



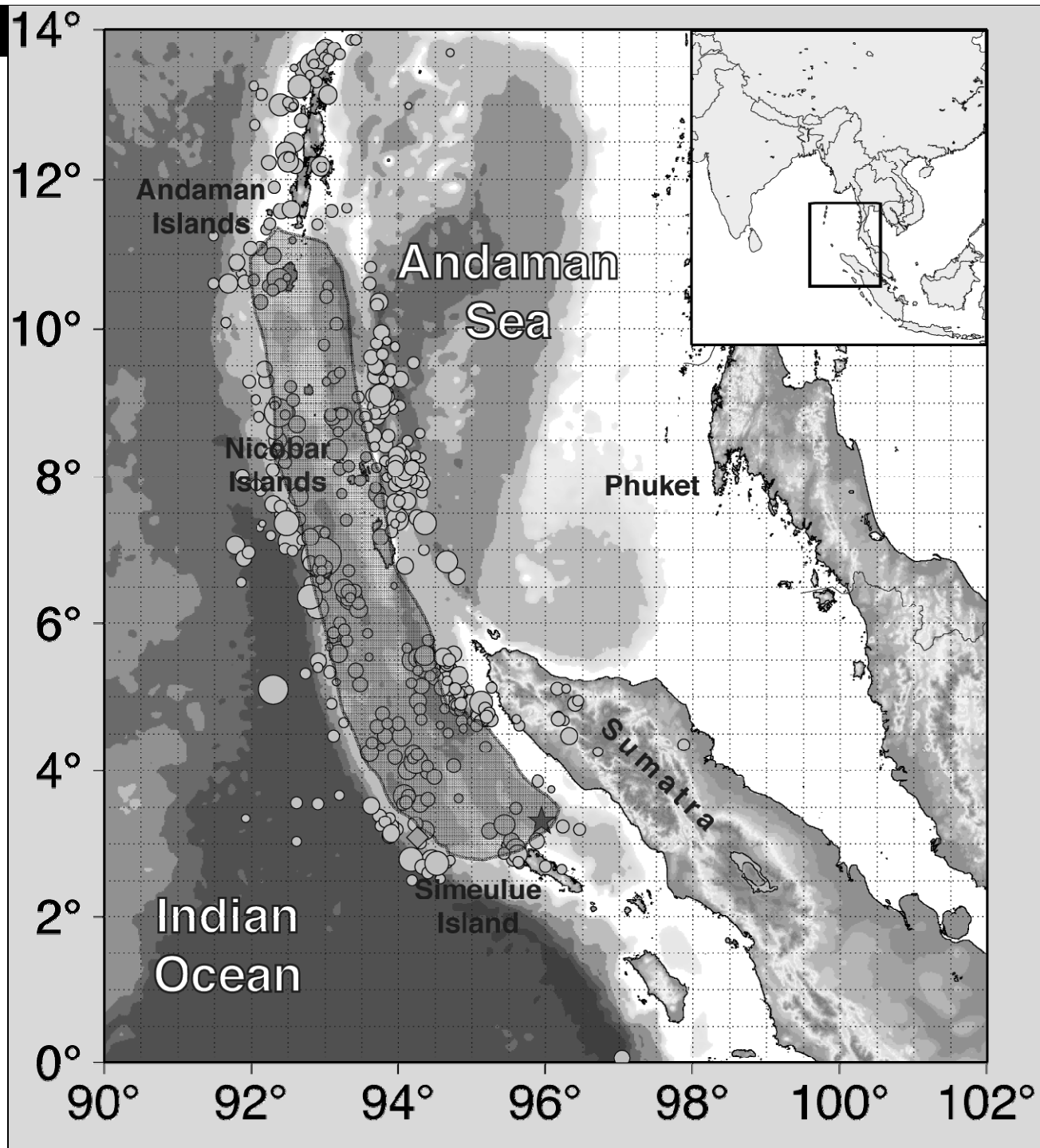
Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

