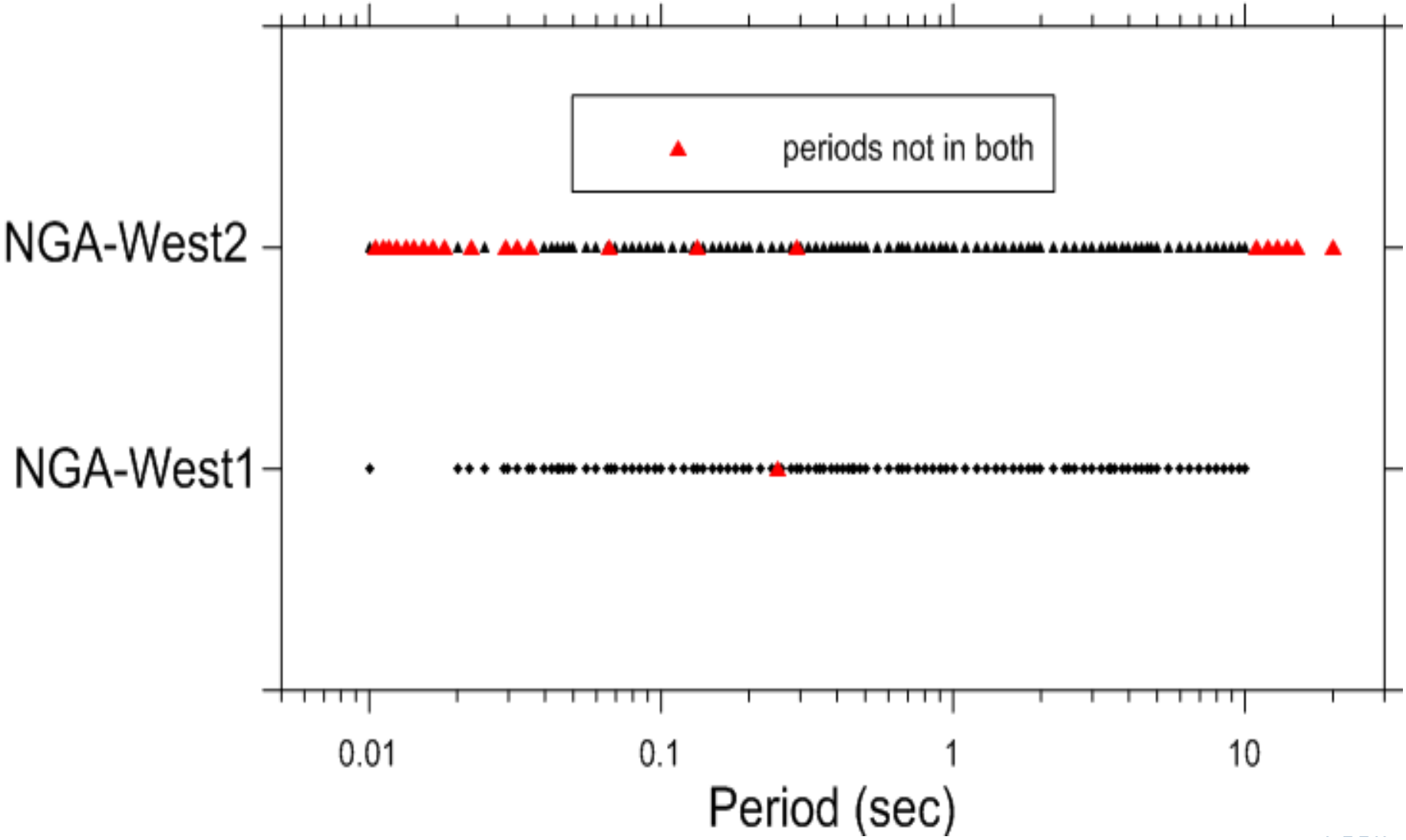
