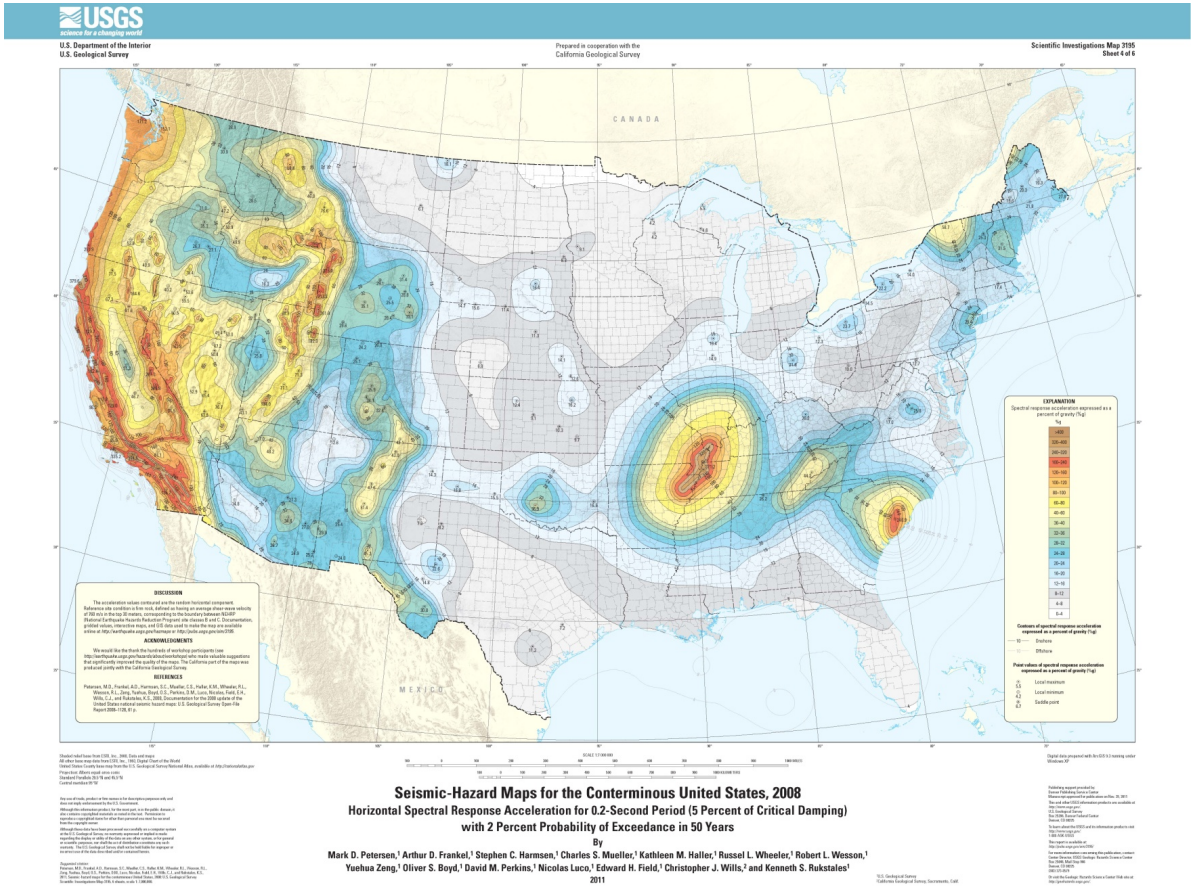
Workshop on the CEUS Source Model
February 22–23, 2012 Memphis, TN