The USGS Role in the NEHRP Partnership

David Applegate
U.S. Geological Survey

U.S. Department of the Interior
U.S. Geological Survey





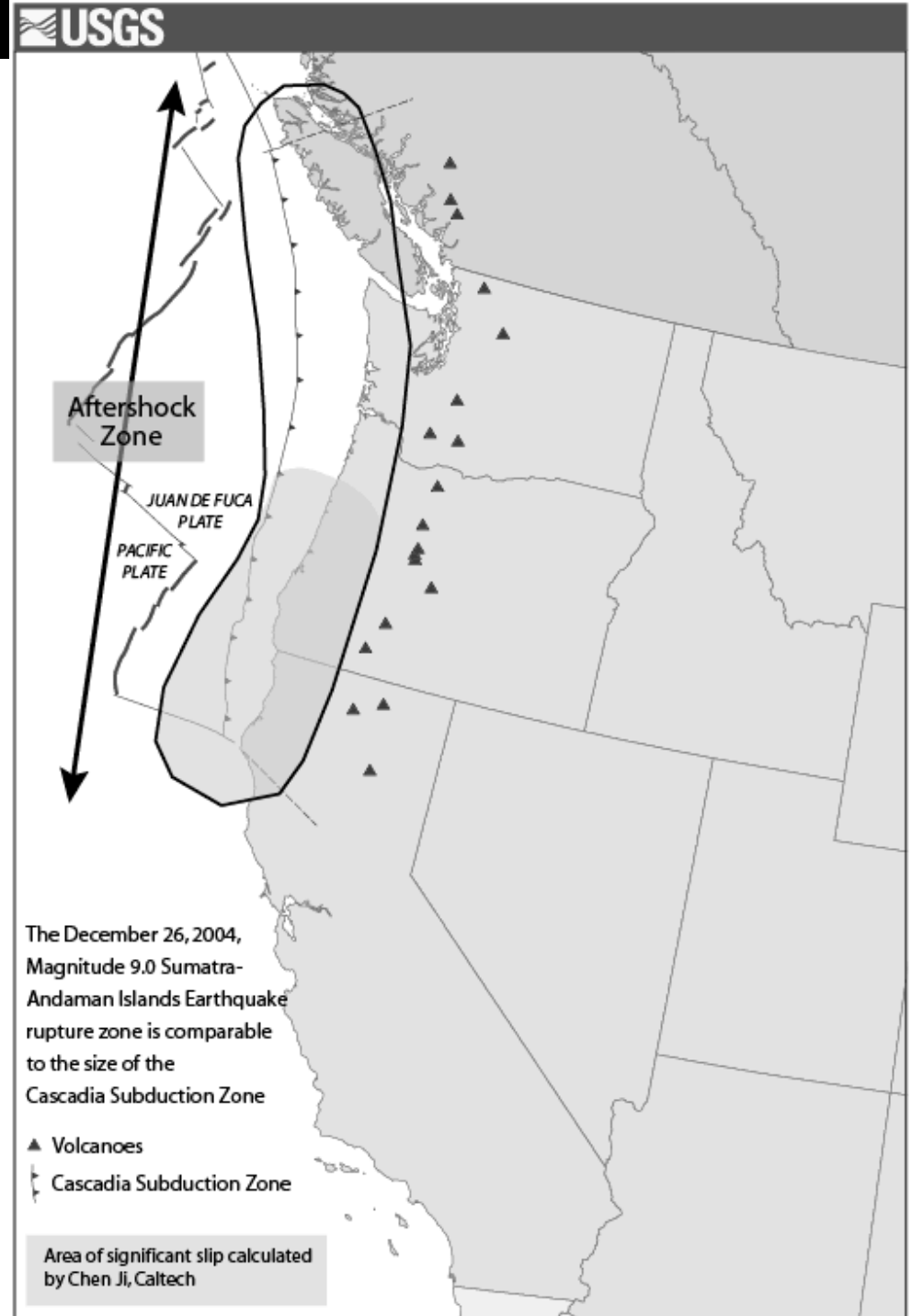


©2005 USC Tsunami Research Group



Images: USC Tsunami Research Group

- The Cascadia subduction zone off the coast of the Pacific Northwest has dimensions and seismic potential similar to the subduction zone that ruptured off Sumatra
- Detective work by USGS geologist Brian Atwater and others has shown that the last magnitude-9 earthquake struck in 1700
- Given the recurrence interval of great Cascadia earthquakes, USGS estimates a 10-15% chance in the next 50 years.

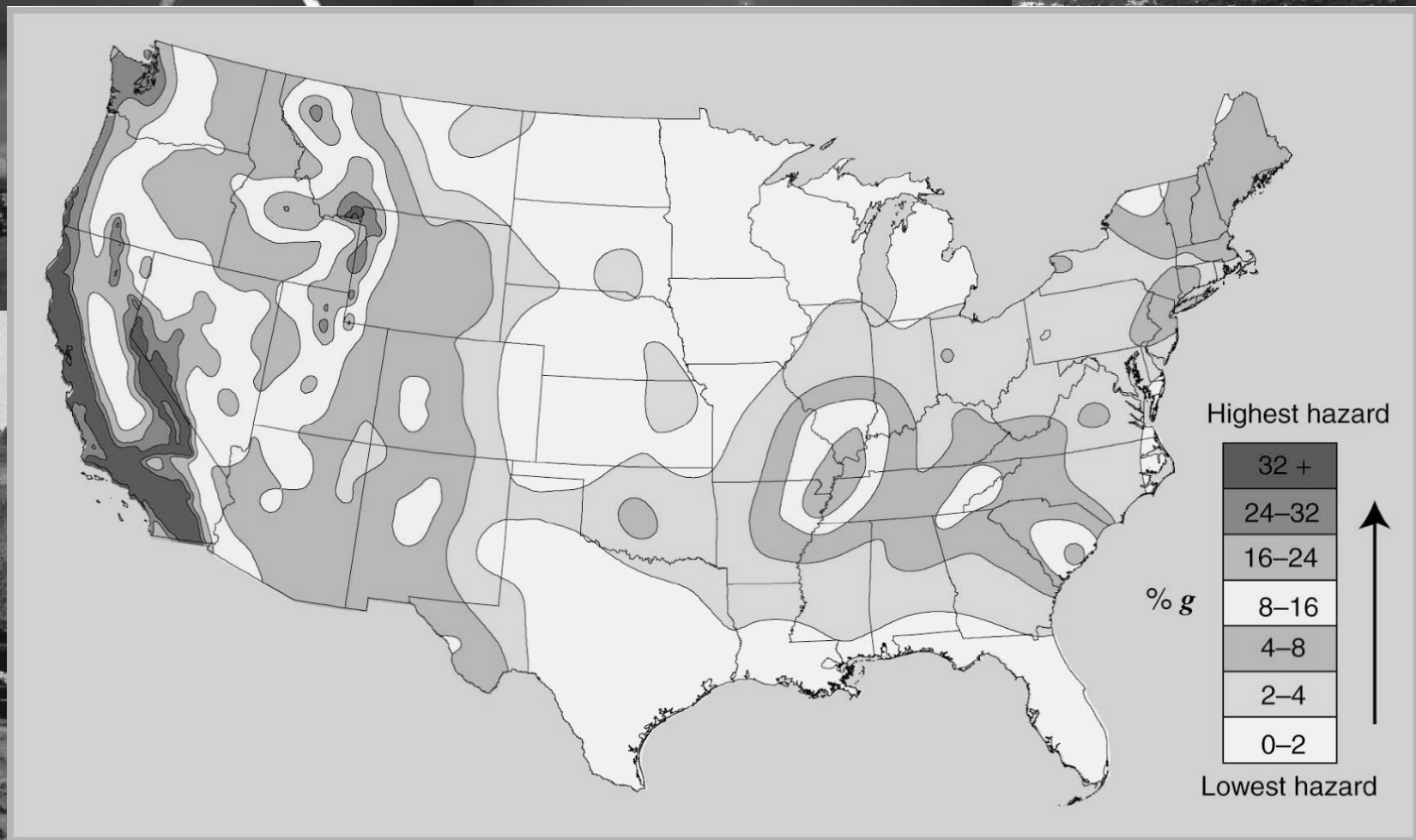


Earthquakes are a national hazard

St. Louis

Memphis

Evansville



The Mandate of the National Earthquake Hazard Reduction Program

- Develop effective measures for earthquake hazard reduction;
- Promote their adoption;
- Improve the understanding of earthquakes and their effects on communities, buildings, structures, and lifelines.

Making the handoff

- Research to results
- Science to engineering to implementation
- Hazard to risk to public understanding



The USGS Role in NEHRP

- Provide earthquake monitoring and notifications
- Assess seismic hazards, and
- Conduct research needed to reduce the risk from earthquake hazards nationwide.

