The Effect of Along-Strike Variation in Dip on Rupture Propagation on Strike-Slip Faults

Julian Lozos
Department of Geological Sciences, California State University, Northridge
julian.lozos@csun.edu

Strike-slip faults are nonplanar structures. Most large strike-slip faults have mapped complexities and discontinuities along strike, but seismological and geodetic inversions, as well as field geophysical studies, suggest dip can also vary substantially along the length of these faults. The southern San Andreas Fault, which twists from a northwest dip in the Carrizo Plain to vertical in the Mojave Desert to a southeast dip through San Gorgonio Pass, is a particularly notable example. A large body of observational and modeling research on the effects of along-strike geometrical complexity on rupture propagation already exists. However, I know of no previous existing modeling studies addressing the effect of an along-strike change in dip on rupture propagation on strike-slip faults. In this geometrical parameter study, I conduct 3D dynamic models of rupture propagation on strike-slip faults with a planar strike but a change in dip midway along the fault, in order to see how far rupture is able to propagate beyond the dip inflection point. I test a variety of compressional and extensional dip angles, and I vary the abruptness at which the dip change occurs. I explore this parameter space for several initial stress amplitudes and orientations. I find that larger and more abrupt changes in dip are more likely to stop rupture before it reaches the end of the fault. I also find that compression vs. extension has little effect on rupture extent compared to dip angle and abruptness when the fault is favorably aligned within a regional stress field, but for unfavorable alignments, compressional systems are more likely to stop rupture than extensional ones regardless of dip angle. This study may help assess possible rupture segmentation and endpoints for strike-slip faults with variable dip, as well as providing potential explanations for rupture endpoints along apparently planar fault segments.