**SUPPLEMENTARY TABLE CAPTIONS**

**Table S1.** All locations and station names for continuous and campaign GPS stations used in this study.

**Table S2.** List of continuous and campaign stations whose velocities were estimated by hand within TSVIEW software; the reason for manual velocity estimation is presented in column two; the statistics for estimated velocities from the postseismic-reduced velocity field before manual noise or outlier removal is presented in columns four through seven; the statistics for estimated velocities after removal of excessive noise, outliers or un-modeled signals is presented in columns eight through eleven.

**Table S3A,B,C.** All model statistics results for the postseismic-reduced GPS field (A), the observed GPS velocity field (B) and our partially reduced GPS velocity field (C). We present a normalized RMS score between our geodetically determined fault slip rates and published available geologic slip rates for all geologic slip rates (column 7), Holocene geologic slip rates only (column 8) and Pleistocene geologic slip rates only (column 9); lower RMS scores indicate geodetic rates that are closer to geologic rates (within the sum of 1σ geologic and 1σ geodetic uncertainties). See main text for equation used to calculate the RMS score and χ2 misfit values.

**Table S4.** Percentages of misfit reduction between each set of GPS velocity datasets; column 2 compares the fully postseismic-reduced (long- and short-term transients removed) field to the observed (unreduced) GPS field; column 3 compares the partially reduced (only short term postseismic transients removed) to the observed (unreduced) GPS field; and column 4 compares the fully reduced field to the partially reduced field. The fully reduced field has he greatest reduction in misfit value (see **Figure 7** for visual representation).

**SUPPLEMENTAL FIGURE CAPTIONS**

**Figure S1.** Map of the Joshua Tree Integrative Geodetic Network (JOIGN) run by the University of Arizona (A), and the San Bernardino Mountains (run by California State University, San Bernardino (CSUSB)) campaign station network (B), with all campaign stations labeled with their four-character names. Stations G076 and G078 were surveyed separately by researchers from the University of California, Riverside and data were downloaded from the UNAVCO data repository.

**Figure S2.** Illustration of fault geometries at depth as seen by the program TDEFNODE (McCaffrey, 2005); All surface traces, delineated by blue nodes, are defined by the user using latitude and longitude points, while geometry at depth is initially defined by the user input of dip and fault depth using layers of nodes that are individually numbered for each fault (see orange and yellow nodes) with numbering increasing down dip. For fault motion to be estimated, the user must specify a “locking depth” by assigning a coupling ratio of 1 or 0 (1 being completely coupled and 0 being freely slipping).

**Figure S3A – P.** Final model-calculated fault parallel slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the postseismic-reduced GPS velocity field.

**Figure S4A – P.** Final model-calculated dip-slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the postseismic-reduced GPS velocity field.

**Figure S5A – P.** Final model-calculated fault parallel slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the partially postseismic-reduced GPS velocity field.

**Figure S6A – P.** Final model-calculated dip-slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the partially postseismic-reduced GPS velocity field**.**

**Figure S7A – P.** Final model-calculated fault parallel slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the observed (unreduced) GPS velocity field.

**Figure S8A – P.** Final model-calculated dip-slip rates for all models (SGP1-SGP16) showing fault slip rates calculated from the observed (unreduced) GPS velocity field.

**Figure S9**. Residual plots for our four best-fit models to GPS data, along with their calculated misfit values.