FY 2005 enacted: \$46.9 million

FY 2005 supplemental: \$4.0 million

FY 2006 request: \$51.3 million



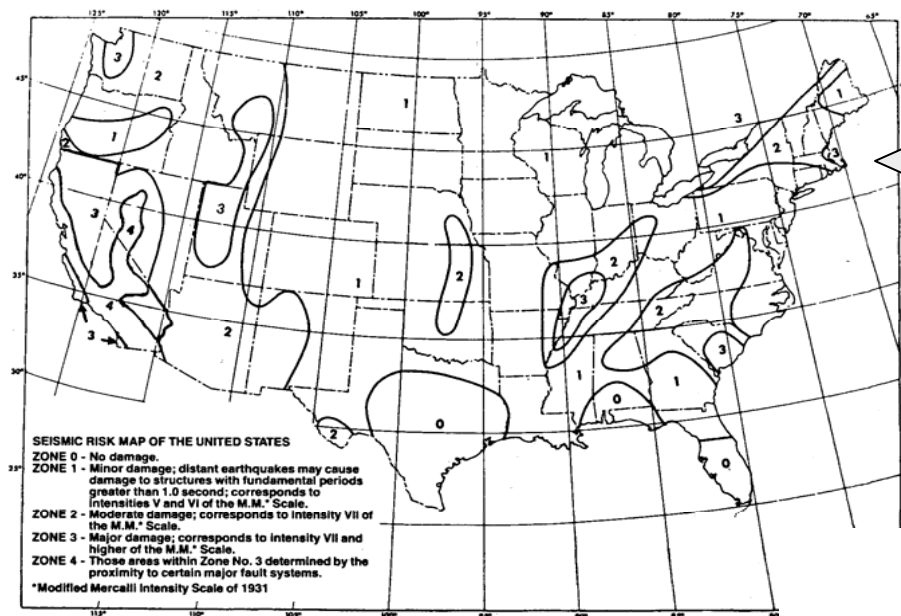


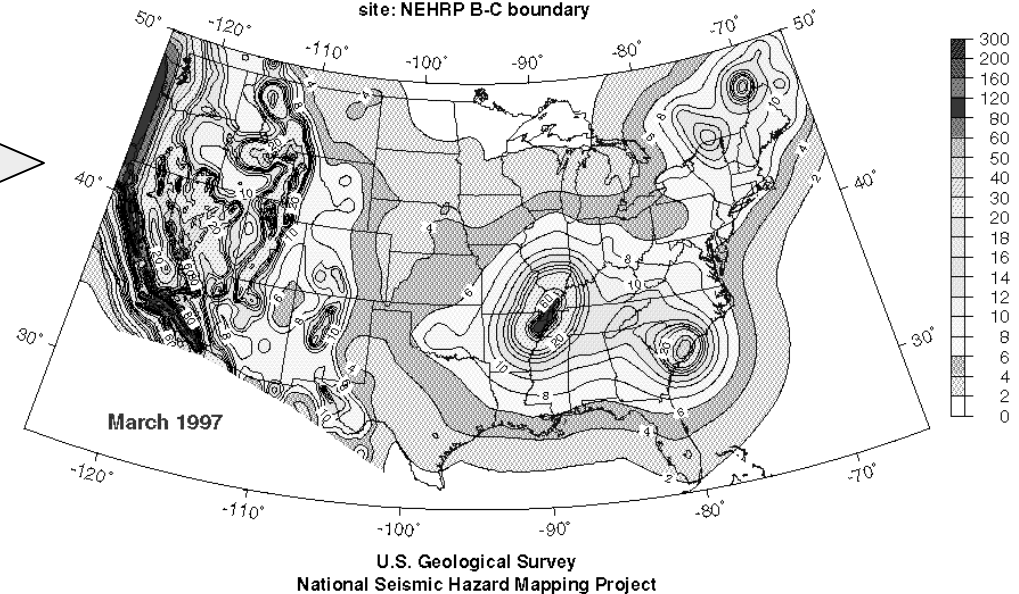
Figure 2-12. "Seismic Risk Map of the United States" reproduced from the *Uniform Building Code*, 1982 ed permission of the publisher, the International Conference of Building Officials. See Figure 2-13 for Alaska and Ha

Seismic element of 1996 Building Codes based on 1970s map

Seismic element of 2000 & 2003 Int'l Building Code based on the 1996 USGS national seismic hazard map



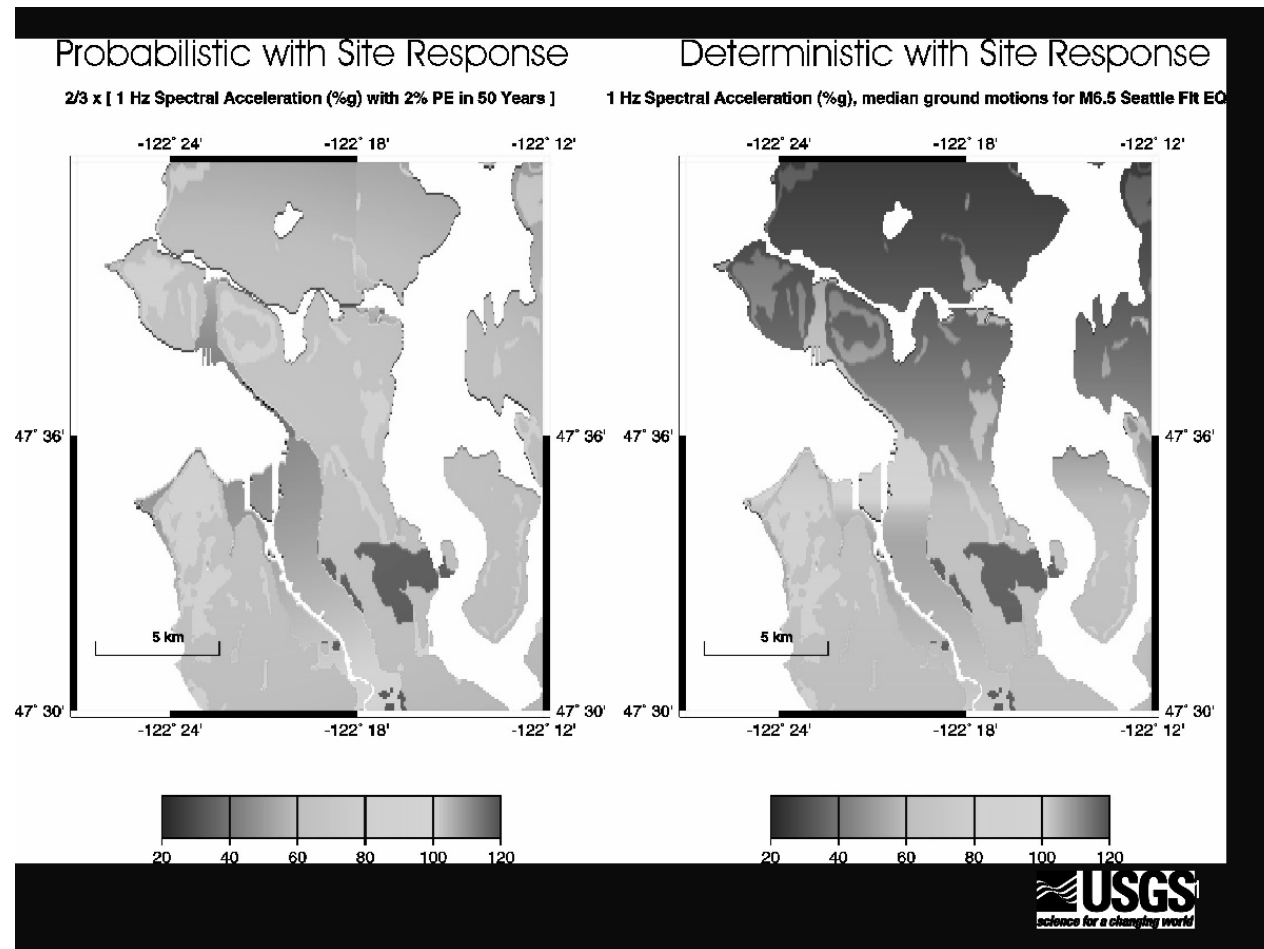
1.0 sec Spectral Accel. (%g) with 2% Probability of Exceedance in 50 Years
site: NEHRP B-C boundary



