Earthquake Hazard Forecasts for California

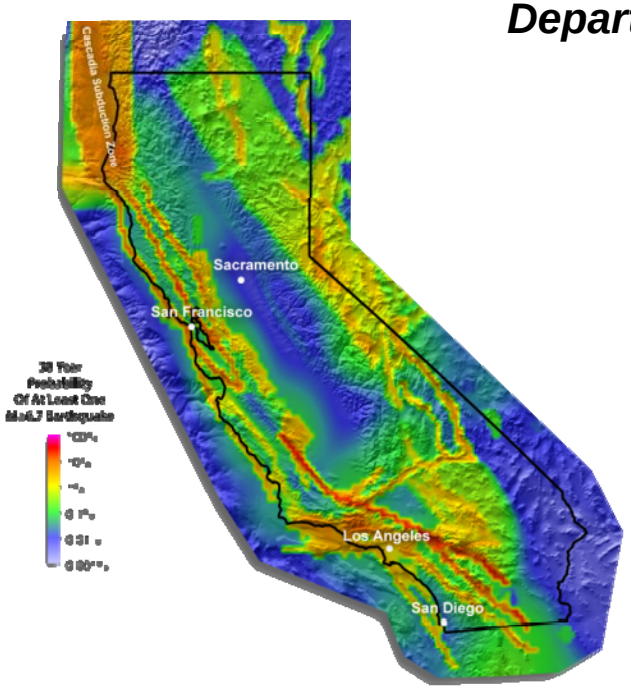
Results of the Uniform California Earthquake Rupture Forecast 2

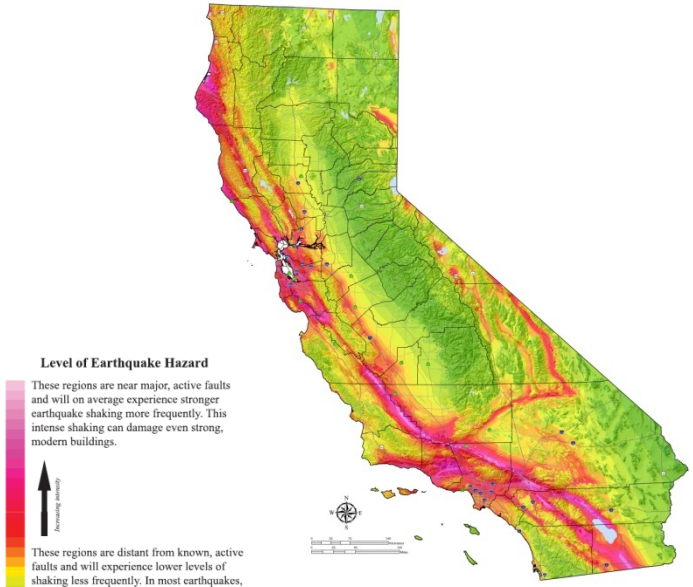
and the

The National Seismic Hazard Mapping Program, 2008

Chris Wills, California Geological Survey

Department of Conservation





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A seismic shaking hazard map shows an estimate of shaking from all potential earthquakes.

The 2007 Working Group on California Earthquake Probabilities developed a seismic hazard model that estimates the likelihood of earthquakes in the next 30 years and is the input to the National Seismic Hazard Maps.

The Working Group on California Earthquake Probabilities uses a consensus-building approach.

WGCEP held numerous workshops to gather and evaluate data on the rates of earthquakes. The resulting model is consistent with data provided by specialists in seismology, geodesy, and geology.

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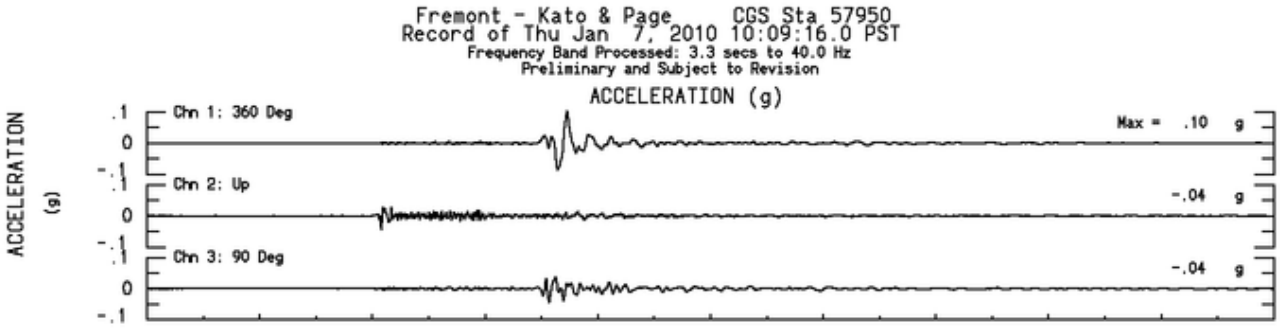
But first: how do we measure earthquake shaking?

