



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

USGS Presentations

ACEHR Meeting, Golden CO

October 23-24, 2007



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

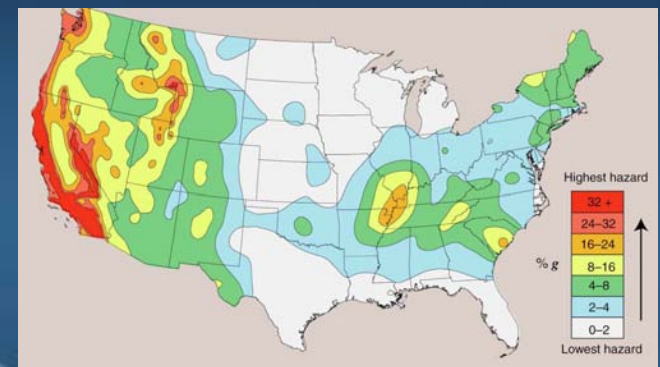
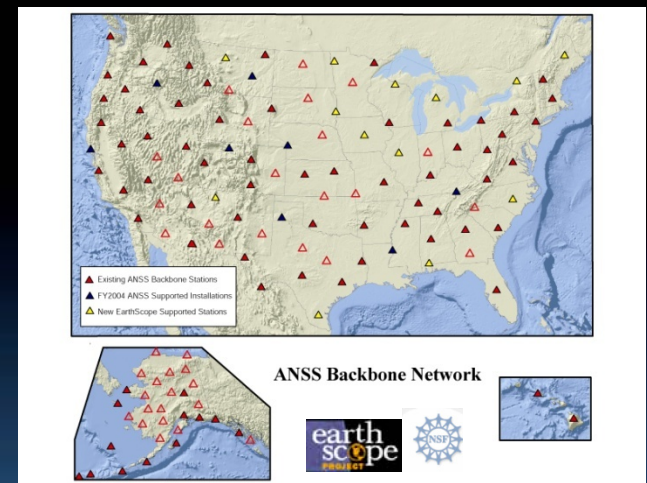
USGS Statutory Implementation Activities



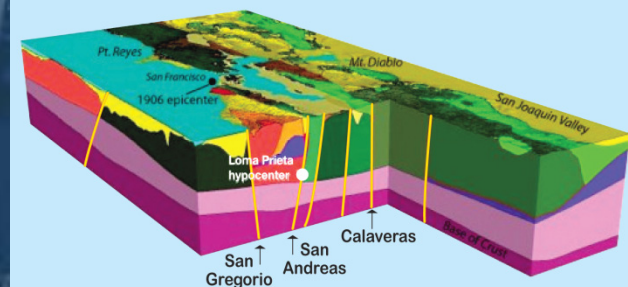
The USGS role in NEHRP

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

Statute: The United States Geological Survey shall conduct research and other activities necessary to characterize and identify earthquake hazards, assess earthquake risks, monitor seismic activity, and improve earthquake predictions.



3D Geologic "fault and block" model



Bob Jachens, Russ Graymer, Bob Simpson, and Carl Wentworth

USGS

Program Responsibility: Conduct a systematic assessment of the seismic risks in each region of the Nation prone to earthquakes, including, where appropriate, the establishment and operation of intensive monitoring projects on hazardous faults, seismic microzonation studies in urban and other developed areas where earthquake risk is determined to be significant, and engineering seismology studies.

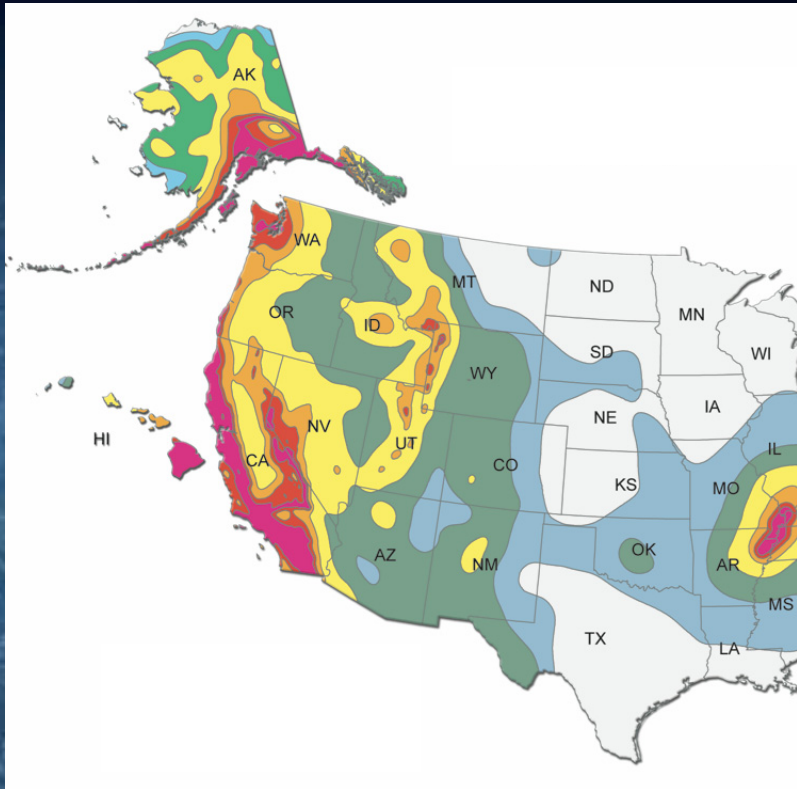
Recent and ongoing activities that support this Program Responsibility:

- National seismic hazard maps
- Urban seismic hazard maps
- Hazard to risk handoff: Scenarios, PAGER, DamageMap
- Intensive fault monitoring projects (Parkfield, Hayward)



national **earthquake** hazards reduction program

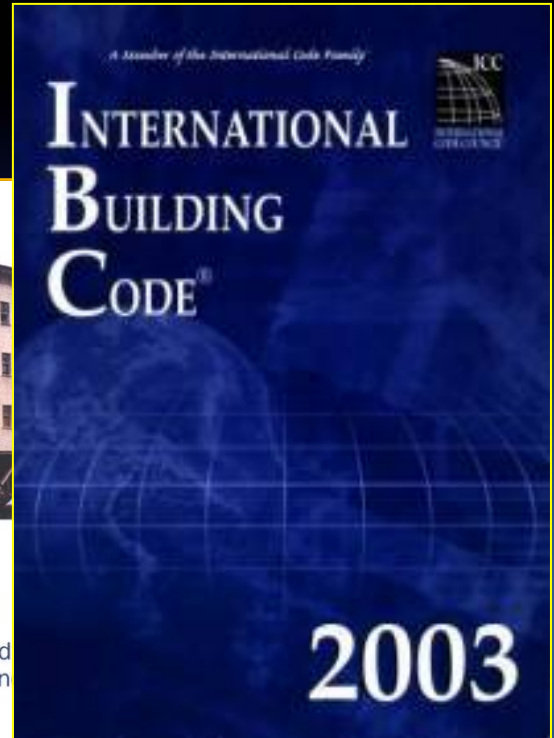
Translating USGS national hazard maps into model building codes



**2003 NEHRP
Recommended Provisions**
for Seismic Regulations for New Buildings and
Structures and Accompanying Commentary and
FEMA 450-CD – 2003 Edition/June 2004



FEMA



**Seismic element of NEHRP
Provisions and Int'l Building
Code based on the USGS
national seismic hazard map**

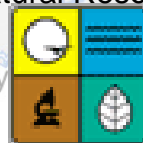
Urban hazard mapping in the Central U.S. involves many local and state partners



