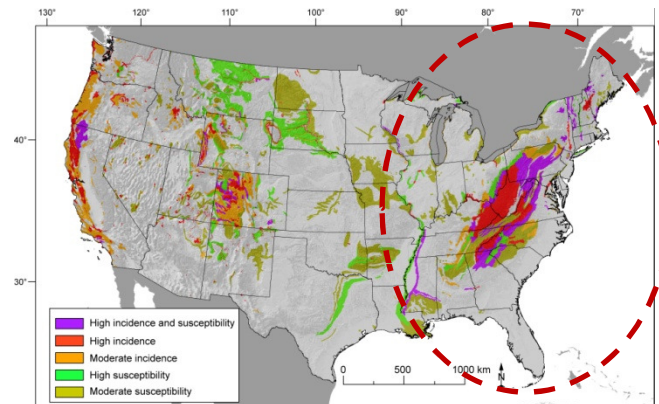


Job Advertisement Landslide Expert USGS Eastern Region (closes in June)



Contact
Paula Gori
pgori@usgs.gov



Kingston, TN



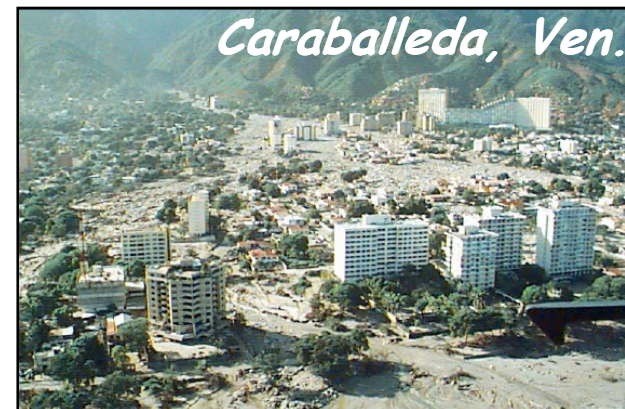
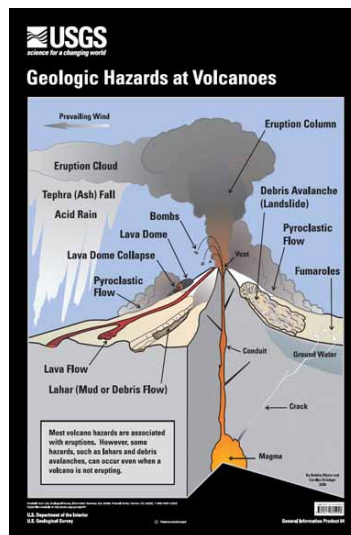
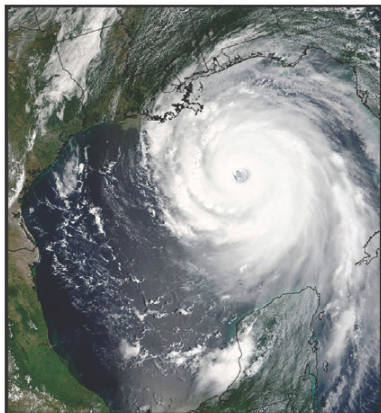
Mamayas, Puerto Rico



U.S. Geological Survey

Thomas L. Holzer

1. USGS interest in extreme events
2. ShakeMap and PAGER
3. Suggestions for GEER to think about before the next extreme event



1. USGS Interest in Extreme Events (Congressionally-mandated Programs)

- Coastal and Marine Geology
- Water Discipline Programs
- Earth Surface Dynamics
- Earthquake Hazards
- Landslide Hazards
- Volcano Hazards

Extreme Events Investigations Relevant to GEER

➤ Coastal and Marine Geology

- Hurricane/Large Storm
- Tsunami
- Offshore

➤ Water Discipline Programs

- Flooding/Storm Surge

➤ Earth Surface Dynamics

- Debris Flows
- Landslides
- Flooding
- Fire
- Wind
- Large Storm

➤ Earthquake Hazards

- Shaking
- Site Response
- Surface Fault Rupture
- Liquefaction/Soil Softening
- Landslides

➤ Landslide Hazards

- Climatic
- Seismic

➤ Volcano Hazards

- Pyroclastic Flows
- Lahars
- Ash
- Lava
- Gas

USGS Program Objectives Post-event Investigations

- Hazard Assessment
- Hazard Mapping
- Process Understanding
- Foreign Assistance