Earthquake shaking is measured as acceleration and compared with the acceleration due to gravity (g)



The January 7, 2010 earthquake east of San Jose had a peak acceleration measured in Fremont of 0.1 g

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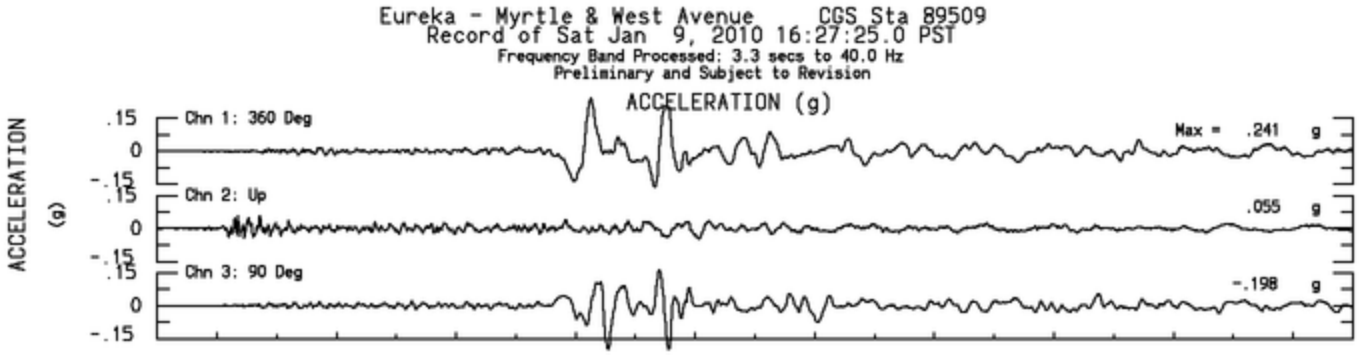
The January 9, 2010 earthquake west of Eureka had a peak acceleration measured in Eureka of about 0.2 g to 0.25 g



Eureka Natural Foods shortly after the quake.
Photo by Shaun Walker, Eureka Times-Standard

A house that was “knocked off its foundation”.
Photo by Josh Jackson, Eureka Times-Standard

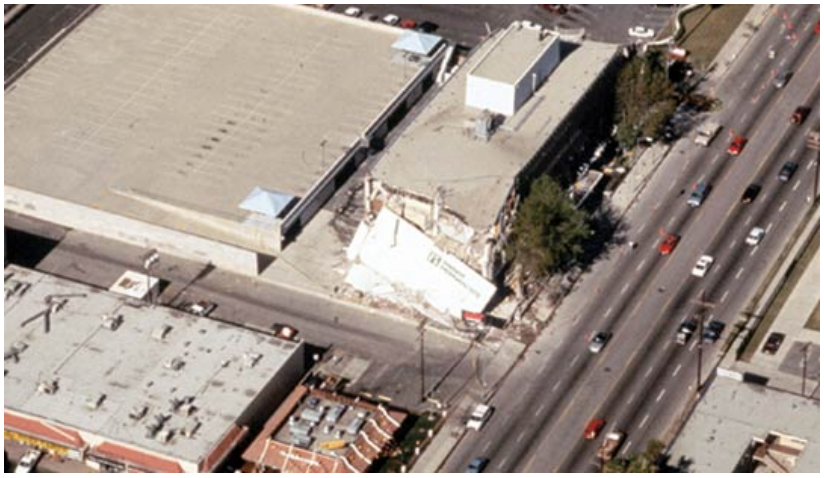
Marina District, San Francisco

The Loma Prieta earthquake of 1989 had a peak acceleration measured in San Francisco of about 0.2 g, and over 0.6 g near Santa Cruz. Even the relatively low level of shaking in San Francisco damaged especially vulnerable structures on especially vulnerable soils. O.6 g can cause extensive damage to vulnerable structures, but generally is not damaging to well-built modern structures.

Watsonville
photo by Robert A. Eplett California
Governor's Office of Emergency Services

Santa Cruz

Damage to Apartment Building in San Fernando Valley due to Northridge earthquake
photo by Robert A. Eplett,California Governor's Office of Emergency Services , 1994

