Local near-instantaneous dynamic triggering of large earthquakes

Wenyuan Fan and Peter M. Shearer
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Abstract: We analyze teleseismic P waves from 88 large earthquakes (7.0 ≤ Mw < 8.0) from January 2004 to September 2015, with Global Centroid Moment Tensor (GCMT) centroid depths shallower than 40 km. We detect and locate 42 previously unidentified large early aftershocks triggered by M > 7 earthquakes within a few fault lengths (~300 km), during times that high-amplitude surface waves arrive from the mainshock. The observations indicate that near-to-intermediate field dynamic triggering commonly exists and fundamentally affects the aftershock activities of large earthquakes. The mainshocks and their early aftershocks are located at major subduction zones and continental boundaries, and all three types of focal mechanisms can trigger early aftershocks.

Figure caption: Time versus distance plot of triggered events. Forty-two triggered early aftershocks are shown as pentagrams with the same color of their triggering large earthquakes. The colored bars for each triggered early aftershock show one standard error of the epicentral distances and triggering times. The shaded region shows the likely influence of passing surface waves of a ~40s duration M7 earthquake. The insert shows the distribution of the triggering velocity for the 42 triggered events, defined as epicentral distance divided by the triggered time.