USGS science for a changing world

THE UNIVERSITY OF MEMPHIS
Center for Earthquake Research and Information

nehrp

WEST TENNESSEE SEISMIC SAFETY COMMISSION

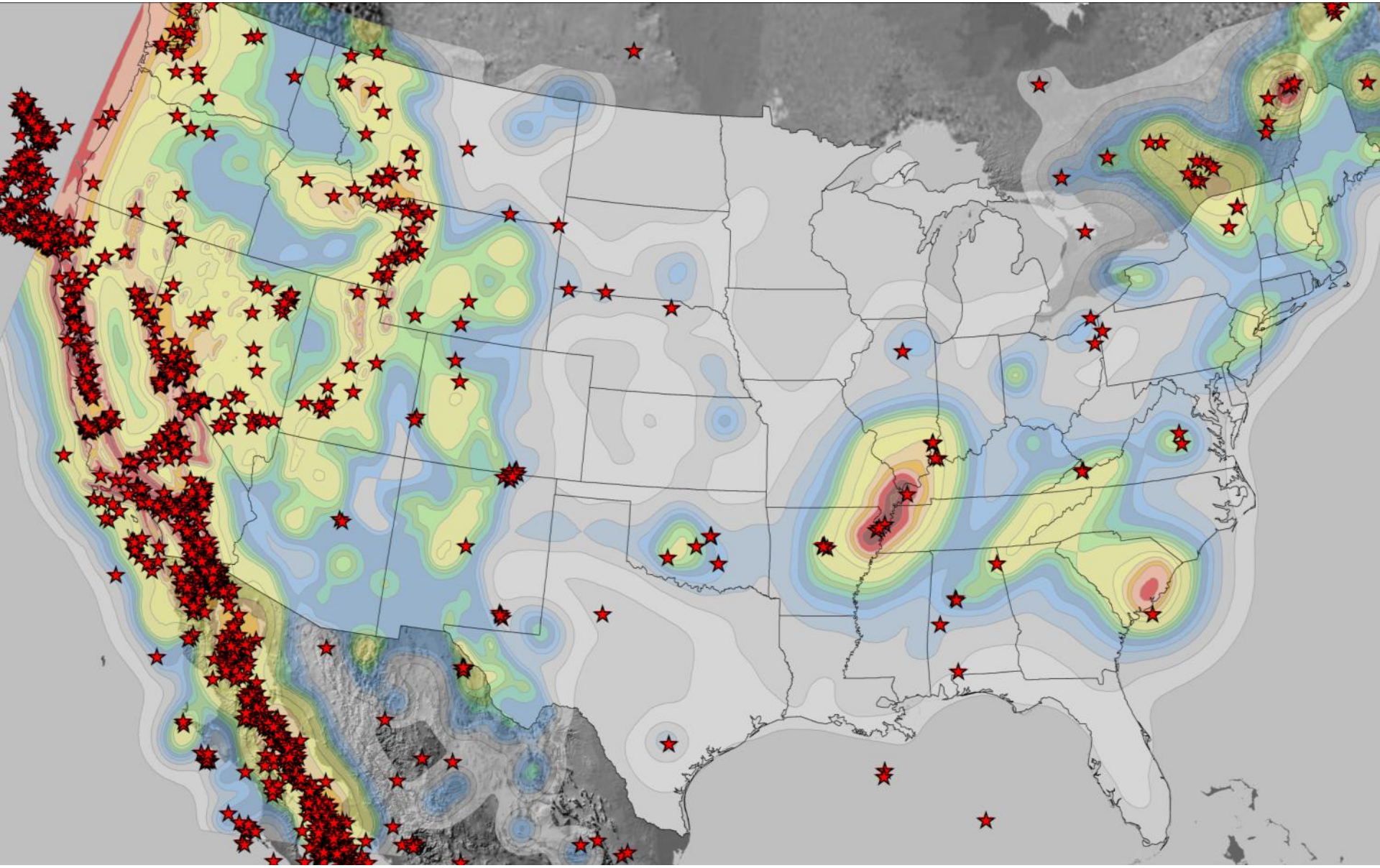


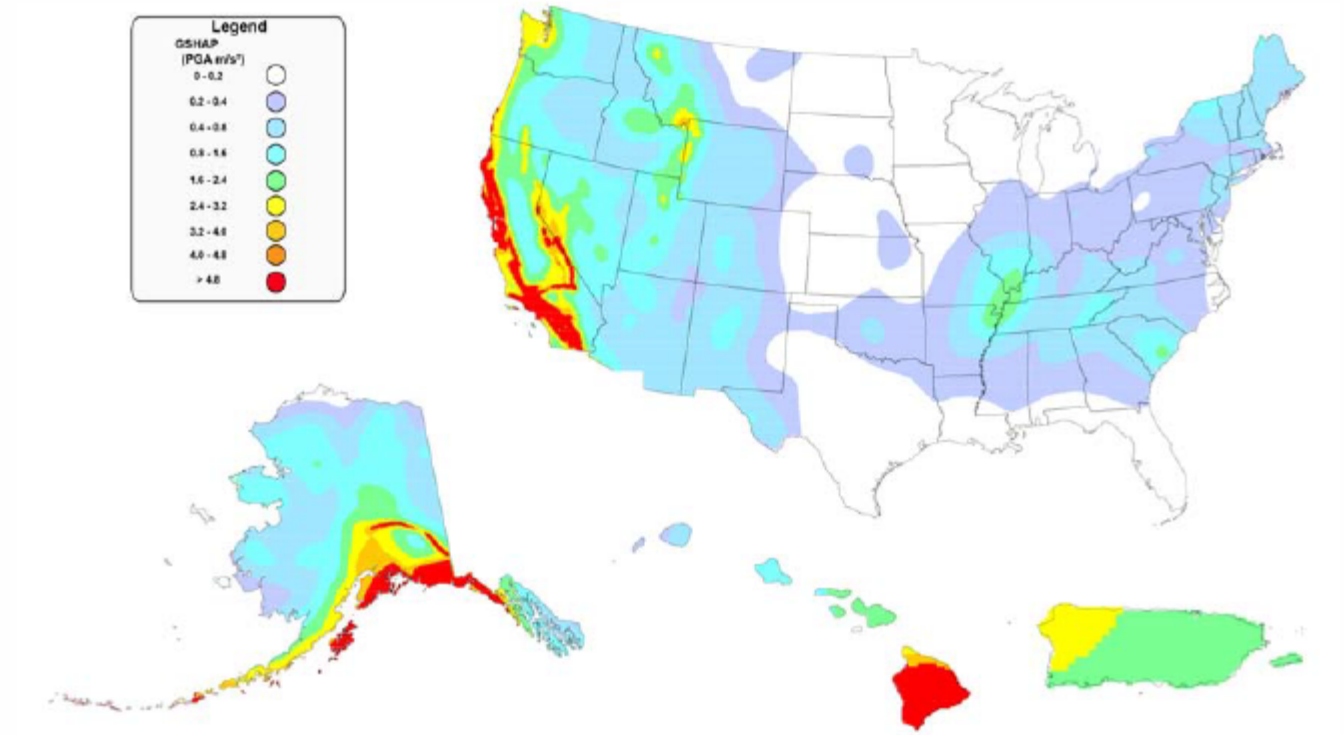
Thanks to CERI for hosting the meeting –
Beverly Cook, Gary Patterson, Chuck Langston, others

