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

# Earthquake Early Warning as an Integral Part of Developing the USGS Advanced National Seismic System

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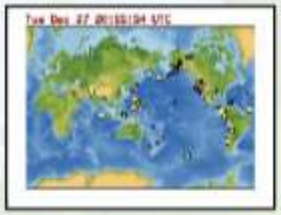
# ANSS Earthquake Information Products & Tools



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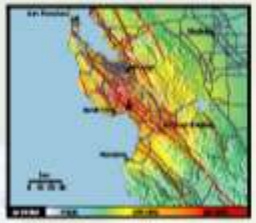

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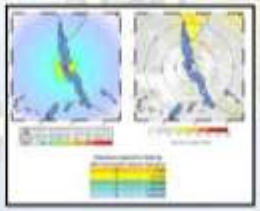
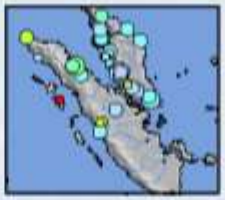


## PAGER

Estimates of population exposure to significant earthquake shaking anywhere in the world within minutes.
***http://earthquake.usgs.gov/pager/***


## Realtime Feeds & Data

Real-time earthquake data in a variety of formats including RSS, CAP, CSV, and KML.
***http://earthquake.usgs.gov//eqcenter/feeds_data.php***



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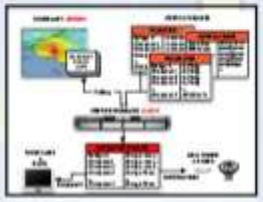

## ShakeCast

Automated ShakeMap delivery, damage assessment, and notification for critical lifeline operators.
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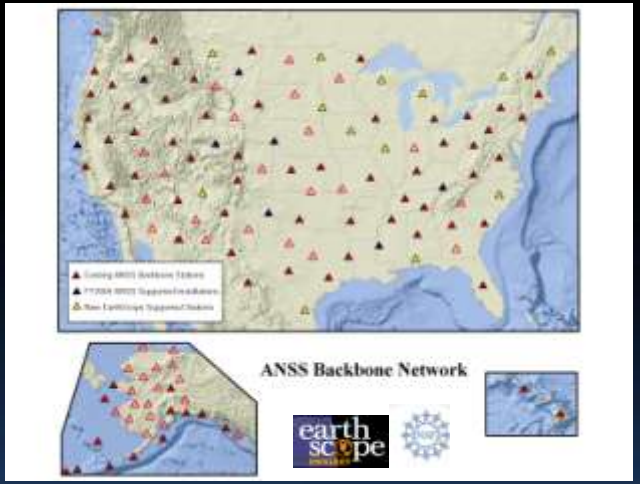
## CISN Display

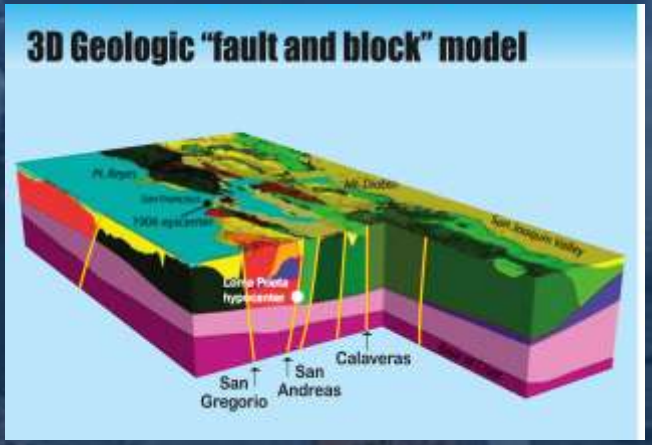
Downloadable software to visualize and receive notifications for seismicity anywhere in the world on your computer
***http://www.cisn.org/software/cisndisplay.html***

