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# Strain accumulation rates in California inferred from aftershocks

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The usual measure of the time delay before the onset of the power law aftershock decay rate is the parameter $c$ of the modified Omori law (MOL),

$$\Lambda(t) = \frac{K}{(c+t)^p},$$

where $K$ is a constant aftershock rate, $t$ is the elapse time from the mainshock and $p$ is the slope of the power law aftershock decay rate. In a limited power law model (LPL),

$$\Lambda(t) = \frac{A\,(\gamma(q,\lambda_b t) - \gamma(q,\lambda_a t))}{t^q},$$

the power law decay is limited in time by two characteristic rate constants ($\lambda_a < \lambda_b$). Over long times ($t > 1/\lambda_a$), an exponential decay dominates while over short times ($t < 1/\lambda_b$), a linear decay dominates. In this case, the power law regime is delayed according to a decreasing magnitude of an upper limit of the overload distribution, a function which combines the state of stress and the state of strength in the aftershock zone just after the mainshock. Finally, assuming $q = p = 1$ and $\lambda_a \to 0$, it is possible to show that at $t = 0$

$$c = \frac{K}{A\lambda_b}.$$

Such a relationship gives a physical interpretation to the parameter $c$ of the MOL. Then, the evolution of the $c$ and $\lambda_b$ values provide a possible indicator of long-term changes within the brittle upper crust.

Here, we analyse seismicity along the San Andreas fault (California, USA) over the last 20 years in order to determine the time delay before the onset of the power law aftershock decay rate. We show that the evolution of the $\lambda_b$-value may be related to different scenarios of slip rates (1) in Southern California, (2) along the creeping segment near Parkfield and (3) in the San Francisco Bay region. Then we discuss the stress accumulation rates at a regional length scale, and the interplay between seismic and aseismic slip.