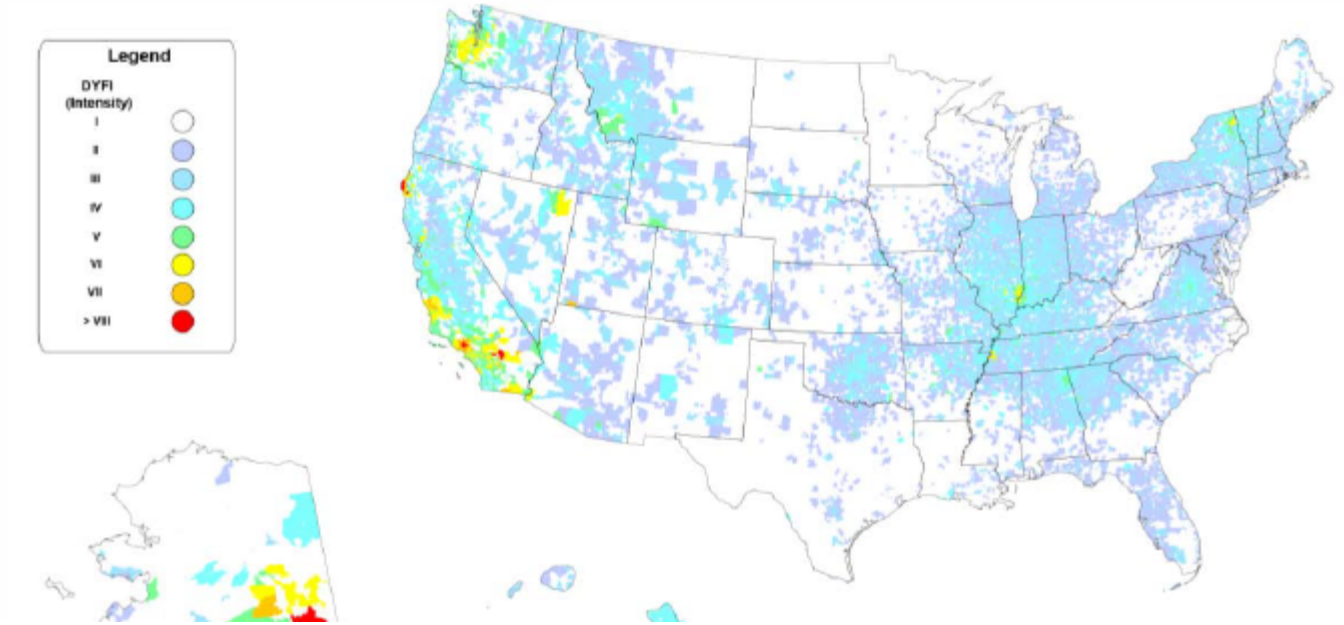
National Seismic Hazard Maps: Uses

- Building codes: BSSC, ASCE7, IBC, IRC, Railroad, Transportation
- Insurance rates: CEA, reinsurance, others
- Public policy: CA seismic hazard mapping act, FEMA (HAZUS), Mitigation fund allocation

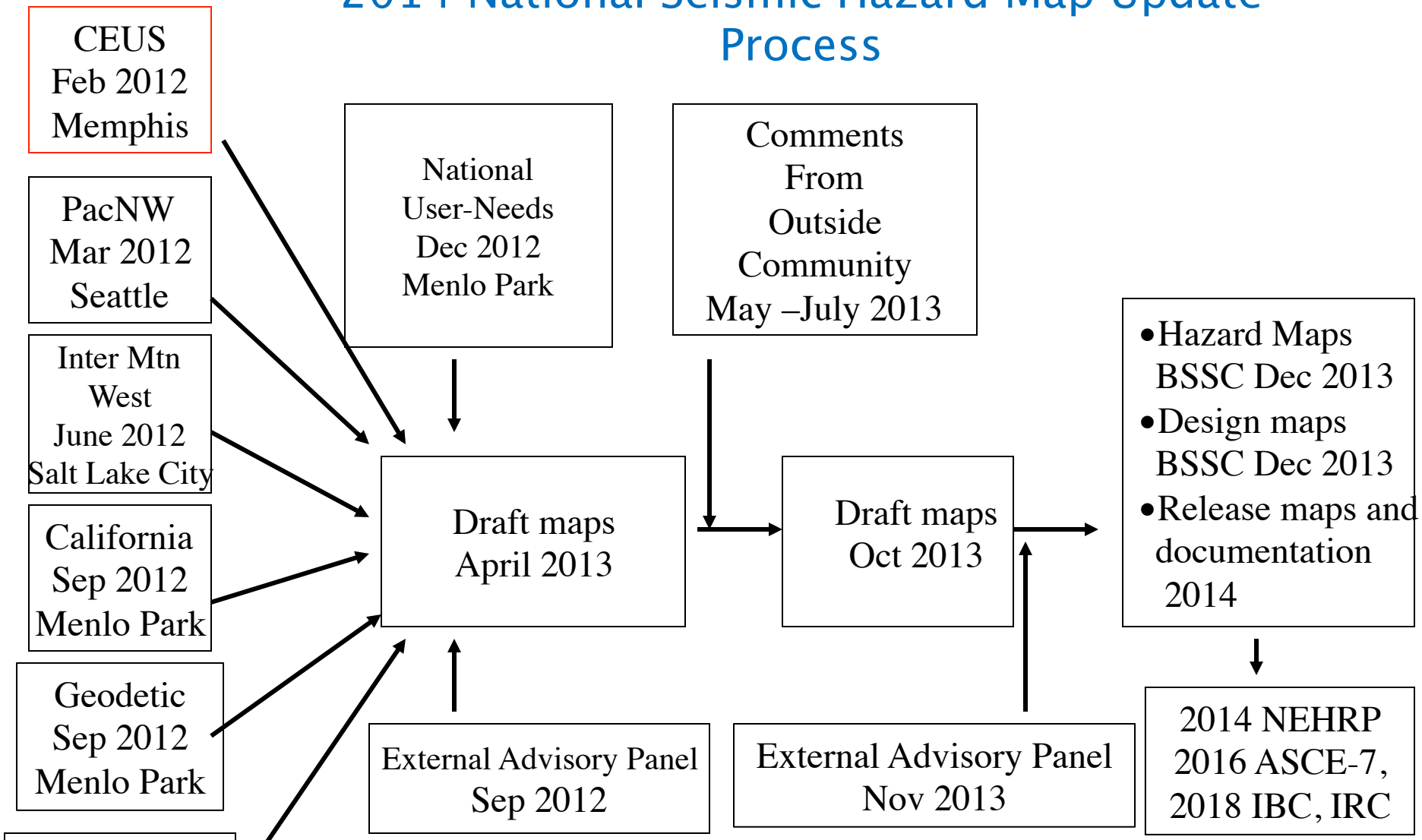
1996 USGS PGA 2% in 50; ★ M4.0 and greater since 1997




