OBSERVATIONS AND SIMULATIONS OF LARGE EARTHQUAKES ON CREEPING FAULTS

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Locked faults release their tectonic strain during earthquakes and postseismic slip. In contrast, creeping faults release a sometimes significant portion of their tectonic strain aseismically, over long periods of time. Creeping faults are uncommon in continental active-tectonic regions, but more than 20 have been detected in countries around the world. The most famous is a 100-km-long portion of the San Andreas fault, in central California.

A few of the world's continental creeping faults have been observed to produce large earthquakes, and the question is if these large earthquakes behave similarly to or differently from large earthquakes on locked faults.

Harris and Abrahamson [2014] showed the peak strong ground shaking from well-recorded locked-fault earthquakes and creeping-fault earthquakes of the same magnitude to be similar.

A review article by Harris [2017] investigated if large earthquakes on creeping faults and large earthquakes on locked faults produce similar or different rupture areas. The finding was that the rupture areas are similar for earthquakes of the same magnitude.

A caveat for both studies is that the largest creeping-fault earthquakes were magnitude 6.6, and larger earthquakes on creeping faults might behave differently.

When there is a paucity of observations, scientists can use computational simulations to provide results. The Hayward fault in the San Francisco Bay Area is an active creeping fault that produced a large earthquake in 1868. It would be good to know what the next large Hayward fault earthquakes will look like. Simulations are used to investigate what might control a dynamically propagating earthquake rupture that starts on the Hayward fault or its companion faults to the north and south.