Project Abstract

We investigate the distribution of earthquake ruptures in three separate dimensions along California strike-slip faults. Previous work by Powers and Jordan (in prep.) shows that the average rate of small earthquakes along California strike-slip faults obeys a power-law of the form $R \sim (x^2 + d^2)^{-\gamma / 2}$, where the rate $R$ is in events/km$^2$, $x$ is the distance from a fault, $\gamma$ is the decay rate of seismicity, and $d$ is the near-fault inner scale. However, they do not consider the depth variability of earthquake hypocenters. We therefore perform a reconnaissance of their fault-referenced data set to determine if there is significant on-fault versus off-fault variability in earthquake depths. For each fault segment, we compute the depth variance in 4d km wide fault-normal bins, centered on the fault. For particularly long fault segments, we take the average variance over several shorter fault-parallel sub-segments. Results show interesting regional variations. In southern California, on-fault earthquake hypocenters are strongly localized in depth, but become more distributed with distance from a fault. In contrast, variance of hypocenter depths in northern California is similar both on and off of faults. Similar regional variations are observed for $\gamma$ and $d$, so depth variance likely correlates with fault properties such as seismic productivity, creep rate, and cumulative offset. These results have important implications for fault-based models of seismicity, which can be used to improve current earthquake forecasting methods such as ETAS.