Title: A Possible joint San Andreas-Imperial Fault Rupture in the Salton Trough Region

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We investigate the potential for large through-going ruptures across the Salton Trough using both field data and numerical simulations. Geological records from paleoseismic trenches inform us of details of past ruptures (length, magnitude, timing), while dynamic rupture models allow us to evaluate numerically the mechanics of such earthquakes. The two most recent events (Mw 6.9 1940 and Mw 6.4 1979) on the Imperial fault (IF) both ruptured up to the northern end of the mapped fault, potentially implying that ruptures must terminate there. This result is supported by small displacements, ~20 cm, measured at the Dogwood site near the end of the mapped rupture in each event. However, 3D paleoseismic data from the same site corresponding to the most recent pre-1940 event (1710 CE) and the 5th (1635 CE) and 6th events back reveal up to 1.5 m of slip in those events. Since we expect the surface displacement to decrease toward the termination of a rupture, we postulate that in these earlier cases the rupture propagated further north than in 1940 or 1979. Furthermore, paleoseismic data from the Coachella site (Philibosian et al., 2011) on the San Andreas fault (SAF) indicates slip events ca. 1710 CE and 1588–1662 CE. Thus, the timing of two large paleoseismic displacements on the IF cannot be distinguished from the timing of the two most recent events on the southern SAF. We investigate the possibility of through-going rupture across the Salton Trough using 3D dynamic finite element rupture modeling. In our work, we consider two scenarios: rupture initiating on the IF propagating northward, and rupture initiating on the SAF propagating southward. Initial results show that in the former case, rupture propagates north of the mapped northern terminus of the IF only under certain pre-stress conditions, such as values of the seismic strength parameter S = 0.45 to 2.0, and tends to stop for S = 2.5. If rupture initiates on the SAF in the north, we find that it is easier for it to propagate across the entire stepover region. The results have implications for potential earthquakes in the region, with the possibility of a preferred direction of rupture propagation through the stepover.