CEUS Catalogs

1996 – goal: m_{bLg} >= 3, dominated by NCEER91

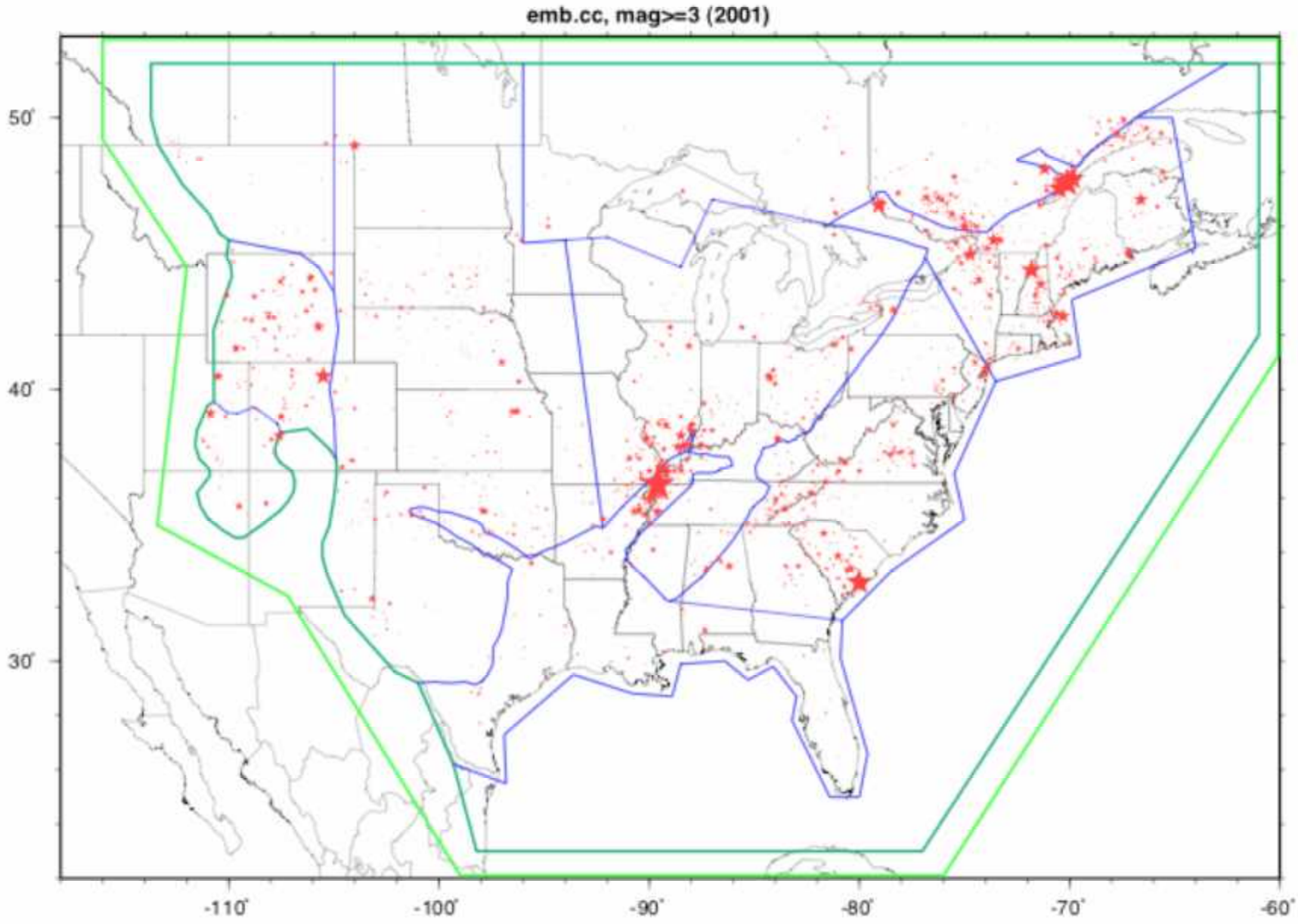
- source catalogs: NCEER > USHistory > SRA > PDE > DNAG
  (we prefer national-scale catalogs for uniformity)
  1) reformat, convert magnitudes, & combine
  2) select single records & decluster (Gardner & Knopoff)
  3) delete: Rocky Mtn Arsenal, Rangely, Cogdell, Utah coal mining
- ~2900 mainshocks, 1700-1995
  73% NCEER, 15% PDE, 8% SRA, 2% DNAG, 1% USHistory

