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Insights into Earthquake Cycling and Clustering from linked Stress Release Models

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In seismic hazard analysis, the temporal evolution of seismicity is often modeled by a Poisson process, assuming that earthquakes occur independently of each other. The Poisson model, however, has its drawbacks: it is not based on physical grounds and, for example, it cannot account for correlated earthquake occurrence observed in nature such as foreshock and aftershock activity accompanying large earthquakes. Here we investigate the linked stress release model, a stochastic version of elastic rebound theory, regarding the impact for seismic hazard assessment. In particular, we are concerned with the occurrence of seismic cycles as well as clustering of large events. Our simulations indicate that large earthquakes do occur quasiperiodically in the stress release model independently whether or not fault zone coupling (stress triggering) is considered. In the case of coupling, however, we find that large earthquakes generate Omori-type aftershock sequences at adjacent seismogenic zones. Moreover, the largest earthquakes of neighboring regions become correlated in time.