WIDE-AREA AUGMENTATION SYSTEM PERFORMANCE ANALYSIS REPORT

Report #27

Reporting Period: October 1 to December 31, 2008

January 2009

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Website: http://www.nstb.tc.faa.gov/

Executive Summary

Since 1999 the WAAS Test Team at the William J. Hughes Technical Center has reported GPS performance as measured against the GPS Standard Positioning Service (SPS) Signal Specification. These quarterly reports are known as the PAN (Performance Analysis Network) Report. In addition to that report, the WAAS Test Team reports on the performance of the Wide-Area Augmentation System (WAAS). This report is the twenty-seventh such WAAS quarterly report. This report covers WAAS performance during the period from October 1, 2008 to December 31, 2008.

The following table shows observations for accuracy and availability made during the reporting period for CONUS and Alaska sites. The international sites are excluded from this table, but are included in the body of the report. See the body of the report for additional results in accuracy, availability, safety index, range accuracy; WAAS broadcast message rates and GEO ranging availability. Please note that the results in the table below are valid when the Localizer Precision with Vertical Guidance (LPV) service is available. LPV service is available when the calculated Horizontal Protection Level (HPL) is less than 40 meters and the Vertical Protection Level (VPL) is less than 50 meters. LPV 200 service is available when the calculated HPL is less than 40 meters and the VPL is less than 35 meters.

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	Alaska Site/Maximum	Alaska Site/Minimum
95% Horizontal Accuracy	Arcata 1.35 meters	Denver 0.569 meters	Cold Bay 0.75 meters	Anchorage 0.537 meters
95% Vertical Accuracy	Miami 1.828 meters	Kansas City 0.885 meters	Kotzebue 1.48 meters	Cold Bay 1.04 meters
LPV Availability (HPL < 40 meters & VPL < 50 meters)	Washington DC 100%	Arcata 99.98%	Juneau 100%	Barrow 98.6%
LPV 200 Availability (HPL < 40 meters & VPL < 35 meters)	Washington DC 100%	Oakland 96.12%	Juneau 100%	Cold Bay 88.22%
95% HPL	Arcata 17.14 meters	Memphis 11.37 meters	Cold Bay 26.03 meters	Fairbanks 13.17 meters
95% VPL	Arcata 32.99 meters	Minneapolis 18.68 meters	Barrow 38.16 meters	Juneau 22.40 meters

Please note that the section “GPS Broadcast Orbit vs. Precise Orbits” will be included in the GPS PAN report and removed from the WAAS PAN report for this report and all future reports.

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1.0 INTRODUCTION

The FAA began monitoring GPS SPS performance in order to ensure the safe and effective use of the satellite navigation system in the National Airspace System (NAS). The Wide Area Augmentation System (WAAS) adds more timely integrity monitoring of GPS and improves position accuracy and availability of GPS within the WAAS coverage area.

Objectives of this report are:

a. To evaluate and monitor the ability of WAAS to augment GPS by characterizing important performance parameters.
b. To analyze the effects of GPS satellite operation and maintenance, and ionospheric activity on the WAAS performance.
c. To investigate any GPS and WAAS anomalies and determine their impact on potential users.
d. To archive performance of GPS and WAAS for future evaluations.

The WAAS data transmitted from Geostationary satellites (GEO) PRN#135 (CRW) and PRN#138 (CRE) were used in the evaluation. For this evaluation period, both CRW and CRE GEOs provide a ranging capability for enroute through NPA and PA service.

Table 1.1 and Table 1.2 list NSTB and WAAS reference station receivers used in Precision Approach (PA) and Non-Precision Approach (NPA) evaluation process, respectively. This report presents results from three months of data, collected from October 1, 2008 to December 31, 2008

Table 1-1 PA Sites

	Number of Days Evaluated	Number of Samples
NSTB:		
Arcata	91	7889382
Oklahoma City	87	7555172
WAAS:		
Albuquerque	92	7936599
Anchorage	92	7936901
Atlanta	92	7937574
Barrow	92	7919719
Bethel	92	7929113
Billings	92	7932659
Boston	90	7783773
Chicago	92	7936143
Cleveland	92	7938522
Cold Bay	91	7886338
Dallas	92	7933408
Denver	92	7933985
Fairbanks	92	7931787
Gander	92	7933438
Goose Bay	92	7926465
Houston	92	7928713
Iqaluit	92	7927668
Jacksonville	92	7936829
Juneau	84	7231443
Kansas City	92	7935360
Kotzebue	72	6198942
Los Angeles	92	7935589
Memphis	92	7938101
Merida	92	7931428
Mexico City	85	7342006
Miami	92	7936180
Minneapolis	92	7931365
New York	92	7938251
Oakland	92	7935591
Puerto Vallarta	88	7645767
Salt Lake City	92	7937312
San Jose Del Cabo	88	7624695
San Juan	92	7932545
Seattle	92	7936624
Tapachula	92	7923584
Washington DC	92	7938120
Winnipeg	92	7933880

Table 1-2 NPA Sites

Location	Number of Days Evaluated	Number of Samples
Albuquerque	92	7939277
Anchorage	92	7939580
Atlanta	92	7938111
Barrow	92	7922910
Bethel	92	7931801
Billings	92	7935314
Boston	90	7786445
Cleveland	92	7941063
Cold Bay	91	7889110
Fairbanks	92	7934393
Gander	92	7936131
Honolulu	92	7923137
Houston	92	7931438
Iqaluit	92	7929796
Juneau	84	7236834
Kansas City	92	7940263
Kotzebue	72	6199900
Los Angeles	92	7940673
Merida	92	7934113
Miami	92	7939065
Minneapolis	92	7934057
Oakland	92	7939427
Salt Lake City	92	7939985
San Jose Del Cabo	88	7627298
San Juan	92	7938754
Seattle	92	7940205
Tapachula	92	7927805
Washington DC	87	7480290

The report is divided in the performance categories listed below. This report also includes WAAS LPV and LPV 200 Service Availability at Selected Airports, WAAS Deterministic Code Noise and Multipath (CNMP) Bounding Analysis, WAAS reference station survey validation and SQM type and PRN bias monitoring.

1. WAAS Position Accuracy
2. WAAS Operational Service Availability
3. Coverage
4. Integrity
5. WAAS Range Domain Accuracy
6. GEO Ranging Performance

Table 1.3 lists the performance parameters evaluated for the WAAS in this report. Please note that these are the performance parameters associated with the WAAS IOC system. These requirements are extracted from the FAA Specification FAA-E-2892B Change 1and FAA Specification FAA-E-2976, as applicable.

Table 1-3 WAAS Performance Parameters

Performance Parameter	Expected WAAS Performance
LPV Accuracy Horizontal	≤ 1.5m error 95% of the time
LPV Accuracy Vertical	≤ 2m error 95% of the time
LNAV Accuracy Horizontal	≤ 36m error 95% of the time
Availability LPV CONUS	99% availability of 100% of CONUS
Availability LPV Alaska	95% availability of 75% of Alaska
Availability LNAV CONUS	99.99% availability with HPL < 556m
Availability LNAV Alaska	99.9% availability with HPL < 556m
Availability Enroute OCONUS	99.9% availability with HPL < 2nmi
Probability of HMI	< 10e-7 per approach

* Instantaneous availability (i.e. Availability is calculated every second.)

1.1 Event Summary

Table 1.4 lists test events that occurred during the reporting period that affected WAAS performance or the ability to determine the WAAS performance. These events include GPS or WAAS anomalies, relevant receiver malfunctions, and receiver maintenance conducted. Detailed analyses of particular events are documented in the Discrepancy Reports (DR). The DRs are posted on the website http://www.nstb.tc.faa.gov under 'WAAS Technical Reports' and can also be accessed via hyperlink from Table 1.4 below.

Table 1-4 Test Events

GPS Week	Date	Sites	Events
1499 day 2	10/02/09	All	Split Selected Source: CRW – ZDC, CRE - ZTL
1499 day 5	10/03/08	All	CRW GUS switchover: APA faulted, switched to APC – 12s gap
1500 day 0	10/05/08	Alaska	SQM Monitor trip on PRN24. See DR #76 – "False trip on PRN 24 with minimal effect on WAAS Coverage"
1500 day 3	10/08/08	All	PRN 26 outage (NANU 2008123) and CRW GUS switchover (manual APA to APC resulted in 3s gap) caused a drop in coverage.
1500 day 4	10/09/08	All	CRE GUS switchover: BRE to QWE – 3s gap
1500 day 6	10/11/06	CRW	At 20:02:55, the Omni section briefly lost lock on PRN 135 at both Napa and Littleton. This was due to a fairly hefty carrier phase spike - around ~0.05 cycles, as measured on the GEO channel. Both L1 and L5 at both sites experienced the phase spikes. The GEO channels experienced the spikes but did not lose lock.
1501 day 6	10/18/08	All	CRW GUS switchover: APC switched to APA – 7s gap. Split Selected Source: CRW–ZLA, CRE-ZDC. ZLA clock error did not correspond to switchover.
1502 day 6	10/25/08	All	CRE GUS switchover: BRE to QWE – 3s gap
1503 day 3	10/29/08	All	PRN 2 outage (NANU 2008136) caused a drop in coverage.
1503 day 5 to 1508 day 3	10/31/08 to 12/03/08	Kotzebue	Kotzebue is not evaluated due to lack of ring 2 data.
1503 day 3 1504 day 4 1507 day 2 1508 day 3 to 1508 day 5 1509 day 0	10/29/08 11/13/08 11/25/08 12/03/08 to 12/05/08 12/07/08	Alaska	Changes in the downlink carrier frequency from the CRW caused reduced PA Ranging Availability. See DR #77 – "CRW Downlink Frequency Spikes".
1504 day 1	11/03/08	All	CRW GUS switchover: APC switched to APA – 3s gap
1504 day 3	11/05/08	All	CRE GUS switchover: QWE to BRE – 10s gap
1505 day 0	11/14/08	Iqaluit	High VPE and HPE caused by loss of SVs due to scintillation on both threads.
1505 day 3	11/12/08	All	CRW GUS switchover: APA to APC – 3s gap
1505 day 3	11/12/08	All	CRE GUS switchover: QWE to BRE – 3s gap
1505 day 5	11/14/08	All	CRE GUS switchover: CRE – 1 missed message caused by carrier phase spike.
1505 day 5	11/14/08	All	Interruption in WAAS Ring2 data transmission due to telecomm line problems.
1507 day 2	11/25/08	CRW	Napa – 2 missed messages due to Doppler spikes.
1508 day 1	12/01/08	All	CRE – Source Select, ZDC to ZTL. Split Selected Source, CRW - ZLA
1509 day 0	12/07/08	CRW	Napa – 4 missed messages due to Doppler spikes.
1509 day 0 1509 day 1	12/07/08 12/08/08	Brewster	Two Brewster SIGGEN L5 IF Switch Faults in 24 hours.
1509 day 2	12/09/08	All	CRW GUS switchover: APC switched to APA – 3s gap
1510 day 0	12/14/08	All	CRE GUS switchover: QWE to BRE – 5s gap, Manual sw. for Woodbine maintenance.
1510 day 5	12/19/08	All	PRN 14 outage (NANU 2008147) caused a drop in coverage.
1511 day 6	12/27/08	All	CRE GUS switchover: BRE faulted, QWE to primary.

Report Overview

Section 2 provides the vertical and horizontal position accuracies from data collected, on a daily basis, at one-second intervals. The 95% accuracy index and the maximum accuracy for the reporting period are tabulated. The daily 95% accuracy index is plotted graphically for each receiver. Histograms of the vertical and horizontal error distribution are provided for the combined 38 WAAS receiver location within the WAAS service area.

Section 3 summarizes the WAAS instantaneous availability performance, at each receiver, for three operational service levels during the reporting period. Daily availability is also plotted for each receiver evaluated. The number of outages and outage rate for each site is reported.

Section 4 provides the percent of coverage provided by WAAS on a daily basis. Quarterly roll-up graphs presented indicate the portions of service volume covered, and the percentage of time that WAAS was available.

Section 5 summarizes the number of HMI's detected during the reporting period and presents a safety margin index for each receiver. The safety index reflects the amount of over bounding of position error by WAAS protection levels. This section also includes update rates of WAAS messages transmitted from CRE and CRW.

Section 6 provides the UDRE and GIVE bounding percentage and the 95% index of the range and ionospheric accuracy for each satellite tracked by the WAAS receiver at 12 locations.

Section 7 provides the GEO ranging performance for CRE and CRW.

Section 8 summarizes WAAS anomalies and problems identified during the reporting period, which adversely affect WAAS performance described in Table 1.3.

Section 9 provides WAAS LPV availability and outages at selected airports.

Section 10 provides the assessment of WAAS CNMP bounding for 114 WAAS receivers.

Section 11 provides the surveyed positions of all WREs and the difference between the WRE survey in the current software and the survey in this report.

Section 12 provides the daily and quarterly average of SQM PRN type biases and PRN biases.

2.0 WAAS POSITION ACCURACY

Navigation error data, collected from WAAS and NSTB reference stations, was processed to determine position accuracy at each location. This was accomplished by utilizing the GPS/WAAS position solution tool to compute a MOPS-weighted least squares user navigation solution, and WAAS horizontal and vertical protection levels (HPL & VPL), once every second. The user position calculated for each receiver was compared to the surveyed position of the antenna to assess position error associated with the WAAS SIS over time. The position errors were analyzed and statistics were generated for three operational service levels: WAAS LPV, WAAS LPV 200, and WAAS LNAV/VNAV, as shown in Table 2.1. For this evaluation, the WAAS operational service level is considered available at a given time and location, if the computed WAAS HPL and VPL are within the horizontal and vertical alarm limits (HAL & VAL) specified in Table 2.1.

Table 2-1 Operational Service Levels

WAAS Operational Service Levels	Horizontal Alert Limit HAL (meters)	Vertical Alert Limit VAL (meters)
LPV (LOC/VNAV)	40	50
LNAV/VNAV	556	50
LPV 200	40	35

Table 2.2 shows PA horizontal and vertical position accuracy maintained for 95% of the time at LPV and LNAV/VNAV operational service levels for the quarter. The table also includes 95% SPS accuracy for certain locations. Figures 2.1 to 2.6 show the daily horizontal and vertical 95% accuracy for LPV operational service level for the period. Note that WAAS accuracy statistics presented are compiled only when all WAAS corrections (fast, long term, and ionospheric) for at least 4 satellites are available. This is referred to as PA navigation mode. The percentage of time that PA navigation mode was supported by WAAS at each receiver is also shown in Table 2.2. A user is considered to be in NPA navigation mode if only WAAS fast and long term corrections are available to a user (i.e. no ionospheric corrections). Table 2.3 shows NPA horizontal position accuracy for 95% and 99.999% of the time. This table also shows the maximum NPA horizontal position error for the quarter. Figures 2.7 to 2.8 show the daily horizontal 95% accuracy for NPA.

During this reporting period, the 95% horizontal and vertical accuracy at evaluated CONUS and Alaska sites are less than 2 meters for both WAAS operational service levels. The maximum 95% CONUS horizontal and vertical LPV errors are 1.35 meters at Arcata and 1.82 meters at Miami, respectively. The minimum 95% CONUS horizontal and vertical LPV errors are 0.56 meters at Denver and 0.88 meters at Kansas City, respectively. The maximum 95% and 99.999% NPA horizontal errors are 2.08 meters and 5.22 meters, both at Honolulu, respectively. The minimum 95% and 99.999% horizontal errors are .834 meters at Barrow and 1.878 meters at Kotzebue, respectively.

For this evaluation period, both CRW and CRE GEOs provide a ranging capability for enroute through NPA and PA service.

Table 2.4 shows the maximum horizontal and vertical position errors while the calculated HPL and VPL met the LPV service levels. The column marked ‘Horizontal (or Vertical) Error/HPL (or VPL)’ is the ratio of position error to protection level at the time the maximum error occurred. The column marked ‘Horizontal (or Vertical) Maximum Ratio’ is the maximum position error to protection level ratio for the quarter.

Figures 2.9 to 2.12 show the distributions of the vertical and horizontal errors at all 38 WAAS receiver locations combined in triangle charts and 2-D histogram plots for the quarter. The triangle charts in Figure 2.9 and 2.10 show the distributions of vertical position errors (VPE) versus vertical protection levels (VPL) and horizontal position errors (HPE) versus horizontal protection levels (HPL). The horizontal axis is the position error and the vertical axis is the WAAS protection levels. Lower protection levels equate to better availability. The diagonal line shows the point where error equals protection level. Above and to the left of the diagonal line in the chart, errors are bounded (WAAS is providing integrity in the position domain); below and to the right, errors are not bounded (HMI could be present). The 2-D histogram plots in Figure 2.11 and 2.12 show the distributions of vertical and horizontal position errors and normalized position errors. The blue trace shows the distributions of the actual vertical and horizontal errors. The horizontal axis is the position errors and the vertical axis is the total count of data samples (log scale) in each 0.1-meter bin. The magenta trace show the distributions of the actual vertical and horizontal errors normalized by one-sigma value of the protection level; vertical - (VPL/5.33) and horizontal - (HPL/6.0). The horizontal axis is the standard units and vertical axis is the observed distribution of normalized errors data samples in each 0.1-sigma bin. Narrowness of the normalized error distributions shows very good observed safety performance.

Table 2-2 PA 95% Horizontal and Vertical Accuracy

Location	Horizontal (HAL=40m) (Meters)	Horizontal (HAL=556m) (Meters)	Vertical (VAL=50m) (Meters)	Percentage in PA mode (%)	SPS Accuracy	
					95% Horizontal (Meters)	95% Vertical (Meters)
Arcata	1.350	1.350	1.492	100	*	*
Oklahoma City	0.751	0.751	1.016	100	*	*
Albuquerque	0.608	0.608	0.963	100	2.043	4.242
Anchorage	0.537	0.537	1.102	100	*	*
Atlanta	0.758	0.758	1.012	100	2.255	4.751
Barrow	0.550	0.550	1.143	99.98101	*	*
Bethel	0.578	0.578	0.900	100	2.028	5.306
Billings	0.960	0.960	1.184	100	2.227	4.371
Boston	0.830	0.830	1.176	100	2.445	4.604
Chicago	1.042	1.042	0.900	100	*	*
Cleveland	0.711	0.711	0.891	100	2.392	4.532
Cold Bay	0.751	0.752	1.046	100	*	*
Dallas	0.551	0.551	1.017	100	*	*
Denver	0.569	0.569	1.022	100	*	*
Fairbanks	0.578	0.578	1.227	100	1.771	5.379
Gander	0.809	0.809	1.121	99.97930	*	*
Goose Bay	0.708	0.708	1.352	99.97994	*	*
Houston	0.772	0.772	1.196	100	2.051	4.697
Iqaluit	0.915	0.919	2.087	99.97682	*	*
Jacksonville	0.708	0.708	1.200	100	*	*
Juneau	0.707	0.707	1.101	100	*	*
Kansas City	0.682	0.682	0.885	100	2.278	4.508
Kotzebue	0.582	0.582	1.488	99.98419	1.759	5.160
Los Angeles	0.790	0.790	0.897	100	2.064	4.867
Memphis	0.655	0.655	0.966	100	*	*
Merida	0.580	0.580	1.301	100	*	*
Mexico City	0.574	0.574	1.178	100	*	*
Miami	0.859	0.859	1.828	100	2.123	5.267
Minneapolis	0.861	0.861	1.000	100	2.323	4.558
New York	0.918	0.918	1.149	100	*	*
Oakland	0.772	0.772	0.932	100	2.109	4.890
Puerto Vallarta	0.596	0.596	1.199	100	*	*
Salt Lake City	0.629	0.629	0.906	100	2.128	4.380
San Jose Del Cabo	0.601	0.601	1.260	100	*	*
San Juan	0.937	1.093	1.746	99.99321	*	*
Seattle	0.875	0.875	0.915	100	2.226	4.420
Tapachula	0.748	0.750	1.545	100	*	*
Washington DC	0.746	0.746	0.996	100	2.430	4.594
Winnipeg	0.759	0.759	1.194	100	*	*

* SPS accuracy not computed for this location.

Table 2-3 NPA 95% and 99.999% Horizontal Accuracy

Location	95% Horizontal (meters)	99.999% Horizontal (meters)	Percentage in NPA mode (%)	Maximum Horizontal Error
Albuquerque	0.987	2.197	100	2.623
Anchorage	0.994	1.903	100	2.069
Atlanta	1.214	3.311	100	3.839
Barrow	0.834	1.928	99.993	5.384
Bethel	1.312	2.327	100	3.167
Billings	1.720	3.286	100	3.945
Boston	1.451	2.350	100	2.469
Cleveland	1.312	2.365	100	2.711
Cold Bay	1.332	2.296	100	2.620
Fairbanks	1.076	2.524	100	2.710
Gander	1.545	2.533	99.993	2.665
Honolulu	2.082	5.224	100	7.281
Houston	1.221	3.182	100	3.313
Iqaluit	1.129	2.291	99.993	10.287
Juneau	1.108	2.130	100	2.975
Kansas City	1.321	2.581	100	2.831
Kotzebue	0.992	1.878	99.992	6.151
Los Angeles	1.011	2.711	100	3.993
Merida	0.966	3.113	100	3.373
Miami	1.233	2.919	100	3.113
Minneapolis	1.561	2.907	100	3.503
Oakland	1.397	3.005	100	3.333
Salt Lake City	1.135	2.826	100	3.054
San Jose Del Cabo	0.896	3.764	100	4.019
San Juan	1.087	4.421	100	4.635
Seattle	1.316	2.793	100	3.186
Tapachula	1.198	4.988	100	5.110
Washington DC	1.564	2.586	100	2.918

Table 2-4 Maximum Position Errors and Position Error/Protection Level Ratio

Location	Horizontal Error (m)	Horizontal Error/HPL	Horizontal Maximum Ratio	Vertical Error (m)	Vertical Error/VPL	Vertical Maximum Ratio
Arcata	3.496	0.232	0.234	6.250	0.151	0.200
Oklahoma City	1.971	0.119	0.180	3.758	0.159	0.166
Albuquerque	1.905	0.149	0.149	3.105	0.121	0.162
Anchorage	1.496	0.086	0.118	3.811	0.130	0.137
Atlanta	1.909	0.202	0.203	3.794	0.173	0.173
Barrow	3.068	0.204	0.204	4.502	0.136	0.166
Bethel	1.666	0.051	0.135	2.924	0.076	0.116
Billings	2.184	0.215	0.221	3.692	0.172	0.175
Boston	1.842	0.138	0.142	3.622	0.166	0.166
Chicago	1.933	0.127	0.189	4.133	0.128	0.171
Cleveland	1.536	0.143	0.157	3.216	0.156	0.176
Cold Bay	2.131	0.091	0.112	6.356	0.132	0.141
Dallas	1.801	0.134	0.169	2.845	0.203	0.203
Denver	1.742	0.159	0.170	4.571	0.181	0.181
Fairbanks	1.789	0.094	0.140	5.017	0.175	0.219
Gander	1.929	0.087	0.102	3.520	0.079	0.113
Goose Bay	1.708	0.075	0.113	3.006	0.080	0.131
Houston	1.802	0.105	0.158	3.077	0.126	0.190
Iqaluit	3.355	0.094	0.182	6.977	0.246	0.246
Jacksonville	1.964	0.167	0.171	2.988	0.097	0.167
Juneau	1.717	0.131	0.134	3.650	0.224	0.224
Kansas City	1.686	0.164	0.168	3.401	0.223	0.223
Kotzebue	2.336	0.125	0.160	5.149	0.141	0.154
Los Angeles	2.322	0.147	0.150	3.245	0.118	0.138
Memphis	1.635	0.151	0.194	3.050	0.112	0.162
Merida	1.947	0.074	0.112	4.377	0.091	0.125
Mexico City	2.051	0.114	0.119	3.603	0.097	0.119
Miami	2.070	0.089	0.148	4.731	0.116	0.184
Minneapolis	2.082	0.210	0.210	3.757	0.167	0.180
New York	1.849	0.131	0.172	3.235	0.106	0.153
Oakland	2.387	0.158	0.158	4.233	0.134	0.143
Puerto Vallarta	2.072	0.107	0.107	4.007	0.091	0.119
Salt Lake City	1.973	0.168	0.178	2.908	0.152	0.152
San Jose Del Cabo	1.905	0.090	0.109	4.389	0.171	0.171
San Juan	2.721	0.085	0.085	5.416	0.109	0.133
Seattle	2.551	0.142	0.205	4.972	0.245	0.281
Tapachula	2.869	0.130	0.132	6.296	0.162	0.164
Washington DC	1.821	0.096	0.164	3.199	0.149	0.184
Winnipeg	2.214	0.211	0.211	3.146	0.164	0.164

