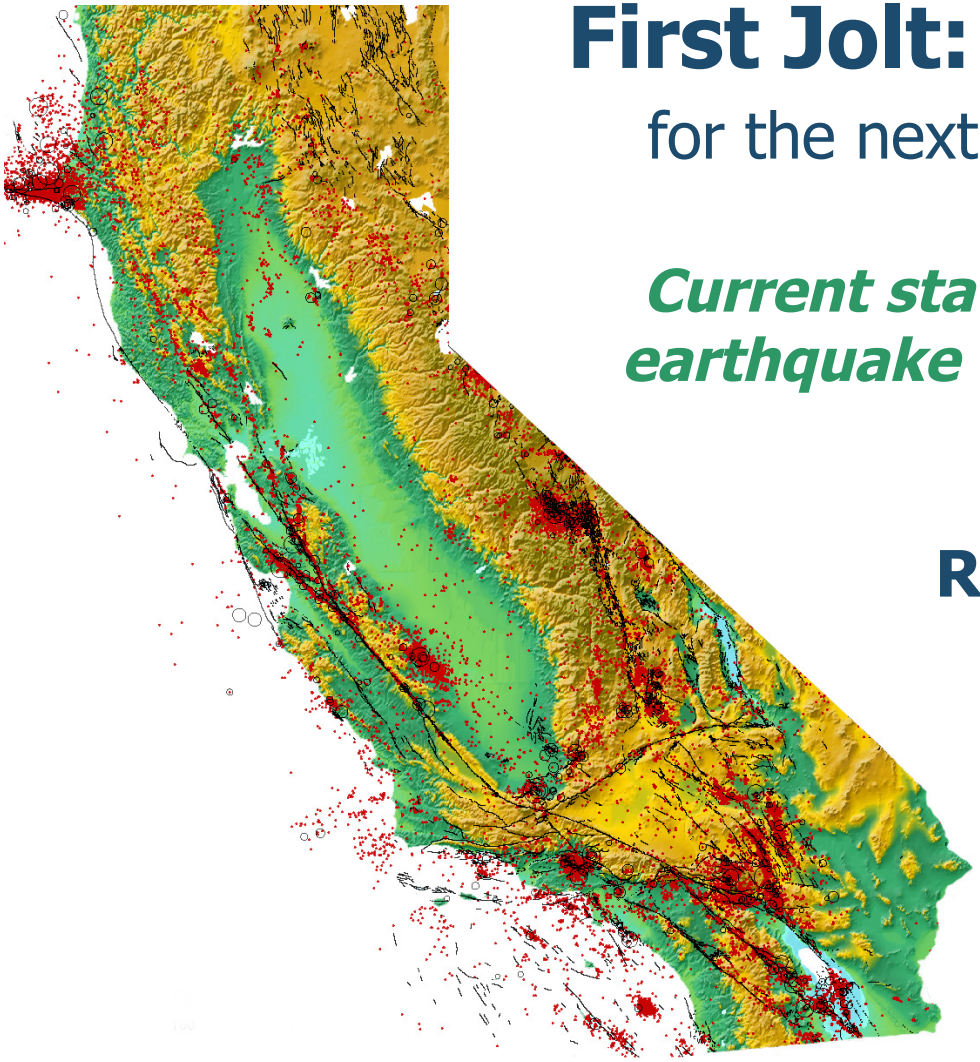

First Jolt: ShakeAlert

for the next big earthquake in California

Current status and future outlook for earthquake early warning in California

Richard Allen

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a collaboration between...

Berkeley Seismological Laboratory, University of California

Seismological Laboratory, California Institute of Technology

Swiss Seismological Service

SCEC, an NSF + USGS center

USGS, science for a changing world

What is ShakeAlert?