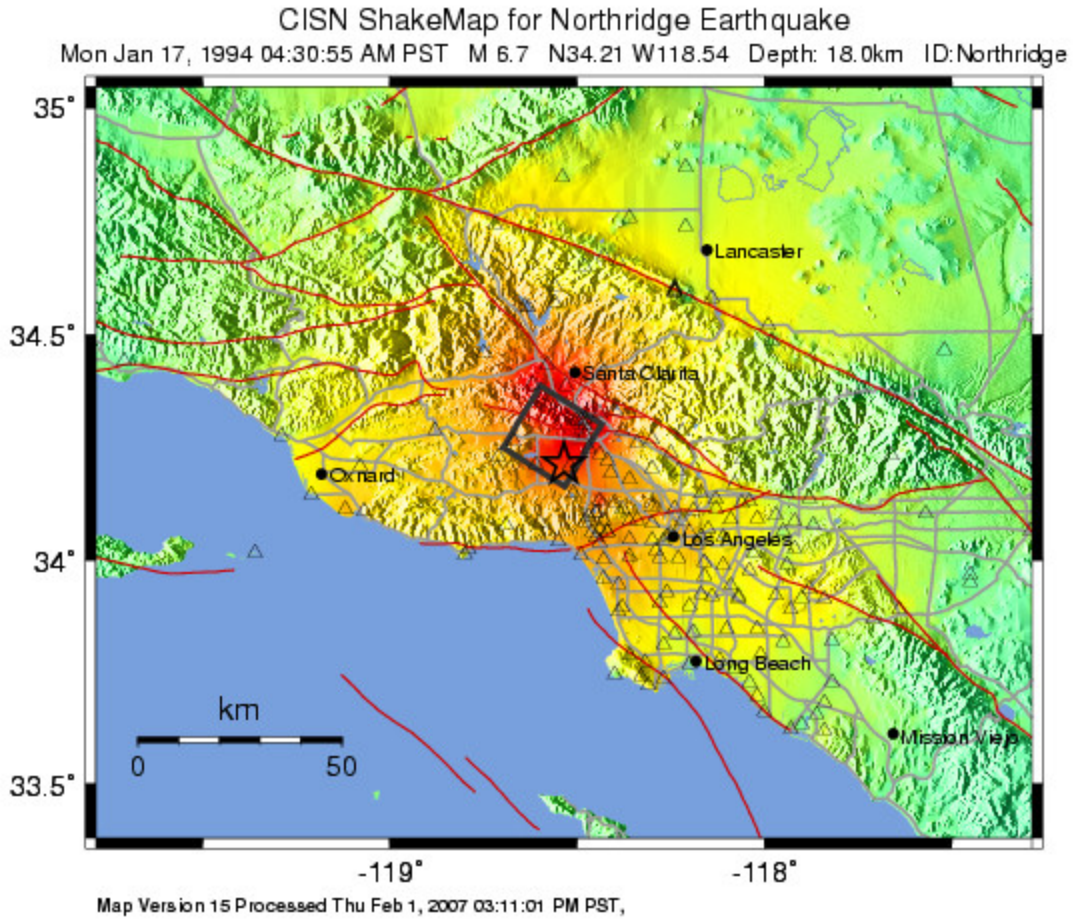


Damage to office building in San Fernando Valley due to Northridge earthquake
Photo by Lloyd Cluff, 1994.

The Northridge earthquake of 1994 had a peak acceleration measured in the San Fernando Valley of about 0.5-0.6 g, and measured accelerations of 0.9 g in Sylmar and Santa Monica

Damage to Olive View Hospital due to San Fernando earthquake, 1971

A ShakeMap is a summary of the shaking from an earthquake, showing the locations where there are measurements, and estimates everywhere else.



