Distribution of slip across the Pacific-North America plate boundary in the vicinity of the San Bernardino Mountains, California: Results from 12 years of GPS observations

Sally McGill, *California State University, San Bernardino;* Joshua Spinler and Richard Bennett, *University of Arizona, Tucson;* John McGill, *California State University, San Bernardino*; Robert de Groot, *Southern California Earthquake Center*

Campaign GPS data collected from 2002-2014 by >150 undergraduate students (45% from under-represented ethnic groups—Latino/a, African American, Native American), nearly 100 middle and high school teachers (13% from under-represented ethnic groups) and >80 high school students (50% from under-represented ethnic groups) result in 41 new site velocities from the San Bernardino Mountains and vicinity. We combined these velocities with 93 continuous GPS velocities and 216 published velocities to obtain a velocity profile across the Pacific-North America plate boundary through the San Bernardino Mountains. We modeled the plate-boundary-parallel, horizontal deformation with 5-14 parallel and one obliquely oriented (San Andreas) screw dislocations within an elastic half-space. Our rate for the San Bernardino strand of the San Andreas fault (6.5 ± 3.6 mm/yr) is consistent with recently published latest Quaternary rates at the 95% confidence level, and is slower than our rate for the San Jacinto fault (14.1 ± 2.9 mm/yr) (Figure 1). Our modeled rate for all faults of the Eastern California Shear Zone (ECSZ) combined (15.7 ± 2.9 mm/yr) is faster than the summed latest Quaternary rates for these faults, even when an estimate of permanent, off-fault deformation is included. The rate discrepancy is concentrated on faults near the 1992 Landers and 1999 Hector Mine earthquakes; the geodetic and geologic rates agree within uncertainties for other faults within the ECSZ (Figure 1). Coupled with the observation that post-earthquake geodetically measured deformation is faster than the pre-1992 deformation, this suggests that the ECSZ geodetic-geologic rate discrepancy is directly related to the timing and location of these earthquakes and is likely the result of viscoelastic deformation in the mantle that varies over the time scale of an earthquake cycle, rather than a redistribution of plate boundary slip at a time-scale of multiple earthquake cycles or longer.

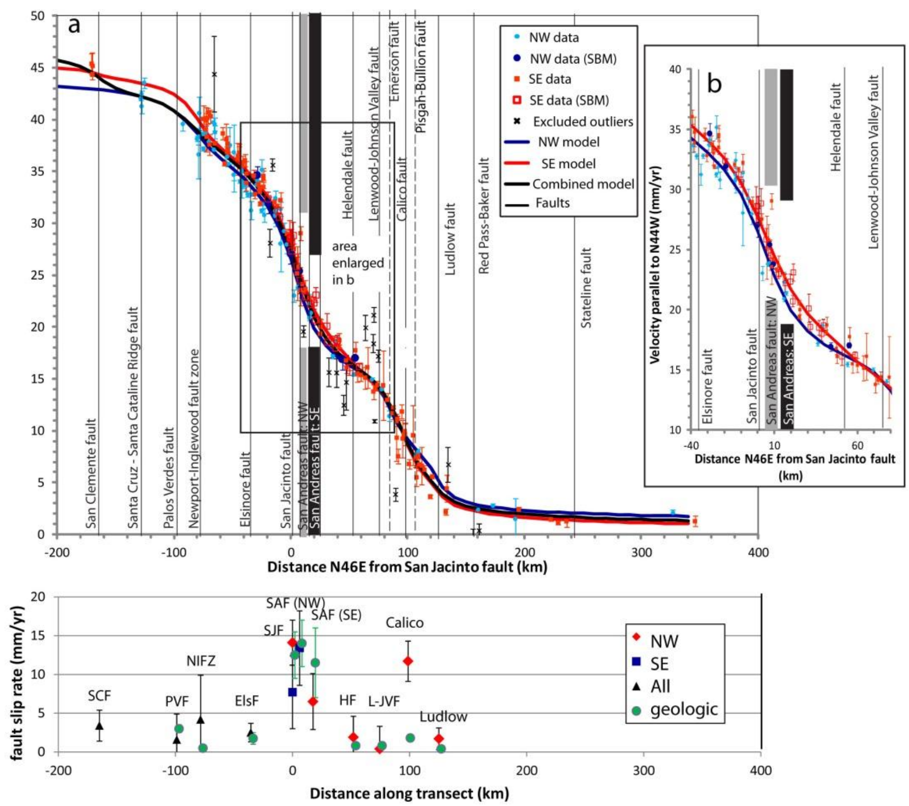

Figure 1: (a) GPS site velocity profile across the Pacific-North America plate boundary through the San Bernardino Mountains. Red (blue) curve is model fit to velocities in NW (SE) half of transect. Black curve is fit to all velocities in transect. (b) Enlargement of area near the San Andreas and San Jacinto faults, showing evidence for different slip rates for these faults in NW and SE halves of transect. "SBM" symbols show constraints placed on the model by our campaign data (c) Modeled slip rates and 95% confidence intervals compared to geologic slip rates. Modeled slip rates for the SJF and SAF are plotted separately for NW and SE transects to show the along-strike transfer of slip rate between these two faults. Modeled SAF rate agrees well with geologic rate in NW transect and agrees marginally in SE transect.