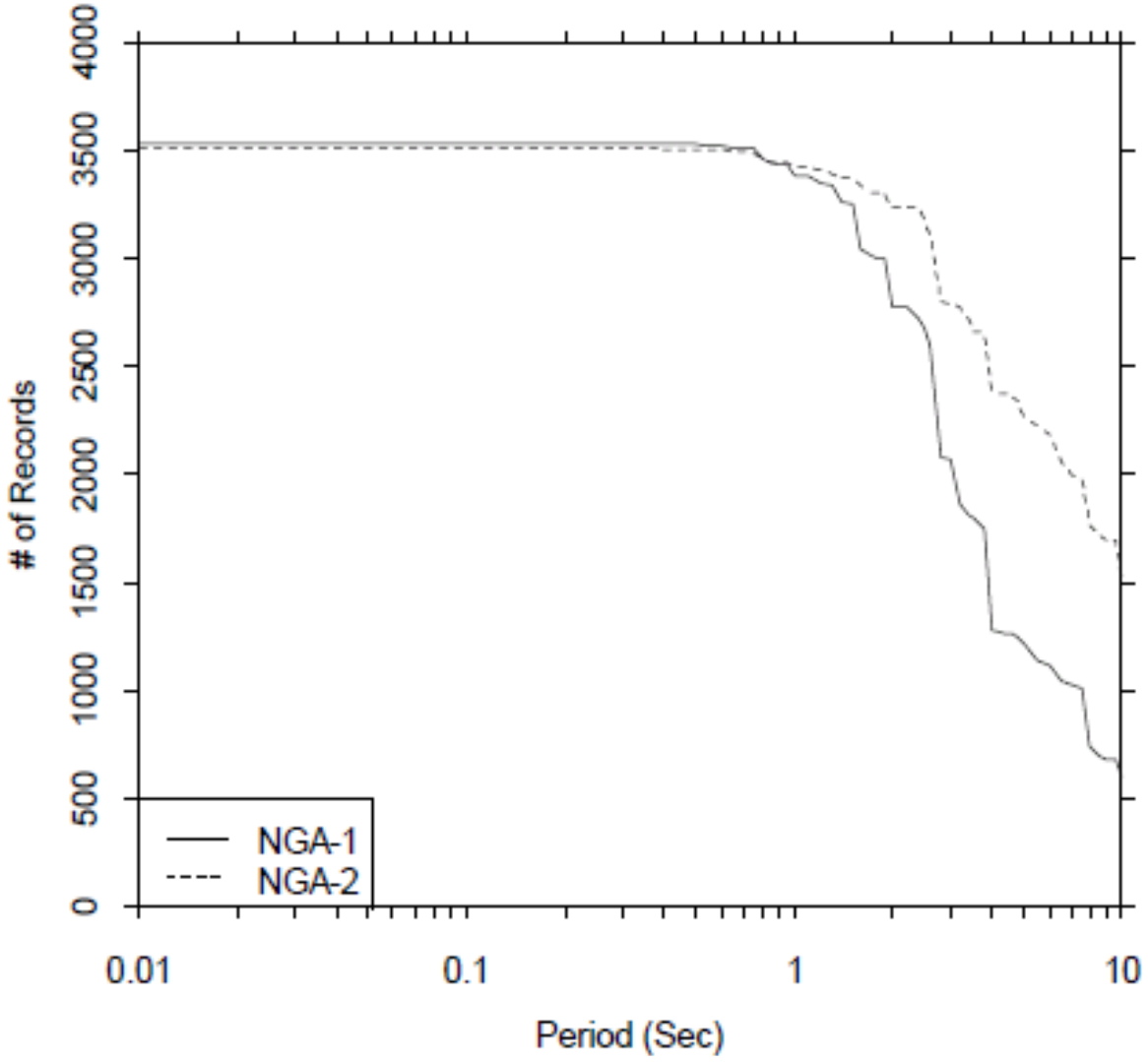
PEER Record processing