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+

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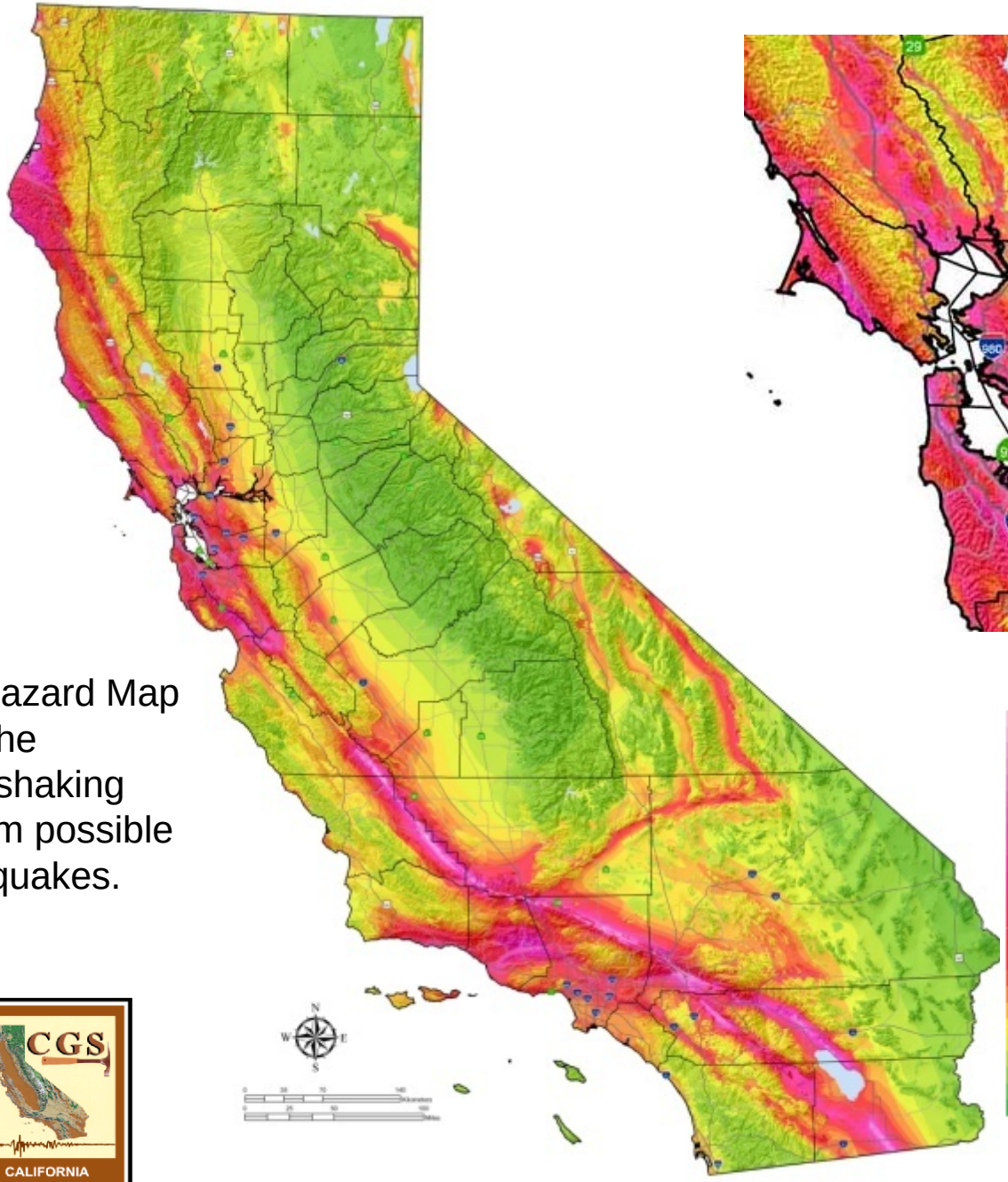
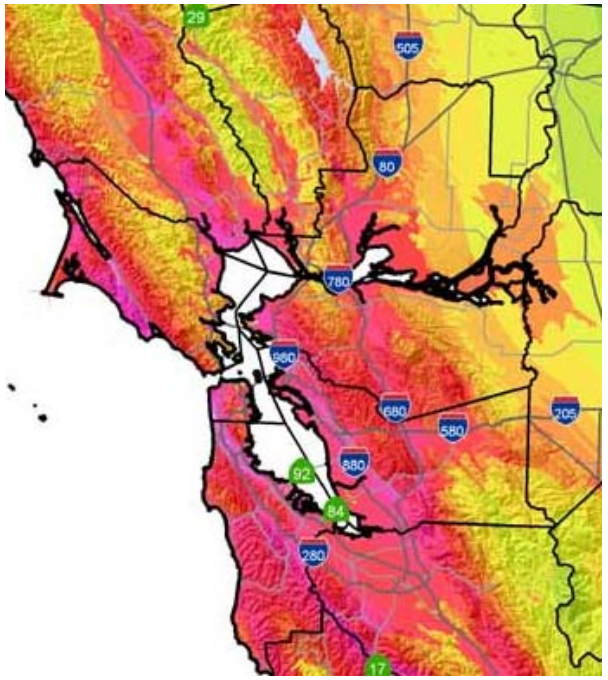
A Seismic Hazard Map represents the earthquake shaking potential from possible future earthquakes.





Level of Earthquake Hazard

These regions are near major, active faults and will on average experience stronger earthquake shaking more frequently. This intense shaking can damage even strong, modern buildings.

Increasing intensity

These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.

