

Earthquake and Tsunami activities of the United States Geological Survey

Presentation to the Ring of Fire Delegation

Dr. Michael L. Blanpied, mblanpied@usgs.gov
USGS Earthquake Hazard Program
August 28, 2010





So many earthquakes... too many earthquakes?

News Release

April 14, 2010

Dr. Michael Blanpied
Clarice Nassif Ransom

703-648-6696
703-648-4299

mblanpied@usgs.gov
cransom@usgs.gov

Is Recent Earthquake Activity Unusual? Scientists Say No.

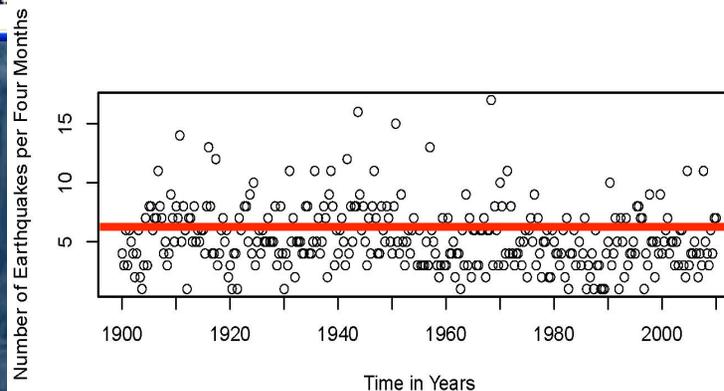
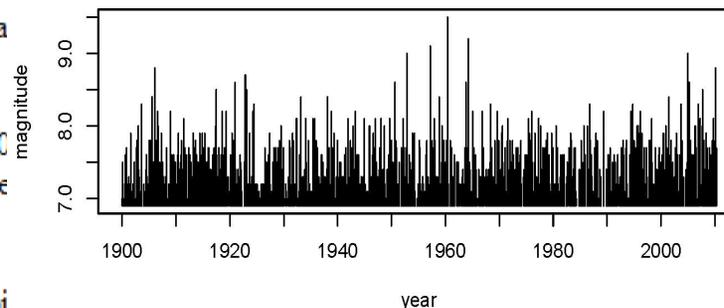
SHARE

China's tragic magnitude 6.9 earthquake on April 13 and the recent devastating earthquake in Haiti have many wondering if this earthquake activity is unusual.

Scientists say 2010 is not showing signs of unusually high earthquake activity. Since 1900, about 1,000 major earthquakes — the size that seismologists define as major — have occurred worldwide. In 1906, there were 27, while 1986 and 1989, while 1943 had 32, with considerable variability from year to year.

With six major earthquakes striking in the first four months of this year, 2010 is well within the range of activity seen in 2009, to April 14, 2010, there have been 18 major earthquakes, a number also well within the range of activity seen in 2009.

Real Data: Centennial and PDE Catalogs



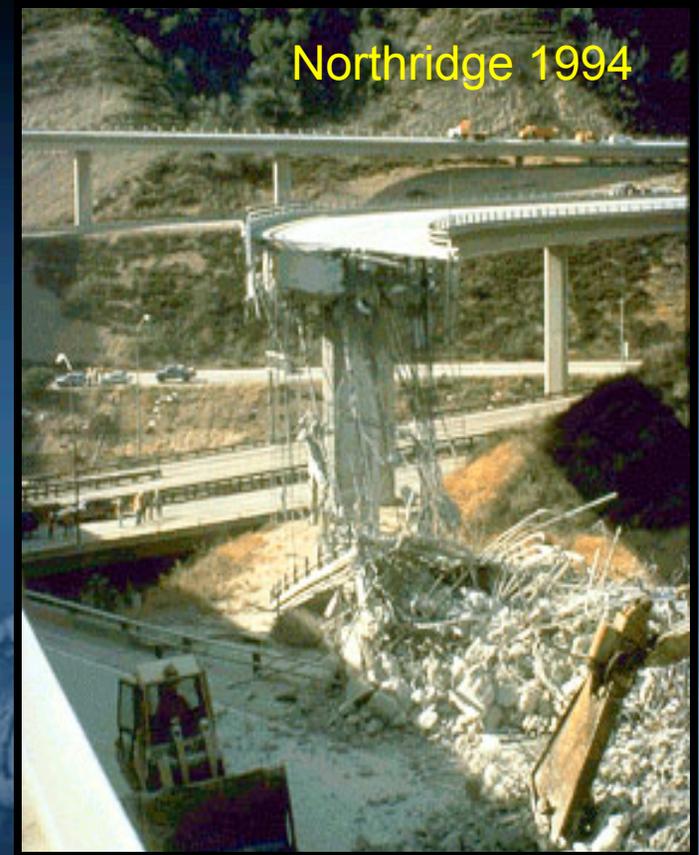
USGS statutory roles and responsibilities

- USGS has the delegated federal responsibility to provide notification and warnings for **earthquakes**, **volcanoes**, and **landslides**.
- In addition, USGS seismic networks support NOAA in carrying out its **tsunami** warning responsibility; USGS streamgages and storm surge monitors support NOAA's **flood** and **severe weather** (including **hurricane**) warnings; our geomagnetic observatories support **solar storm** forecasts.
- USGS geospatial information supports response operations for **wildfire** and many other hazards.



The mandate of the National Earthquake Hazard Reduction Program

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



FEMA

NIST

National Institute of
Standards and Technology

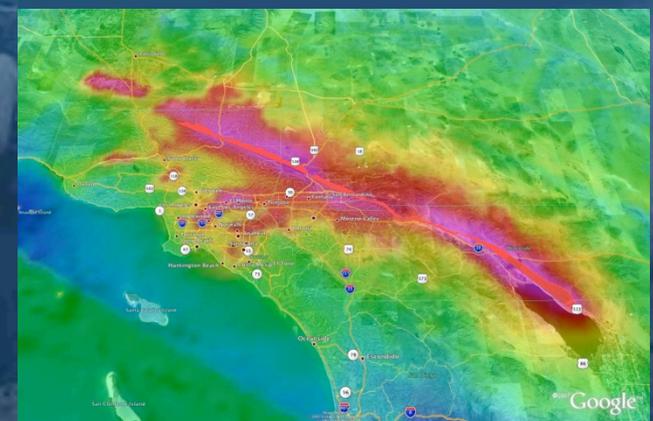
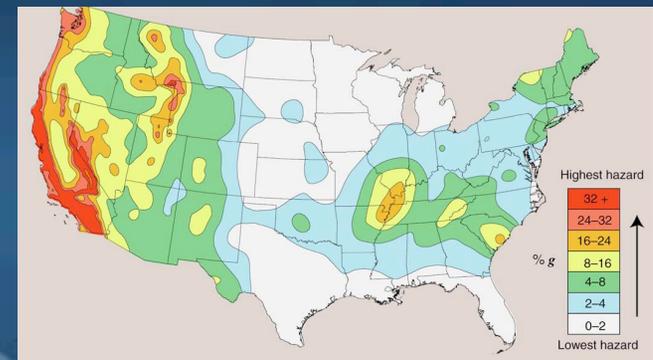


USGS
science for a changing world

national earthquake hazards reduction program

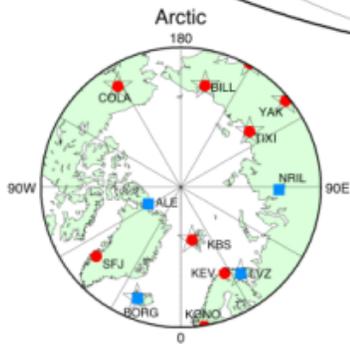
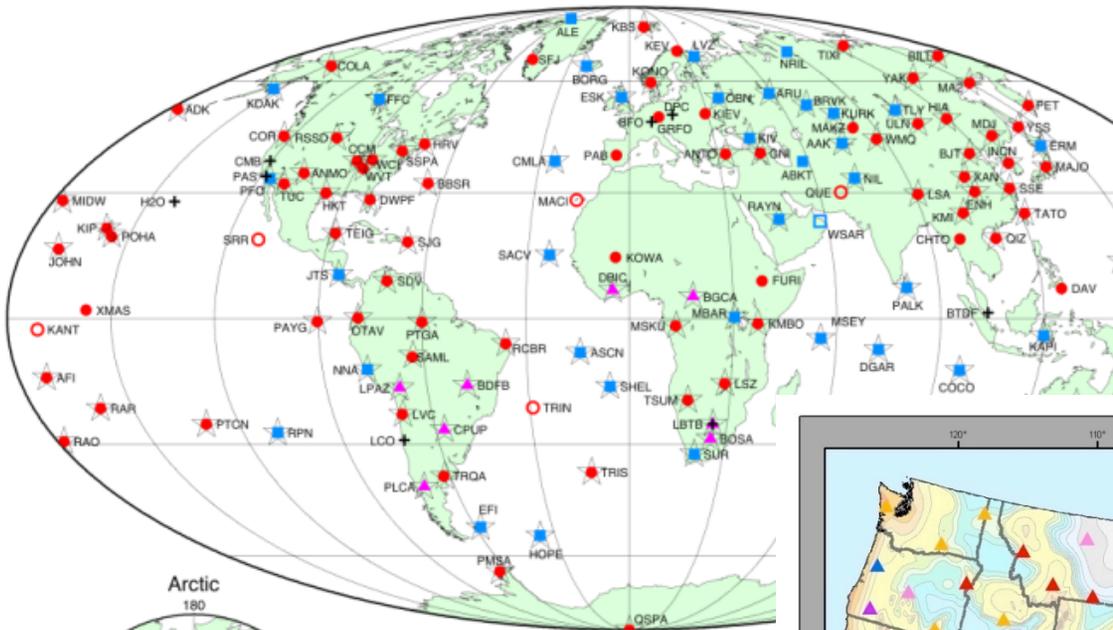
The USGS role in NEHRP

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



USGS provides rapid information on earthquakes worldwide

Global Seismographic Network

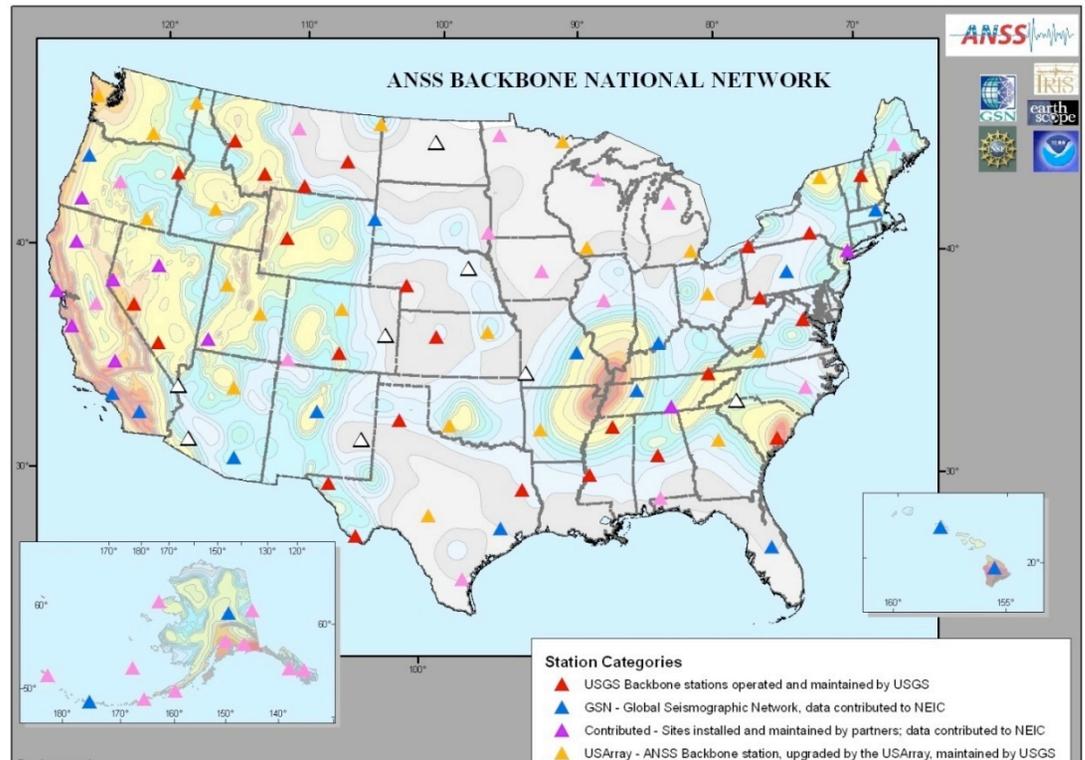


- | | | |
|-----------|---------|------------------------|
| Installed | Planned | |
| 85 ● | 6 ○ | IRIS/USGS Stations |
| 39 ■ | 2 □ | IRIS/IDA Stations (UC) |
| 8 + | | Other/Affiliated GSN S |
| 9 ▲ | | GTSN Stations (AFTA) |
| 117 ☆ | | Telemetered stations |

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



USGS National Earthquake Information Center, Golden, Colorado



Station Categories

- ▲ USGS Backbone stations operated and maintained by USGS
- GSN - Global Seismographic Network, data contributed to NEIC
- ▲ Contributed - Sites installed and maintained by partners; data contributed to NEIC
- ▲ USArray - ANSS Backbone station, upgraded by the USArray, maintained by USGS

USGS Earthquake Notification System

Over
175,000
users



USGS Earthquake Hazards Program » Earthquake Notification Service: Customizable Alerts

USGS
science for a changing world

USGS Home
Contact USGS
Search USGS

Earthquake Hazards Program

Home **Earthquake Center** Regional Information Learning & Education Research & Monitoring Additional Resources

Home » Earthquake Center » Earthquake Notification Service » Earthquake Notification Service: Customizable Alerts

Latest Earthquakes

- USA
- World

EQ Notification Service

- Feeds & Data
- Animations
- Recent Earthquakes
- Historic Earthquakes
- "Top 10" Lists & Maps
- Significant EQs
- Earthquake Search
- EQ Summary Posters
- Scientific Data
- About EQ Maps
- Did You Feel It?
- Energy & Broadband Solutions
- Fast Moment Tensors
- Media Info
- PAGER
- Seismogram Displays
- ShakeMaps

This system provides automated email notification for worldwide earthquakes. It's a free service offered by the U.S. Geological Survey.