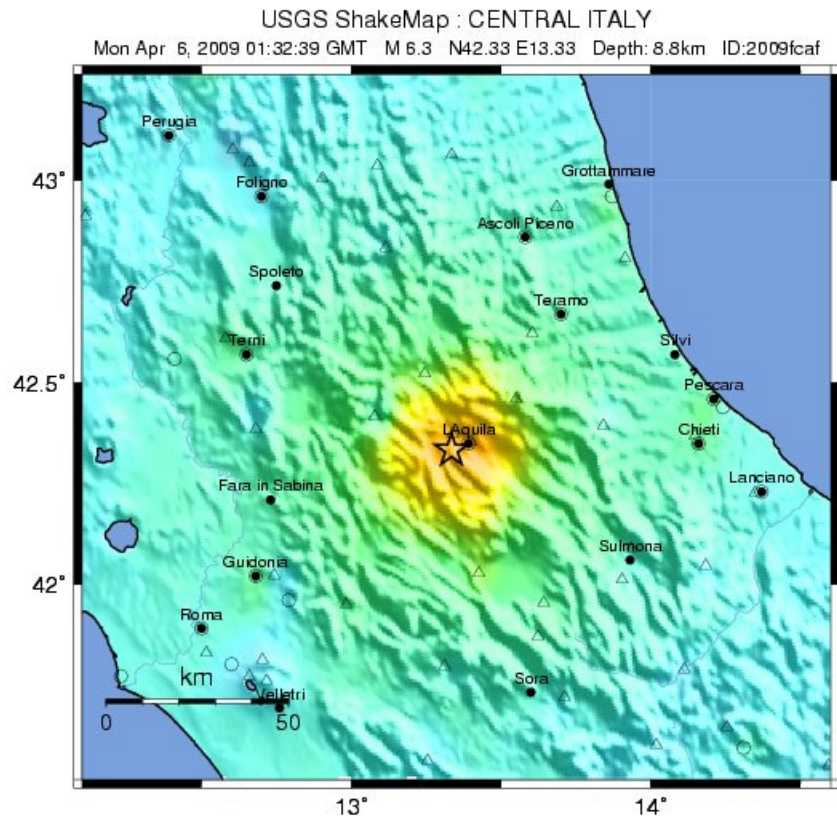
2. ShakeMap and PAGER

<http://earthquake.usgs.gov>

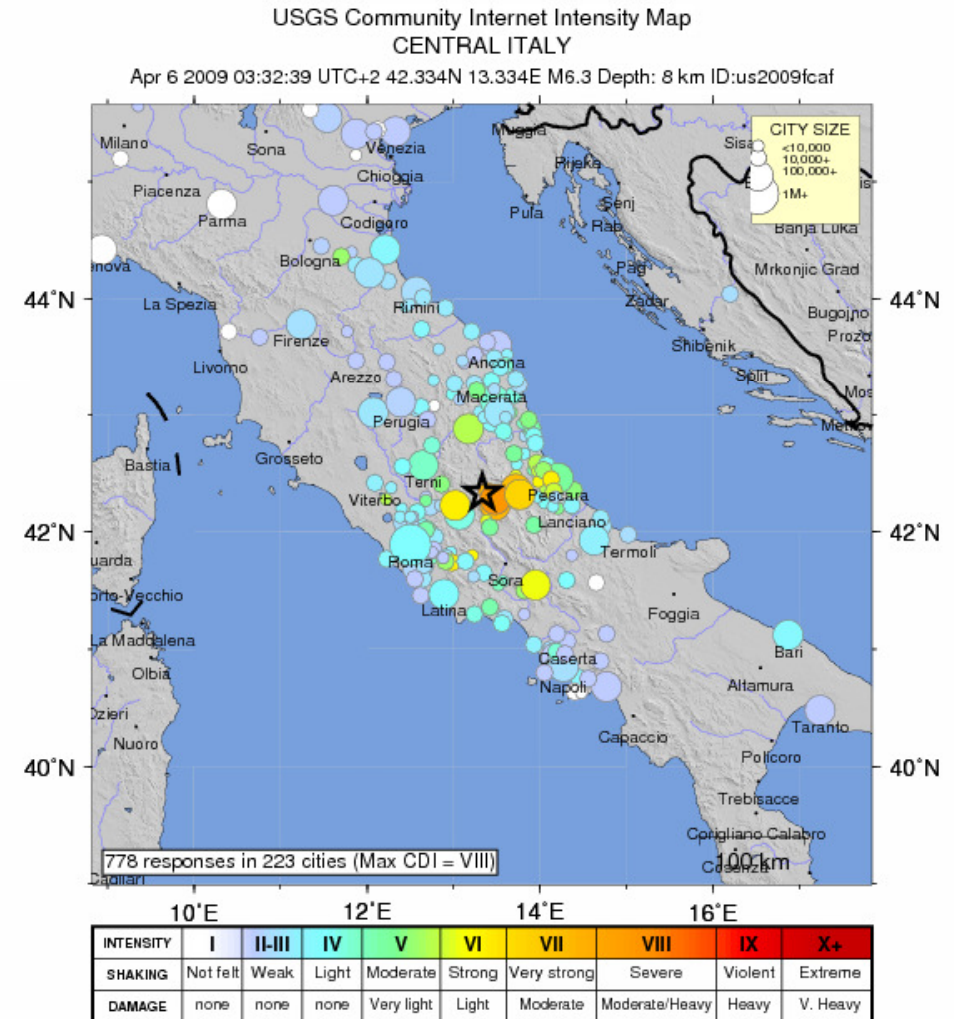


ShakeMap Abruzzo Earthquake

Did you feel it? (Community Internet Intensity Map)



PERCEIVED SHAKINGS	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.(%)	<.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+



	10°E	12°E	14°E	16°E					
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	V. Heavy