- Processing originally performed with FORTRAN
- Updated in R for the CA SMM events
- Acausal filter (when not pass-through)
- AVD compatible time series

New Period list (111 Periods+PGA,PGV,PGD)



Effect of Re-Processing



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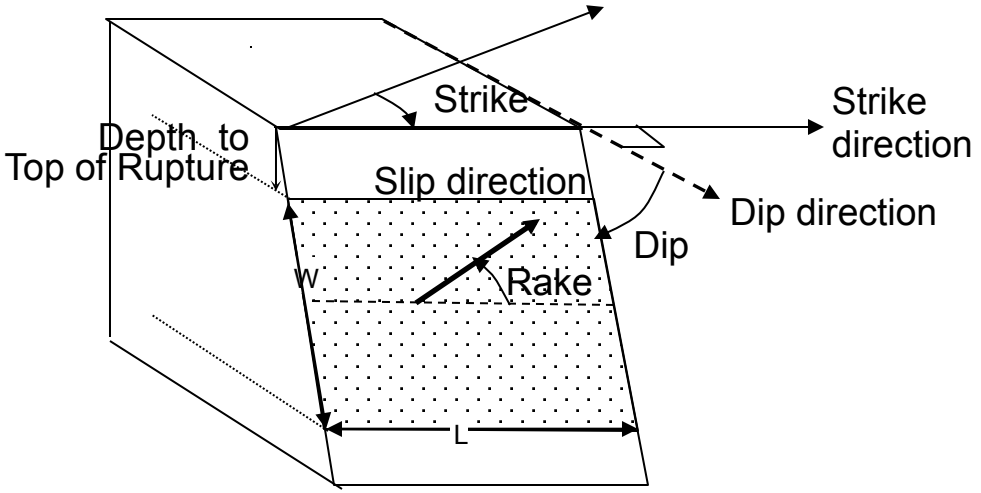
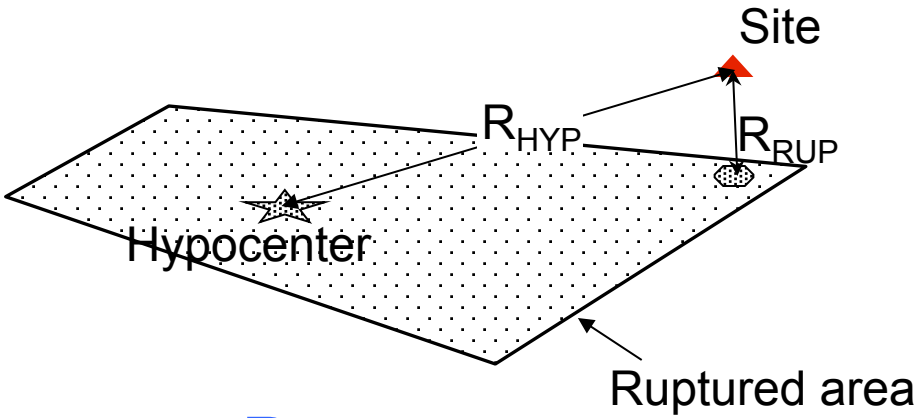
NGA West 2 Flat File

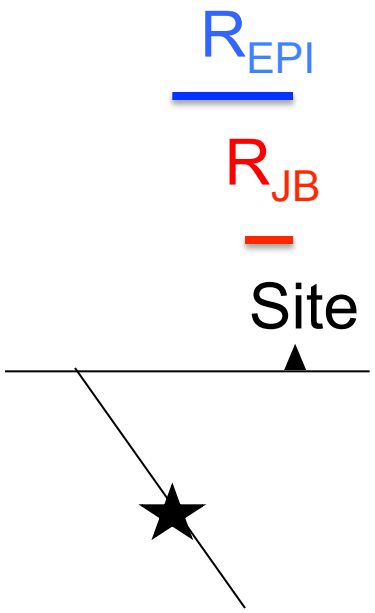
- Three metadata databases
  - Source



NGA West 2 Flat File

- Three metadata databases
  - Source
  - Path





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NGA West 2 Flat File

- Three metadata databases
  - Source
  - Path
  - Site

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NGA West 2 Flat File

- Three metadata databases
  - Source
  - Path
  - Site
- Combined with spectra
- Extensive QA

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NEW/Updates to Metadata

- New event classification
- New distance metrics
- New directivity parameters
- New late trigger flags
- Removed co-located stations

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New Event Classification

- NGA W1: aftershock events were determined by developer
- NGA W2: consistent framework for identifying aftershock events (see K. Wooddell's presentation)
- Class 2: event in close proximity (time and space) to a past rupture surface