[Introduction to ENS - What you need to know](#)

Manage Your Account

Username:

Password:

OR

Register for a New Account

[See recent events processed](#)

[Forgot your username or password?](#)

If you have questions or problems, [Send mail to the ENS Administrator.](#)

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

About Us Contact Us Site Map Site Search

Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: <http://earthquake.usgs.gov/eqcenter/ens/index.php>
Page Contact Information: [Web Team](#)
Page Last Modified: March 07, 2006 11:28:22 AM.

FIRSTGOV.gov
The U.S. Government's Official Web Portal

TAKE PRIDE IN AMERICA

ENS can be customized to suit your needs

The screenshot displays the USGS Earthquake Hazards Program website, specifically the 'Earthquake Notification Service: Customizable Earthquake Alerts' page. The page is titled 'Earthquake Notification Service: Customizable Earthquake Alerts' and features a navigation menu with options like 'Home', 'Earthquake Center', 'Regional Information', 'Learning & Education', 'Research & Monitoring', and 'Additional Resources'. The main content area shows a user's profile for 'waldjd' with two custom regions: 'Continental US' and 'World'. Each region has a map and a table of parameters including Depth, Networks, Geographic Bounds, Day Mag, Night Mag, Day Begins, Day Ends, Address 1, and Address 2. The 'Continental US' profile has a polygon geographic bound, while the 'World' profile has a rectangle geographic bound. The right sidebar contains user-specific information like 'Welcome waldjd!', 'Log Out', 'Recent Events Sent to Me', 'Map of Recent Events', 'My Email Addresses', and 'Admin Functions'.

USGS
science for a changing world

USGS Home
Contact USGS
Search USGS

Earthquake Hazards Program

Home | **Earthquake Center** | Regional Information | Learning & Education | Research & Monitoring | Additional Resources

Home » Earthquake Center » Earthquake Notification Service » Earthquake Notification Service: Customizable Earthquake Alerts

Latest Earthquakes
- USA
- World
- EQ Notification Service
- Feeds & Data
- Animations

About EQ Maps
Did You Feel It?
Energy & Broadband Solutions
Fast Moment Tensors
Historic Earthquakes
- "Top 10" Lists & Maps
- Significant EQs
- EQ Summary Posters
- Scientific Data
Last 8-30 Days EQs
Media Info
PAGER
Seismogram Displays
ShakeMaps

Earthquake Notification Service: Customizable Earthquake Alerts

[My Notification Profiles](#) | [My Account](#)

Earthquake Notification Profiles Associated with waldjd's Account

Continental US (Custom region)

Depth: 0.00 to 800.00km
Networks: CI, NC, NN, UU, UW, AK, NM, HV, AT, PR, SE, US, LD, MB, WY, AR

Geographic Bounds: polygon

Day Mag:	4
Night Mag:	4.5
Day Begins:	08:00
Day Ends:	22:00
Address 1:	3036386000@vtext.com (short)
Address 2:	wald@usgs.gov (long)

[View with Google maps](#)

[DELETE PROFILE](#) | [EDIT PROFILE](#)

World (Custom region)

Depth: 0.00 to 800.00km
Networks: CI, NC, NN, UU, UW, AK, NM, HV, AT, PR, SE, US, LD, MB, WY, AR

Geographic Bounds: rectangle

South Latitude:	-90.000
North Latitude:	90.000
East Longitude:	180.000
West Longitude:	-180.000
Day Mag:	5.7
Night Mag:	6.1

[View with Google maps](#)

Welcome waldjd!
[Log Out](#)
Recent Events Sent to Me
[Map of Recent Events](#)
My Email Addresses
3036386000@mmode.com (short)
3036386000@vtext.com (short)
[wald@usgs.gov \(long\)](#)
[Add New Email Address](#)
Add New Profile
 Predefined Profile
 Rectangle Profile
 Circle Profile
 Polygon Profile

Admin Functions
[Recent Events List](#)
[Recent Events Map](#)
[Admin Page](#)

ENS can be customized to suit your needs

The image shows a screenshot of the USGS Earthquake Notification Service (ENS) website. The browser window title is "USGS Earthquake Hazards Program | Earthquake Center | Earthquake Notification Service | Earthquake Notification Service: Customi...". The page header includes the USGS logo and navigation links: "USGS Home", "Contact USGS", and "Search USGS".

The main content area is titled "Earthquake Notification Service: Customizable Earthquake Alerts". It features a "Welcome waldjd!" message with a "Log Out" link, and a "Map of Recent Events" link. Below this is a section for "Notification Profiles Associated with waldjd's Account".

The profile configuration interface is split into two panes. The left pane, titled "USGS ENS Map Input", shows a map of the western United States with a red polygon boundary drawn around a region in the Rocky Mountains. The map includes a search bar, navigation controls, and a "Done" button. The right pane shows the profile configuration details:

Notification Profiles Associated with waldjd's Account

Depth: 0.00 to 800.00km
Networks: CI, NC, NN, UU, UW, AK, NM, HV, AT, PR, SE, US, LD, MB, WY, AR
Geographic Bounds: polygon

Day Mag:	4
Night Mag:	4.5
Day Begins:	08:00
Day Ends:	22:00
Address 1:	3036386000@vtext.com (short)
Address 2:	wald@usgs.gov (long)

Buttons: DELETE PROFILE, EDIT PROFILE

Depth: 0.00 to 800.00km
Networks: CI, NC, NN, UU, UW, AK, NM, HV, AT, PR, SE, US, LD, MB, WY, AR
Geographic Bounds: rectangle

South Latitude:	-90.000
North Latitude:	90.000
East Longitude:	180.000
West Longitude:	-180.000
Day Mag:	5.7
Night Mag:	6.1

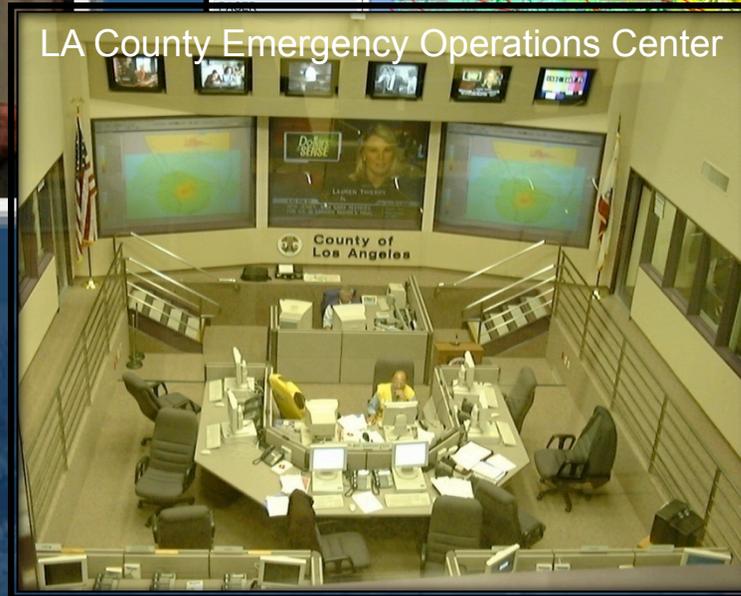
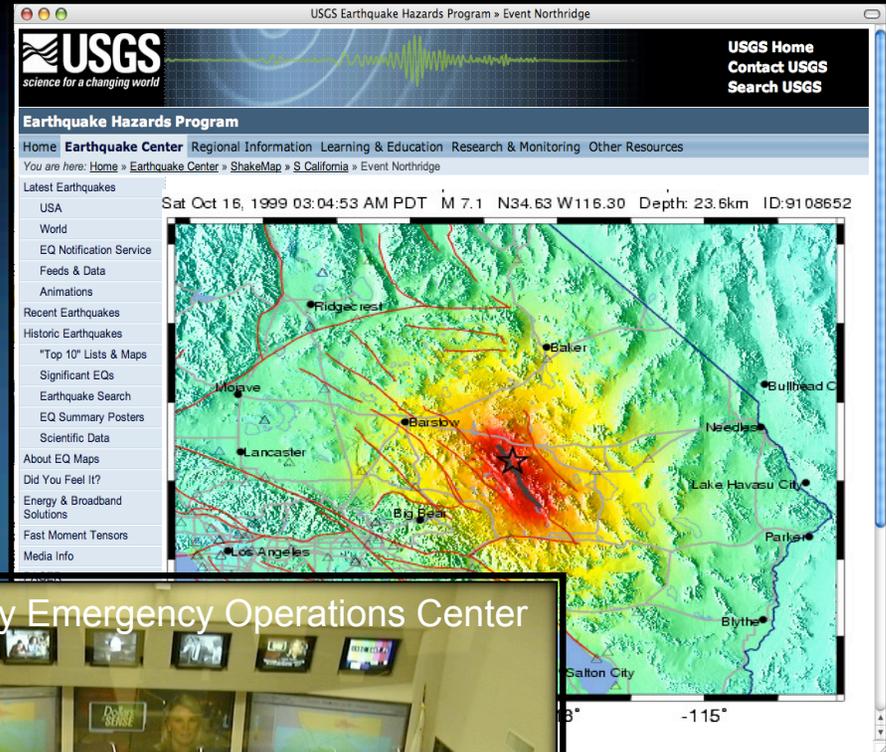
Buttons: Recent Events List, Recent Events Map, Admin Page

Admin Functions: Predefined Profile, Rectangle Profile, Circle Profile, Polygon Profile

ShakeMap: A tool for rapid post-earthquake response, coordination, and situational awareness



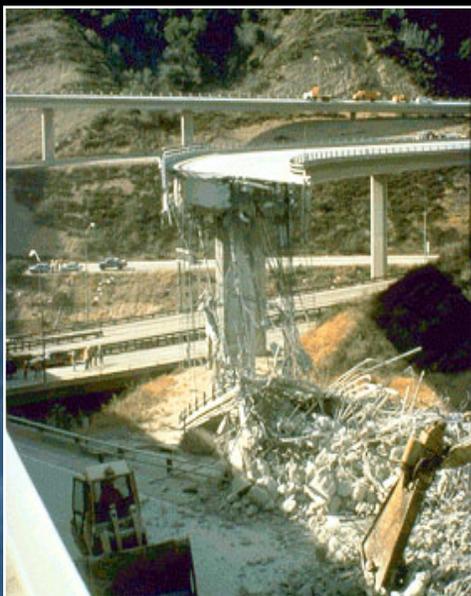
California Governor Schwarzenegger pointing to ShakeMap at his press conference following the 2008 M5.4 Chino Hills earthquake that hit LA.



Very strong	Severe	Violent	Extreme
Moderate	Moderate/Heavy	Heavy	Very Heavy
18-34	34-65	65-124	>124
16-31	31-60	60-116	>116
VII	VIII	IX	X+