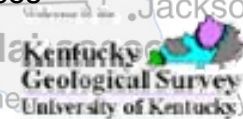
St. Louis

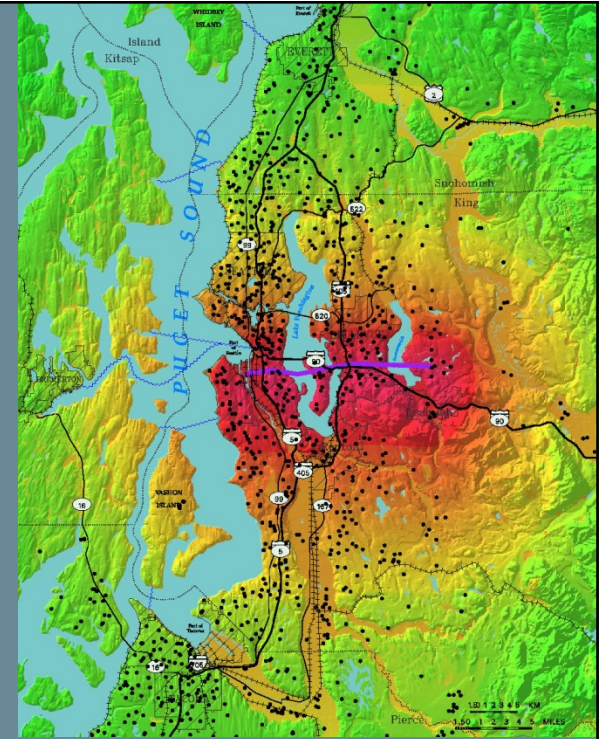


Memphis



Evansville





Seattle Fault Earthquake Scenario

www.eeri.org

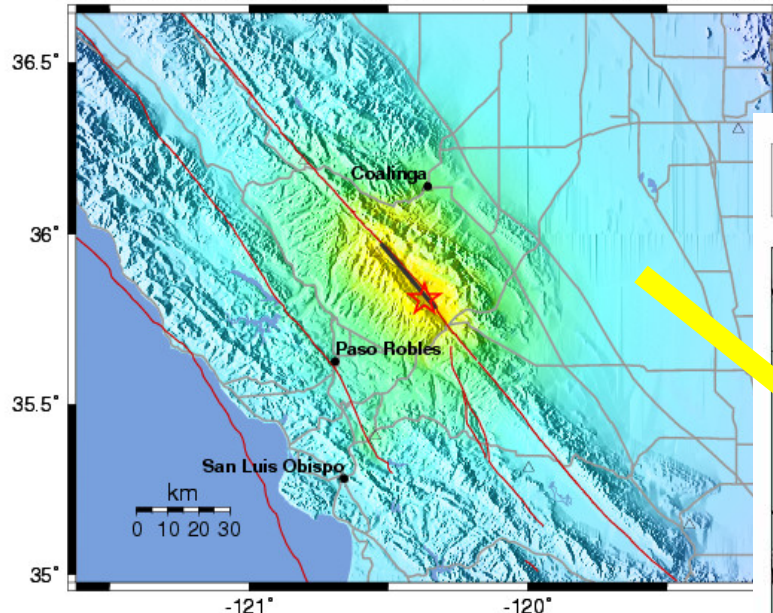


**Earthquake Engineering
Research Institute**

ShakeMap supports targeted response and rapid loss estimation

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

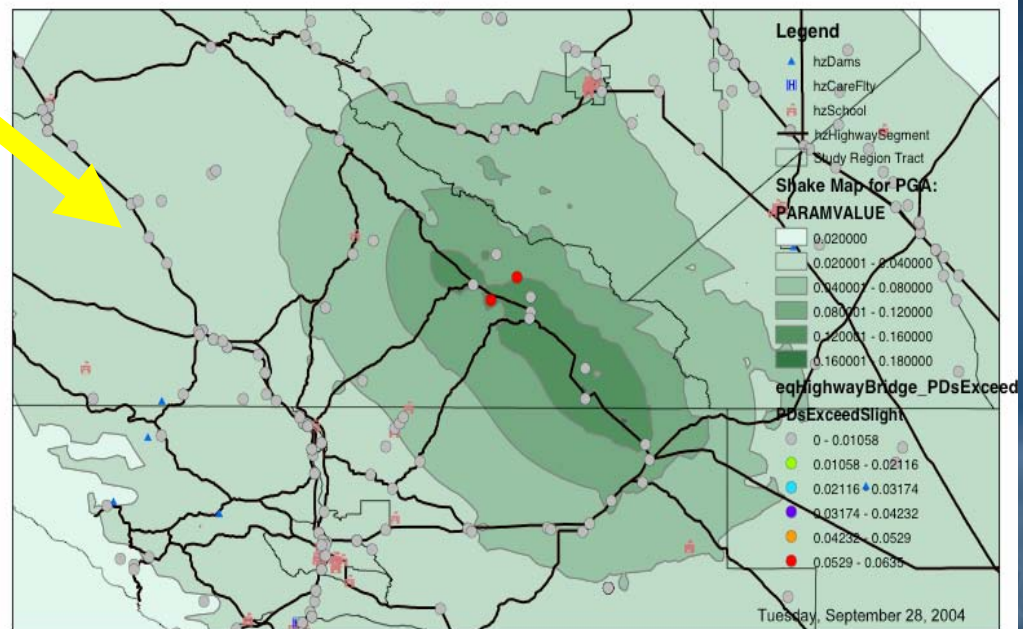
CISN Rapid Instrumental Intensity Map Epicenter: 11 km SSE of Parkfield, CA
Tue Sep 28, 2004 10:15:24 AM PDT M 6.0 N35.81 W120.37 Depth: 7.9km ID:51147892



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	Ext
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-85	85-124	>
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-18	18-31	31-80	80-118	>
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X

Study Region : Parkfield Region
Hazard Scenario : ShakeMap Mw 6.0 Parkfield



(c) 1997-2003 FEMA



FEMA-generated loss estimation results
based on ShakeMap data

PAGER

Prompt Assessment of Global Earthquakes for Response

<http://earthquake.usgs.gov/pager/>



M 8.4, SOUTHERN SUMATRA, INDONESIA

Origin Time: Wed 2007-09-12 11:10:26 UTC

Location: 4.52°S 101.38°E Depth: 30 km

PAGER Version 11

Created: 6 hrs, 7 mins after earthquake

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	--*	54,342k*	53,605k	12,285k	2,632k	2,014k	480k	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan 2005

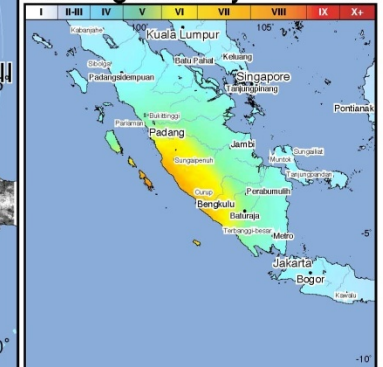
Selected City Exposure



MMI City	Population
VII Curup	46k
VII Sungaipenuh	95k
VII Pagaralam	70k
VI Bengkulu	309k
V Palembang	1,441k
IV Singapore	3,547k
IV Jakarta	8,540k
IV Tangerang	1,372k
IV Bekasi	1,520k
III Kuala Lumpur	1,453k
III Bandung	1,699k

bold cities appear on map (k = x1000)

Shaking Intensity

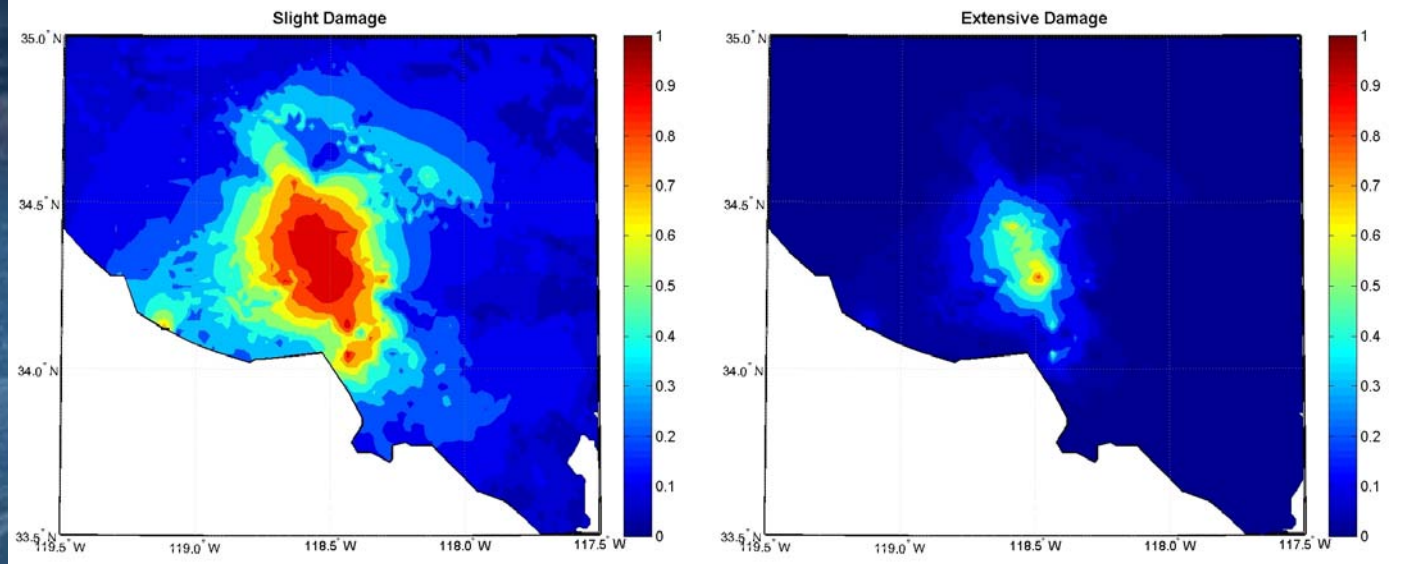


Overall, structures in this region are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 7.9 earthquake struck the offshore Bengkulu, Indonesia region on June 4, 2000, with estimated population exposures of 2,000 at intensity VIII and 510,000 at intensity VII, resulting in 103 deaths. Recent earthquakes in this area have also triggered tsunami, landslides and liquefaction hazards that have contributed to losses.

