Auxiliary Material for

Insights Into Distributed Plate Rates Across the Walker Lane from GPS Geodesy.

Zachery M. Lifton[a]
Andrew V. Newman[a]
Kurt L. Frankel[a]
Christopher W. Johnson[a]
Timothy H. Dixon[b]

([a] School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA
[b] Department of Geology, University of South Florida, Tampa, FL)

Geophysical Research Letters, 2013

Introduction

This data set contains three figures and one table to supplement the main text. Figure "fs01.png" shows an extension of our velocity profile across the San Andreas Fault and our dislocation model results for that profile. Figure "fs02.png" shows the location of transect subsets (color coded) used to produce the subset velocity profiles in figure "fs03.png". GPS velocity data for the 76 campaign and continuous stations used in our study are presented in table "ts01.doc". Campaign monuments include 26 Mobile Array of GPS for Nevada Transtension [MAGNET] monuments, 12 existing monuments that were surveyed as early as 1994, and 10 new monuments installed for this study. We also used 28 continuous stations from the Plate Boundary Observatory [PBO] network. These data were collected by us or downloaded from the UNAVCO data archive [http://facility.unavco.org/data/dai2/app/dai2.html#]. All GPS data were processed using GIPSY/OASIS II software with precise point positioning [*Zumberge et al.,* 1997]. All velocities are calculated in ITRF relative to stable North America, using the MORVEL Euler pole of -6.8°, -84.8° rotating 0.189° My-1 [NA-ITRF2005, *DeMets et al*., 2010].

1. fs01.png (Figure S1) Plate parallel velocity profile dislocation models across most of the Pacific-North America plate boundary. Black filled circles and black error bars are data from this study. The profile crosses the San Andreas Fault (SAF), the Sierra Nevada Frontal Fault (SNFF), the White Mountains Fault (WMF), and the Death Valley-Fish Lake Valley Fault (DVFLVF). The dislocation model is similar to those described in the main text, but here includes the SAF. The solid black line is the best-fit model, with 1 km locking depth of the SAF and 15 km locking depth on the SNFF, WMF, and DVFLVF; the dashed black line is the solution for 15 km locking depth on all faults. The sharp gradient across the SAF is due to the proximity to the creeping Parkfield section, which contributes coseismic slip to our measurements of interseismic strain. The dislocation model requires an unreasonably shallow apparent locking depth to account for the coseismic contributions. Our GPS velocities are relative to North America using the Euler pole from the MORVEL reference frame [*DeMets et al.*, 2010]. The absolute

amplitude of the displacement field will be shifted ~0.5 mm/yr to the southeast if we use the GEODVEL reference frame [*Argus et al.*, 2010]. For comparison, we also show profile #4 from *McCaffrey* [2005] (gray filled circles, gray error bars, and gray curve). *McCaffrey*'s [2005] profile crosses the plate boundary further south, at ~36°N, and shows deformation spread over a wider region and a less distinct plateau of velocities across the Sierra Nevada block.

2. fs02.png (Figure S2) Walker Lane GPS velocity field with sited colored by transect. Colors correspond to profiles in Fig. S3. CVF – Clayton Valley Fault; DV-FLVF – Death Valley-Fish Lake Valley Fault; EIF – Eastern Inyo Fault; EPF – Emigrant Peak Fault; LMF – Lone Mountain Fault; LVC – Long Valley Caldera; SNFF – Sierra Nevada Frontal Fault; SPLM – Silver Peak-Lone Mountain extensional complex; WMF – White Mountains Fault.

3. fs03.png (Figure S3) Additional plate-parallel and plate-normal velocity profiles along transects perpendicular to plate motion. (C) and (D) are duplicated from Fig. 2 and are included here for completeness. Circle colors correspond to circle colors on Fig. S2. DV-FLVF – Death Valley-Fish Lake Valley Fault; EIF – Eastern Inyo Fault; LVC – Long Valley Caldera; SNFF – Sierra Nevada Frontal Fault; SPLM – Silver Peak-Lone Mountain extensional complex; WMF – White Mountains Fault.