2002 changes

- extend through 2001
- delete: Paradox Valley, CO
- improve handling of man-made events
  (Street KY mining, Kirkham&Rogers CO mining, PDE explosions, etc.)

changes we are considering for 2006

- extend through 2006
- J.Armbruster's updates to NCEER
- delete DNAG
- add EqCanada?, VirginiaTech?, others? (concerns about uniformity)


emb.cc, mag>=3 (2001)
50°
40°
30°
-110°
-100°
-90°
-80°
-70°
-60°
GMT May 5 08:48

Computing Hazard From Seismicity

• smoothed seismicity defines the hazard for most of CEUS

set grid resolution and compute *b* ...

Models 1-3: gridded and smoothed historical seismicity

Model 1: $m_{bLg} \geq 3$ since 1924 (1976 west of -105°), smooth = 50 km

Model 2: $m_{bLg} \geq 4$ since 1860 (1963 west of -105°), smooth = 75 km

Model 3: $m_{bLg} \geq 5$ since 1700 (1860 west of -105°), smooth = 75 km

For each model, get maximum-likelihood rate in each grid cell, multiply by a completeness adjustment factor, and smooth spatially. Then, for each cell,

$$Rate_{Historical} = 0.5 \times Rate_{Model1} + 0.25 \times Rate_{Model2} + 0.25 \times Rate_{Model3}$$

Model 4: average background rates in craton and extended-margin zones

Then, for each cell compare $Rate_{Historical}$ and $Rate_{Background}$ ...

If $Rate_{Historical} \geq Rate_{Background}$, then $Rate_{Final} = Rate_{Historical}$

Otherwise, $Rate_{Final} = 0.8 \times Rate_{Historical} + 0.2 \times Rate_{Background}$

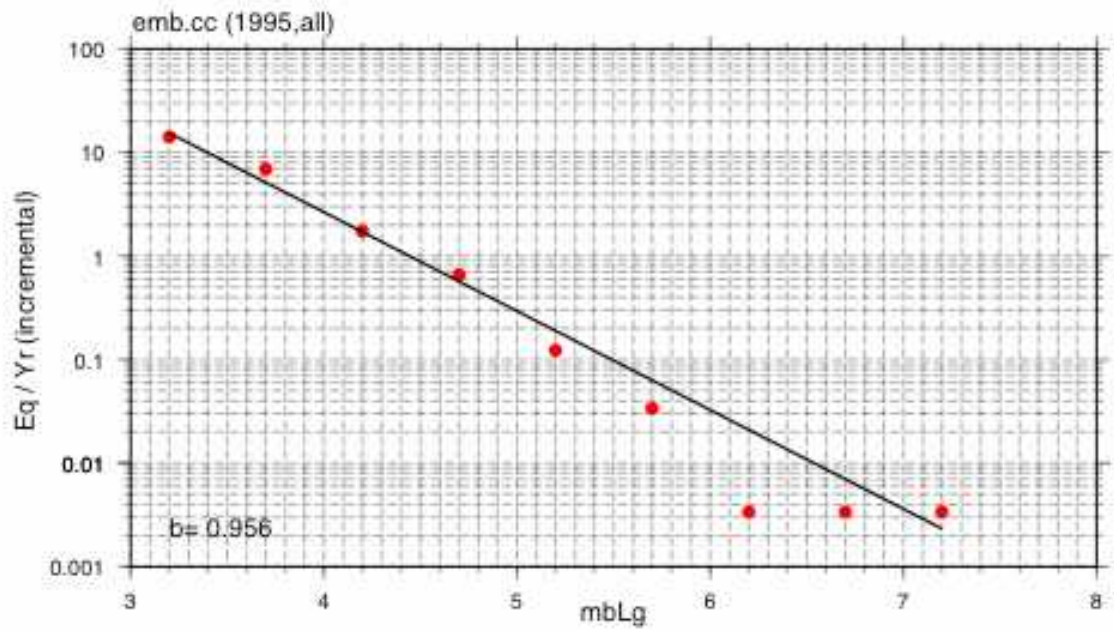
(violates the overall seismicity budget in the CEUS by only about 10%...)