Figure 2-1 95% Horizontal Accuracy at LPV

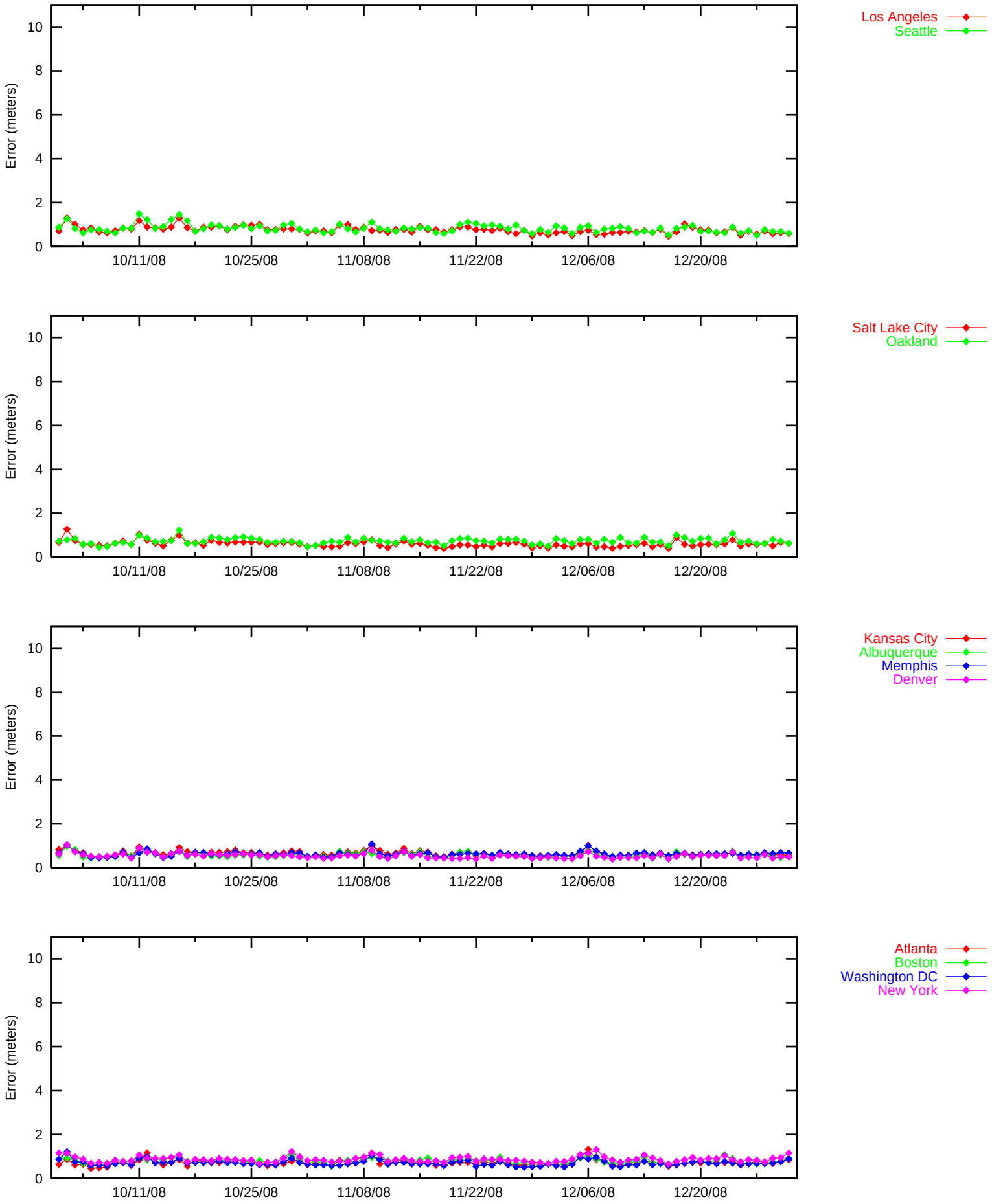


Figure 2-2 95% Horizontal Accuracy at LPV

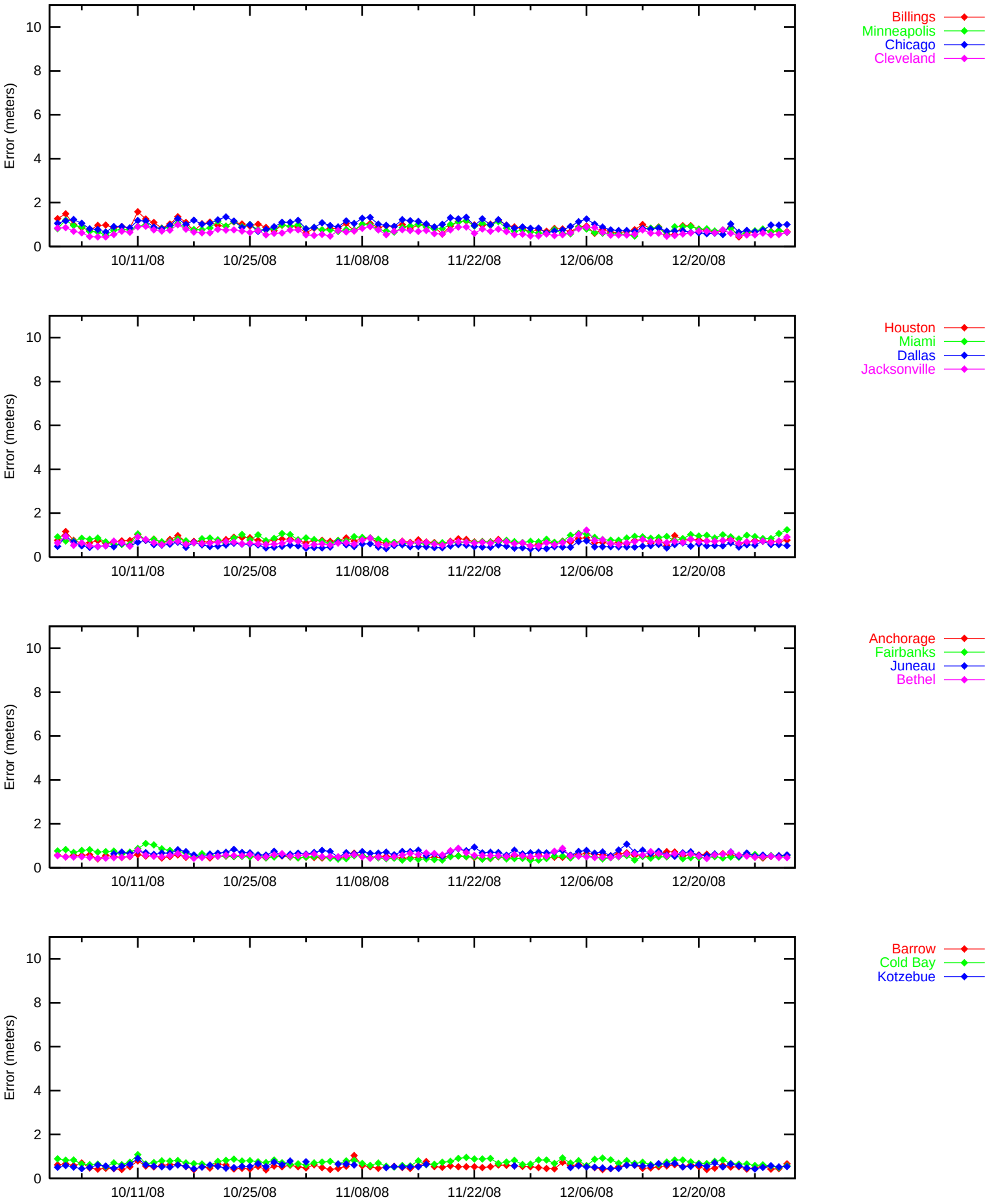


Figure 2-3 95% Horizontal Accuracy at LPV

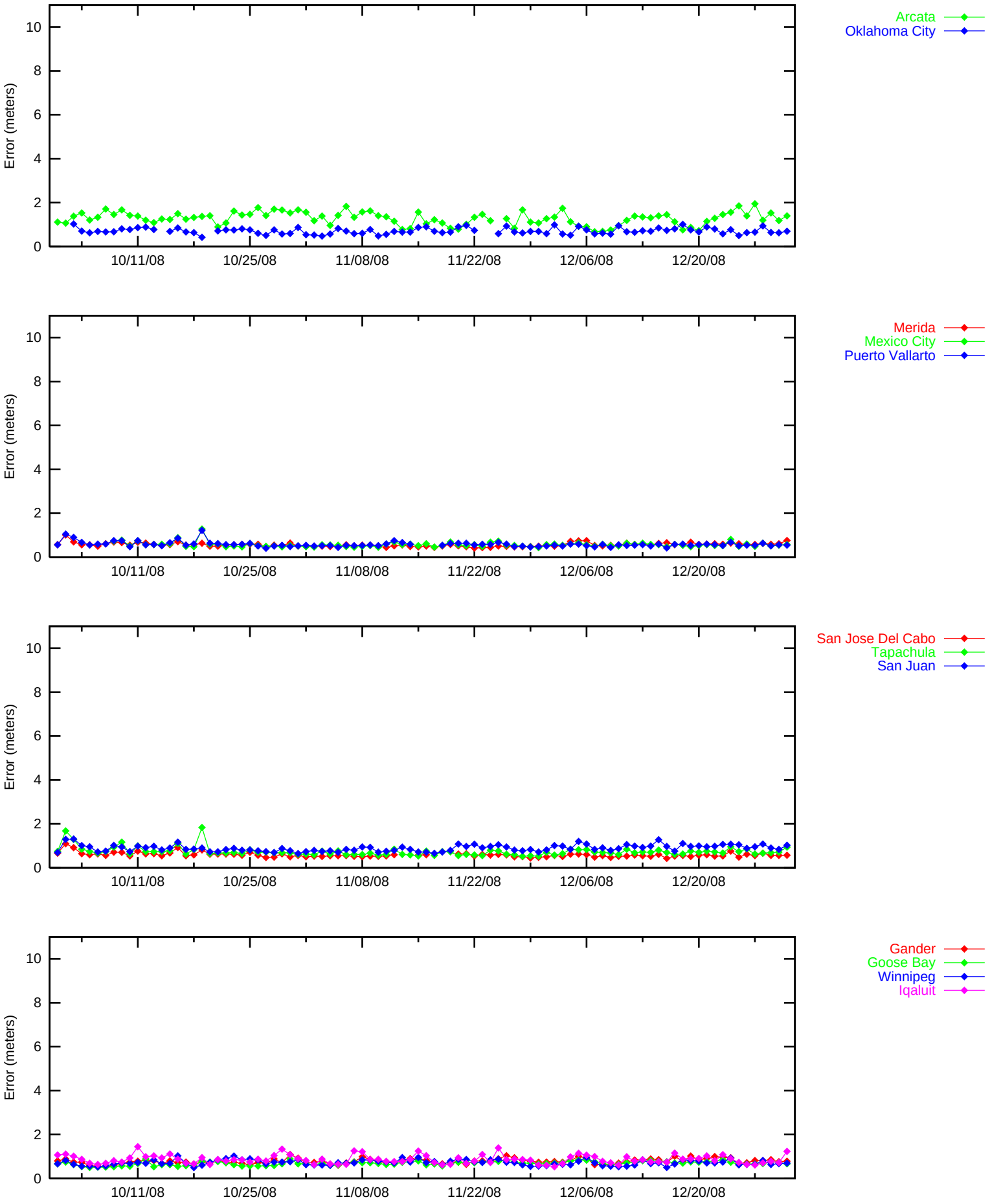


Figure 2-4 95% Vertical Accuracy at LPV

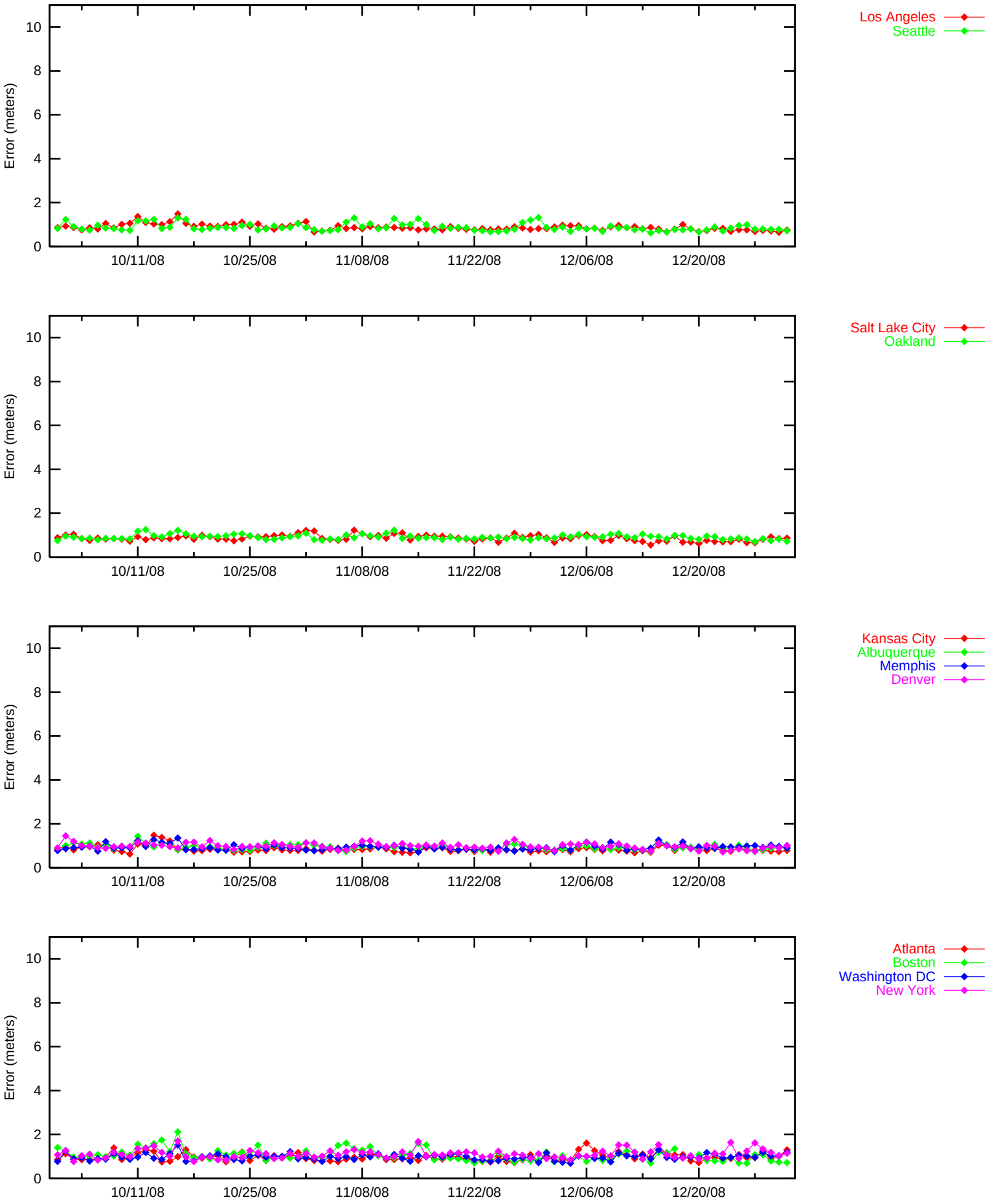


Figure 2-5 95% Vertical Accuracy at LPV

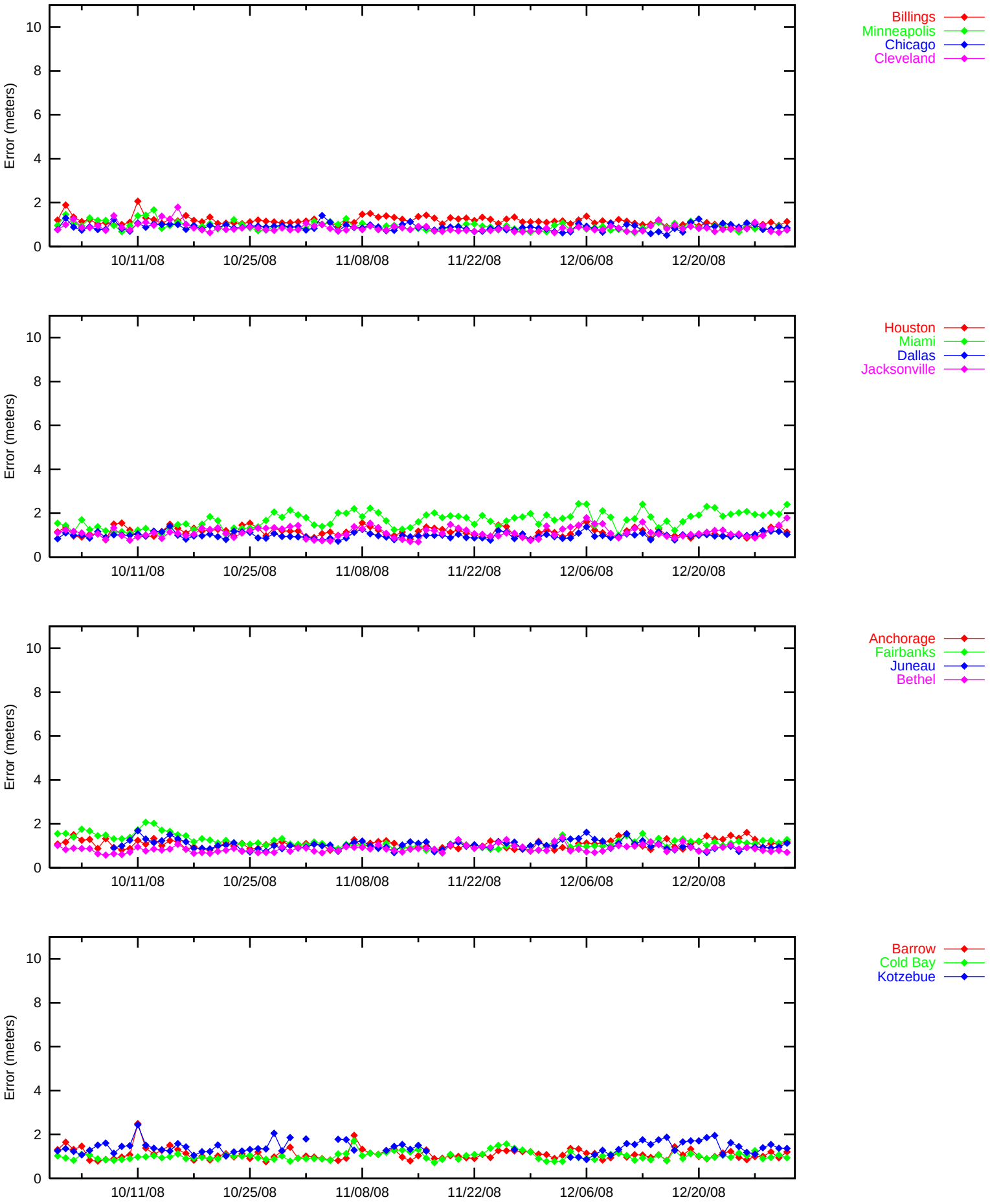


Figure 2-6 95% Vertical Accuracy at LPV

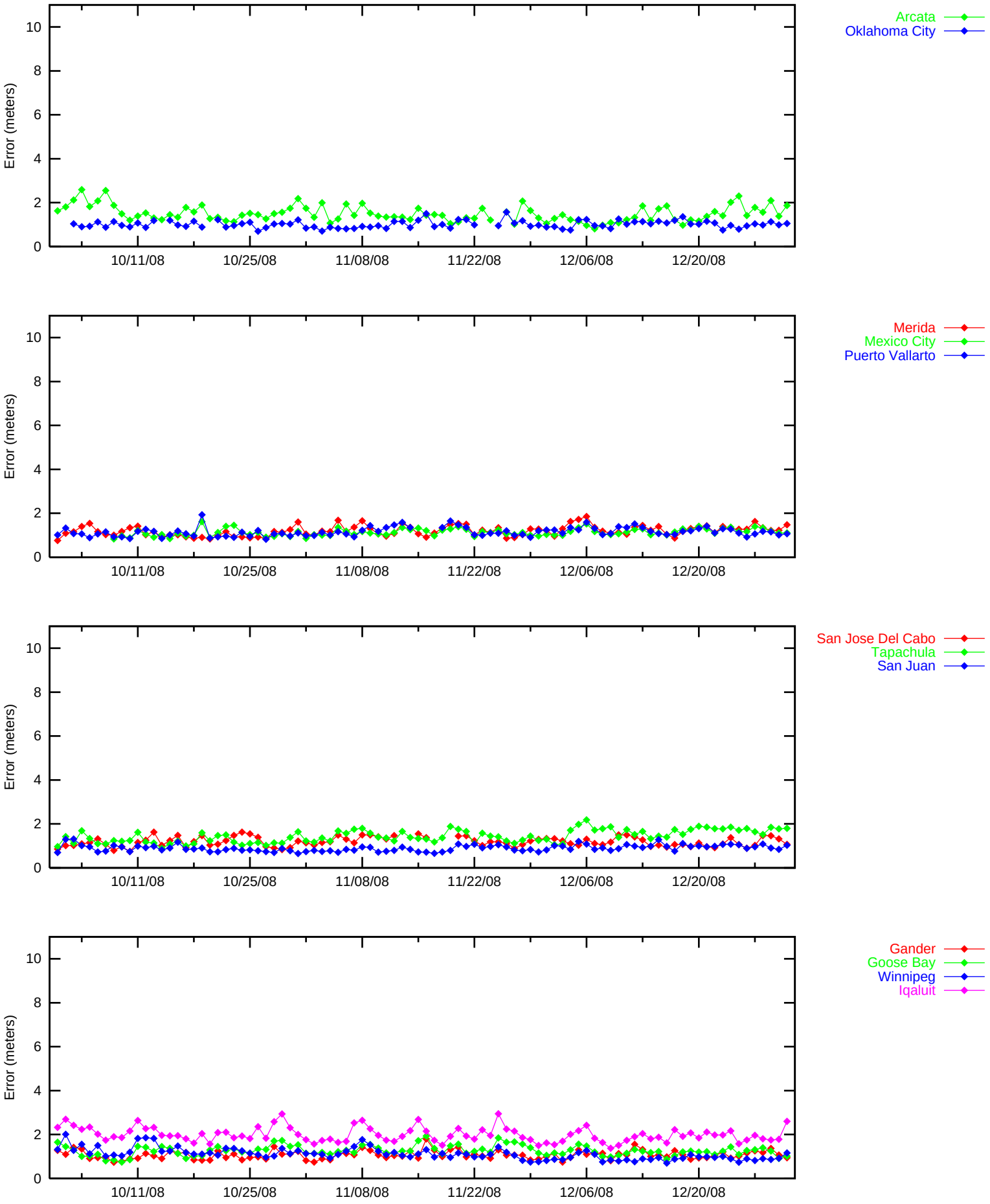


Figure 2-7 95% NPA Horizontal Accuracy

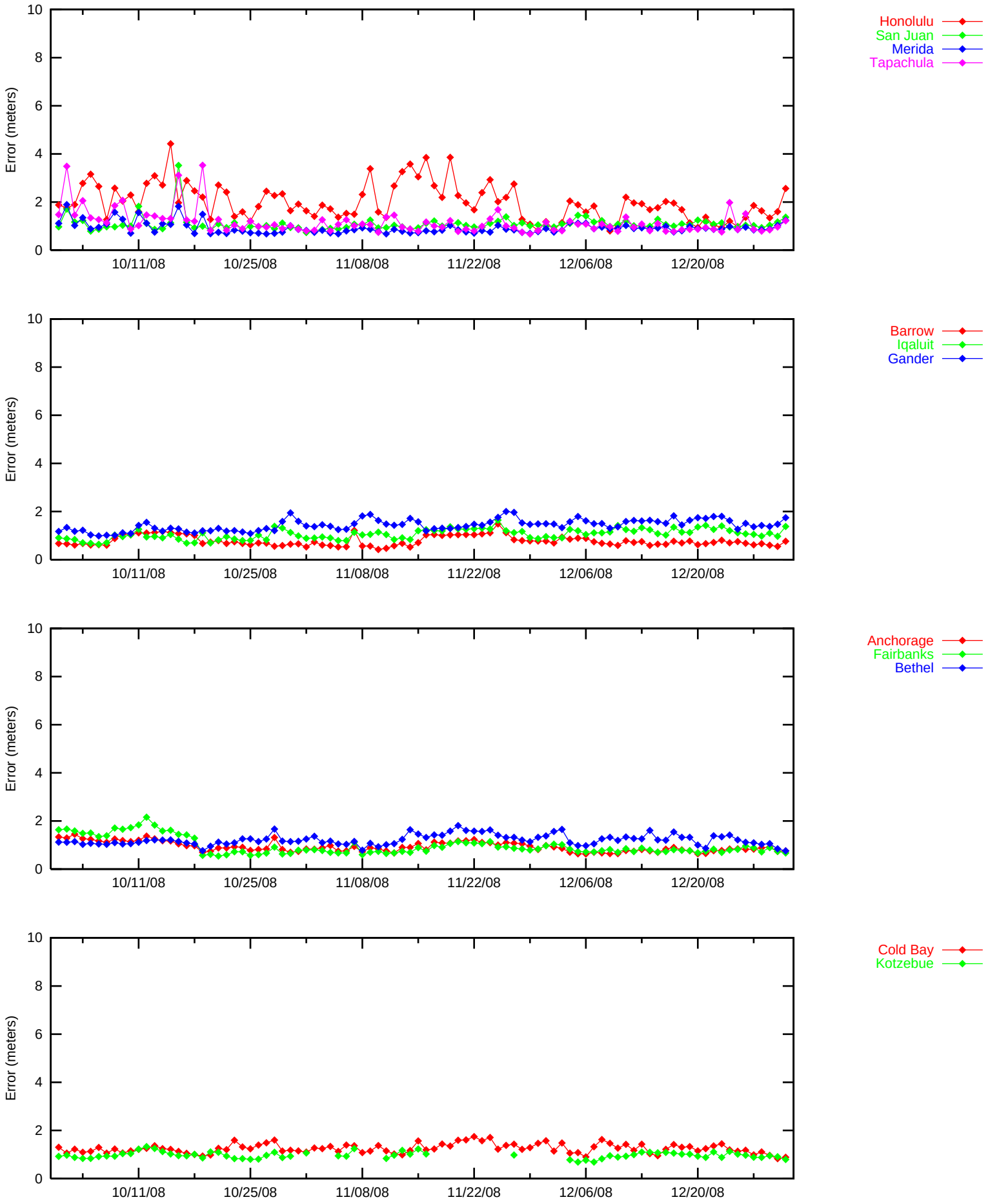


Figure 2-8 95% NPA Horizontal Accuracy

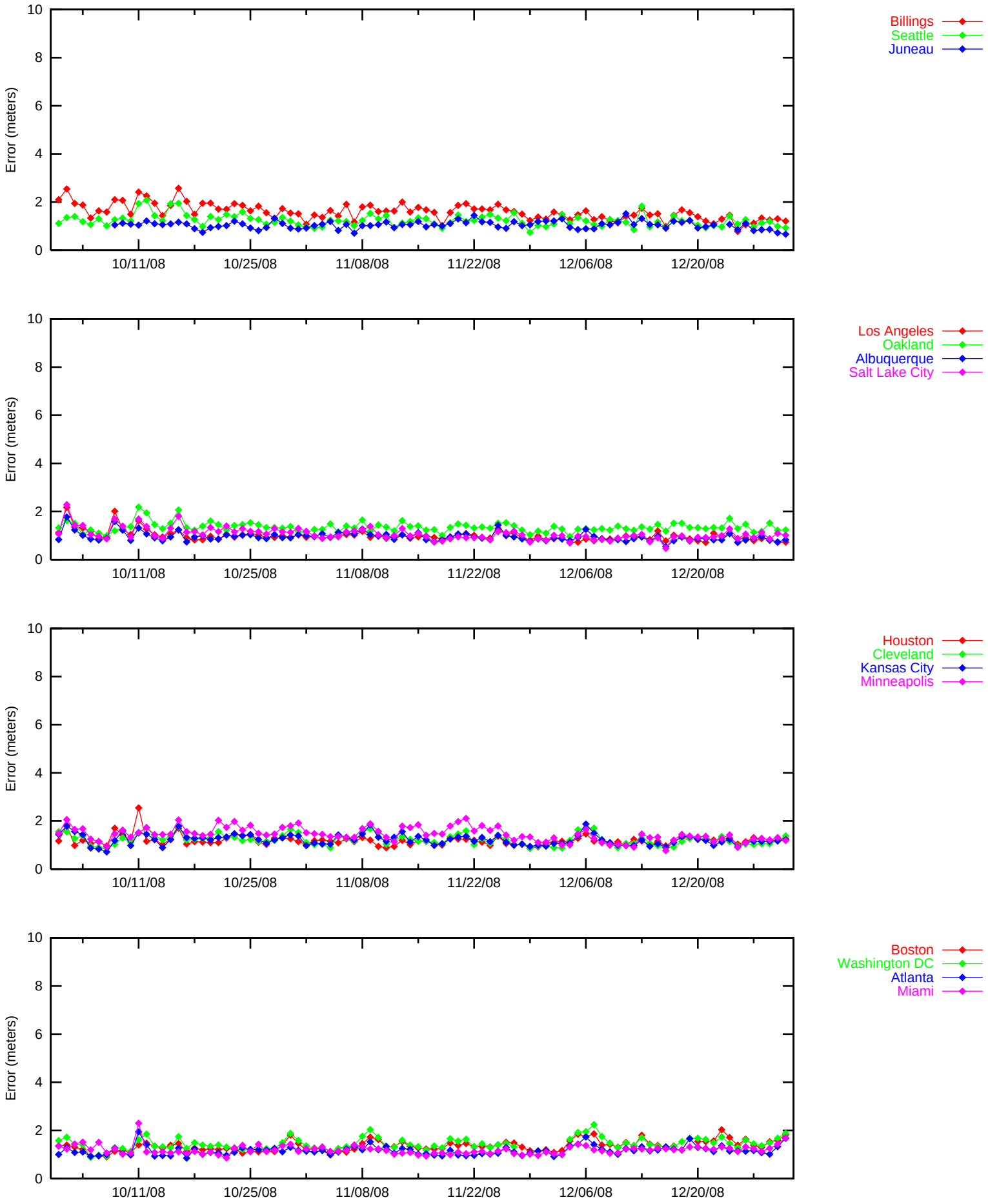


Figure 2-9 Horizontal Triangle Chart for the Quarter

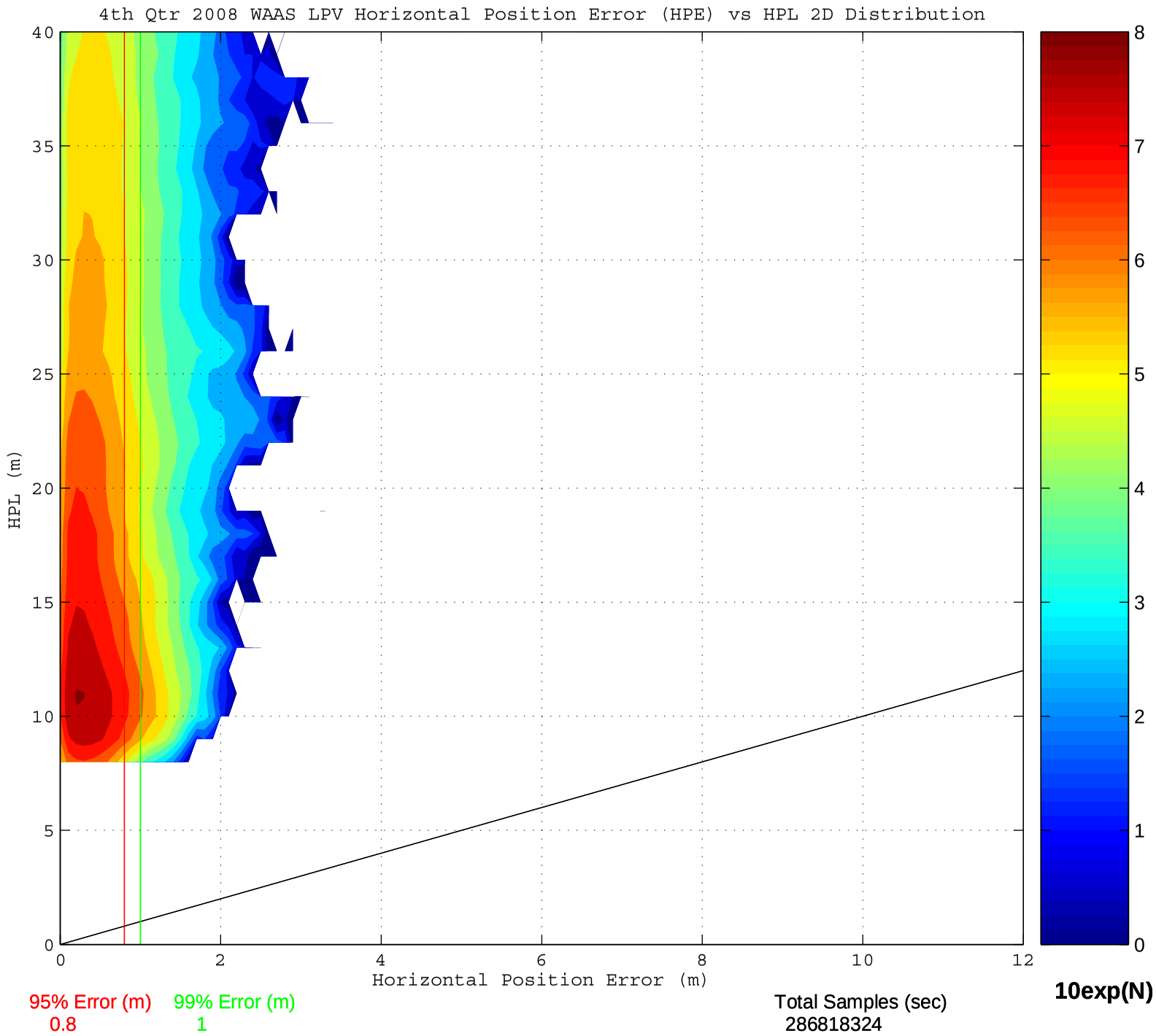


Figure 2-10 Vertical Triangle Chart for the Quarter

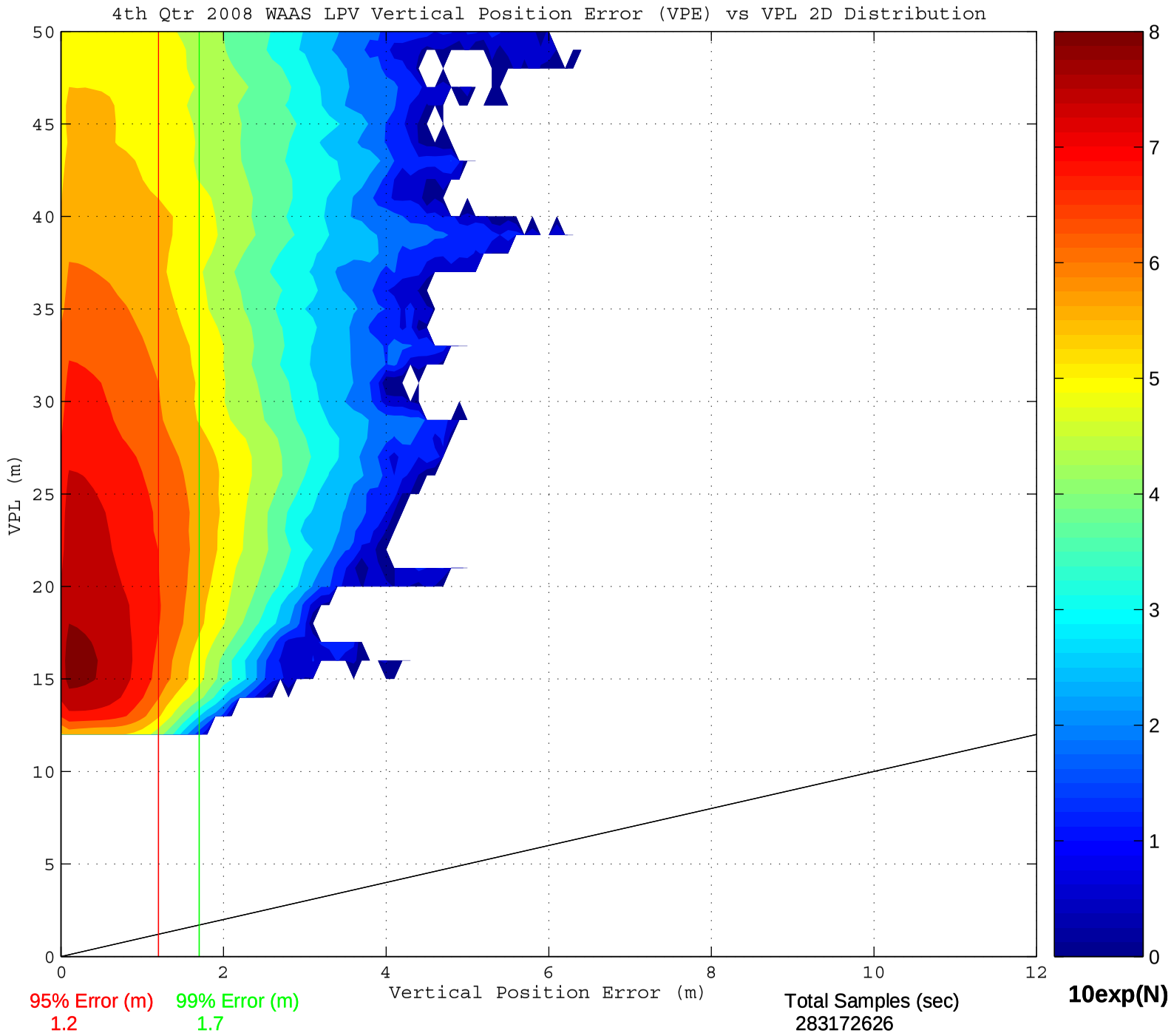


Figure 2-11 2-D Horizontal Histogram for the Quarter

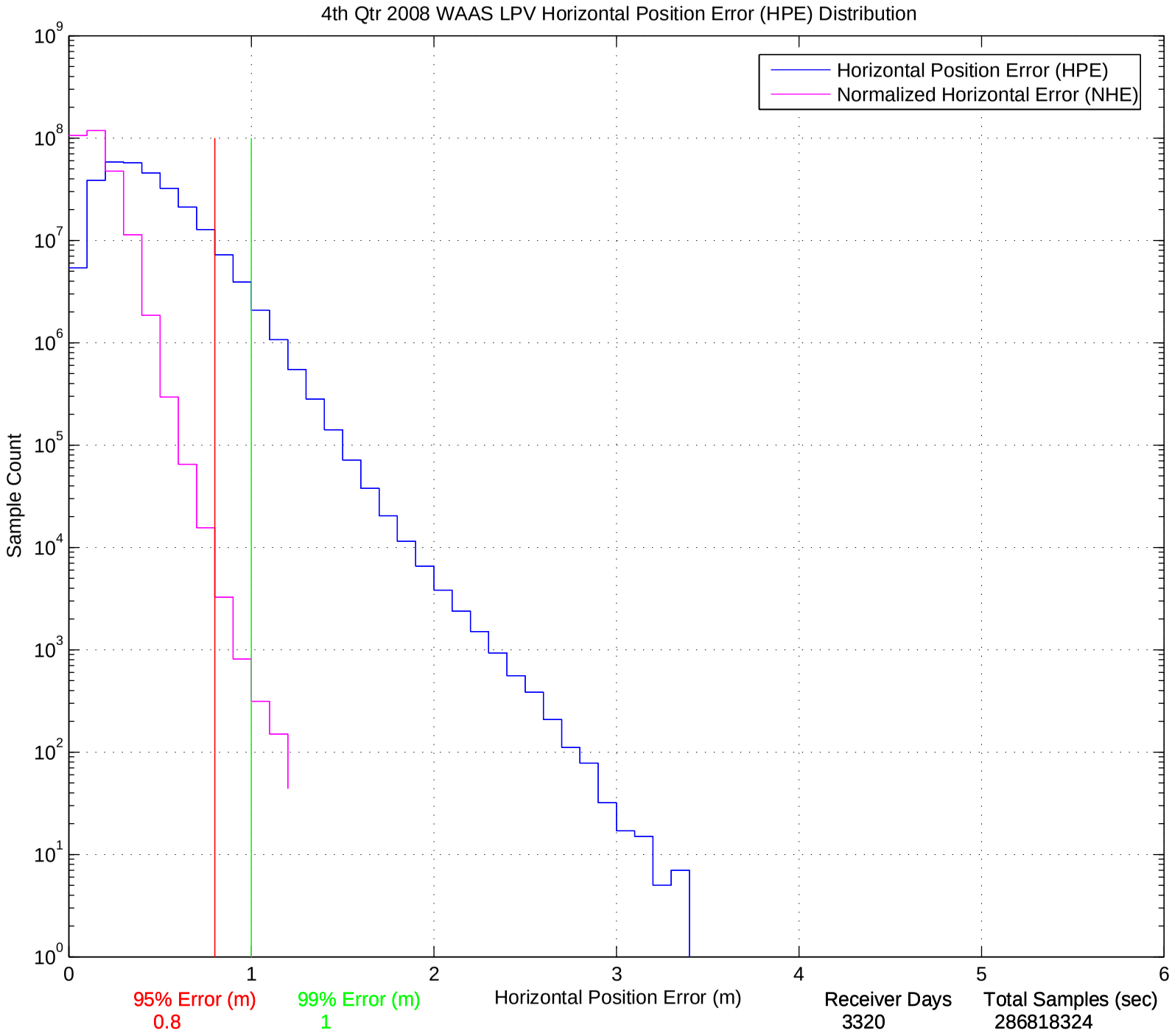
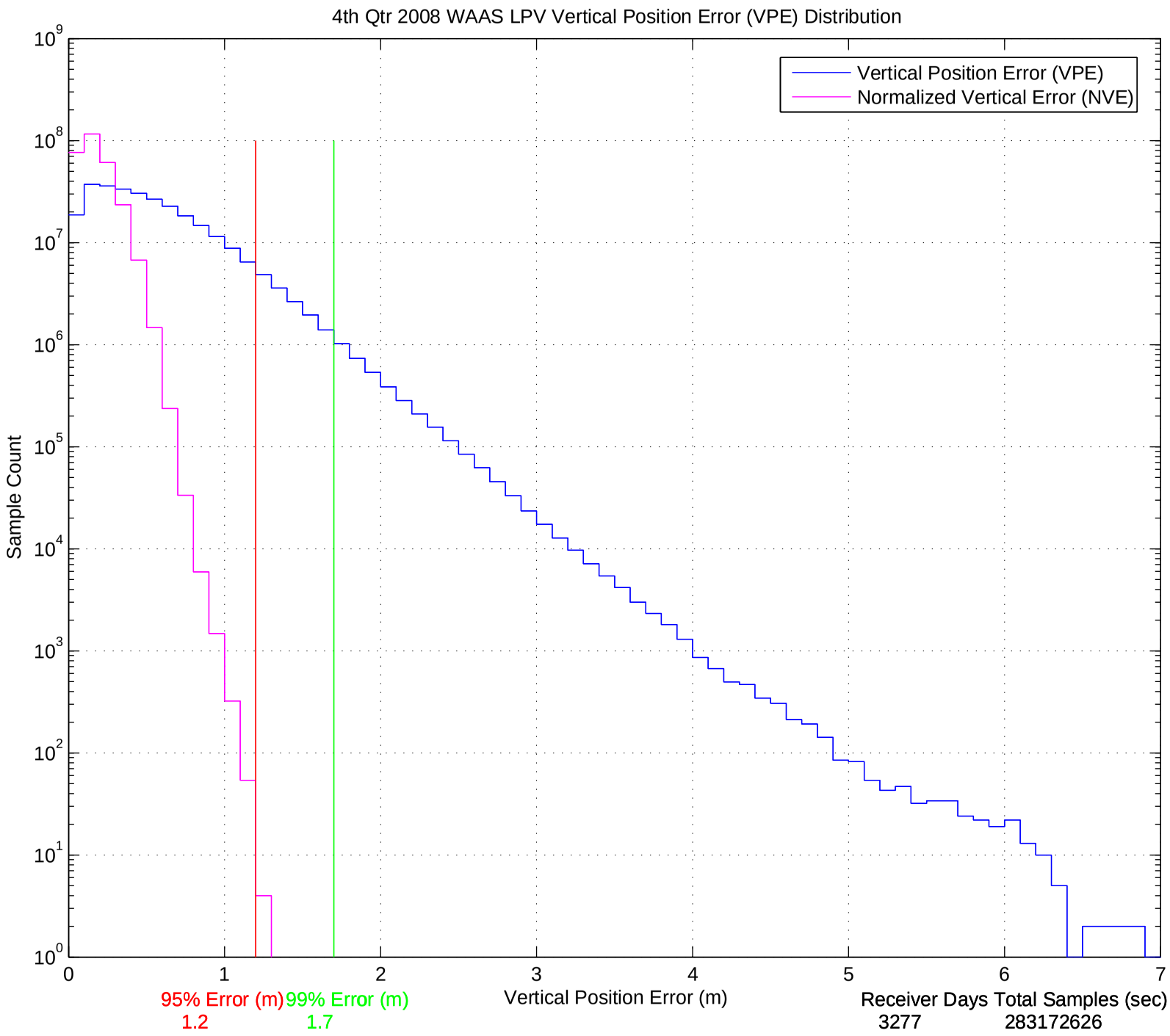


Figure 2-12 2-D Vertical Histogram for the Quarter



3.0 AVAILABILITY

WAAS availability evaluation estimates the probability that the WAAS can provide service for the operational service levels (LPV and LPV 200) defined in Table 2.1. At each receiver, the WAAS message, along with the GPS/GEO satellites tracked, were used to produce WAAS protection levels in accordance with the WAAS MOPS. Table 3.1 shows the protection levels that were maintained for 95% of the time for each receiver location for the quarter. The table also included the percentage in PA mode as described in section 2.0.

Availability LPV and LPV 200 service is evaluated by monitoring the WAAS protection levels at receiver locations throughout the test period. If both the vertical and horizontal protection levels are not greater than their respective alert limits (VAL and HAL) then the service is available. If either of the protection levels exceeds the required alert level then the operational service at that location is considered unavailable and an outage in service is recorded with its duration. The operational service is not considered available again until the protection levels are both within the alert limits for at least 15 minutes. Although this will reduce operational service availability minimally, it substantially reduces the number of service outages and prevents excessive switching in and out of service availability. The percent of time that LPV and LPV 200 service is available using the fifteen-minute window criteria is presented in Table 3.2. The LPV and LPV 200 service outages and associated outage rate for the test period is presented in Table 3.4. The outage rate is the percent of approaches that theoretically would be interrupted by a loss of operational service once the approach had started. Figures 3.1 through 3.6 show the daily availability of LPV and LPV 200 service levels, and Figures 3.7 through 3.12 show the daily interruptions of LPV and LPV 200 service levels for the evaluation period.

The following table shows the maximum and minimum 95% HPL and VPL observed at the evaluated CONUS and Alaska sites this evaluation period. The international sites are excluded from this table, but can be found in Table 3.1.