4. ts01.doc GPS station positions and velocities.

4.1 Column "Station ID", four letter station name.

4.2 Column "Longitude", degrees, longitude of station.

4.3 Column "Latitude", degrees, latitude of station.

4.4 Column "Elevation", meters, elevation above mean sea level of station.

4.5 Column "Velocity East", mm/year, east component of station velocity.

4.6 Column "Velocity North", mm/year, north component of station velocity.

4.7 Column "Uncertainty East", mm/year, uncertainty in east component of station velocity.

4.8 Column "Uncertainty North", mm/year, uncertainty in north component of station velocity.

4.9 Column "Years Occupied", years in which station was occupied.

References:

Argus, D. F., R. G. Gordon, M. B. Heflin, C. Ma, R. J. Eanes, P. Willis, W. R. Peltier, and S. E Owen. (2010). The angular velocities of the plates and the velocity of Earth's centre from space geodesy. Geophysical Journal International, 180(3), 913–960. doi:10.1111/j.1365-246X.2009.04463.x.

DeMets, C., R. G. Gordon, and D. F. Argus (2010), Geologically current plate motions, Geophysical Journal International, 181(1), 1–80, doi:10.1111/j.1365-246X.2009.04491.x.

McCaffrey, R. (2005). Block kinematics of the Pacific–North America plate boundary in the southwestern United States from inversion of GPS, seismological, and geologic data. *Journal of Geophysical Research*, *110*(B7), B07401. doi:10.1029/2004JB003307.

Zumberge, J., Heflin, M., Jefferson, D., Watkins, M., & Webb, F. (1997). Precise point positioning for the efficient and robust analysis of GPS data from large networks. *Journal of Geophysical Research*, *102*, 5005–5018.

Table S1

GPS station positions and velocities.

