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Applying the ETAS model for aftershock forecasting in low seismicity regions

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Most of Europe has relatively low seismicity but there are still areas in low seismicity zones that are capable of moderate to large earthquakes that have the potential to trigger damaging aftershocks. Forecasting models for aftershock occurrence have been developed for high seismicity areas, including California, Italy and New Zealand. One of these models it the Epidemic Type Aftershock Sequences (ETAS) model. The ETAS model is a stochastic point process model, which has a number of parameters that are usually fitted over a learning period before being applied in a forecasting sense.

Here we investigate how best to apply the ETAS model in a situation where no data was available to fit the ETAS parameter before the occurrence of a moderate to large earthquake. For this purpose we simulate aftershock sequences with common ETAS parameters; we study the efficiency of estimating the parameters from first aftershocks in order to forecast the on-going aftershock sequence and compare the probability gain of different forecasts; finally we investigate how many earthquakes are required for stable parameter estimations. The results will be useful input for the forecasting of time-varying earthquake hazard in Europe.