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	Alaska Site/Maximum	Alaska Site/Minimum
95% HPL	Arcata 17.14 meters	Memphis 11.37 meters	Cold Bay 26.03 meters	Fairbanks 13.17 meters
95% VPL	Arcata 32.99 meters	Minneapolis 18.68 meters	Barrow 38.16 meters	Juneau 22.40 meters

Availability of NPA service is evaluated by monitoring the WAAS horizontal protection level at receiver locations throughout the test period. If the horizontal protection level is not greater than the horizontal alert limit (HAL = 556m) then the service is available. If the horizontal protection level exceeds the required alert level or if WAAS navigation message is not received then the NPA service at that location is considered unavailable and an outage in service is recorded with its duration. The NPA service is not considered available again until the horizontal protection level is within the alert limit for at least 15 minutes. The percent of time that NPA service is available using the fifteen-minute window criteria is presented in Table 3.3. The NPA service outages and associated outage rate for this period is presented in Table 3.5. The outage rate is the percent of NPA approaches that theoretically would be interrupted by a loss of operational service once the approach had started.

During this reporting period, satellite outages have caused the loss of LPV and NPA service on 10/8/09, 10/29/09, and 12/27/09 (see Table 1.4 for these events). Changes in the downlink carrier frequency from the CRW caused reduced ranging availability on multiple days (see DR #77). NPA outages at Iqaluit and Gander are mainly due to CRE GUS switchovers and NPA outages at Barrow and Kotzebue are due to CRW GUS switchovers.

Table 3-1 95% Protection Level

Location	95% HPL (meters)	95% VPL (meters)	Percentage in PA mode
Arcata	17.142	32.994	100
Oklahoma City	11.493	21.322	100
Albuquerque	12.102	22.406	100
Anchorage	14.059	24.017	100
Atlanta	11.619	21.273	100
Barrow	19.387	38.168	99.981010
Bethel	17.613	29.071	100
Billings	12.835	20.495	100
Boston	15.218	21.873	99.999960
Chicago	12.407	18.876	100
Cleveland	13.411	20.725	100
Cold Bay	26.037	37.878	100
Dallas	11.417	21.470	100
Denver	11.773	21.776	100
Fairbanks	13.178	25.027	100
Gander	26.798	37.758	99.979300
Goose Bay	21.465	28.415	99.979940
Houston	11.562	20.534	100
Iqaluit	30.406	41.026	99.976820
Jacksonville	12.459	23.470	100
Juneau	13.268	22.404	100
Kansas City	11.572	19.462	100
Kotzebue	16.686	33.223	99.984190
Los Angeles	14.830	28.453	100
Memphis	11.376	19.045	100
Merida	17.088	31.300	100
Mexico City	20.366	34.472	100
Miami	14.223	26.884	100
Minneapolis	13.007	18.684	100
New York	14.520	21.705	100
Oakland	16.760	32.816	100
Puerto Vallarta	22.559	37.838	100
Salt Lake City	11.899	21.707	100
San Jose Del Cabo	21.043	36.774	100
San Juan	65.066	91.878	99.993210
Seattle	14.125	23.929	99.999990
Tapachula	31.357	52.329	100
Washington DC	13.722	21.770	99.999960
Winnipeg	14.876	20.472	100

Table 3-2 Quarterly Availability Statistics

Location	LPV WAAS *With 15 minute window*	LPV 200 WAAS *With 15 minute window*
Arcata	0.99985335	0.96681194
Oklahoma City	0.99998994	0.99997671
Albuquerque	0.99996699	0.99687360
Anchorage	100	100
Atlanta	100	0.99999232
Barrow	0.98600315	0.88735738
Bethel	100	0.99342372
Billings	100	0.99983171
Boston	100	0.99989067
Chicago	100	100
Cleveland	100	100
Cold Bay	0.99893943	0.88225803
Dallas	100	0.99994139
Denver	0.99997479	0.99861734
Fairbanks	100	0.99988628
Gander	0.99329294	0.88501090
Goose Bay	0.99953914	0.98588638
Houston	100	0.99994
Iqaluit	0.97276753	0.85148533
Jacksonville	100	0.99986682
Juneau	100	100
Kansas City	100	0.99999849
Kotzebue	0.99811260	0.95953362
Los Angeles	0.99999912	0.99142785
Memphis	100	0.99993109
Merida	0.99606695	0.97812714
Mexico City	0.99983179	0.94893883
Miami	100	0.99911028
Minneapolis	100	0.99999849
New York	100	0.99997090
Oakland	0.99987562	0.96125968
Puerto Vallarta	0.99892503	0.89234012
Salt Lake City	100	0.99999849
San Jose Del Cabo	0.99971487	0.89417582
San Juan	0.18419185	0.00551667
Seattle	0.99999723	0.99932742
Tapachula	0.90163701	0.49364000
Washington DC	100	100
Winnipeg	100	0.99978258

Table 3-3 NPA Availability

Location	NPA Availability (Excluding RAIM/FDE)
Albuquerque	100
Anchorage	100
Atlanta	100
Barrow	0.9999311
Bethel	100
Billings	100
Boston	100
Cleveland	100
Cold Bay	100
Fairbanks	100
Gander	0.9999296
Honolulu	100
Houston	100
Iqaluit	0.9999304
Juneau	100
Kansas City	100
Kotzebue	0.9999202
Los Angeles	100
Merida	100
Miami	100
Minneapolis	100
Oakland	100
Salt Lake City	100
San Jose Del Cabo	100
San Juan	100
Seattle	100
Tapachula	100
Washington DC	100

Table 3-4 LPV and LPV 200 Outage Rate

Location	LPV Outages	LPV Outage Rates	LPV 200 Outages	LPV 200 Outage Rates
Arcata	1	0.000019	205	0.004031
Oklahoma City	1	0.000020	3	0.000060
Albuquerque	1	0.000019	89	0.001687
Anchorage	0	0.00	0	0.00
Atlanta	0	0.00	3	0.000057
Barrow	124	0.002382	691	0.014749
Bethel	0	0.00	109	0.002076
Billings	0	0.00	2	0.000038
Boston	1	0.000019	12	0.000231
Chicago	0	0.00	0	0.00
Cleveland	0	0.00	0	0.00
Cold Bay	48	0.000914	621	0.013388
Dallas	0	0.00	2	0.000038
Denver	1	0.000019	53	0.001003
Fairbanks	0	0.00	5	0.000095
Gander	113	0.002151	507	0.010832
Goose Bay	15	0.000284	189	0.003628
Houston	0	0.00	2	0.000038
Iqaluit	285	0.005543	1010	0.022443
Jacksonville	0	0.00	5	0.000095
Juneau	0	0.00	0	0.00
Kansas City	0	0.00	1	0.000019
Kotzebue	34	0.000824	347	0.008751
Los Angeles	1	0.000019	128	0.002440
Memphis	0	0.00	1	0.000019
Merida	82	0.001557	186	0.003597
Mexico City	4	0.000082	375	0.008074
Miami	0	0.00	28	0.000530
Minneapolis	0	0.00	1	0.000019
New York	0	0.00	4	0.000076
Oakland	1	0.000019	318	0.006253
Puerto Vallarta	48	0.000943	610	0.013411
Salt Lake City	0	0.00	1	0.000019
San Jose Del Cabo	19	0.000374	334	0.007348
San Juan	824	0.086554	77	0.270049
Seattle	1	0.000019	18	0.000340
Tapachula	612	0.012882	1245	0.047864
Washington DC	1	0.000019	1	0.000019
Winnipeg	0	0.00	1	0.000019

Table 3-5 NPA Outage Rates

Location	NPA Outages	NPA Outage Rate
Albuquerque	0	0
Anchorage	0	0
Atlanta	0	0
Barrow	7	0.0001325
Bethel	0	0
Billings	0	0
Boston	0	0
Cleveland	0	0
Cold Bay	0	0
Fairbanks	0	0
Gander	8	0.0001512
Honolulu	0	0
Houston	0	0
Iqaluit	8	0.0001513
Juneau	0	0
Kansas City	0	0
Kotzebue	6	0.0001452
Los Angeles	0	0
Merida	0	0
Miami	0	0
Minneapolis	0	0
Oakland	0	0
Salt Lake City	0	0
San Jose Del Cabo	0	0
San Juan	0	0
Seattle	0	0
Tapachula	0	0
Washington DC	0	0