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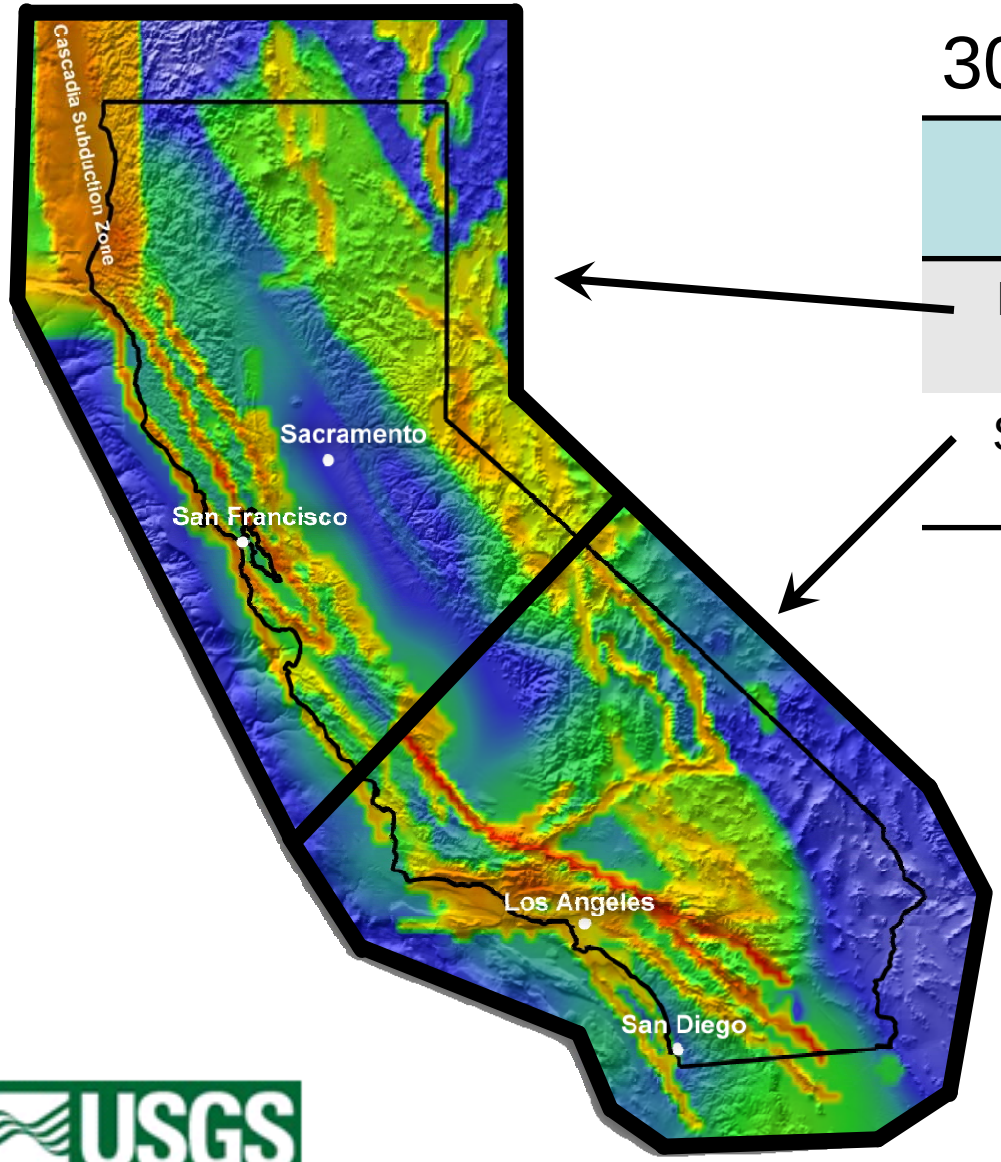
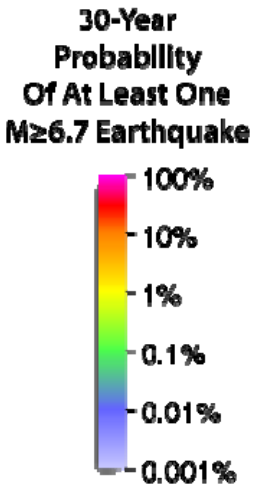


30-Year Probabilities

	Magnitude ≥6.7	Magnitude ≥7.5
Northern Area	93%	15%
Southern Area	97%	37%



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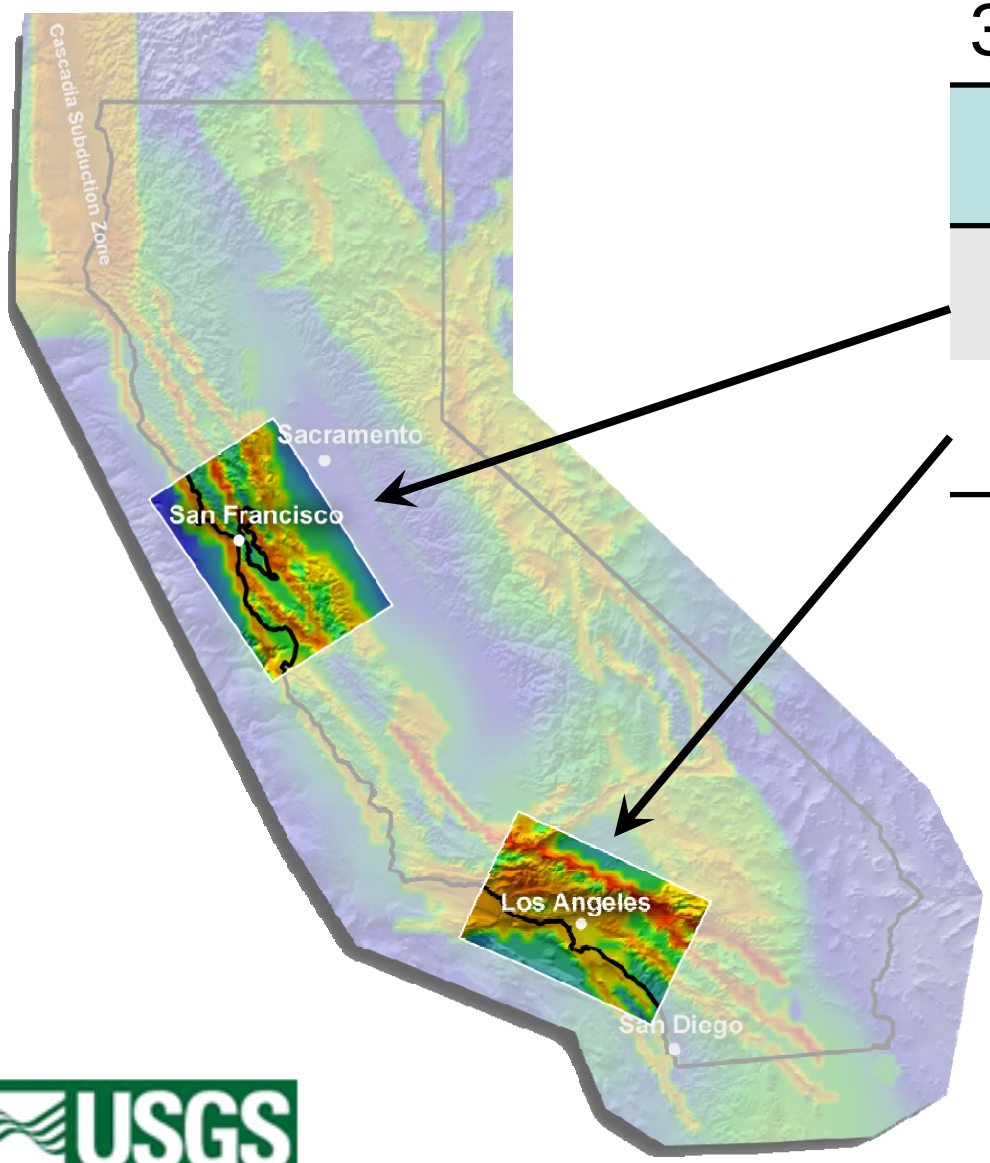

