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Effect of data quality on a hybrid Coulomb/STEP model for earthquake forecasting

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Operational earthquake forecasting is rapidly becoming a 'hot topic' as civil protection authorities seek quantitative information on likely near future earthquake distributions during seismic crises. At present, most of the models in public domain are statistical and use information about past and present seismicity as well as b-value and Omori's law to forecast future rates. A limited number of researchers, however, are developing hybrid models which add spatial constraints from Coulomb stress modeling to existing statistical approaches. Steacy et al. (2013), for instance, recently tested a model that combines Coulomb stress patterns with the STEP (short-term earthquake probability) approach against seismicity observed during the 2010-2012 Canterbury earthquake sequence. They found that the new model performed at least as well as, and often better than, STEP when tested against retrospective data but that STEP was generally better in pseudo-prospective tests that involved data actually available within the first 10 days of each event of interest. They suggested that the major reason for this discrepancy was uncertainty in the slip models and, in particular, in the geometries of the faults involved in each complex major event. Here we test this hypothesis by developing a number of retrospective forecasts for the Landers earthquake using hypothetical slip distributions developed by Steacy et al. (2004) to investigate the sensitivity of Coulomb stress models to fault geometry and earthquake slip. Specifically, we consider slip models based on the NEIC location, the CMT solution, surface rupture, and published inversions and find significant variation in the relative performance of the models depending upon the input data.