Legend
GSHAP
(PGA m/s²)
0 - 0.2
0.2 - 0.4
0.4 - 0.8
0.8 - 1.6
1.6 - 2.4
2.4 - 3.2
3.2 - 4.0
4.0 - 4.8
> 4.8


Legend
DYFI
(Intensity)
I
II
III
IV
V
VI
VII
> VII

2014 National Seismic Hazard Map Update Process



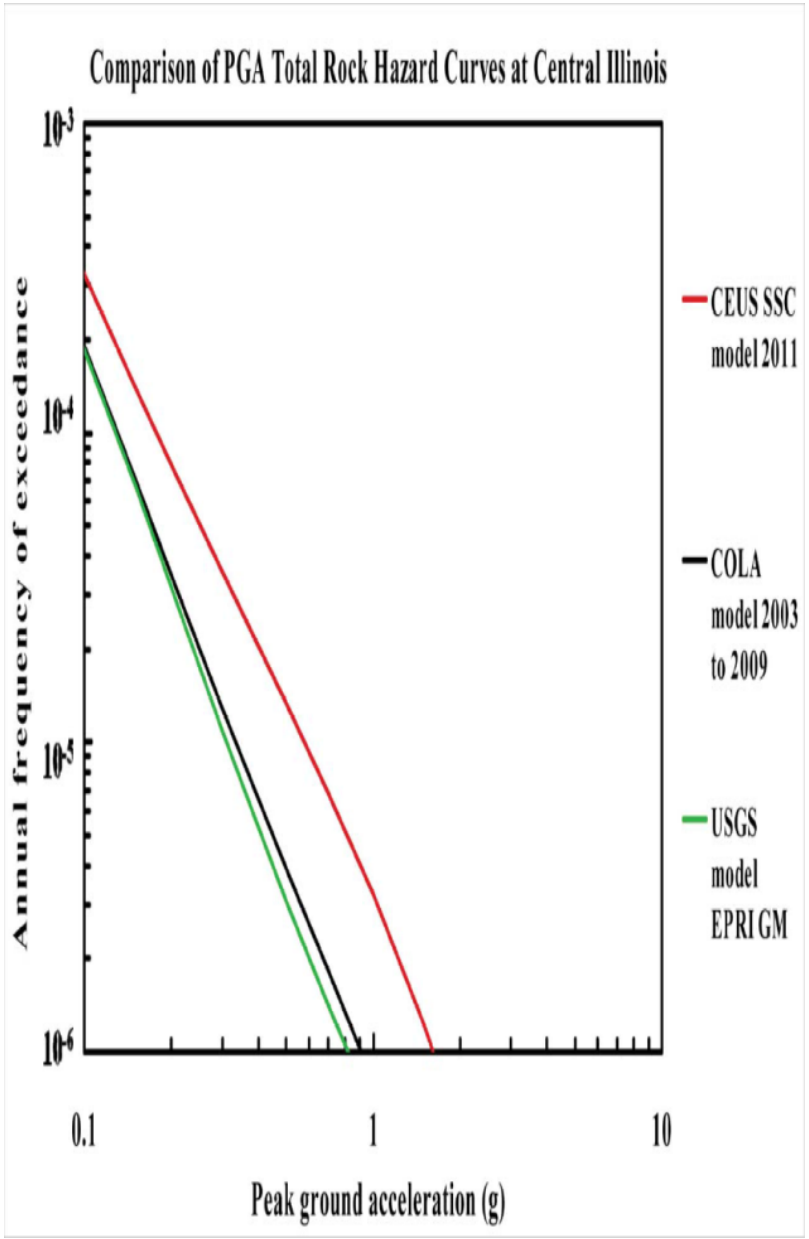
•The *International Building Code* (IBC) is in use or adopted in 50 states, the District of Columbia,
the U.S. Virgin Islands, NYC, Guam, and the Northern Marianas Islands.

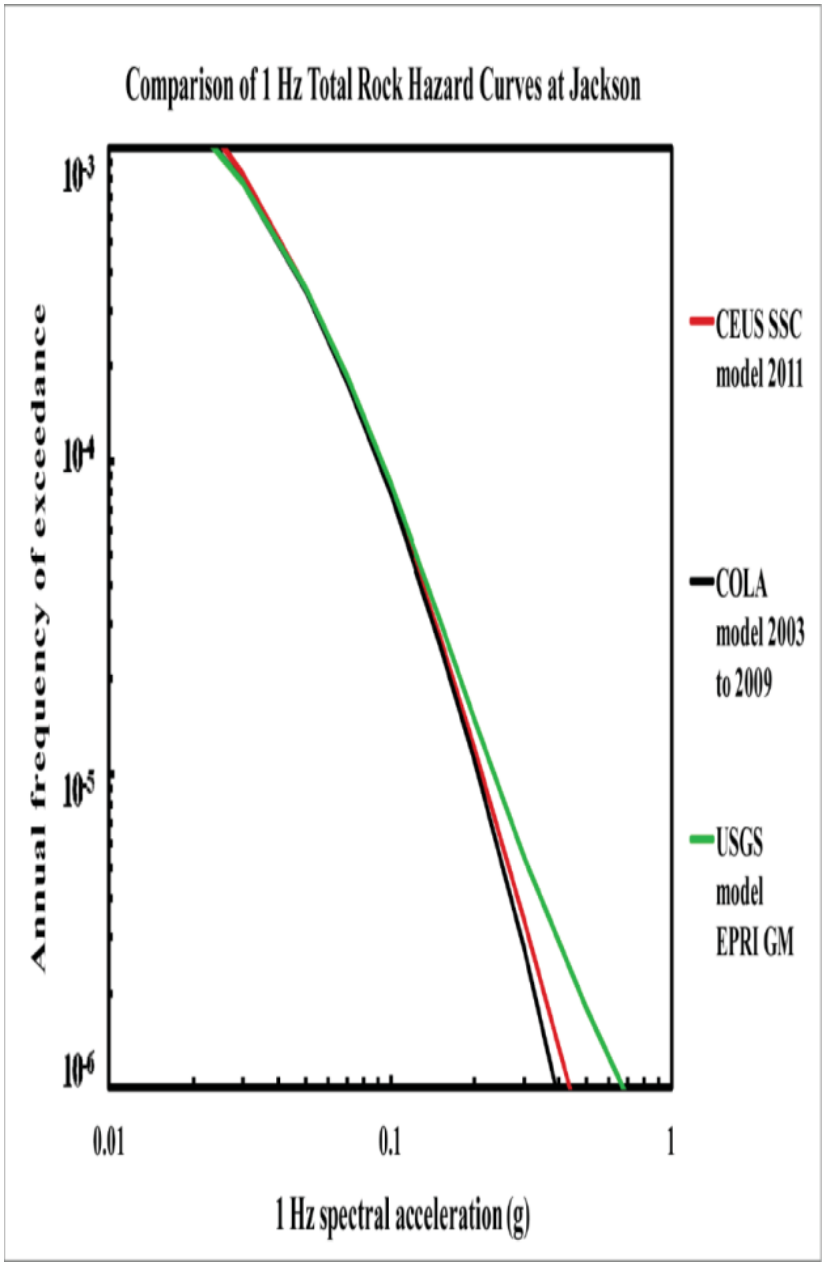
•The *International Residential Code* (IRC) is in use or adopted in 49 states, the District of Columbia,
and the U.S. Virgin Islands.