Developing a Uniform California Earthquake Rupture Forecast

- Goal: A statewide, time-dependent earthquake rupture forecast that uses “best available science” and is endorsed by the USGS, California Geological Survey, and Southern California Earthquake Center.
- Time-independent version delivered to the USGS National Seismic Hazard Mapping project by June 2007 (preliminary version by June 2006).
- Time-dependent version delivered to California Earthquake Authority by September 1, 2007.
- Formal evaluation by CEPEC and/or NEPEC

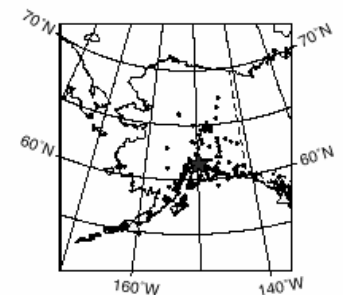
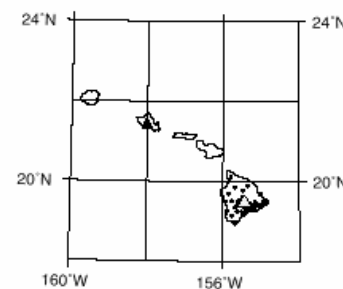
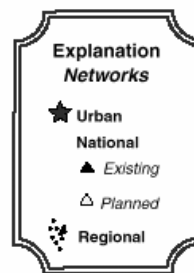
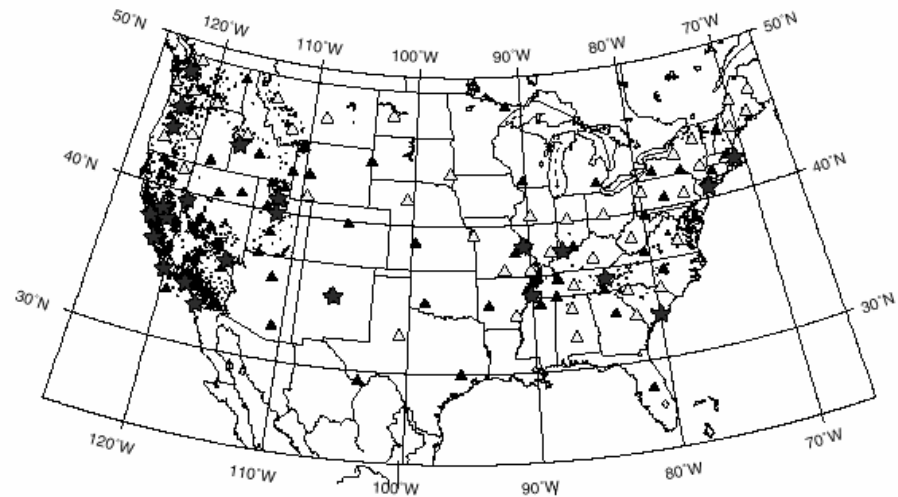
Urban hazard maps that include dynamic rupture, 3-D basin response, non-linear soil response



Advanced National Seismic System

Emphasis on **urban** monitoring.

- 6000 strong motion instruments in 26 at-risk urban areas;
- 50% of these instruments in buildings and structures;
- 1000 new/upgraded regional stations;
- 50 new national backbone stations.



Earthquake Reporting 1994

Northridge Earthquake (M 6.7)

Location and magnitude

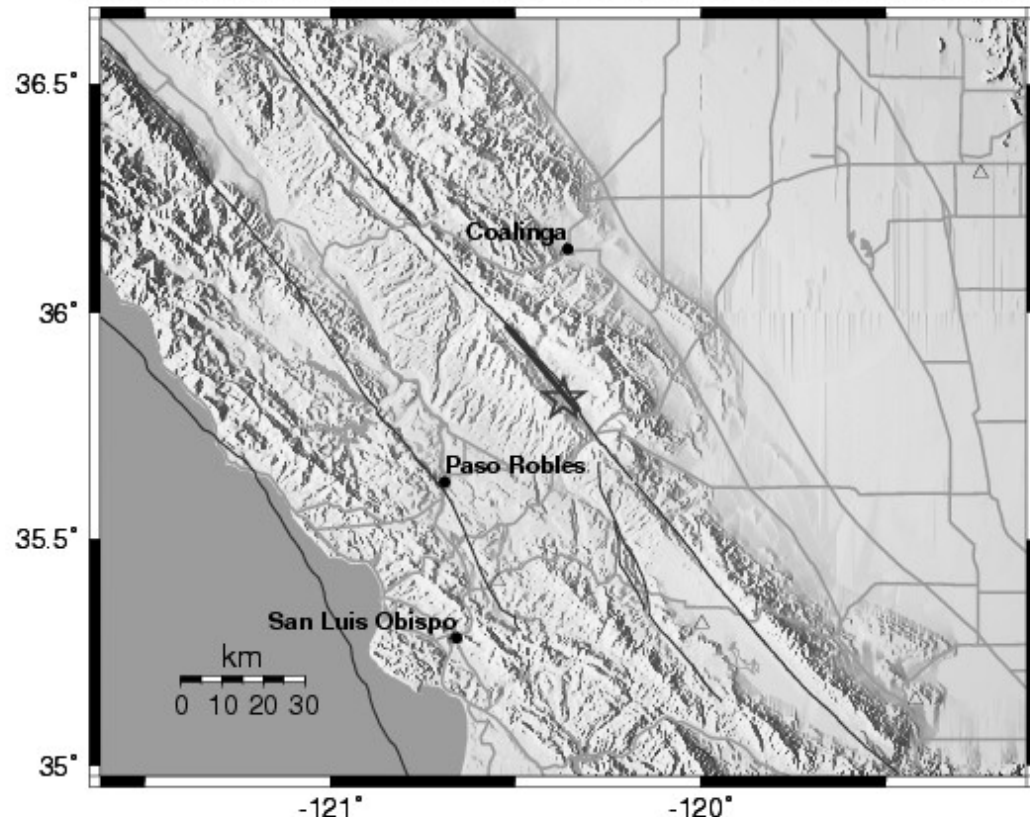


ShakeMap: Northridge (Mag. 6.7)