	Magnitude ≥6.7
San Francisco	63%
Los Angeles	67%

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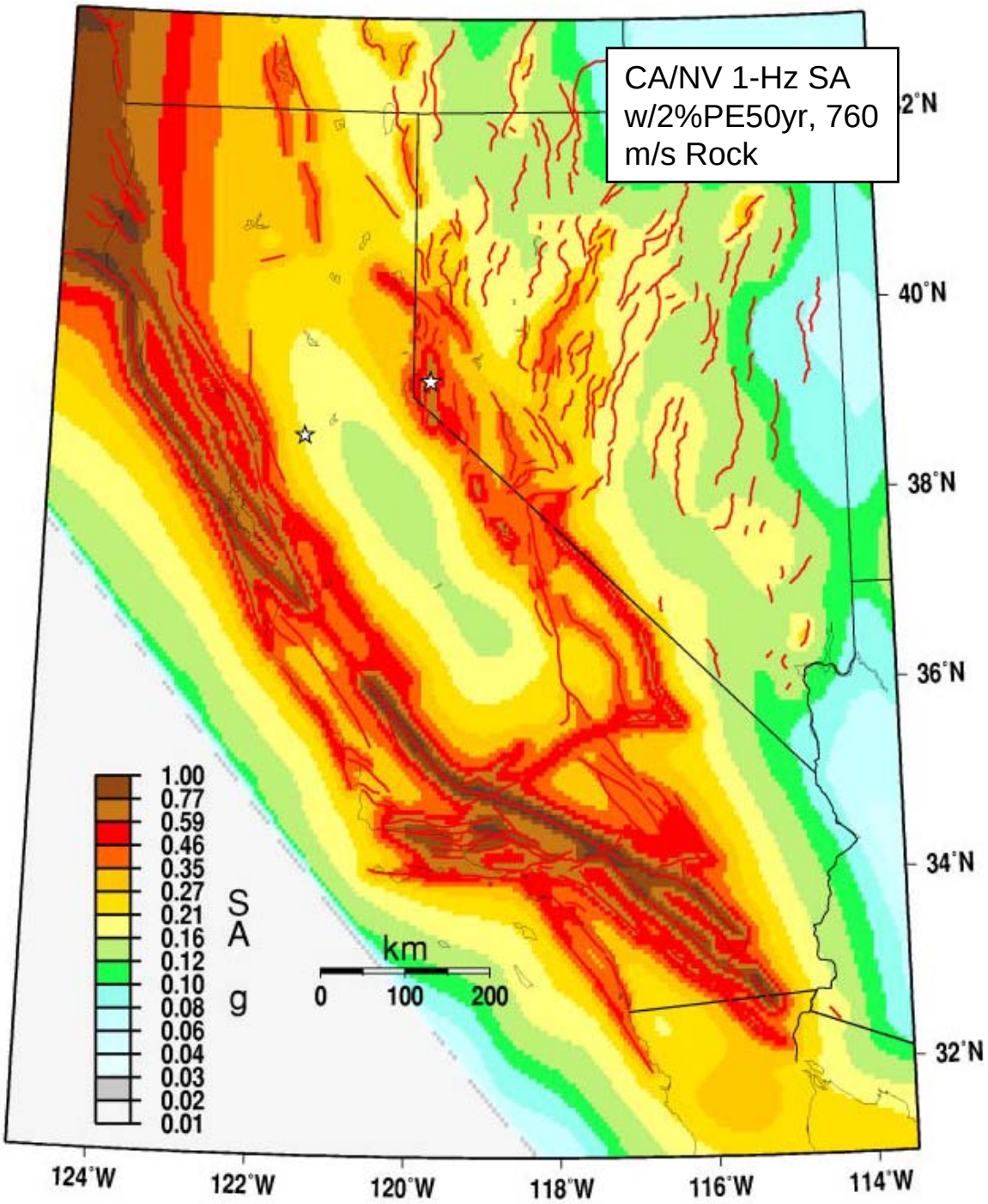

