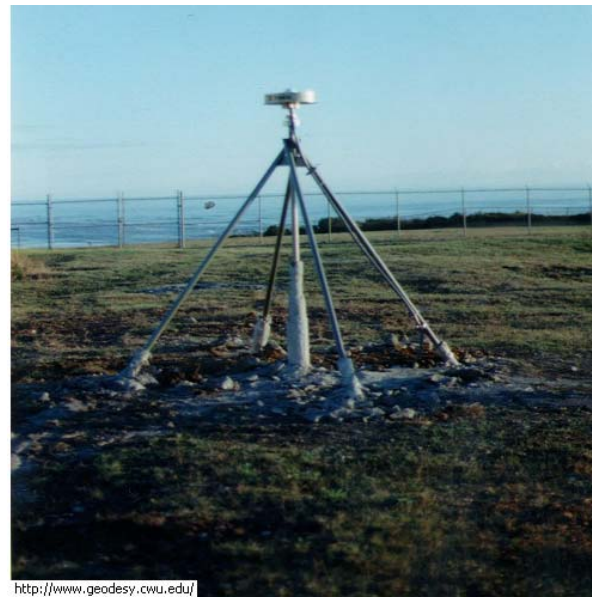


ID	STATION	TYPE	LAT	LON	HEIGHT	LATE	LONE	HE	TYPE	XVEL	YVEL	ZVEL	XERR	YERR	ZERR
1	BRMU	POS	34.594281880	-116.429378200	1337838.60	0.05	0.05	0.20	VEL	-20.22	-0.95	0.22	0.02	0.02	0.09
2	ISLK	POS	37.357958370	-115.158458200	1090011.00	0.11	0.13	0.41	VEL	-16.12	-10.56	-0.32	0.05	0.04	0.15
3	GLPT	POS	34.015004430	-119.363467700	22453.60	0.07	0.08	0.30	VEL	-46.92	11.41	-25.31	0.26	0.24	0.97
4	NRC2	POS	34.157442960	-118.830315800	246562.20	0.04	0.04	0.17	VEL	-40.08	18.25	1.51	0.04	0.02	0.09
5	LINJ	POS	36.319118840	-114.931788500	761058.70	0.13	0.21	0.51	VEL	-15.79	-9.68	1.26	0.09	0.06	0.23
6	WKPK	POS	36.050010750	-117.521943200	1791346.80	0.12	0.16	0.47	VEL	-19.17	-4.64	0.32	0.07	0.05	0.21
7	EGAN	POS	35.201251720	-118.910422100	76830.20	0.07	0.07	0.26	VEL	-25.22	4.91	2.06	0.08	0.07	0.29
8	COPO	POS	34.468300990	-117.153971100	888910.00	0.05	0.05	0.20	VEL	-26.21	2.45	-0.32	0.02	0.02	0.08
9	MDO1	POS	33.540072030	-116.629696000	1265713.40	0.05	0.05	0.19	VEL	-31.78	12.27	1.29	0.02	0.02	0.08
10	IRKJ	POS	34.126018010	-117.896485700	144765.50	0.08	0.08	0.34	VEL	-38.02	11.46	0.83	0.15	0.08	0.34
11	PBPP	POS	33.480450770	-119.029734300	14821.80	0.07	0.08	0.31	VEL	-41.36	21.25	2.33	0.23	0.21	0.86
12	PATT	POS	34.582197410	-119.981511500	204883.70	0.05	0.06	0.22	VEL	-39.40	20.10	3.40	0.15	0.09	0.35
13	GOSH	POS	34.264278540	-116.884240900	2051064.40	0.05	0.06	0.21	VEL	-23.88	5.89	0.90	0.02	0.02	0.09
14	MEM2	POS	34.920461340	-119.405847900	1332919.60	0.11	0.12	0.43	VEL	-33.18	12.88	4.85	0.50	0.29	1.17
15	TJRN	POS	34.000534140	-115.998190300	1373646.90	0.07	0.08	0.28	VEL	-16.76	-5.48	-1.03	0.20	0.18	0.73
16	CHZZ	POS	35.878387640	-118.074091700	2471209.00	0.06	0.06	0.23	VEL	-20.09	1.12	5.44	0.19	0.11	0.44