Figure 3-1 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

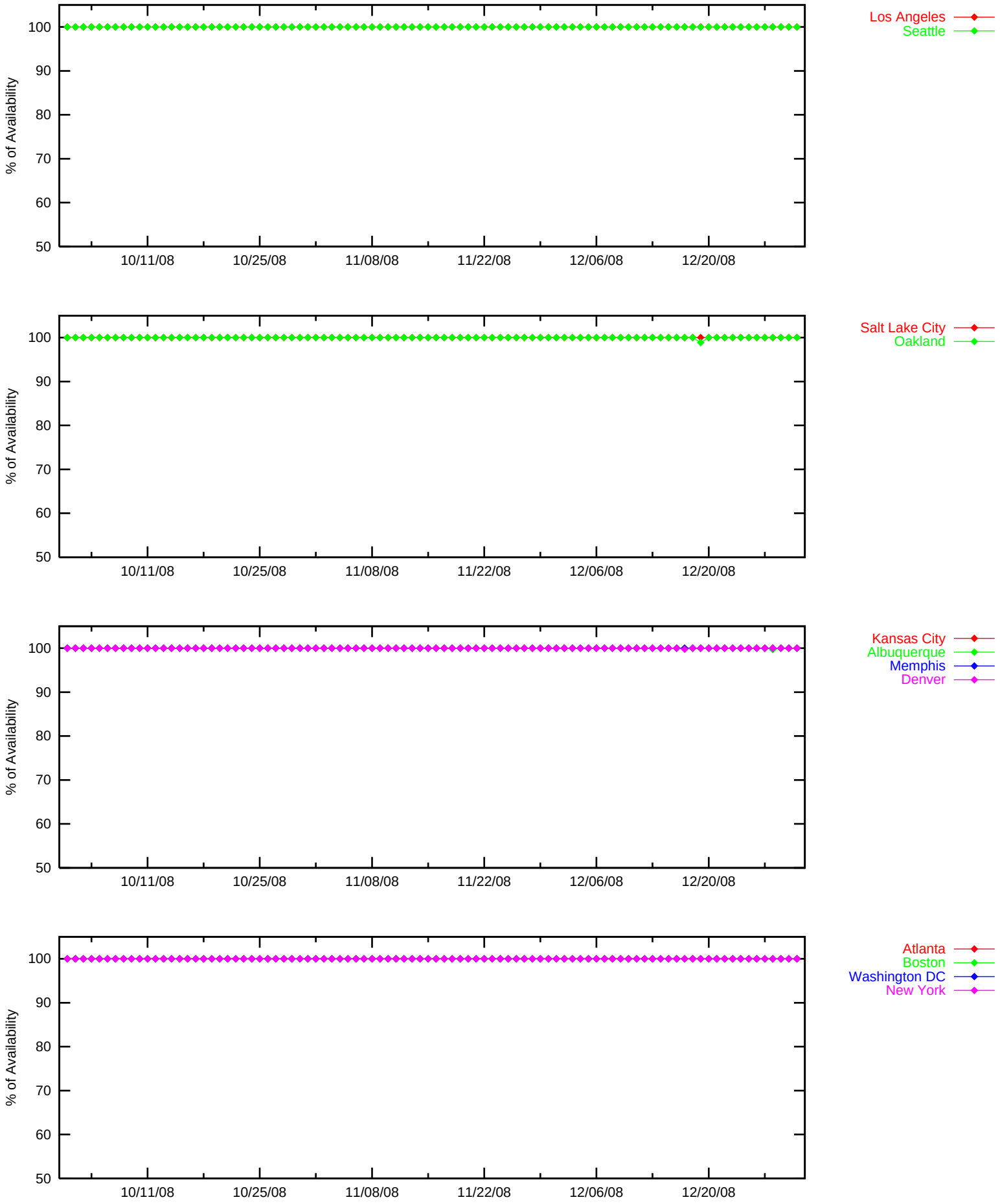


Figure 3-2 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

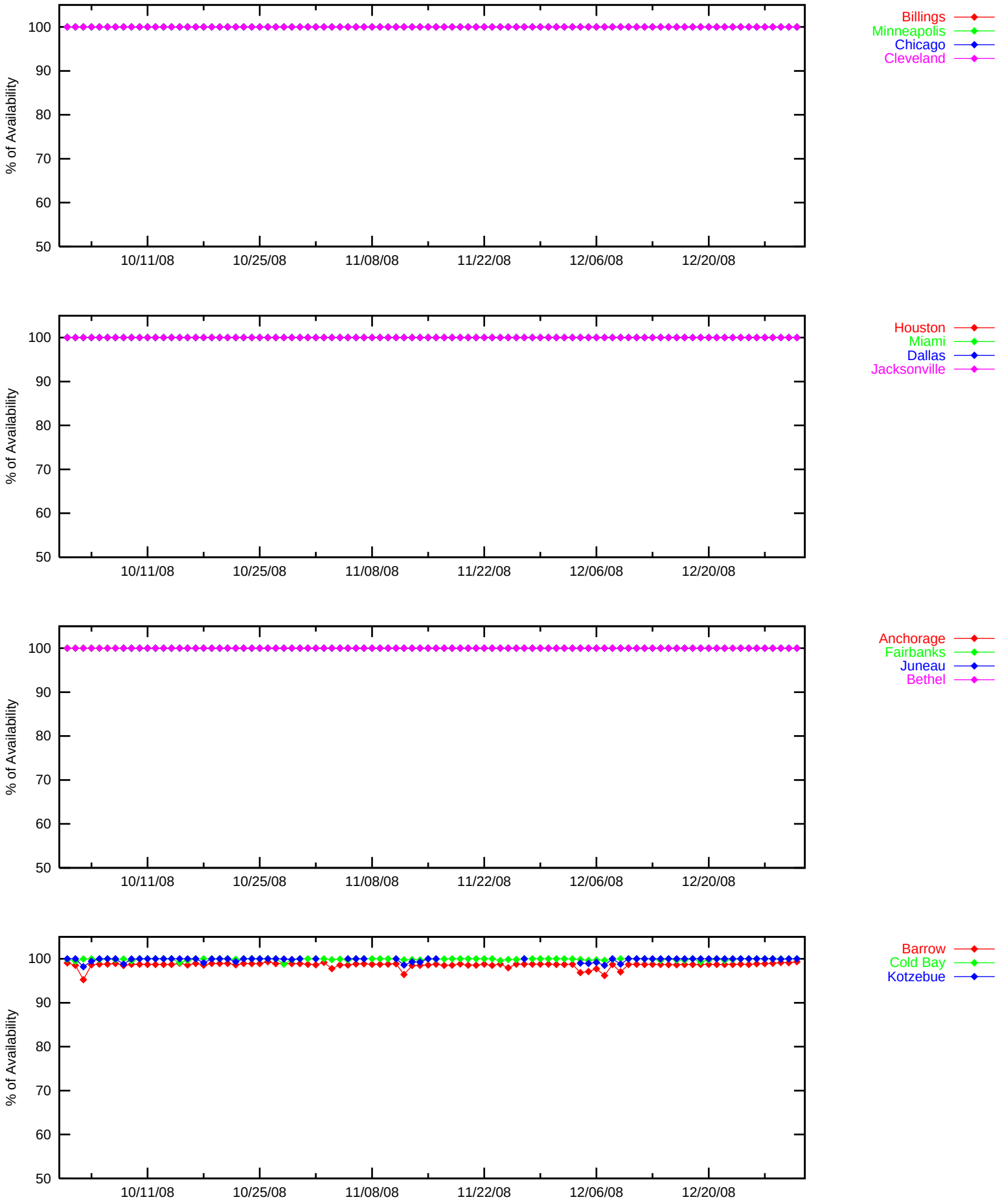


Figure 3-3 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

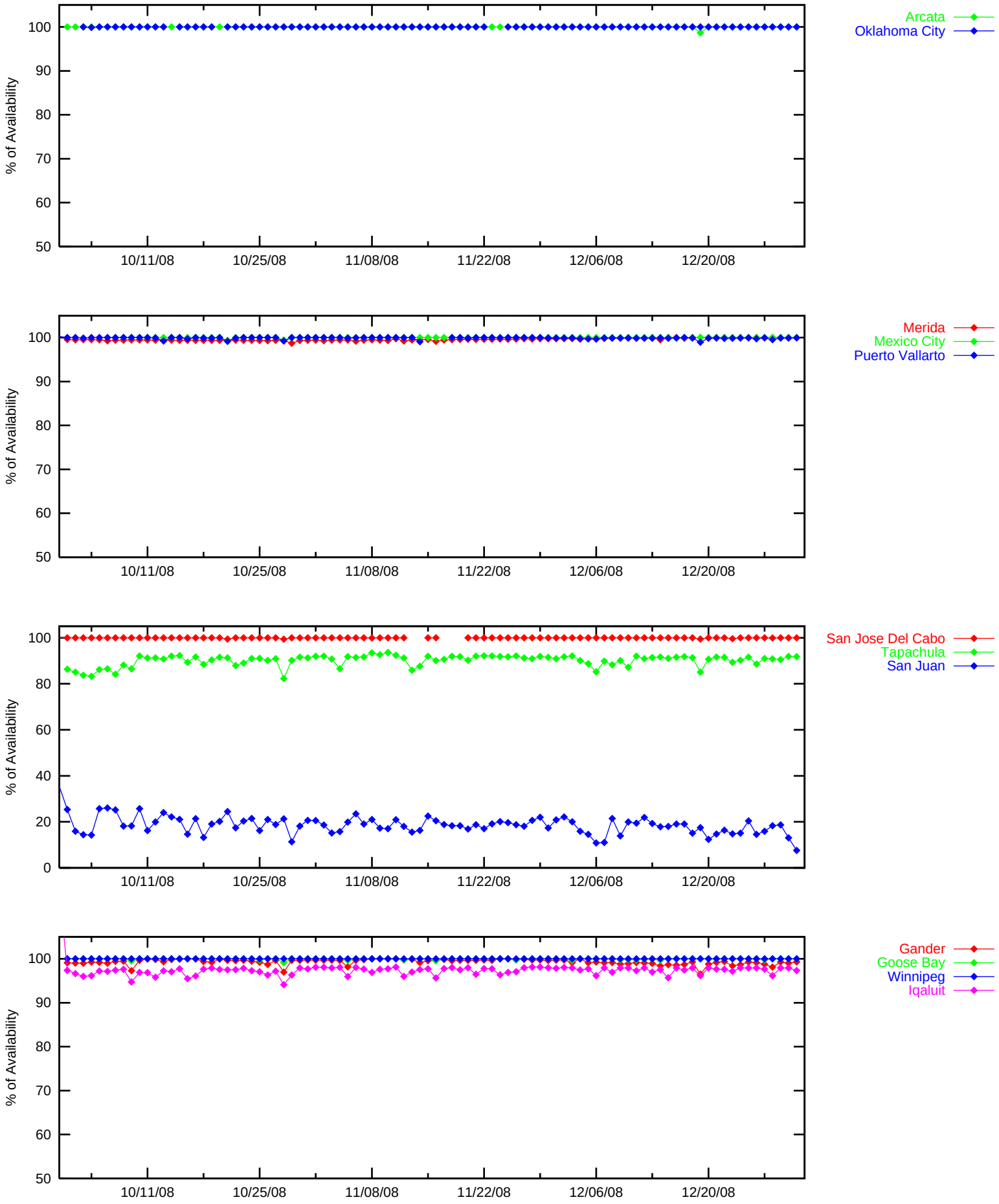


Figure 3-4 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

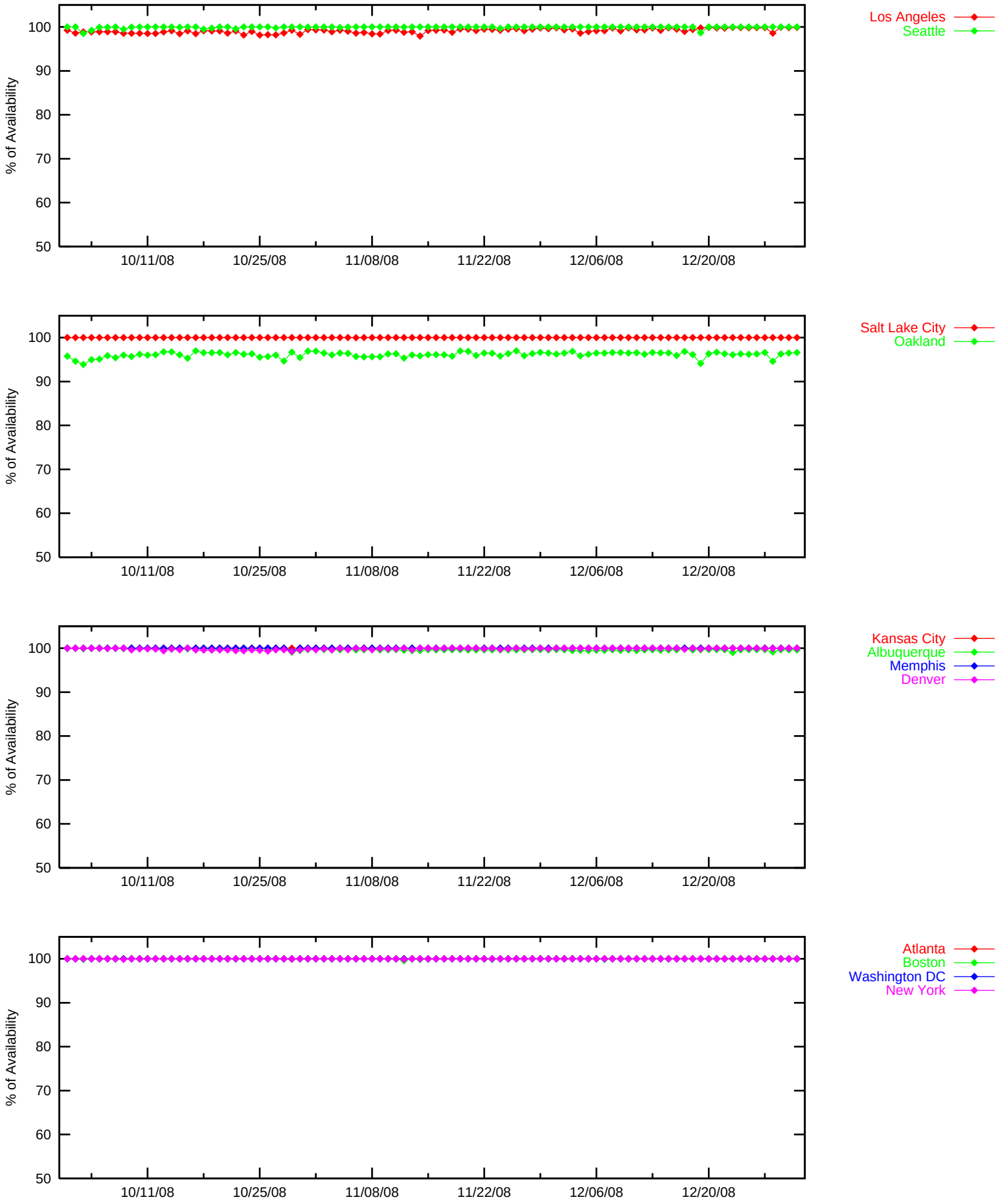


Figure 3-5 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

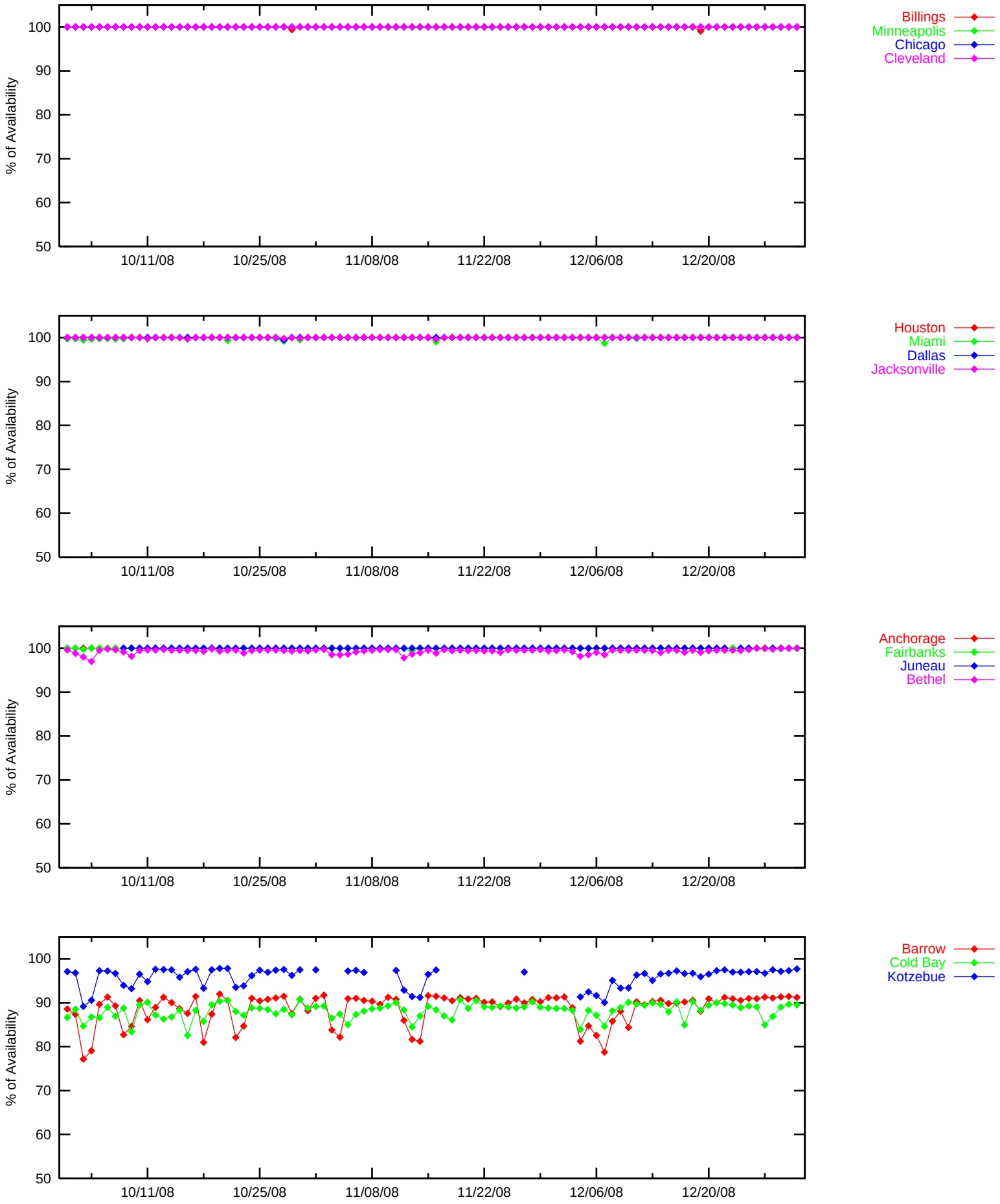


Figure 3-6 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

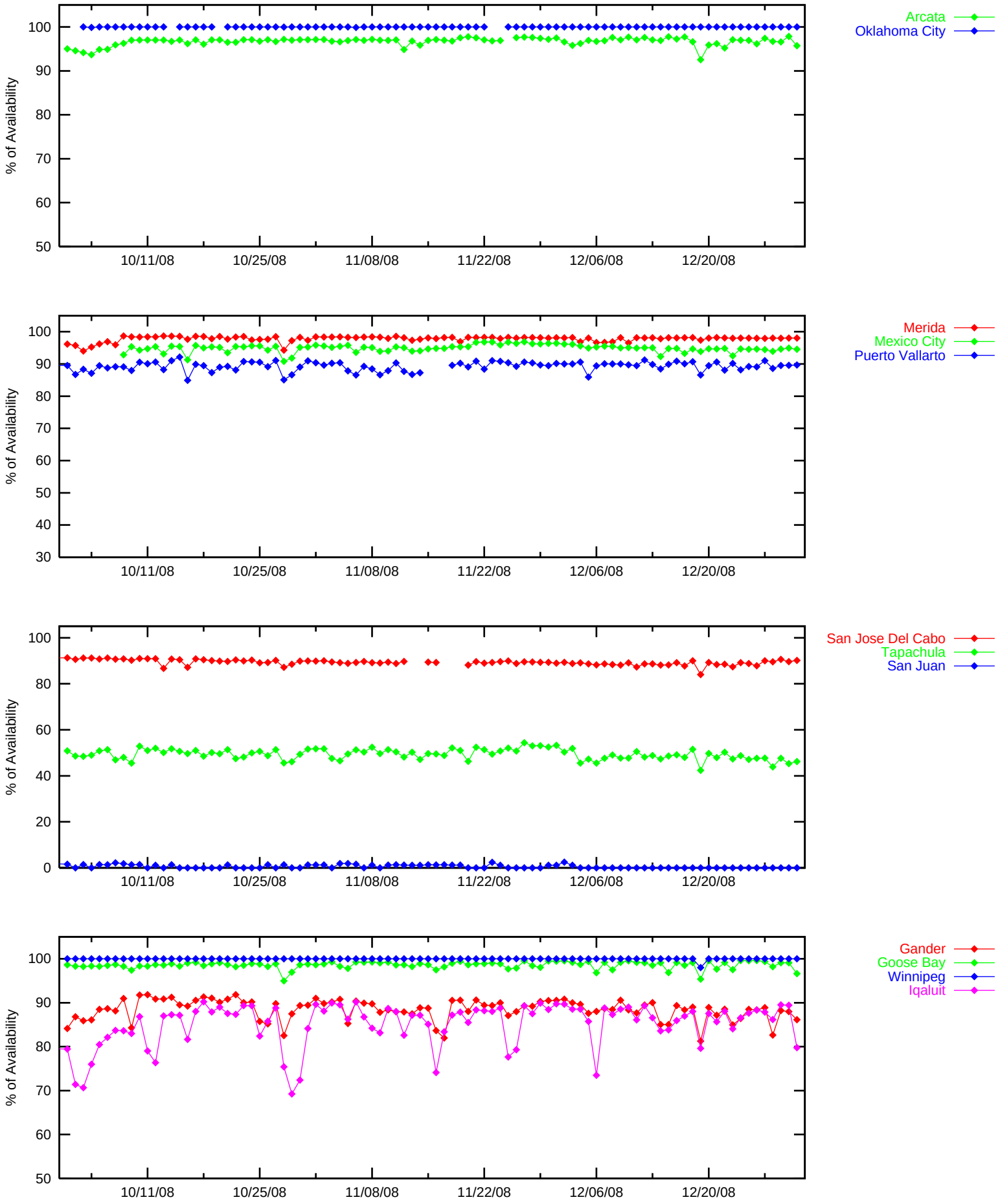


Figure 3-7 LPV Outages (HAL = 40m & VAL=50m)

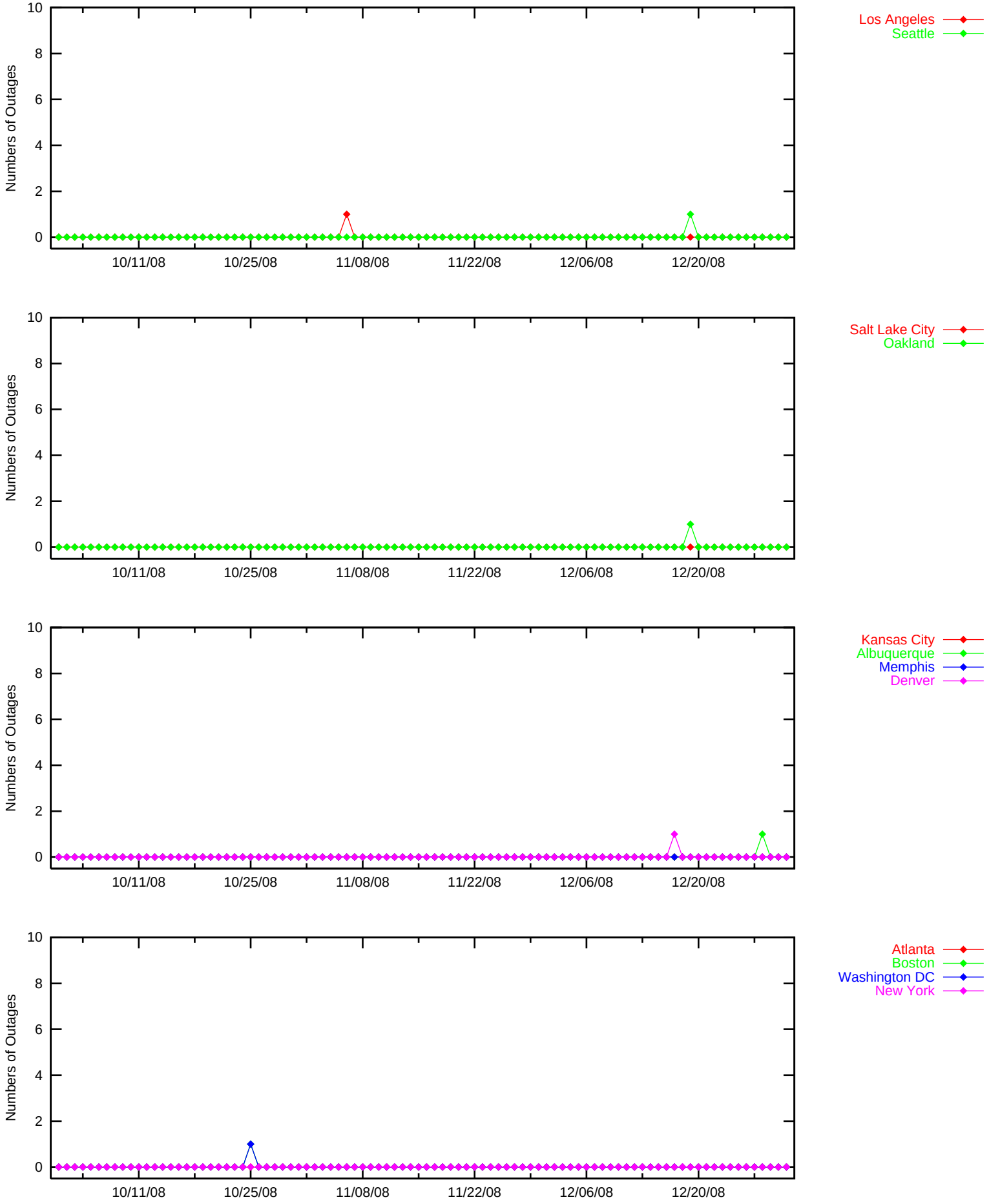


Figure 3-8 LPV Outages (HAL = 40m & VAL=50m)

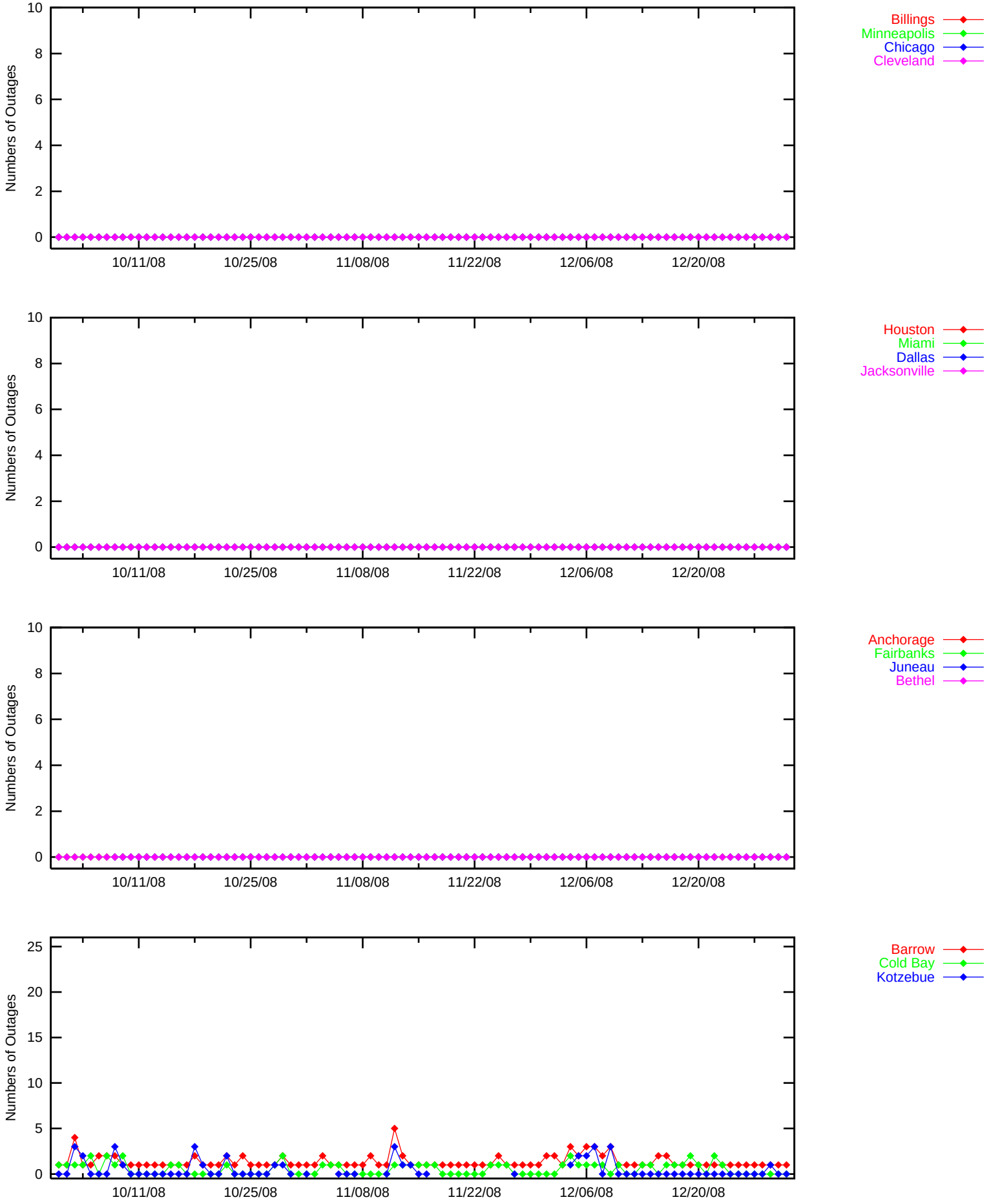


Figure 3-9 LPV Outages (HAL = 40m & VAL=50m)

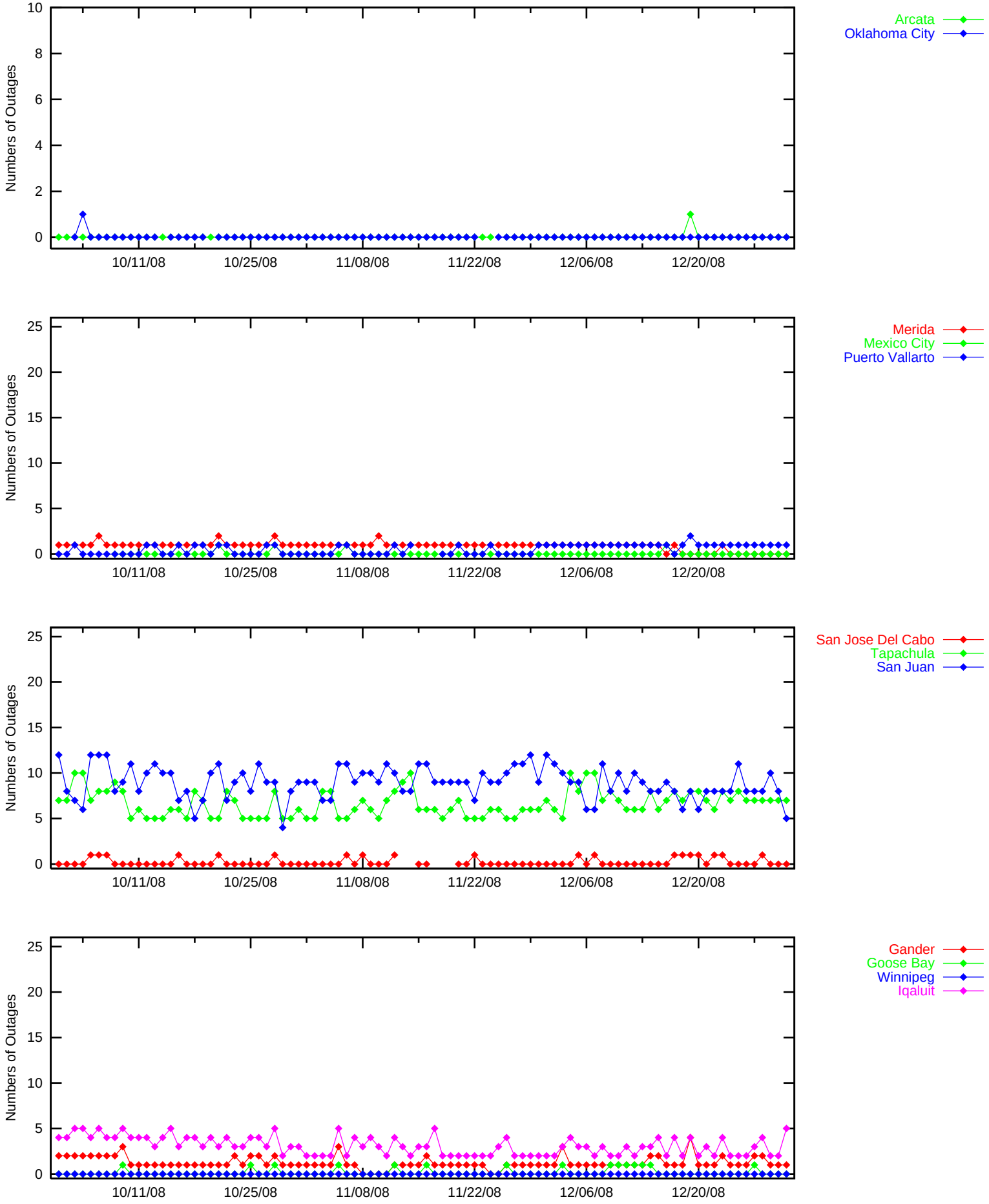


Figure 3-10 LPV 200 Outages (HAL = 40m & VAL=35m)

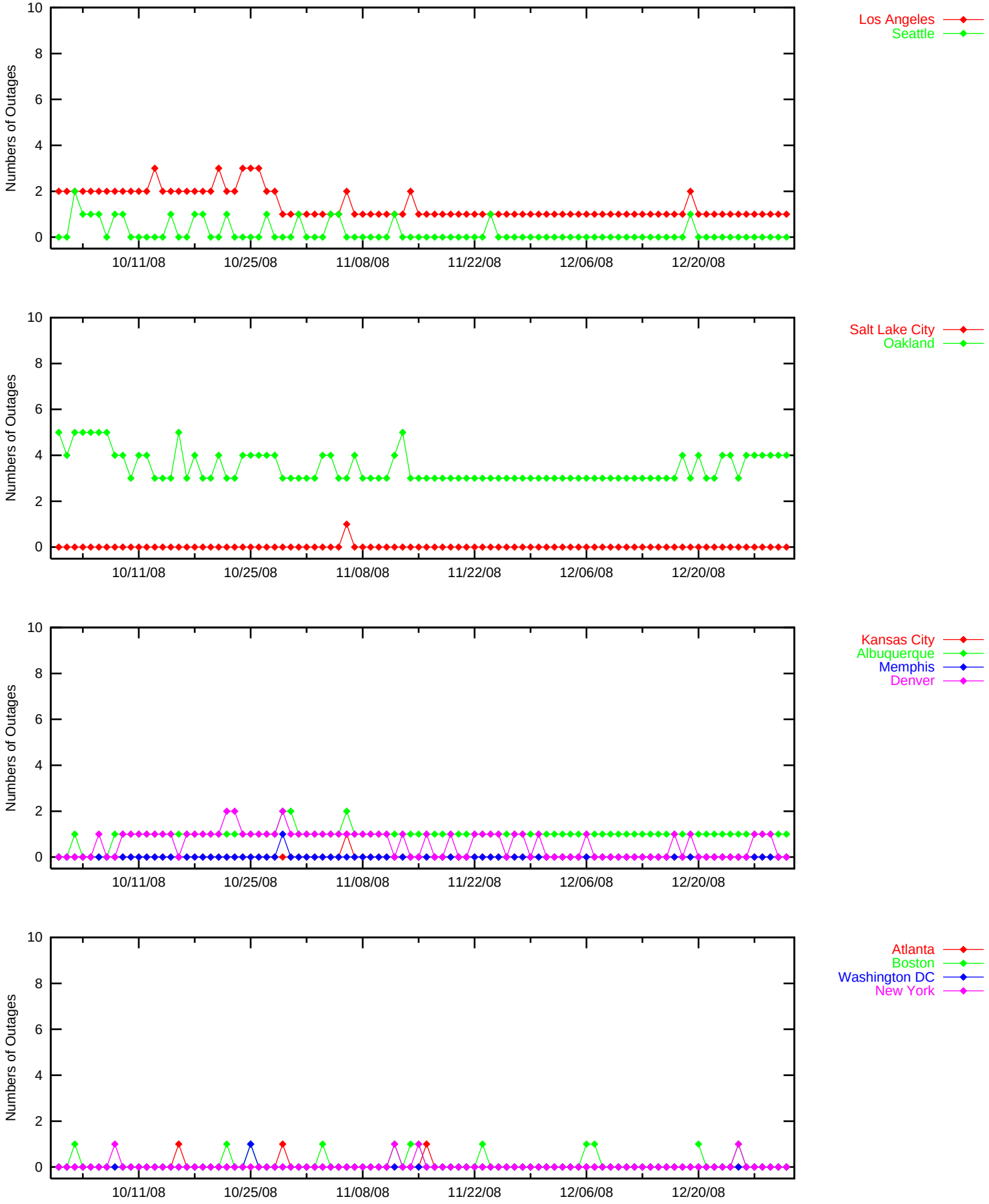


Figure 3-11 LPV 200 Outages (HAL = 40m & VAL=35m)

