Quarterly Report
Massachusetts Institute of Technology
GAGE Facility GPS Data Analysis Center Coordinator

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Period: 2024/07/01-2024/09/30

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Summary

Under the GAGE2 Facility Data Analysis sub-award, MIT has been processing SINEX files from Central Washington University (CWU) and aligning them to the GAGE NAM14 reference frame. In this report, we show analyses of the data processing for the period 2024/07/01 to 2024/09/30, as well as time series velocity field analyses for the GAGE reprocessing analyses (1996-2024). Several earthquakes were investigated this quarter up to 2024/09/15, and two of them generated any detectable co-seismic offsets but at only one site for each earthquake.

Analysis files (pbo format velocity files and offset files) are generated monthly and sent via Python in the middle of each month.

We continue to process ANET data. These solutions are in the ANT14 frame as defined in the ITRF2014 plate motion model [*Altamimi et al.*, 2017].

GPS Analysis of Level 2a and 2b products

Level 2a products: Rapid products

Final and rapid level 2a products have been, in general, generated routinely during this quarter for the CWU solutions. The description of these products, the delivery schedule, and the delivery list remain unchanged from the previous quarter and will not be reported here.

Level 2a products: Final products

The final products are generated weekly and are based on the final JPL orbits and clocks. Finals and rapid solutions are now being generated in the IGS14 system. In this quarter, 2014 stations were processed. In addition, up to 44 sites were processed in the ANET solutions, three less than last quarter. The number of stations processed fluctuated as data systems were updated at EarthScope.

Level 2a products: 12-week, 26-week supplement products

Each week, we also process the Supplemental (12-week latency) and six-month supplemental (26-week latency) analyses from CWU for the main GAGE2

Networks of the Americas stations (NOTA). The delivery schedule for these products is also unchanged.

Analysis of Final products: June 15, 2024– September 21, 2024

For this report, we generated the statistics using the ~3 months of CWU results between June 15, 2024, and September 21, 2024. These results are summarized in Table 1 and Figure 1.

For the three months of the final position time series generated, we fit linear trends and annual signals and compute the RMS scatters of the position residuals in north, east, and up for each station in the analysis. Table 1 shows the median (50%), 70%, and 95% limits for the RMS scatters CWU. The detailed histograms of the RMS scatters are shown in Figure 1 CWU.

Table 1: Statistics of the fits of 2014 stations for CWU analyzed in the finals analysis between June 15, 2024, and September 21, 2024.
Figure 1 shows histograms of the RMS scatters.

Center	North (mm)	East (mm)	Up (mm)
Median (50%)			
CWU	0.97	0.93	4.48
70%			
CWU	1.17	1.12	5.24
95%			
CWU	2.18	2.17	8.13

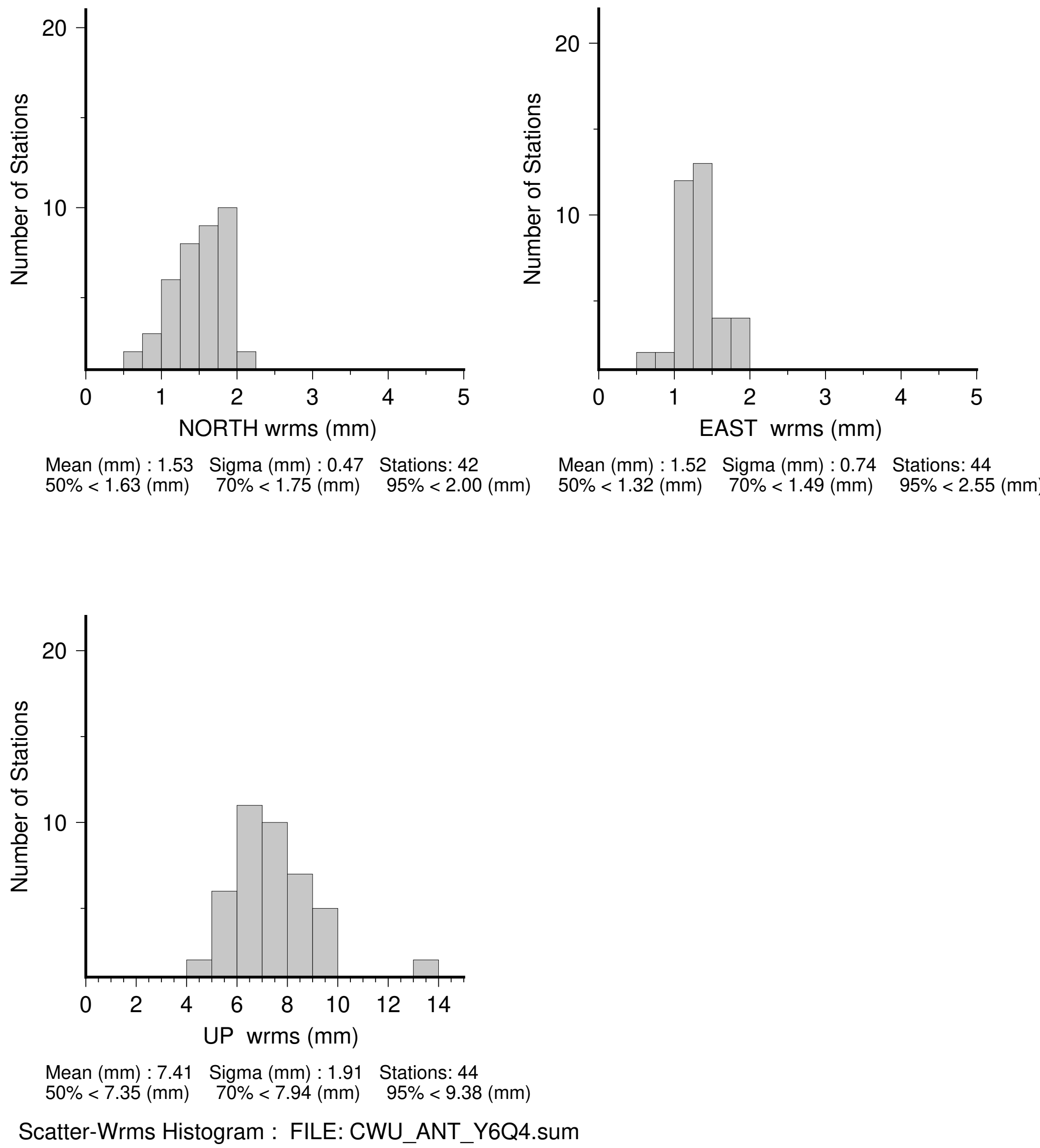

Figure 1: CWU solution histograms of the North, East, and Up RMS scatters of the position residuals for 2014 stations analyzed between June 15, 2024 and September 21, 2024. Linear trends and annual signals were estimated from the time series.

For the CWU analysis, we also evaluate the RMS scatters of the position estimates by network type. The figures below are based on our monthly submissions, but here, we use nominally three months of data to evaluate the RMS scatters. In Table 2, we give the median, 70, and 95 percentile limits on the RMS scatters. The geographical distributions of the RMS scatters by network type are shown in Figures 2-7. The values plotted are given in

CWU_FIN_Y6Q4.tab. There are 2015 stations in the file for sites with at least two measurements during the month.

Table 2: Head and tail of WRMS scatter summary file CWU_FIN_Y6Q4.tab.

```
Tabular Position RMS scatters created from CWU_FIN_Y6Q4.sum
ChiN/E/U are square root of chisquared degree of freedom of the fits.
Values of ChiN/E/U near unity indicate that the estimated error
bars are consistent the scatter of the position estimates

.Site     #    N (mm)  ChiN     E (mm) ChiE    U (mm)  ChiU     Years
 1LSU    99      1.5   0.81      2.2   1.06      6.2   0.68     21.42
 1NSU    99      1.0   0.61      1.2   0.71      5.0   0.67     20.67
 1ULM    98      1.2   0.73      1.2   0.73      4.8   0.64     21.27
 70DM    99      1.0   0.53      0.9   0.61      4.9   0.63     23.42
…
 ZDV1    99      1.1   0.56      0.8   0.52      4.2   0.56     21.30
 ZKC1    99      1.1   0.61      1.0   0.60      5.9   0.77     21.30
 ZLA1    98      1.1   0.60      1.0   0.66      3.9   0.50     21.30
 ZLC1    99      1.1   0.58      0.9   0.59      4.4   0.58     21.53
 ZME1    99      1.0   0.59      1.2   0.72      5.6   0.75     21.53
 ZMP1    99      0.9   0.48      0.9   0.58      5.1   0.69     21.77
 ZNY1    98      1.2   0.63      0.9   0.58      6.6   0.85     21.69
 ZOA1    92      0.7   0.36      0.6   0.40      3.5   0.47     22.22
 ZSE1    98      1.0   0.48      1.0   0.71      4.4   0.60     21.69
 ZTL4    99      1.5   0.87      1.1   0.66      7.0   0.94     21.88
```

Table 2: RMS scatter of the position residuals for the CWU solution between June 15, 2024, and September 21, 2024, divided by network type. The division of networks is based on the JAVA script unavcoMetdata.jar with network codes PBO, Nucleus, Mid- SCIGN_USGS, America GAMA, COCONet and Expanded PBO

Network	North (mm)	East (mm)	Up (mm)	#Sites
Median (50%)				
PBO	0.86	0.82	4.03	821
NUCLEUS	0.77	0.78	3.85	190
GAMA	0.92	1.01	5.02	14
COCONet	1.58	1.62	7.49	71
USGS_SCIGN	0.86	0.85	4.17	121
Expanded	1.10	1.04	5.19	797
70%				
PBO	1.03	0.98	4.54	
NUCLEUS	0.88	0.87	4.21	
GAMA	1.00	1.05	5.05	

COCONet	1.78	1.91	8.39
USGS_SCIGN	0.99	0.99	4.65
Expanded	1.27	1.24	5.82
95%			
PBO	1.92	1.64	6.61
NUCLEUS	1.55	1.25	5.42
GAMA	1.09	1.20	5.34
COCONet	4.96	6.51	22.30
USGS_SCIGN	1.61	1.42	6.81
Expanded	2.39	2.54	9.19

