

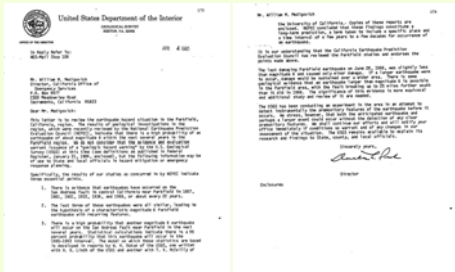
Abstract

The 1985 prediction of a magnitude 6 quake at Parkfield was too vague in several important respects to meet the accepted definition of an earthquake prediction. Even so, it failed because no significant event occurred in the 95 percent time window (1985-1993) anywhere near Parkfield. The magnitude 6 earthquake near Parkfield in 2004 failed to satisfy the prediction not just because it was late; it also differed in character from the event predicted. Furthermore the 2004 event was expectable according to a simple null hypothesis assuming a Gutenberg-Richter magnitude distribution with Poissonian recurrence. The 2004 event is commonly interpreted as confirming the characteristic earthquake hypothesis. Not so. The characteristic model as applied at Parkfield rests largely on selected data not appropriate for hypothesis testing. The most comprehensive expression of the original characteristic earthquake model failed rigorous tests. Even had the recent Parkfield event occurred earlier, it would not outweigh the other data. Modified versions of the hypothesis, allowing for data errors and inter-segment interaction, have not failed but they could not be falsified within our lifetimes in any experiment yet underway. Nevertheless the characteristic model is widely used in official hazard analysis; a more rigorous approach would be appropriate.

http://seec.ess.ucla.edu/~ykagan/park2004_index.html

Jackson, D. D., and Y. Y. Kagan, 2006. The 2004 Parkfield earthquake, the 1985 prediction, and characteristic earthquakes: lessons for the future, *Bull. Seismol. Soc. Amer.*, 96(4B), S397-S409.

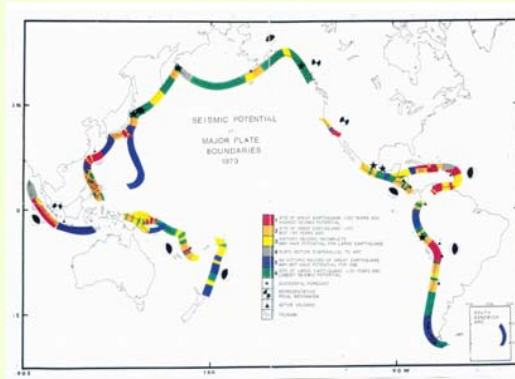
The 1985 prediction (Shearer, USGS Open-file report 85-507, 1985)



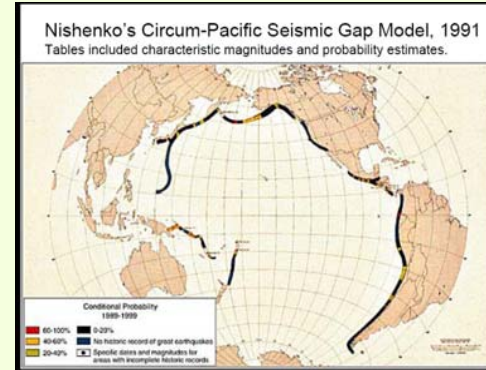
The 1985 Parkfield prediction: What went wrong (AGU2006 Fall, S23C-0175)

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Seismic Gap Model of McCann, Nishenko, Sykes, and Krauss, 1979.



First comprehensive, testable seismic gap model, by Nishenko and Sykes (1989) and Nishenko, (1991). It's methodology was similar to that used in the Parkfield prediction. This model was rejected in test by Rong et al. (2003). Way too few "characteristic" events occurred. Even if the 1985 prediction had succeeded, it would not change the results of the comprehensive test.