ShakeMap for the M6.0 Parkfield earthquake Sep. 28, 2004

CISN Rapid Instrumental Intensity Map Epicenter: 11 km SSE of Parkfield, CA
Tue Sep 28, 2004 10:15:24 AM PDT M 6.0 N35.81 W120.37 Depth: 7.9km ID:51147892

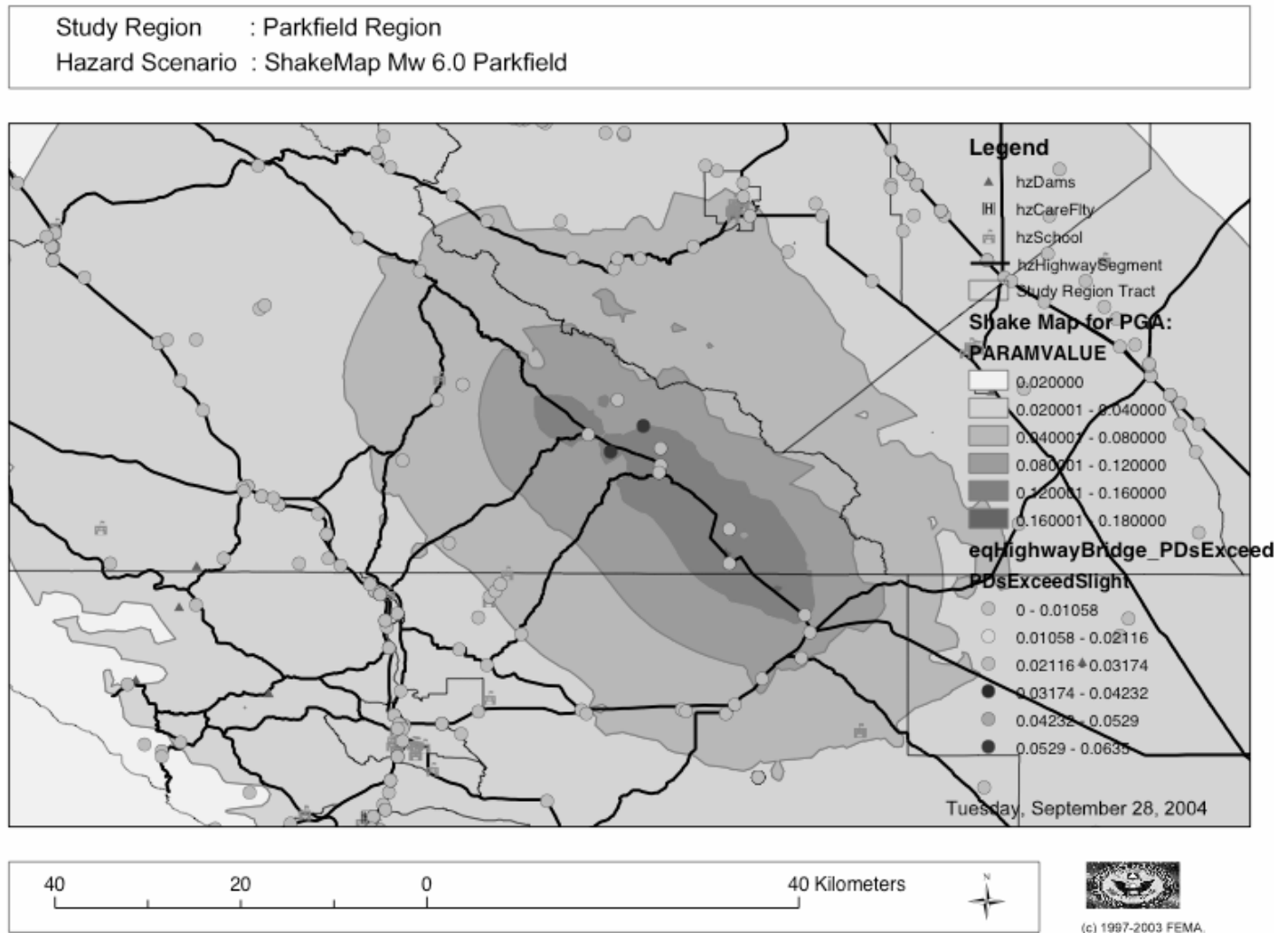


Processed: Tue Sep 28, 2004 12:18:03 PM PDT, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



HAZUS Results for M6.0 Parkfield earthquake



Courtesy of D. Bausch, FEMA

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

Recently released report on **Economic Benefits of Improved Seismic Monitoring**

- Potential benefits of improved seismic monitoring far exceed the costs: Annual costs \$10's millions, potential benefits \$100's millions.
- In performance-based engineering alone, benefits are estimated at \$142 million annually –about three times the cost of operating the full ANSS.
- Improved monitoring information will greatly reduce uncertainty of loss estimation modeling, potentially decreasing the cost of insurance and reinsurance, and shifting costs from disaster relief payments and grants (publicly financed) to insurance recoveries (financed through premiums).
- Improved seismic monitoring can also significantly increase the accuracy of tsunami warnings.



Available at <http://www.nap.edu>

USGS External Grants & Contracts

- Approximately 25% of core program funds
- Gives flexibility and adds breadth of expertise to program
- \$6 Million supports ~ 100 grants
- \$3.1 Million in cooperative agreements for regional seismic networks
- \$1.1 Million in cooperative agreement to Southern California Earthquake Center, NSF ~ \$5 million
- Leverages support from other state and federal agencies, and universities





