Project Abstract

We use dynamic 3-D finite element analysis to investigate slip partitioning and rupture propagation on an oblique left-lateral/normal fault system that branches near the surface into vertical and non-vertical branches. The model consists of a 70° dipping oblique-slip fault that extends from a depth of 15km to 5km depth and then branches upwards into a vertical segment and a segment dipping 45° The use of a simple regional stress field resolved onto all fault segments results in rupture propagation only on the base and vertical faults. However, the addition of a 2km by 3km barrier onto the bottom portion of the vertical fault causes enough of a stress perturbation on the upper dipping fault to nucleate rupture on this segment, resulting in a strongly partitioned slip distribution in the system. In all cases, strike-slip motion is concentrated on the vertical fault, and dip-slip motion is concentrated on the dipping fault. These results are not sensitive to the size and along-strike location of the barrier. Other observations in our models show that as the dipping fault slips, it induces a small amount of backwards slip on the vertical fault due to the high stress drop in our models, and the close proximity of the two branch segments. Our results may have important implications for the dynamics of branched faults and geometrically complex fault systems in general.