Purpose of CEUS Workshop

- Workshop- open discussions
- New published science
- Logic tree for uncertainty analysis- examine parameter distributions, not just central values
- Implications of recent earthquakes (Virginia, Oklahoma, Ohio, Arkansas, Texas, etc.)
- Recent hazard models: CEUS-SSC Nuclear Power Plants, Canada hazard model
- Review of 2008 model, which is the basis of 2014 model
- Due to timeline, we will not review NGA-East Ground motion model in detail – will be discussed at workshop in October, 2012, at Berkeley, CA

Comparison of new CEUS-SSC and USGS 2008



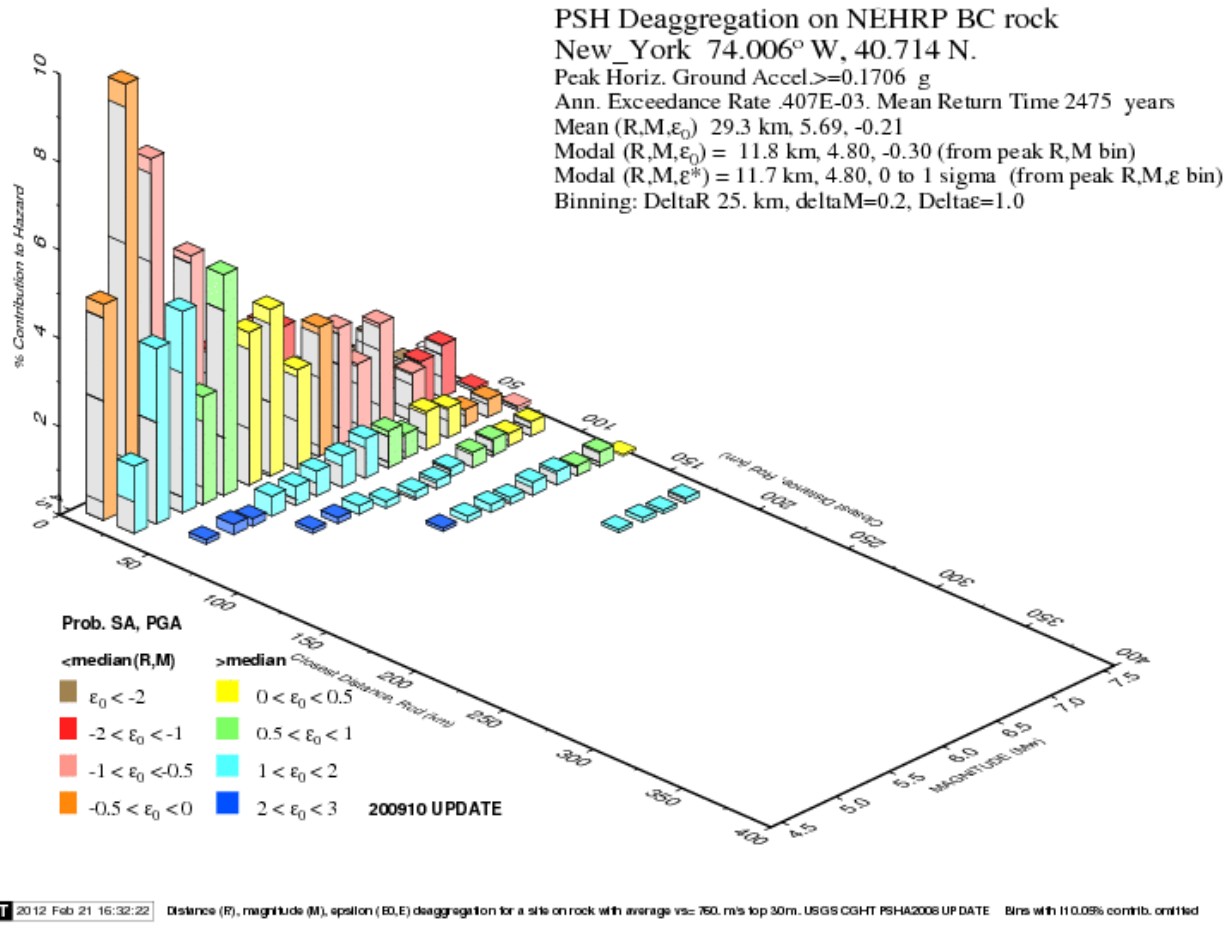


2008 Hazard Model

1. Background seismicity model – relies on earthquake catalog, maximum magnitudes, declustering, catalog parameters – including magnitude uncertainties for rate calculation
    1. **Smoothed**: Based on locations of M 3,4,5 earthquakes – locations of smaller earthquakes can indicate locations of larger earthquakes
    2. **Floor**: provides some level of hazard in places that have no earthquakes in catalog (catalog is short)
2. Fault models
    1. New Madrid,
    2. Charleston,
    3. Cheraw,
    4. Meers
3. Ground motion models
    1. 7 models to provide wide range of uncertainty–with varying model functions, stress drops, geometric spreading, kappa, etc.

Alternative models modeled in logic tree

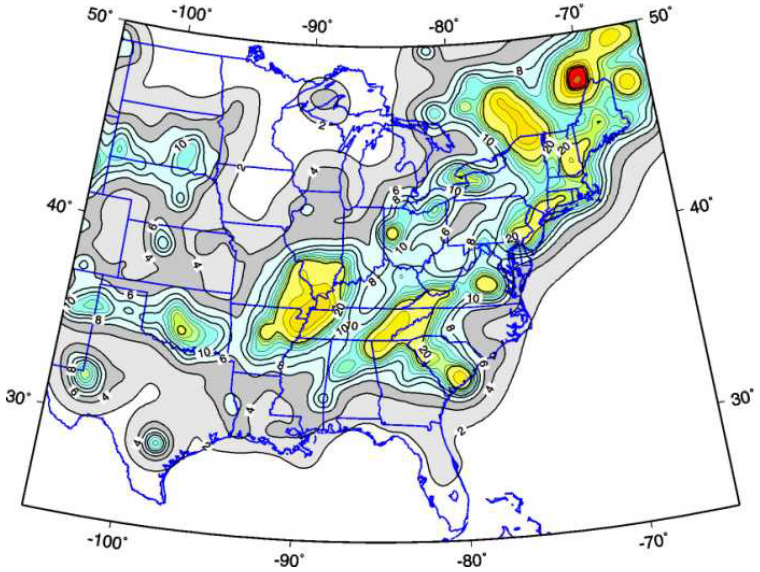
New York City PGA Deaggregation



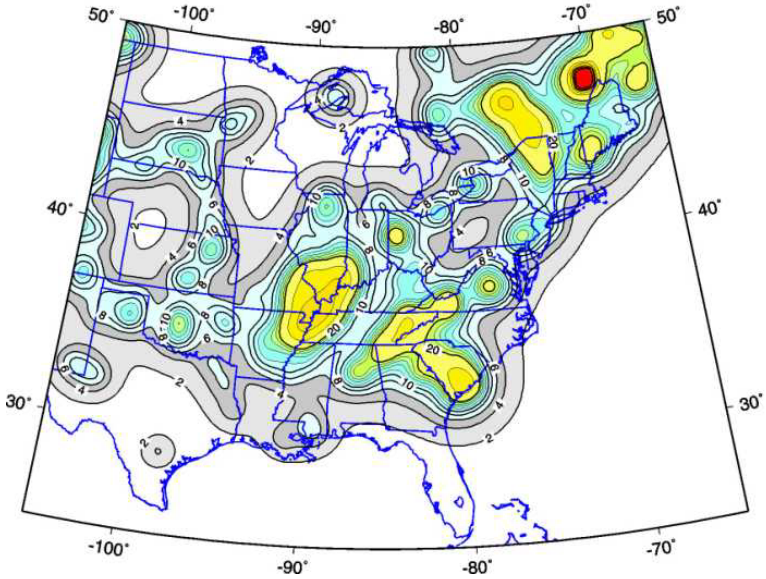
GMT 2012 Feb 21 16:32:22 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30m. USGS CGHT PSHA2008 UPDATE Bins with l10.05% contrib. omitted