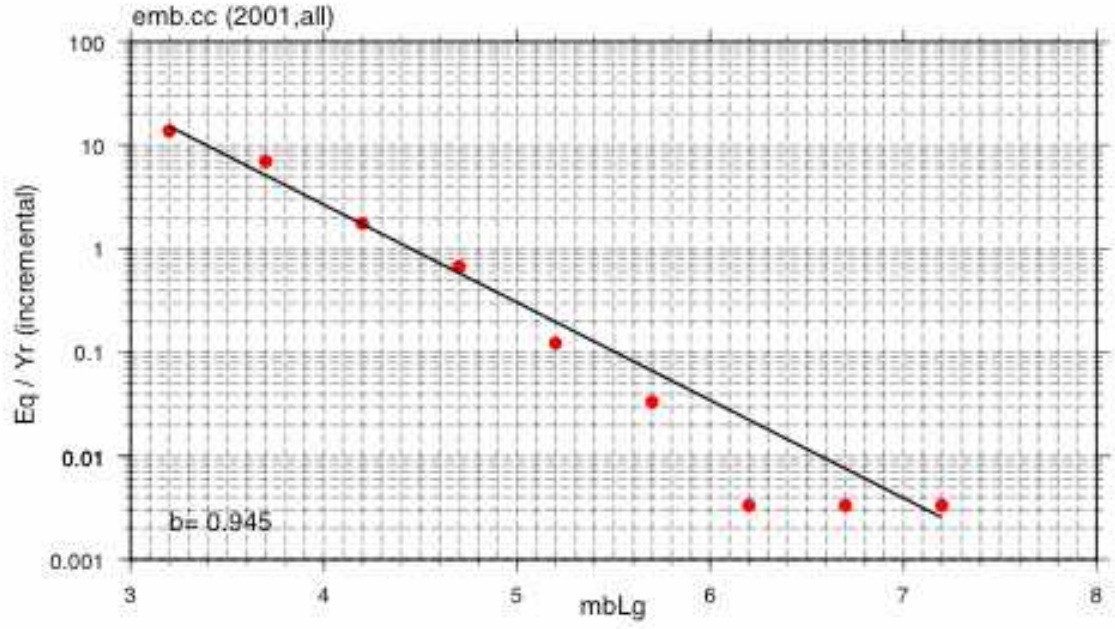
In trying to include as many epicenters as possible in the model, we recognize that we may have been a bit optimistic about completeness.