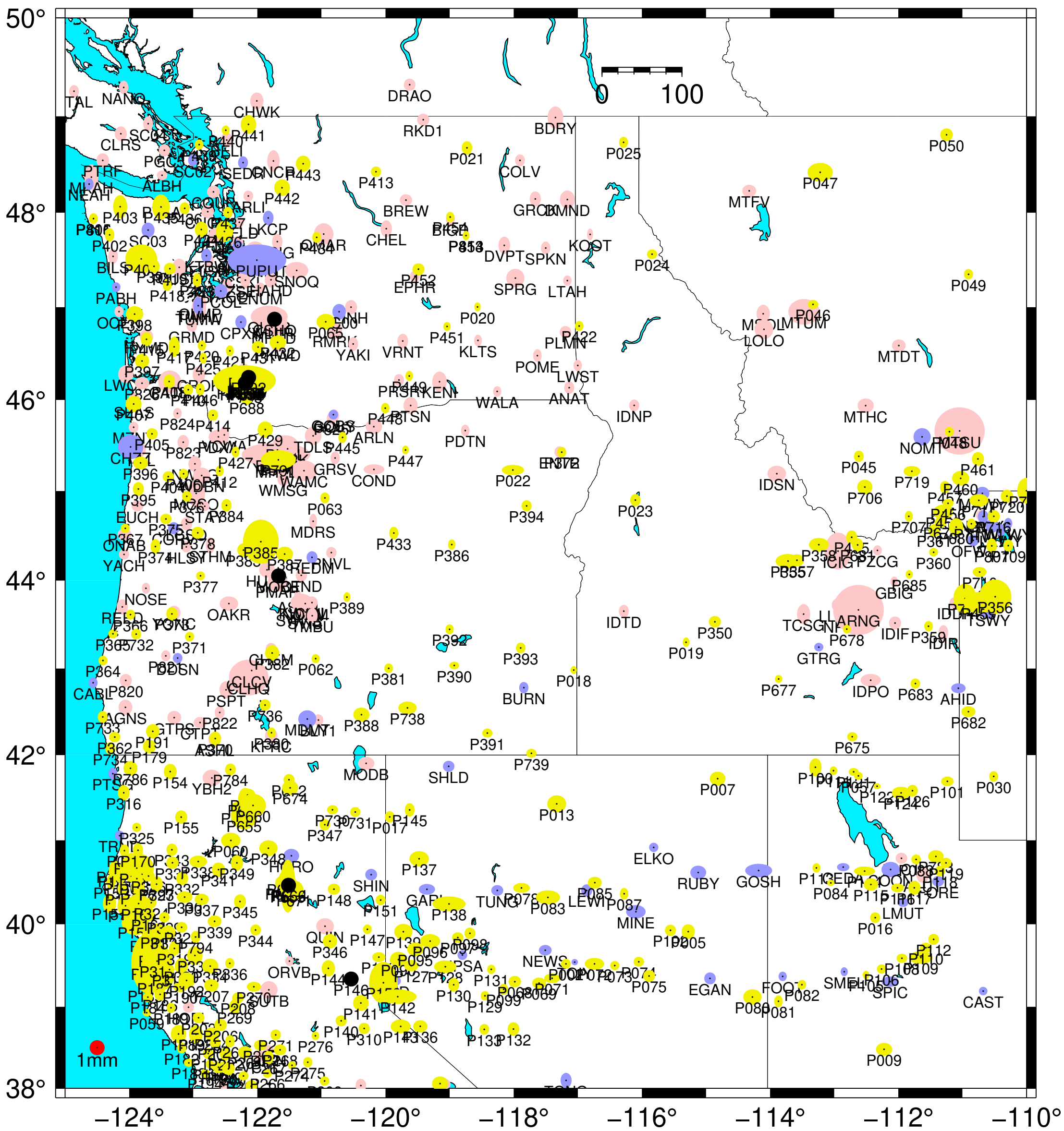

Figure 2: Distribution of the RMS scatters of horizontal position estimates from the CWU analysis for the Northern Western United States. The color of the ellipses that give the north and east RMS scatters denotes the network given by the legend in the figure. The small red circle shows the size of 1 mm scatters. Sites shown with black circles have combined RMS scatters in north and east greater than 5 mm or are sites that have no data during this 3-month interval.

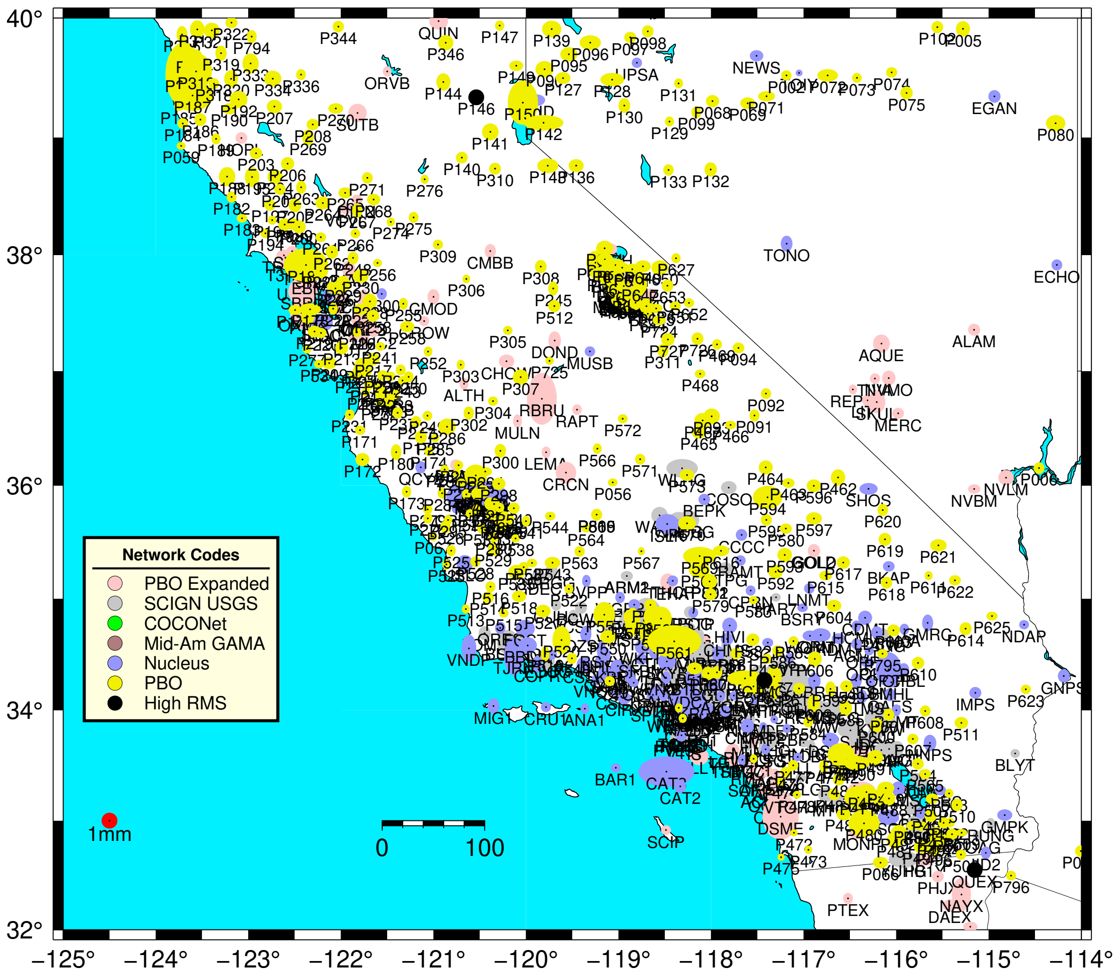

Figure 3: Same as Figure 4 except for the Southern Western United States. Black circles show large RMS scatter sites.

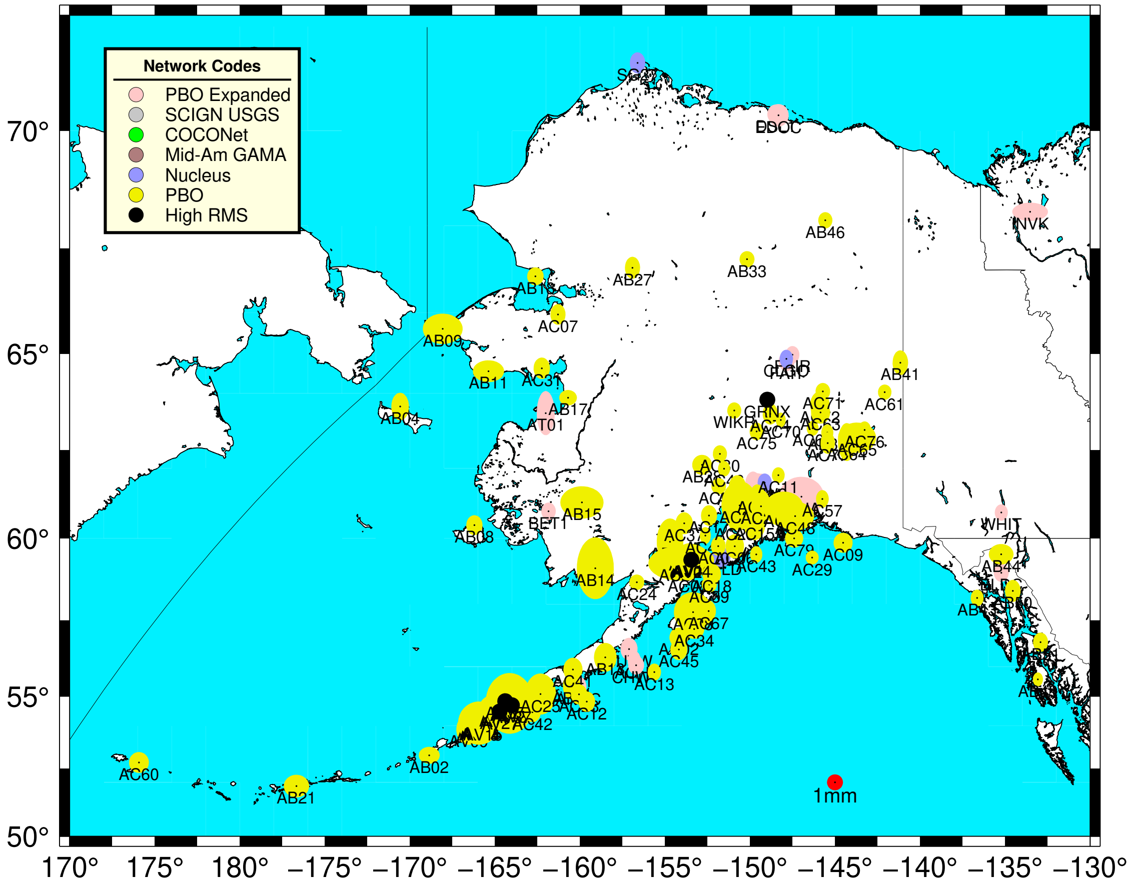

Figure 4: Same as Figure 4 except for the Alaskan region.