➔ Earthquake Early Warning

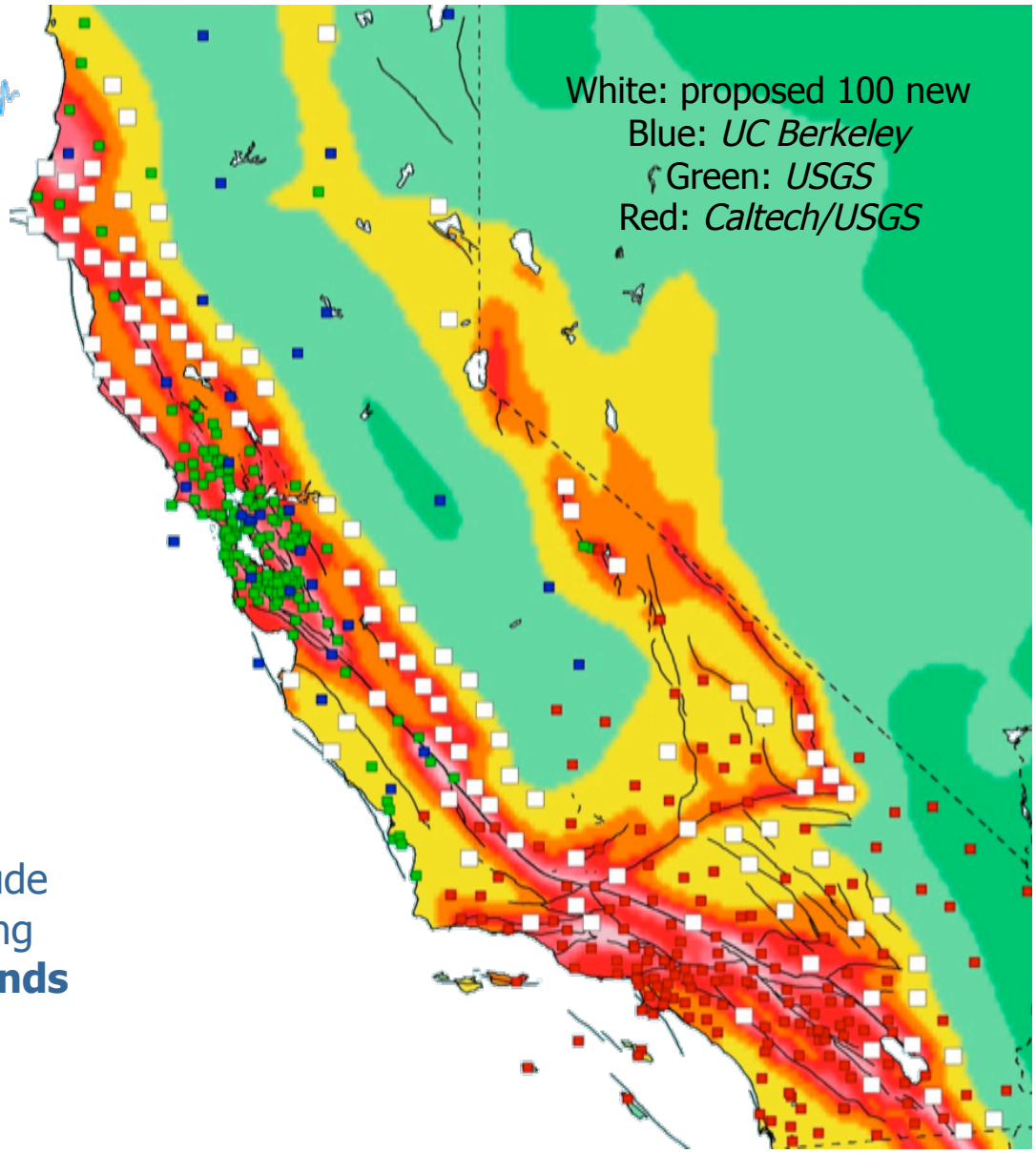
- rapid detection of earthquake nucleation
- instant alerts of forthcoming ground shaking
- updated shaking predictions as ground motion propagates
- more rapid "post-earthquake" information ie ShakeMaps

