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Modelling the effect of fault geometry on earthquake triggering

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This study incorporates the rupture extensions of big earthquakes in the formulation of the Epidemic Type Aftershock Sequence model (ETAS) model, which is a point process model widely applied in the studies of spatiotemporal seismicity, rather than regarding every earthquake as a point in space and time. We apply the new model to the catalog from Sichuan province, China between 1990 and 2013, during which the Wenchuan Mw7.9 earthquake occurred in May 2008. Our results show that the modified model has better performance in both data fitting and aftershock simulation, confirming that the elliptical aftershock zone is caused by the superposition of isotropic triggering effects from each patch of the rapture extension. Also, using the technique of stochastic reconstruction, we found that the direct productivities of aftershocks from each patch on the mainshock fault are positively correlated to the slip distribution. We also confirm that the elliptical aftershock zone is caused by the superposition of isotropic triggering effects from each patch of the rapture extension.

Figure: (Left panel) Reconstruction results of aftershock productivity from each patch of Wenchuan mainshock fault based on the new ETAS model, which considers the rupture extension of large earthquakes instead of regarding all the earthquakes as point source. The values are in the logarithm scale. The Wechuan mainshock is marked by the black pentagon.
(Right panel) Contour image of the vertical component of the coseismic displacement distribution and isoseismal lines caused by Wenchuan mainshock.

Keywords: earthquake fault, ETAS model, earthquake forecast, aftershock