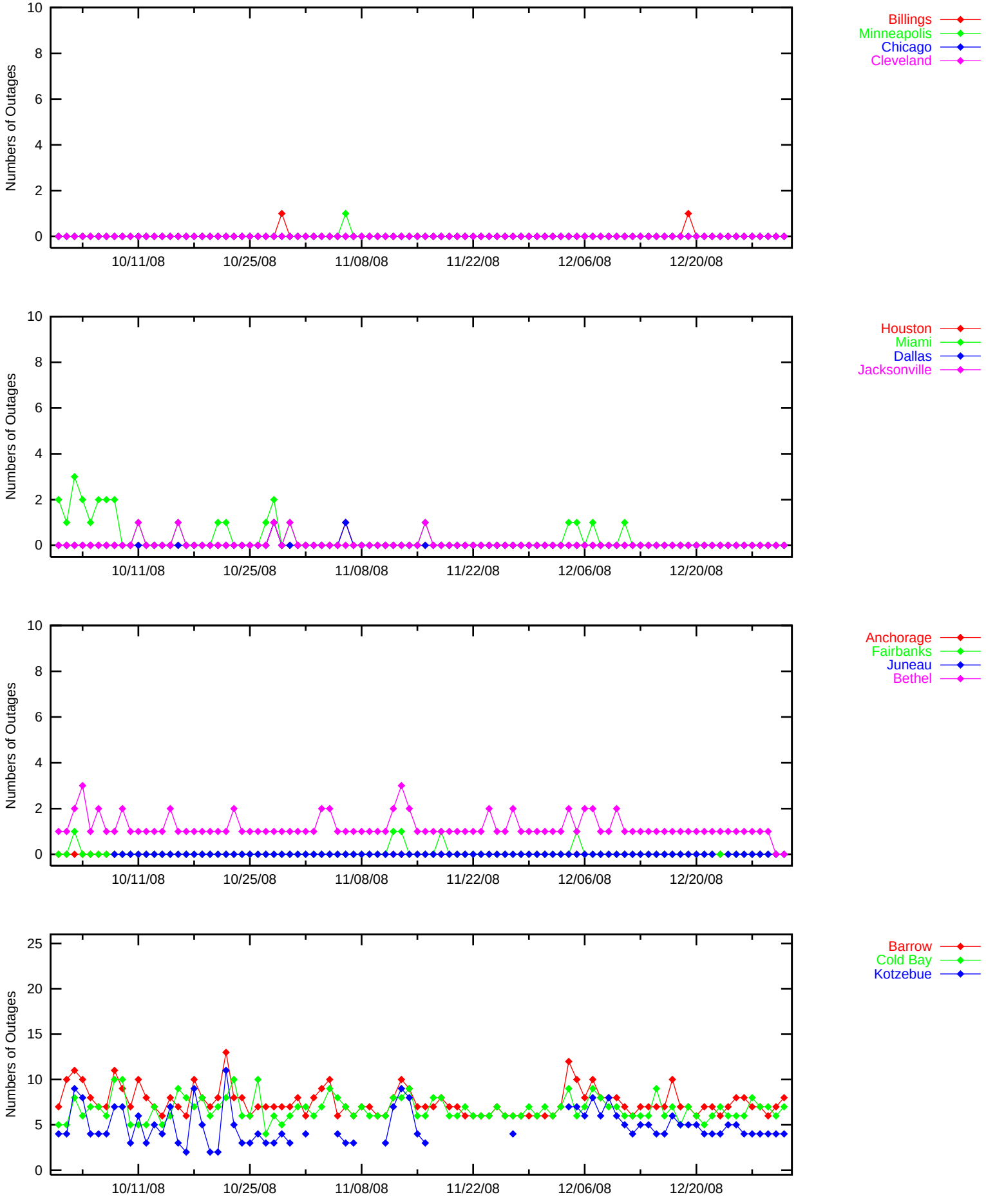
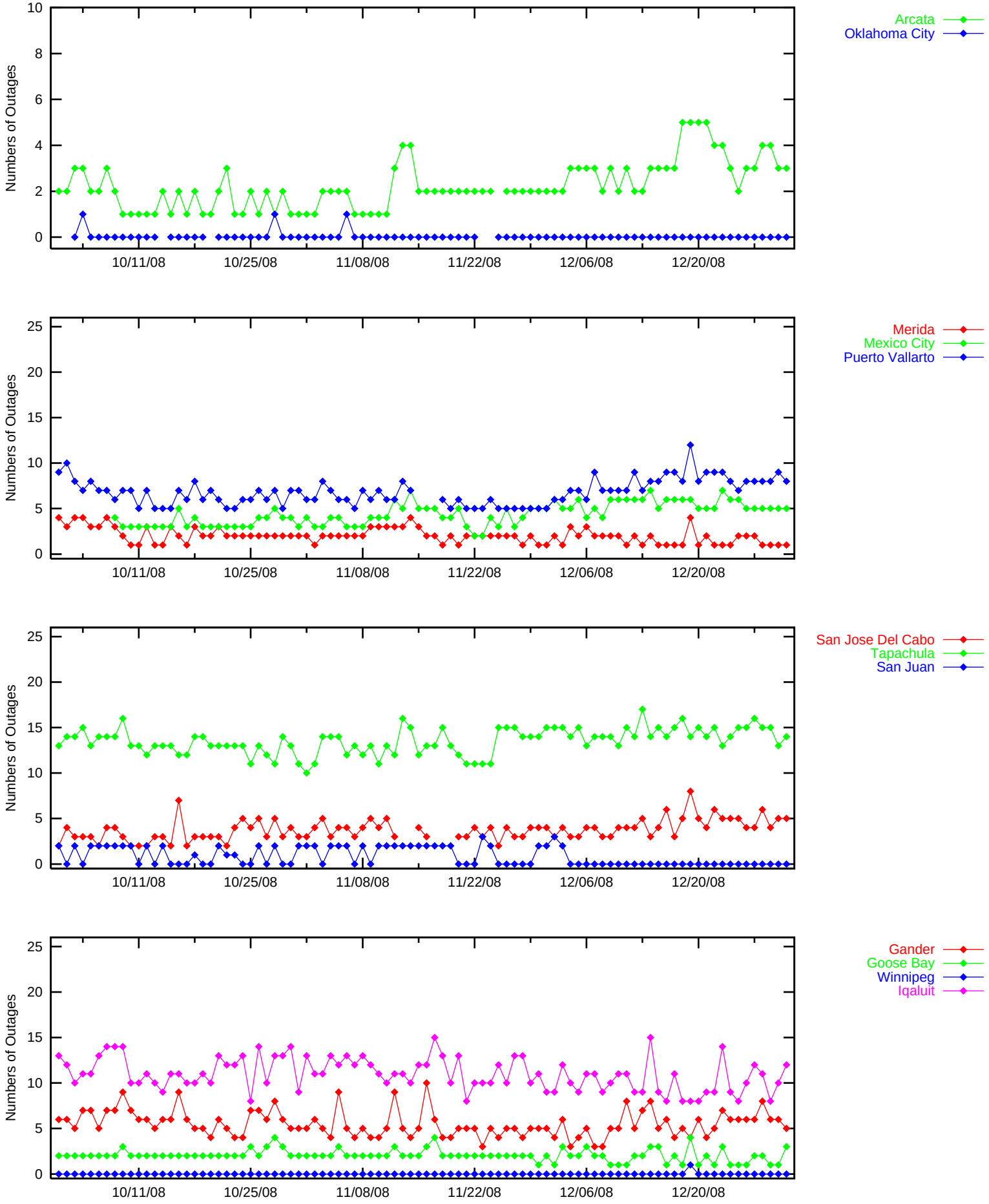


Figure 3-12 LPV 200 Outages (HAL = 40m & VAL=35m)



4.0 COVERAGE

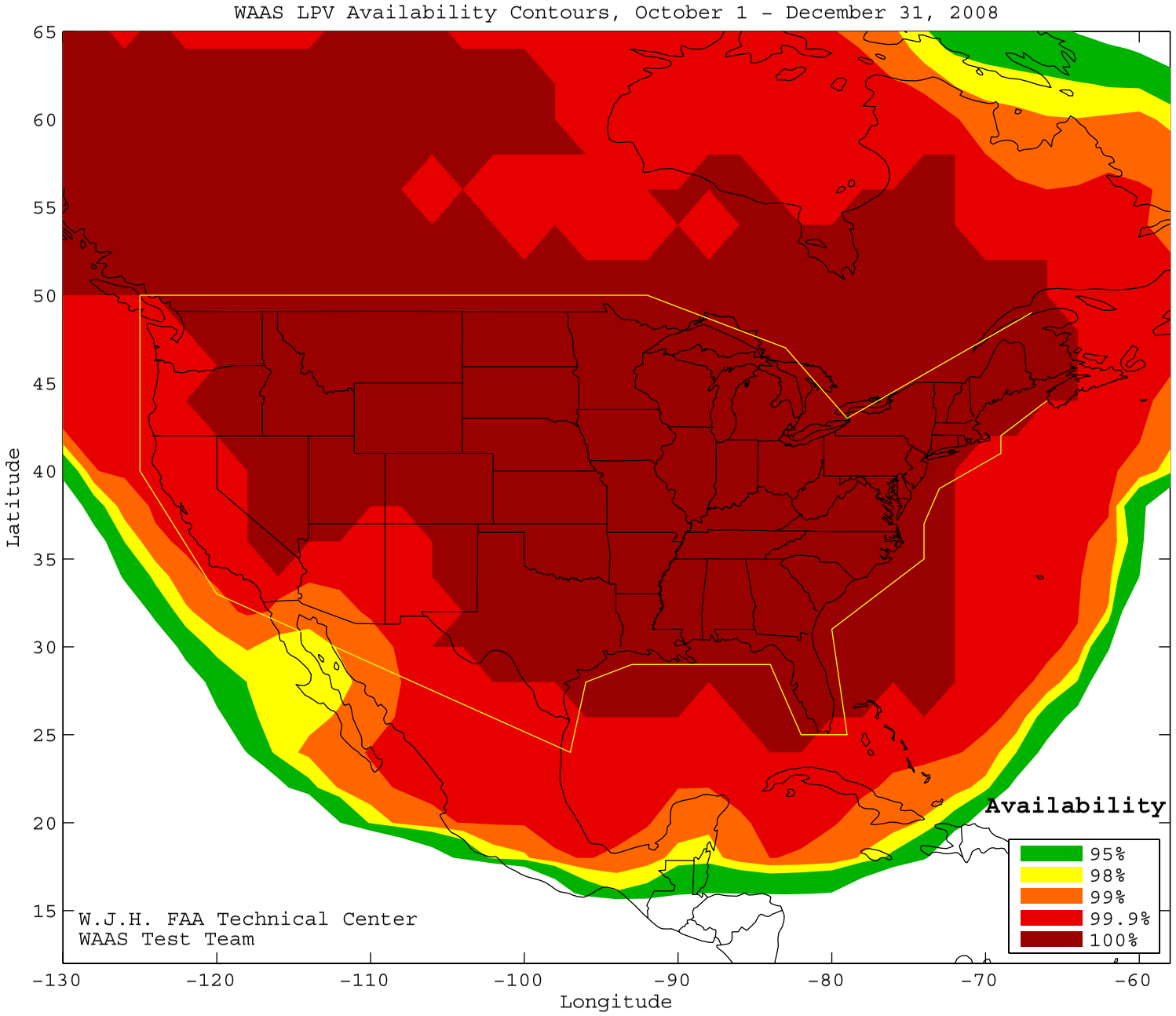
WAAS coverage area evaluation estimates the percent of service volume where WAAS is providing LPV, LPV 200, and NPA services. The WAAS message and the GPS/GEO satellite status are used to determine WAAS availability across North America. For PA coverage, protection levels were calculated at 30-sec intervals and at two degree spacing over the PA service volume, while NPA coverage was calculated at 30-sec intervals and five degree spacing over the NPA service volume.

Daily analysis for PA was conducted for LPV and LPV 200 service levels. The coverage plots provide 100, 99.9, 99, 98 and 95% availability contours. Rollup PA coverage for the quarter are shown as followed: LPV CONUS coverage in Figure 4.1, LPV Alaska coverage in Figure 4.2, LPV 200 CONUS coverage in Figure 4.3 and LPV 200 Alaska coverage in Figure 4.4. Figure 4.5 shows the daily LPV and LPV 200 CONUS coverage, and Figure 4.6 shows the daily LPV Alaska coverage at 99% availability and ionosphere KP index values for this quarter. Please see Appendix B for coverage plots of 99% LPV 200 availability contour and 98% LPV availability contour.

Daily analysis for NPA was based on a 99.9% availability requirement. The NPA coverage plots provide 100, 99.9 and 99% availability contours. Figure 4.5 shows the rollup NPA coverage for the quarter. Figure 4.6 shows the daily NPA coverage at 99.9% availability and ionosphere Kp index values for this quarter.

During this evaluation period, low PA and NPA coverage are mainly due to satellites outages and GUS switchovers. Please refer to Table 1.4 for events that affected coverage. Small coverage drops in Alaska 99% LPV coverage are mainly due to CRW GUS switchovers. Changes in the downlink carrier frequency from the CRW caused reduced ranging availability and coverage on multiple days (see DR #77).

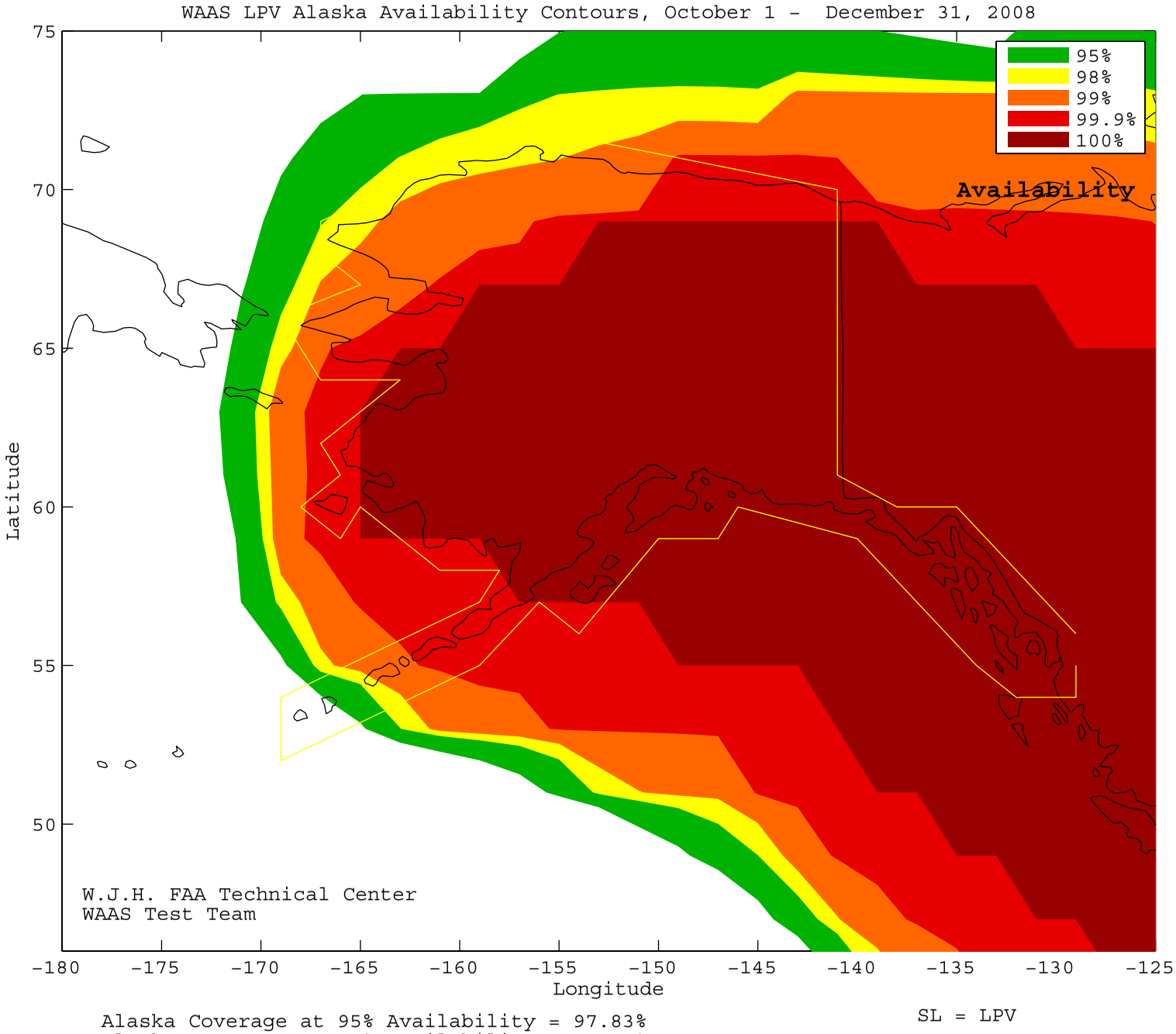
Figure 4-1 LPV CONUS Coverage for the Quarater



CONUS Coverage at 95% Availability = 100%
CONUS Coverage at 99% Availability = 100%
CONUS Coverage at 100% Availability = 85.83%

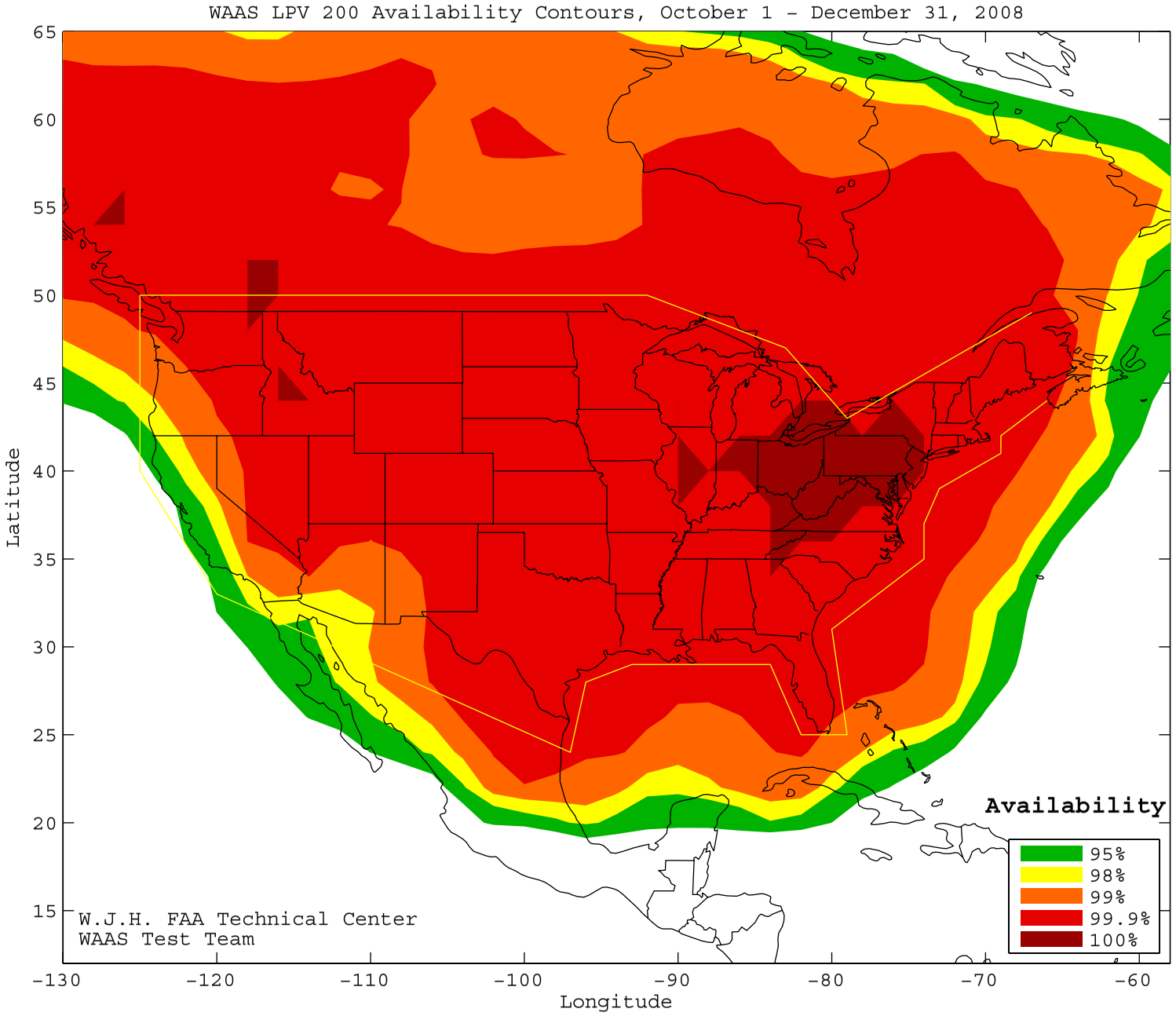
SL = LPV

Figure 4-2 LPV Alaska Coverage for the Quarter



Alaska Coverage at 95% Availability = 97.83%
Alaska Coverage at 99% Availability = 93.48%
Alaska Coverage at 100% Availability = 76.09%

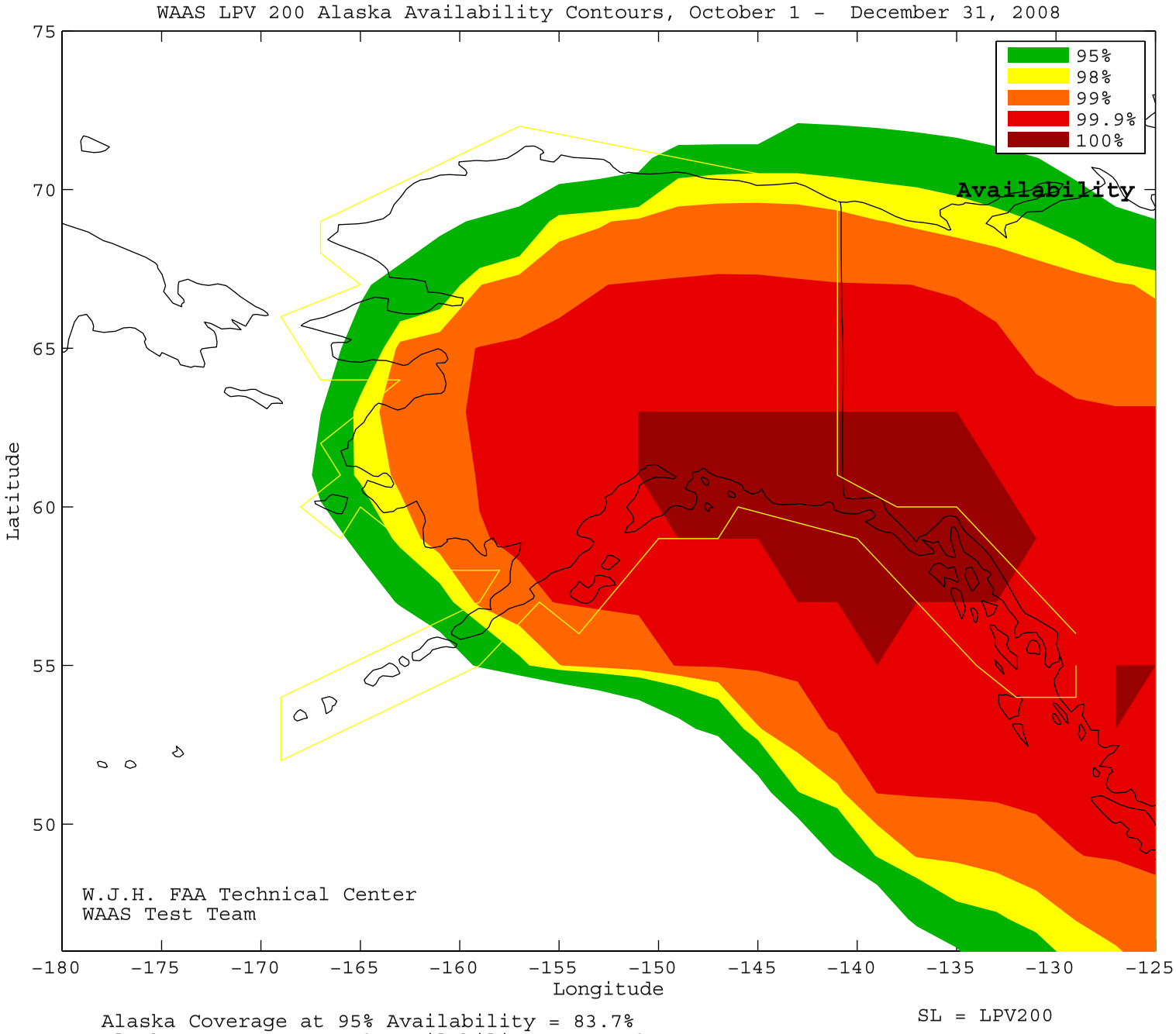
Figure 4-3 LPV 200 CONUS Coverage for the Quarter



CONUS Coverage at 95% Availability = 100%
CONUS Coverage at 99% Availability = 93.93%
CONUS Coverage at 100% Availability = 14.17%