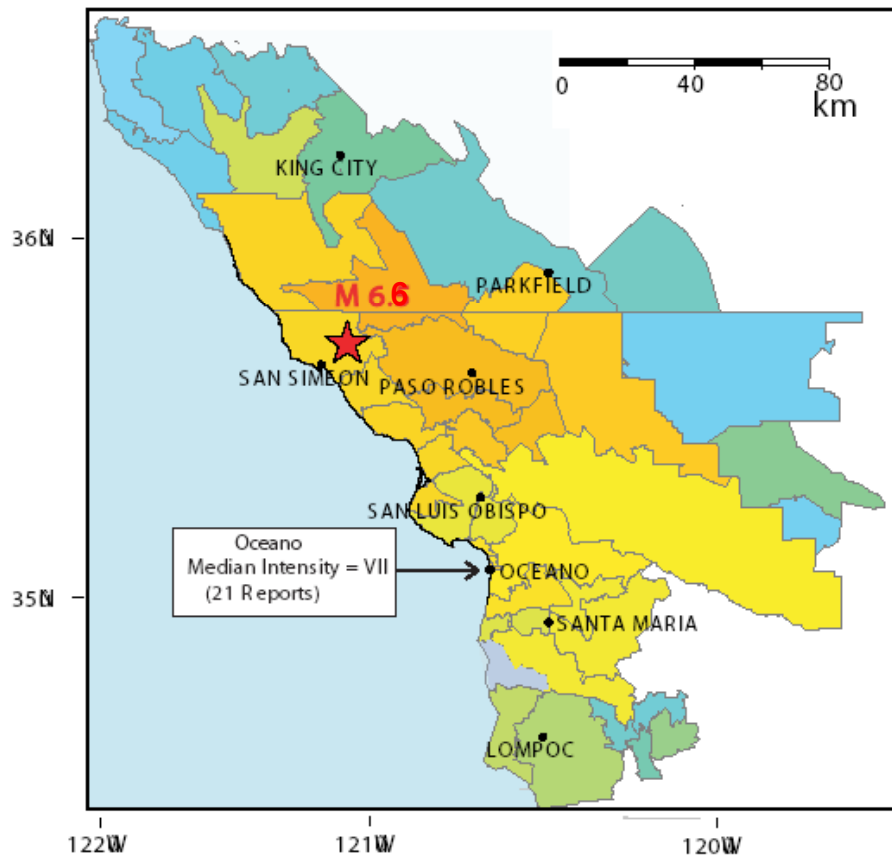
Processed: Fri May 8 09:22:18 2009

CIIM 2003 M6.6 San Simeon EQ

"I was on the computer in my office when my dog came in in a panic. I reached over to pet her when the quake began. I got to my feet and looked out the window toward my neighbors house. Approximately 10 or so seconds into the quake I notice a large crack appearing on the side of their house. At that time I knew it was time to evac. I made it to the front door, approximately 30 feet away. My mother in law came from her back house in a panic. I told her to stay under the doorway in the hall. The rolling subsided considerably the more of a ocean swell for quite a few seconds and then came back with a up and down violent shaking. ..."

USGS Community Internet Intensity Map

DECEMBER 22, 2003 San Simeon Earthquake (Mag 6.5)
17,367 responses in 1046 ZIP areas. Maximum intensity = VIII



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



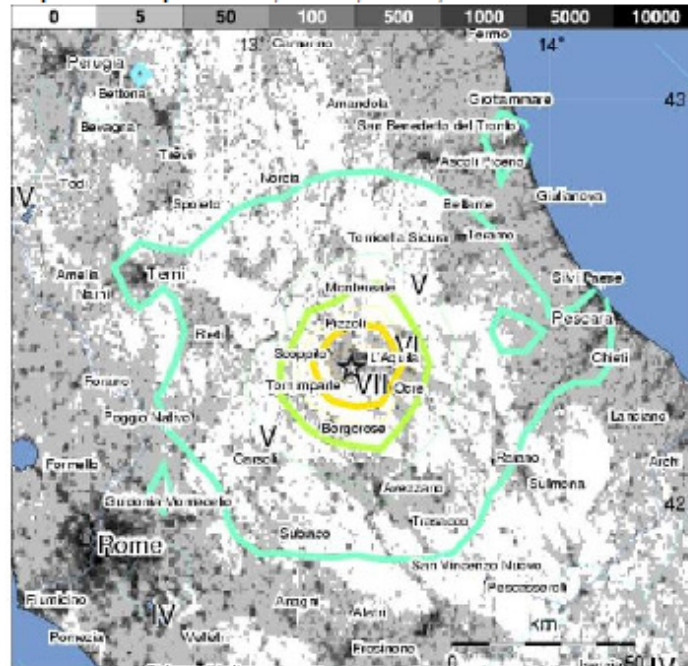
PAGER-- April 6, 2009, Abbruzzo M6.3 Earthquake

Estimated Population Exposed to Earthquake Shaking

Est. Modified Mercalli Intensity	Est. Population Exposure ($k = \times 1000$)	Perceived Shaking	Potential Structure Damage	
			Resistant	Vulnerable
X	0	Extreme	V. Heavy	V. Heavy
IX	0	Violent	Heavy	V. Heavy
VIII	4k	Severe	Moderate/Heavy	Heavy
VII	79k	Very Strong	Moderate	Moderate/Heavy
VI	28k	Strong	Light	Moderate
V	989k	Moderate	V. Light	Light
IV	5,310k*	Light	None	None
II-III	3k*	Weak	None	None
I	--*	Not Felt	None	None

*Estimated exposure only includes population within the map area.

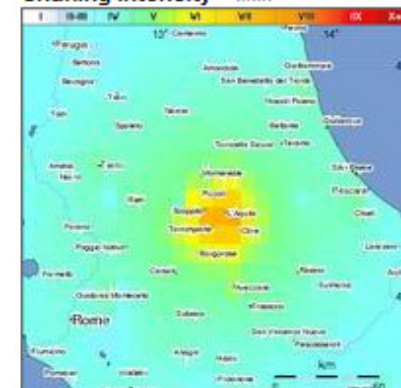
Population Exposure Population per ~1 square km from Landsat 2005



Selected City Exposure

MMI	City	Population
VII	L'Aquila	68k
VII	Tornimparte	2k
VII	Scoppito	2k
VII	Pizzoli	3k
VI	Ocre	1k
VI	Poggio Picenze	1k
V	Terni	105k
IV	Pescara	116k
IV	Guidonia	75k
IV	Rome	2563k
IV	Perugia	149k