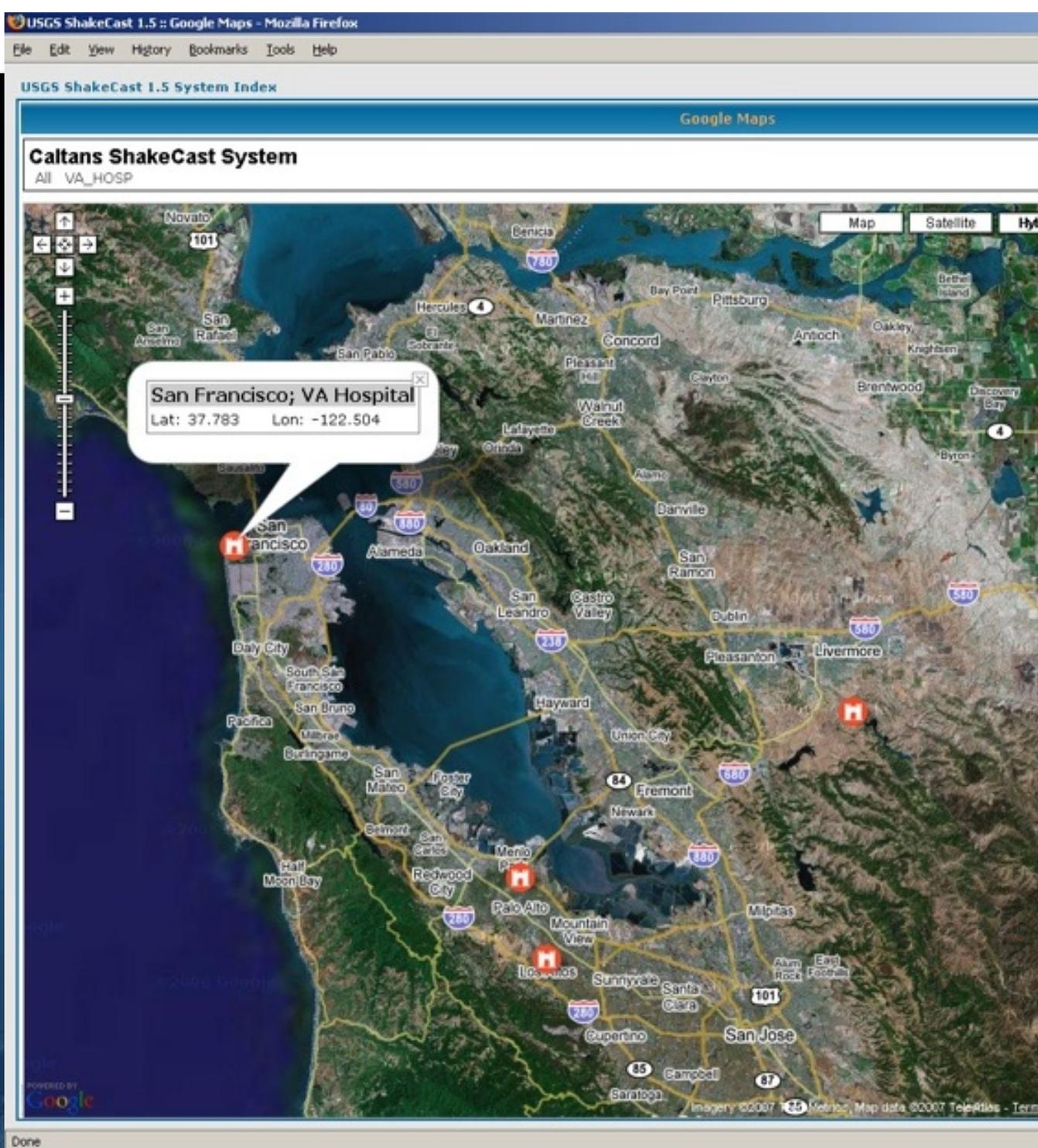


ShakeCast

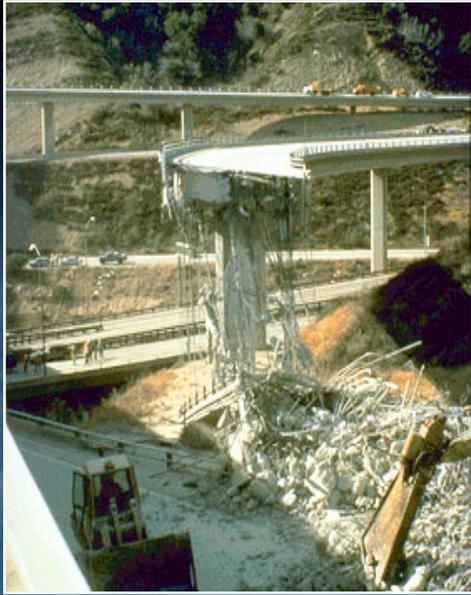


Automated
notifications to
operators of
critical facilities

 USGS



ShakeCast



Automated notifications to operators of critical facilities



USGS ShakeCast 1.5 :: Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

USGS ShakeCast 1.5 System Index

Google Maps

Caltans ShakeCast System
All VA_HOSP

San Francisco; VA Hospital
Lat: 37.783 Lon: -122.504

Facility Damage Estimates from ShakeMap
Bridges presented in the table below are sorted in order of potential damage level.

Bridge Name	Bridge No	Dist-Cty-Rte-PM	Damage Level	Value	Exceedance Ratio
Pisgah Overhead	54 0689L	08-SBD-040-R37.41	RED	47.6856	1.163
Pisgah Overhead	54 0689R	08-SBD-040-R37.44	RED	47.6856	1.163
Lavic Road OC	54 0734	08-SBD-040-R41.91	YELLOW	56.4714	0.867
Ash Hill Wash	54 0758L	08-SBD-040-R54.75	GREEN	25.5495	0.887
Ash Hill Wash	54 0758R	08-SBD-040-R54.77	GREEN	25.5495	0.887
Argos Wash	54 0737L	08-SBD-040-R43.84	GREEN	48.8524	0.053
Argos Wash	54 0737R	08-SBD-040-R43.84	GREEN	48.8524	0.053

POWERED BY Google

Imagery ©2007 Map data ©2007 TeleAtlas - Term

Done

Situational awareness available in 20 minutes

Prompt Assessment of Global Earthquakes for Response



M 6.9, SOUTHERN QINGHAI, CHINA

Origin Time: Tue 2010-04-13 23:49:37 UTC

Location: 33.27°N 96.63°E Depth: 10 km

**PAGER
Version 2**

Created: 37 minutes, 54 seconds after earthquake

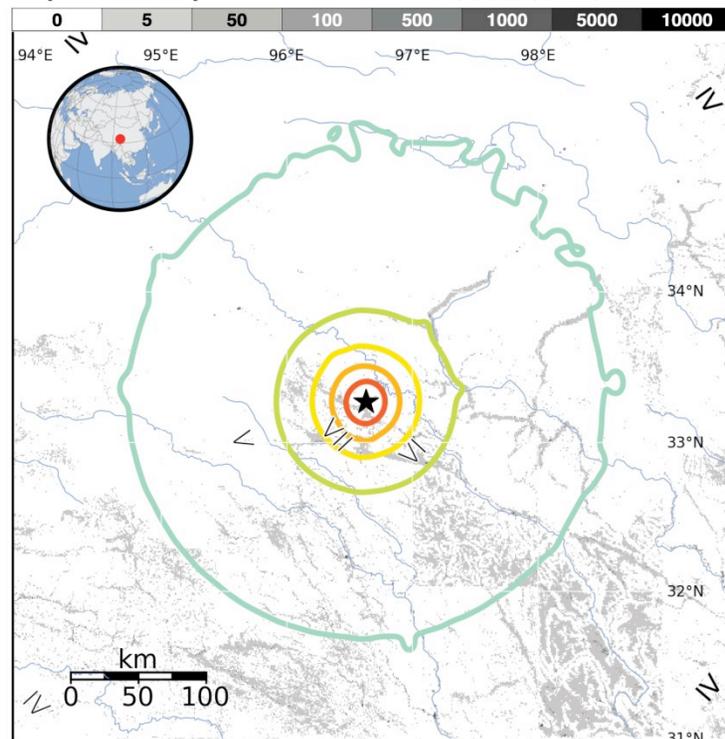
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		--*	--*	540k*	237k	48k	9k	5k	3k	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	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

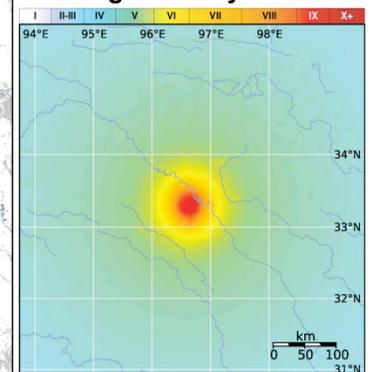
population per ~1 sq. km from Landsat



Selected City Exposure

MMI City Population (k = x1000)
bold cities appear on map

Shaking Intensity



Overall, the population in this region resides in structures that are highly vulnerable to earthquake shaking, though some resistant structures exist. On June 15, 1982 (UTC), a magnitude 5.6 earthquake 338 km Southeast of this one struck China, with estimated population exposures of 1,000 at intensity VII and 2,000 at intensity VI, resulting in a reported 11 fatalities.



Situational awareness available in 20 minutes

Prompt Assessment of Global Earthquakes for Response



M 6.9, SOUTHERN QINGHAI, CHINA

Origin Time: Tue 2010-04-13 23:49:37 UTC

Location: 33.27°N 96.63°E Depth: 10 km



USAID FROM THE AMERICAN PEOPLE

PAGER Version 2

Created: 37 minutes, 54 seconds after earthquake

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		--*	--*	540k*	237k	48k	9k	5k	3k	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	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.



Summary Alert Orange



USAID FROM THE AMERICAN PEOPLE

M 6.9, SOUTHERN QINGHAI, CHINA

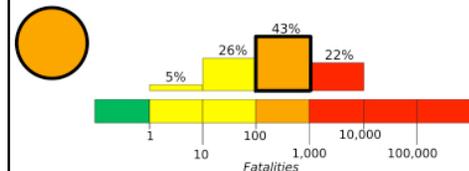
Origin Time: Tue 2010-04-13 23:49:37 UTC (07:49:37 local)

Location: 33.27°N 96.63°E Depth: 10 km

PAGER Version 2

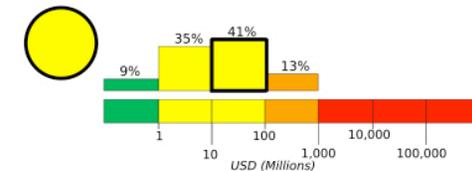
Created: 38 minutes, 39 seconds after earthquake

Estimated Fatalities



Orange alert level for fatalities. Significant casualties are likely and the disaster is potentially widespread. Past events with this alert level have required a regional or national level response.

Estimated Economic Losses



Yellow alert level for economic losses. Some damage is possible. Estimated economic losses are less than 1% of GDP of China.

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		--*	--*	540k*	233k	50k	9k	6k	3k	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	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

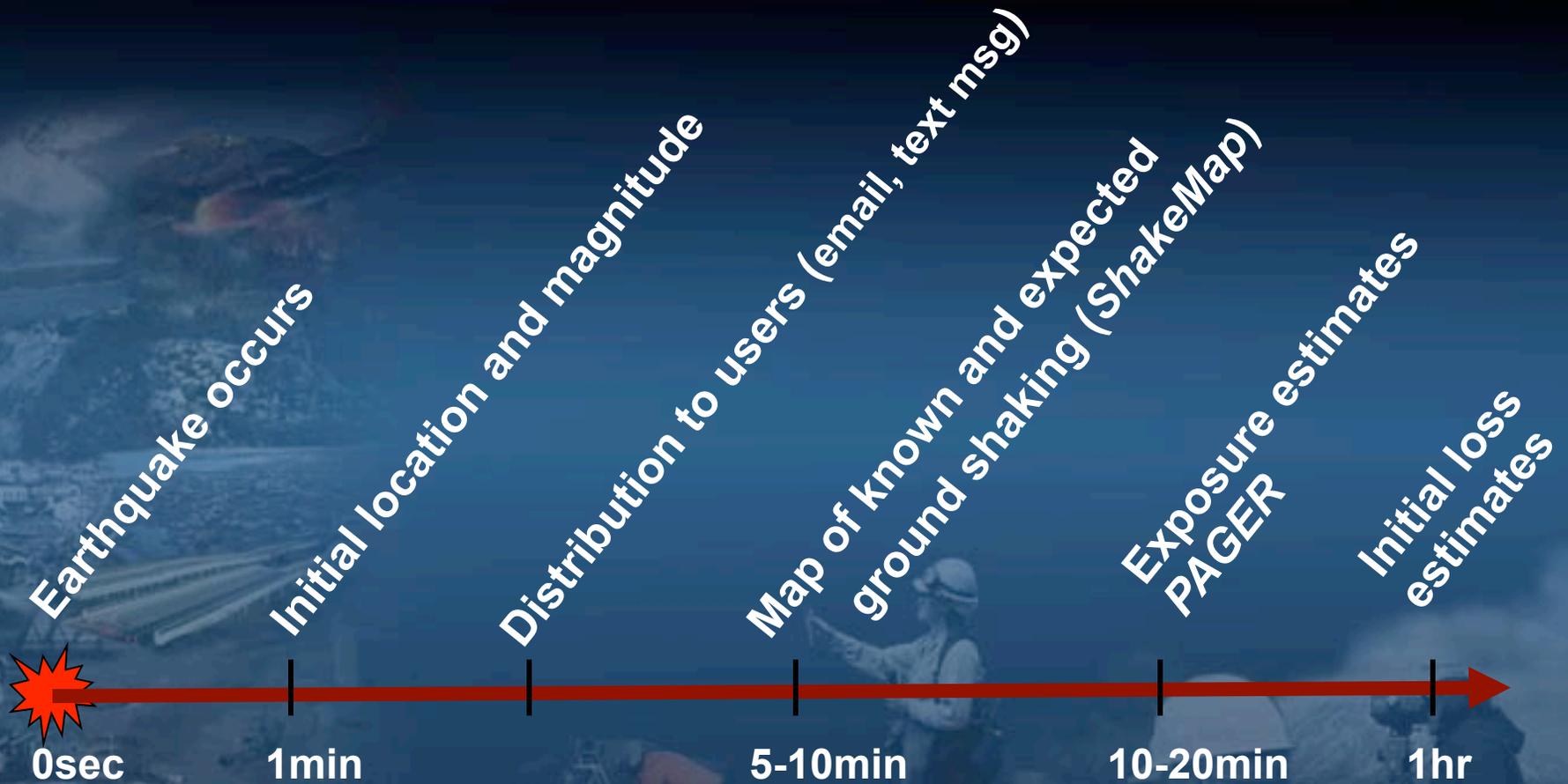
population per ~1 sq. km from Landsat

Structures:

Overall, the population in this region resides

Beta-test product:
LossPAGER

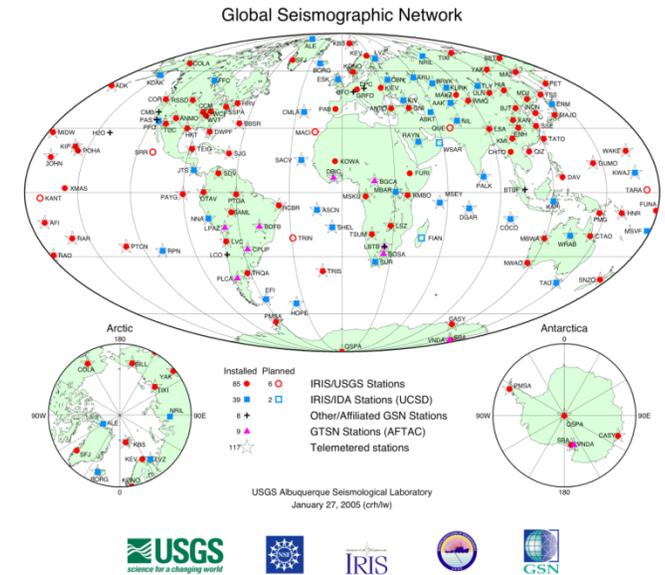
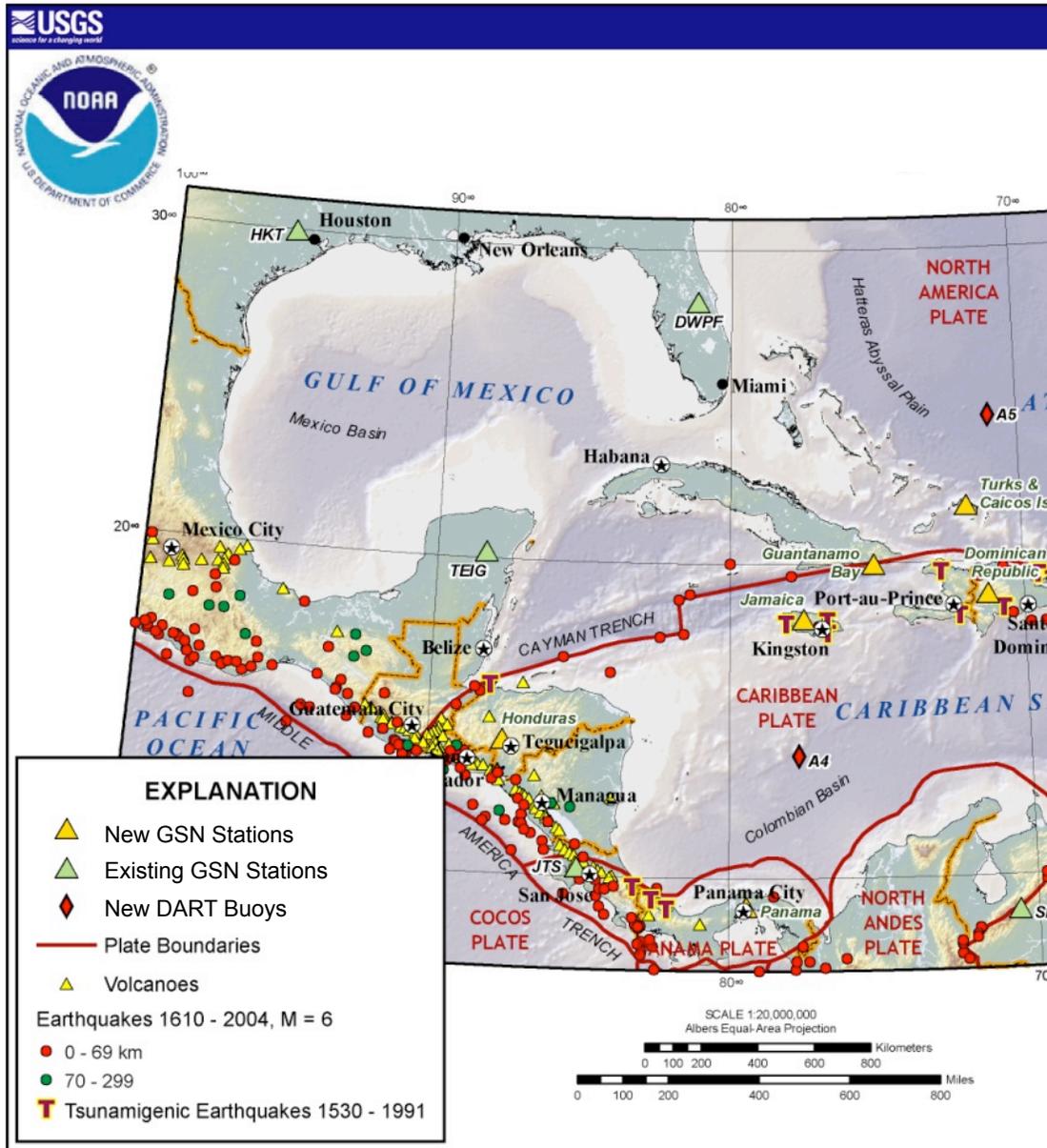
An earthquake information timeline (domestic earthquake)



 USGS

 nehrp

NOAA-USGS Post-Sumatra tsunami warning initiative



3 August 2005 1230 MDT

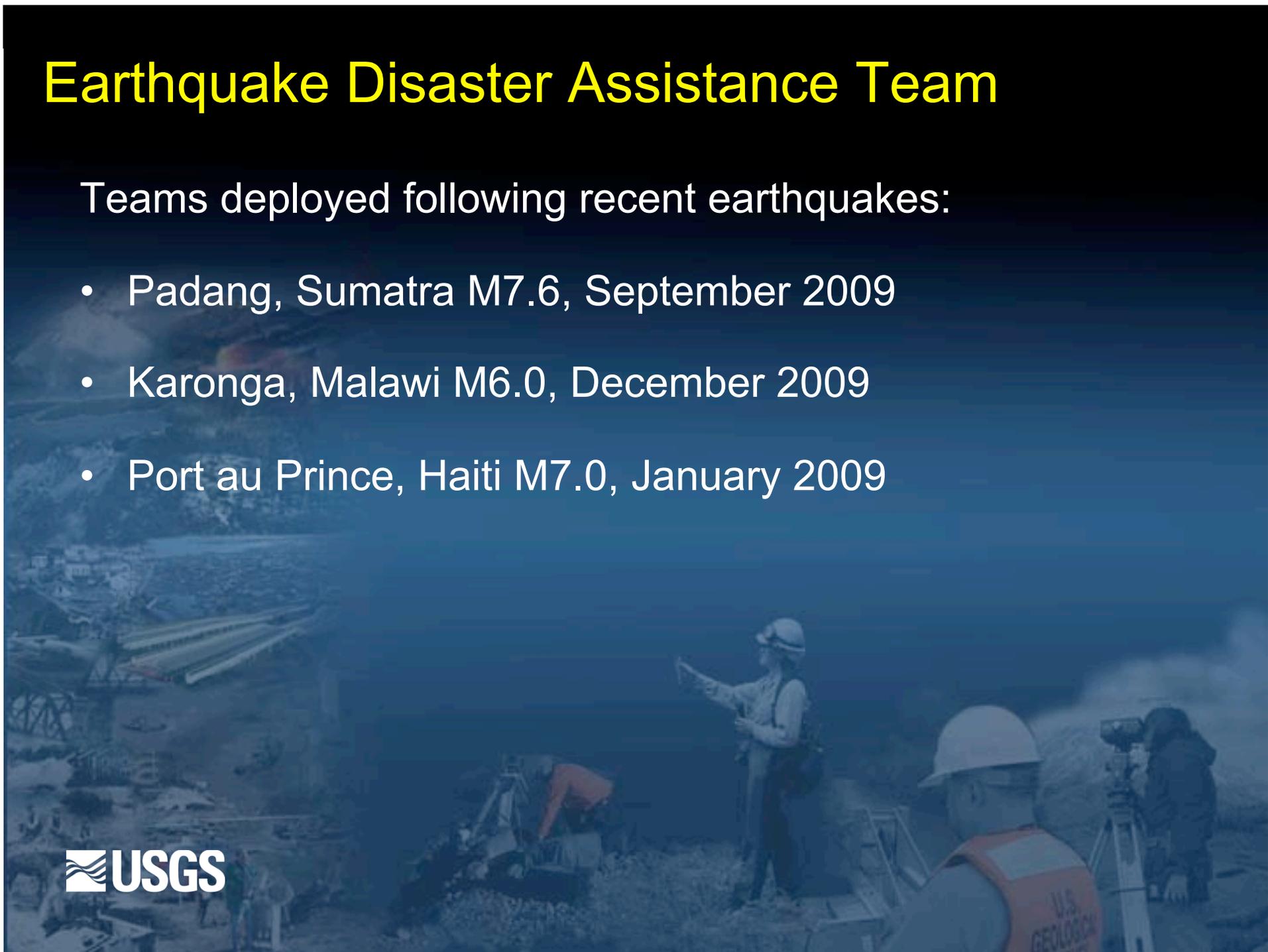
Earthquake Disaster Assistance Team

- Cooperative program of the USGS and USAID's Office of Foreign Disaster Assistance (OFDA)
- Purposes:
 - Support OFDA's response activities to earthquake disasters in developing nations.
 - Make USGS experts or scientific services available to assist local geological agencies, when requested.
 - Conduct rapid assessment of earthquake, tsunami, and landslide hazards and impacts.
 - Provide advice and training to build capacity in monitoring, hazard asmt., microzonation, etc.
- Can also support mitigation and capacity-building projects.

Earthquake Disaster Assistance Team

Teams deployed following recent earthquakes:

- Padang, Sumatra M7.6, September 2009
- Karonga, Malawi M6.0, December 2009
- Port au Prince, Haiti M7.0, January 2009



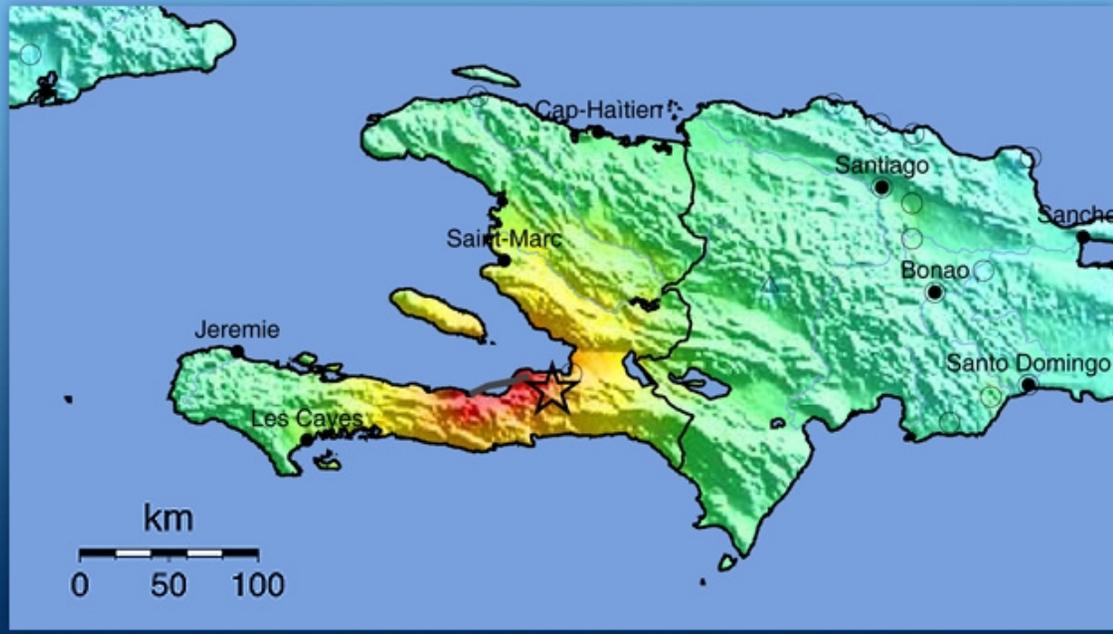


HELP for HAITI

The President speaks on the urgent situation after the earthquake in Haiti and the government's response. Read his remarks and learn how to contribute to the relief effort.

[Learn More](#)

- 1 | 2 | 3 | 4



Map courtesy of USGS

A NEW FOUNDATION



The President's Plan for Health Insurance Reform
Cut through the rhetoric on health insurance reform. Read the essentials of the President's plan, and watch a video with highlights of his speech to Congress.