Improving the handoff: Research into development of Damage Maps

Northridge
M6.7, 1994

Low-Rise Unreinforced Masonry Bldg., Low-Code

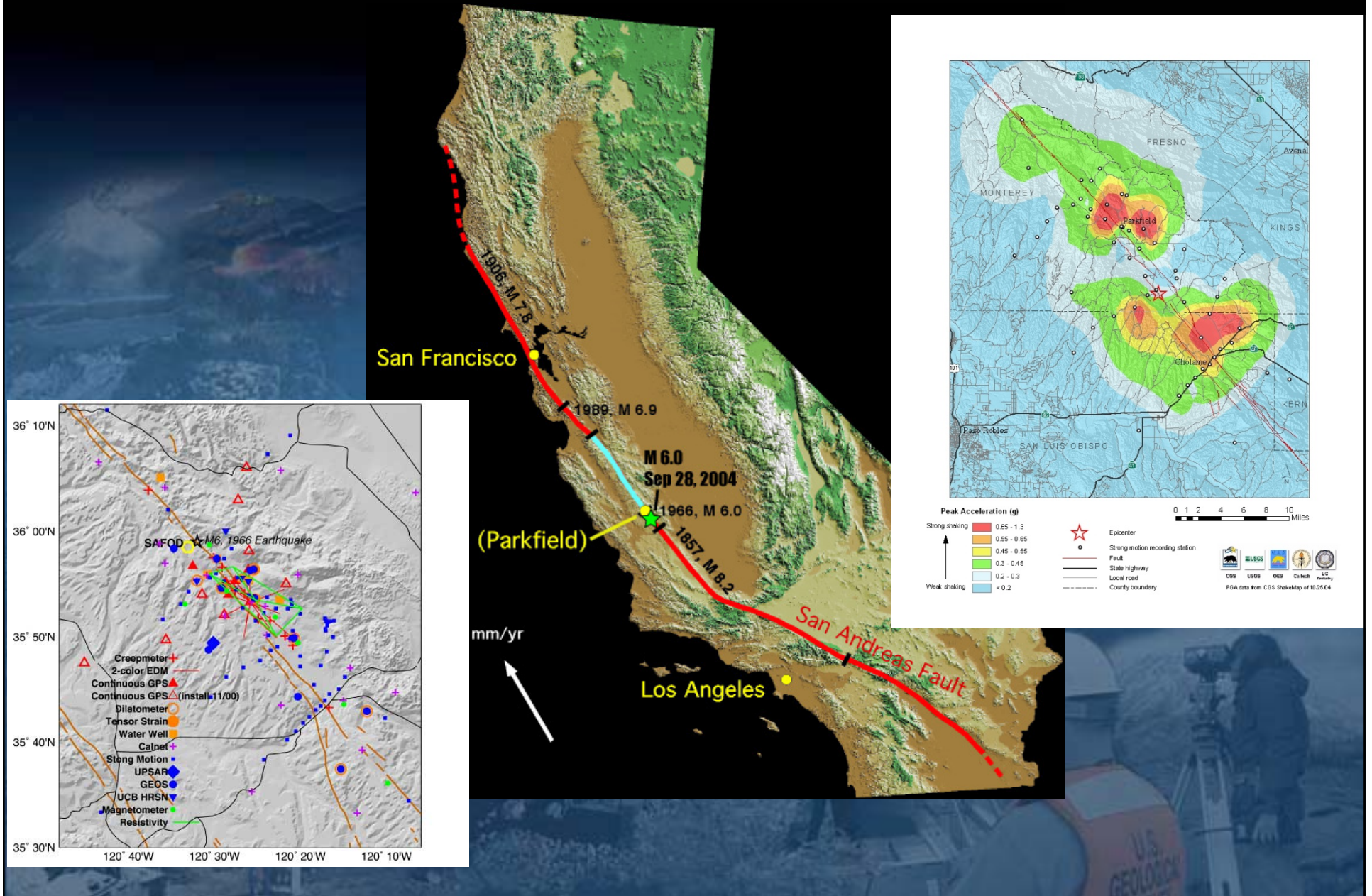


- Derived by combining fragility curves with ground motions from ShakeMaps (with uncertainties) to show probability of exceeding a given damage-state for each of the generic building types and code levels.

USGS



Long-term monitoring at Parkfield



USGS

Program Responsibility: Work with officials of state and local governments to ensure that they are knowledgeable about the specific seismic risks in their areas.

Recent and ongoing activities that support this Program Responsibility:

- **Cooperation with regional earthquake consortia**
- **Public preparedness booklets and outreach**
- **Multi-hazards demonstration project in southern California**
- **Scenarios**



What if it happened again?

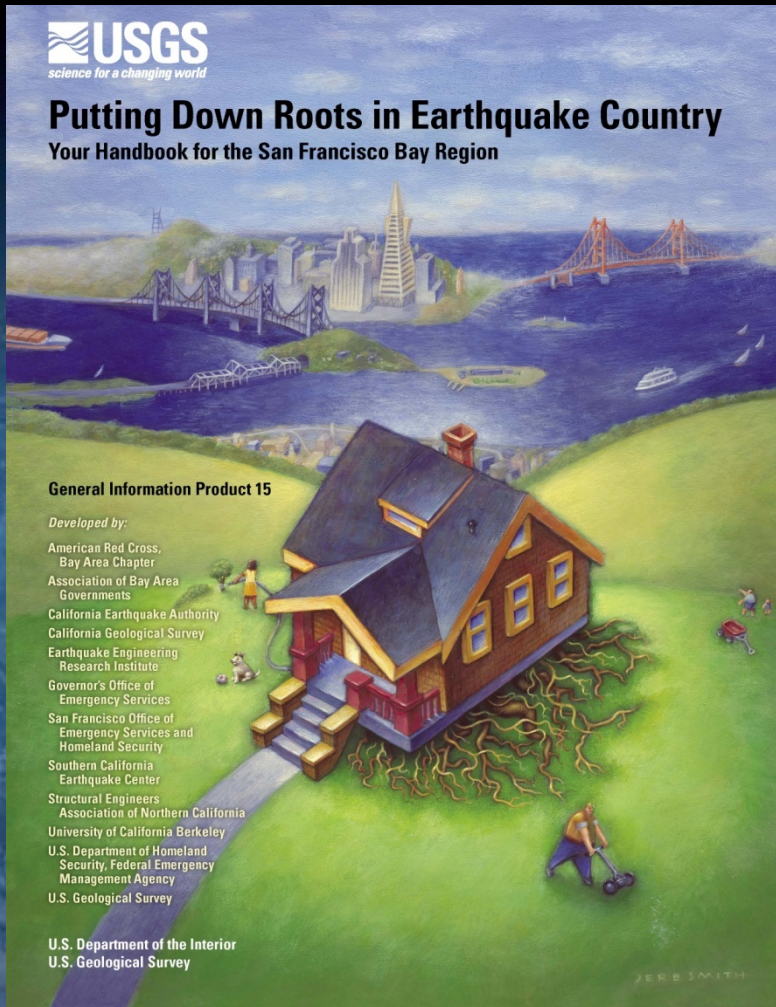


100th Anniversary Earthquake Conference

- \$90-120 billion forecasted property loss to buildings
- 7,000 to 10,000 commercial buildings closed
- 160,000 to 250,000 households or at least 400,000 people displaced
- As many as 3,400 fatalities

Total price tag could reach \$150 Billion

Data from: *When the Big One Strikes Again - Estimated Losses due to a Repeat of the 1906 San Francisco Earthquake*, produced for the 100th Anniversary Earthquake Conference