Shaking Intensity MMI



3. Suggestions for GEER to think about

- Data management
- Anticipate case histories
and set priorities

Loma Prieta Professional Papers

<http://pubs.usgs.gov/pp/pp1550/>, 1551, 1552, 1553



Earthquake Occurrence

Performance of the Built Environment

Societal Response

Strong Ground Motion and Ground Failure

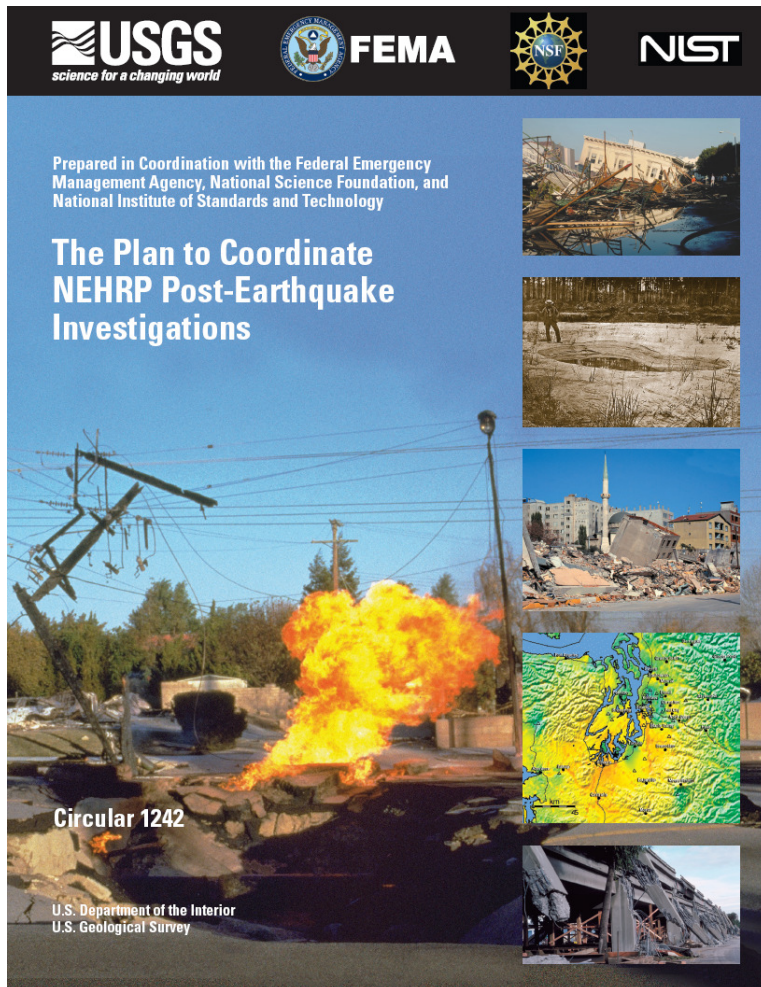
The image displays a collection of USGS Professional Papers related to the Loma Prieta Earthquake of October 17, 1989. The papers are arranged in five vertical columns, each representing a different theme:

- Earthquake Occurrence (Orange/Beige covers):** Includes papers 1550-A (Main-Shock Characteristics), 1550-B (Forecasts), 1550-C (Preseismic Observations), 1550-D (Aftershocks and Postseismic Effects), and 1550-E (Tectonic Processes and Models).
- Strong Ground Motion and Ground Failure (Red covers):** Includes papers 1551-A (Strong Ground Motion), 1551-B (Landslides), 1551-C (Hydrologic Disturbances), 1551-D (Marina District), and 1551-E (Liquefaction).
- Performance of the Built Environment (Blue covers):** Includes papers 1552-A (Lifelines), 1552-B (Highway Systems), 1552-C (Earth Structures and Engineering Characterization of Ground Motion), and 1552-D (Building Structures).
- Societal Response (Green covers):** Includes papers 1553-A (Loss Estimation and Procedures), 1553-B (Public Response), 1553-C (Fire, Police, Transportation, and Hazardous Materials), and 1553-D (Recovery, Mitigation, and Reconstruction).

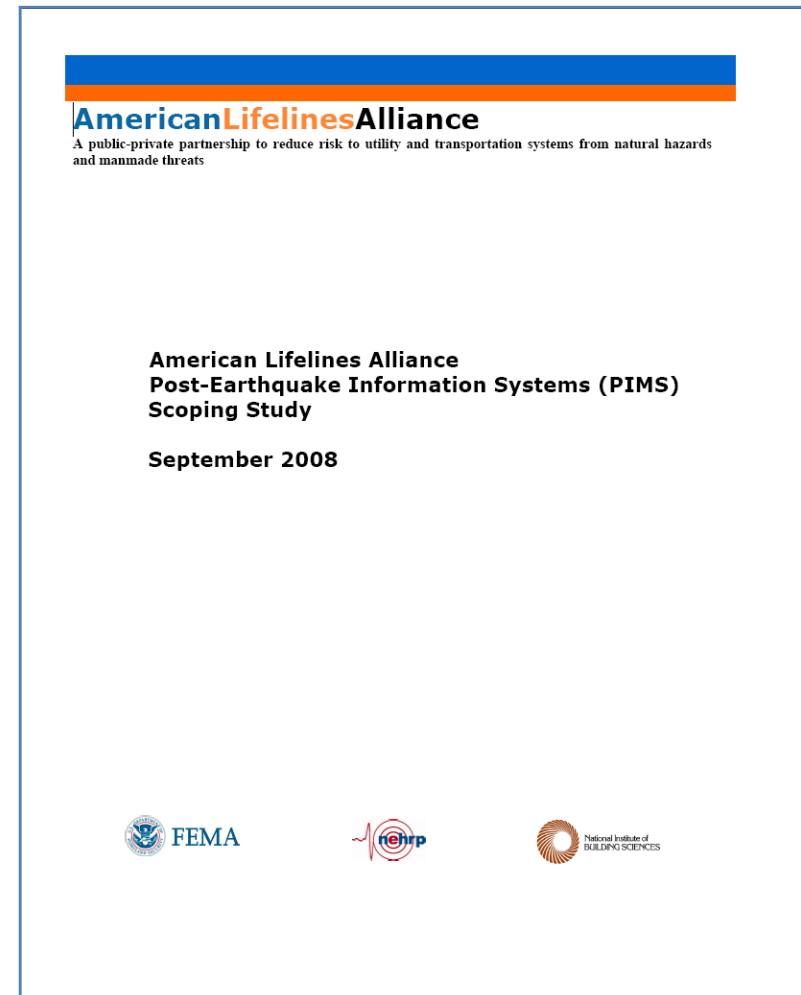
Each cover features the title, a small photograph or illustration, and the USGS logo at the bottom. The papers are presented in a 3D perspective, overlapping each other.

