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Properties of the aftershock decay rate across different stress regimes

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In the limited power law model (LPL), the aftershock decay rate is controlled by a power law scaling exponent and two characteristic rates, λ_a and λ_b. These rates limit the power-law aftershock decay rate over short and long times and can be related to fracture mechanics of rocks as follows:

1. Over long time, $t > 1/\lambda_a$, a transition from a power-law to an exponential decay results from the minimum velocity of subcritical crack growth. From real aftershock sequences and laboratory experiments, it has been inferred that the time of this transition may be related to faulting patterns and the localization process of the deformation along dominant major faults.
2. Over short time, $t < 1/\lambda_b$, the model predicts a linear decay rate with a duration which may be determined from both the magnitude of the stress perturbation and the stress accumulated across the fault system.

$\{\lambda_a, \lambda_b\}$ can be estimated from observed aftershock sequences using the method of maximum likelihood and, in a vast majority of cases, the LPL fits the data better than other formula (e.g. the Modified Omori Law).

Fracture populations and the magnitude of stress are mainly controlled by the tectonic loading and the orientation of the crustal stress field. Hence, using the LPL, we investigate changes in λ_a-value and λ_b-value according to different stress regimes.