SURFACE RUPTURE BEHAVIORS CONTROLLED BY EARTHQUAKE SOURCE DYNAMICS

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Surface rupture produced by earthquakes pose great threat on near-surface infrastructures. To understand the potential controlling mechanisms, we first collect data for earthquakes with $M_w \geq 6.0$ and $M < 6$ surface-breaching events in seismically active regions. For strike-slip and normal events, almost all earthquakes with magnitudes over 6.7 broke the surface. In contrast, buried and surface-breaching events co-exist with moderate magnitude (6.0-6.7) without systematic difference in hypocentral depth (5-20 km). For reverse events, there is no clear magnitude boundary. We propose that the complex surface rupture behaviors for moderate earthquakes can be attributed to the indeterministic rupture propagation on heterogenous faults, termed the hypocentral dependent effect, as demonstrated by our dynamic rupture models. While those small surface-breaching events are supposed to occur on infrequent shallow isolated velocity-weakening patches with intense stress release. Our study contributes to the understanding of the surface rupture behaviors references for assessing near-surface damage in future earthquakes.