Data Management

Plan recognized need (2002)



Scoping study (2008)
<http://www.americanlifelinesalliance.org/>



Set Priorities for Case Histories

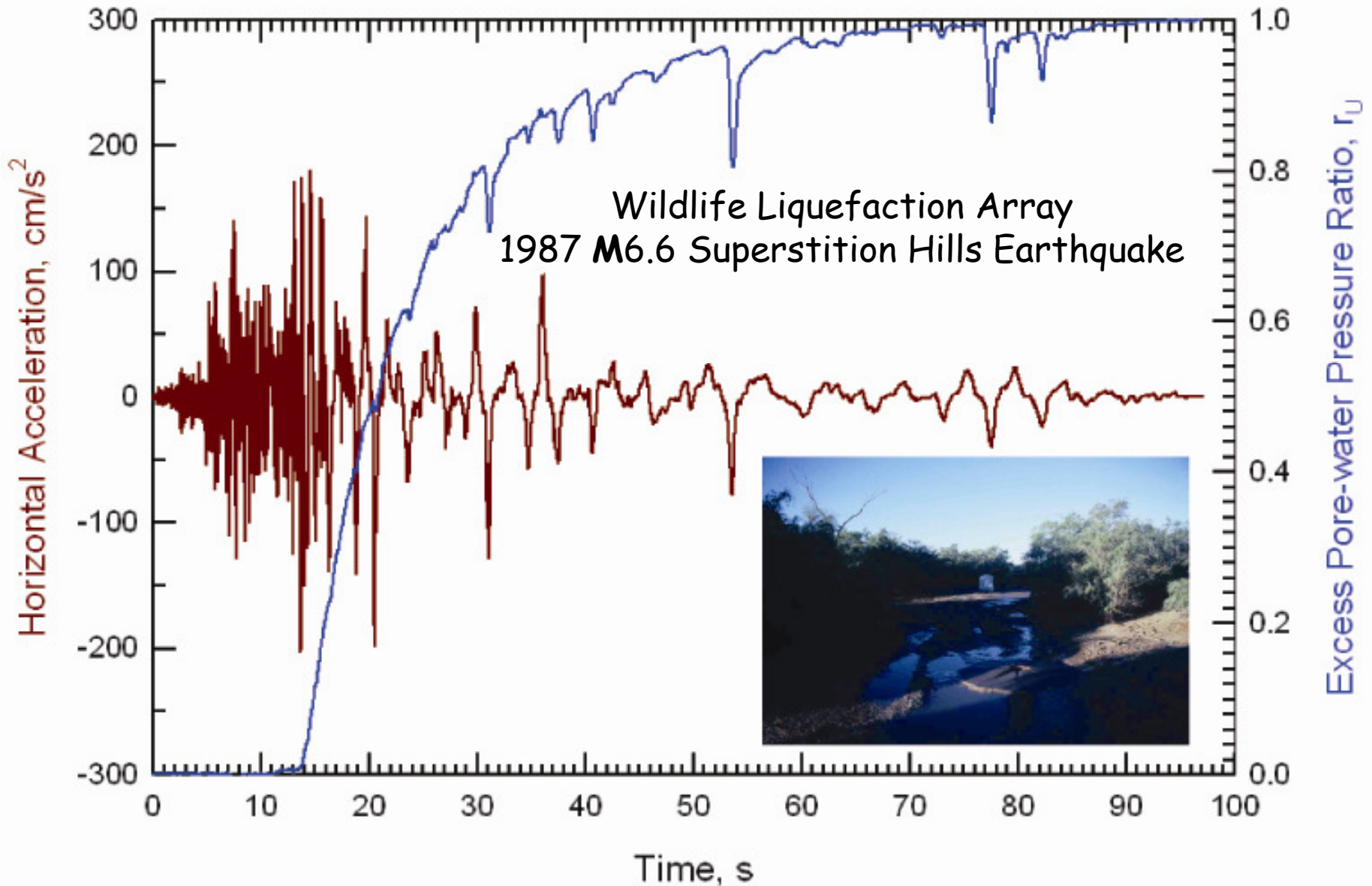
“Delayed” failures

Failures after earthquake shaking has subsided are typically attributed to pore-water pressure migration. Some of these failures may be caused by cyclic straining from surface waves.

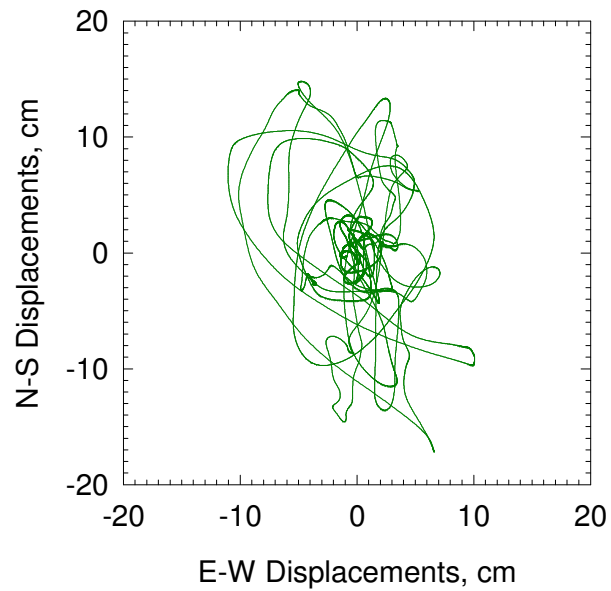
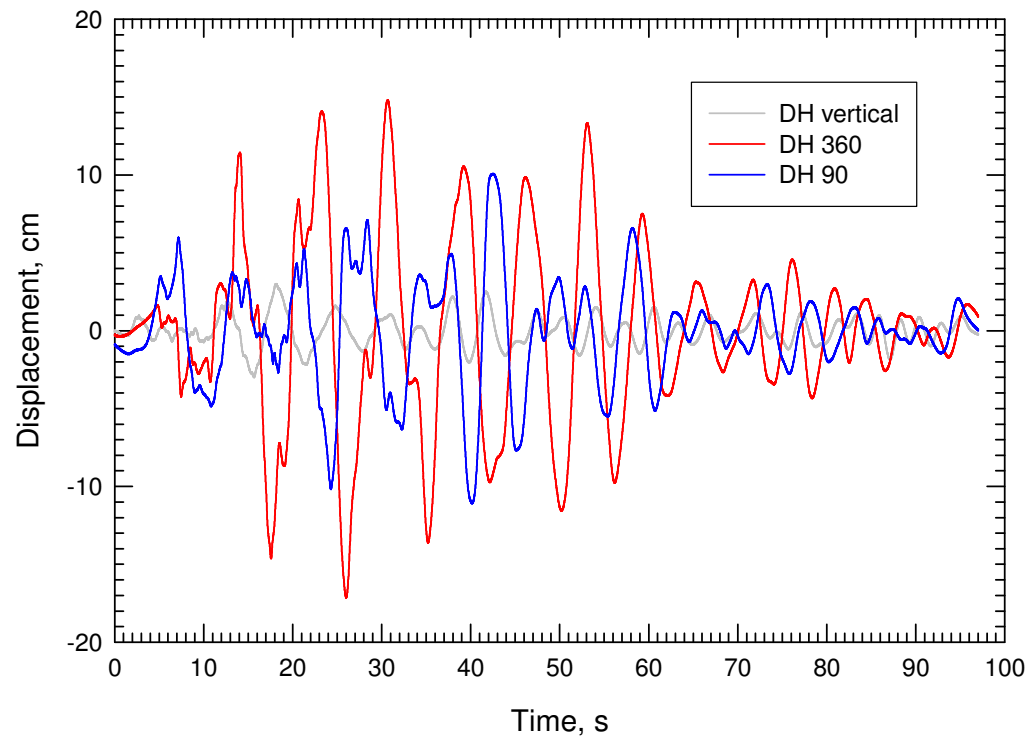


