



NGA-East SSHAC Workshop 3C Introduction



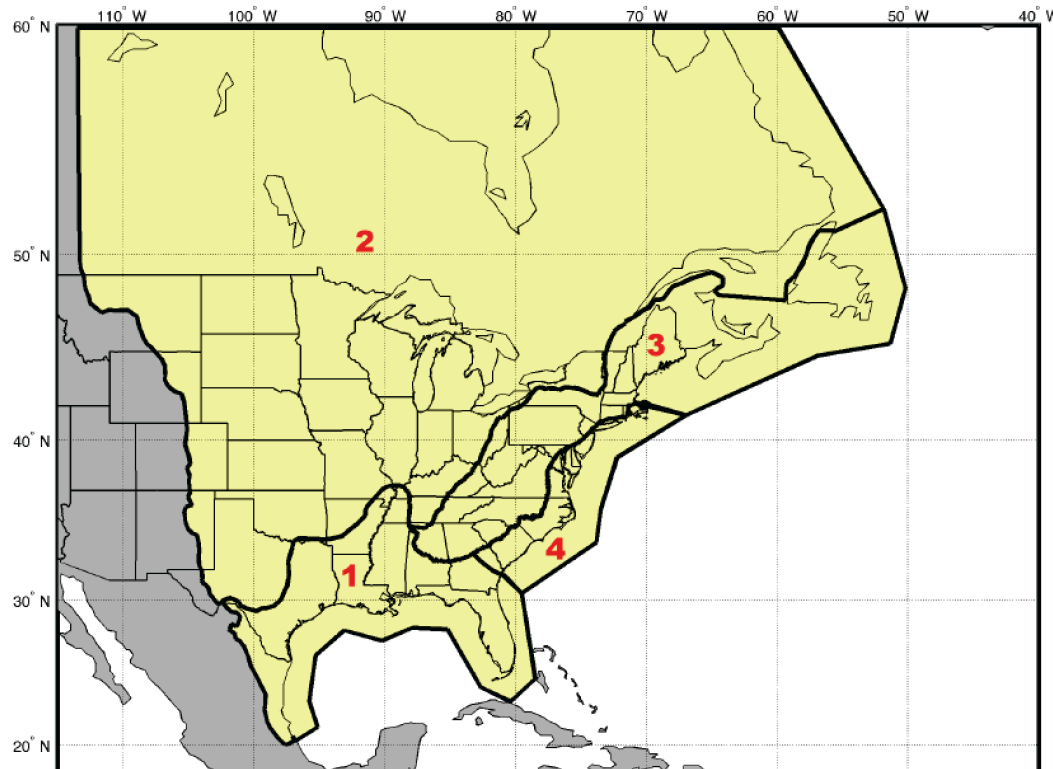
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<http://peer.berkeley.edu/ngaeast/>

Input to Seismic Hazard Analyses (SHA)

- Deterministic and Probabilistic SHA requires two main pieces:
 - Seismic Source Characterization (CEUS SSC)
 - Ground Motion Characterization (NGA-East GMC)



The NGA-East Project



*A science/development phase
AND a SSHAC Level 3 project*

Objective – to develop GMC model:

- Ground-Motion Models (GMMs)/GMPEs
 - Median
 - Standard Deviation “Sigma” (aleatory variability)
- Logic trees (epistemic uncertainty)
- For:
 - Average horizontal ground motions (5%-damped PSA for $f=0.1-100\text{Hz}$), for
 - Hard rock sites ($V_S=3000\text{ m/s}$, $\kappa=0.006\text{ s}$) located up to 1,200 km from
 - Future earthquakes in CENA **M**4.0-8.2