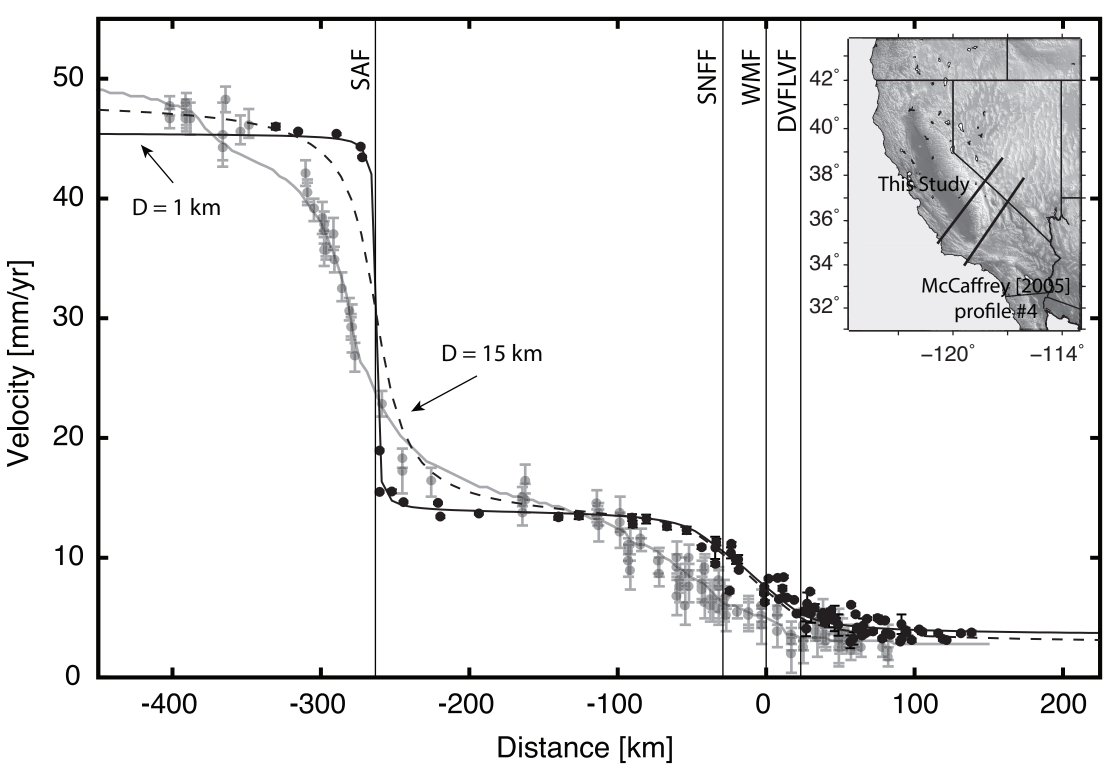
Station ID	Longitude [° W]	Latitude [° N]	Elevation [m]	Velocity[a] East [mm/yr]	Velocity[a] North [mm/yr]	Uncertainty[b] East [mm/yr]	Uncertainty[b] North [mm/yr]	Years Occupied
CHIA	-118.2069696	37.83817050	1982.8452	-4.9	3.6	0.5	0.4	2005, 2007, 2009, 2011
CLDL	-117.8855495	38.03091445	1389.9126	-4.2	3.0	0.2	0.3	2002, 2010, 2011
COL2	-118.0539701	38.08877954	1468.2873	-4.8	3.0	0.2	0.3	2005, 2007, 2008, 2009, 2010, 2011
COLU	-117.2383991	37.74347047	1687.8772	-3.7	1.9	0.1	0.3	2002, 2010, 2011
DEEP	-118.0471973	37.34255335	1640.6484	-6.0	4.8	0.3	0.4	2005, 2007, 2009, 2011
DUNF	-117.3088504	37.31361674	1961.3906	-4.0	2.1	0.2	0.3	2005, 2007, 2009, 2011
DYER	-118.0393350	37.74280420	1511.9377	-4.5	3.4	0.1	0.1	1999 – 2010 inclusive
EPAS	-117.8807044	37.91966955	1817.0489	-4.0	2.2	0.3	0.4	2005, 2007, 2008, 2009, 2011
FISH	-118.0462849	37.73698880	1442.6225	-3.9	3.5	0.3	0.2	1998, 2001, 2010, 2011
FSH2	-118.0064933	37.56705062	1620.9603	-4.3	4.0	0.3	0.4	2005, 2007, 2009, 2011
FURN	-118.0173757	37.56177425	1698.2984	-4.4	4.4	1.1	0.9	2010, 2011, 2012
GABB	-117.4545416	38.34440095	1519.9937	-3.1	1.7	0.3	0.3	1998, 2001, 2003, 2011