Delayed Failures and Surface Waves

Holzer and Youd, *Bull. Seis. Soc. Amer.* (2007) 97:3, pages 961-976

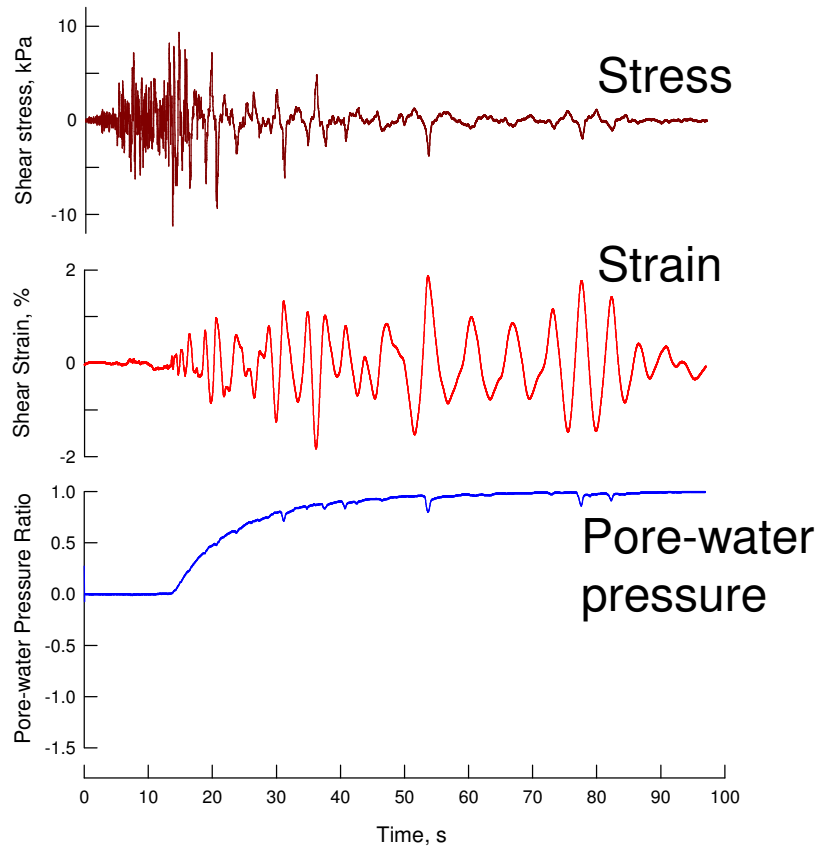


Downhole Displacements



Site was excited by
Love Waves

Wildlife (1987)

