Geophysical Research Abstracts, Vol. 9, 06243, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06243

Recurrence time distributions of large earthquakes: the role of fault interaction

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We study the effect of fault interaction on the recurrence time distribution of large earthquakes on the same fault. A single isolated fault is modeled by a Brownian relaxation oscillator leading to a Brownian passage-time distribution for the recurrence intervals. Interaction between different faults is imposed in terms of stress increase and decrease resulting in three possible ways: the occurrence of an earthquake is advanced or delayed; or the earthquake is triggered instantaneously. The results indicate the existence of two regimes: for weakly coupled faults, the recurrence time distribution of earthquakes on one fault follows mostly the Brownian passage-time distribution For a strongly coupled system, the faults are synchronized and the effect of instantaneous triggering becomes dominant: the recurrence time distribution follows a Gamma or a Weibull distribution. The transition from weak to strong coupling is abrupt and behaves like a phase transition. It occurs when the stress transfer equals the average stress deficit. The results are interpreted in terms of a phase diagram. This diagram inludes a regime, where the distribution of recurrence times is similar to a numerical model for California. We claim that the emergence of the Gamma and the Weibull distribution can be considered as an effect of fault interaction.