UCERF2 is a ***source model.*** It provides the probability of "all possible" earthquakes in a region. This gets turned into ***hazard***, which is the probability of exceeding a specified ground motion at a point in a period of time.

Because UCERF2 was prepared in cooperation with the National Seismic Hazard Mapping Program of USGS. It is the source model for the 2008 version of the NSHMP. NSHMP calculated ground shaking hazard by combining the source model with Ground Motion Prediction Equations.

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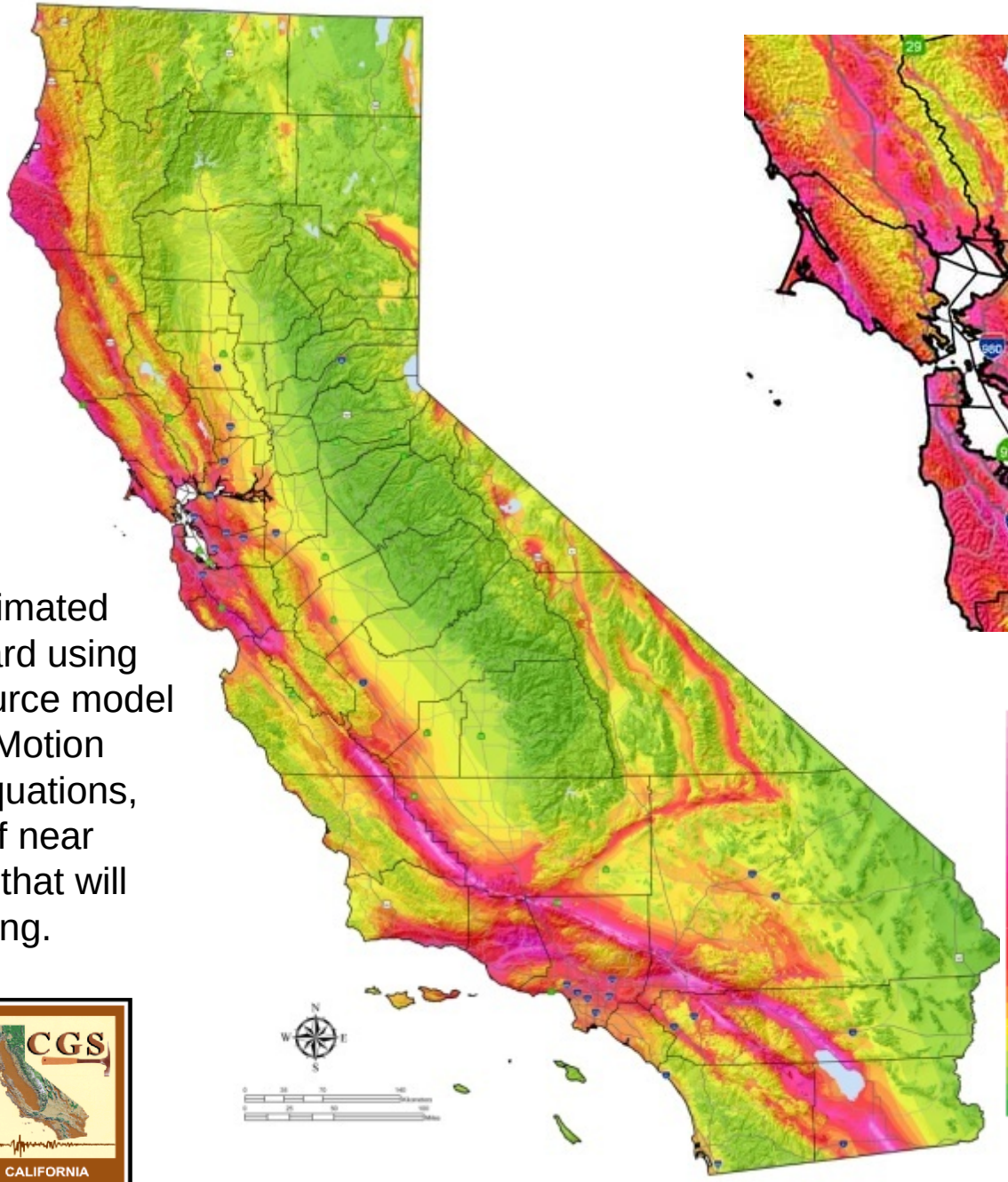
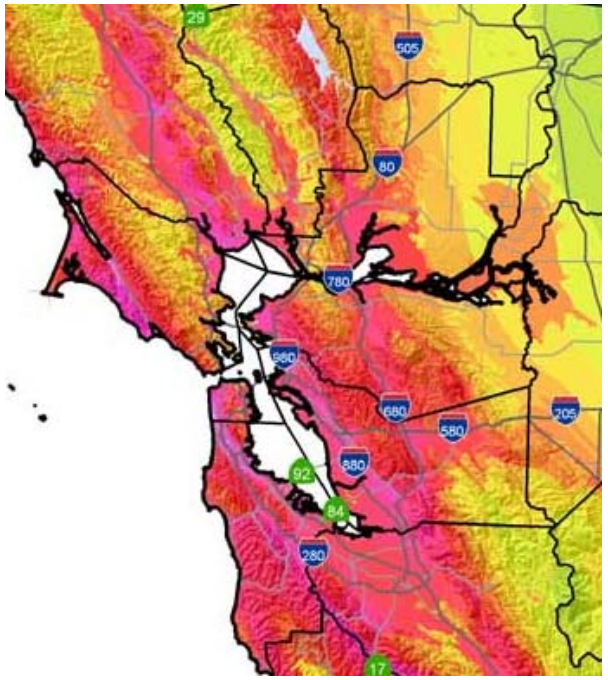
CGS has estimated shaking hazard using the same source model and Ground Motion Prediction Equations, plus a map of near surface soils that will amplify shaking.