# 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.





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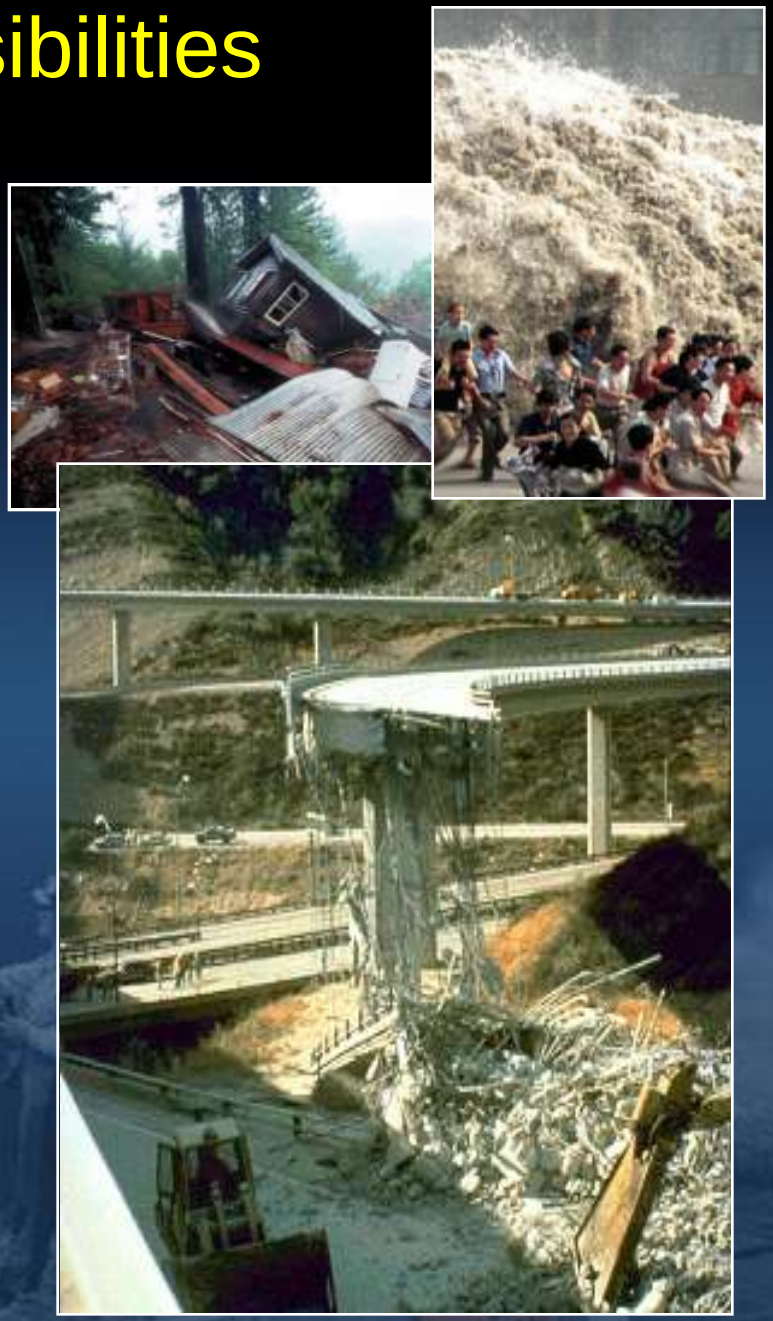
# USGS Stafford Act Responsibilities

- USGS has the lead federal responsibility to provide notification and warnings for **earthquakes**, **volcanoes**, and **landslides**.
- Currently, most USGS reporting is in the immediate post-earthquake period, providing *situation awareness*
- USGS supports no earthquake prediction research
- Earthquake ‘early warning’ can help us meet our Stafford Act  mission



