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LONG- AND SHORT-TERM CALIFORNIA FORECASTS

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In this project we developed long-term and short term earthquake forecasts for California to test important hypotheses about earthquakes and to provide validated input to seismic hazard models. Our work in long-term forecasting centers around the 2007 Working Group on California Earthquake Probabilities (WG07) report and issues raised by it. We went beyond the type of comparisons expected in the Regional Earthquake Likelihood Models (RELM) project by testing the various components of the WG07 stationary and time-dependent models. We also developed simpler models, based on geodetic, geologic and seismological data which can be compared to the WG07 models in the same categories. We tested WG07 and our new models retrospectively and set up prospective tests. We compared several branching (clustering) models to develop an optimal model daily forecast model. We used that model to study whether clustering behavior varies with space and time, and in order to compare our optimal model with the USGS Short Term Earthquake Probability (STEP) model and other daily forecasts. We submitted one of our refined branching model to the Collaboratory for Study of Earthquake Predictability (CSEP), and are running the model at UCLA as well to validate the CSEP calculations. We also developed a test for evaluating earthquake rate models with catalogs having time dependent completeness, magnitude roundoff, and location and magnitude errors. Figs. 1-2 display examples of our forecasts for California-Nevada region.

Below we list publications (with appropriate SCEC publication numbers) and abstracts, related to the topic of this proposal.

PUBLICATIONS:

1. Wang, Qi, David D. Jackson, Yan Y. Kagan, 2009. California earthquakes, 1800-2007: a unified catalog with moment magnitudes, uncertainties, and focal mechanisms, *Seism. Res.*

Lett., **80**(3), 446-457, SCEC #1269.

2. Kagan, Y. Y. and D. D. Jackson, 2009. Short- and long-term earthquake forecasts for California and Nevada, accepted by *Pure Appl. Geoph.* (*Seismogenesis and Earthquake Forecasting: The Frank Evison Volume*), SCEC #1246.
3. Console, R., D. D. Jackson and Y. Y. Kagan, 2009. Using the ETAS model for catalog declustering and seismic background assessment, accepted by *Pure Appl. Geoph.* (*Seismogenesis and Earthquake Forecasting: The Frank Evison Volume*), SCEC #1257.
4. Kagan, Y. Y., 2009. Statistical distributions of earthquake numbers, *Geophys. J. Int.*, submitted, see http://eq.ess.ucla.edu/∼kagan/nbd_index.html

ABSTRACTS

5. Werner M J, Jackson D D, Kagan Y Y, 2008. Next-Day Earthquake Forecasts for California, *XXXI General Assembly European Seismol. Commission, Programme and Abstracts*, Hersonissos, Crete, p. 200, abstract.
6. Kagan, Y. Y. and D. D. Jackson, 2008. Testability of forecasts from fault-based and earthquake-based simulators, Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract S32A-02.
7. Werner, M. J., D. D. Jackson, Y. Y. Kagan, 2008. Next-Day Earthquake Forecasts for California, Poster, Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract S33A-1922, abstract.
8. Werner, M. J., D. D. Jackson and Y. Y. Kagan, 2009. 24h High-Resolution Earthquake Forecasts for California IASPEI, abstract.

