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# Bayesian inference in linear mixed models for spatial distribution of fault slip

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Bayesian inference in linear mixed models for spatial distribution of fault slip Surface displacements produced by large earthquakes can in general be related with a spatial slip distribution on a fault interface by linear integral equations. With known fault geometry, parametric expansion of the slip distribution by a finite number of known basis functions yields a set of observation equations expressed in a simple vector form. Linear mixed models are able to handle an extraordinary range of complications in regression-type analyses. Their most use is to account for within subject correlation in longitudinal data analysis. They are also the standard tool for smoothing spatial count data. In particular, the classical geostatistical approach called kriging can be cast as a linear mixed model by adding random effects to the traditional linear model. In this paper, we apply the linear mixed model to fault slip distribution, and take the 2004 M6.0 Parkfield earthquake as a study case. In a first step we use the Gaussian nature of the posterior distribution to sample random realizations from the linear mixed model and to report on several descriptive statistics. In order to take non-linear constraints like positivity into account, we use a Markov Chain Monte Carlo (MCMC) sampler to sample from the posterior distribution of slip-distributions that can explain the geodetic observations.