UC SANTA BARBARA PRESS RELEASE: August 15, 2005

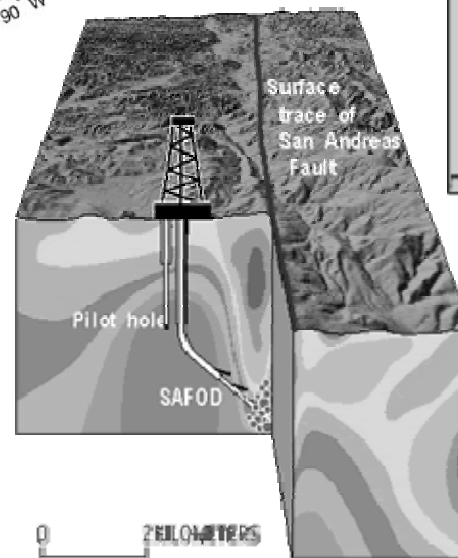
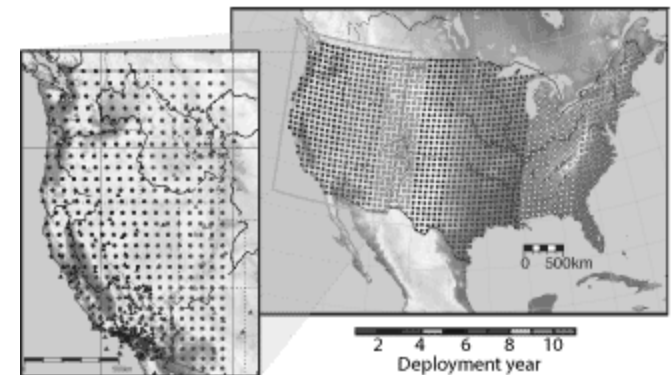
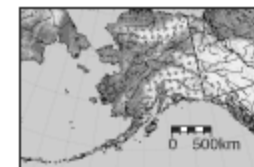
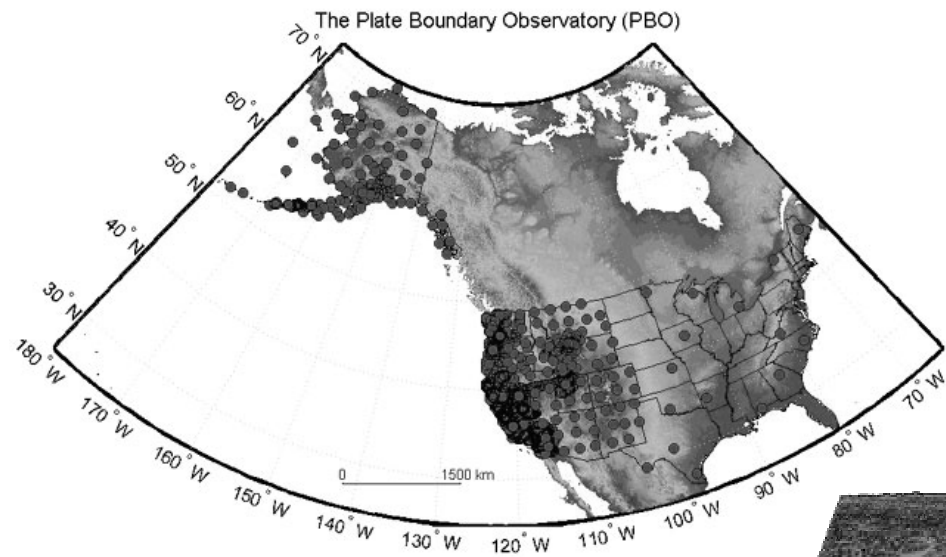
A groundbreaking collaborative experiment was initiated last week to help gain a better understanding of the nature of earthquake ground motion mechanisms. The experiment is being sponsored under the National Earthquake Hazards Reduction Program (NEHRP) by both the U.S. Geological Survey (USGS) External Grants Program and the National Science Foundation (NSF) George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) Program.

NEES@UTexas personnel have been shaking the NEES@UCSB Wildlife Liquefaction Array site, located south of the Salton Sea in California's Imperial Valley... using the Tri-Axial Mobile Shaker, which is also known as "T-Rex".

This experiment is a great example of multi-agency and multi-disciplinary collaboration to address important scientific problems. The combined resources of these different agencies and institutions are able to accomplish far more than would be possible by individual participants alone.



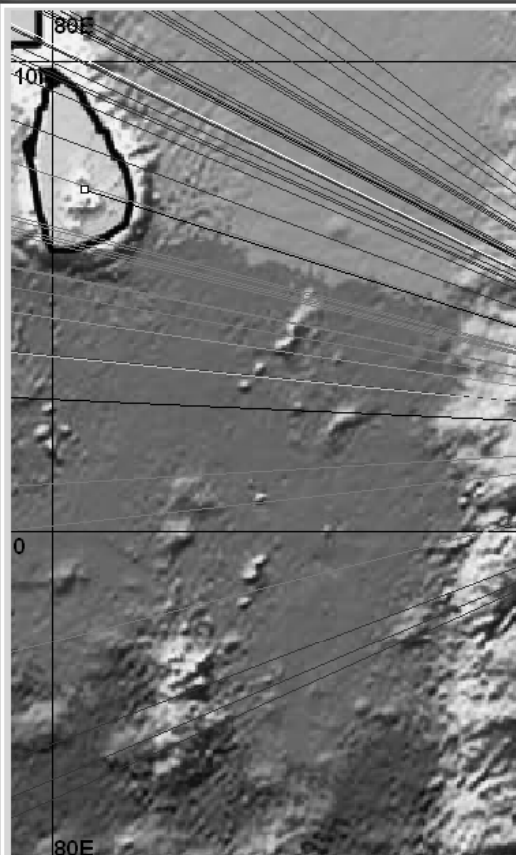
earth scope



USGS Role in President's Tsunami Warning Initiative



MapDisplay



Zoom In

Region Zoom

- ☐ Snap To Latest
- ☐ Show All Events
- ☐ Show Station Names
- ☐ Hold Zoom Level

Zoom Out

World Zoom

Review Event



Event List

Event ID	Origin Time	Region
1	03/23/2005 02:17:49	Vanuatu Islands
2	03/23/2005 05:59:07	Myanmar-India border region
3	03/23/2005 07:45:39	Chile-Bolivia border region
4	03/23/2005 09:17:06	Andaman Islands, India, region
6	03/31/2005 19:14:39	Off west coast of northern Sumate
7	03/23/2005 11:32:49	Central Peru
9	03/23/2005 13:30:31	Bougainville - Solomon Islands regio
10	03/23/2005 13:59:32	Bouvet Island region
12	03/23/2005 14:55:18	North of Solomon Islands
13	03/23/2005 18:11:31	Utah, United States

SummaryDisplay - Event:84 - Origin:3728

Region

Northern Sumatra,
Indonesia

Time

Origin Date/Time:

03/28/2005 16:09:34

Time Since Event

14 Day(s), 6 Hour(s), 58 Minute(s), 49 Second(s)

Location

Num. Phases:	116(117)
Latitude:	2.05
Longitude:	97.15
Depth:	10 km

Other Location Parameters:

RMS Misfit:	2.22
Latitude Error:	6.60 km
Longitude Error:	5.40 km
Vertical Error:	0.00 km
Azimuthal Gap:	35 deg
Min. Station Dist:	16.40 deg

Magnitude

8.2

Mwp

Mag:	Type:	Quality:	
-/-	MI:	-/-	MI Display
-/-	Md:	-/-	Md Display
6.1	Mb:	6/-	Mb Display
8.2	Mwp:	10/-	Mwp Display
-/-	Ms:	-/-	Ms Display
-/-	Mblg:	-/-	Mblg Display
-/-	Mw:	-/-	Mw Display