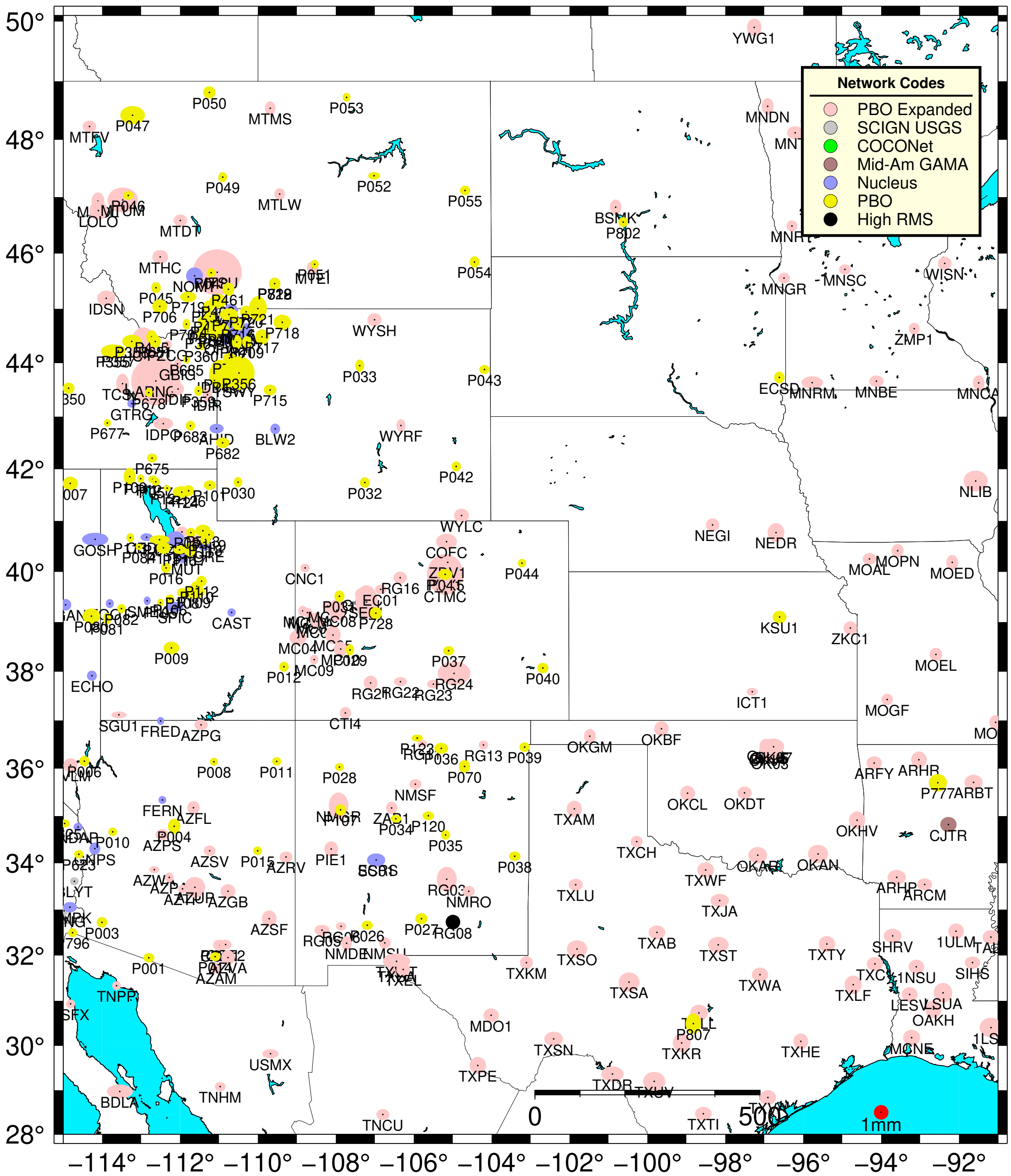

Figure 5: Same as Figure 4 except for the Central United States

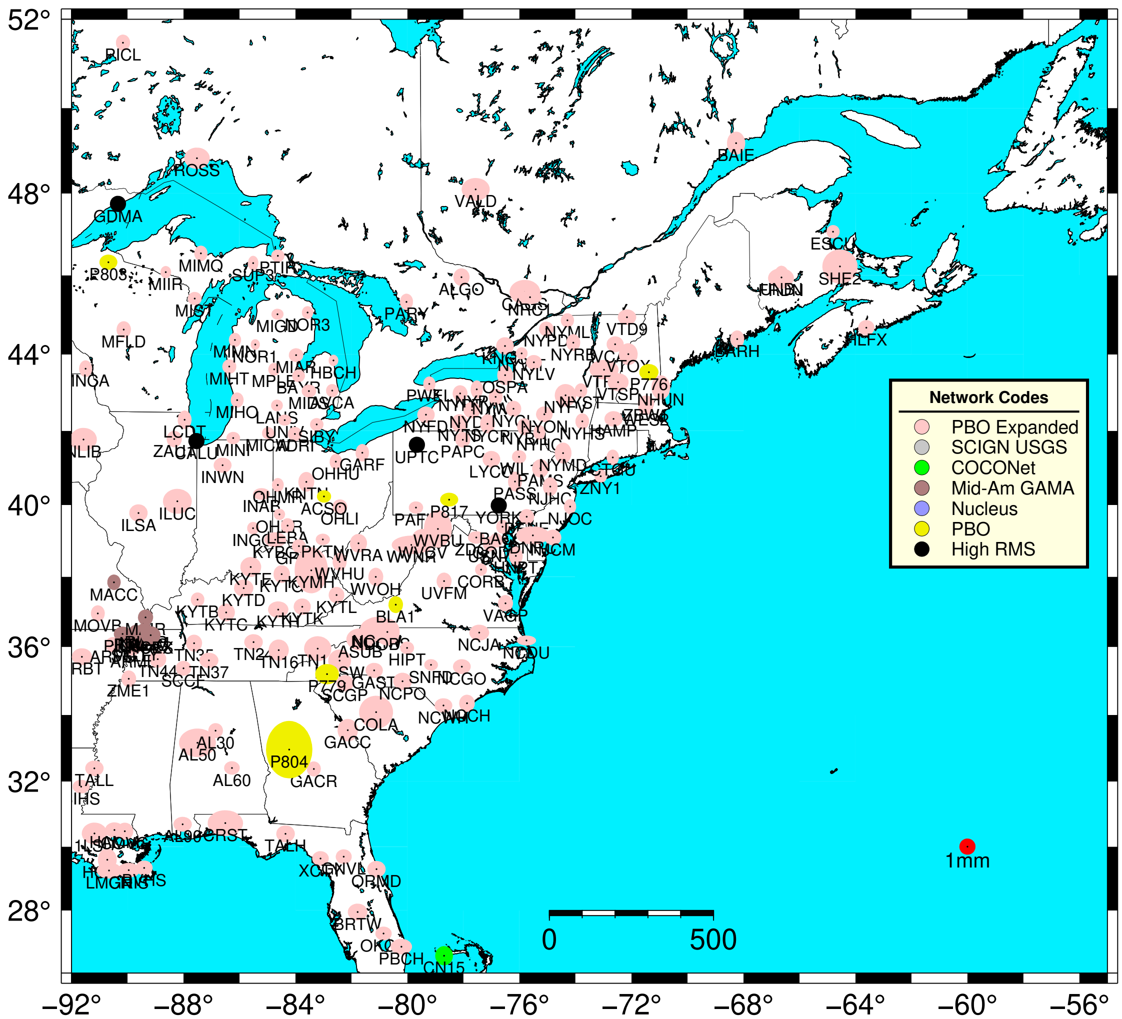

Figure 6: Same as Figure 4 except for the Eastern United States

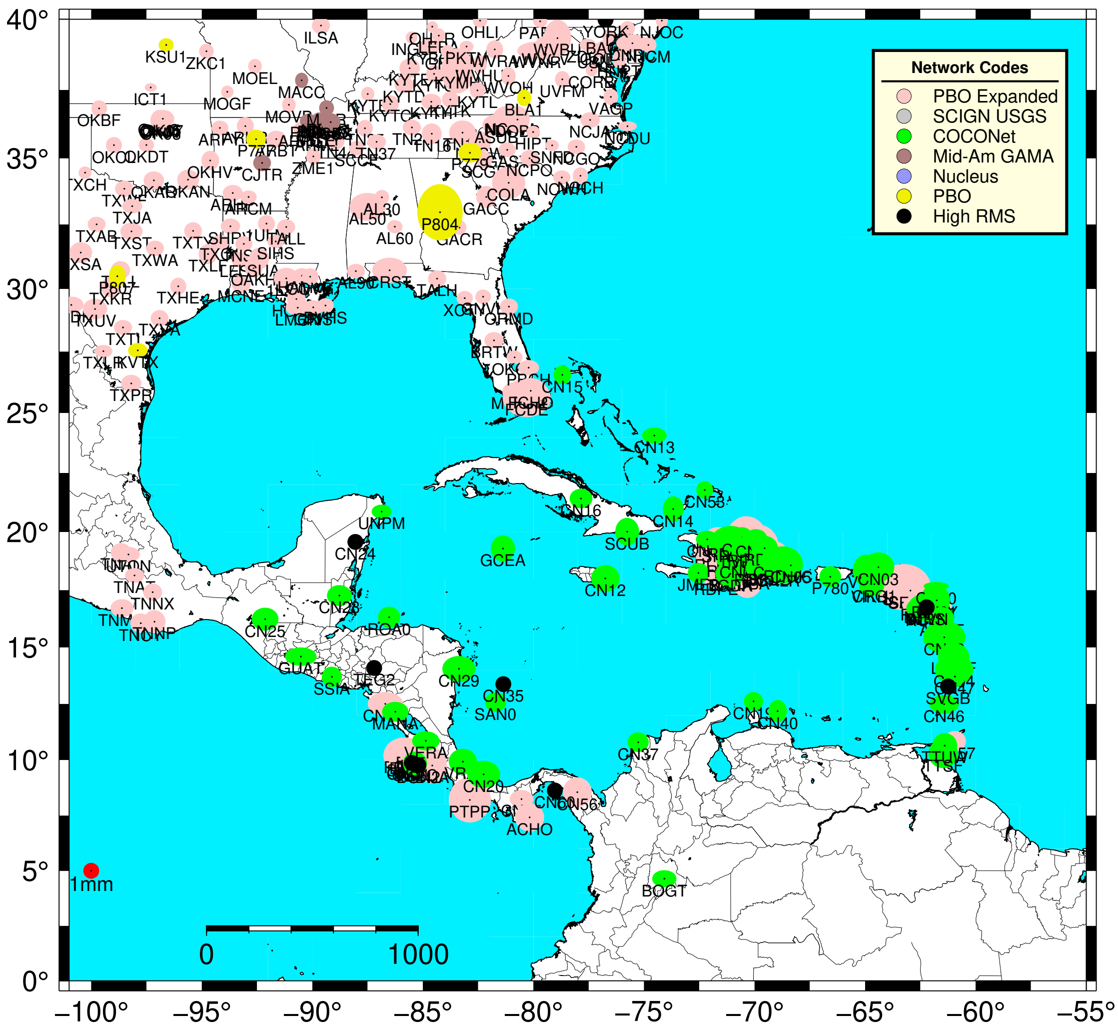

Figure 7: Same as Figure 4 except for the Caribbean region.

GLOBK Apriori coordinate file and earthquake files

As part of the quarterly analysis, we run a complete analysis of the time series files and generate position, velocity, and other parameter estimates from these time series. These files can be directly used in the GLOBK analysis files sent with the GAGE analysis documentation. The current earthquake and discontinuity files used in the GAGE ACC analyses are All_NOTA_eqs.eq All_NOTA_ants.eq All_NOTA_unkn.eq. These names have been changed to reflect that they now refer to the Network of America and no longer just the plate boundary observatory. The GLOBK apriori coordinate file All_CWU_nam14.apr is the current estimate based on data analysis in this quarterly report.