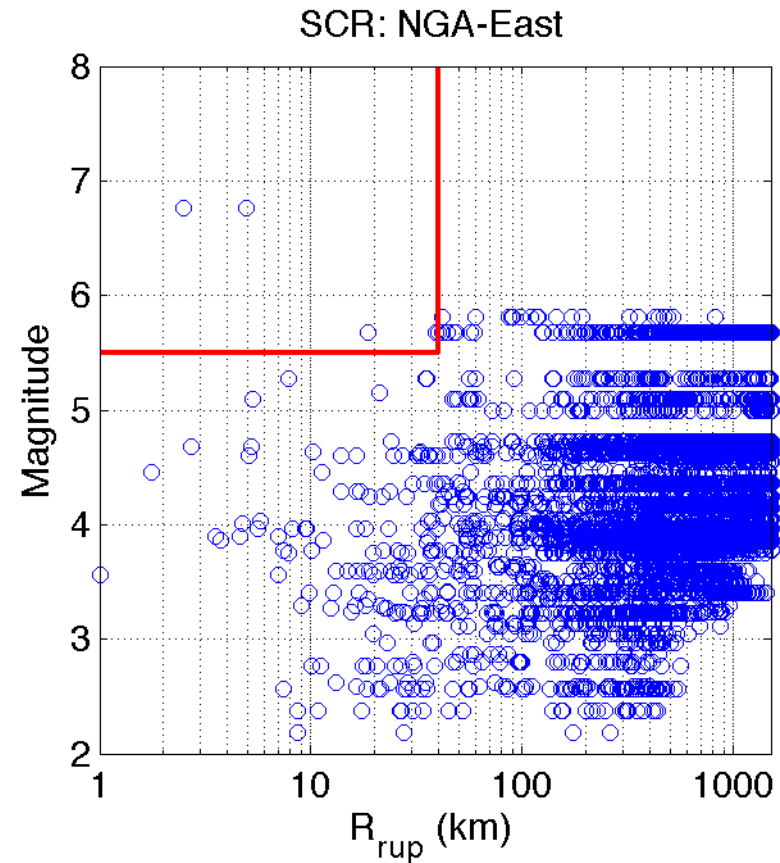
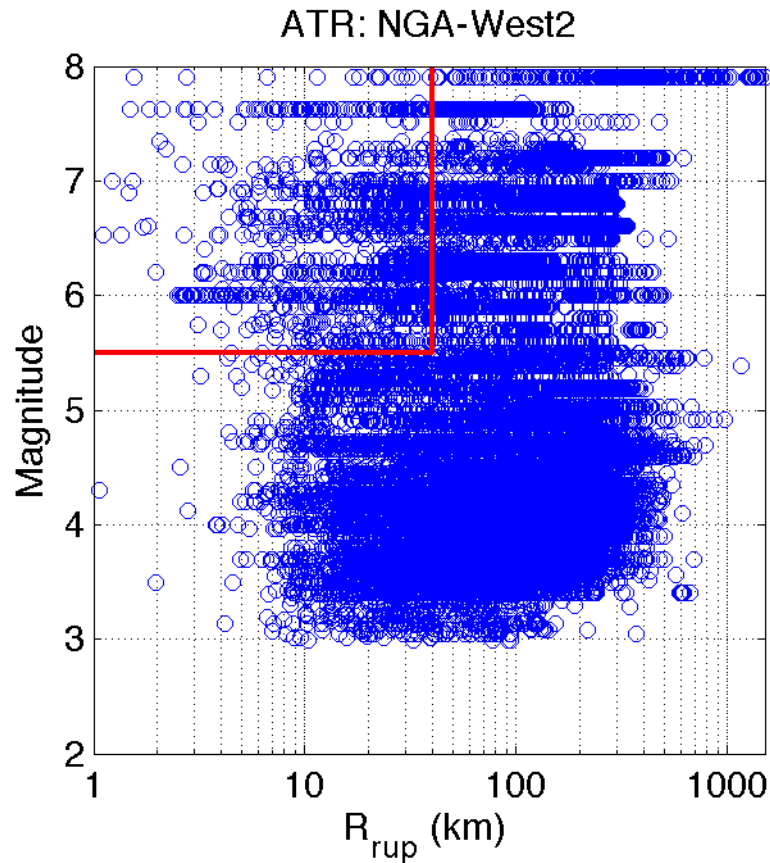
Critical Issues and Approach