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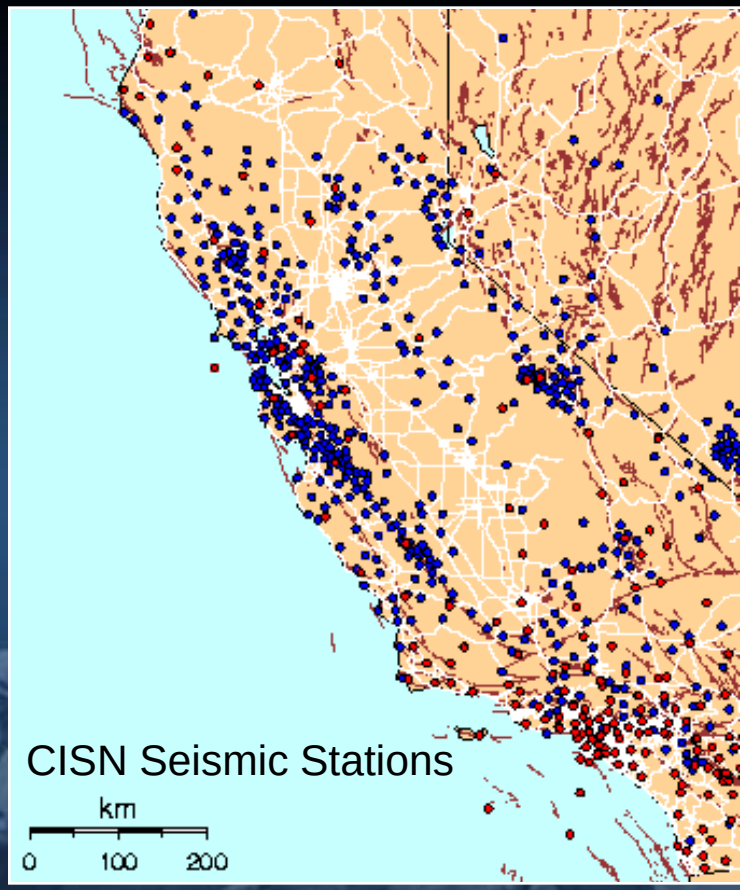
# ANSS/CISN Early Warning R&D Project

- The CISN EEW project is a collaboration among the USGS, the California Institute of Technology, the University of California-Berkeley, the Swiss Seismological Service, and the Southern California Earthquake Center.
- Our goals are to identify improvements to the existing monitoring networks needed to support reliable earthquake warnings, and to better understand how a warning system could be used in California to improve safety and reduce losses.
- Tests on of several algorithms on several recent California earthquakes have demonstrated that strong shaking can be detected and analyzed within seconds

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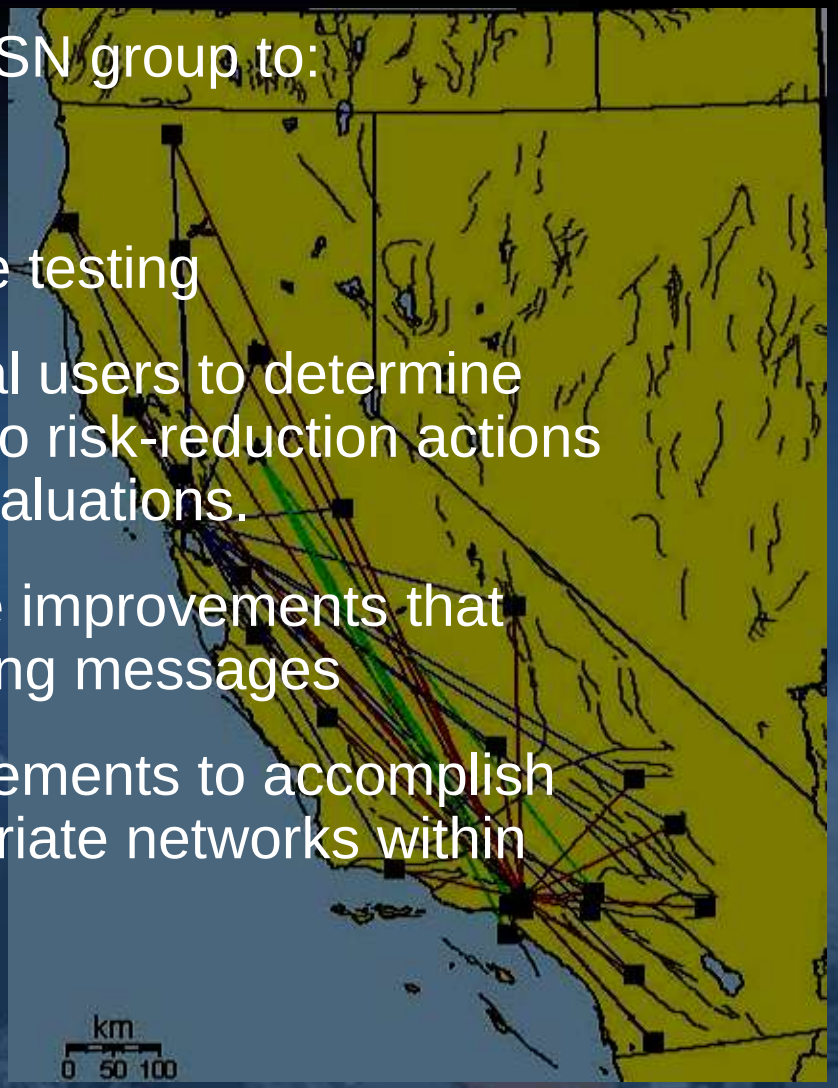
CGS USGS OES Caltech UC Berkeley