Snapshot velocity field analysis from the reprocessed PBO analysis.

For this quarterly report, we generate velocity estimates for the reprocessed results and the current GAGE analyses that are in the NAM14 reference frame using the CWU analysis. There are 2716 stations in the CWU solution. The statistics of the fits to results are shown in Table 3. Because these are cumulative statistics, they are little changed from last quarter. In this analysis, offsets are estimated for antenna changes and earthquakes. Annual signals are estimated, and for some earthquakes, logarithmic post-seismic signals are also estimated. The full tables of RMS fit, along with the duration of the data used, are given in cwu_nam14_240921.tab. The velocity estimates are shown by region and network type in Figures 8-14. The color scheme used is the same as Figures 2-7. The snapshot velocity field file for CWU is cwu_nam14_240921.snpvel.

Table 3: Statistics of the fits of 2716 stations analyzed CWU in the reprocessed analysis for data collected between Jan 1, 1996 and September 21, 2024.

Center	North (mm)	East (mm)	Up (mm)
Median (50%)			
CWU	1.42	1.38	6.26
70%			
CWU	1.79	1.75	7.14
95%			
CWU	4.21	3.80	11.78

In Figures 8-14, different tolerances are used for maximum standard deviation in each figure so that regions with small velocity vectors can be displayed at large scales without the plots being dominated by large error bar points. The standard deviations of the velocity estimated are computed using the GLOBK First-order-Gauss-Markov Extrapolation (FOGMEX) model that aims to account for temporal correlations in the time series residuals. This algorithm is also called the "Realistic Sigma" model.

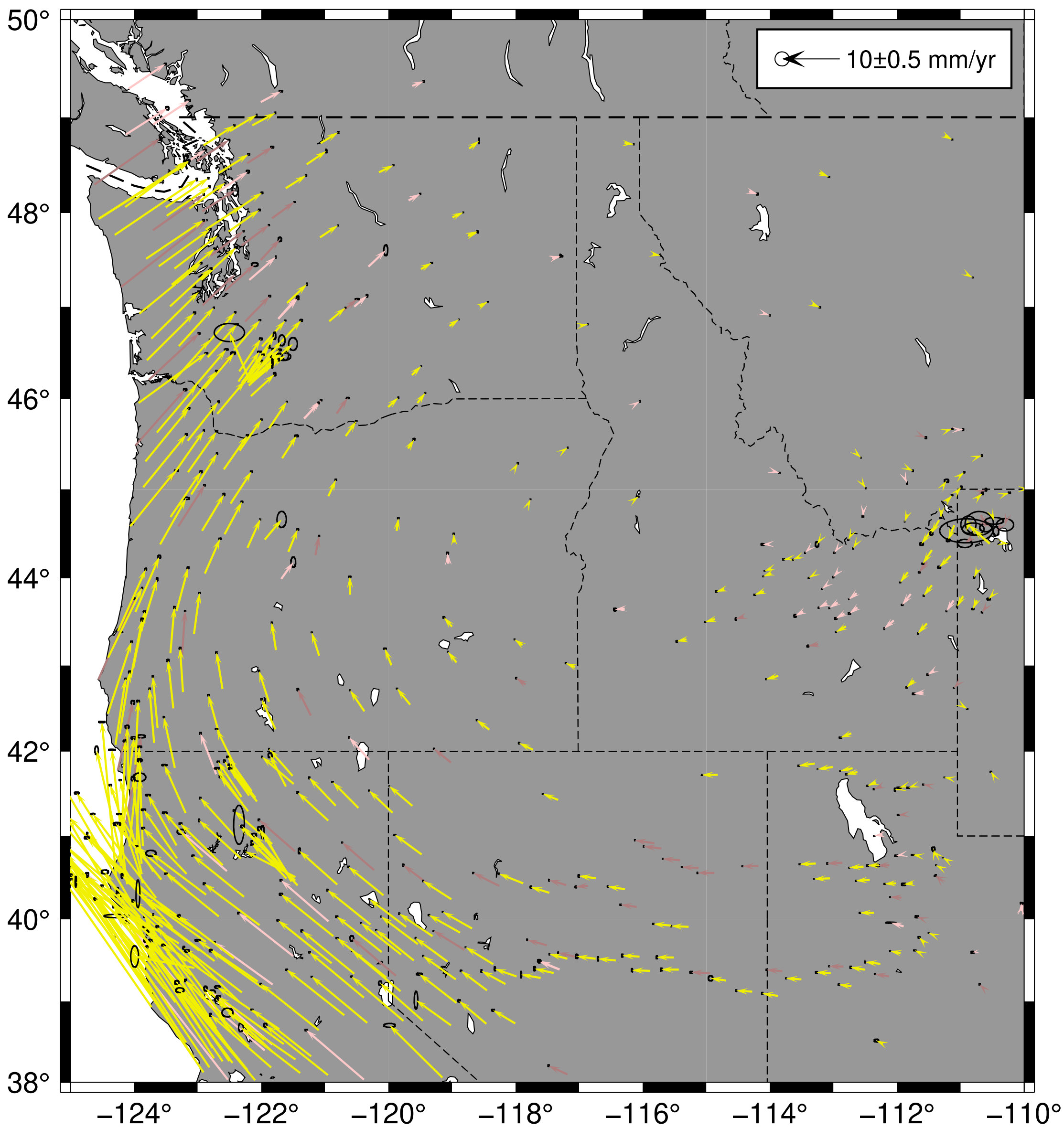

Figure 8: Velocity field estimates for the Pacific northwest from the CWU solution generated using time series analysis and the FOGMEX error model. 95% confidence interval error ellipses are shown. The color scheme of the vectors matches the network type legend in Figure 4. Only velocities with horizontal standard deviations less than 2 mm/yr are shown (this value is reduced from previous reports due to the improved velocity sigmas).

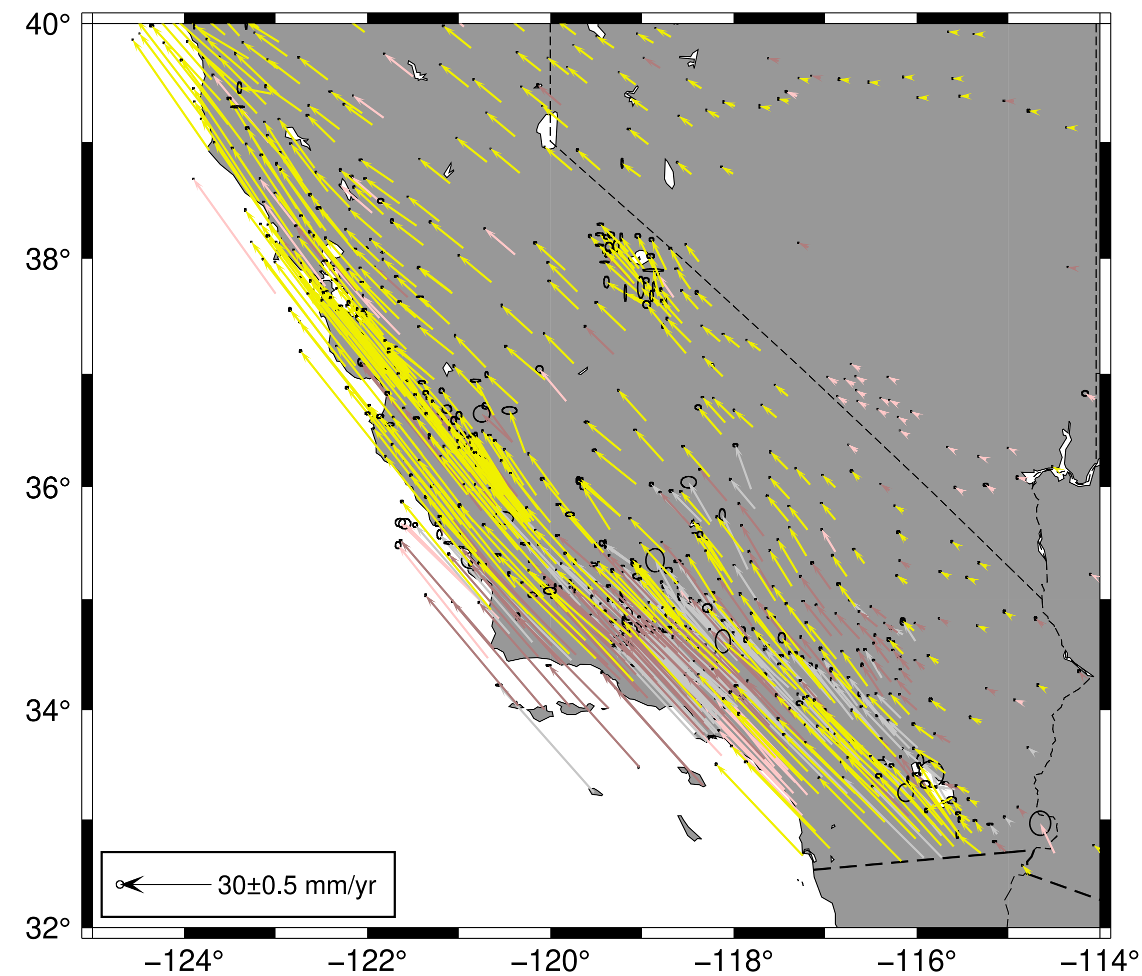

Figure 9: Same as Figure 8 except for South Western United States. Only velocities with horizontal standard deviations less than 2 mm/yr are shown.

