Plate Coupling Variations in the 1964 Alaska Earthquake Rupture Zone

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The 1964 Alaska earthquake remains the second largest ever recorded, and slip in the earthquake was highly variable in space. Past studies have concluded that coseismic slip was concentrated in two large asperities, one beneath Prince William Sound and the eastern Kenai Peninsula (20-25 m average slip) and the second beneath and offshore of Kodiak Island (10-15 m average slip). Coseismic slip in the gap between them was much smaller, less than 5 meters. Previously, we found that horizontal site velocities measured today with GPS require the present distribution of locked and creeping regions on the plate interface to match the pattern of coseismic slip: the regions of high coseismic slip are locked today, while the region of low coseismic slip is creeping today.

Now, a careful reanalysis of the vertical GPS velocities shows that the Prince William Sound asperity actually consists of two distinct locked regions (Figure 1). GPS velocities show two separate subsidence regions, separated by a ridge of little subsidence. This suggests two distinct locked patches in the subsurface. The "ridge" of low vertical motions corresponds to the inferred edge of the subducted Yakutat block. The eastern subsidence bowl is centered on Prince William Sound, and we interpret it as being due to a locked region on the Yakutat-North America interface. The western patch is located beneath the Kenai Peninsula and we interpret it as being due to a locked region on the Pacific-North America interface.

Figure 1. Contour map of vertical velocities in south-central Alaska based on data from 1992-present. Contours are in mm/yr. Small blue diamonds represent GPS sites, mostly campaign GPS surveys. UNAVCO supported this project through many equipment loans over the last decade.