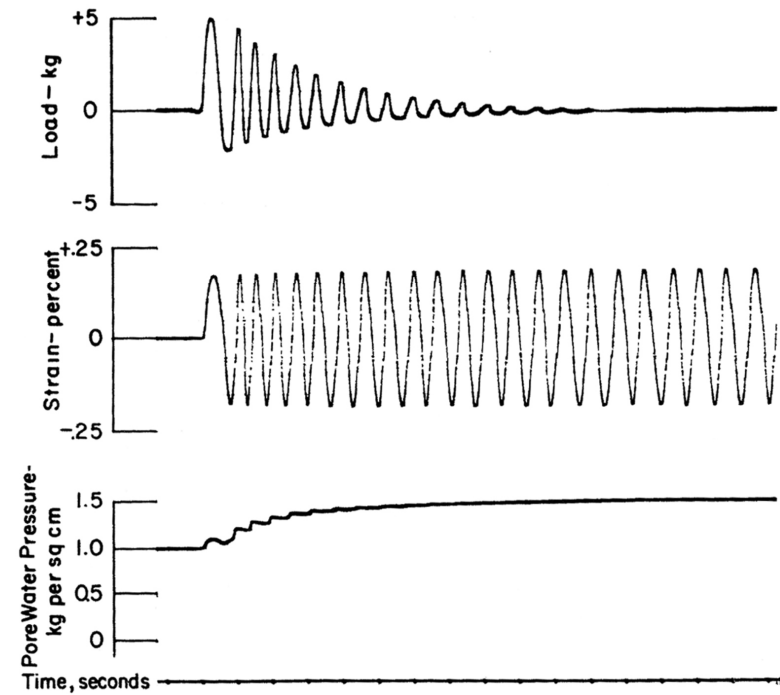


Seed and Lee (1966) Cyclic Strain Test Constant Amplitude Strain

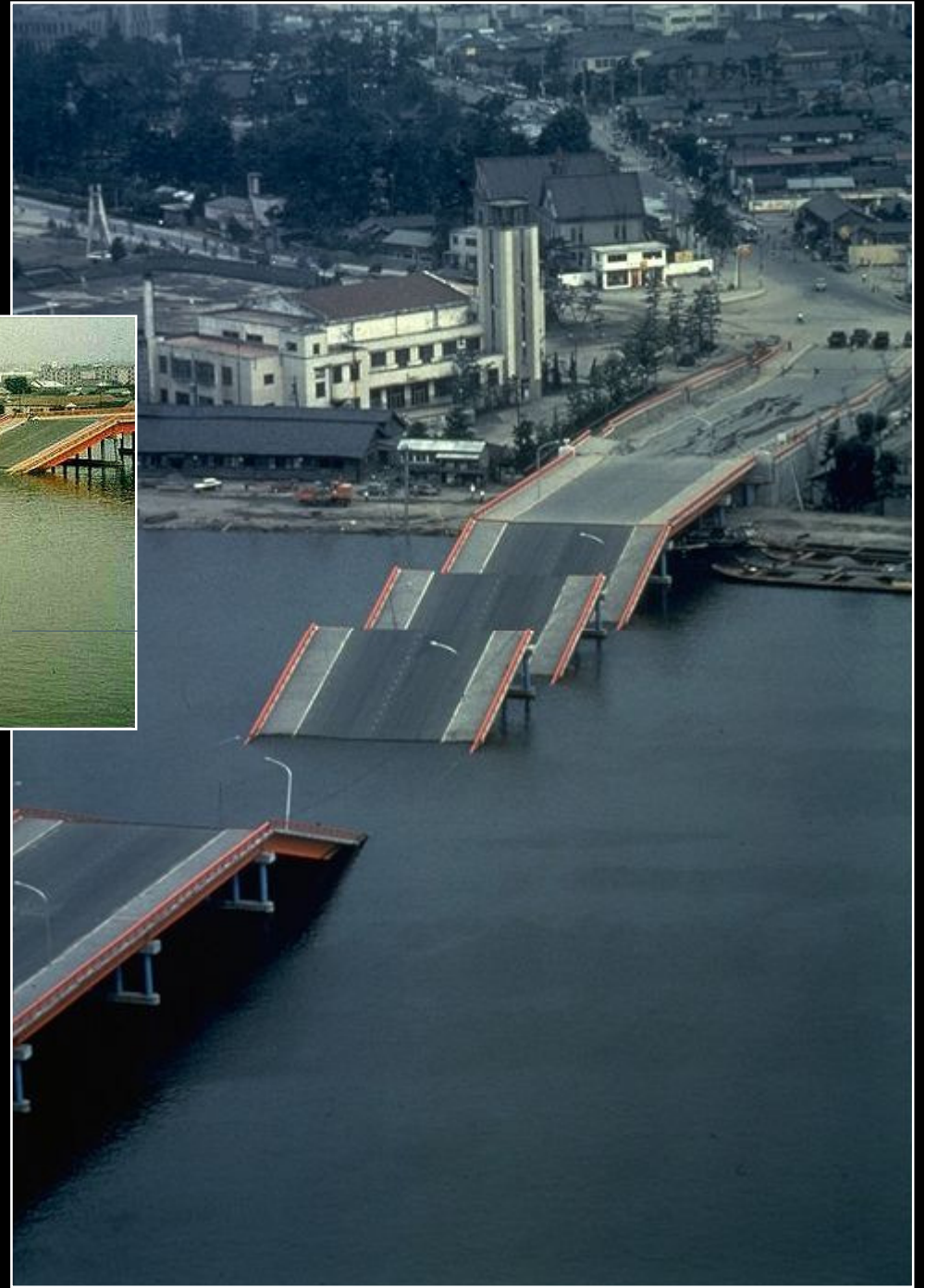
Initial void ratio = 0.87

Initial confining pressure = 1.5 kg per sq cm

Initial pore water pressure = 1.0 kg per sq cm



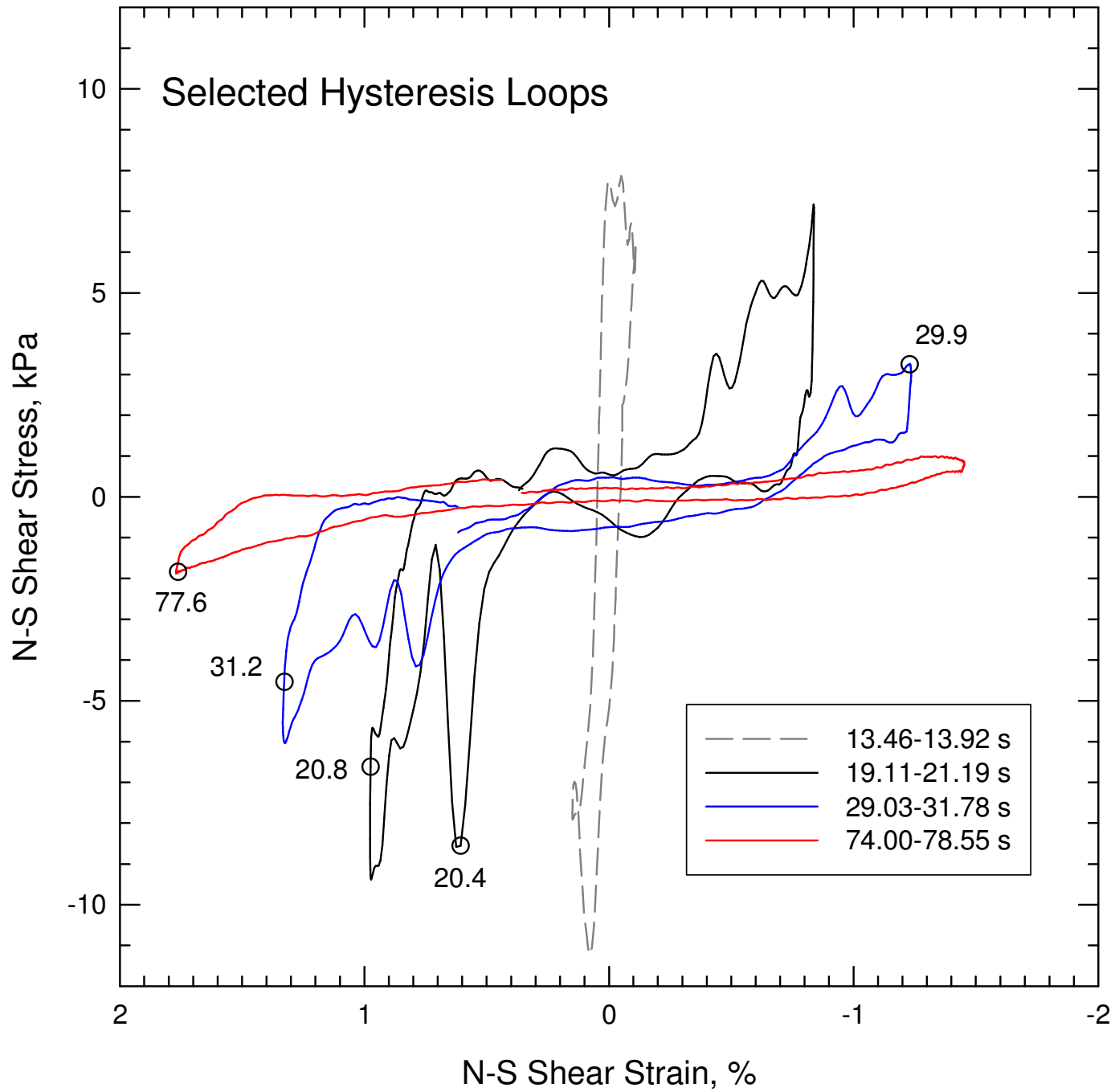
Showa Bridge