Background seismicity: Spatially smoothed seismicity, Floor- 2002 model, 2%PE 50 yr

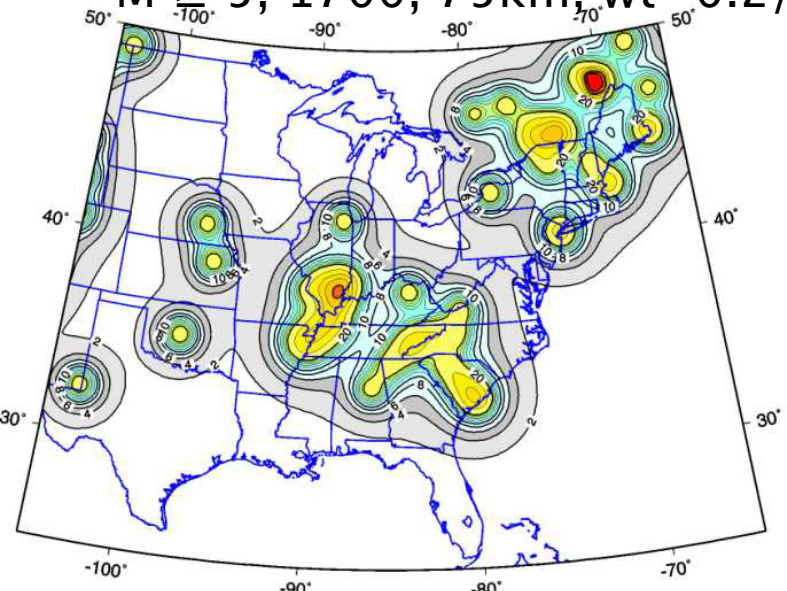
M ≥ 3, 1924, 50km, wt=0.4/0.5



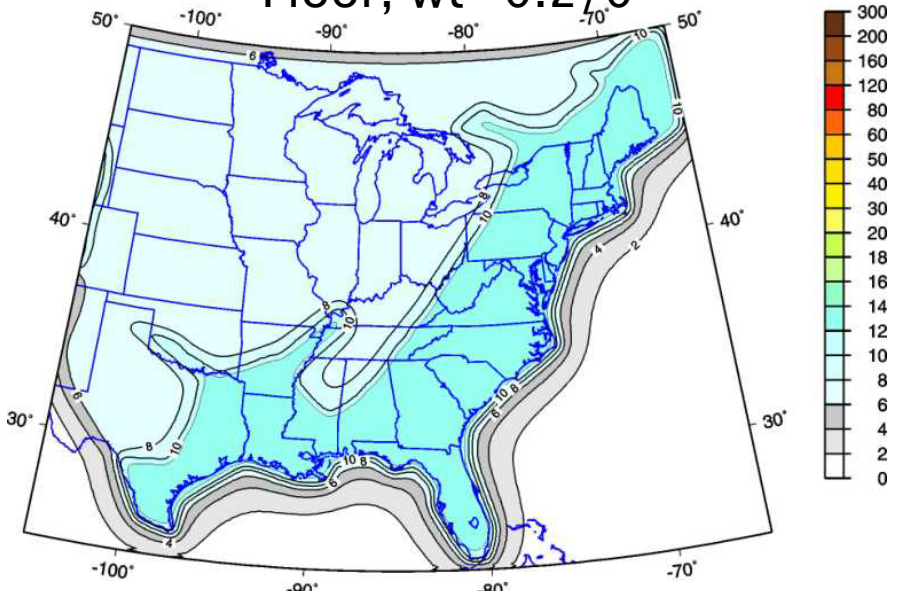
M ≥ 4, 1860, 75km , wt=0.2/0.25



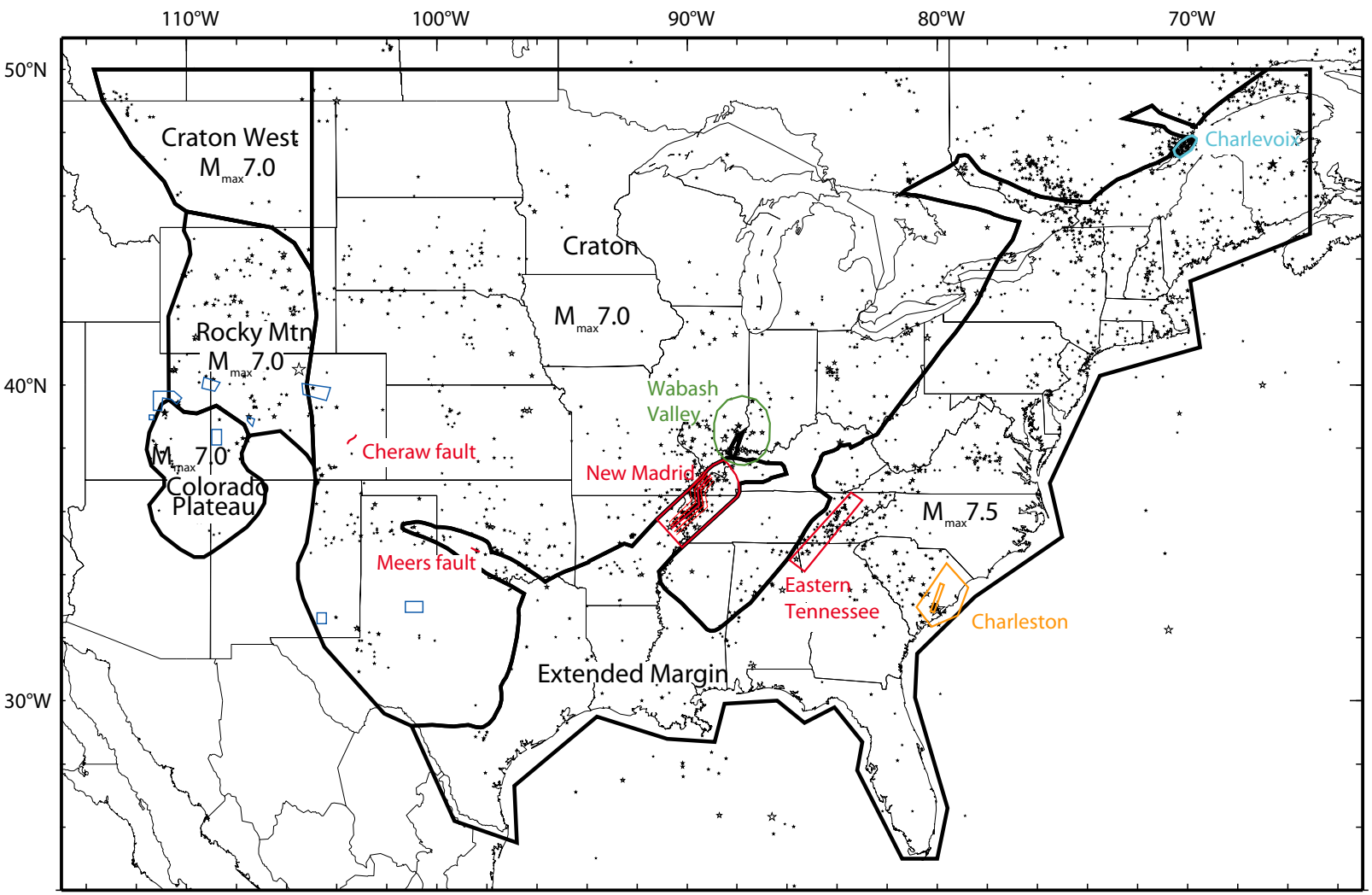
M ≥ 5, 1700, 75km, wt=0.2/0.25



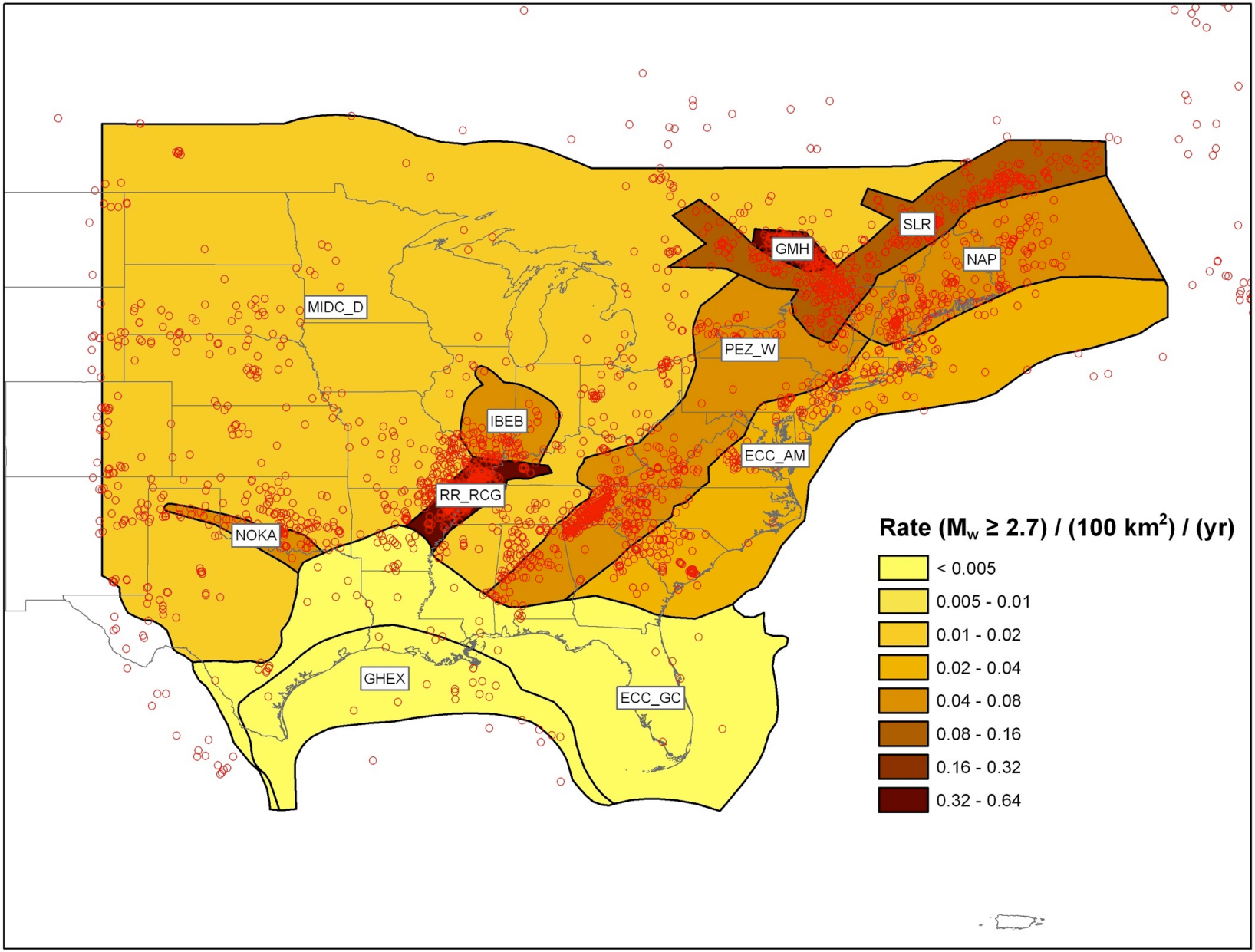