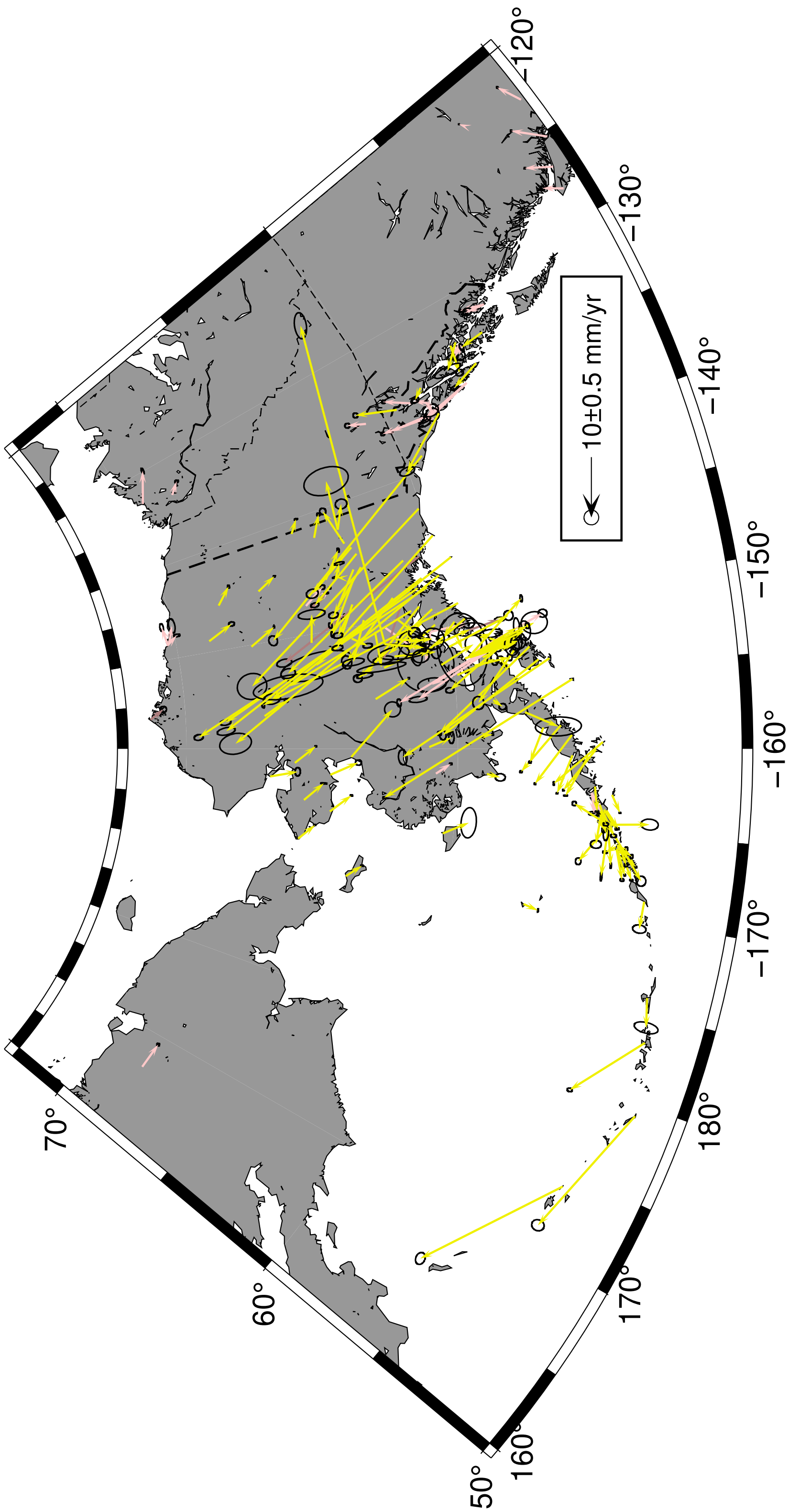

Figure 10: Same as Figure 8 except for Alaska. Only velocities with horizontal standard deviations less than 5 mm/yr are shown

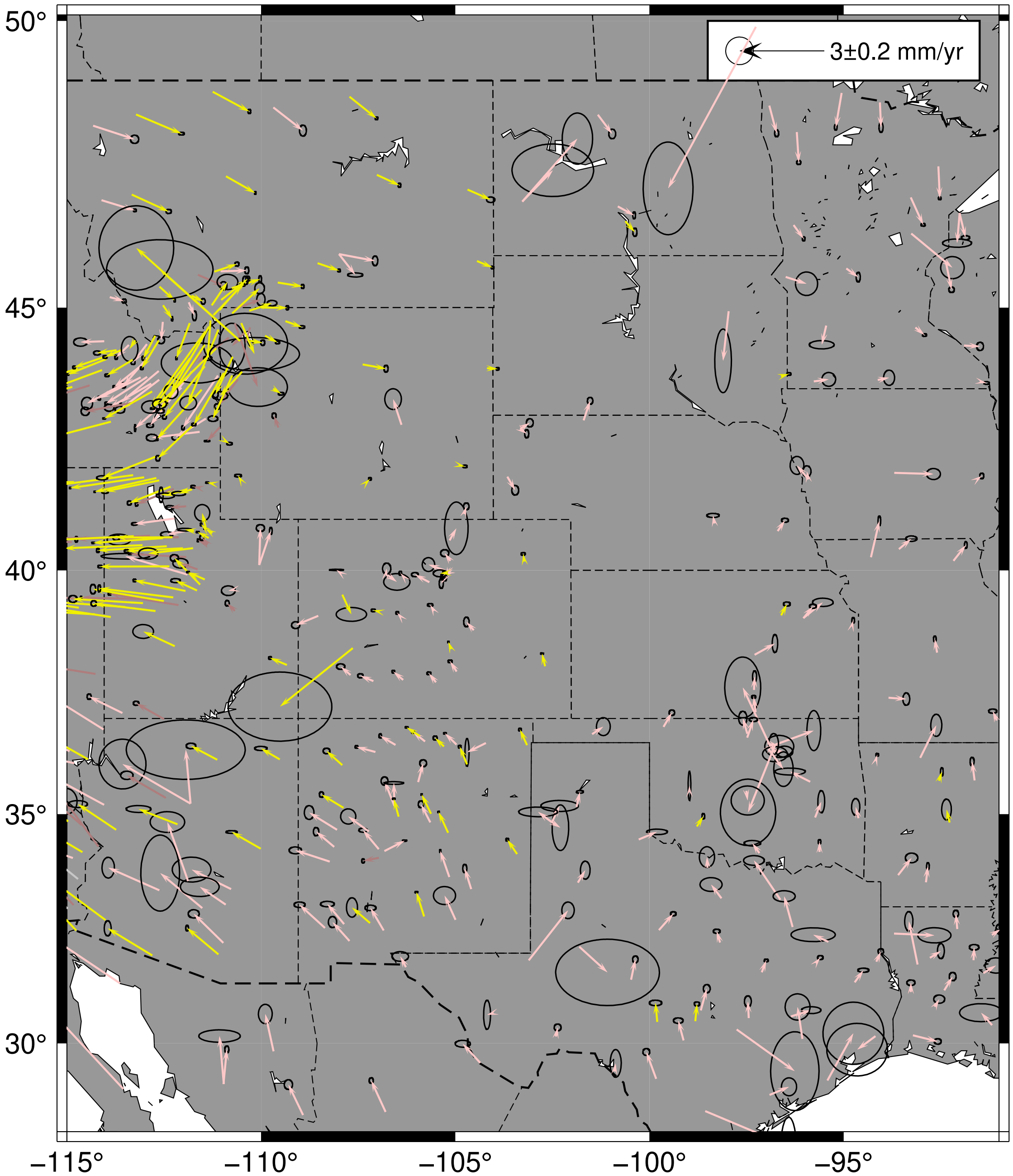

Figure 11: Same as Figure 8 except for Central United States. Only velocities with horizontal standard deviations less than 1 mm/yr are shown.

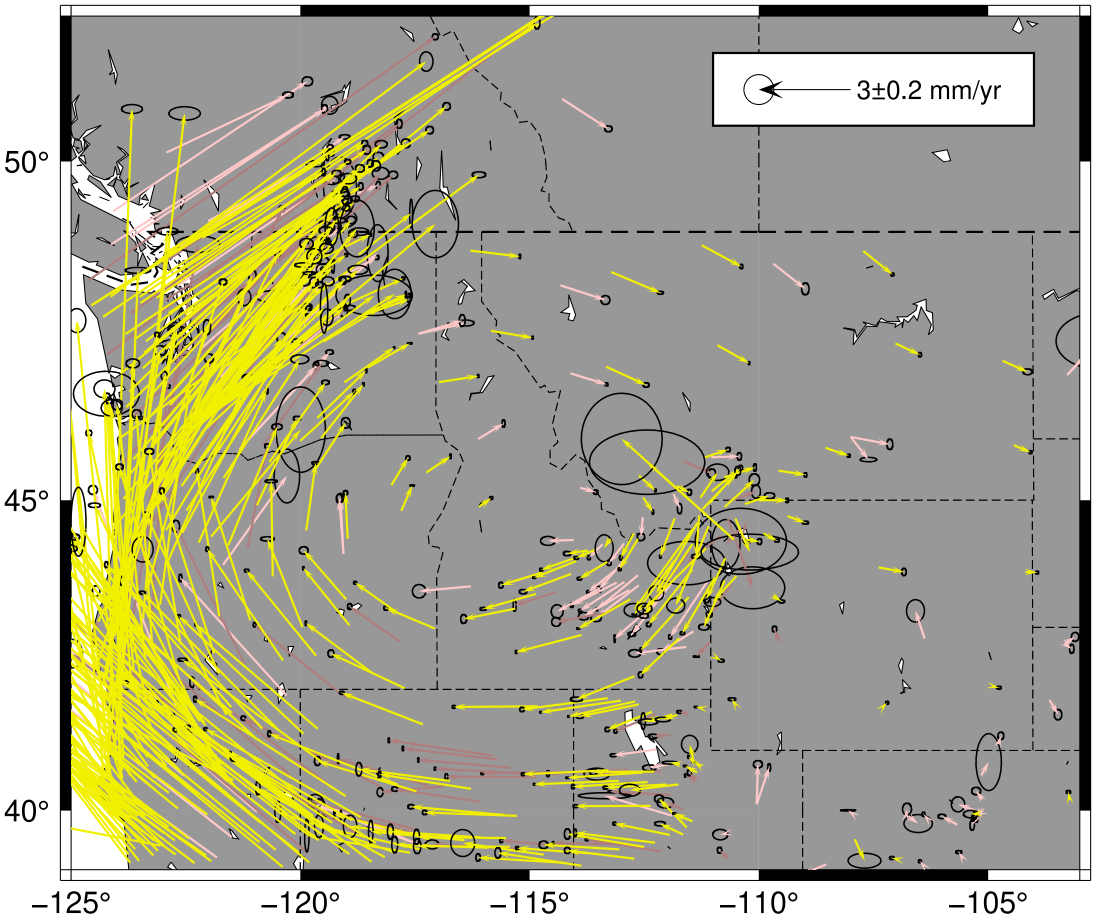

Figure 12: Same as Figure 8 except for Western Central United States. Only velocities with horizontal standard deviations less than 1 mm/yr are shown. Anomalous vectors at longitude 250º are in the Yellowstone National Park and most likely are showing volcanic processes.