GEMF	-117.2984995	37.74503285	1857.4646	-3.7	1.0	0.2	0.4	2005, 2007, 2009, 2011
GOLD	-117.3589724	37.82279605	1525.6699	-3.1	1.7	0.2	0.2	1998, 2001, 2010, 2011, 2012
HOLT	-117.9236800	38.45881028	1976.9901	-3.6	2.2	0.3	0.5	2006, 2007, 2008, 2009, 2010
ICOR	-117.2982893	37.46633251	1555.3395	-4.0	1.8	0.2	0.4	2005, 2007, 2009, 2011
LATE	-118.2830751	38.08197168	1738.9940	-4.4	3.7	0.2	0.7	2001, 2003, 2010, 2012
LEDY	-118.1803636	37.72282657	2038.0235	-2.5	3.2	0.7	1.2	2010, 2011, 2012
LIDA	-117.4962857	37.44630447	1936.8269	-4.4	0.4	0.7	1.8	2010, 2011, 2012
LIME	-117.9815300	37.23887429	1821.5378	-5.4	4.1	0.1	0.3	1998, 2001, 2003, 2010
LNMT	-117.5678855	38.04302221	1531.1835	-4.6	2.1	0.8	1.7	2010, 2011, 2012
LWSH	-117.5373659	37.52385460	2010.6035	-3.7	1.3	0.7	1.5	2010, 2011, 2012
MILR	-117.4418638	38.11989194	1487.1938	-4.2	1.6	0.3	0.4	2006, 2007, 2008, 2009, 2011
MINA	-118.0737541	38.40741196	1471.4340	-3.7	3.2	0.2	0.4	2001, 2003, 2011
MNA2	-118.1551354	38.41961546	1497.8931	-4.3	3.0	0.3	0.4	2005, 2007, 2008, 2009, 2010, 2011
MOHO	-118.2451385	38.24620487	1965.3126	-4.9	3.9	0.2	0.3	2005, 2007, 2008, 2009, 2010, 2011