[Learn More](#)

◀ BACK | NEXT ▶

SEARCH the SITE

PHOTO of the DAY



THE BLOG

January 13, 2010 at 9:53 AM EST

FEATURED LEGISLATION

[Ryan White HIV/AIDS Treatment Extension Act of 2009](#)

PAGER

Prompt Assessment of Global Earthquakes for Response

Rapidly estimated that over 2 million people were exposed to violent shaking



M 7.0, HAITI REGION

Origin Time: Tue 2010-01-12 21:53:10 UTC
 Location: 18.46°N 72.53°W Depth: 13 km



PAGER Version 8

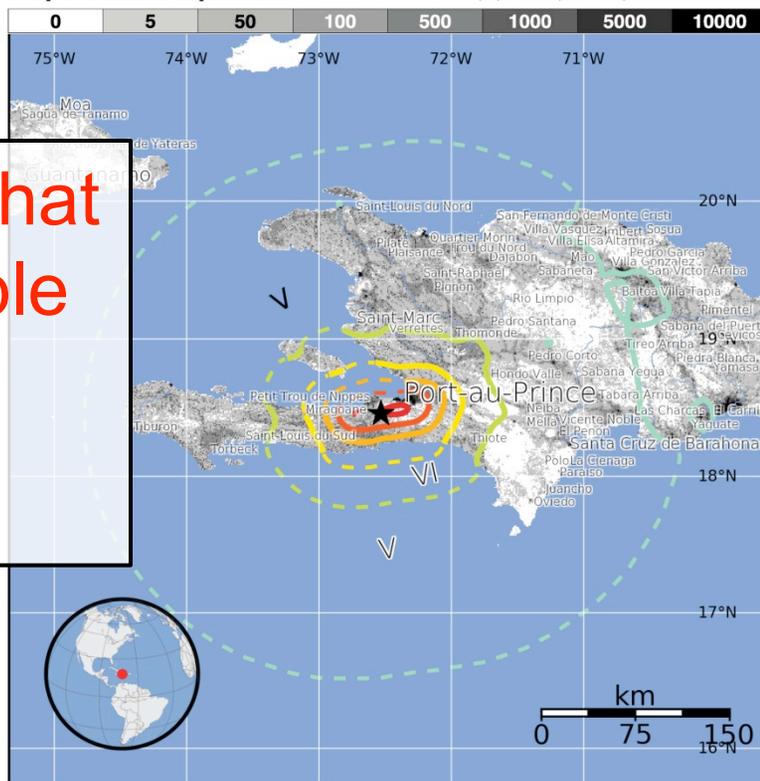
Created: 1 day, 20 hours after earthquake

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	--*	--*	5,887k*	7,261k	1,049k	571k	314k	2,246k	332k	
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	V. Heavy
	Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

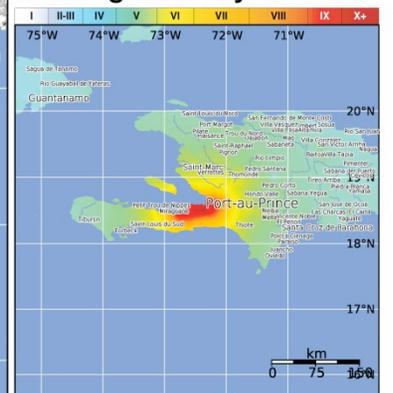


Selected City Exposure

MMI City	Population
X Grand Goave	5k
IX Port-au-Prince	1,235k
IX Carrefour	442k
IX Petionville	108k
IX Delmas 73	383k
IX Croix des Bouquets	9k
VI Miragoane	6k
V Verrettes	49k
III Santo Domingo	2,202k
III Guantanamo	273k

bold cities appear on map (k = x1000)

Shaking Intensity



Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. On June 24, 1984 (UTC), a magnitude 6.7 earthquake struck the Dominican Republic, with estimated population exposures of 320,000 at intensity VII and 2,964,000 at intensity VI, resulting in 5 reported fatalities. Recent earthquakes in this



[USGS Home](#)
[Contact USGS](#)
[Search USGS](#)

Earthquake Hazards Program

[Home](#) | [About Us](#) | [Contact Us](#)

- EARTHQUAKES**
- HAZARDS
- LEARN
- PREPARE
- MONITORING
- RESEARCH

Past

- [Past 8-30 days](#)
- [Significant Earthquakes](#)
- [Earthquake Lists & Maps](#)
- [Search for an Earthquake](#)

Present

- [Real-time - CA/NV](#)
- [Real-time - USA](#)
- [Real-time - Worldwide](#)
- [About Earthquake Maps](#)
- [KML / RSS Feeds & Data](#)
- [Earthquake Notifications](#)
- [Seismogram Displays](#)
- [Earthquake Animations](#)
- [Did You Feel It?](#)
- [ShakeMaps](#)
- [PAGER](#)
- [EQ Summary Posters](#)

Future

- [Earthquake Scenarios](#)
- [Prediction](#)
- [Probabilities](#)

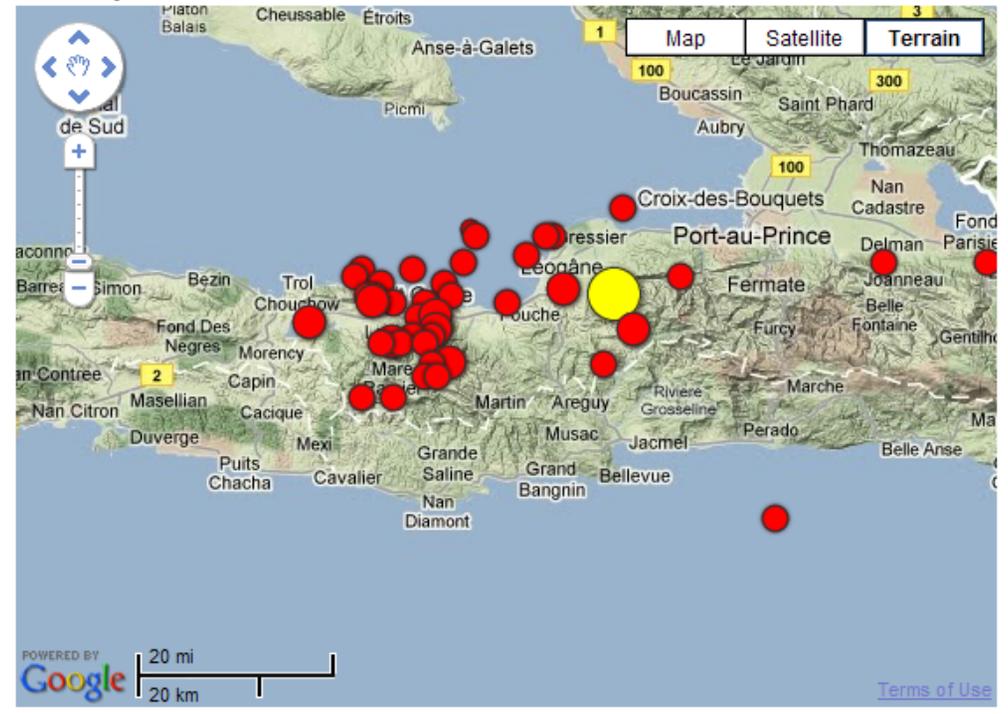
Location

- [Info by State](#)
- [Info by Country/Region](#)

Aftershock Mapping

Aftershock Map - Mainshock and 42 Aftershocks

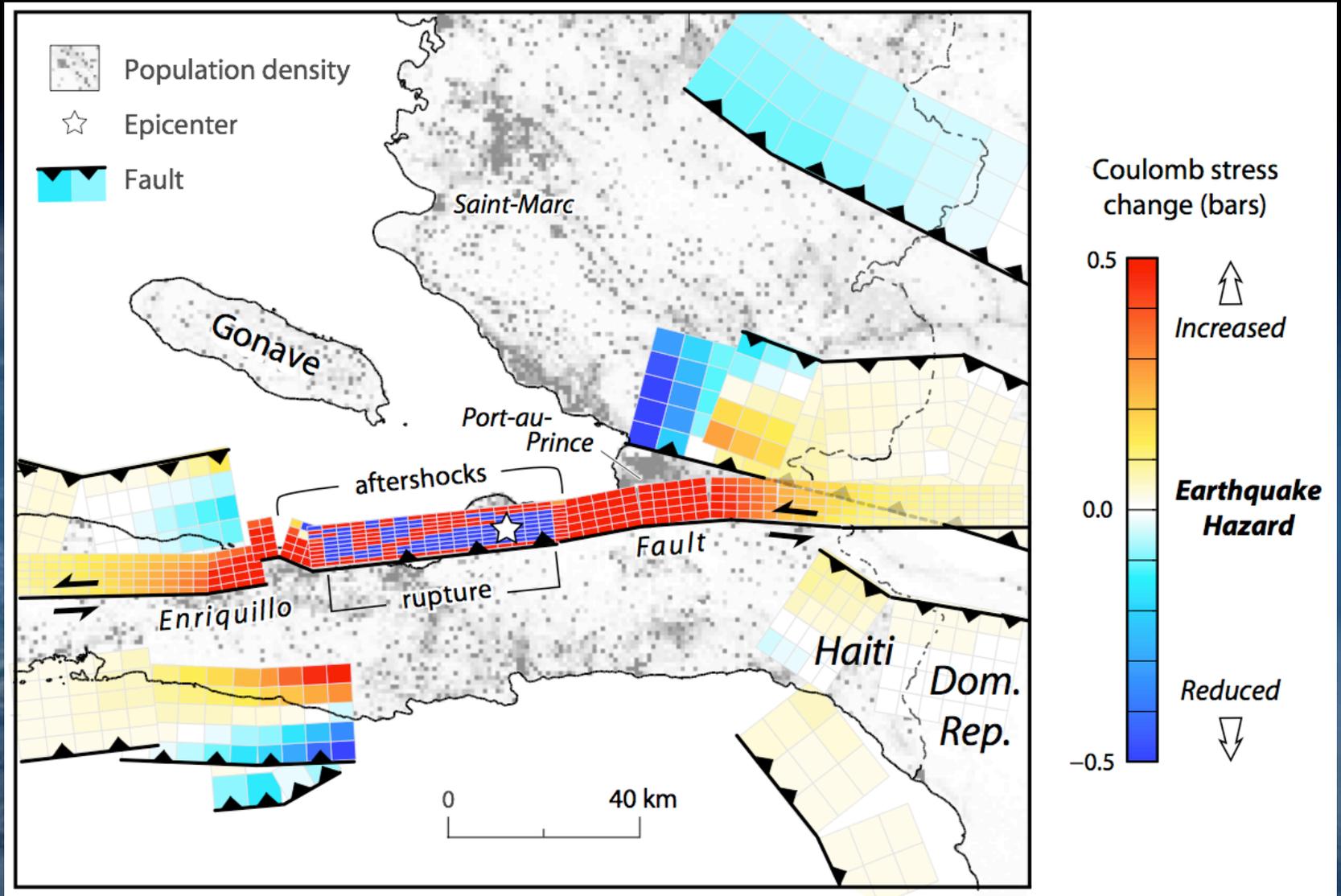
Last Updated: 04 March 2010, 00:08:59 UTC



