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Highly Heterogeneous Pore Fluid Pressure Enabled Rupture of Orthogonal Faults During the 2019 Ridgecrest Mw7.0 Earthquake

Qibin Shi and Shengji Wei
Nanyang Technological University, Earth Observatory of Singapore, Asian School of the Environment, Singapore
(qshi003@e.ntu.edu.sg)

Here, we show that the 2019 Mw7.0 Ridgecrest mainshock as well as its Mw6.5 foreshock ruptured orthogonal conjugate faults. We invert the waveforms recorded by the dense strong motion network at relatively high frequencies (up to 1 Hz for *P*; 0.25 Hz for *S*) to derive multiple□point source models for both events, aided by path calibrations from a Mw5.4 and a Mw5.5 earthquake. We demonstrate that the mainshock started from a shallow (3 km) depth with a Mw5.2 event and ruptured the main fault branches oriented in the NW□SE direction. At ~11 s, two Mw6.2 subevents took place on the SW□NE oriented fault branches that conjugate to the main fault to the NE and SW. The SW branch rupture partially overlapped with the foreshock rupture. We suggest the coseismic rupture on nearly orthogonal faults was enabled by high pore fluid pressure, which greatly weakened the immature fault system in a heterogeneous way.