Floor, wt=0.2/0



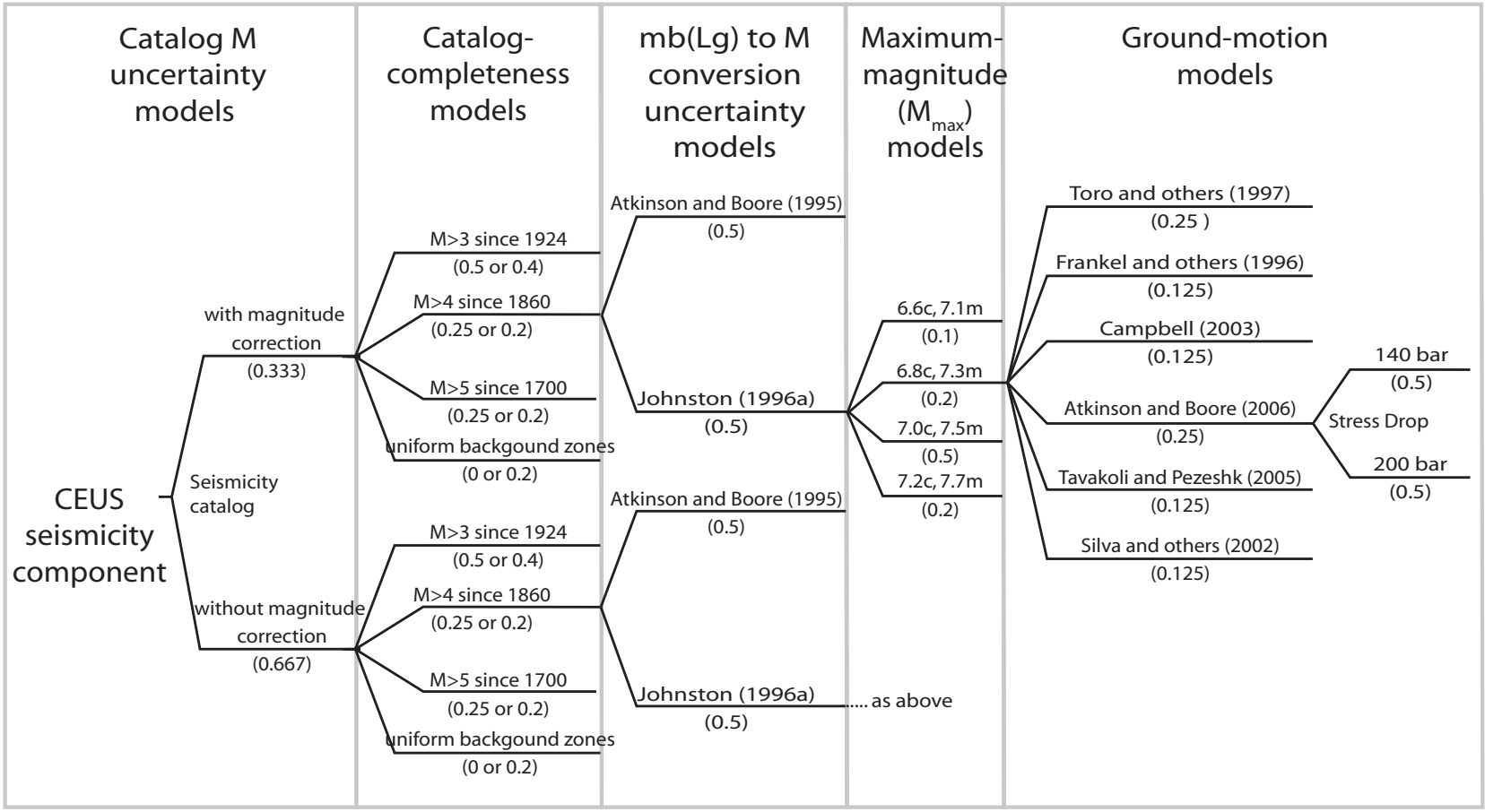
Seismicity zones



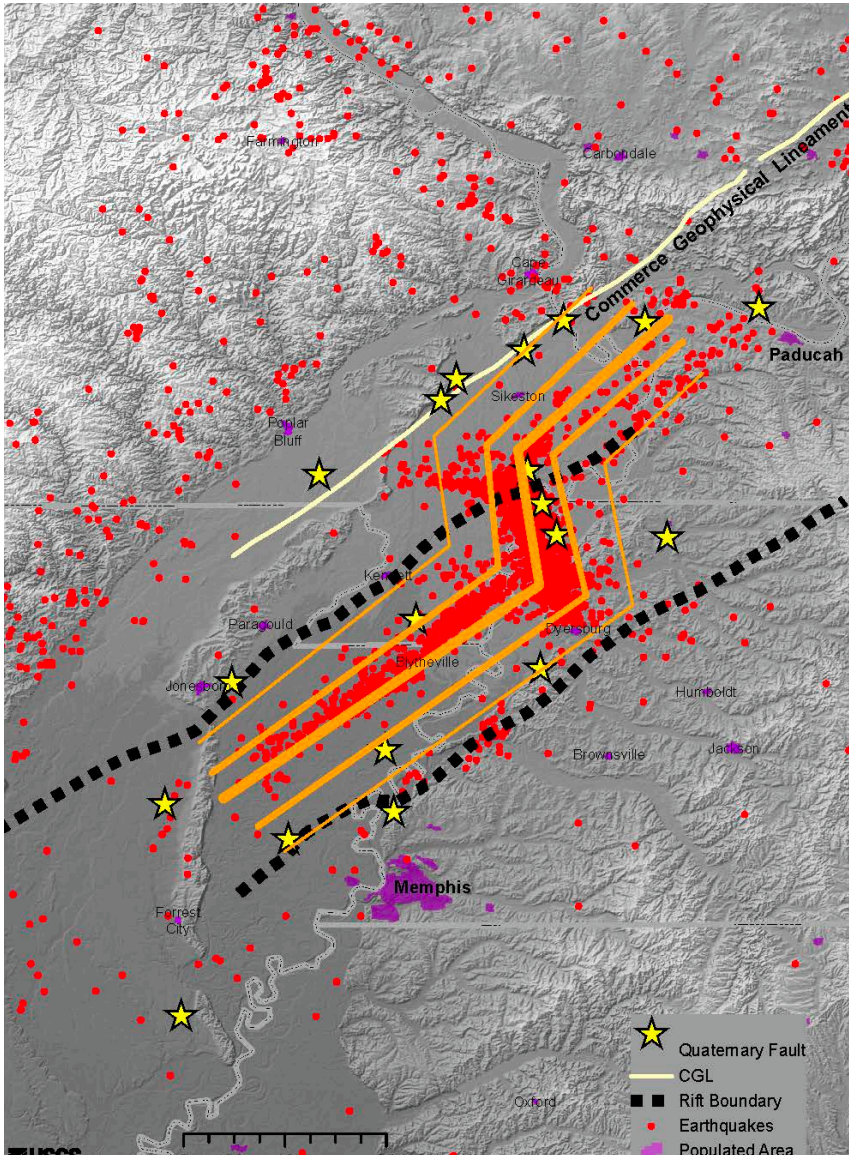
CEUS-SSC


SLR
GMH
NAP
MIDC_D
PEZ_W
IBEB
ECC_AM
RR_RCG
NOKA
GHEX
ECC_GC
Rate ($M_w \geq 2.7$) / (100 km^2) / (yr)
< 0.005
0.005 - 0.01
0.01 - 0.02
0.02 - 0.04
0.04 - 0.08
0.08 - 0.16
0.16 - 0.32
0.32 - 0.64