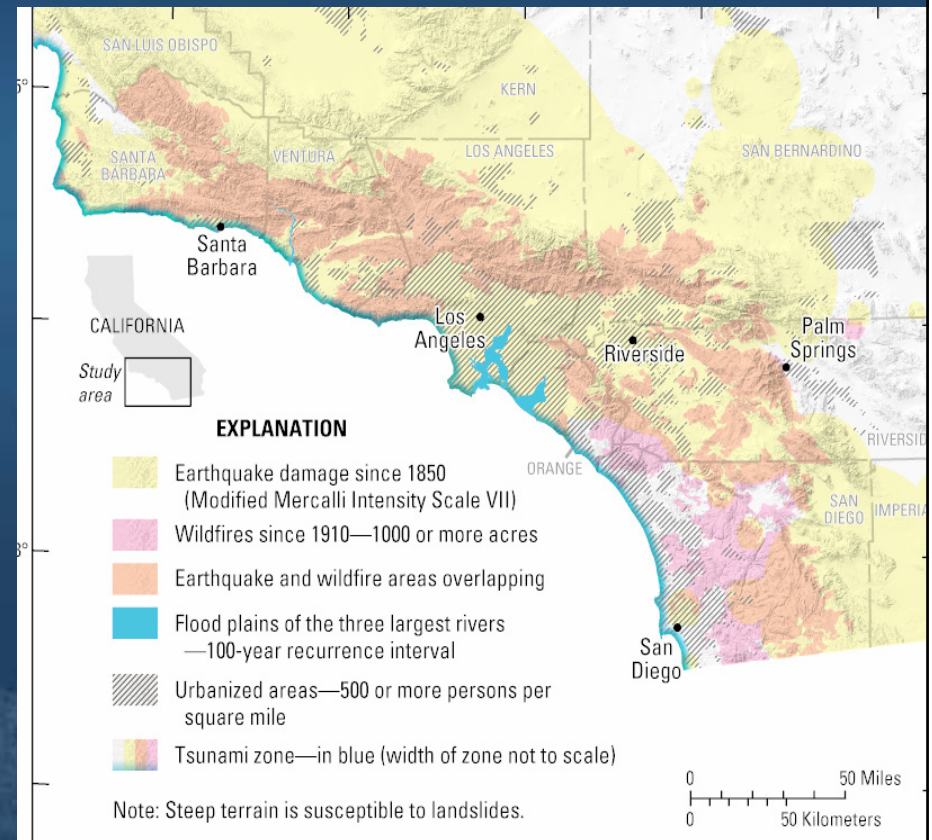


USGS



USGS Hazards Initiative in FY07: Multi-Hazard Demonstration Project

- Focused on reducing losses in Southern California: a region subject to multiple hazards
- Integrate information from multiple hazards to improve usefulness
- Work closely with dozens of partner organizations to leverage resources and optimize performance



USGS



Partnerships and planning

- Built new partnerships
 - Formed Earthquake Country Alliance
 - Formulated Dare to Prepare campaign
- Drafted strategic plan with community input



Open-File Report 2007-1255

U.S. Geological Survey

**Increasing Resiliency to Natural Disasters:
A Strategic Plan for the Multi-hazards Demonstration Project in Southern California**

Internal Draft: Not for citation or release

Draft version: October 14, 2006



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

USGS

***Program Responsibility:** Develop standard procedures, in consultation with the Director of the Federal Emergency Management Agency and the Director of the National Institute for Standards and Technology, for issuing earthquake predictions, including aftershock advisories.*

***Program Responsibility:** Issue when necessary, and notify the Director of the Federal Emergency Management Agency and the Director of the National Institute of Standards and Technology, of an earthquake prediction or other earthquake advisory, which may be evaluated by the National Earthquake Prediction Evaluation Council.*

Recent and ongoing activities that support this Program Responsibility:

- **Parkfield experiment**
- **Re-chartered the National Earthquake Prediction Evaluation Council**
- **Daily aftershock probability map for California**

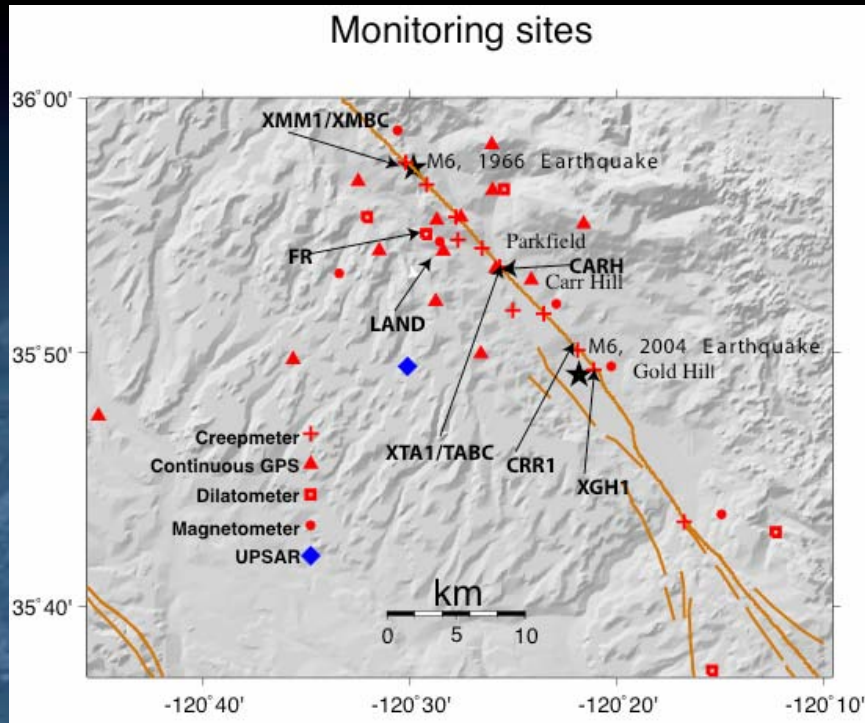


national **earthquake** hazards reduction program

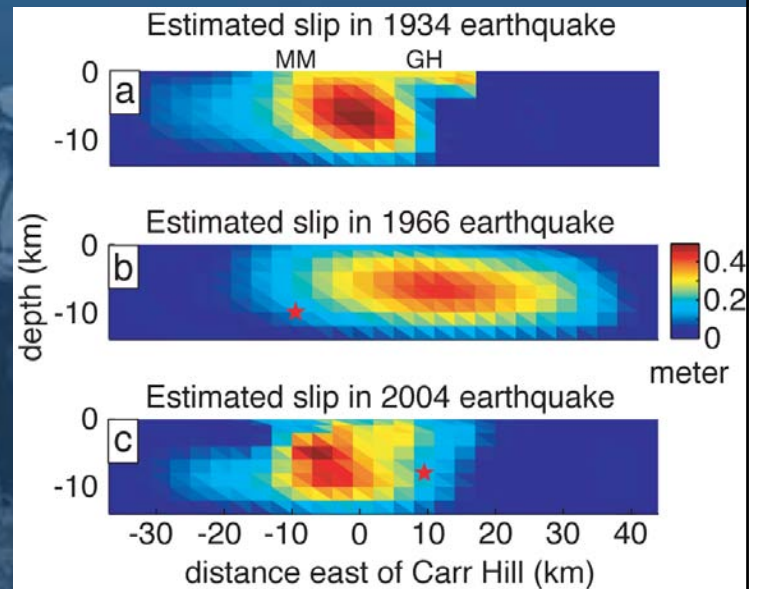
Parkfield: Testing prediction hypotheses

Prior to Sept. 28, 2004 Earthquake

- No foreshocks
- No precursory ground deformation
- No precursory changes in electrical or magnetic fields



Instead, we learned a great deal about rupture processes, strong ground motion and interevent strain accumulation



Re-established National Earthquake Prediction Evaluation Council

- Established by NEHRP legislation in 1980 to advise USGS Director, reviewing claimed earthquake forecasts and predictions
- Endorsed Parkfield experiment in 1986
- Endorsed intermediate-term earthquake forecasts for California in 1988, 1990, 1995
- Operated until 1995 then re-chartered in 2005
- Recent topics include California-wide time-dependent earthquake forecast model and implications of episodic tremor and slip in Cascadia
- Well coordinated with California's CEPEC



