Mapped faults are the foundation of many seismic hazard studies. It is generally assumed that fault traces constrain the location, orientation, and size of future earthquakes. Yet many earthquakes, like the 1992 Landers, CA and 1999 Denali, AK earthquakes, rupture beyond previously mapped traces. Other events, like the 1994 Northridge, CA and the 2010 Christchurch, New Zealand earthquakes, serve as additional evidence that large earthquakes can and do occur off of mapped faults. My study examines the relationship between earthquakes and pre-existing faults, extends Wesnousky’s recent fault compilation [2006], and expands Black’s [2008] fault-jumping probability models. I update Wesnousky’s [2006] data set to include additional earthquakes, for which surface rupture maps have recently been published. I add additional parameters and use this new data set to estimate fault-jumping probability.

I distinguish between three types of faults; those already mapped at a scale appropriate to hazard studies such as Uniform California Earthquake Rupture Forecasts of 2007 and 2011; those that could be mapped from available surface imaging like LiDAR and high resolution optical pictures; and those that have no surface evidence detectable with present technology. I also distinguish between several types of earthquake ruptures; those that stay inside the limits of mapped faults; those that push the limits; those that violate the limits; and those that occur off of mapped faults. I match the fault types with the earthquake types, and make quantitative models of the probability that earthquakes will extend beyond mapped fault traces.