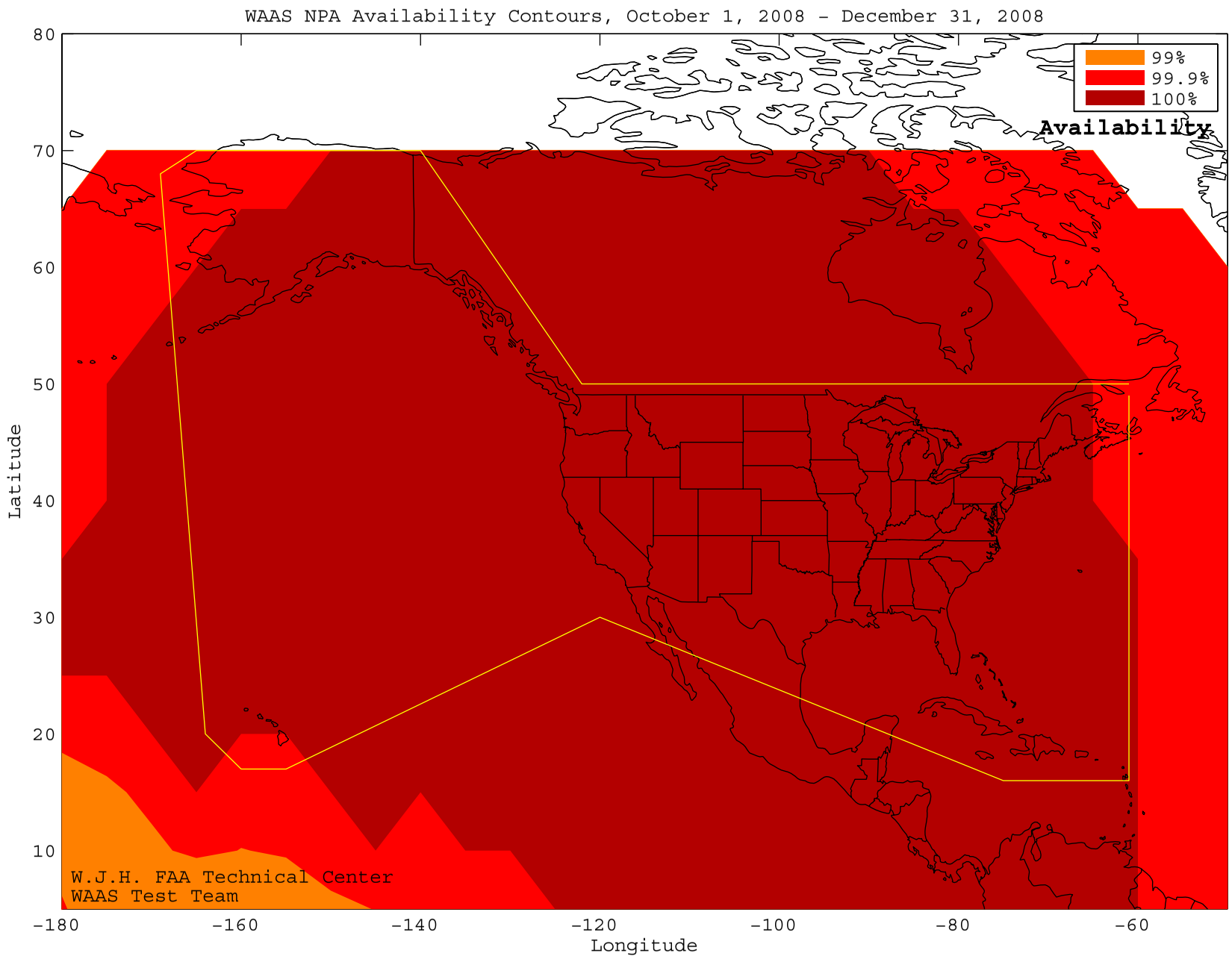
SL = LPV 200

Figure 4-4 LPV 200 Alaska Coverage for the Quarter



Alaska Coverage at 95% Availability = 83.7%
Alaska Coverage at 99% Availability = 71.74%
Alaska Coverage at 100% Availability = 19.57%

Figure 4-5 NPA Coverage for the Quarter



WAAS Coverage at 99% Availability = 100%
WAAS Coverage at 99.9% Availability = 100%
WAAS Coverage at 100% Availability = 99.26%

SL = NPA

Figure 4-6 Daily LPV and LPV 200 CONUS Coverage

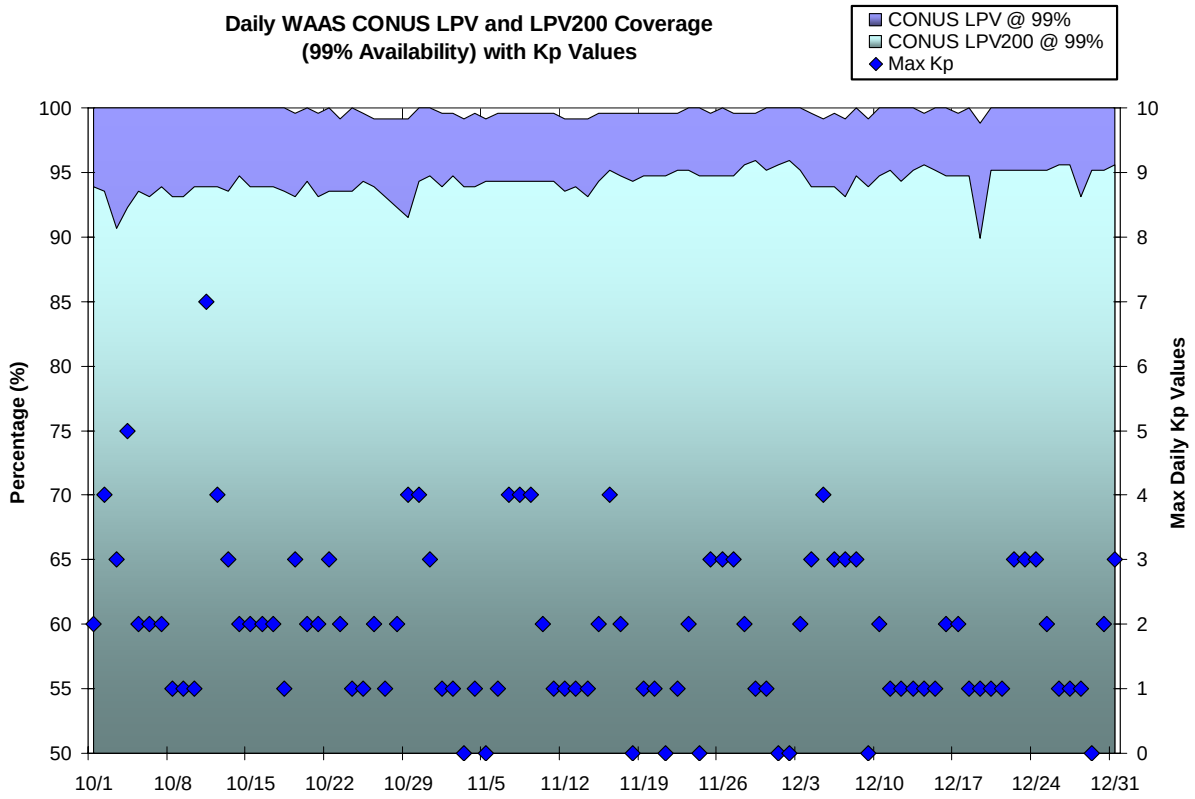


Figure 4-7 Daily LPV Alaska Coverage

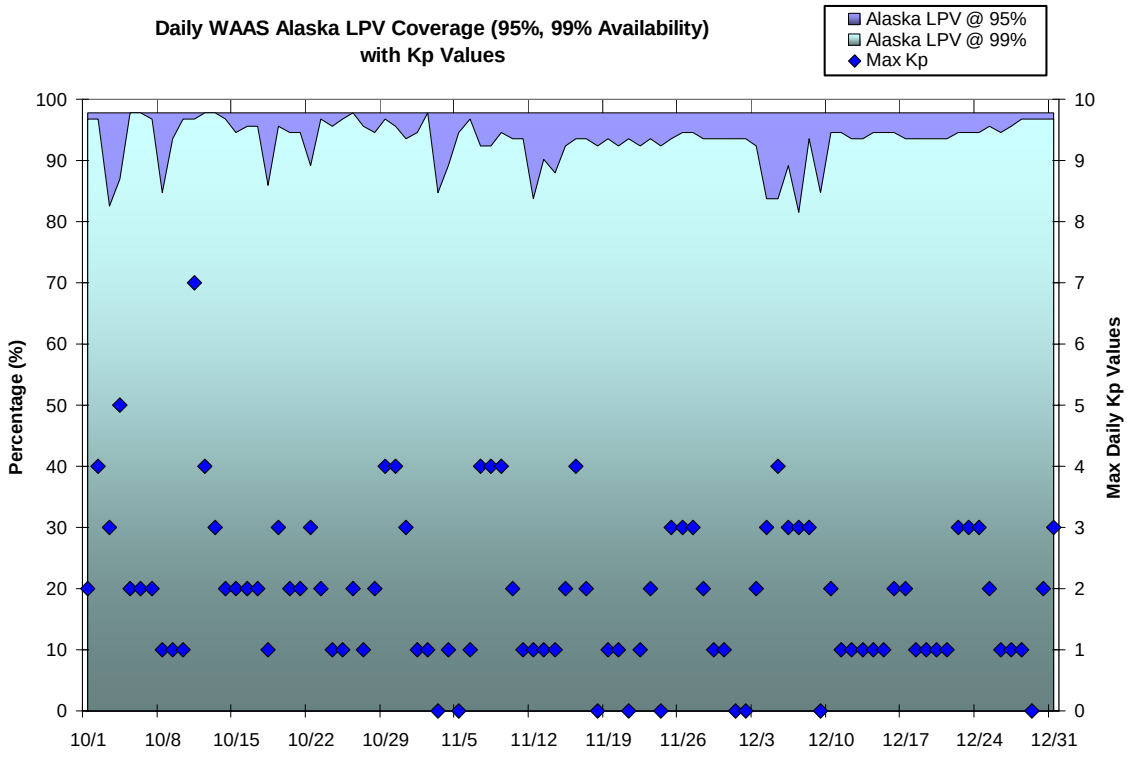
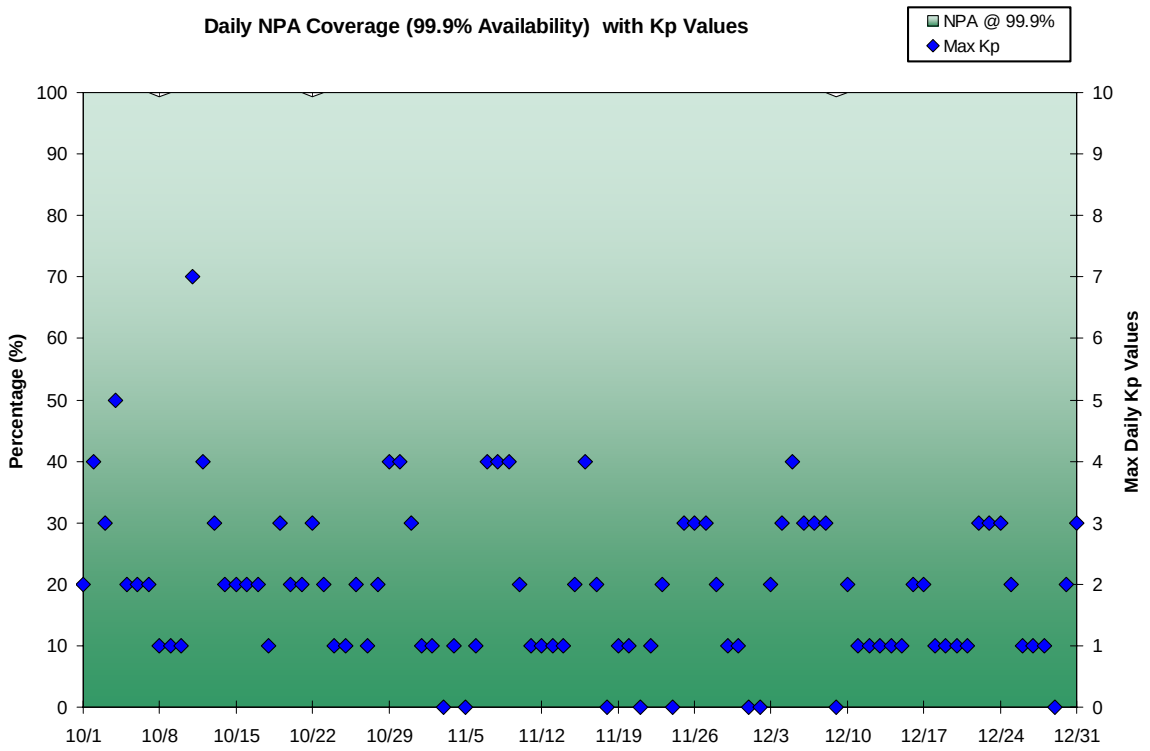


Figure 4-8 Daily NPA Coverage



5.0 INTEGRITY

5.1 HMI Analysis

Analysis of integrity includes the identification and evaluation of HMI (hazardously misleading information), as well as the generation of a safety index to illustrate the margin of safety that WAAS protection levels are providing. The safety index is a metric that shows how well the protection levels are bounding the maximum observed error when LPV service is available. The process for determining this index involves dividing the protection limit observed by the maximum observed error. An observed safety index of greater than one indicates safe bounding of the greatest observed error, less than one indicates that the maximum error was not bounded, and a result equal to one means that the error was equal to the protection level. An HMI occurs if the position error exceeds the protection level in the vertical or horizontal dimensions at any time and 6.2 seconds or more passes before this event is corrected by WAAS.

Table 5.1 lists the safety index and the number of HMIs. For this evaluation period, the lowest safety margin index is 3.27 at Seattle. There was no HMI event. Since WAAS was made available to the public in August 2000 there has not been an HMI event. WAAS was commissioned by the FAA for safety of life services in July 2003.

Table 5-1 Safety Margin Index and HMI Statistics

Location	Safety Index		
	Horizontal	Vertical	Number of HMIs
Arcata	4.32	6.63	0
Oklahoma City	8.42	6.29	0
Albuquerque	6.70	8.23	0
Anchorage	11.67	7.67	0
Atlanta	4.96	5.77	0
Barrow	4.90	7.37	0
Bethel	19.79	13.13	0
Billings	4.65	5.82	0
Boston	7.25	6.02	0
Chicago	7.90	7.81	0
Cleveland	7.01	6.40	0
Cold Bay	10.99	7.59	0
Dallas	7.45	4.92	0
Denver	6.30	5.52	0
Fairbanks	10.60	5.71	0
Gander	11.51	12.67	0
Goose Bay	13.31	12.51	0
Houston	9.54	7.94	0
Iqaluit	10.67	4.06	0
Jacksonville	6.00	10.34	0
Juneau	7.63	4.47	0
Kansas City	6.08	4.49	0
Kotzebue	8.03	7.10	0
Los Angeles	6.81	8.50	0
Memphis	6.64	8.93	0
Merida	13.50	11.01	0
Mexico City	8.81	10.30	0
Miami	11.18	8.61	0
Minneapolis	4.77	6.00	0
New York	7.63	9.47	0
Oakland	6.35	7.44	0
Puerto Vallarta	9.31	10.84	0
Salt Lake City	5.95	6.56	0
San Jose Del Cabo	11.06	5.86	0
San Juan	11.76	9.18	0
Seattle	3.56	3.27	0
Tapachula	7.69	6.17	0
Washington DC	10.38	6.73	0

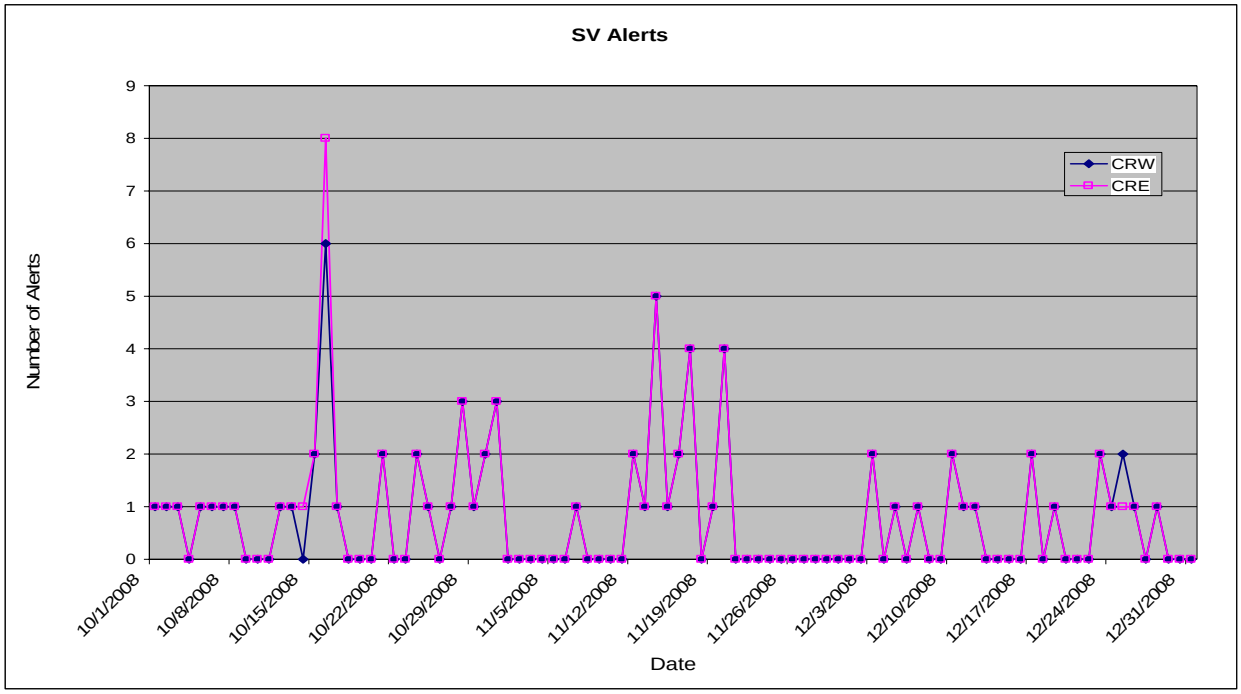
5.2 Broadcast Alerts

The WAAS transmits alert messages to protect the users from satellite degradation or severe ionospheric activity, both of which can cause unsafe conditions for a user. Space Vehicle (SV) alerts increase the User Differential Range Error (UDRE) of satellites, which can reduce the weighting of the satellite in the navigation solution, or completely exclude it from the navigation solution. An increase in UDRE's after an alert effectively increases the user protection levels (HPL and VPL), which affect the availability. Additionally, if an alert message sequence lasts for more than 12 seconds, WAAS fast corrections can time out, causing a loss of continuity. Table 5.2 shows the total number of alerts and the average number of alerts per day. Figure 5.1 shows the number of SV alerts that occurred daily during the reporting period. Often the number of alerts on one GEO is the same as the number of alerts on the other GEO. Therefore, lines tend to overlap in most points on this plot.

Table 5-2 WAAS SV Alert

	Number of Alerts		Average Alerts Per Day	
Message Type	**CRW**	**CRE**	**CRW**	**CRE**
2	31	31	0.3407	0.3407
3	17	17	0.1868	0.1868
4	24	26	0.2637	0.2857
5	0	0	0.0000	0.0000
6	0	0	0.0000	0.0000
24	0	0	0.0000	0.0000
26	0	0	0.0000	0.0000
Total Alerts	72	74	0.7912	0.8132

Figure 5-1 SV Daily Alert Trends



5.3 Availability of WAAS Messages (CRE and CRW)

For an accurate and current user position to be calculated, the content of the WAAS message must be broadcast and received within precise time specifications. This aspect of the WAAS is critical to maintaining integrity requirements. Each message type in the WAAS SIS has a specific amount of time for which it must be received anew. Although the content of every message is relevant to the functionality of the system, the importance of different messages varies along with the frequency with which they must be received. Table 5.3 lists the maximum intervals at which each message must broadcast to meet system requirements.

GUS switchovers or broadcast WAAS alerts can interrupt the normal broadcast message stream. If these events occur at a time when the maximum interval of a specific message is approaching, that message may be delayed, resulting in its late transmittal.

Late messages statistics reported during the quarter were mainly caused by GEO SIS outages, GUS switchovers and SV alerts except message type 7 and 10. Occasionally, message type 7 and 10 were late and they were not caused by GEO SIS outages, GUS switchovers or SV alerts. The lateness of type 7 and type 10 messages has little or no impact on user performance and safety.

Tables 5.4 to 5.8 show fast correction, long correction, ephemeris covariance, ionosphere correction, and ionospheric mask message rates statistics broadcasted on CRW. Table 5.9 to 5.13 show message rates statistics broadcasted on CRE.

Table 5-3 Update Rates for WAAS Messages

Data	**Associated Message Types**	**Maximum Update Interval** (seconds)	**En Route, Terminal, NPA Timeout** (seconds)	**Precision Approach Timeout** (seconds)
WAAS in Test Mode	0	6	N/A	N/A
PRN Mask	1	60	None	None
UDREI	2-6, 24	6	18	12
Fast Corrections	2-5, 24	See Table A-8 in RTCA DO-229C	See Table A-8 in RTCA DO-229C	See Table A-8 in RTCA DO-229C
Long Term Corrections	24, 25	120	360	240
GEO Nav. Data	9	120	360	240
Fast Correction Degradation	7	120	360	240
Weighting Factors	8	120	240	240
Degradation Parameters	10	120	360	240
Ionospheric Grid Mask	18	300	None	None
Ionospheric Corrections	26	300	600	600
UTC Timing Data	12	300	None	None
Almanac Data	17	300	None	None

Table 5-4 WAAS Fast Correction and Degradation Message Rates – CRW

Message Type	**On Time**	**Late**	**Max Late Length (seconds)**
1	106407	1	135
2	1324825	34	31
3	1324766	49	26
4	1324798	43	24
7	98387	11	132
9	93147	0	0
10	98562	14	138
17	31545	1	307

Table 5-5 WAAS Long Correction Message Rates (Type 24 and 25) - CRW

PRN	On Time	Late	Max Late Length (seconds)
2	47819	0	0
3	51538	0	0
4	49117	0	0
5	47459	0	0
6	52325	0	0
7	48746	0	0
8	47837	0	0
9	50645	0	0
10	49157	0	0
11	52700	0	0
12	49822	0	0
13	48155	0	0
14	48003	2	158
15	51349	0	0
16	49641	0	0
17	48237	0	0
18	48453	0	0
19	49687	0	0
20	50867	0	0
21	47865	0	0
22	49101	0	0
23	47926	0	0
24	48965	0	0
25	49889	0	0
26	49766	1	180
27	48688	1	180
28	49312	0	0
29	48299	2	158
30	51966	0	0
31	49475	0	0
32	48970	0	0

Table 5-6 WAAS Ephemeris Covariance Message Rates (Type 28) – CRW

PRN	On Time	Late	Max Late Length (seconds)
2	39261	0	0
3	42313	0	0
4	40325	0	0
5	38924	0	0
6	42990	1	127
7	39989	1	326
8	39261	0	0
9	41612	3	175
10	40358	0	0
11	43297	0	0
12	40963	0	0
13	39546	0	0
14	39435	0	0
15	42143	0	0
16	40761	0	0
17	39631	1	121
18	39758	0	0
19	40745	1	175
20	41787	0	0
21	39279	0	0
22	40362	0	0
23	39388	0	0
24	40187	0	0
25	40944	5	185
26	40898	0	0
27	39981	0	0
28	40486	2	210
29	39710	0	0
30	42795	0	0
31	40545	0	0
32	40215	0	0
135	76154	1	192
138	75785	0	0

Table 5-7 WAAS Ionospheric Correction Message Rates (Type 26) - CRW

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27581	8	306
0	1	27572	9	306
0	2	27588	9	308
1	0	27586	10	309
1	1	27585	11	307
1	2	27584	8	307
1	3	27587	5	306
1	4	27595	9	306
2	0	27595	9	306
2	1	27584	8	314
2	2	27587	9	313
2	3	27591	9	307
2	4	27589	7	305
2	5	27591	5	305
3	0	27601	7	306
3	1	27592	8	306
3	2	27582	11	308
9	0	27585	12	316
9	1	27581	4	304
9	2	27573	8	306
9	3	27608	5	303
9	4	27575	14	318
9	5	27575	14	324
9	6	27596	13	306

Table 5-8 WAAS Ionospheric Mask Message Rates (Type 18) – CRW

Band	On Time	Late	Max Late Length (seconds)
1	35853	0	0
2	35949	2	372
3	35923	1	305
9	35902	0	0

Table 5-9 WAAS Fast Correction and Degradation Message Rates – CRE

Message Type	On Time	Late	Max Late Length (seconds)
1	108171	2	126
2	1324814	42	31
3	1324770	49	26
4	1324800	44	21
7	100241	11	134
9	93147	0	0
10	100198	9	140
17	31707	1	309

Table 5-10 WAAS Long Correction Message Rates (Type 24 and 25) - CRE

PRN	On Time	Late	Max Late Length (seconds)
2	47814	0	0
3	51540	1	158
4	49116	1	170
5	47453	1	151
6	52336	0	0
7	48762	0	0
8	47848	0	0
9	50646	1	127
10	49151	0	0
11	52707	0	0
12	49823	0	0
13	48165	1	121
14	48007	1	134
15	51354	0	0
16	49630	0	0
17	48237	0	0
18	48450	1	158
19	49715	0	0
20	50867	1	151
21	47873	0	0
22	49100	0	0
23	47937	1	144
24	48961	1	127
25	49882	0	0
26	49769	0	0
27	48692	0	0
28	49307	0	0
29	48304	1	134
30	51962	0	0
31	49475	1	122
32	48973	0	0

Table 5-11 WAAS Ephemeris Covariance Message Rates (Type 28) – CRE

PRN	On Time	Late	Max Late Length (seconds)
2	39259	0	0
3	42313	1	172
4	40325	1	193
5	38918	0	0
6	42995	1	146
7	39990	1	147
8	39264	1	152
9	41620	1	152
10	40344	1	136
11	43303	0	0
12	40950	1	128
13	39551	0	0
14	39450	1	160
15	42131	1	210
16	40772	0	0
17	39642	0	0
18	39746	1	130
19	40743	0	0
20	41796	1	123
21	39283	1	210
22	40374	0	0
23	39381	0	0
24	40182	1	205
25	40952	0	0
26	40917	0	0
27	39990	1	128
28	40504	1	128
29	39708	0	0
30	42785	2	205
31	40550	0	0
32	40208	2	147
135	67276	1	159
138	75760	2	159

Table 5-12 WAAS Ionospheric Correction Message Rates (Type 26) – CRE

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27595	9	329
0	1	27576	16	363
0	2	27590	10	352
1	0	27585	7	364
1	1	27589	11	365
1	2	27586	10	341
1	3	27579	13	341
1	4	27594	10	334
2	0	27571	13	357
2	1	27579	17	346
2	2	27576	12	346
2	3	27591	16	481
2	4	27577	14	493
2	5	27580	10	529
3	0	27591	11	529
3	1	27578	9	529
3	2	27587	5	514
9	0	27585	8	320
9	1	27589	9	324
9	2	27592	12	339
9	3	27581	11	346
9	4	27586	6	327
9	5	27584	8	339
9	6	27571	20	576

Table 5-13 WAAS Ionospheric Mask Message Rates (Type 18) - CRE

Band	On Time	Late	Max Late Length (seconds)
1	36144	2	388
2	36161	0	0
3	36143	0	0
9	36166	0	0

6.0 SV RANGE ACCURACY

Range accuracy evaluation computes the probability that the WAAS User Differential Range Error (UDRE) and Grid Ionospheric Vertical Error (GIVE) statistically bound 99.9% of the range residuals for each satellite tracked by the receiver. A UDRE is broadcast by the WAAS for each satellite that is monitored by the system and the 99.9% bound (3.29 sigma) of the residual error on a pseudorange after application of fast and long-term corrections is checked. The pseudorange residual error is determined by taking the difference between the raw pseudorange and a calculated reference range. The reference range is equal to the true range between the corrected satellite position and surveyed user antenna plus all corrections (WAAS Fast Clock, WAAS Long-Term Clock, WAAS Ionospheric delay, Tropospheric delay, Receiver Clock Bias, and Multipath). Since the true ionospheric delay and multipath error are not precisely known, the estimated variance in these error sources are added to the UDRE before the comparing it to the residual error.