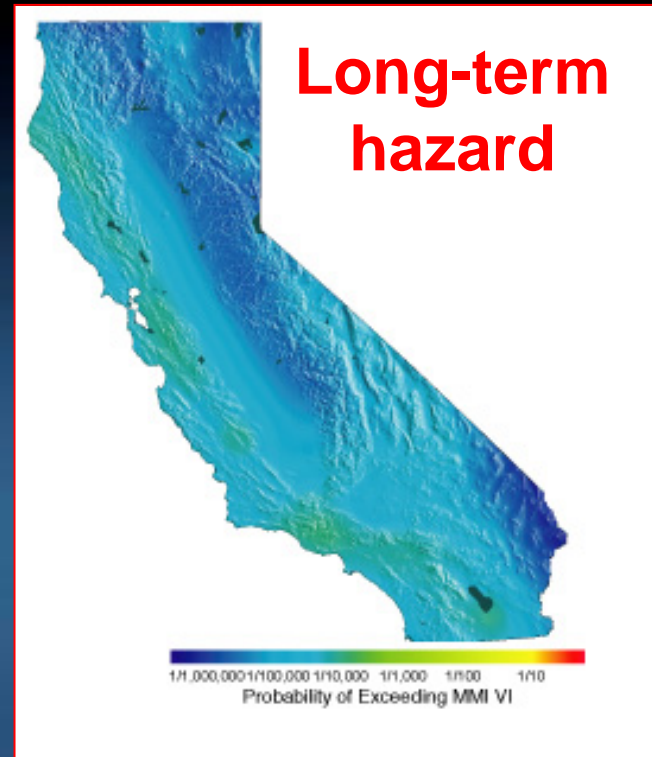
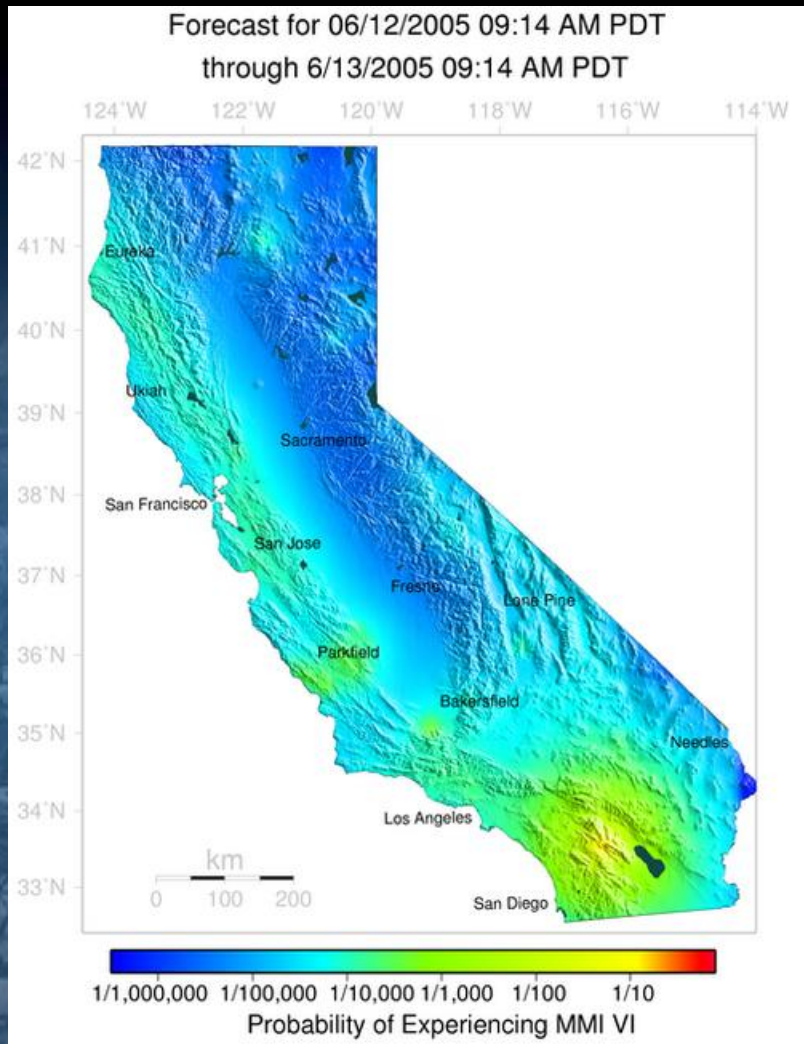
SCEC Collaboratory for the Study of Earthquake Predictability

- Goals:
 - Reduce the controversy surrounding earthquake prediction through a collaboratory infrastructure to support a wide range of scientific prediction experiments
 - Promote rigorous research on earthquake predictability through the SCEC program and its global partnerships
 - Help the responsible government agencies assess the feasibility of earthquake prediction and the performance of proposed prediction algorithms
- Main Objective:
 - Rigorous comparative testing of diverse prediction experiments spanning a variety of fault systems



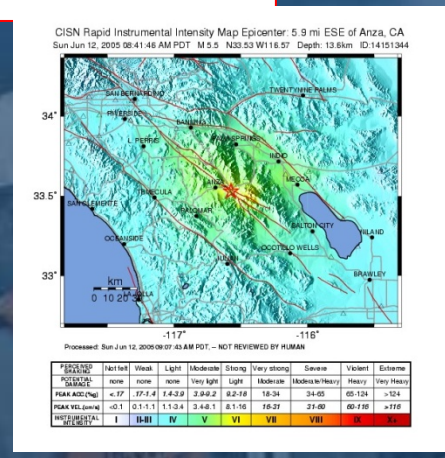
CSEP is currently funded by grant from Keck Foundation

24-hour aftershock forecast map



+

Aftershock hazard



USGS

Program Responsibility: Operate a forum for the international exchange of earthquake information, using the National Earthquake Information Center.

Recent and ongoing activities that support this Program Responsibility:

- **NEIC responsibility for reporting on global earthquakes**
- **USGS website (millions of hits per day)**
- **Development of PAGER and global intensity reports**
- **Partnership with NSF-supported IRIS Consortium for global seismic data archiving**
- **Current effort to digitize historic seismic chip records**



Improved global reporting of earthquakes

NOAA's National Weather Service
Pacific Tsunami Warning Center

Site Map News Organization Search [NWS Search] Go

Local forecast by "City, St, or Zip Code" [City, St, Zip] Go

NOAA > NWS > PTWC Home Page > Bulletins

PTWC Bulletins

PACIFIC OCEAN

- Latest
- Previous

HAWAII ISLANDS

- Latest
- Previous

INDIAN OCEAN

- Latest
- Previous

PUERTO RICO/VIRGIN IS.

- Latest
- Previous

Bulletins
 Pacific Ocean
 Hawai'i Islands
 Indian Ocean
 Puerto Rico/Virgin Is.
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 TsunamiReady
 About Us
 Our Mission
 Our Office
 Pacific Region
 Regional HQ
 Central Pacific
 Hurricane Center

USGS Earthquake Hazards Program - Magnitude 8.3 - KURIL ISLANDS - Microsoft Internet Explorer

http://earthquake.usgs.gov/center/recenteqs/Quakes/usvcam.php#details

USGS
 science for a changing world

Earthquake Hazards Program

Home Earthquake Center Regional Information About Earthquakes Research & Monitoring Other Resources

You are here: Home > Earthquake Center > Latest Earthquakes > World > Magnitude 8.3 - KURIL ISLANDS

Latest Earthquakes

USA

World

Magnitude 8.3 - KURIL ISLANDS

2006 November 15 11:14:16 UTC

Version en Español

Details Summary Maps Scientific & Technical Where can I find...?

Earthquake Details

Magnitude 8.3 (Great)

Date-Time Wednesday, November 15, 2006 at 11:14
 = Coordinated Universal Time
 Wednesday, November 15, 2006 at 10:14
 = local time at epicenter [Time of Earthquake in...](#)

Location 46.577°N, 153.247°E

Depth 26.7 km (16.6 miles)

Region KURIL ISLANDS

Distances
 440 km (275 miles) ENE of Kuril'sk, Kuril Island
 505 km (315 miles) SSW of Severo-Kuril'sk, Ks
 1650 km (1030 miles) NE of TOKYO, Japan
 7185 km (4460 miles) NE of MOSCOW, Russia

Location Uncertainty
 Parameters
 horizontal +/- 6.7 km (4.2 miles); depth +/- 20.0 km
 Net=232, Nph=232, Dmin=16 km, Rms=1.02 sec
 M-type=moment magnitude (Mw), Version=9

Source USGS NEIC (WDCS-D)

Event ID usvcam

This event has been reviewed by a seismologist.

[Did you feel it?](#)
 Report shaking and damage at your location. You can also view a map displaying accumulated shaking.

