Earthquake forecast modelling for the Mw 7.8 Kaikoura Earthquake and triggered Slow Slip Events

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The November 14th, 2016, *M*w 7.8 Kaikoura, New Zealand earthquake affected a large part of central New Zealand. The event ruptured around 12 independent faults and caused significant damage and shaking in many areas. This has meant that recovery effort has also been distributed over a very large area and has required a new approach to the dissemination of information about the potential for future shaking. We have provided forecasting information that targets a broad range of end-users who have become increasingly sophisticated in their use of the forecast information. Our information has ranged from aftershock probability tables through to detailed and specific engineering information. Additionally, the main shock triggered three slow slip events (SSE) on the Hikurangi subduction zone that were unique in character in our approximately 20 years of observations; these SSE provided a difficult challenge to the on going forecasting efforts and required a new approach to incorporate the effect of the SSE.
As is typical in such aftershock sequences, data quality issues have provided a challenge to the forecast modelling. The models we have applied are based on our past work and have used a hybrid of the STEP, ETAS and EEPAS models to produce the forecasts. An important change has been the use of the negative binomial distribution, constrained by ETAS simulations (Harte, 2013), to describe the uncertainty in the STEP rates. These uncertainties were also used to produce stochastic events sets for use in hazard calculations for engineering decisions (e.g., forecast design spectra as compared to the design standard or probabilities of landslide). To date the aftershock productivity has been low when compared to average New Zealand aftershock behavior.

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