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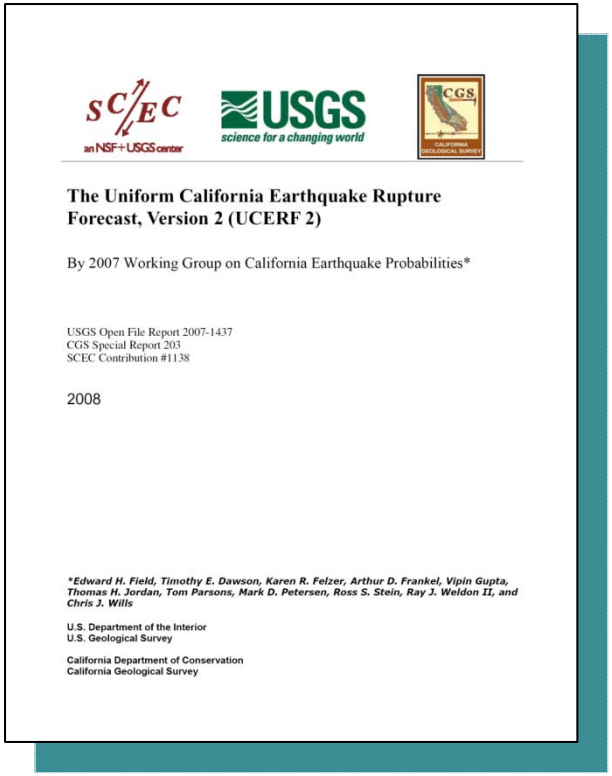
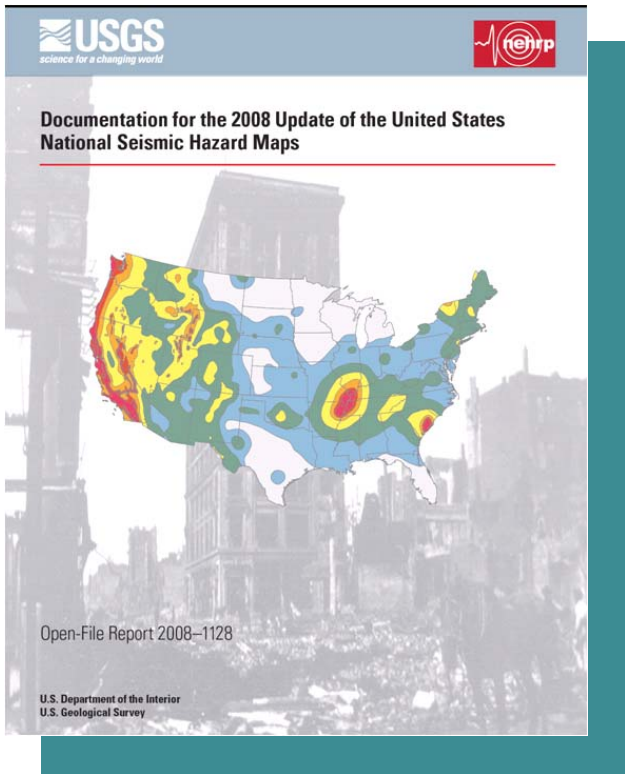
Thank You

For further information:





The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2) http://pubs.usgs.gov/of/2007/1437/
also published as CGS Special Publication 203 :
http://www.conservation.ca.gov/cgs/rghm/psha/Pages/sp_203.aspx

Documentation for the 2008 Update of the United States National Seismic Hazard Maps http://pubs.usgs.gov/of/2008/1128/

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