GPS Monitoring of the San Bernardino Mountains and Inland Empire for Slip Rate Modeling of Southern California Plate Boundary Faults


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Although there has been no major earthquake on the southern San Andreas fault (SAF) in more than two centuries, the surrounding crust still moves. This crustal deformation causes strain accumulation on the SAF as well as the San Jacinto fault (SJF) and many others in the area. To get a better picture of how much strain is currently building on these faults, we used precise Global Positioning System (GPS) surveying to measure site velocities within the San Bernardino Mountains and surrounding areas, and we modeled these data along with site velocities from SCEC’s Crustal Motion Model 4 (CMM4) to characterize crustal deformation within a transect across the plate boundary using two-dimensional elastic half-space models in MS Excel. We tested hundreds of thousands of slip rate combinations to find which combinations provide a good fit to the site velocities. From the combinations that produce the best-fitting lines, our results showed that the faults west of the SJF system could have total slip values of 4.5 to 13.5 mm/yr with the individual faults at: San Clemente: 0-1 mm/yr, San Diego Trough: 0-1 mm/yr, Palos Verdes: 0-5 mm/yr, Newport-Inglewood: 0-3 mm/yr, and Elsinore: 0-8 mm/yr. The SJF-SAF system could have total slip of 15 to 26 mm/yr with the two faults at: SJF: 2-24 mm/yr, SAF: 0-20 mm/yr. The Eastern California Shear Zone had totals from 13 to 17 mm/yr with the individual faults at: Helendale: 0 mm/yr, Lenwood: 1.5-2 mm/yr, Emerson: 6.7-8.7 mm/yr, West Calico: 0 mm/yr, Pigmaw: 2.2-2.9 mm/yr, Ludlow: 1.5-2 mm/yr, Red Pass Lake: 0.7-1 mm/yr, and Baker: 0.4-0.5 mm/yr.