

Bottom up California earthquake rupture forecast

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Steps in Bottom-Up Process

Draw 1,000,000 “Simquakes”, then assign attributes

Magnitude distribution

Historical + instrumental catalog; Wang et al.

Distinguish main- vs after-shocks; on- vs off-fault events.

Spatial distribution

Smoothed seismicity relevant to decadal forecast

Geodetic + geologic strain rate relevant for long-term forecasts

Fault assignment

Morgan Page program

Focal mechanism distribution

On faults

Off faults

Clustering model

Distance kernels from Kagan and Jackson, CSEP model

Modified Omori temporal distribution

First-generation clustering only.

Testing

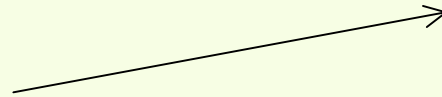
Retrospective testing; Subsets of catalog; paleo-seis

Prospective testing: formulate probability densities in CSEP format

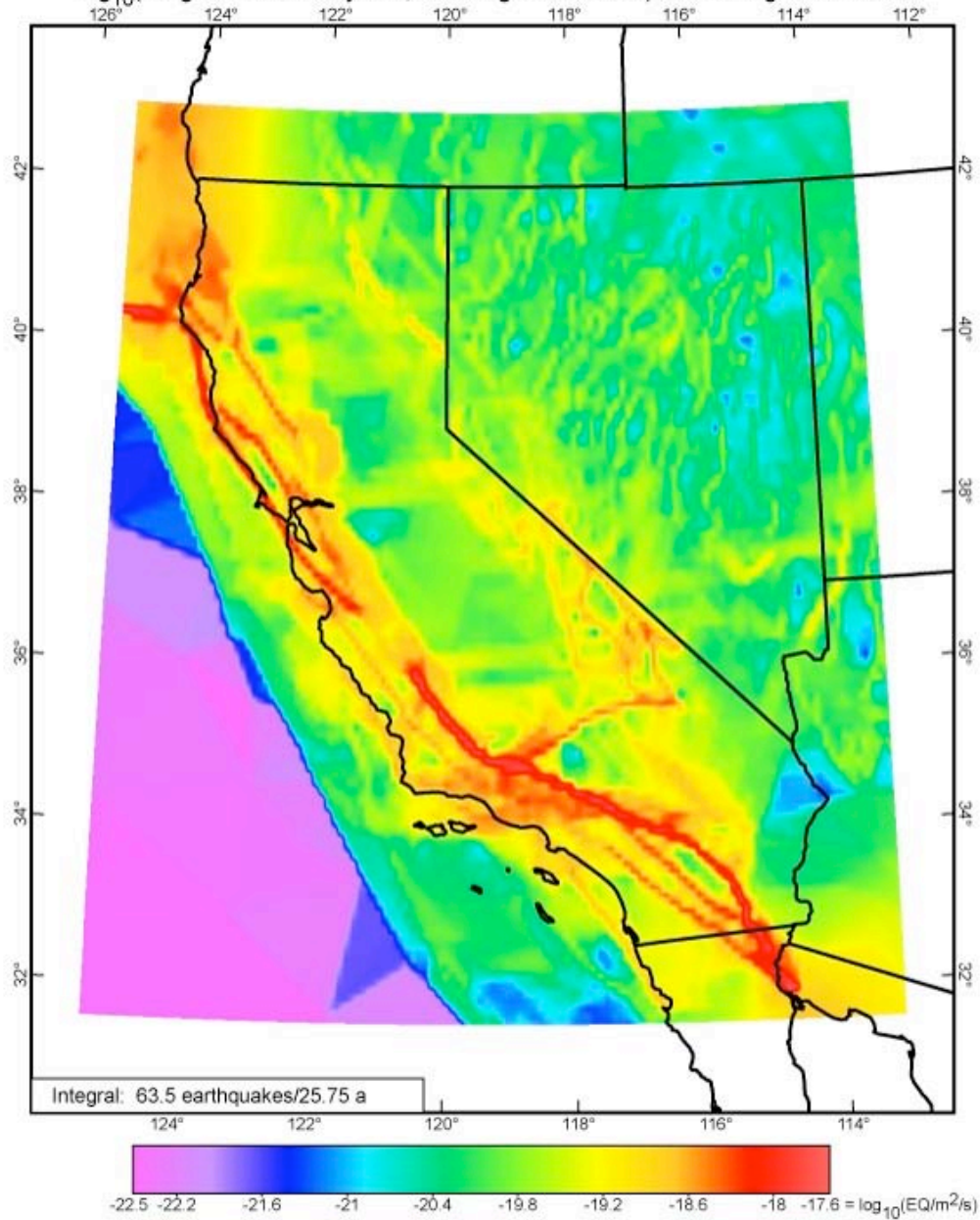
All events

Triggered events

Spontaneous events



SHIFT submission to RELM, 2005.09.01 (GCN2004084)
 Log_{10} (long-term seismicity rate, including aftershocks) above magnitude 5.663



Assumptions

- Future will be like past (as we think it was).
- 50% aftershocks at magnitude 4.7+, tapered to 25% at 7.0+
- Catalogs and paleo-seismic records show samples of random processes.
- Spatial, temporal, focal orientation clustering.

Problems to be solved

- Magnitude-dependent assignment of simquakes to faults.
- How badly can we violate mag vs fault length scaling? Some big quakes will fall on small faults.
- How to evaluate consistency with paleoseismic data? Model predicts a very specific displacement history on each fault; when is such a history inconsistent?

Advantages of plan

- Satisfies test criteria from start
 - Magnitude distribution
 - Moment rate
 - Ratio of on-fault to off-fault
 - Magnitude-area-length scaling
- Includes aftershocks
- Short term (days – decades) included clustering
- Tunable time interval: 1 day to 10,000 years
- Uses strain-rate data for longer time windows