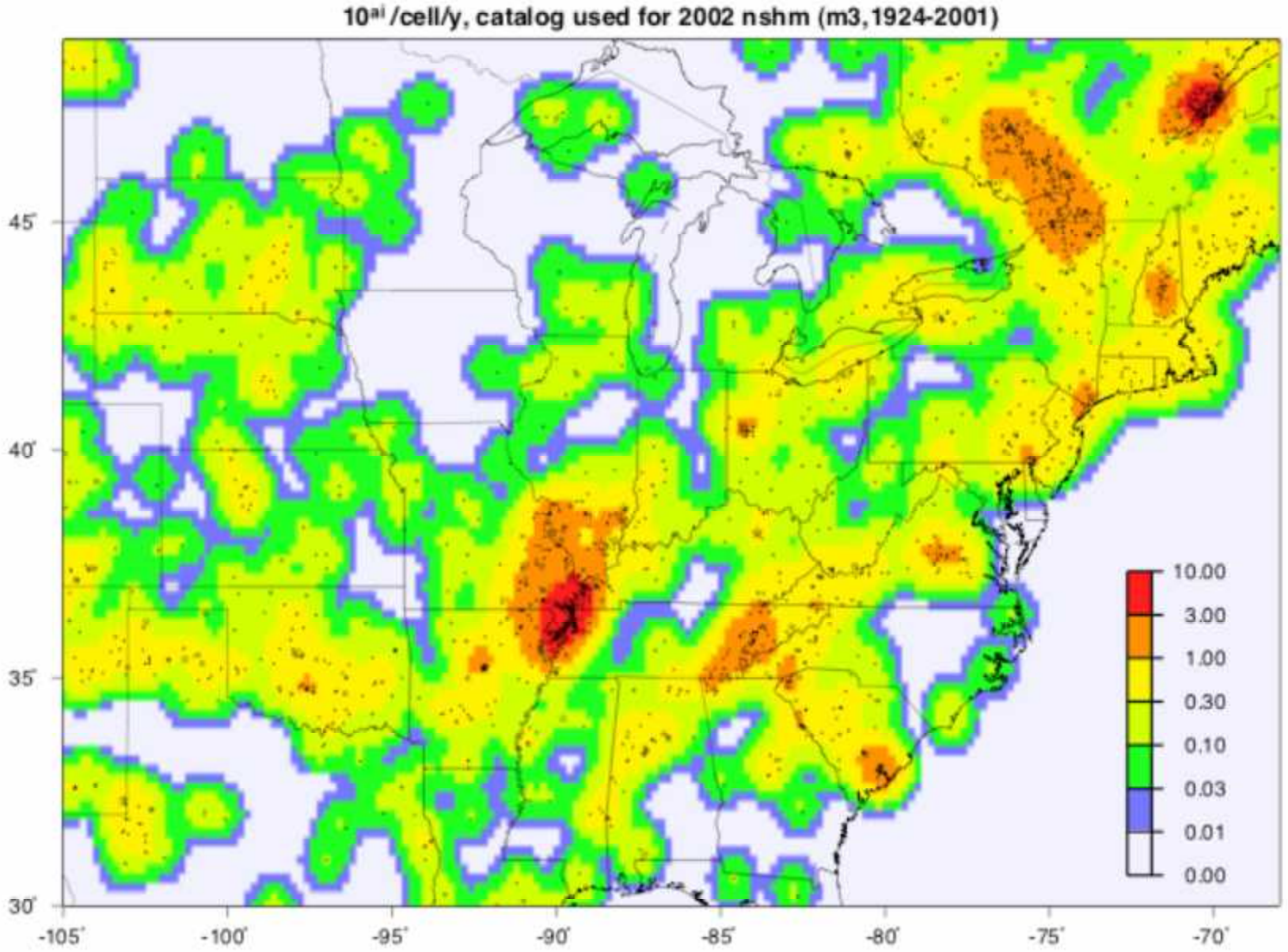
Regional completeness adjustment factors, which range from about 1.1 to 1.9 depending on the model and region, are equal to the ratios of modern, known-complete seismicity rates and the assumed-complete rates.

example:

CAF for mag3 model = avg. 1976 rate / avg. 1924 rate in a region


emb.cc (1995,all)
100
10
1
0.1
0.01
0.001
Eq / Yr (incremental)
b= 0.956
3
4
5
6
7
8
mbLg


emb.cc (2001,all)
100
10
1
0.1
0.01
0.001
Eq / Yr (incremental)
b= 0.945
3
4
5
6
7
8
mbLg


10^ai /cell/y, catalog used for 2002 nshm (m3,1924-2001)
45°
40°
35°
30°
-105°
-100°
-95°
-90°
-85°
-80°
-75°
-70°
10.00
3.00
1.00
0.30
0.10
0.03
0.01
0.00