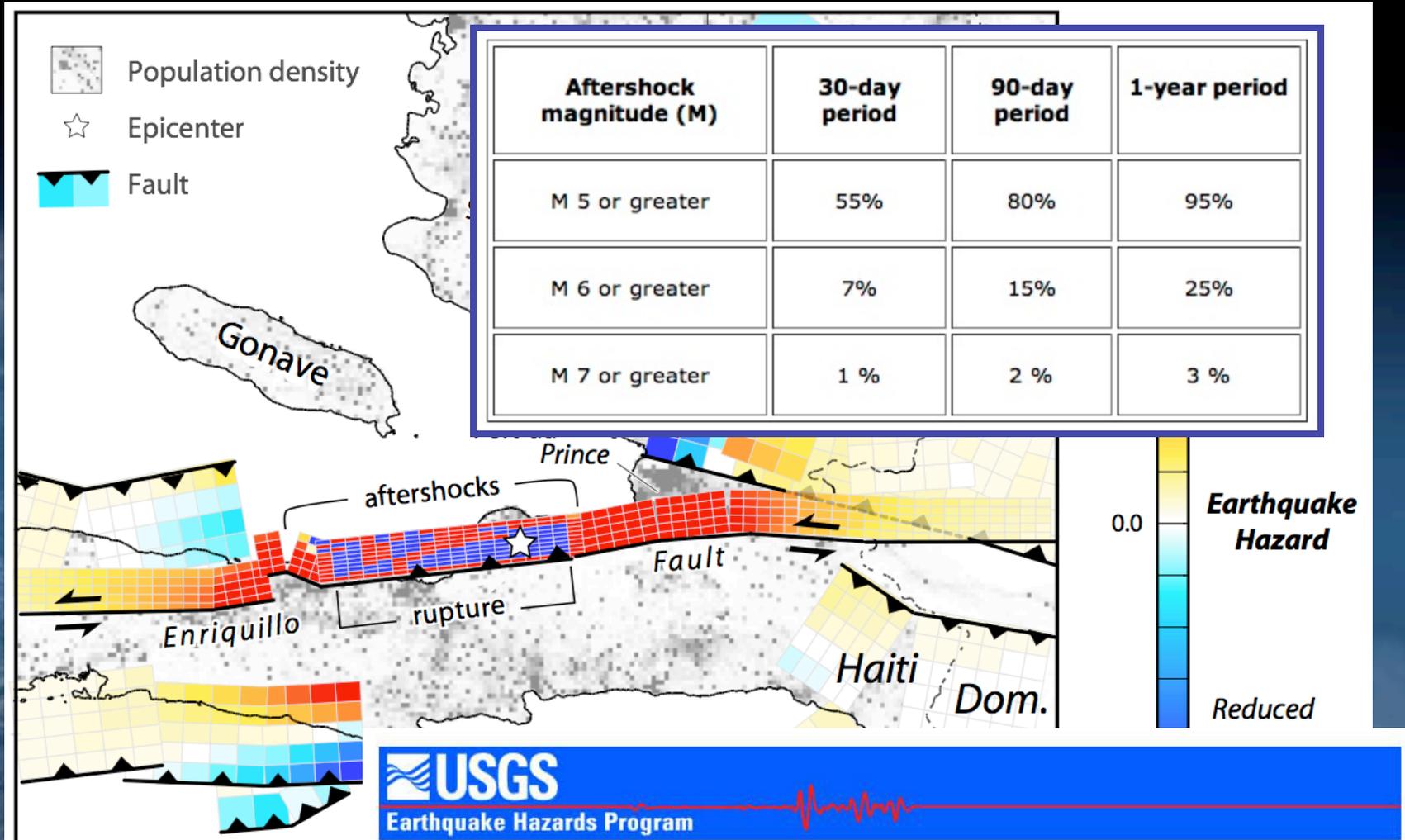
Legend



Stress increase on Enriquillo & adjoining faults



Stress increase on Enriquillo & adjoining faults



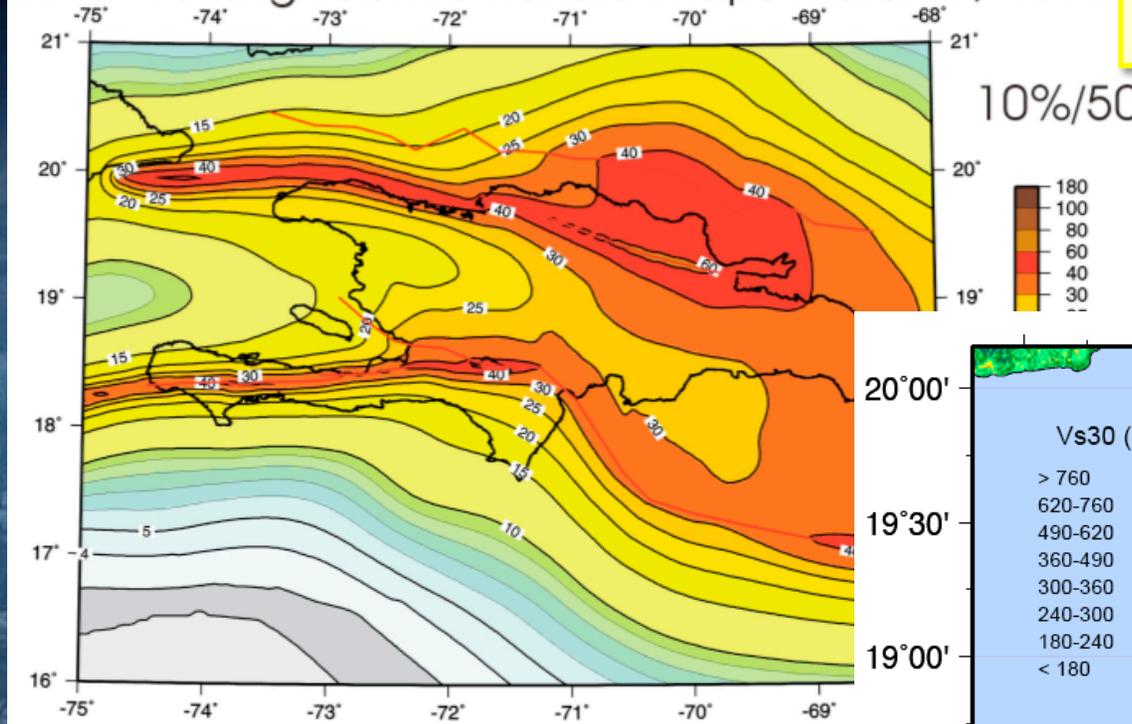
Information summary distributed in English, French, Spanish and Creole

Risk tranblemanntè ak mezu sékirité nan Péyi Dayiti ak tout zòn Karayib-la
 Komuniké Sant enspéksyon jéolojik ÉtaZini
 28 janvyé 2010

Échèl Richtè, sé yon manyè pou mezuré puisans yon tranblemanntè.
 Yon lòt mo pou di puisans yon tranblemanntè, sé mayitud.
 Yon lòt mo pou di tranblemanntè, sé séyis, ou byen kataklis tou, ki pi jénéral.

USGS/USAID Earthquake Disaster Assistance Team: Improved seismic hazard analysis

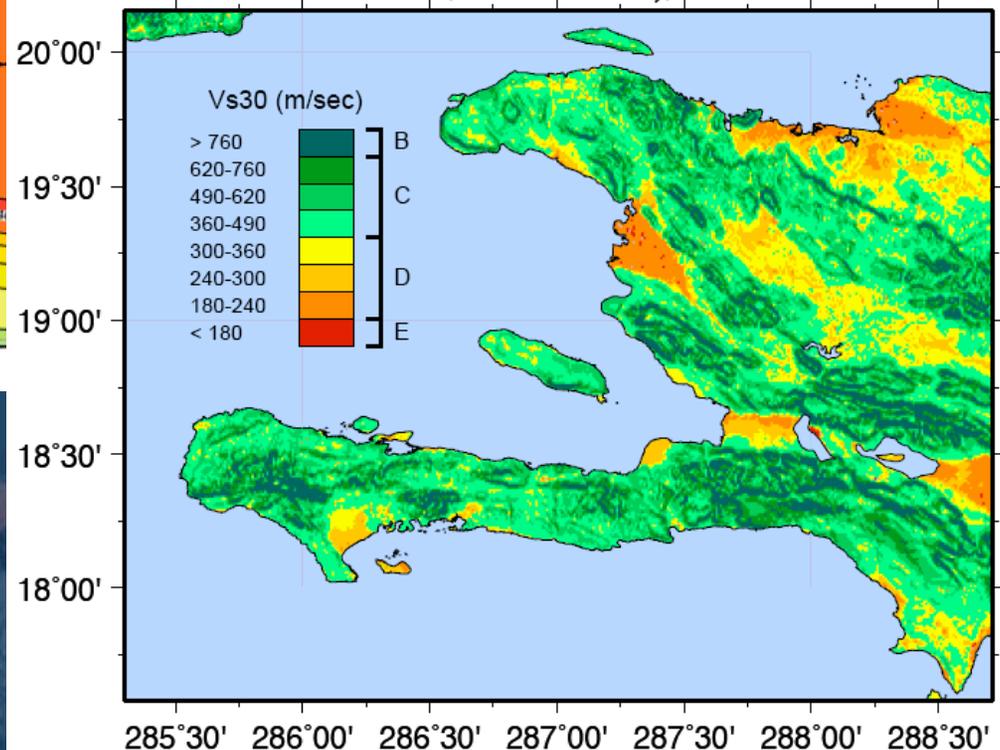
USGS working seismic hazard maps March 5, 2010



Shaking hazard

Shallow seismic wave speed

Vs30 (30-m shear velocity) m/s

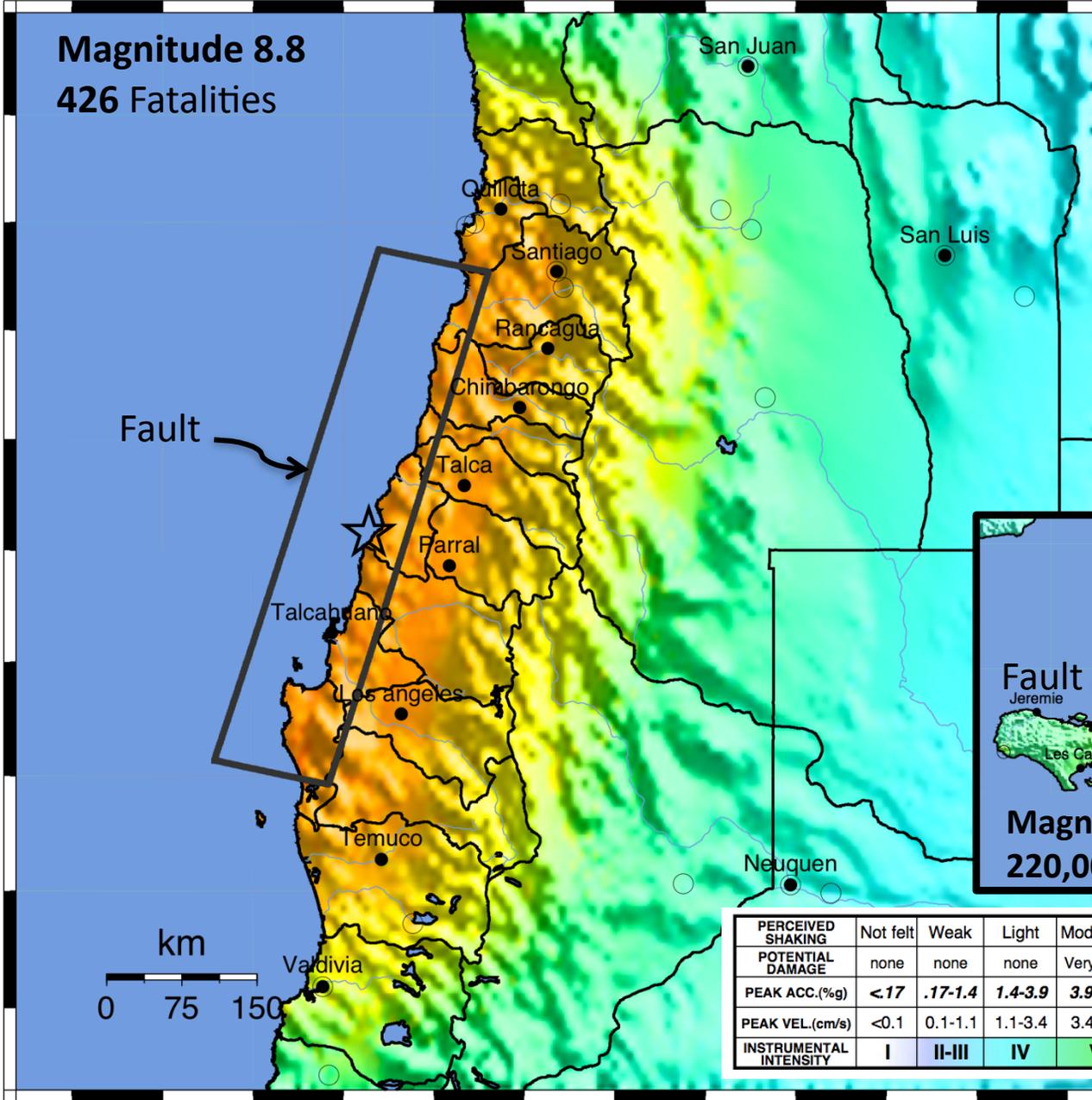


USGS ShakeMap : OFFSHORE MAULE, CHILE

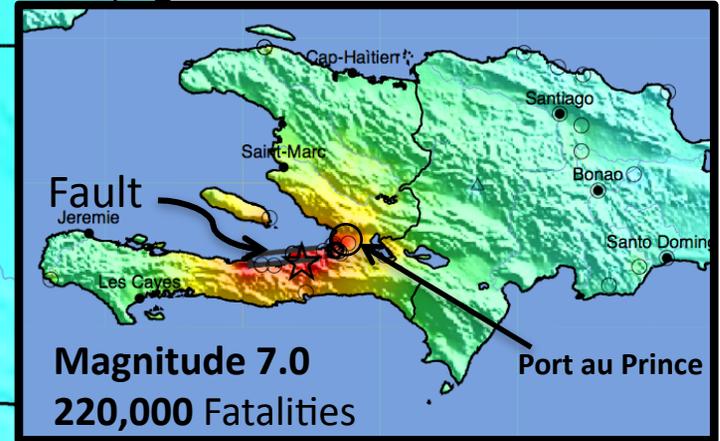
Sat Feb 27, 2010 06:34:14 GMT M 8.8 S35.85 W72.72 Depth: 35.0km ID:2010tffan

**USGS ShakeMap
Estimated Shaking
Intensities**

Same Map Scale!