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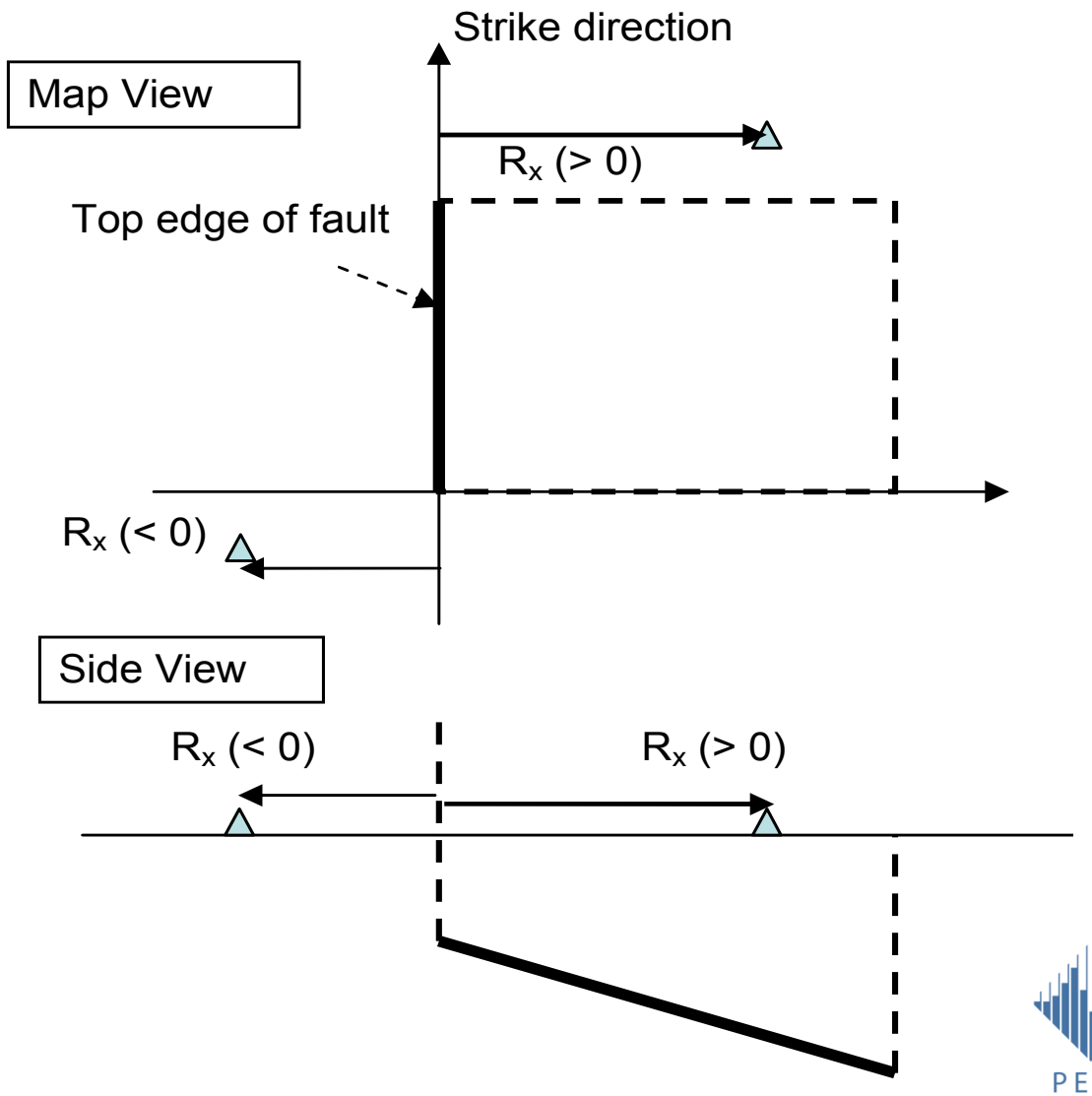
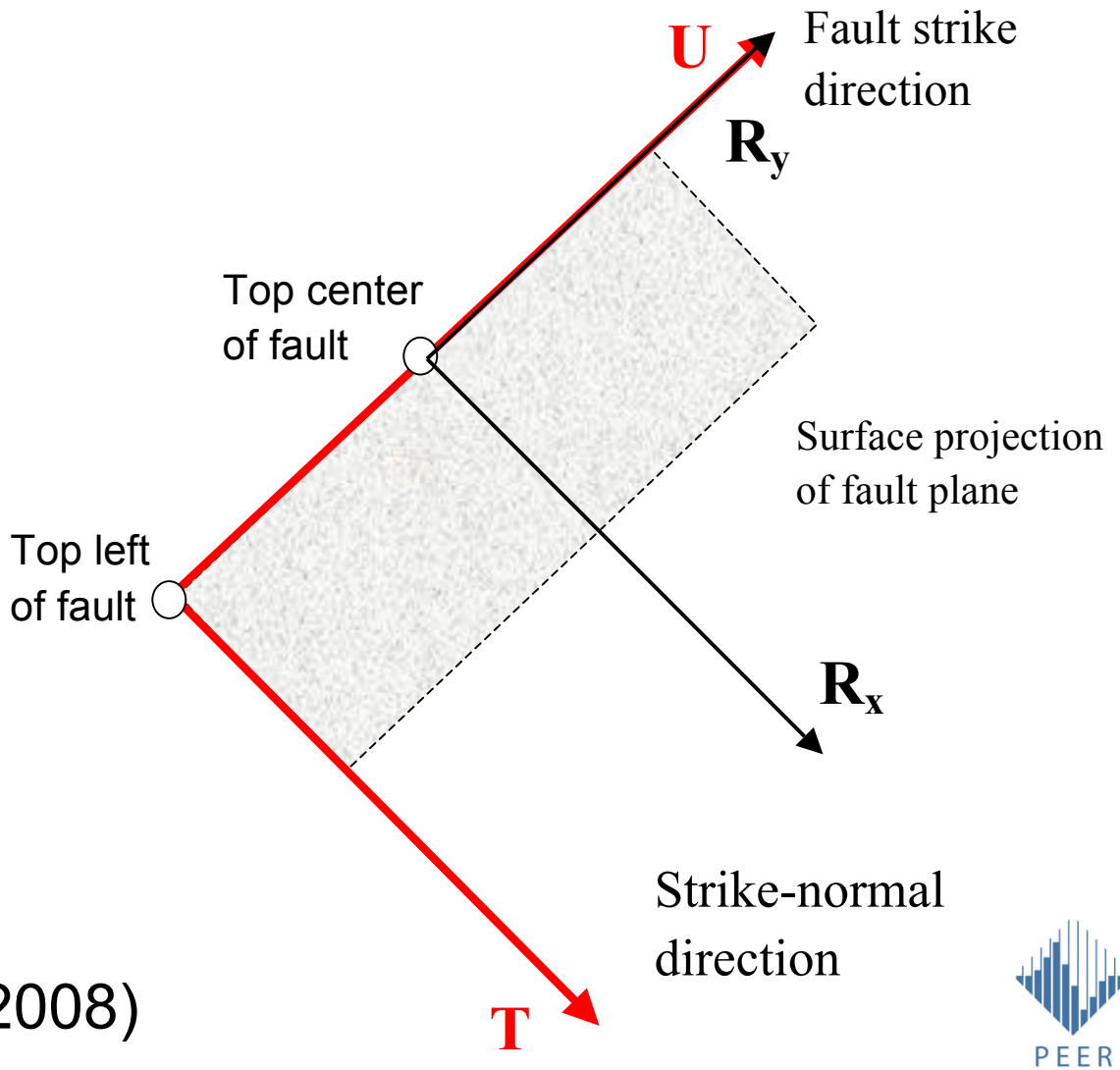
New Distance Metrics

- R_X was not provided in NGA-W1



New Distance Metrics

- R_X was not provided in NGA-W1
- Generalized U and T (R_X) are now provided



Spudich and Chiou (2008)

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Added Quality Flags

- Removed co-located stations, dt-warnings
- Quantified late trigger cases in time series
  - Triggered instruments may miss p-wave/s-wave arrival
  - Modern digital have pre-event memory

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Summary

- PEER NGA-W2 Database, is largest uniformly processed data set in the world
- M 3 to 7.9; R_{RUP} 0.7 to 1500 km; V_{S30} 90 to 2100 m/s
- Database can be used by structural/geotechnical engineers as well as ground motion hazard analyst and financial loss modelers
- Database will be use to update the attenuation models for the West Coast of the United States
- Database will be available early 2013

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Thank you

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