➔ a continuum of earthquake information

Earthquake early warning

Statewide seismological networks

CISN California Integrated Seismic Network ANSS



Continuous real-time seismic data currently streams from 400 stations across the state

An additional 100 have been proposed to fill the gaps (white)

Real-time processing

- detects earthquakes
- estimates the magnitude
- predicts ground shaking

...all in a few seconds

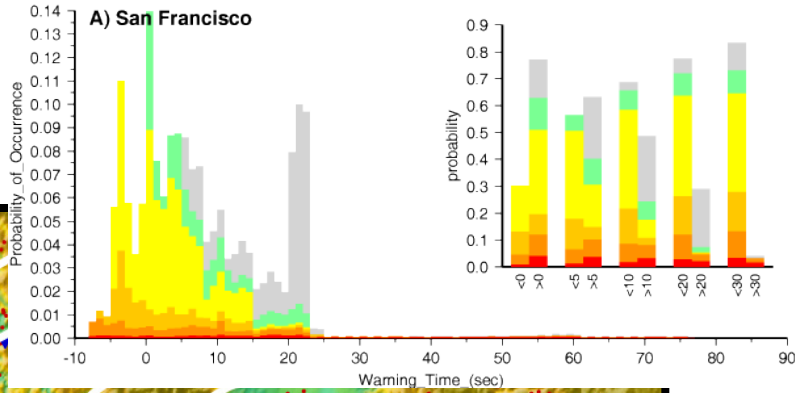
Berkeley Seismological Laboratory

Warning times

at San Francisco City Hall

A few to tens of seconds

up to ~1 min

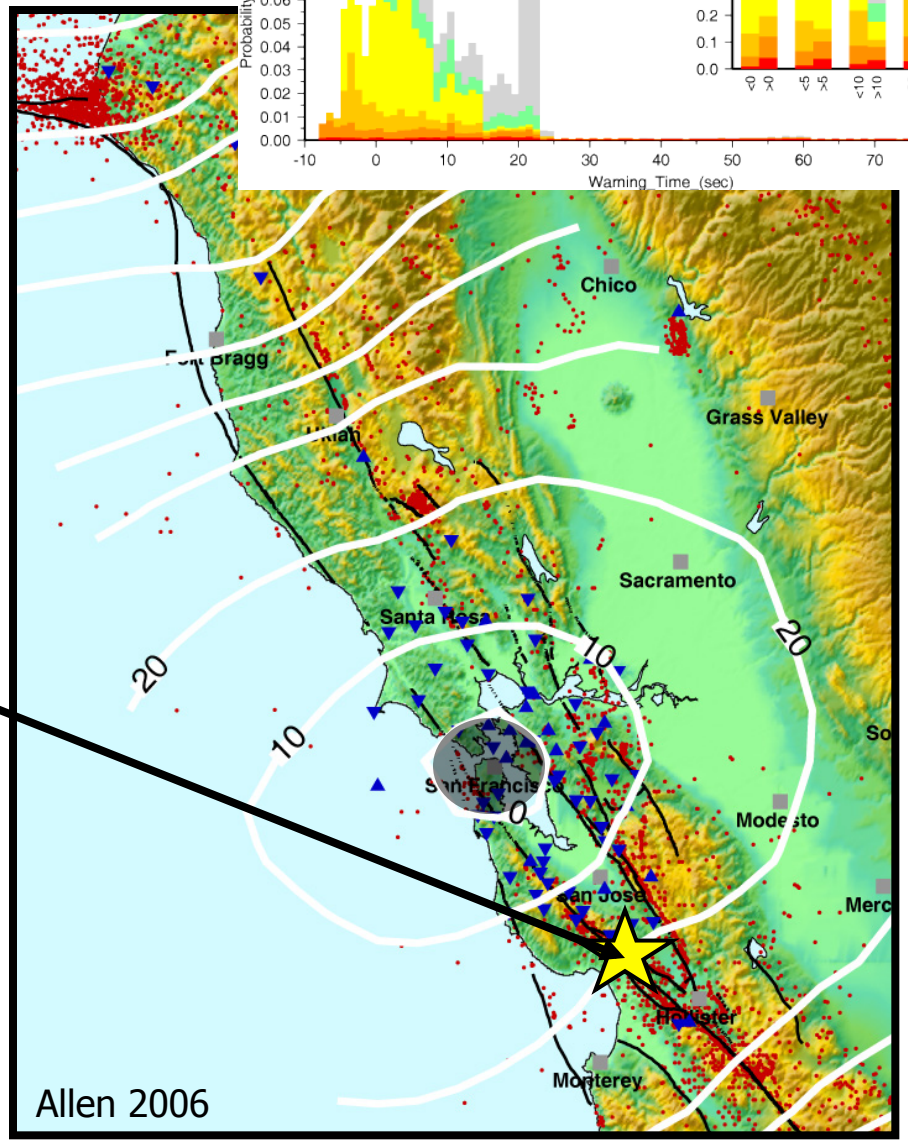


Loma Prieta earthquake

- **20 sec warning** for San Francisco and Oakland

84% of the fatalities

were in San Francisco and Oakland



- Existing stations
- 2 sec system latency
- From "Alarm" time (4 sec data, 4 stations)

Who would use this?

1. Personnel protection

Move to a safe zone

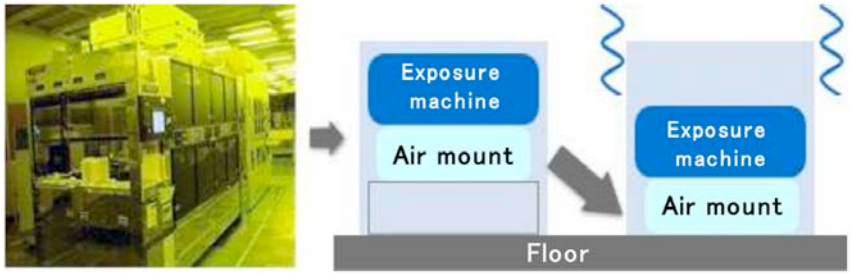
- **under a table**
- **away from falling hazards and windows**
- **away from hazardous chemicals and machinery**