Preliminary Earthquake Report

USGS science for a changing world

AASS

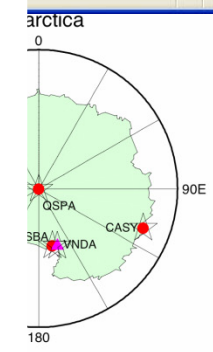
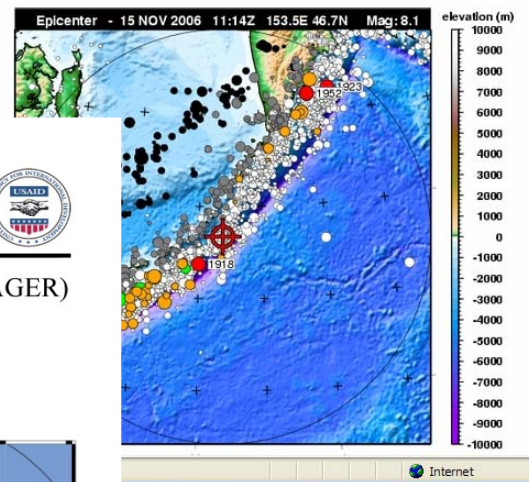
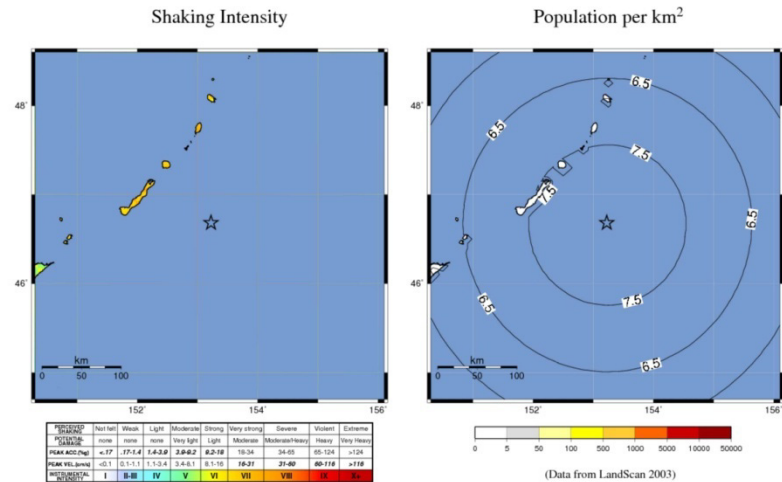
GSN

PAGER

PAGER V2 Wed Nov 15, 2006, 03:08:47 PM GMT

M8.3 KURIL ISLANDS

N46.68 E153.22 27.7km Wed Nov 15, 2006 11:14:16 AM GMT



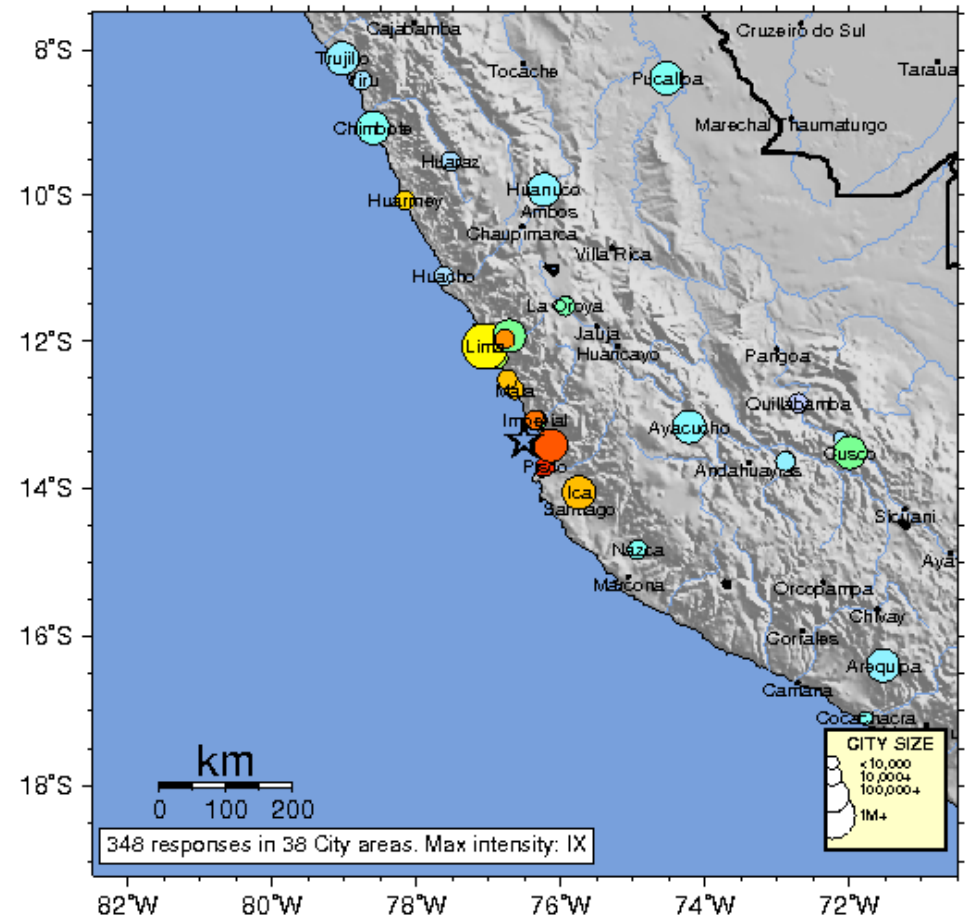
Population exposed to shaking
 No population exposure



Program

Global felt intensity reports: Did you feel it?

USGS Community Internet Intensity Map (67 miles NW of Ica, Peru)
 ID:2007gbcv 23:40:58 GMT AUG 15 2007 Mag=8.0 Latitude=S13.35 Longitude=W76.51



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy



USGS

Program Responsibility: Operate a National Seismic System.

Program Responsibility: Support regional seismic networks, which shall complement the National Seismic System.

Section 13. Advanced National Seismic Research and Monitoring System

Recent and ongoing activities that support this Program Responsibility:

- **Development of Advanced National Seismic System incorporating both national backbone and regional networks plus urban and structural instrumentation**
 - **Highest-rated major capital investment in Department of the Interior**



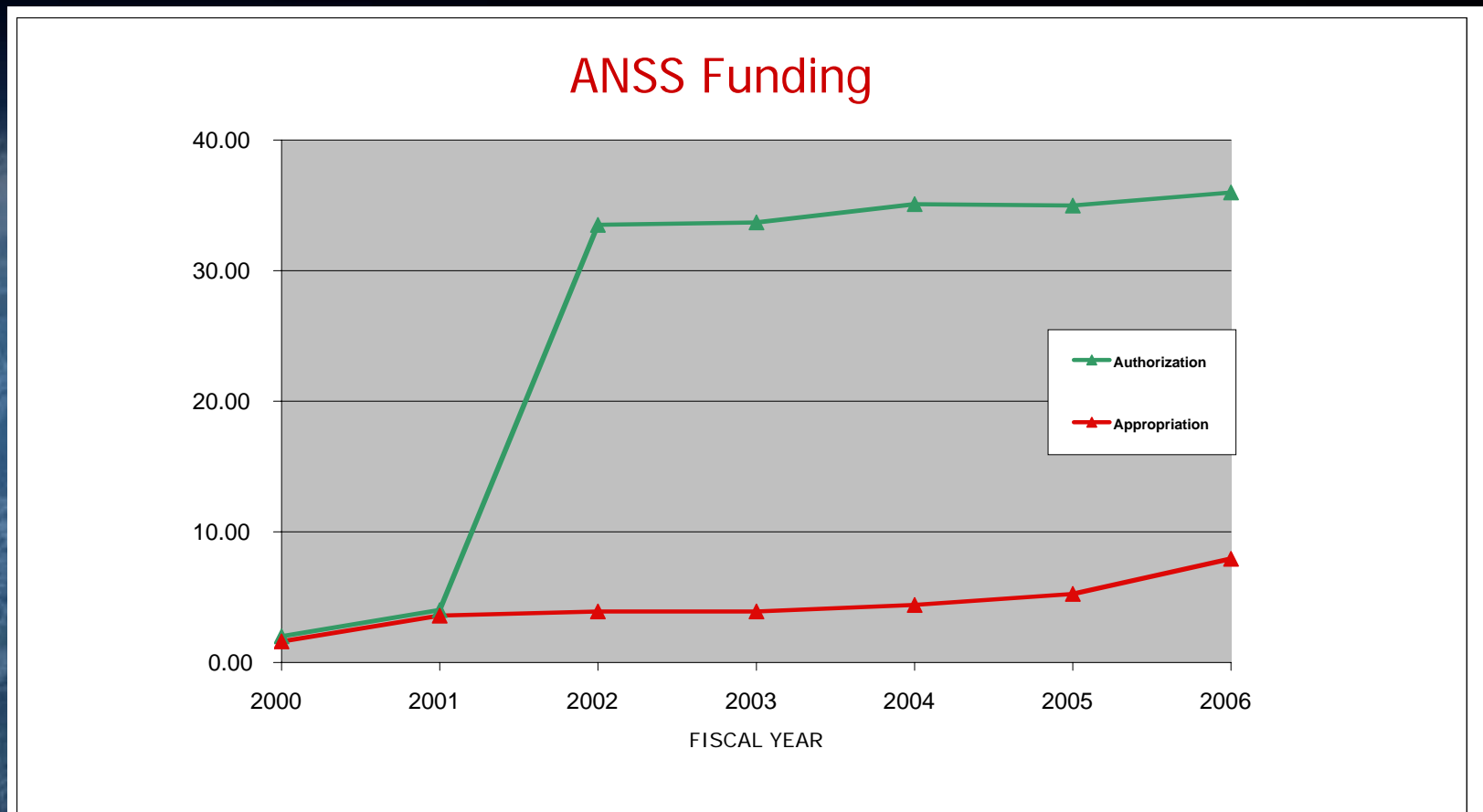
national **earthquake** hazards reduction program