The Global Positioning System (GPS)

is a constellation of 30 satellites that is used for global navigation and precise geodetic position measurements (Assistant Secretary of Defense, 2001). Daily position estimates for each GPS receiver stations (ex. worksheet top left) are determined from satellite signals that are recorded by GPS receivers on the ground (ex. middle left photo). Data from various organizations and institutions that collect and analyze geodetic position information are catalogued and analyzed at the Jet Propulsion Laboratory, California Institute of Technology under contract with the National Aeronautics and Space Administration. GPS time-series data for each receiver location are analyzed (ex. below left) to determine the horizontal and vertical ground position of each location relative to the International Terrestrial Reference Frame (ITRF2000). The reference ellipsoid for latitude, longitude, and height is WGS84 (ref). Latitude and longitude are given in degrees. Height, geographic positions, and positional errors are given in mm. Velocities and their errors are given in mm/yr.

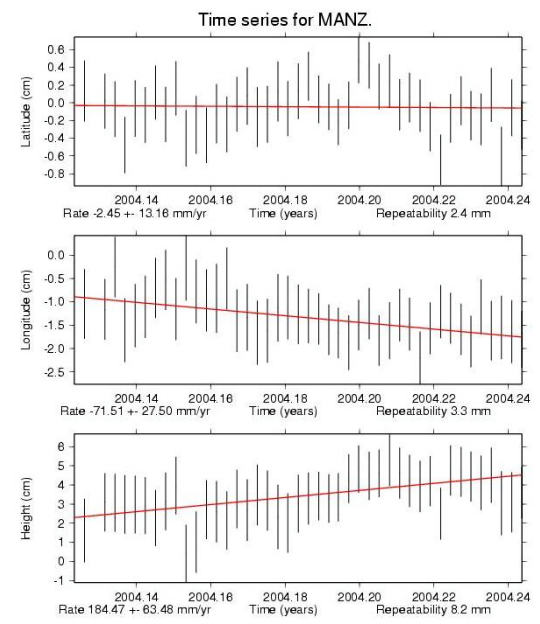


<http://www.geodesy.cwu.edu/>

Spatial analysis of GPS plate-motion data

obtained from the NASA JPL portal on the Internet World-Wide-Web for the geographic reference frame