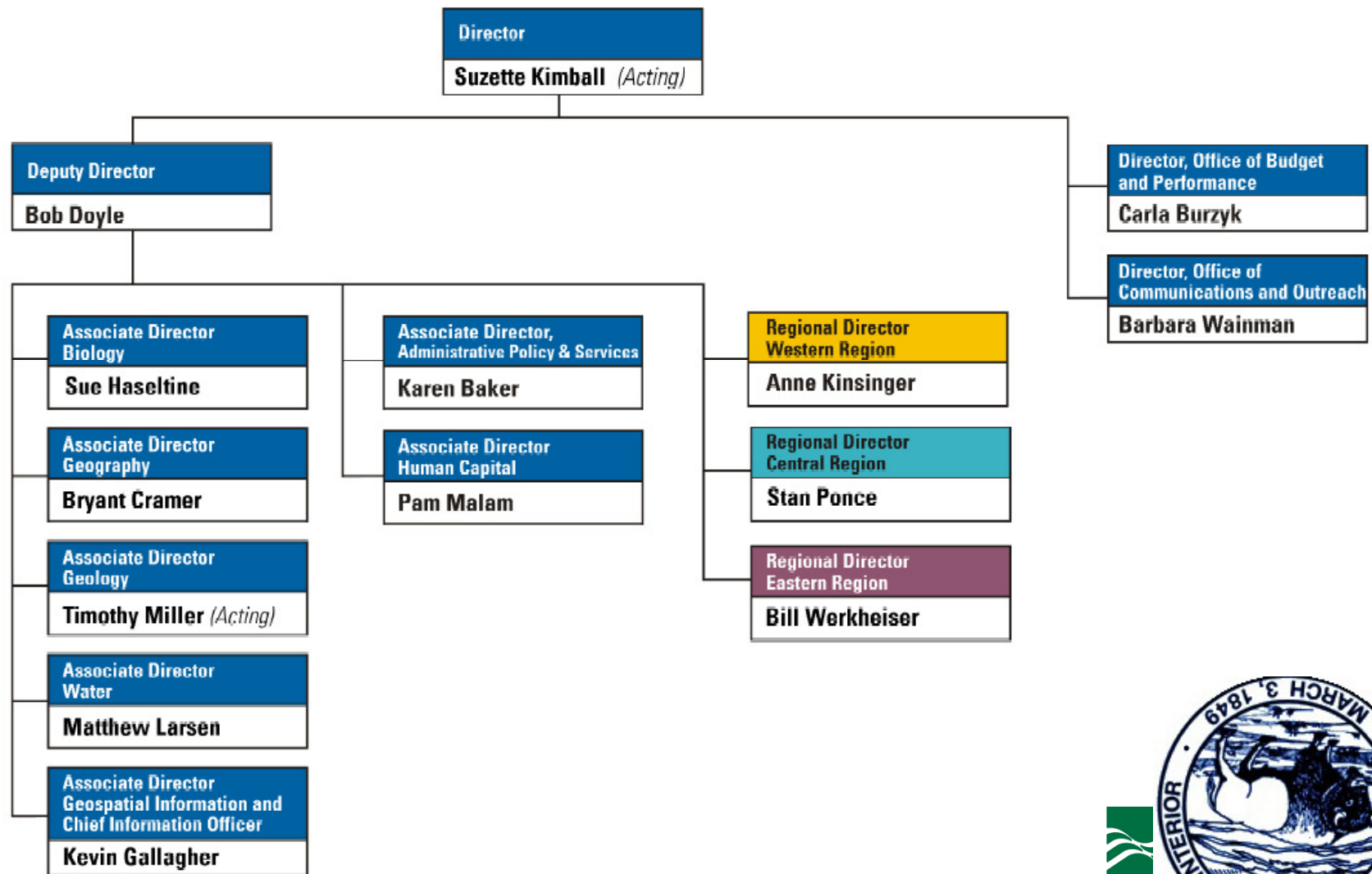
1964 Niigata M7.5 Earthquake

Lower San Fernando Dam Failure 1971 San Fernando M6.6 Earthquake





U.S. Geological Survey Organization Chart



February 2009



Regions

1. Eastern
2. Central
3. Western

KEY

- Regional boundary
- Geographic area boundary
- Geographic area headquarters