# Progress in the first three years

To date, USGS has funded the CISN group to:

- Algorithm design and testing
- Seismic monitoring infrastructure testing
- Identify and partner with potential users to determine the efficacy of warnings related to risk-reduction actions and emergency management evaluations.
- Carry out specific CISN software improvements that enable rapid production of warning messages
- Identify seismic network enhancements to accomplish EEW for CISN and other appropriate networks within ANSS.

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# Issues remaining to be addressed

Before building a prototype system, we need to better understand and demonstrate quantitatively:

1) expected warning times for various source/network configurations;

2) the frequency of false alarms and missed warnings;

3) capital costs of building the network, and its operational costs;

4) the types of users of an early warning service and their needs (so as to determine the most useful products);

5) the economic benefits of the proposed system (e.g., benefit/cost ratio);

6) the technological limitations of the current CISN networks to provide warnings (e.g., hardware, software communications).

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# 2009-2010 Investments in CISN Networks

We know that by replacing older high-latency digitizers we can significantly decrease warning times. Consequently, we plan for a major upgrade of the CISN network.

USGS has received nearly $30million of so-called 'economic stimulus' funding
-- about 2/3 of which will be used to upgraded obsolete equipment to expand the ANSS.
--some of those upgrades reduce latency at CISN networks stations, thereby enabling EEW.

However, because we are not able to make <new> long-term funding commitments with stimulus funds, we will not be using them to build a prototype EEW system in California.

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# 2009-2010 Investments in CISN Networks

Specific milestones for next funding period will be:

**Year 1:**

- Identify and partner with potential users to determine their warning needs and desired uses of EEW products, which we view as a critical next step.




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# 2009-2010 Investments in CISN Networks

**Year 2:**

- Combine the best aspects or integrate the independent results of tested EEW algorithms into a single beta system that can be implemented CISN-wide, for portable-system use, and for specific user applications.
- In consultation with selected users, develop one or more warning products, and document their accuracy and timeliness

**Year 3:**

- Deliver automated warning products to previously selected users in a test mode.
- Prepare design-level specifications for prototype EEW system in California, a full cost and deployment proposal, and a cost-benefit analysis.


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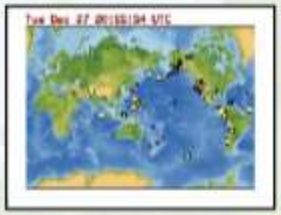

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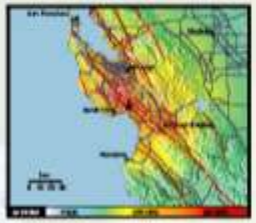

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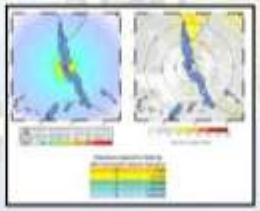

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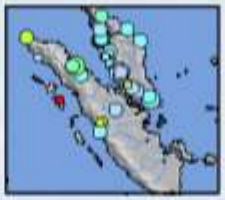

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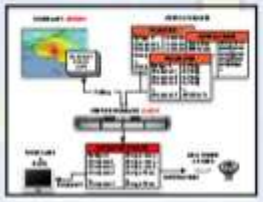

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