Conclusions

- The 1985 "prediction" did not meet the standard definition (time, magnitude, location, probability).
- Technical details, especially magnitude and location, were vague and inconsistent.
- In spite of loopholes, the prediction failed with respect to time and location.
- A G-R, Poissonian null hypothesis works better than the "characteristic" model at Parkfield:
 - The magnitude distribution resembles the G-R distribution more than a characteristic distribution. Same is true for many "seismic gaps" around the globe (Figures 1 and 3).
 - Magnitude 6 earthquakes explain about 1/10 of the moment accumulation on the segment; a G-R distribution with corner magnitude 8 explains it all.
- The 2004 did release moment where predicted; it may signal some rupture control by relatively persistent conditions, but general applicability is doubtful.
- The 2004 Parkfield event adds little support to the characteristic earthquake hypothesis. There is presently no testable formulation of the characteristic hypothesis that hasn't already been rejected.

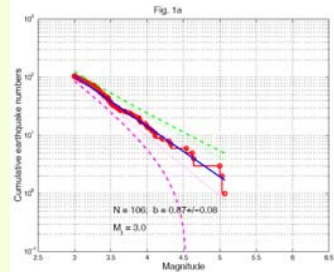


Fig. 1a. Magnitude-frequency relation for the Parkfield earthquakes, based on ANSS (2006) catalog. Earthquakes are selected in the Parkfield box proposed by Michael and Jones (1998). Solid line is the G-R approximation. Dotted and dashed lines are 95% confidence limits, former are conditioned by the total number of earthquakes observed, and latter are estimates based on the Poisson assumption for earthquake occurrence. (a) Time period 1967-2003 (before the 2004 Parkfield earthquake).

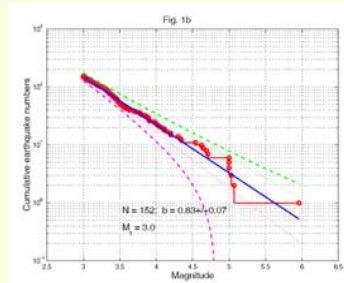


Fig. 1b. Time period 1967-2005 (including time after the 2004 Parkfield earthquake).

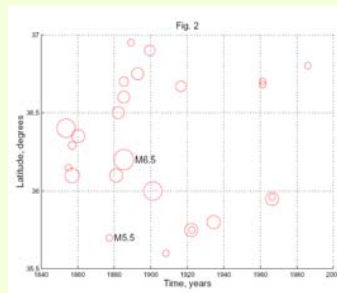


Fig. 2b. Temporal pattern of magnitude 5.5 and larger earthquakes along the San-Andreas fault trace. Diameter of circles is roughly proportional to earthquake magnitude.

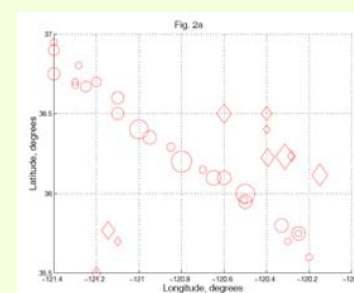


Fig. 2a. Spatial pattern of magnitude 5.5 and larger earthquakes along the San Andreas fault since 1800 (from Topozada et al. (2000)). The symbol size is proportional to event magnitude, earthquakes along the fault trace are shown as circles, outside the San Andreas as diamonds. Contrary to popular belief, moderate earthquakes have occurred in the "locked zone" north of latitude 36 before 1900 as shown in the picture on the left.

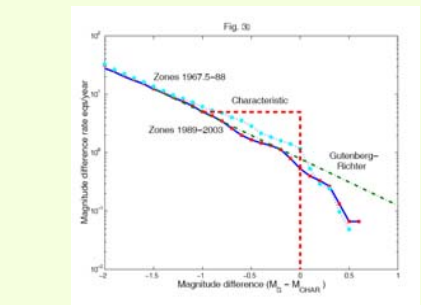


Fig. 3. Distribution of PDE magnitude differences for two time periods: July 1, 1968 - January 1, 1989 and January 1, 1989 - January 1, 2003, calculated relative to the characteristic magnitude (Nishenko, 1991). Circles, time interval July 1, 1968 - January 1, 1989; crosses, time interval January 1, 1989 - January 1, 2003; dash-dot line, the G-R relation; dashed line, the predicted distribution of characteristic magnitudes.

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