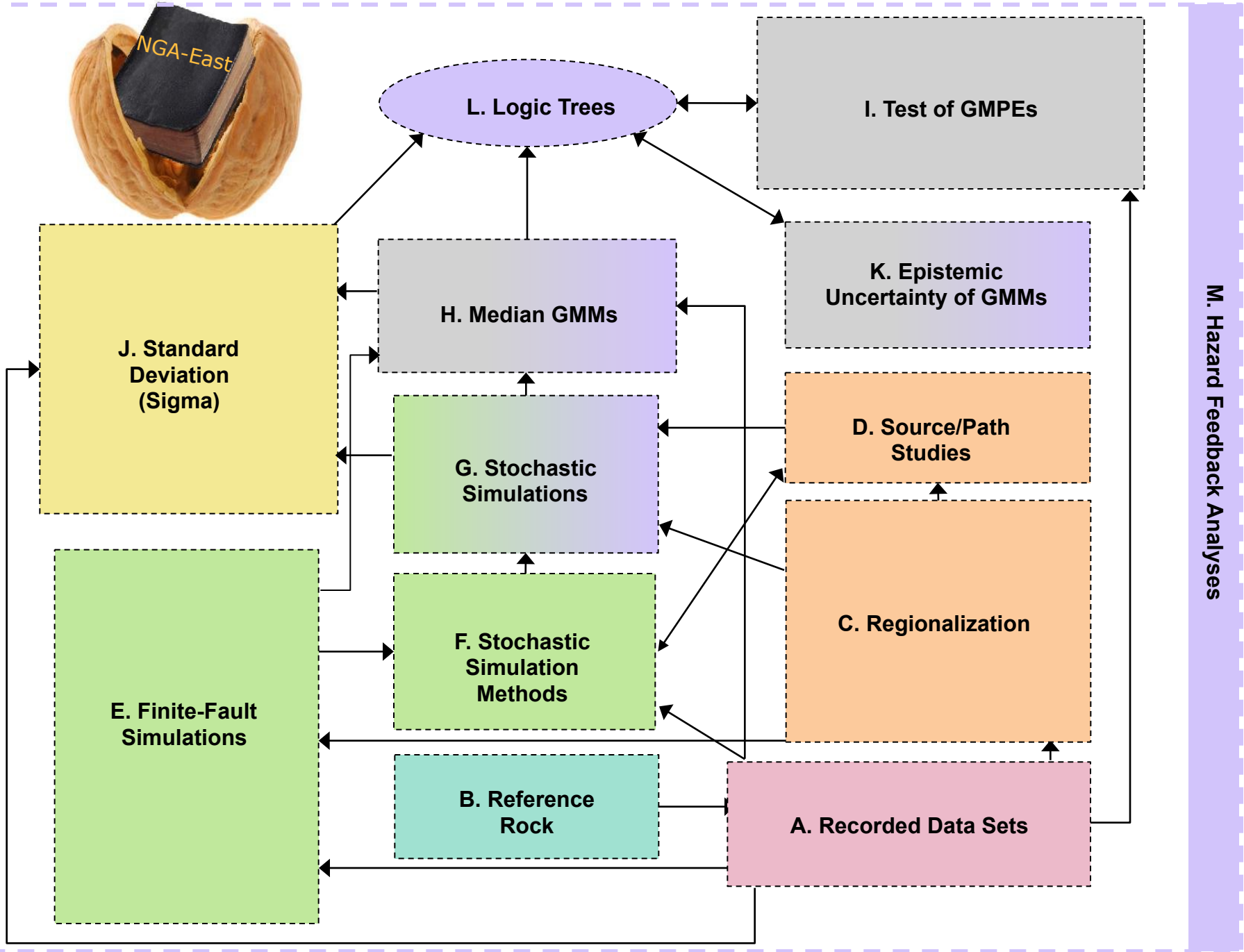
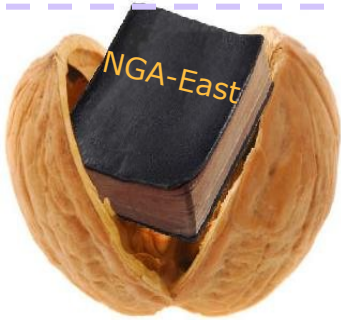
- Hazard-critical issues:
 - Regionalization of source and path parameters
 - Geometrical spreading in first 40 km
 - Stress drop (or parameter) and extrapolation of ground motions to large **M**
 - Standard deviation of ground motions
 - Quantification of site effects
- Solution:
 - 1) run a multi-disciplinary science project with working groups focused on specific research tasks
 - 2) build models making extensive use of seismological constraints (simulations)
 - 3) perform the evaluation and integration under the SSHAC Level 3 umbrella

NGA-East – a hybrid project

- Multi-disciplinary **science** project with working groups focused on specific research tasks
- **SSHAC** Level 3 project for evaluation and integration of ground-motion models

The NGA-East Challenge: developing GMC model with limited data





NGA-East Science: PEER Reports



PACIFIC EARTHQUAKE ENGINEERING
RESEARCH CENTER

Reference-Rock Site Conditions for Central and Eastern North America:

Part I – Velocity Definition

Developed by

NGA-East Geotechnical Working Group

Youssef M.A. Hashash, Albert R. Kottke, Jonathan P. Stewart,
Kenneth W. Campbell, Byungmin Kim, Ellen M. Rathje,
and Walter J. Silva

In Collaboration with:

Sissy Nikolaou and Cheryl Moss

PEER 2014/11
AUGUST 2014



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Reference-Rock Site Conditions for Central and Eastern North America:

Part II – Attenuation (Kappa) Definition

Developed by

NGA-East Geotechnical Working Group

Kenneth W. Campbell
and
Youssef M.A. Hashash, Byungmin Kim, Albert R. Kottke,
Ellen M. Rathje, Walter J. Silva

Under the Auspice of
Pacific Earthquake Engineering Research Center

PEER 2014/12
AUGUST 2014



PACIFIC EARTHQUAKE ENGINEERING
RESEARCH CENTER

Scaling Relations between Seismic Moment and Rupture Area of Earthquakes in Stable Continental Regions