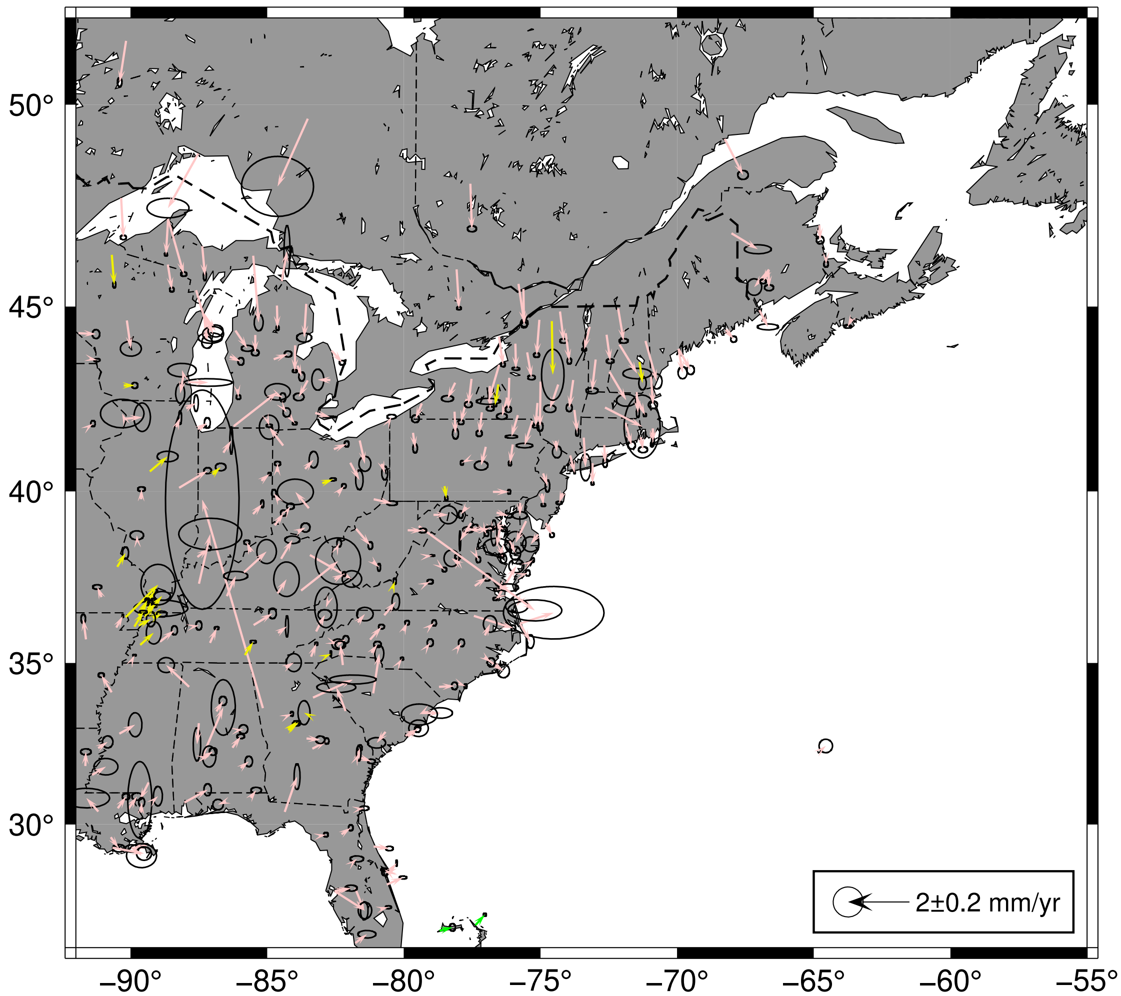

Figure 13: Same as Figure 8 except for the Eastern United States. Only velocities with horizontal standard deviations less than 2 mm/yr are shown. The systematic velocity of sites in the Northeast and central US show deviations for current GIA models in the horizontal velocities.

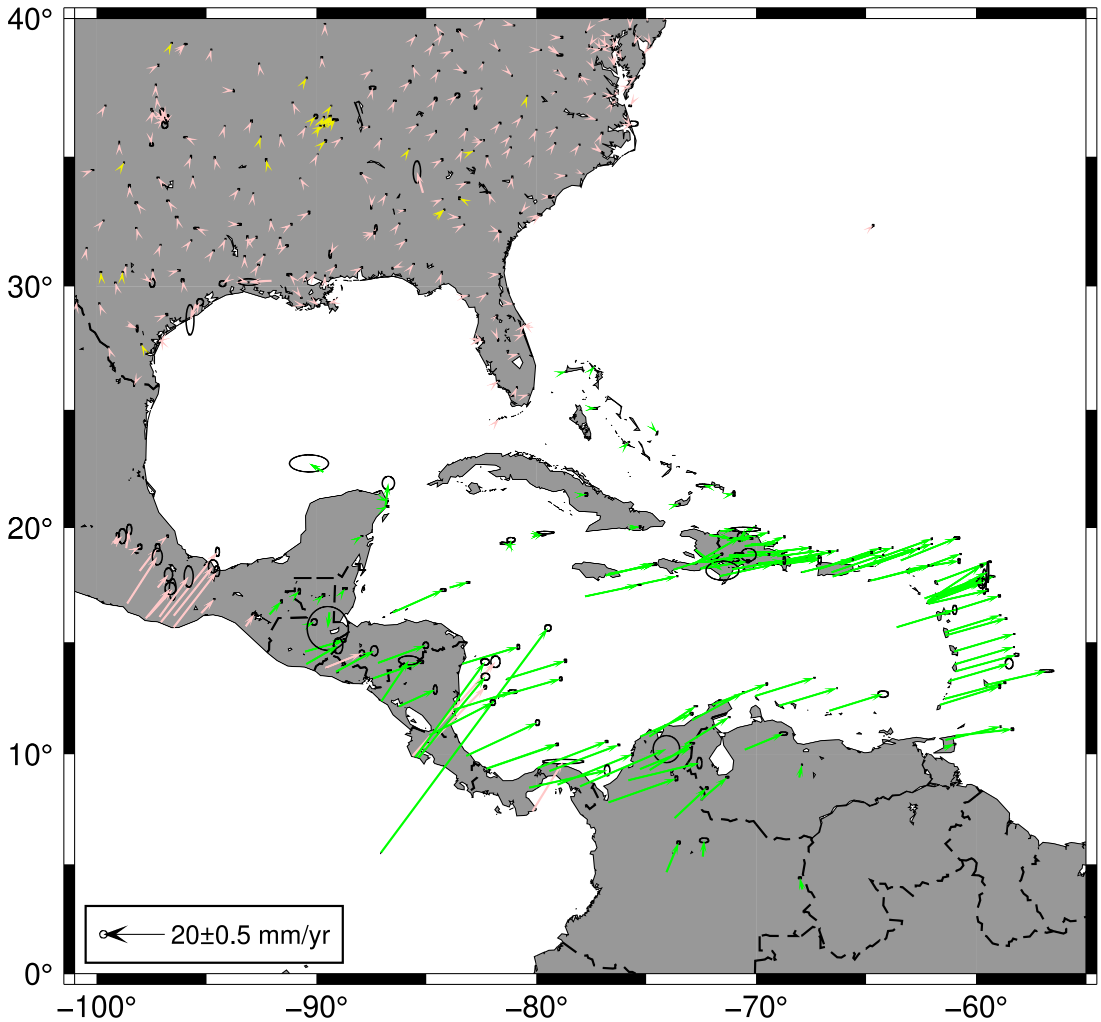

Figure 14: Same as Figure 8 except for the Caribbean region. Only velocities with horizontal standard deviations less than 5 mm/yr are shown.

Earthquake Analyses: 2023/12/15-2024/09/15

We use the NEIC catalog to search for earthquakes that could cause coseismic offsets at the sites analyzed by the GAGE analysis centers. Of the 32 earthquakes examined during this quarter, two generated co-seismic offsets greater than 1 mm but at only one operating station for each earthquake. These earthquakes are ID 72 ANSS(ComCat) us6000nekb, mww5.6 12 km SE of Puerto Armuelles (10.567 km depth), located at latitude and longitude 8.2100° -82.7741° on 2024/07/22 at 20:18 UTC and ID 73 ANSS(ComCat) ci40865184 mw5.2 24 km SW of Lamont (11.6 km depth),), located at latitude and longitude 35.1090° -119.0970° on 2024/08/07 at 04:10 UTC.

Antenna and other discontinuity events.

Antenna swaps at 42 sites have been added to the list of offsets estimated when fitting velocities and other parameters to the CWU time series. These offsets were spread throughout the quarter.

Anomalous sites

The following sites have been noted as having anomalous motions during this quarter. We updated the ACC_GAGE website to show times of earthquakes, antenna changes, and offsets for unknown reasons. Plots for CWU are now generated with and without offsets (computed from the Kalman filter time series analysis) removed. The landing page for http://geoweb.mit.edu/~tah/ACC_GAGE/ now has the following explanation.

NOTA RAPID Solution Outlier sites for PROD ID 20230120183013

Analyses from Central Washington University (CWU). Series are:
NMT -- Old plots from New Mexico Tech Analyses (Ends 9/15/2018).
PBO -- Old plots from Combined NMT+CWU analyses (Ends 9/15/2108).
CWURAW -- Raw time series with linear trend removed
CWUOFF -- Time series with linear trend and offsets from cwu.kalts_nam14.off removed
Vertical lines denote times of offsets in time series:
Purple, solid: Earthquakes (OffEq ! EQ)
Blue, dotted: Antenna changes (Break ! AN)
Cyan, dashed: Breaks for unkown reasons (Break ! UN)

N after site name means NOTA operated site, U means UNAVCO/Earthscope log file.

Site	N	Issues related to site
		2024-07-11
FCHO	U	Miami site, in GAGE station pages. 10 mm runoff in East. http://geoweb.mit.edu/~tah/ACC_GAGE/FCHO.CWUOFF.png
FCI2	U	Very close to FCHO. Looks like an antenna change but no update to Earthscope log. FCI1 has same type of offset (local effect or common antenna change?) http://geoweb.mit.edu/~tah/ACC_GAGE/FCI2.CWUOFF.png
KYBO		CORS site. Looks like an antenna change but no log update. http://geoweb.mit.edu/~tah/ACC_GAGE/KYBO.CWUOFF.png
		2024-07-19 Not in monthly.
P271	N	Continued poroelastic effects (see https://docs.google.com/document/d/1ecIF4wWENzKBqXBYHbUToXex8vKUYuKAV-uca8VkD8Y/edit) http://geoweb.mit.edu/~tah/ACC_GAGE/P271.CWUOFF.png
P281	N	Non-steady motions particularly in East. (No photos on station pages at the moment). http://geoweb.mit.edu/~tah/ACC_GAGE/P281.CWUOFF.png
SAJU	U	Site on west coast Costa Rica. Large postseismic but strange “noise” in

