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# Retrospective Testing of Clustered Seismicity Models on Prominent Earthquake Sequences

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We apply the concept of community-based earthquake forecast testing as introduced in the Collaboratory Study for Earthquake Predictability (CSEP) retrospectively to three earthquake sequences: the 1992 Landers, the 1997 Colfiorito sequence and the 2008 Iceland sequence. The abundant seismicity in these sequences offers ideal conditions for studying earthquake interaction. We analyze the performance of models from different classes: (1) a modified the Short-Term Earthquake Probability model, (2) a suite of Epidemic Type Aftershock Sequence models with and without time and space dependent parameters as well as various spatial triggering kernels, and (3) and a suite of models deriving seismicity rates from the rate and state theory following stress changes due to the main shock and moderate aftershocks.

Forecasts of 24 hours duration, updated every day, are computed starting shortly before the date of the largest shock, forecasting seismicity on a predefined grid, magnitude range and period. The forecasts are evaluated for data consistency and relative performance of the models. Results show that the statistical models perform well as sufficient data becomes available from the sequence, but perform poorly during the initial phase due to the lack of sequence specific information. Models using information from stress changes tend to perform better at the beginning of the sequence where stress changes from the large shock appear to have a significant influence; however, as the sequence unfolds, they loose predictive power.

Although three sequences are not a statistically representative sample, the concept of retrospective analysis of multiple aftershock sequences promises new insights into the potential of model classes to generate reliable earthquake forecasts in real-time.