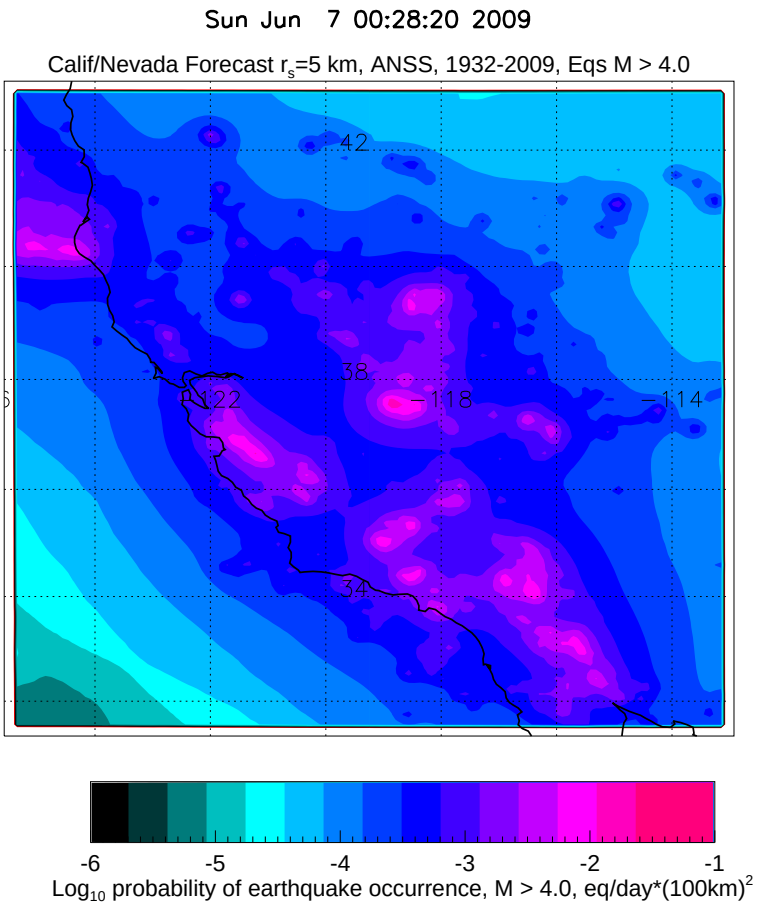

Figure 1:

Earthquake long-term potential based on smoothed seismicity. Earthquakes ($M \geq 4.0$) from the ANSS catalog since 1932 are used. Earthquake occurrence is modelled by a time-independent (Poisson) process. Colors show the long-term probability of earthquake occurrence.

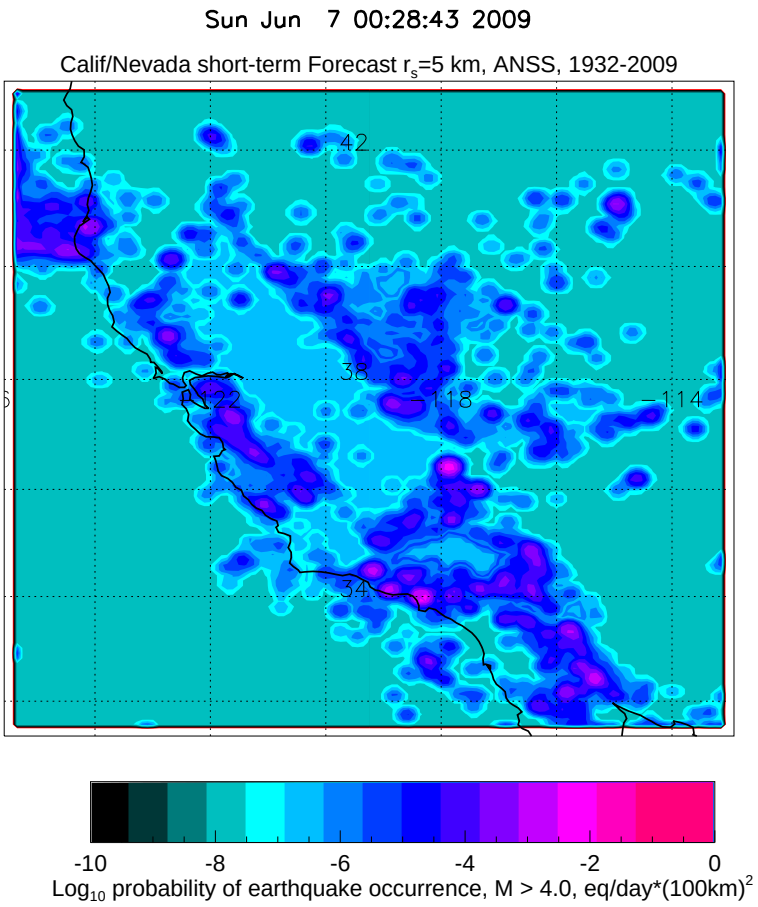

Figure 2:

Earthquake short-term potential based on smoothed seismicity. Earthquakes ($M \geq 4.0$) from the ANSS catalog since 1932 are used. Earthquake occurrence is modelled by a temporal process controlled by Omori's law type dependence. Colors show the long-term probability of earthquake occurrence.