		mid-2023, no meta data changes. http://geoweb.mit.edu/~tah/ACC_GAGE/SAJU.CWUOFF.png
SPRG		PANGA site in eastern WA, starting to develop annual in East component (mainly).Unknown height jump in June 2008. http://geoweb.mit.edu/~tah/ACC_GAGE/SPRG.CWUOFF.png
TBLP	U	Restart after long gap (2021). Site in central California Looks like new antenna but no metadata update. http://geoweb.mit.edu/~tah/ACC_GAGE/TBLP.CWUOFF.png
		2024-08-02
AZGB		CORS site in Arizona, Recently becoming noisy in rapids. 10 mm level systematics in time series. May be vegetation nearby (increase in easy annual.) http://geoweb.mit.edu/~tah/ACC_GAGE/AZGB.CWUOFF.png
LEPA	U	Costa Rico site with slow slip events. http://geoweb.mit.edu/~tah/ACC_GAGE/LEPA.CWUOFF.png
		2024-08-09
AC11	N	Very large long term systematics. NE of Anchorage. http://geoweb.mit.edu/~tah/ACC_GAGE/AC11.CWUOFF.png
GRNX	N	Very skewed in North. 50 mm offset in rapids. Near Denali. All photos are now missing. http://geoweb.mit.edu/~tah/ACC_GAGE/GRNX.CWUOFF.png
TTSF	N	20 mm jump in height in rapid. No meta data changes. Check later to see if persists. http://geoweb.mit.edu/~tah/ACC_GAGE/TTSF.CWUOFF.png
		2024-08-16 Not in telecon notes
ICT1		CORS site with new antenna, log file updated. http://geoweb.mit.edu/~tah/ACC_GAGE/ICT1.CWUOFF.png
		2024-08-30
P540	N	Switch to new antenna not in metadata yet. Check later to see if updated. http://geoweb.mit.edu/~tah/ACC_GAGE/P540.CWUOFF.png
CARH	U	No meta update after antenna change and gap (HUNT is the same). Also TBLP http://geoweb.mit.edu/~tah/ACC_GAGE/CARH.CWUOFF.png http://geoweb.mit.edu/~tah/ACC_GAGE/HUNT.CWUOFF.png
		2024-09-06
NGSW	U	Site in Shumagin gap, recently installed with strange outliers in Jan 2023. Seems low altitude for snow. Mostly NE outliers. Possible EQ 24/08/01 http://geoweb.mit.edu/~tah/ACC_GAGE/NGSW.CWUOFF.png
WMGD	U	Brawly seismic zone. Systematic with 2-year gap, just came back on line. Seems to OK. http://geoweb.mit.edu/~tah/ACC_GAGE/WMDG.CWUOFF.png
		2024-09-13
MC01		CORS site with new antenna. Log updated, check later. http://geoweb.mit.edu/~tah/ACC_GAGE/MC01.CWUOFF.png
P056	N	Large ground water signal, interesting differences in ling term

		behaviors of each component. http://geoweb.mit.edu/~tah/ACC_GAGE/P056.CWUOFF.png
		2024-09-27 Not in Telecon
AC25	N	Interesting change in rate after large earthquakes in 2020. King Cove in Aleutian Islands. http://geoweb.mit.edu/~tah/ACC_GAGE/AC25.CWUOFF.png
LMSG		LA Basin Site. Fitting issue with log from Ridgecrest and antenna change 2022 with large gap in data. http://geoweb.mit.edu/~tah/ACC_GAGE/LMSG.CWUOFF.png
		2024-10-04
GRZA	U	Great example of height post-seismic (Costa Rica) http://geoweb.mit.edu/~tah/ACC_GAGE/GRZA.CWUOFF.png
OBSR	U	Strange steps in time series. Site on Mt. Rainier volcano. http://geoweb.mit.edu/~tah/ACC_GAGE/OBSR.CWUOFF.png
RYMD		PANGA site near Seattle. Data quality maybe degrading? http://geoweb.mit.edu/~tah/ACC_GAGE/RYMD.CWUOFF.png
		2024-04-26
CN60	N	Jump of N 26mm, E -8mm on 2024/04/21. No change in metadata. Site on Contadora Island, Panama. Time series plots not updated on station page. http://geoweb.mit.edu/~tah/ACC_GAGE/CN60.CWUOFF.png
HAMM		CORS site in Louisiana, east jump in rapids ~20 mm. Persisted so added offset added after firmware change on day of offset. TRM Alloy http://geoweb.mit.edu/~tah/ACC_GAGE/HAMM.CWUOFF.png
		2024-05-02
BARA	U	Dominican Republic site. Offsets in North and East by ~20 mm. http://geoweb.mit.edu/~tah/ACC_GAGE/BARA.CWUOFF.png
TN35		Height jump in rapids. Tennessee CORS site. No metadata updates. See if persists. http://geoweb.mit.edu/~tah/ACC_GAGE/TN35.CWUOFF.png
		2024-05-10
MTDT		CORS site in Montana. Offsets in North and Height in rapid. See if they persist. http://geoweb.mit.edu/~tah/ACC_GAGE/MTDT.CWUOFF.png
MTLW		CORS site in Montana. Offset mostly in height of about the same magnitude as MTDT. Looks like antenna change but no metadata update. http://geoweb.mit.edu/~tah/ACC_GAGE/MTLW.CWUOFF.png
		2024-05-17 Not in monthly
DVPB	U	NE of LA. Poor offset estimates because postseismic from 2019/07/06 (Ridgecrest EQ) poorly separated from antenna change after large gap. http://geoweb.mit.edu/~tah/ACC_GAGE/DVPB.CWUOFF.png
PHJX	U	Just south of Mexican border. Post-seismic curvature for El Major Cucapah from but large gap and an a 2012 aftershock make estimation difficult. http://geoweb.mit.edu/~tah/ACC_GAGE/PHJX.CWUOFF.png
		2024-05-23
BON2	U	Site in Costa Rica. Went bad in 2022 when NetR9 changed (2022 80, new serial number). Rapid solutions show 8 mm NE, 33 mm U RMS.

		(Data edited from plots). http://geoweb.mit.edu/~tah/ACC_GAGE/BON2.CWUOFF.png
		2024-05-31
TN16		CORS site, Antenna change. Meta data needs to be updated. http://geoweb.mit.edu/~tah/ACC_GAGE/TN16.CWUOFF.png
		2024-06-07
WVBU		CORS site in Virginia. Strong annual in East 2019-2023. Recent small drift in North. (WVMF 45 km away shows strong growth in North annual). May be wrong year in log file for (first) antenna change. http://geoweb.mit.edu/~tah/ACC_GAGE/WVBU.CWUOFF.png
		2024-06-21 Not in Monthly
P794	N	Site in Covelo CA (2088 meters high). Looks like snow event may have bent monument. Tall pole with bracing. http://geoweb.mit.edu/~tah/ACC_GAGE/P794.CWUOFF.png
TN13		Antenna change from TPSG3_A1 to LEIAR10 looks like 50 mm height change. (sh_plot_update to check later (-50 mm dU change seen at TN16 for same swap 20 days earlier). http://geoweb.mit.edu/~tah/ACC_GAGE/TN13.CWUOFF.png
		2024-06-27
KYMH		Previously reported failed antenna, CORS site in Kentucky. Break in data but no new meta data. http://geoweb.mit.edu/~tah/ACC_GAGE/KYMH.CWUOFF.png
P265	N	New antenna. Check when metadata updated. http://geoweb.mit.edu/~tah/ACC_GAGE/P265.CWUOFF.png
RBRU		Site near Fresno, CA. Looks like tree growth. http://geoweb.mit.edu/~tah/ACC_GAGE/RBRU.CWUOFF.png
UPTC		CORS site in Pennsylvania, Had a span of low accuracy data (2014-2021), improved but then went offline. Back online with new receiver but data quality is low (same antenna). RFI at site? New data edited from plots. http://geoweb.mit.edu/~tah/ACC_GAGE/UPTC.CWUOFF.png
WAMC		PANGA sites, Look like new atenna but no meta data update yet. http://geoweb.mit.edu/~tah/ACC_GAGE/WAMC.CWUOFF.png
		2024-07-08
YBH2		CORS site run by BSL in Yreka Blue Horn Mine, Northern Califormia. Looks like antenna change but no new logfile. http://geoweb.mit.edu/~tah/ACC_GAGE/YBH2.CWUOFF.png
P170	N	Northern California, 100 mm East jump in rapids. Check later to see if it persists. http://geoweb.mit.edu/~tah/ACC_GAGE/P170.CWUOFF.png

GNSS Rapid processing

Since 2021/10/20, CWU has generated a combined GPS and Galileo rapid solution because JPL has made available orbit and clock files from a global GPS and Galileo solution. These solutions are experimental, and for a number of sites, there are systematic mean differences in position between the GPS-only and the combined solutions. For this reason, these combined solutions are not distributed through the EarthScope GAGE products portal. Initially, there were inconsistencies in the GPS-only and combined analyses (e.g., elevation angle cutoff) that affected the comparison of the results, specifically when comparing mean positions and WRMS scatters of the fits to linear trends. Starting on 2024/03/26, these inconsistencies were resolved and since that time, a direct comparison of the GPS-only and combined GPS and Galileo solutions is possible. Results of the comparisons are reported daily to the GAGE_ACS email list. With over three months of consistently processed results now available, we compare the results below. The current analysis used 478 stations with up to 193 days of comparison. The median NEU scatters for the GPS+GAL solutions are 0.81, 0.81, and 3.90 mm. The corresponding values from the common GPS-only solutions are 0.90, 0.88 , and 4.19 mm, slightly larger than those from the GPS+GAL solution.

Table 4: Mean differences between GPS-only and GPS+Galileo rapid solutions. Differences are taken as GPS+GAL minus GPS-only position estimates. The largest 10 positive and negative differences in Up, North, and East are shown. The sig column is the standard deviation of the mean (assuming white noise statistics), wrms is the weighted root-mean-square scatter about the mean, and nrms is the normalized root mean square ($\sqrt{\chi^2/f}$).

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Stat	enu	#	MeanDiff (mm)	sig (mm)	wrms (mm)	nrms	Receiver	Antenna	Radome
FLIN	U	193	-14.55	0.16	2.22	0.25	SEPT POLARX5	NOV750.R4	NOVS
SASK	U	193	-13.20	0.18	2.48	0.29	JAVAD TRE_G3TH DELTA	NOV750.R4	NOVS
HDIL	U	22	-11.45	1.34	6.31	0.47	SEPT POLARX5	TRM59800.80	SCIT
ARBT	U	192	-10.13	0.36	4.99	0.54	TRIMBLE NETR9	TRM115000.00	NONE
PTRF	U	192	-8.71	0.30	4.12	0.42	SEPT POLARX5S	SEPCHOKE_B3E6	SPKE
1LSU	U	139	-7.79	0.55	6.50	0.58	TRIMBLE ALLOY	TRM115000.00	NONE
MHMS	U	191	-6.64	0.27	3.71	0.37	SEPT POLARX5	TWIVC6150	SCIT
P776	U	193	-6.64	0.34	4.74	0.50	SEPT POLARX5	TRM59800.80	SCIT
SELD	U	193	-6.38	0.33	4.64	0.48	SEPT POLARX5	TRM159800.00	SCIT
YORK	U	159	-6.28	2.32	29.21	1.16	TRIMBLE ALLOY	TRM115000.10	NONE
....									
HCEX	U	50	5.97	0.69	4.88	0.53	SEPT POLARX5	SEPPOLANT_X_MF	NONE
CJTR	U	175	6.26	0.31	4.16	0.45	SEPT POLARX5	SEPPOLANT_X_MF	NONE
ARML	U	175	7.00	0.30	3.95	0.43	SEPT POLARX5	SEPPOLANT_X_MF	NONE
HCES	U	52	7.54	0.61	4.40	0.49	SEPT POLARX5	SEPPOLANT_X_MF	NONE
LCHS	U	161	7.85	0.35	4.50	0.49	SEPT POLARX5	SEPPOLANT_X_MF	NONE
P385	U	193	8.27	0.52	7.29	0.74	SEPT POLARX5	TRM59800.80	SCIT
MCTY	U	161	9.10	0.39	4.96	0.52	SEPT POLARX5	SEPPOLANT_X_MF	NONE
P312	U	190	9.19	2.76	38.02	1.18	TRIMBLE NETR9	TRM59800.80	SCIT
P156	U	151	10.58	1.29	15.86	0.97	SEPT POLARX5	TRM59800.80	SCIT
COLA	U	192	21.33	0.99	13.77	1.43	TRIMBLE ALLOY	TRM55971.00	NONE