MONT	-117.7084390	38.07777007	1639.2584	-3.9	1.5	0.2	0.4	2005, 2007, 2008, 2009, 2011
MUSB	-119.3093510	37.16994098	2042.5165	-10.0	8.5	0.4	0.5	2009, 2010, 2011, 2012
ORIE	-117.4526793	37.25308319	1388.8689	-4.4	2.6	0.3	0.5	2005, 2007, 2009, 2011
P091	-117.5315412	36.61432438	1966.8507	-5.3	3.9	0.2	0.4	2007, 2008, 2009, 2010, 2011
P092	-117.4068013	36.80419467	2156.8854	-4.6	3.2	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P093	-117.9941444	36.60602516	1339.0654	-7.4	6.3	0.3	0.3	2007, 2008, 2009, 2010, 2011
P094	-117.7041939	37.20083606	1729.2112	-5.1	3.1	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P245	-119.7061218	37.71311614	1579.8350	-10.3	8.8	0.5	0.7	2009, 2010, 2011, 2012
P305	-120.1967591	37.35221410	96.0578	-10.4	9.0	0.4	0.5	2009, 2010, 2011, 2012
P311	-118.5198015	37.17756286	3698.6404	-7.9	8.2	0.4	0.5	2009, 2010, 2011, 2012
P465	-118.1324330	36.46683388	2901.5420	-8.6	8.9	0.4	0.5	2007, 2008, 2009, 2010, 2011
P466	-117.7894608	36.53124937	2754.5877	-6.8	3.9	0.3	0.4	2007, 2008, 2009, 2010, 2011
P467	-118.0906227	36.57020200	1380.1173	-7.6	7.9	0.3	0.3	2006, 2007, 2008, 2009, 2010, 2011
P468	-118.1183626	36.97568225	2853.3103	-7.1	5.9	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P469	-117.9358096	37.23142509	1794.8141	-5.9	3.9	0.2	0.3	2007, 2008, 2009, 2010, 2011
P512	-119.6944472	37.56263504	1344.7116	-10.1	9.1	0.4	0.5	2009, 2010, 2011, 2012
P627	-118.3785244	37.97310119	2342.1401	-5.1	5.1	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P629	-119.1793726	37.37586648	2725.6622	-10.1	8.2	0.4	0.5	2009, 2010, 2011, 2012
P643	-118.6981621	37.56155280	2121.9835	-6.0	7.8	0.5	0.6	2009, 2010, 2011, 2012
P644	-118.6844028	37.49539211	3458.6137	-6.0	8.5	0.7	0.5	2009, 2010, 2011, 2012
P650	-118.5549002	37.89127658	2298.1762	-5.2	6.6	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P651	-118.3869824	37.56310953	1316.7145	-6.0	5.8	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P652	-118.2384513	37.58915803	3865.2454	-4.8	4.7	0.3	0.3	2007, 2008, 2009, 2010, 2011
P653	-118.4716598	37.73749979	1826.2904	-5.6	6.2	0.2	0.3	2006, 2007, 2008, 2009, 2010, 2011
P723	-118.7247766	37.38042606	3197.7895	-6.3	8.8	1.0	0.9	2009, 2010, 2011
P724	-118.5610691	37.43947702	1371.6190	-7.1	7.0	0.5	0.5	2009, 2010, 2011, 2012
P725	-119.7456063	37.08889501	330.9408	-10.1	9.3	0.4	0.5	2009, 2010, 2011, 2012
P727	-118.4667725	37.27357873	2677.2088	-8.7	7.4	0.3	0.3	2007, 2008, 2009, 2010, 2011
PETT	-118.2341137	37.82928917	2381.2168	-3.7	3.9	0.8	1.4	2010, 2011, 2012
PIGN	-117.6673424	37.41230419	1963.5022	-3.6	3.4	0.8	1.1	2010, 2011, 2012
PILO	-117.9851309	38.26966099	1706.3637	-4.3	2.7	0.2	0.3	2005 – 2011 inclusive