Event Passport	Locator Display
Travel Times	Create Raypetlet

Processing Status

Event Type:

Valid Event

System:

WHITE

Locked By:

Frodo Baggins

Processing History



Overall Status



Refresh

Last Message: Loaded from Origin ID 1000003728

Close

Refresh

Or

Reload

From YYYYMMDDHH

2004081000

to

2005041100

with

500

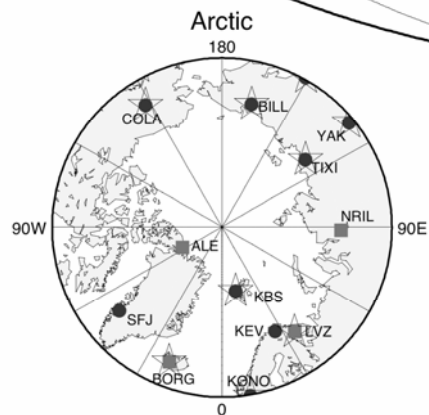
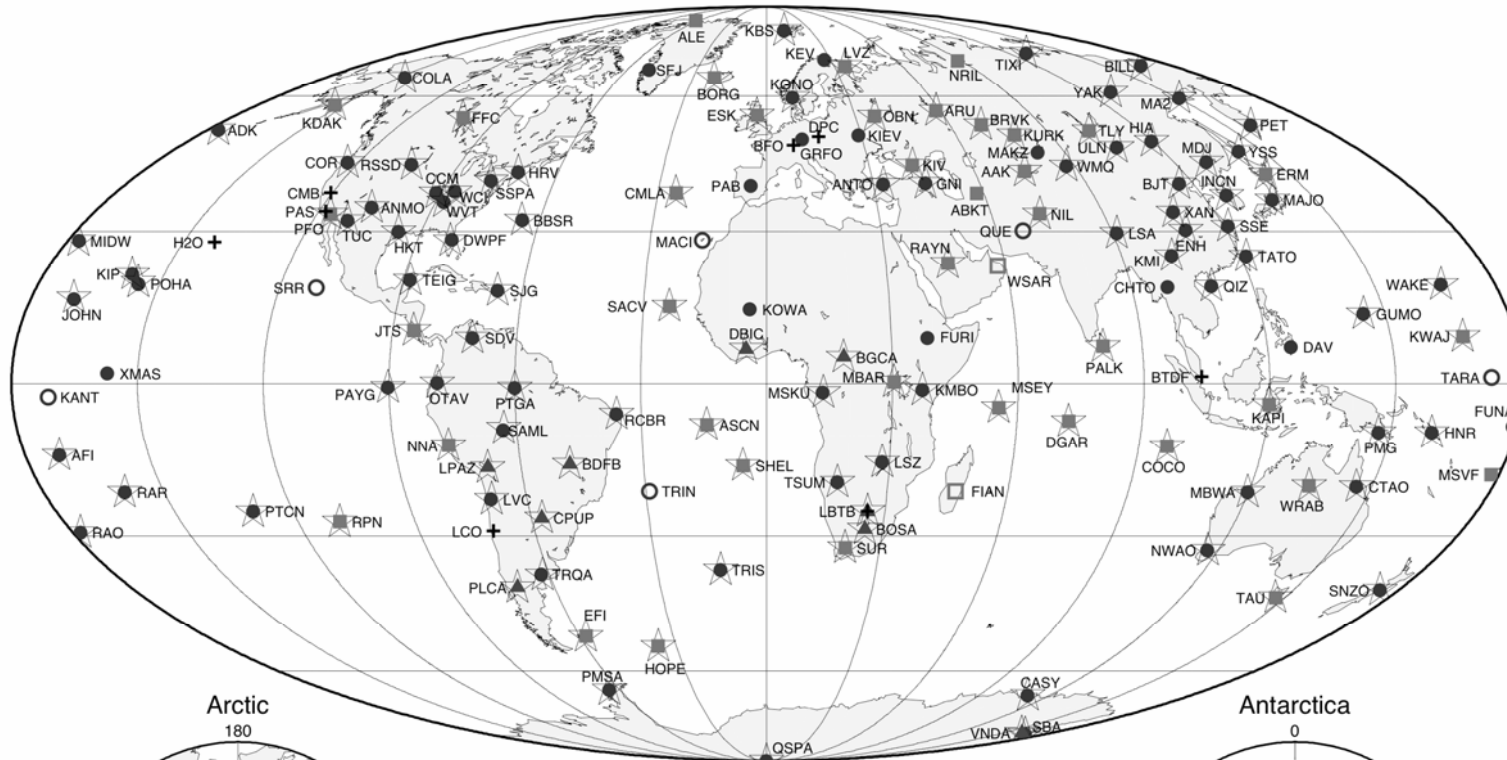
Events (Max = 500)

Last Message:

Msg: MIDoneForOrigin

Close

Global Seismographic Network



Installed Planned

85 ●

6 ○

39 ■

2 □

8 +

9 ▲

117 ☆

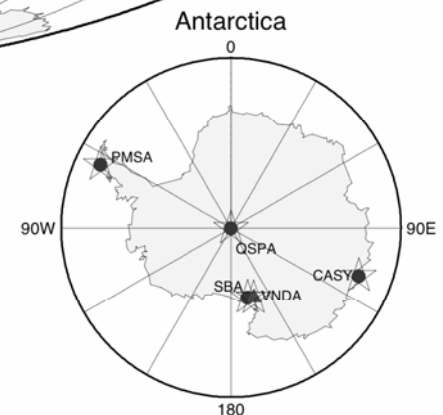
IRIS/USGS Stations

IRIS/IDA Stations (UCSD)

Other/Affiliated GSN Stations

GTSN Stations (AFTAC)