The Advanced National Seismic System

- An integrated national monitoring system
 - A focus on the areas of highest risk
 - 26 urban areas slated for dense instrumentation
 - A commitment to rapid delivery of earthquake information to critical users and the public
 - A strategy to gather critically needed data on earthquake effects on structures
 - A system built through close partnerships with States and local jurisdictions
- 6000 strong motion sensors in 26 at-risk areas
 - 50% of these instruments in buildings and structures
 - 1000 new or upgraded regional stations
 - 100-station Backbone National Network



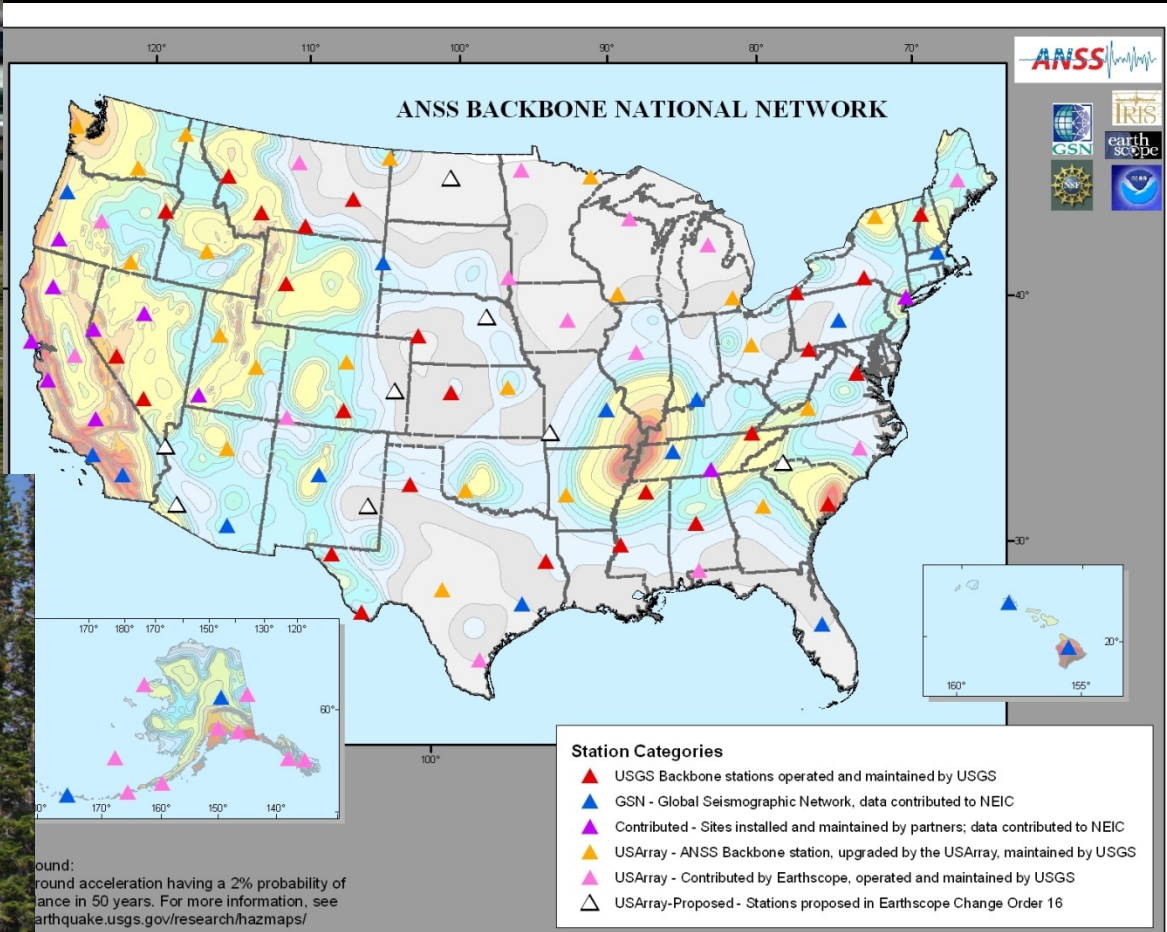
Progress on ANSS



USGS



ANSS Backbone completion



Ground motion hazard map showing contours of peak ground acceleration having a 2% probability of exceedance in 50 years. For more information, see earthquake.usgs.gov/research/hazmaps/



USGS

Program Responsibility: Work with the National Science Foundation, the Federal Emergency Management Agency, and the National Institute of Standards and Technology to develop a comprehensive plan for earthquake engineering research to effectively use existing testing facilities and laboratories (in existence at the time of the development of the plan), upgrade facilities and equipment as needed, and integrate new, innovative testing approaches to the research infrastructure in a systematic manner.

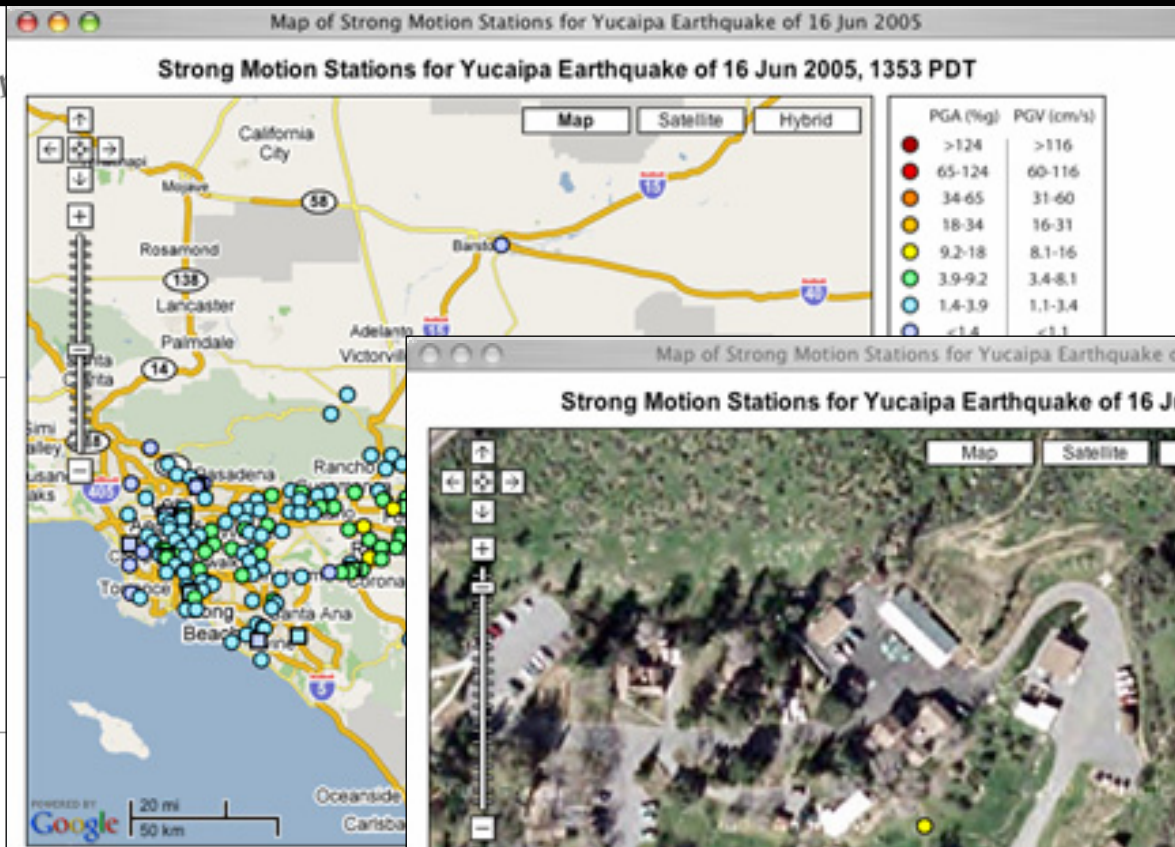
Recent and ongoing activities that support this Program Responsibility:

- **Coordination with NEES**
- **New national engineering strong-motion data center**
- **ANSS structural instrumentation**
- **NEHRP post-earthquake investigations**