C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
TYPE	LAT	LON	HEIGHT	LATE	LONE	HE	TYPE	XVEL	YVEL	ZVEL	XERR	YERR	ZERR	THETA	AZM	MAG	
1	POS	34.594281880	-116.429378200	1337838.60	0.05	0.05	0.20	VEL	-20.22	-0.95	0.22	0.02	0.02	0.09	-92.69	267	20
3	POS	37.357958370	-115.158458200	1090011.00	0.11	0.13	0.41	VEL	-16.12	-10.56	-0.32	0.05	0.04	0.15	-123.228	237	19
4	POS	34.015004430	-119.363467700	22453.60	0.07	0.08	0.30	VEL	-46.92	11.41	-25.31	0.26	0.24	0.97	-76.3321	284	48
5	POS	34.157442960	-118.830315800	246562.20	0.04	0.04	0.17	VEL	-40.08	18.25	1.51	0.04	0.02	0.09	-65.5184	294	44
6	POS	36.319118840	-114.931788500	761058.70	0.13	0.21	0.51	VEL	-15.79	-9.68	1.26	0.09	0.06	0.23	-121.51	238	19
7	POS	36.050010750	-117.521943200	1791346.80	0.12	0.16	0.47	VEL	-19.17	-4.64	0.32	0.07	0.05	0.21	-103.606	256	20
8	POS	35.201251720	-118.910422100	76830.20	0.07	0.07	0.26	VEL	-25.22	4.91	2.06	0.08	0.07	0.29	-78.9831	281	26
9	POS	34.468300990	-117.153971100	888910.00	0.05	0.05	0.20	VEL	-26.21	2.45	-0.32	0.02	0.02	0.08	-84.6598	275	26
10	POS	33.540072030	-116.629696000	1265713.40	0.05	0.05	0.19	VEL	-31.78	12.27	1.29	0.02	0.02	0.08	-68.8888	291	34
11	POS	34.126018010	-117.896485700	144765.50	0.08	0.08	0.34	VEL	-38.02	11.46	0.83	0.15	0.08	0.34	-73.2261	287	40
12	POS	33.480450770	-119.029734300	14821.80	0.07	0.08	0.31	VEL	-41.36	21.25	2.33	0.23	0.21	0.86	-62.8067	297	46
13	POS	34.582197410	-119.981511500	204883.70	0.05	0.06	0.22	VEL	-39.40	20.10	3.40	0.15	0.09	0.35	-62.9715	297	44
14	POS	34.264278540	-116.884240900	2051064.40	0.05	0.06	0.21	VEL	-23.88	5.89	0.90	0.02	0.02	0.09	-76.1446	284	25



3-axis velocity derivatives to map polar angles vector conversion using MS Excel:

Given horizontal velocity components with respect to the X- and Y-coordinate reference axes, the horizontal component of plate motion is a vector having magnitude (MAG in mm/yr) and azimuth bearing (AZM in degrees) determined as:

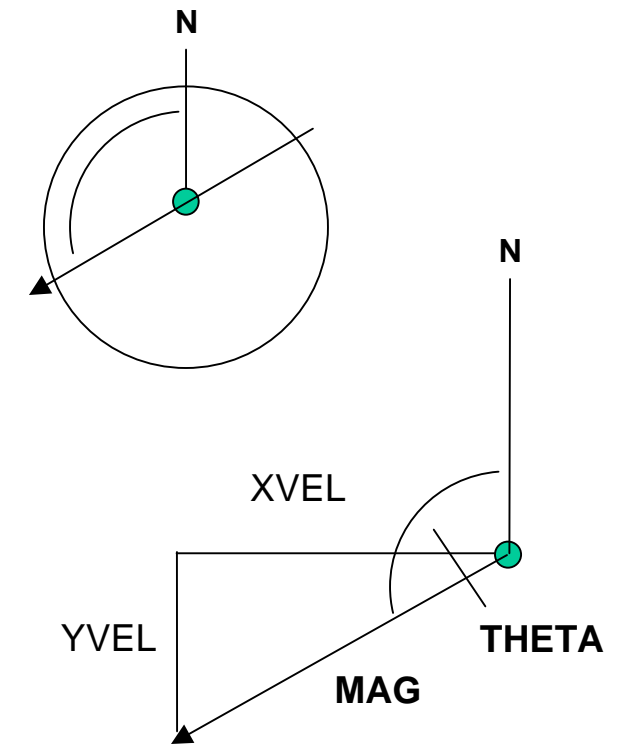
$$MAG = \text{SQRT} (XVEL^2 + YVEL^2) \text{ and } AZM = 360 + THETA$$

where SQRT is the square root function,

Then,

$$THETA = \text{ATAN} (X\text{-COORD}, Y\text{-COORD}), \text{ where ATAN is the arctangent of the specified x- and y- coordinates.}$$

The arctangent is the angle from the x-axis to a line containing the origin (0, 0) and a point with X- and Y-coordinate values. The angle is given in radians between -p and p, excluding -p.



ATAN(THETA)
 XVEL + THETA (0 to 180)
 XVEL - THETA (0 to -180)
 THETA = -123
 AZM = 267 (360 + (-123))