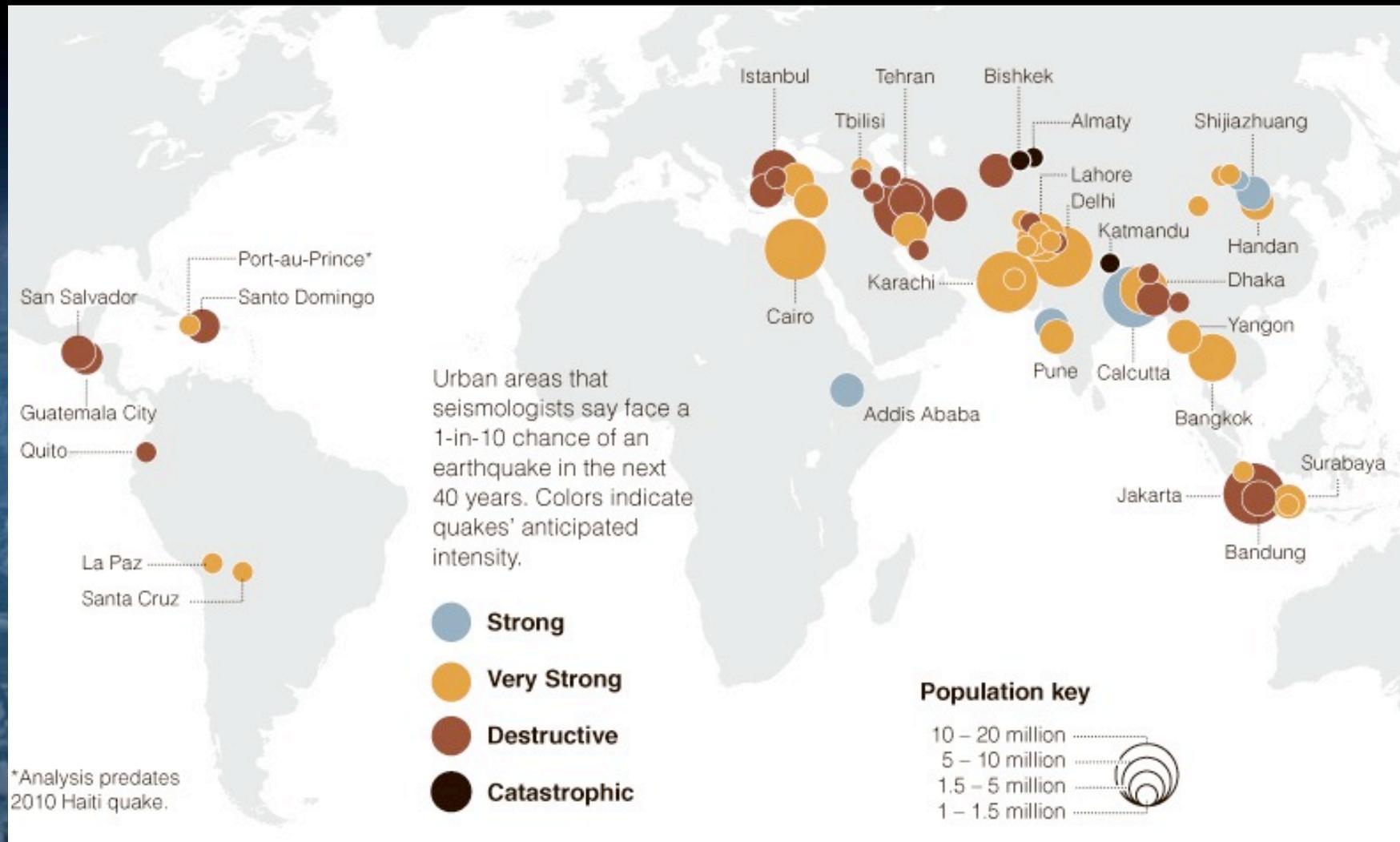


Haiti, Jan 10, 2010



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+

Cities at risk: There will be more bulls-eyes



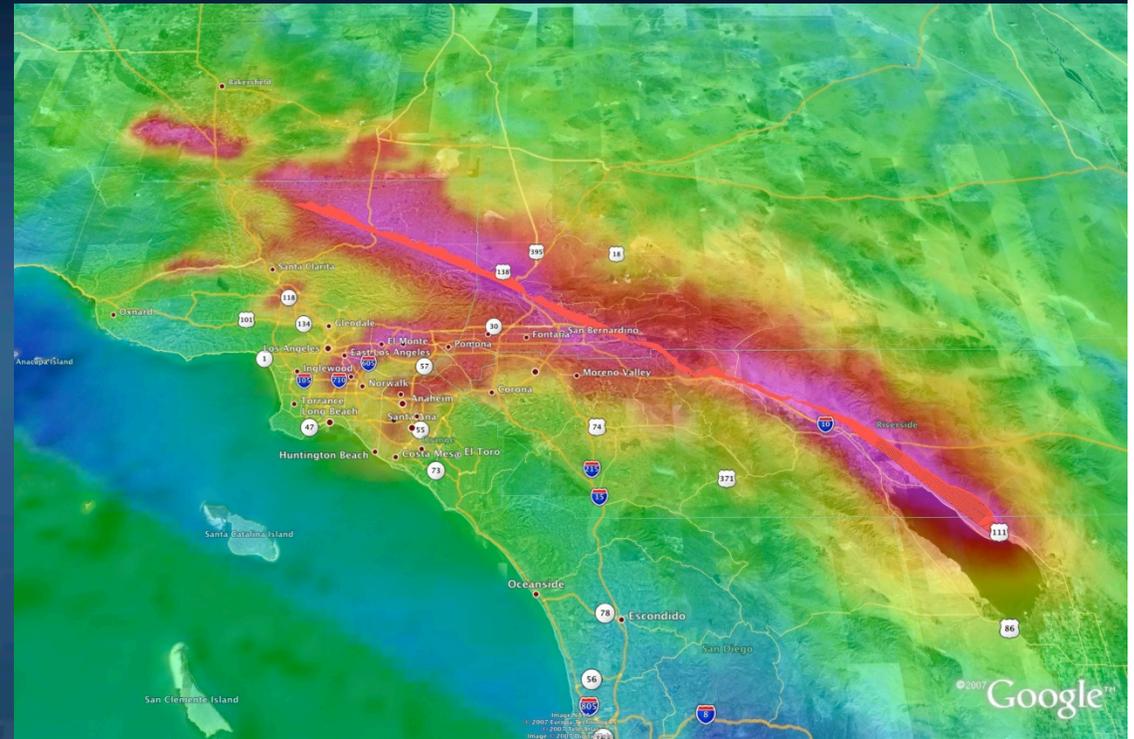
Graphic courtesy of *The New York Times*
Data from Columbia University Earth Institute

San Andreas ShakeOut Scenario



- Top request of emergency managers
- Rallying point for community

- San Andreas 'Big One' simulated magnitude-7.8 earthquake; multi-hazard scenario
- Initiation near Bombay Beach, rupturing to the northwest
- Disruption of critical lifeline infrastructure (freeway, internet, power and gas lines) along surface rupture
- Strong shaking throughout region, including urban areas



California-wide public preparedness drill



The Great California Shake Out

October 15, 2009



Earthquake Country Alliance
We're all in this together.



Putting Down Roots in Earthquake Country

Sur de California Edición Primavera 2006

Echando raíces en tierra de terremotos



Putting Down Roots in Earthquake Country
Your Handbook for the San Francisco Bay Region

General Information Product 15

Developed by:
 American Red Cross, Bay Area Chapter
 Association of Bay Area Governments
 California Earthquake Authority
 California Geological Survey
 Earthquake Engineering Research Institute
 Governor's Office of Emergency Services
 San Francisco Office of Emergency Services and Homeland Security
 Southern California Earthquake Center
 Structural Engineers Association of Northern California
 University of California Berkeley
 U.S. Department of Homeland Security, Federal Emergency Management Agency
 U.S. Geological Survey
 U.S. Department of the Interior
 U.S. Geological Survey

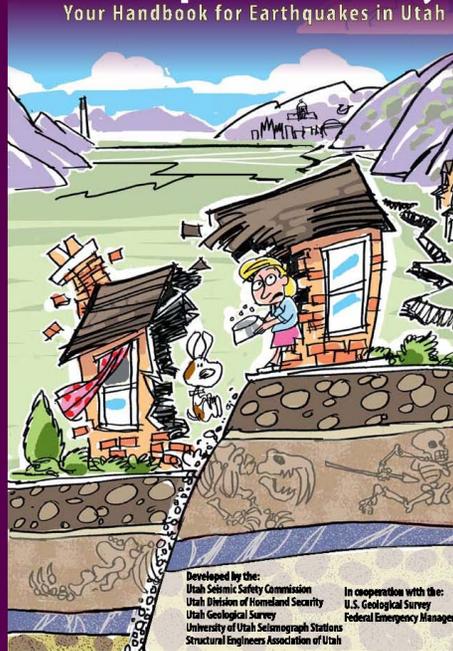
Desarrollado por:

 an NSF-USGS center ... y muchas otras organizaciones. /v



Utah Seismic Safety Commission
 American Red Cross, Pacific Gas & Electric and many more...

Putting Down Roots in Earthquake Country
Your Handbook for Earthquakes in Utah

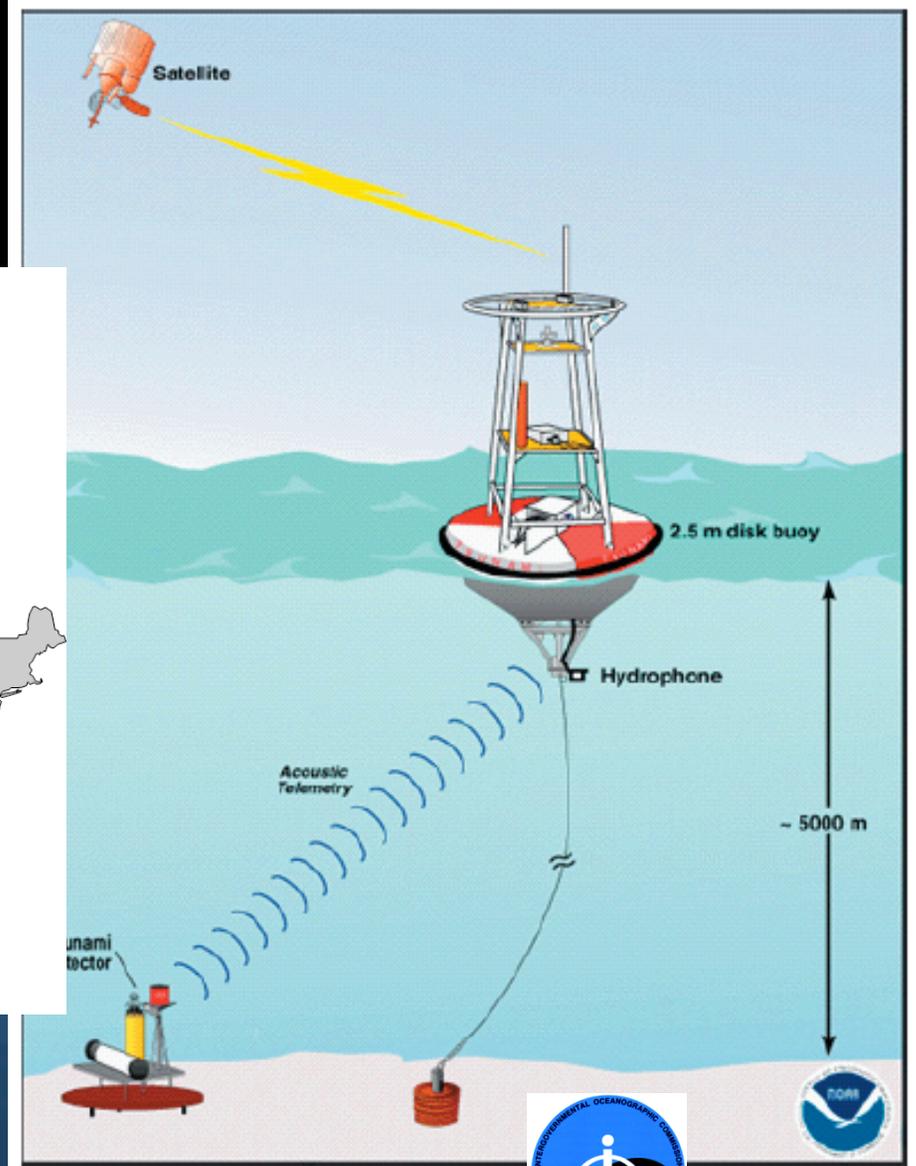
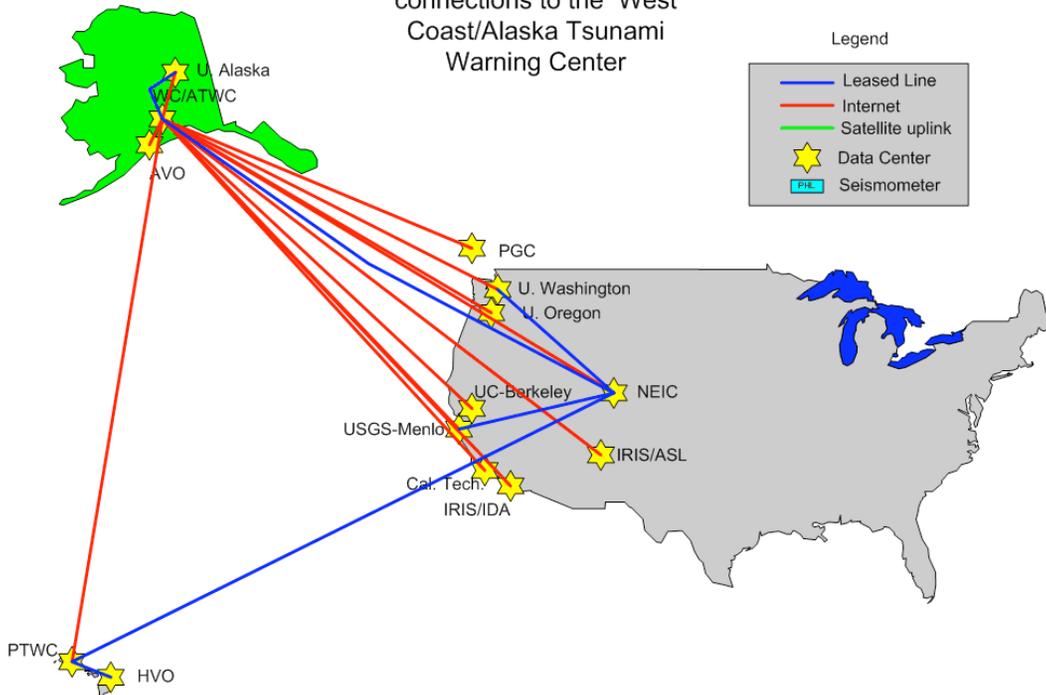


Developed by the:
 Utah Seismic Safety Commission
 Utah Division of Homeland Security
 Utah Geological Survey
 University of Utah Seismograph Stations
 Structural Engineers Association of Utah
 In cooperation with the:
 U.S. Geological Survey
 Federal Emergency Management Agency