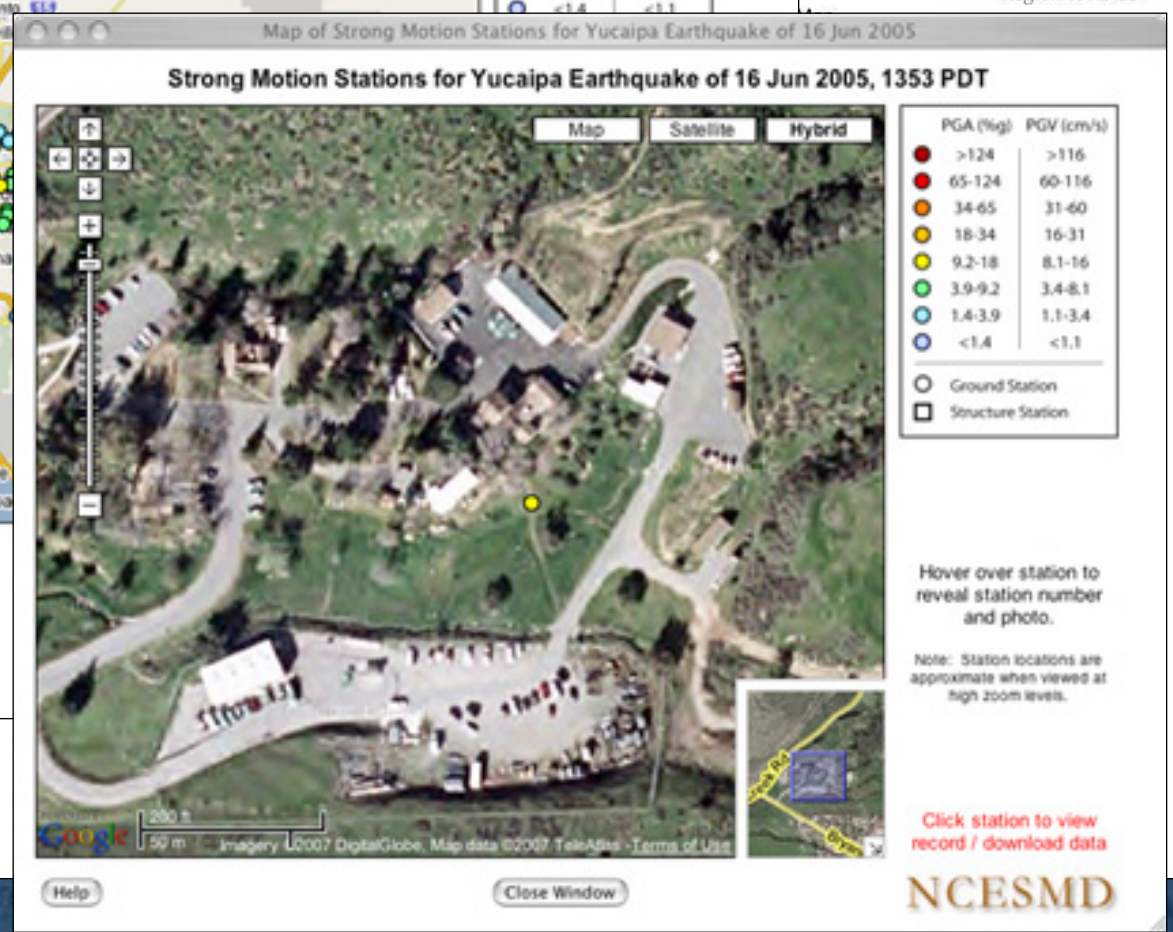
National Center for Engineering Strong Motion Data

US Nation



Report

006
h 9.0 km



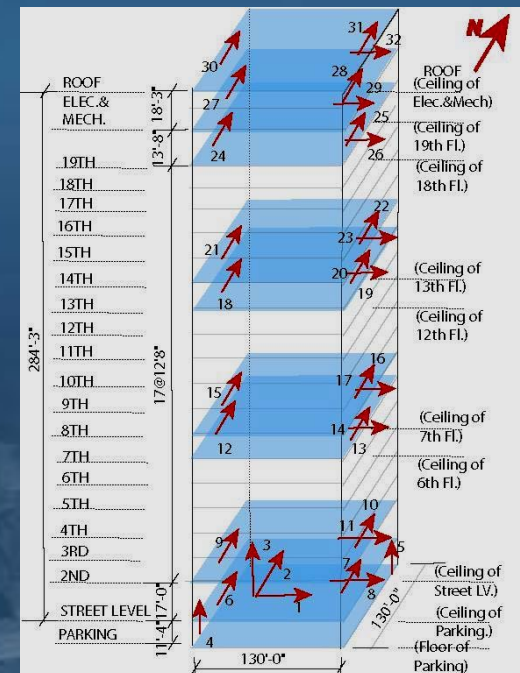
NCESMD



ANSS Instrumented Structures

ANSS focus is on more extensive sensor layouts

- Four completed structures to date:
 - Atwood Building, Anchorage (shown here: 32 accel + 3 downhole array)
 - Factor Building (72 accel + 3 free field + 3 GPS on rooftop)
 - Berkeley City Hall (base isolated)
 - Channing House, Palo Alto (base isolated)
- 12 additional structures selected by SRMC
 - 9 buildings and 3 bridges
 - 5 contracts let to date; 6 planned for 2007
 - includes 3 VA Medical Centers



USGS

Program Responsibility (added in 2004 reauthorization): Work with other Program agencies to coordinate Program activities with similar earthquake hazards reduction efforts in other countries, to ensure that the Program benefits from relevant information and advances in those countries.

Recent and ongoing activities that support this Program Responsibility:

- **US/Japan (UJNR) Panel on Earthquake Research bi-annual workshop**
- **Chinese Earthquake Authority coordination**
- **Federation of Digital Seismographic Networks**
- **GSN and Global Earth Observation System of Systems**
- **USAID supported hazard assessments and training in Indonesia, Afghanistan, and elsewhere**



USGS

Program Responsibility (added in 2004 reauthorization): Maintain suitable seismic hazard maps in support of building codes for structures and lifelines, including additional maps needed for performance-based design approaches.

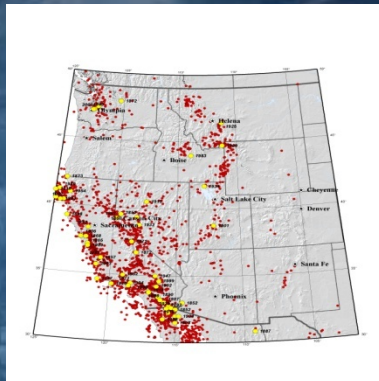
Recent and ongoing activities that support this Program Responsibility:

- **National seismic hazard maps**
 - **Support for BSSC Project 07 to implement new hazard maps in NEHRP Provisions**
- **Urban seismic hazard maps and derivative products**
- **California-wide earthquake forecast model delivered to California Earthquake Authority**

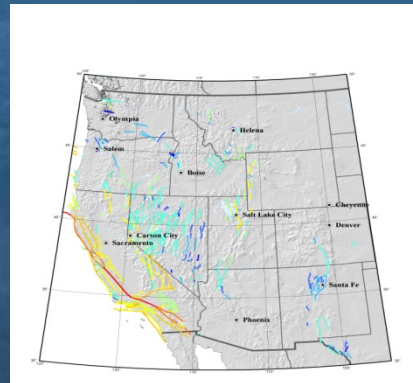


National seismic hazard assessment inputs

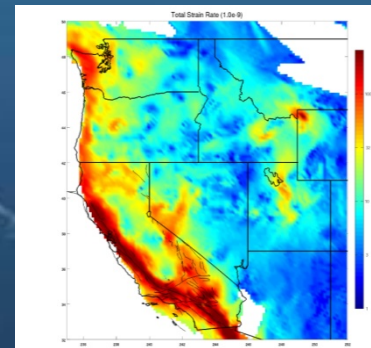
Seismicity



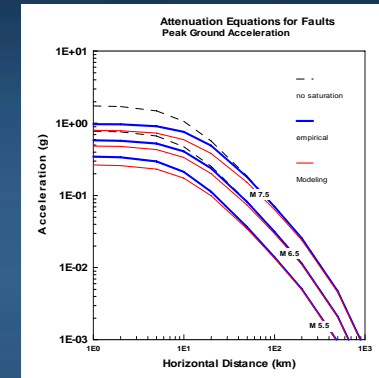
Quaternary Faults



Geodetics



Attenuation Relations



Inputs are derived from regional geology, seismology, and crustal structure studies

Additional USGS statutory responsibilities

- NEHRP legislation
 - Section 11. Post-earthquake investigations
 - Scientific Earthquake Studies Advisory Committee (Public Law 106-503, Title II, Section 210, 42 U.S.C. Section 7709)
- Stafford Act (Disaster Relief Act of 1974) as delegated by executive order: Lead Federal responsibility for notifications and warnings of geologic hazards