Who would use this?

1. Personnel protection
2. Automated mechanical response

- **slow and stop trains,**
- **airplanes "go-around"**
- **red toll/meter lights at entries**
- **open elevator doors and exits**
- **isolate hazardous chemicals**
- **sensitive equipment to safe mode**

OKI **chip manufacturer**



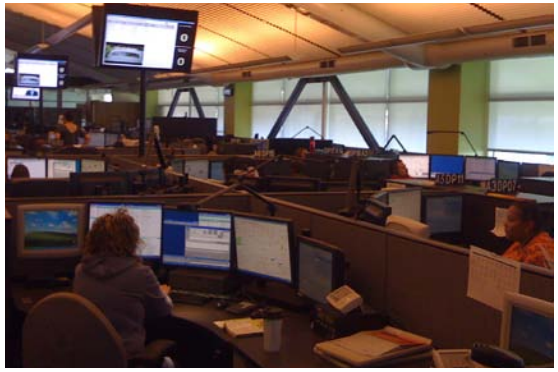
2003: Two earthquakes
•$15 million in losses
•17 and 13 days loss of productivity
Installed warning system + shear walls
Two earthquakes since installation
•$200K in losses
•4.5 and 3.5 days loss of productivity

Who would use this?

1. **Personnel protection**
2. **Automated mechanical response**
3. **Situation awareness**

Understand why systems are failing
Prevent cascading failures

- **transportation and utility systems**
- **information before communications are lost**



Warning to test user group

- **Will begin providing warnings to small test user group in 2010**
- **Currently looking for interested user groups**

Warnings communicated via internet and dedicated links initially