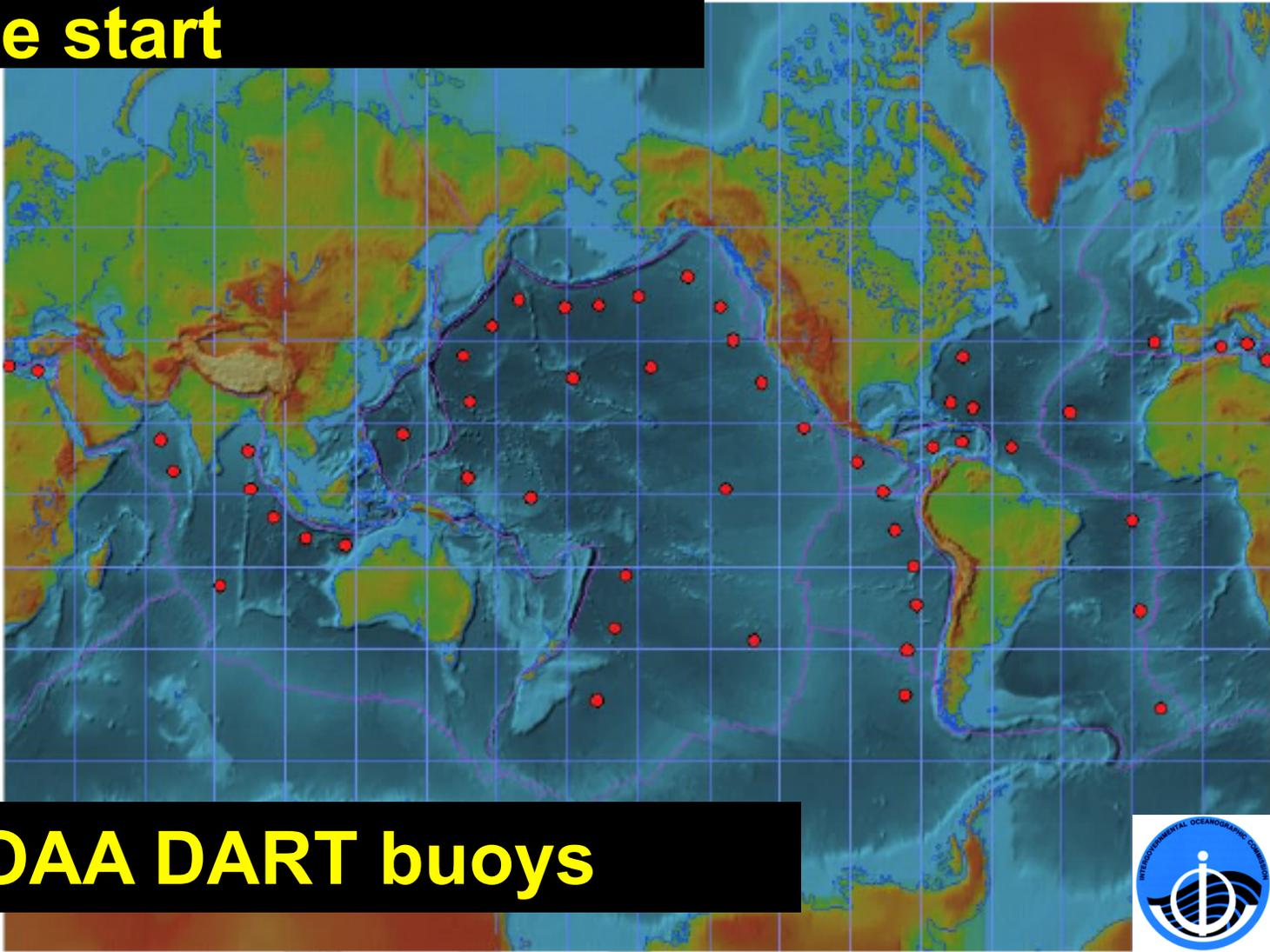
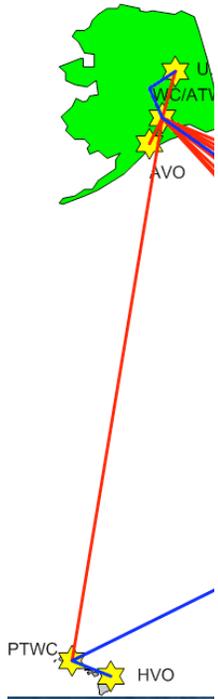
Putting Down Roots for the Central US
(coming soon)

For tsunamis, seismic is the start

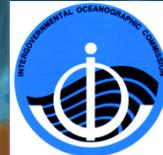
Seismic Data Centers with connections to the West Coast/Alaska Tsunami Warning Center



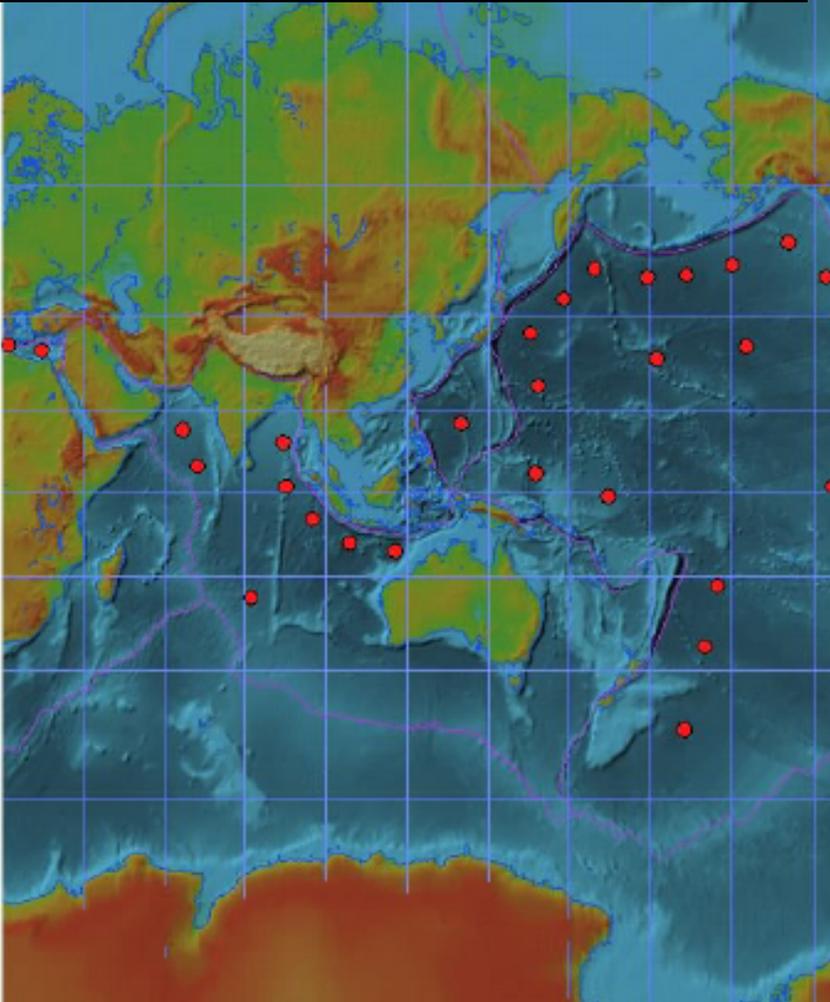
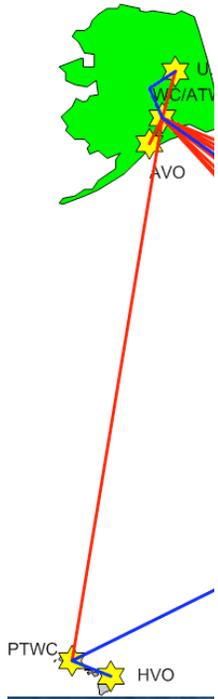
For tsunamis, seismic is the start



NOAA DART buoys



For tsunamis, seismic is the start



The beach is the finish



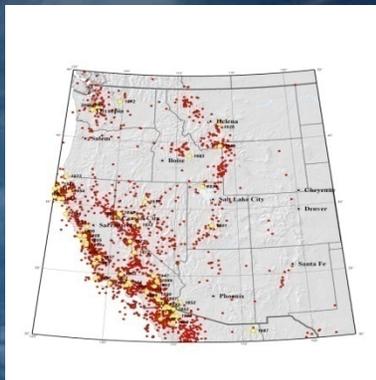
All Hazard Alert Broadcast system installed at Ocean Shores, Washington.



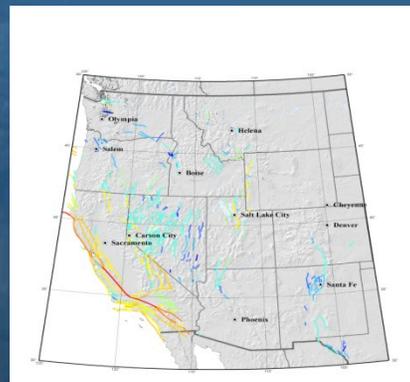
Credit: Washington Emergency Management

National seismic hazard assessment inputs

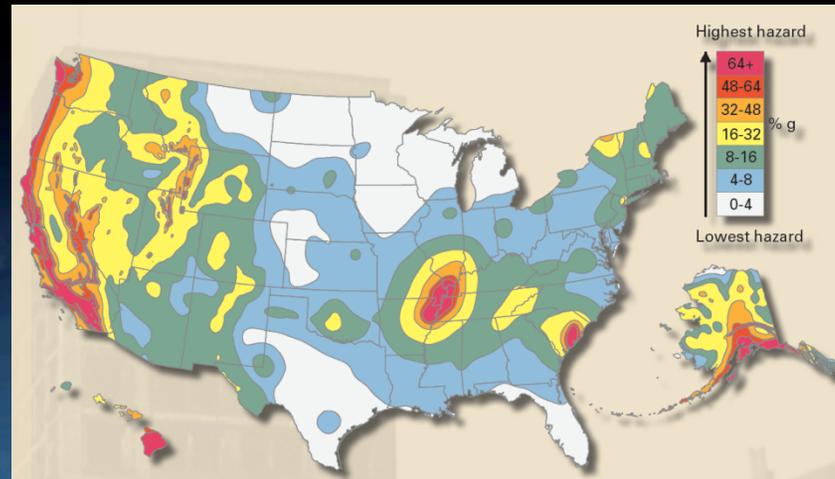
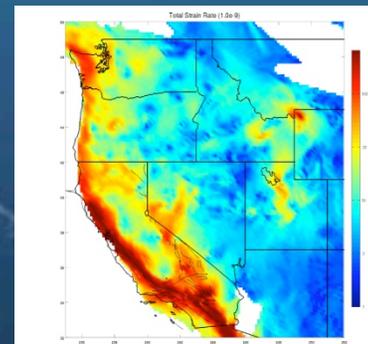
Seismicity



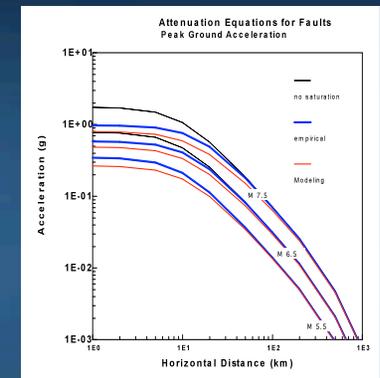
Quaternary Faults



Geodetics



Attenuation Relations

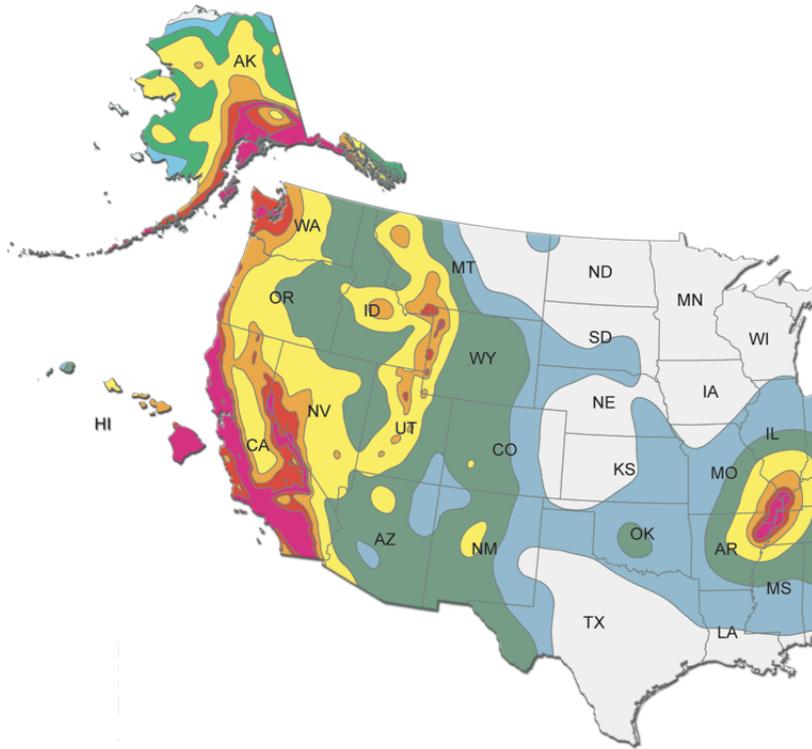


USGS



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

Translating USGS national hazard maps into model building codes



NEHRP Recommended Seismic Provisions

for New Buildings and Other Structures

FEMA P-750 / 2009 Edition



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

For more information on recent earthquakes,
earthquake hazards,
and USGS earthquake monitoring,
research and hazards assessments, see:

[*http://earthquake.usgs.gov*](http://earthquake.usgs.gov)

 USGS