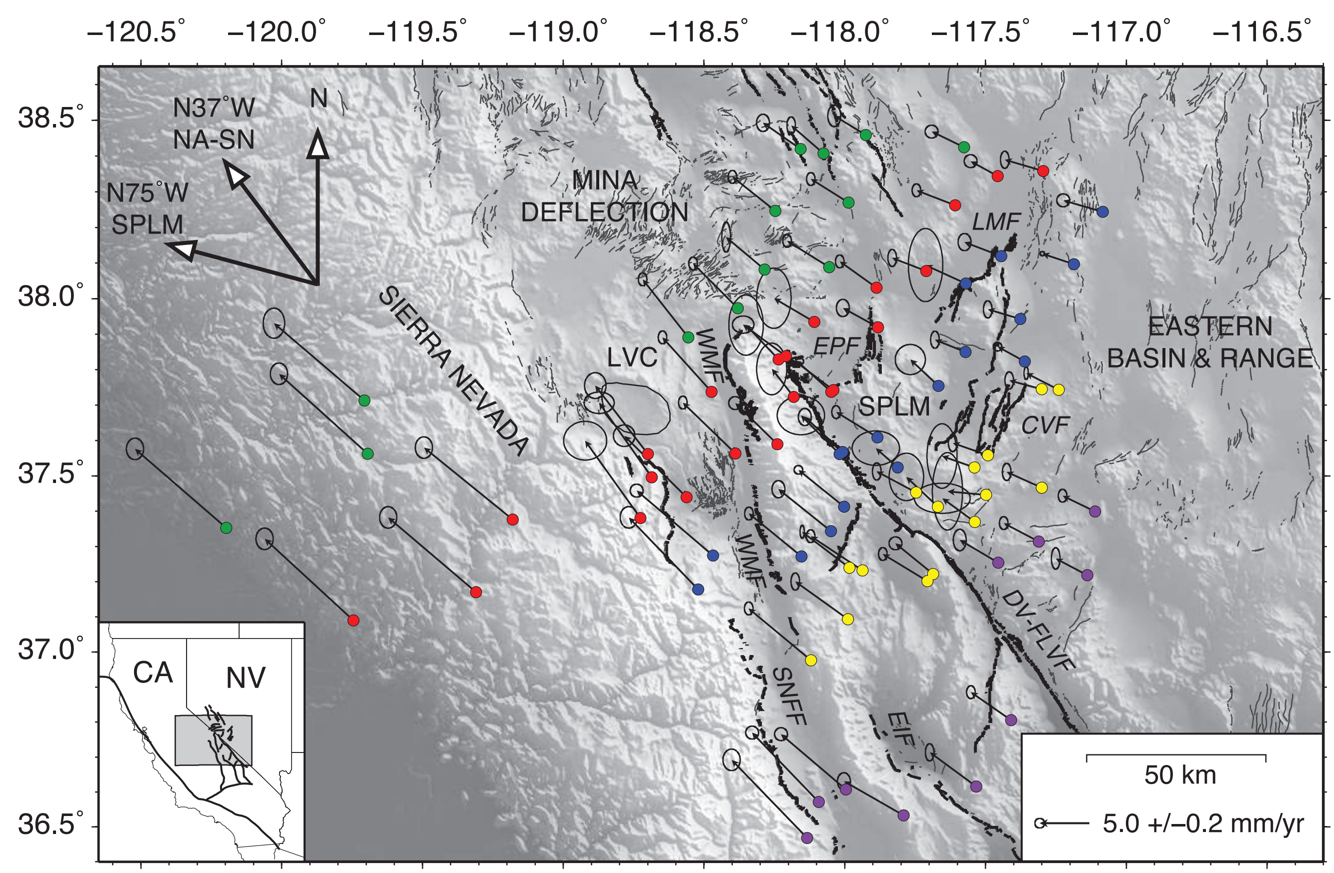
RHIL	-117.5745378	38.42463194	1799.0081	-3.7	1.8	0.3	0.3	2006, 2007, 2008, 2010, 2011
ROYS	-117.6065914	38.26264241	1613.7066	-4.4	1.7	0.2	0.3	2006, 2007, 2008, 2010, 2011
SANA	-117.0815710	38.24445310	1775.9236	-4.5	1.3	0.3	0.3	2006, 2007, 2008, 2010, 2011
SCTY	-117.1365330	37.21820323	1217.7813	-3.6	1.9	0.2	0.5	1998, 2001, 2010
SULF	-117.6842181	37.22117602	1655.1706	-4.3	3.5	0.3	0.3	2005, 2007, 2009, 2011
SYLV	-117.7444661	37.45252051	1887.3640	-4.5	2.4	0.2	0.4	2005, 2007, 2009, 2011
THOM	-117.3749797	37.94290443	1659.3359	-3.7	1.1	0.2	0.4	2005, 2007, 2009, 2011
TONI	-117.2926155	38.35817152	1823.0331	-4.4	1.3	0.2	0.4	2006, 2007, 2008, 2010, 2011
TONO	-117.1840393	38.09719462	2066.0149	-3.6	1.2	0.1	0.1	1999 – 2011 inclusive
TULC	-117.5367022	37.36918001	1848.2879	-3.7	2.7	1.3	0.7	2010, 2011, 2012
UFOS	-117.1090488	37.39880631	1409.2528	-3.7	1.8	0.2	0.3	2005, 2007, 2009, 2011
VBPK	-117.6659345	37.75447794	1649.1486	-3.2	3.0	0.7	0.7	2010, 2011, 2012
VLCH	-118.1071638	37.93474715	1643.9515	-4.6	2.7	0.8	1.4	2010, 2011, 2012
WAUC	-117.9872059	37.09243019	1996.8158	-6.0	4.3	0.2	0.4	1998, 2001, 2003, 2010
WEEP	-117.5689321	37.85003281	1409.9169	-3.5	1.4	0.2	0.4	2005, 2007, 2009, 2011
WOLF	-117.8828754	37.60827119	1915.7570	-4.7	2.9	0.2	0.3	2005, 2007, 2009, 2011
WSTG	-118.1520166	37.27072612	2200.4265	-6.0	4.9	0.2	0.3	1997, 1998, 2001, 2003, 2010
WYMN	-118.0011103	37.41245014	1757.3729	-5.2	4.2	0.2	0.2	1998, 2001, 2003, 2010
ZUMA	-117.4902193	37.55816612	1924.5106	-4.0	1.4	0.2	0.4	2005, 2007, 2009, 2011