Stat	enu	#	MeanDiff (mm)	sig (mm)	wrms (mm)	nrms	Receiver	Antenna	Radome
LONG	N	190	-3.71	0.25	3.45	1.16	SEPT POLARX5	TWIVC6150	SCPL

COLA	N	192	-2.91	0.11	1.57	0.72	TRIMBLE ALLOY	TRM55971.00	NONE
AB18	N	192	-1.62	0.06	0.84	0.29	SEPT POLARX5	TRM59800.99	SCIT
P033	N	192	-1.60	0.16	2.27	0.92	TRIMBLE NETR9	TRM59800.80	SCIT
AB11	N	159	-1.59	0.07	0.87	0.32	SEPT POLARX5	TRM59800.99	SCIT
AB48	N	4	-1.57	1.61	1.40	0.43	SEPT POLARX5	TRM29659.00	SCIT
P669	N	193	-1.57	0.06	0.78	0.29	SEPT POLARX5	TWIVC6050	SCIS
MHMS	N	191	-1.50	0.06	0.80	0.33	SEPT POLARX5	TWIVC6150	SCIT
AC12	N	191	-1.46	0.06	0.82	0.32	SEPT POLARX5	TRM59800.80	SCIT
AV02	N	43	-1.46	0.08	0.52	0.18	SEPT POLARX5	TRM159800.00	SCIT
....									
P001	N	192	1.28	0.18	2.43	1.10	TRIMBLE NETR9	TRM59800.80	SCIT
P776	N	193	1.30	0.06	0.88	0.36	SEPT POLARX5	TRM59800.80	SCIT
P794	N	109	1.35	0.04	0.45	0.19	SEPT POLARX5	TRM59800.00	SCIT
RG08	N	193	1.36	0.11	1.59	0.73	SEPT POLARX5	TRM59800.99	SCIT
GODE	N	179	1.42	0.05	0.70	0.31	SEPT POLARX5TR	AOAD/M_T	JPLA
KYMH	N	170	1.75	0.08	1.04	0.46	TRIMBLE NETR3	TRM57971.00	NONE
P252	N	53	2.28	0.20	1.49	0.65	TRIMBLE NETR9	TRM29659.00	SCIT
OSPA	N	192	2.43	0.08	1.11	0.45	SEPT POLARX5	TWIVC6150	SCIS
P156	N	151	2.99	0.20	2.44	0.65	SEPT POLARX5	TRM59800.80	SCIT
P385	N	193	3.87	0.15	2.09	0.78	SEPT POLARX5	TRM59800.80	SCIT

Stat	enu	#	MeanDiff (mm)	sig (mm)	wrms (mm)	nrms	Receiver	Antenna	Radome
CAT3	E	192	-3.29	0.29	4.04	0.53	TRIMBLE ALLOY	TRM59800.80	SCIT
P187	E	193	-1.81	0.19	2.60	0.86	SEPT POLARX5	TRM59800.99	SCIT
P669	E	193	-1.75	0.06	0.88	0.37	SEPT POLARX5	TWIVC6050	SCIS
CN20	E	193	-1.44	0.20	2.84	1.15	TRIMBLE NETR9	TRM59800.00	SCIT
TFNO	E	46	-1.44	0.11	0.76	0.34	SEPT POLARX5	SEPCHOKE_B3E6	SPKE
AB48	E	4	-1.43	1.01	0.63	0.31	SEPT POLARX5	TRM29659.00	SCIT
P804	E	73	-1.42	1.23	10.51	1.63	TRIMBLE NETR9	TRM59800.80	SCIT
RDF2	E	74	-1.42	0.18	1.51	0.55	TRIMBLE NETR9	TRM57971.00	NONE
KVTX	E	193	-1.41	0.06	0.81	0.38	SEPT POLARX5	TRM59800.99	SCIT
BOGT	E	193	-1.34	0.10	1.39	0.57	JAVAD TRE_3 DELTA	JAVRINGANT_DM	NONE
....									
P156	E	151	1.19	0.19	2.34	0.75	SEPT POLARX5	TRM59800.80	SCIT
KIR0	E	192	1.26	0.05	0.75	0.41	SEPT POLARX5	JAVRINGANT_DM	OSOD
ONSA	E	192	1.31	0.06	0.82	0.47	SEPT POLARX5TR	AOAD/M_B	OSOD
VIS0	E	192	1.33	0.06	0.79	0.45	SEPT POLARX5	AOAD/M_T	OSOD
YORK	E	162	1.52	0.82	10.43	1.73	TRIMBLE ALLOY	TRM115000.10	NONE
P740	E	184	1.55	0.11	1.47	0.58	SEPT POLARX5	TRM59800.99	SCIT
P505	E	176	2.00	0.25	3.33	1.65	TRIMBLE NETR9	TRM59800.80	SCIT
NDAP	E	192	2.61	0.23	3.12	1.60	TRIMBLE NETR9	TRM59800.80	SCIT
EGAN	E	192	2.81	0.25	3.45	1.78	TRIMBLE NETR9	TRM59800.80	SCIS
P191	E	193	5.18	0.36	4.95	2.60	TRIMBLE NETR9	TRM59800.80	SCIT

ANET Processing

The ANET additional sites are being processed as a separate network, and the frame-resolved SINEX files will be given in the Antarctica 2014 reference frame (Altamimi *et al.,* 2016, 2017). We label this frame ant14. Time series and SINEX files are generated only for final orbit solutions and are labeled as fanet (instead of final to avoid name conflicts with loose solutions). The IGS14 loose submission files are labeled with "lse14" to differentiate them for the IGS08 loose submissions which were simply label as loose. The statistics of the time series fits from the CWU solution for this quarter are given in Table 5.

Table 5: Statistics of the fits of 44 stations in the ANET region for CWU analyzed in the final orbit analysis between June 15, 2024 and September 21, 2024.

CWU	North (mm)	East (mm)	Up (mm)
Median			
ANET	1.63	1.32	7.35
70%			
ANET	1.75	1.49	7.94
95%			
ANET	2.00	2.55	9.38

The histogram to the RMS scatter of the results for this quarter are shown in Figure A.1

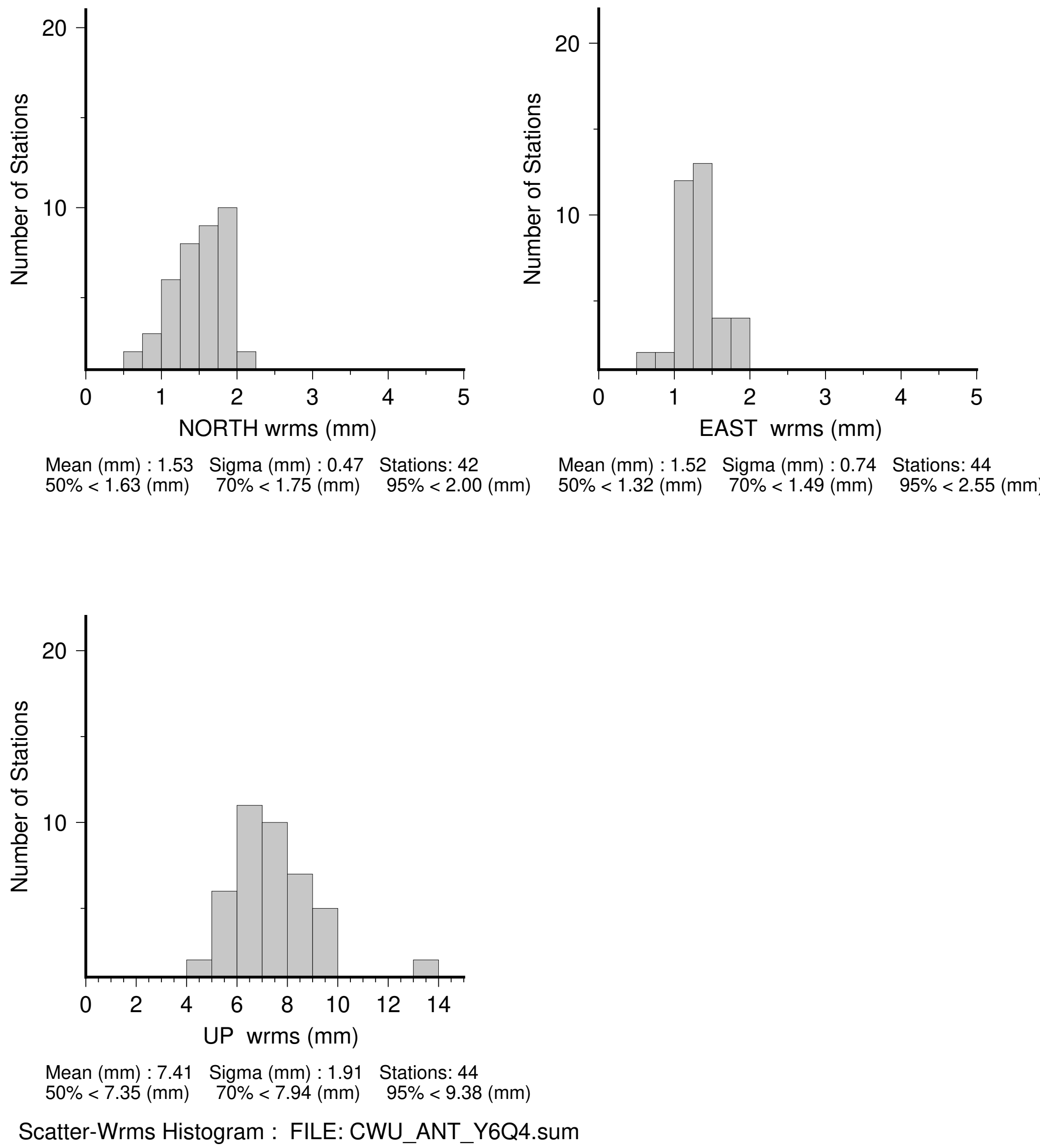

Figure A.1: CWU solution histograms of the North, East and Up RMS scatters of the position residuals for 50 stations in Antarctica analyzed between June 15, 2024 and September 21, 2024. Linear trends and annual signals were estimated from the time series.

References

Altamimi, Z., P. Rebischung, L. Metivier, and X. Collilieux (2016), ITRF2014: A new release of the International Terrestrial Reference Frame modeling nonlinear station motions, *J. Geophys. Res. Solid Earth*, 121, 6109-6131, doi: 10.1002/2016JB013098.

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