Telemetered stations

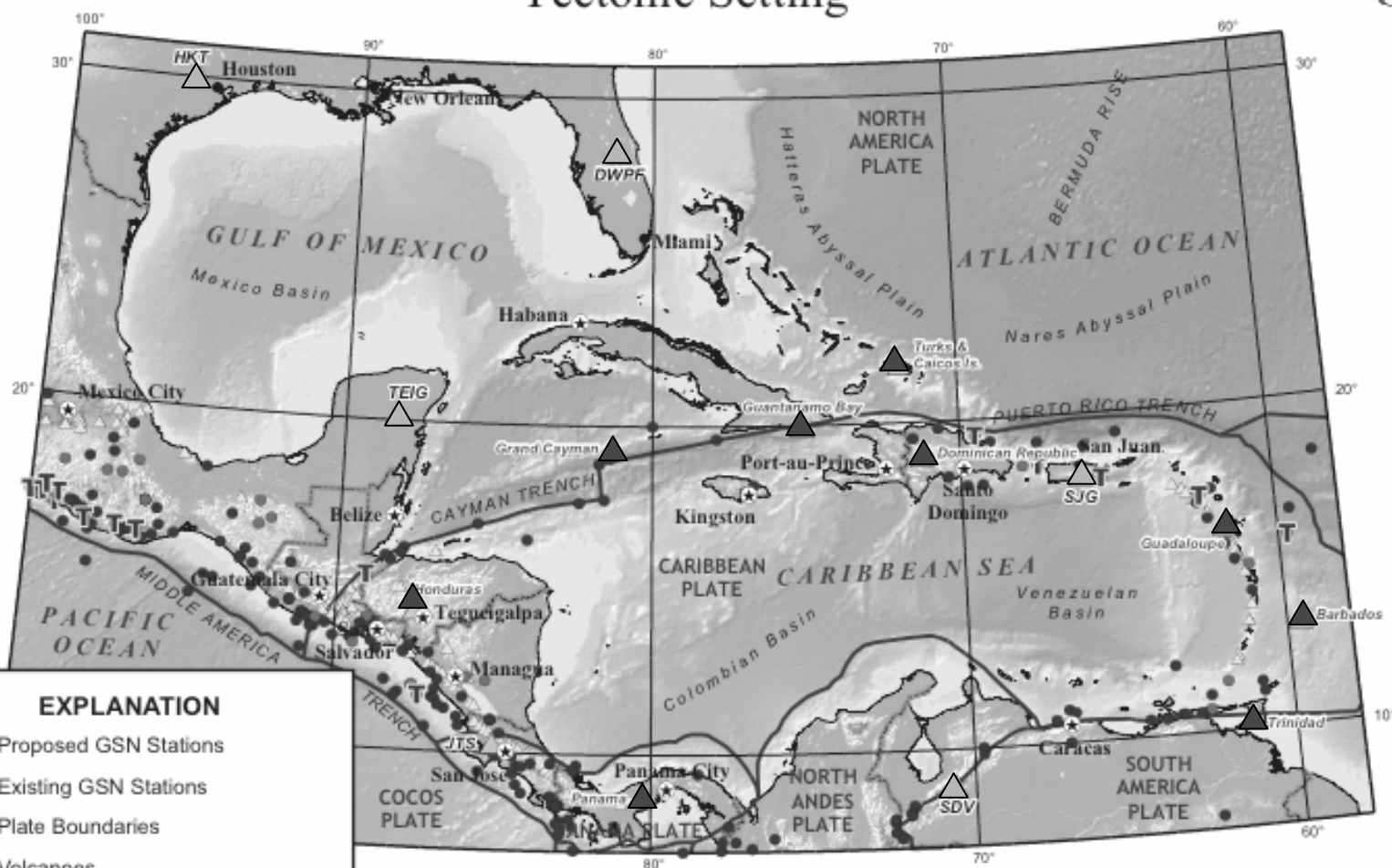


USGS Albuquerque Seismological Laboratory
January 27, 2005 (crh/lw)



DRAFT

Proposed Expansion of the Global Seismographic Network Tectonic Setting



EXPLANATION

- ▲ Proposed GSN Stations
- △ Existing GSN Stations
- Plate Boundaries
- ▲ Volcanoes

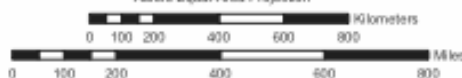
Earthquakes 1610 - 2004, $M \geq 6$

● 0 - 69 km

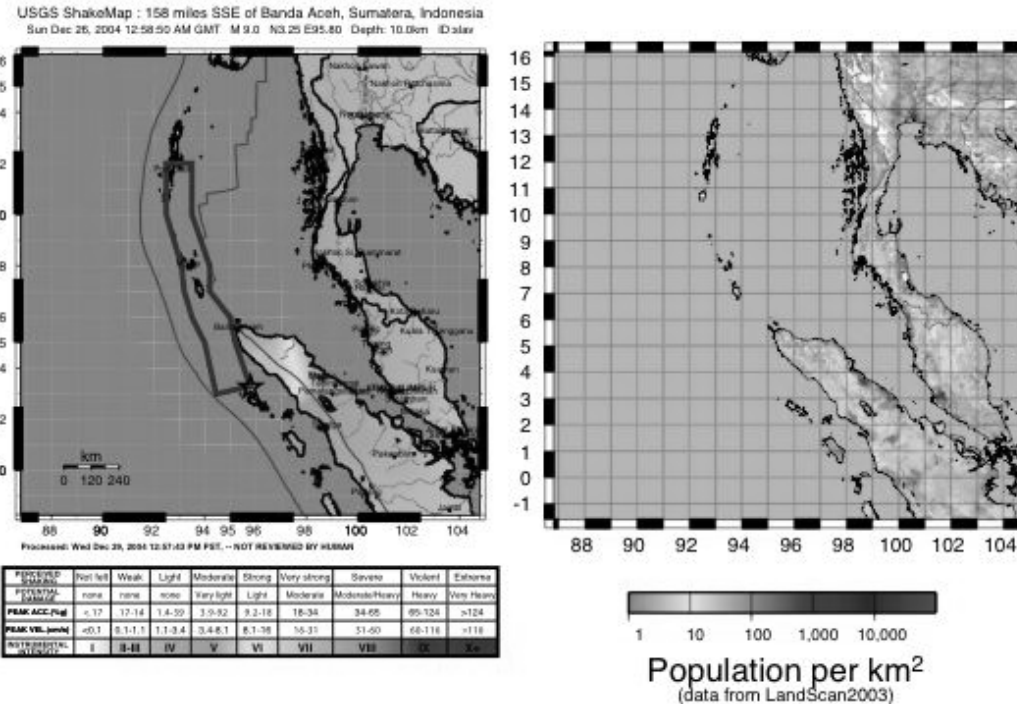
● 70 - 299

T Tsunamiogenic Earthquakes 1610 - 1993

SCALE 1:20,000,000
Albers Equal-Area Projection



Prompt Assessment of Global Earthquakes PAGER



Population exposed to shaking

Population	Intensity of shaking
1,300,000	VIII
1,700,000	VII
1,200,000	VI

These results are from a prototype system and should not be relied on for disaster relief planning



USGS Hazards Initiative (FY07 and beyond)

- USGS is pursuing a major initiative focused on reducing the impacts of catastrophic natural hazards
 - Earthquakes
 - Volcanoes
 - Landslides
 - Floods
 - Wildfire
 - Hurricanes
 - Tsunami



Hazards Initiative Themes

- Modernizing Earth observation hazard networks
- Characterizing hazards and their resulting risks
- Targeted research on hazard processes and prediction
- Assessing at-risk communities
- Early warnings
- Rapid damage assessment & emergency response support
- Disaster recovery information
- Robust infrastructure for information delivery