All velocities are relative to stable North America; Euler pole: -6.8°W, -84.8°N, rotating 0.189°/Myr.

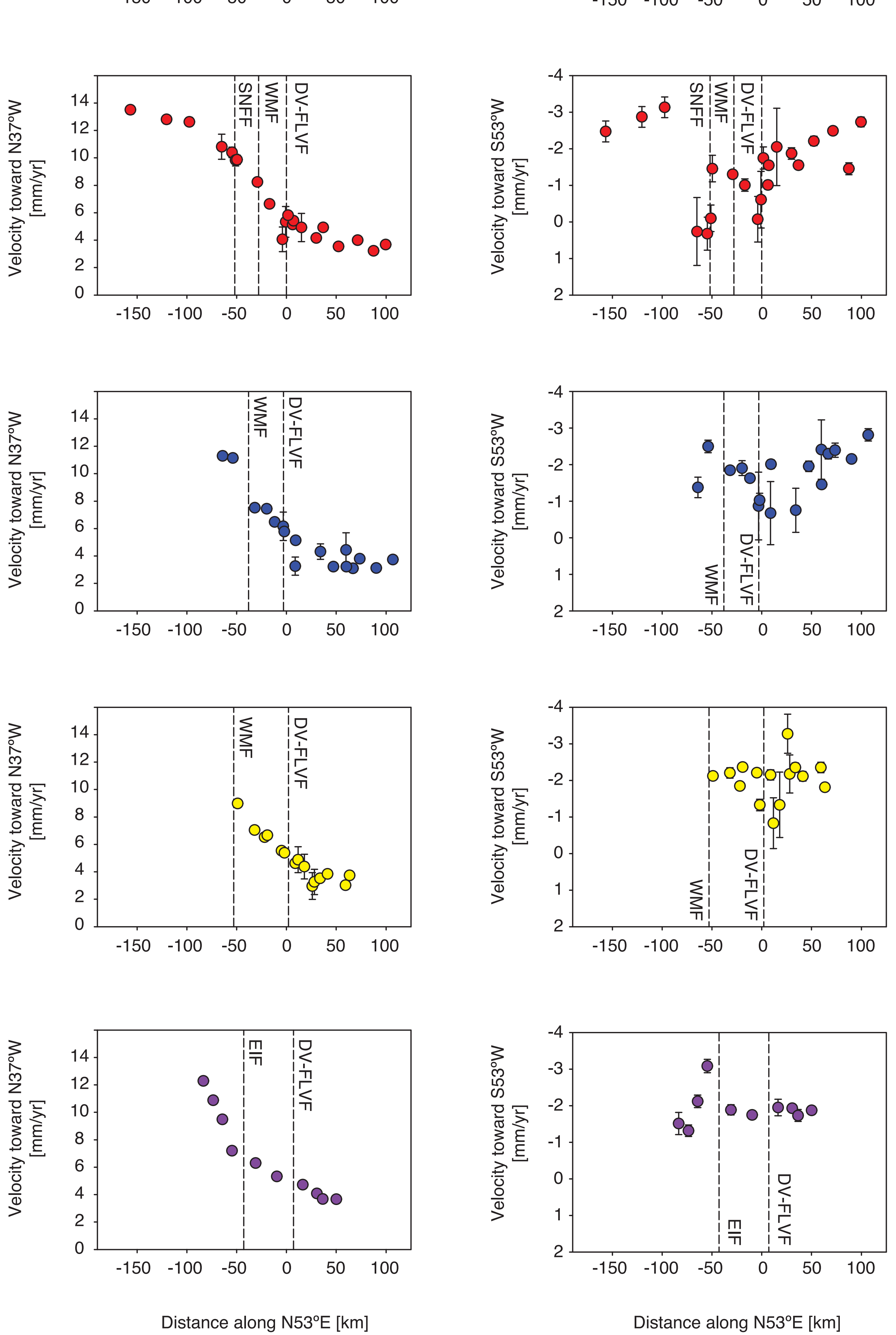
Uncertainties are 1-σ.



SAF
SNFF
WMF
DVFLVF
D = 1 km
D = 15 km
Velocity [mm/yr]
Distance [km]
This Study
McCaffrey [2005]
profile #4



–120.5°
–120.0°
–119.5°
–119.0°
–118.5°
–118.0°
–117.5°
–117.0°
–116.5°
38.5°
38.0°
37.5°
37.0°
36.5°
N
N37°W
NA-SN
N75°W
SPLM
MINA
DEFLECTION
SIERRA NEVADA
LVC
WMF
EPF
SPLM
LMF
CVF
EASTERN
BASIN & RANGE
WMF
SNFF
EIF
DV-FLVF
CA
NV
50 km
5.0 +/–0.2 mm/yr



Velocity toward N37°W [mm/yr]
Velocity toward S53°W [mm/yr]
SNFF
WMF
DV-FLVF
EIF
Distance along N53°E [km]
Distance along N53°E [km]