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Statistical and hybrid statistical/Coulomb modelling of the Canterbury earthquake sequence

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The Canterbury earthquake sequence began with an M=7.2 event in an area of low seismicity east of the the Alpine Fault and west of the city of Christchurch. It was followed by an M=6.3 earthquake to the east in Feb. 2011 that caused serious damage to Christchurch, and there were subsequent M=6 events in June and December which are consistent with stress triggering.

Here we model the likelihood of occurrence of each event using two approaches - the STEP model for earthquake probabilities currently in use in New Zealand and a new model that combines STEP with the spatial constraints imposed by Coulomb stress changes. We base our calculations on the first 10 days of data that would have been available following each significant earthquake and find that the hybrid model outperforms a STEP approach which does not include the spatial information.