Paul Somerville
URS Corporation

Report to the Pacific Earthquake Engineering Research Center

NGA-East Project



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NGA Projects: From FAS to PSA,
Preferred Random Vibration Theory Approaches



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NGA-East Regionalization Report: Comparison of Four Crustal Regions within Central and Eastern North America using Waveform Modeling and 5%-Damped Pseudo-Spectral Acceleration Response

Jennifer Drilling
Marius P. Isken
Walter D. Mooney

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Menlo Park, California

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Richard W. Godbee

Department of Geosciences
Virginia Polytechnic Institute and State University
Blacksburg, Virginia

PEER 2014/15
OCTOBER 2014



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PEER NGA-East Database

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PEER 2014/17
OCTOBER 2014



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NGA-East: Median Ground Motion Models for Central and Eastern North America

PEER Report No. 2015/04
Pacific Earthquake Engineering Research Center
Headquarters at the University of California, Berkeley

April 2015

PEER 2015/04
APRIL 2015

PACIFIC EARTHQUAKE ENGINEERING
RESEARCH CENTER

NGA-East: Median Ground Motion Models for Central and Eastern North America

Mehmet Ali Atik
Jatlik Consulting
San Francisco, California

PEER Report No. 2015/07
Pacific Earthquake Engineering Research Center
Headquarters at the University of California, Berkeley

June 2015

PEER 2015/07
JUNE 2015



PACIFIC EARTHQUAKE ENGINEERING
RESEARCH CENTER

NGA-East: Adjustments to Median Ground-Motion Models for Central and North America

Progress Since March Workshop

- Refined median GMMs
- Finalized “sigma” models
- Assigned weights to median and sigma models
- Developed models for Gulf Coast
- Developed a model for source-depth effects
- Documentation and data dissemination
 - NGA-East GMM report published 2015/04
 - NGA-East Sigma report published 2015/07
 - NGA-East GMM Adjustment report 90% draft
 - SHHAC report: draft in progress

What is SSHAC?

- A set of **procedural guidelines** for seismic hazard analyses
- Procedures defined by the **Senior Seismic Hazard Analysis Committee (SSHAC)**
- Implementation in constant evolution
- Level qualifies complexity (1-4)
- NGA-East is a SSHAC Level 3 project
- Details in SSHAC NUREG/CR-6372 and NUREG-2117

See PEER NGA-East page for link to these documents:

<http://peer.berkeley.edu/ngaeast/>

Goals of SSHAC process

To carry out properly and document completely the activities of evaluation and integration

- **Evaluation**: The consideration of the complete set of data, models, and methods proposed by the larger technical community that are relevant to the hazard analysis.
- **Integration**: Representing the center, body, and range of technically defensible interpretations in light of the evaluation process (**CBR of the TDIs**).

Other Key Features of SSHAC process

- Clearly defined **roles** for all participants.
- Structured interactions among participants, including technical challenge of positions, in **formal workshops** (themes 1-3).
- **Rigorous peer review** of the entire process and **thorough documentation**.

SSHAC Workshop theme 3: Feedback

■ Goals

- To present and discuss the preliminary GMC model
- To ensure that no significant issues have been overlooked (discussions and PPRP feedback)
- To provide hazard-informed focus on finalizing the model (hazard feedback)

■ Key participants

- **Technical Integration Team:** Norm Abrahamson, Christine Goulet, Linda Al Atik, Gail Atkinson, Rob Graves, Bob Youngs
- **Participatory Peer Review Panel:** Gabriel Toro, John Adams, Jon Ake, John Ebel, Jeff Kimball, Rich Lee
- **Proponent and Resource Experts**

This is a formal SSHAC workshop!

- presenters show results from **collective work**
- interactions are structured: only **Resource** and **Proponent Experts** can participate in the discussions
 - see Norm or Christine at breaks if you have a key issue to bring up and are not a RE or PE
- members of public can attend workshop as **Observers**
- comments from Observers are made possible at the **end of the day**, as time allows
- comments on workshop issues can be provided in writing: goulet and abrahamson @berkeley.edu
- recorded, to be posted as part of the SSHAC documentation
 - Use the microphone
 - Use the ReadyTalk chat window to contact us

Today's meeting

- In-person and web/phone attendees
- ALL participants on-site need to use the **microphones** and **announce their name**
- Remote attendees, “raise your hand” or use chat on ReadyTalk to send a question or send an e-mail to:
sahar.der@berkeley.edu
- Agenda and additional info at
 - <http://peer.berkeley.edu/ngaeast/events/>

Agenda overview

- Day 1 Wednesday
 - Median Ground Motions
 - Standard deviation of ground motions
- Day 2 Thursday
 - Hazard feedback analyses
 - Adjustment to median models
 - Gulf Coast/Mississippi embayment region
 - Source-depth effects
 - Summary of everything...