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Radiation of kinked faults in laboratory earthquakes

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We report experimental observations of spontaneously nucleated sub- and supershear ruptures occuring on frictionally held homogeneous interfaces, for both planar and low angle kinked geometries. We monitor acoustic emissions and accelerometric signals, static stress drops, and internal stress field of the samples, using a high-speed camera.

We show that, for planar geometries, acoustic sensors clearly detect the Mach wavefront radiation. Conversely, the stress singularity introduced by a kinked geometry modifies the rupture propagation and radition patterns. Indeed, propagating ruptures may or may not stop when crossing the singularity, depending on the local stress field and the pre-stress level. When they do, arrest phases radiated from the kink are recorded by far field transducers and the accelerometric signature becomes more complex and includes an important high frequency content.

Finally, we compare our experimental results with both, the Mw7.9 2002 Denali and Mw7.1 1999 Duzce earthquakes, for which ground motion data are available at a unique station. We qualitatively compare velocities and slip functions integrated from accelerometric records for different geometries and show that the same features can be seen both at the laboratory and field scales, enhancing a possible scaling of the experiment to nature.