Background seismicity logic tree



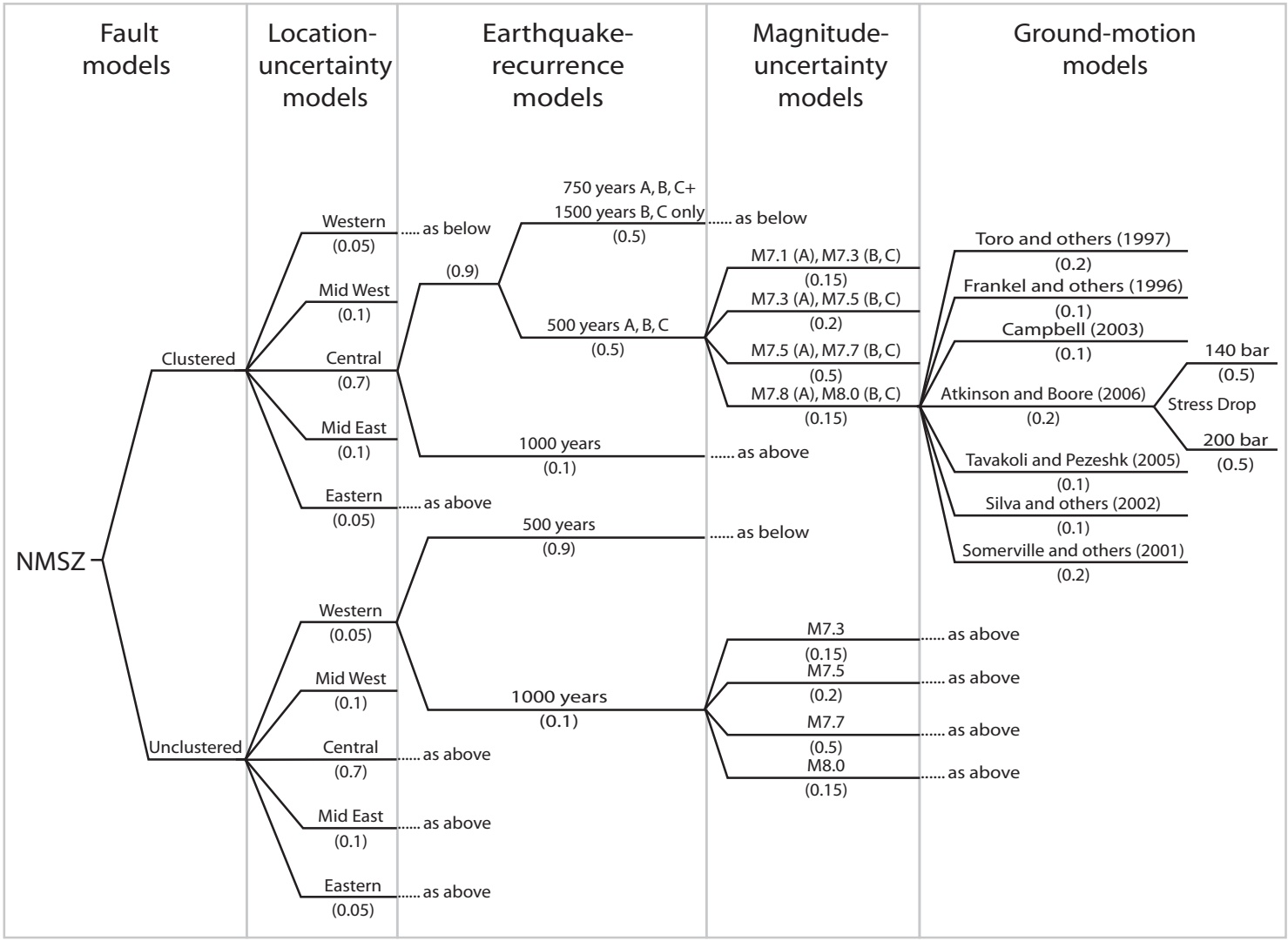
New Madid Seismic Zone



- Quaternary Fault Localities

  M2.0 and greater quakes since 1974

Logic Tree – New Madrid



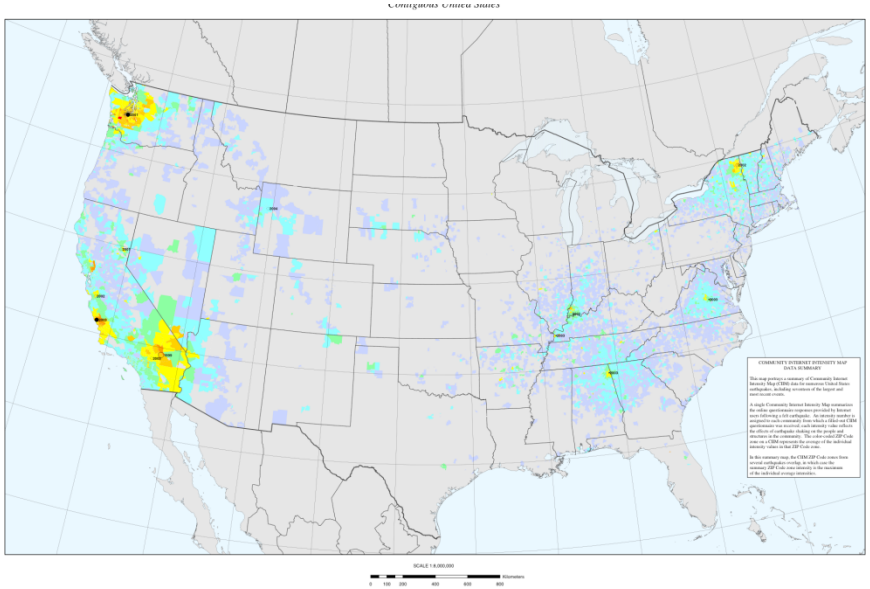
Suggested 2014 update questions

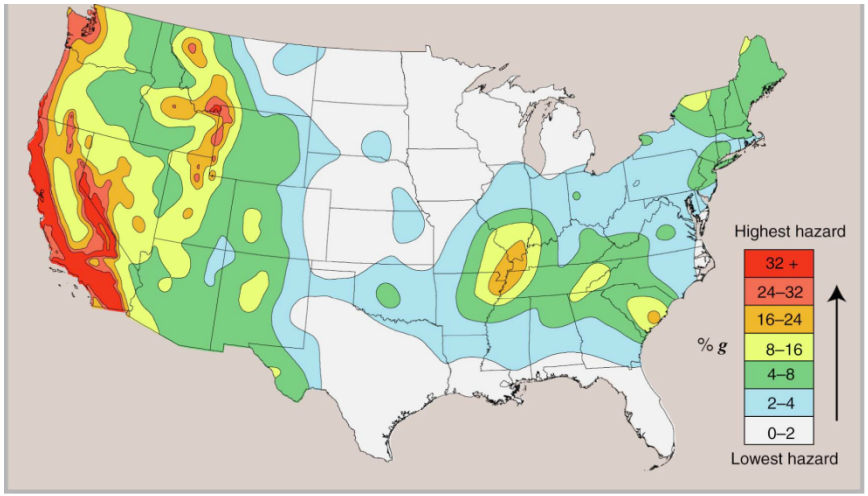
- Should we adopt the new CEUS-SSC Mw catalog, alternative smoothing models, different maximum magnitude distributions?
- Should we adopt alternative magnitudes, rates, and locations of earthquakes in New Madrid?
- What additional new sources should be considered? Should we modify other fault sources?
- What should we learn and apply from recent earthquakes?

Agenda and plan

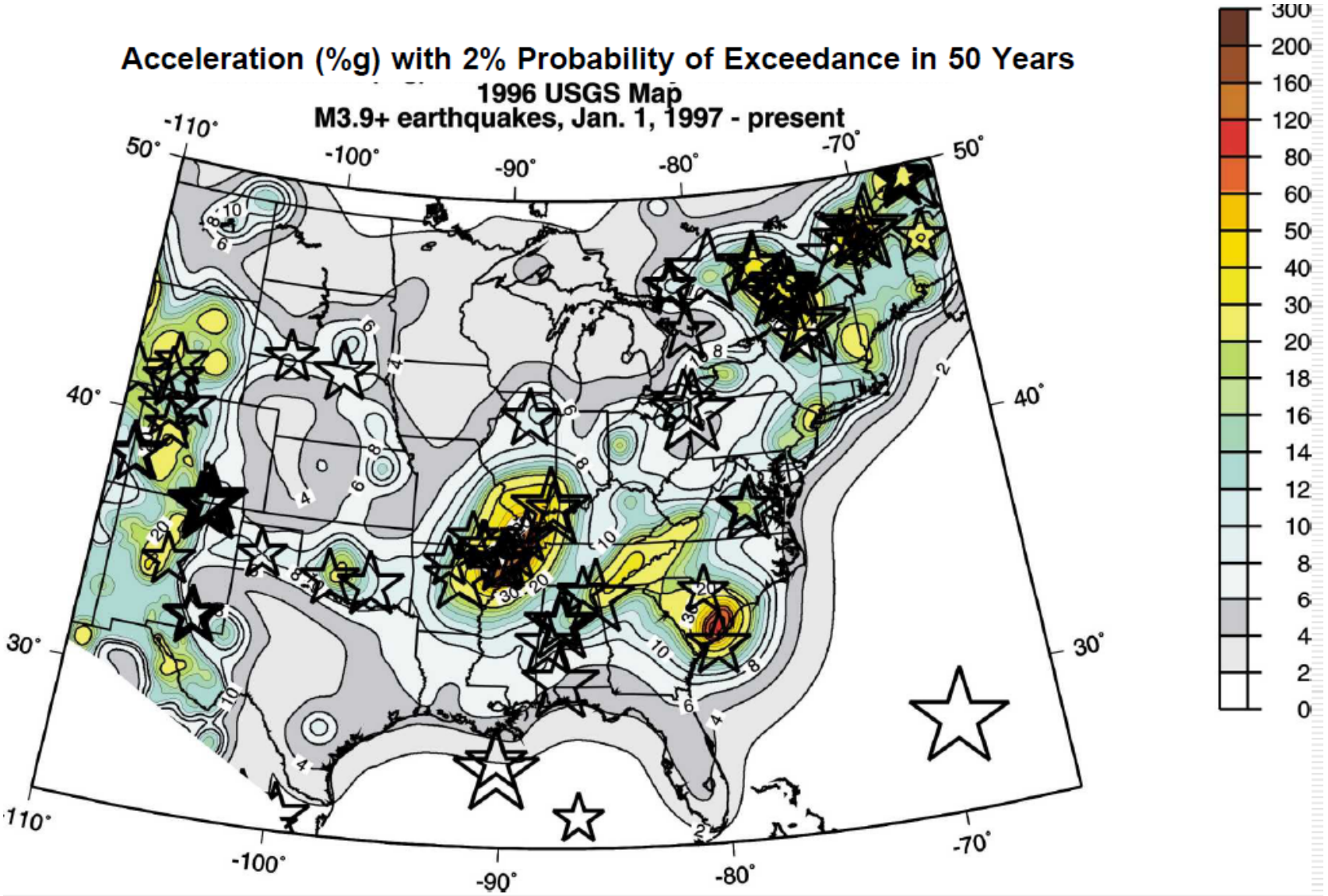
- February 22
  - New Madrid (1811–1812 magnitudes, rates – geodesy, locations)
  - Seismicity model (catalog, Mmax, smoothing, declustering, special zones)
- February 23 (1/2 day)
  - Other sources
  - Users of the map (KY, NRC, Engineering)
  - General comments
- You can also send comments to: cmueller@usgs.gov , mpetersen@usgs.gov, haller@usgs.gov

Comparison of National Maps and DYFI





Comparison of 1996 maps with earthquakes 1997–2002



Logic tree – Charleston