GPS satellite range residual errors were calculated for twelve WAAS receivers during the quarter. Table 6.1 and 6.2 show the range error 95% index and 99.9% (3.29 sigma) bounding statistics for each SV at the selected locations. Figures 6.1 and 6.2 show the range error for each SV as measured by the WAAS receivers at the Atlanta reference station.

A GIVE is broadcast by the WAAS for each IGP that is monitored by the system and the 99.9% (3.29 sigma) bound of the ionospheric error is checked. The WAAS broadcasts the ionospheric model using IGP's at predefined geographic locations. Each IGP contains the vertical ionospheric delay and the error in that delay in the form of the GIVE. The ionospheric error is determined by taking the difference between the WAAS vertical ionospheric delay interpolated from the IGP's and GPS dual frequency measurement at that GPS satellite.

GPS satellite ionospheric errors were calculated for twelve WAAS receivers during the quarter. Table 6.3 and 6.4 show the ionospheric error 95% index and 99.9% (3.29 sigma) bounding statistics for each SV at the selected locations. Figures 6.3 and 6.4 show the ionospheric error for each SV as measured by the WAAS receiver at the Atlanta reference station.

Table 6-1 Range Error 95% index and 3.29 Sigma Bounding

Site →	Billings		Albuquerque		Boston		Washington DC		Houston		Kansas City	
PRN ↓	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.349	100.00	1.175	100.00	1.731	100.00	1.940	100.00	1.740	100.00	1.502	100.00
3	2.034	100.00	1.283	100.00	1.576	100.00	1.299	100.00	1.482	100.00	1.222	100.00
4	2.134	100.00	1.884	100.00	1.518	100.00	0.941	100.00	1.899	100.00	1.505	100.00
5	1.244	100.00	1.207	100.00	1.517	100.00	1.621	100.00	1.198	100.00	1.061	100.00
6	1.963	100.00	1.371	100.00	1.646	100.00	1.299	100.00	1.599	100.00	1.253	100.00
7	1.965	100.00	1.498	100.00	1.402	100.00	1.074	100.00	1.070	100.00	1.359	100.00
8	1.923	100.00	1.205	100.00	1.322	100.00	0.957	100.00	1.009	100.00	1.088	100.00
9	1.586	100.00	1.245	100.00	1.449	100.00	0.871	100.00	1.491	100.00	1.317	100.00
10	0.926	100.00	1.305	100.00	1.046	100.00	1.682	100.00	1.108	100.00	1.402	100.00
11	1.367	100.00	1.088	100.00	1.050	100.00	1.482	100.00	0.942	100.00	0.720	100.00
12	1.637	100.00	1.449	100.00	1.496	100.00	1.105	100.00	1.244	100.00	1.403	100.00
13	2.100	100.00	1.409	100.00	1.298	100.00	1.011	100.00	1.244	100.00	1.549	100.00
14	1.693	100.00	1.177	100.00	1.146	100.00	1.100	100.00	0.941	100.00	0.955	100.00
15	1.860	100.00	1.661	100.00	1.810	100.00	1.473	100.00	1.359	100.00	1.418	100.00
16	0.924	100.00	0.793	100.00	0.843	100.00	1.296	100.00	1.082	100.00	0.953	100.00
17	2.655	100.00	1.557	100.00	1.495	100.00	0.793	100.00	1.266	100.00	1.188	100.00
18	0.937	100.00	0.746	100.00	1.106	100.00	1.629	100.00	1.504	100.00	1.068	100.00
19	1.854	100.00	1.778	100.00	2.044	100.00	1.983	100.00	2.732	100.00	1.988	100.00
20	1.346	100.00	0.881	100.00	1.380	100.00	0.974	100.00	1.487	100.00	1.207	100.00
21	0.800	100.00	1.319	100.00	1.165	100.00	1.706	100.00	1.411	100.00	0.997	100.00
22	1.191	100.00	0.736	100.00	1.203	100.00	1.834	100.00	1.179	100.00	1.122	100.00
23	0.937	100.00	1.463	100.00	1.860	100.00	1.921	100.00	2.198	100.00	1.406	100.00
24	2.179	100.00	1.779	100.00	2.076	100.00	1.065	100.00	1.263	100.00	1.562	100.00
25	1.770	100.00	1.418	100.00	1.725	100.00	1.114	100.00	1.238	100.00	1.254	100.00
26	2.344	100.00	1.619	100.00	1.768	100.00	1.247	100.00	1.844	100.00	1.788	100.00
27	1.966	100.00	1.620	100.00	1.669	100.00	1.349	100.00	1.222	100.00	1.628	100.00
28	0.668	100.00	1.008	100.00	1.083	100.00	1.200	100.00	1.293	100.00	0.897	100.00
29	1.735	100.00	1.593	100.00	1.662	100.00	1.541	100.00	1.579	100.00	1.651	100.00
30	2.142	100.00	1.367	100.00	2.436	100.00	1.531	100.00	1.432	100.00	1.348	100.00
31	2.885	100.00	1.400	100.00	1.255	100.00	0.980	100.00	1.229	100.00	1.754	100.00
32	1.837	100.00	1.275	100.00	1.530	100.00	0.940	100.00	1.163	100.00	1.485	100.00
135	1.902	100.00	1.734	100.00	3.020	100.00	2.209	100.00	2.085	100.00	1.691	100.00
138	1.244	100.00	1.546	100.00	1.439	100.00	1.352	100.00	1.813	100.00	1.622	100.00

Table 6-2 Range Error 95% index and 3.29 Sigma Bounding

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
PRN ↓	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)	95% Range Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.927	100.00	1.680	100.00	1.997	100.00	1.653	100.00	1.431	100	1.012	100.00
3	1.343	100.00	1.207	100.00	1.129	100.00	1.647	100.00	1.377	100	1.440	100.00
4	1.426	100.00	1.604	100.00	2.390	100.00	1.603	100.00	1.519	100	2.094	100.00
5	1.390	100.00	0.912	100.00	1.248	100.00	1.264	100.00	1.069	100	1.196	100.00
6	1.679	100.00	1.409	100.00	1.125	100.00	1.742	100.00	1.696	100	2.040	100.00
7	0.981	100.00	1.246	100.00	1.907	100.00	1.453	100.00	1.442	100	1.805	100.00
8	0.813	100.00	1.235	100.00	0.931	100.00	1.448	100.00	1.318	100	1.588	100.00
9	0.926	100.00	1.660	100.00	1.060	100.00	1.071	100.00	1.277	100	1.359	100.00
10	1.001	100.00	0.811	100.00	1.395	100.00	1.242	100.00	0.841	100	1.200	100.00
11	0.974	100.00	0.878	100.00	1.030	100.00	1.208	100.00	0.917	100	1.228	100.00
12	0.840	100.00	0.916	100.00	1.450	100.00	1.715	100.00	1.358	100	1.527	100.00
13	0.942	100.00	1.369	100.00	1.498	100.00	1.417	100.00	1.483	100	1.747	100.00
14	0.758	100.00	1.240	100.00	1.647	100.00	1.183	100.00	1.013	100	0.988	100.00
15	1.212	100.00	1.113	100.00	1.009	100.00	1.766	100.00	1.491	100	2.138	100.00
16	0.978	100.00	0.922	100.00	1.835	100.00	1.179	100.00	1.007	100	1.052	100.00
17	1.333	100.00	1.464	100.00	1.123	100.00	1.189	100.00	1.192	100	1.654	100.00
18	1.181	100.00	1.150	100.00	1.861	100.00	1.224	100.00	1.296	100	0.829	100.00
19	3.281	100.00	1.915	100.00	2.336	100.00	2.117	100.00	1.943	100	1.549	100.00
20	1.062	100.00	1.458	100.00	1.596	100.00	1.311	100.00	0.974	100	0.993	100.00
21	1.417	100.00	1.026	100.00	1.907	100.00	1.418	100.00	1.214	100	0.836	100.00
22	1.188	100.00	1.009	100.00	2.217	100.00	1.408	100.00	1.253	100	0.825	100.00
23	1.540	100.00	1.392	100.00	2.213	100.00	1.627	100.00	1.442	100	1.139	100.00
24	1.395	100.00	1.414	100.00	1.364	100.00	1.897	100.00	1.439	100	2.101	100.00
25	1.038	100.00	1.171	100.00	1.114	100.00	1.505	100.00	1.442	100	1.937	100.00
26	1.451	100.00	1.495	100.00	1.138	100.00	1.737	100.00	1.610	100	2.052	100.00
27	1.117	100.00	1.451	100.00	1.316	100.00	1.659	100.00	1.702	100	1.974	100.00
28	0.861	100.00	0.670	100.00	1.844	100.00	1.079	100.00	0.856	100	1.079	100.00
29	0.944	100.00	1.252	100.00	1.605	100.00	1.653	100.00	1.494	100	1.916	100.00
30	1.080	100.00	1.318	100.00	1.584	100.00	1.723	100.00	1.602	100	1.906	100.00
31	1.098	100.00	1.249	100.00	1.809	100.00	1.502	100.00	1.169	100	1.444	100.00
32	1.175	100.00	1.295	100.00	1.166	100.00	1.591	100.00	1.207	100	1.701	100.00
135	2.026	100.00	1.471	100.00	2.714	100.00	2.594	100.00	1.961	100	1.367	100.00
138	1.334	100.00	1.724	100.00	2.307	100.00	1.645	100.00	1.334	100	1.506	100.00

Table 6-3 Ionospheric Error 95% index and 3.29 Sigma Bounding

Site →	Billings		Albuquerque		Boston		Washington DC		Houston		Kansas City	
PRN ↓	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	0.764	100.00	0.825	100.00	1.075	100.00	1.092	100.00	1.010	100.00	0.842	100.00
3	0.930	100.00	0.590	100.00	0.609	100.00	0.409	100.00	0.901	100.00	0.526	100.00
4	1.335	100.00	1.222	100.00	1.176	100.00	0.702	100.00	1.258	100.00	1.221	100.00
5	0.509	100.00	0.384	100.00	0.512	100.00	0.347	100.00	0.574	100.00	0.291	100.00
6	0.955	100.00	0.650	100.00	0.786	100.00	0.457	100.00	0.847	100.00	0.512	100.00
7	1.184	100.00	0.720	100.00	0.805	100.00	0.512	100.00	0.655	100.00	0.692	100.00
8	1.089	100.00	0.515	100.00	0.495	100.00	0.430	100.00	0.449	100.00	0.566	100.00
9	0.689	100.00	0.649	100.00	0.577	100.00	0.476	100.00	0.491	100.00	0.619	100.00
10	0.530	100.00	0.564	100.00	0.536	100.00	0.747	100.00	0.515	100.00	0.549	100.00
11	0.530	100.00	0.414	100.00	0.401	100.00	0.677	100.00	0.497	100.00	0.381	100.00
12	0.819	100.00	0.762	100.00	0.603	100.00	0.325	100.00	0.512	100.00	0.632	100.00
13	1.112	100.00	0.735	100.00	0.676	100.00	0.432	100.00	0.722	100.00	0.702	100.00
14	0.971	100.00	0.596	100.00	0.511	100.00	0.397	100.00	0.429	100.00	0.337	100.00
15	1.104	100.00	0.976	100.00	0.678	100.00	1.032	100.00	0.733	100.00	0.882	100.00
16	0.420	100.00	0.437	100.00	0.363	100.00	0.638	100.00	0.784	100.00	0.573	100.00
17	1.654	100.00	0.847	100.00	1.020	100.00	0.504	100.00	0.639	100.00	0.714	100.00
18	0.444	100.00	0.465	100.00	0.732	100.00	0.869	100.00	0.755	100.00	0.609	100.00
19	1.286	100.00	1.306	100.00	1.417	100.00	1.574	100.00	1.879	100.00	1.508	100.00
20	0.420	100.00	0.416	100.00	0.726	100.00	0.500	100.00	0.625	100.00	0.491	100.00
21	0.668	100.00	0.768	100.00	0.891	100.00	1.056	100.00	0.885	100.00	0.635	100.00
22	0.489	100.00	0.435	100.00	0.943	100.00	1.165	100.00	0.640	100.00	0.763	100.00
23	0.936	100.00	1.101	100.00	1.397	100.00	1.512	100.00	1.569	100.00	1.195	100.00
24	1.558	100.00	1.201	100.00	1.211	100.00	0.945	100.00	1.057	100.00	1.118	100.00
25	1.042	100.00	0.730	100.00	0.897	100.00	0.499	100.00	0.731	100.00	0.570	100.00
26	1.188	100.00	0.923	100.00	0.808	100.00	0.743	100.00	0.986	100.00	1.022	100.00
27	1.050	100.00	0.877	100.00	0.760	100.00	0.613	100.00	0.804	100.00	0.976	100.00
28	0.409	100.00	0.415	100.00	0.456	100.00	0.687	100.00	0.689	100.00	0.472	100.00
29	1.156	100.00	1.142	100.00	0.902	100.00	0.800	100.00	1.161	100.00	1.057	100.00
30	1.098	100.00	0.747	100.00	1.157	100.00	0.808	100.00	0.698	100.00	0.632	100.00
31	1.888	100.00	0.742	100.00	0.514	100.00	0.376	100.00	0.951	100.00	0.916	100.00
32	0.983	100.00	0.735	100.00	0.661	100.00	0.366	100.00	0.567	100.00	0.747	100.00

Table 6-4 Ionospheric Error 95% index and 3.29 Sigma Bounding

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
PRN ↓	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)	95% Iono Error	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.174	100.00	1.054	100.00	0.884	100.00	1.069	100.00	0.752	100.00	0.561	100.00
3	0.567	100.00	0.451	100.00	0.590	100.00	0.600	100.00	0.523	100.00	0.708	100.00
4	0.822	100.00	0.923	100.00	0.982	100.00	0.928	100.00	0.959	100.00	1.318	100.00
5	0.329	100.00	0.381	100.00	0.448	100.00	0.473	100.00	0.454	100.00	0.586	100.00
6	0.806	100.00	0.675	100.00	0.649	100.00	0.696	100.00	0.740	100.00	0.954	100.00
7	0.550	100.00	0.682	100.00	0.868	100.00	0.704	100.00	0.698	100.00	1.035	100.00
8	0.493	100.00	0.643	100.00	0.499	100.00	0.619	100.00	0.601	100.00	0.880	100.00
9	0.371	100.00	0.618	100.00	0.674	100.00	0.482	100.00	0.758	100.00	0.774	100.00
10	0.456	100.00	0.326	100.00	0.446	100.00	0.513	100.00	0.347	100.00	0.640	100.00
11	0.501	100.00	0.483	100.00	0.343	100.00	0.488	100.00	0.433	100.00	0.482	100.00
12	0.408	100.00	0.408	100.00	0.558	100.00	0.704	100.00	0.727	100.00	0.826	100.00
13	0.613	100.00	0.685	100.00	0.892	100.00	0.566	100.00	0.613	100.00	0.970	100.00
14	0.384	100.00	0.657	100.00	0.637	100.00	0.547	100.00	0.390	100.00	0.419	100.00
15	0.537	100.00	0.597	100.00	0.802	100.00	0.751	100.00	0.801	100.00	1.186	100.00
16	0.553	100.00	0.548	100.00	0.591	100.00	0.633	100.00	0.377	100.00	0.412	100.00
17	0.740	100.00	0.741	100.00	0.813	100.00	0.641	100.00	0.650	100.00	0.905	100.00
18	0.668	100.00	0.731	100.00	0.734	100.00	0.683	100.00	0.682	100.00	0.604	100.00
19	1.968	100.00	1.418	100.00	1.390	100.00	1.519	100.00	1.449	100.00	1.159	100.00
20	0.556	100.00	0.546	100.00	0.663	100.00	0.680	100.00	0.420	100.00	0.396	100.00
21	0.849	100.00	0.675	100.00	1.095	100.00	1.013	100.00	0.771	100.00	0.614	100.00
22	0.748	100.00	0.735	100.00	1.012	100.00	1.031	100.00	0.738	100.00	0.533	100.00
23	1.110	100.00	1.244	100.00	1.468	100.00	1.461	100.00	1.187	100.00	0.840	100.00
24	1.059	100.00	1.105	100.00	1.176	100.00	1.118	100.00	1.150	100.00	1.448	100.00
25	0.697	100.00	0.629	100.00	0.800	100.00	0.740	100.00	0.714	100.00	1.127	100.00
26	0.921	100.00	0.808	100.00	0.825	100.00	0.800	100.00	0.914	100.00	1.079	100.00
27	0.753	100.00	0.817	100.00	0.914	100.00	0.775	100.00	0.874	100.00	1.144	100.00
28	0.550	100.00	0.550	100.00	0.863	100.00	0.661	100.00	0.501	100.00	0.489	100.00
29	0.897	100.00	0.925	100.00	1.138	100.00	0.852	100.00	0.962	100.00	1.321	100.00
30	0.640	100.00	0.746	100.00	0.974	100.00	0.739	100.00	0.809	100.00	1.027	100.00
31	0.657	100.00	0.604	100.00	0.874	100.00	0.599	100.00	0.649	100.00	0.780	100.00
32	0.623	100.00	0.512	100.00	0.694	100.00	0.660	100.00	0.631	100.00	0.924	100.00

Figure 6-1 95% Range Error (PRN 1 - PRN 16) - Atlanta

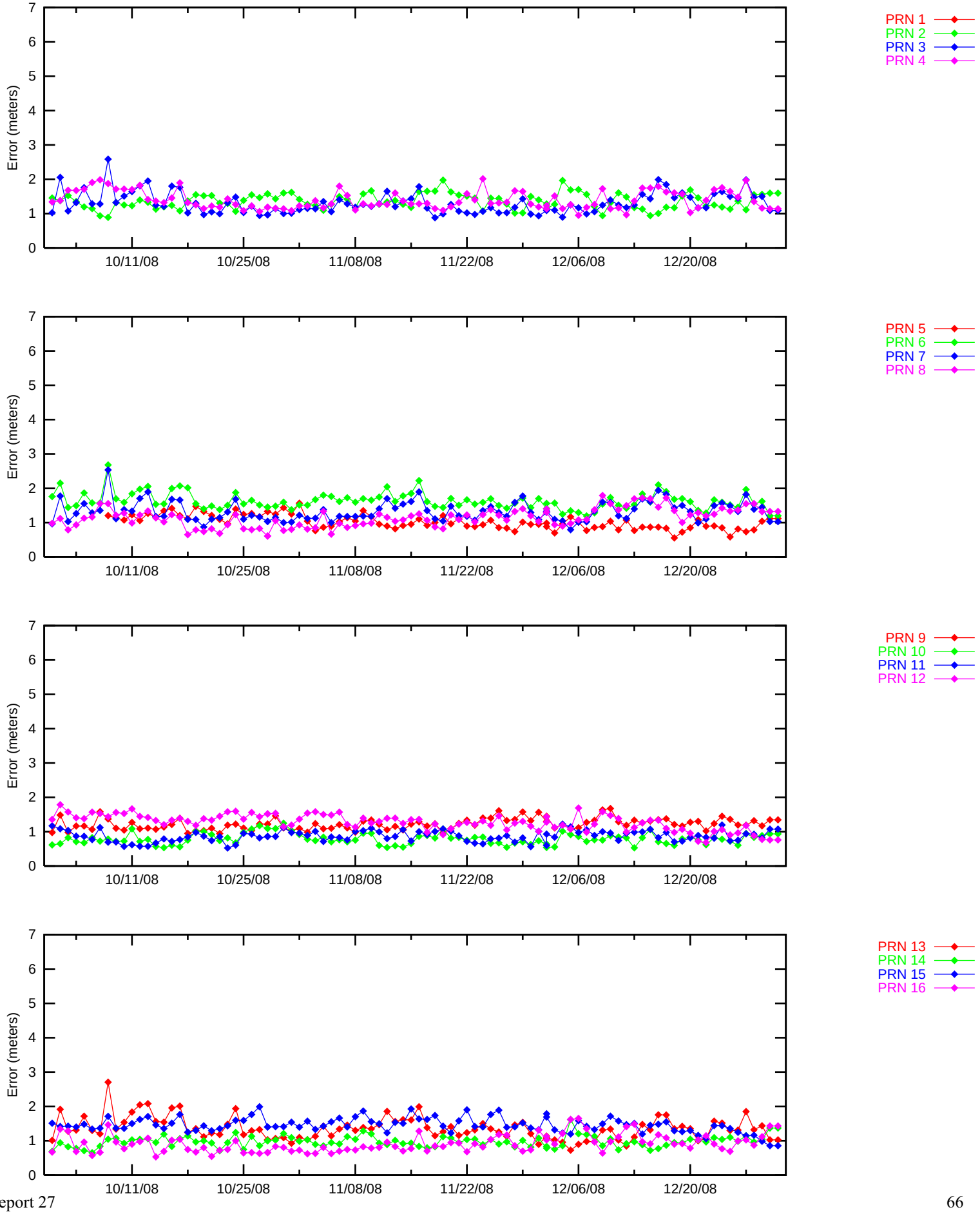


Figure 6-2 95% Range Error (PRN 17 - PRN 32) - Atlanta

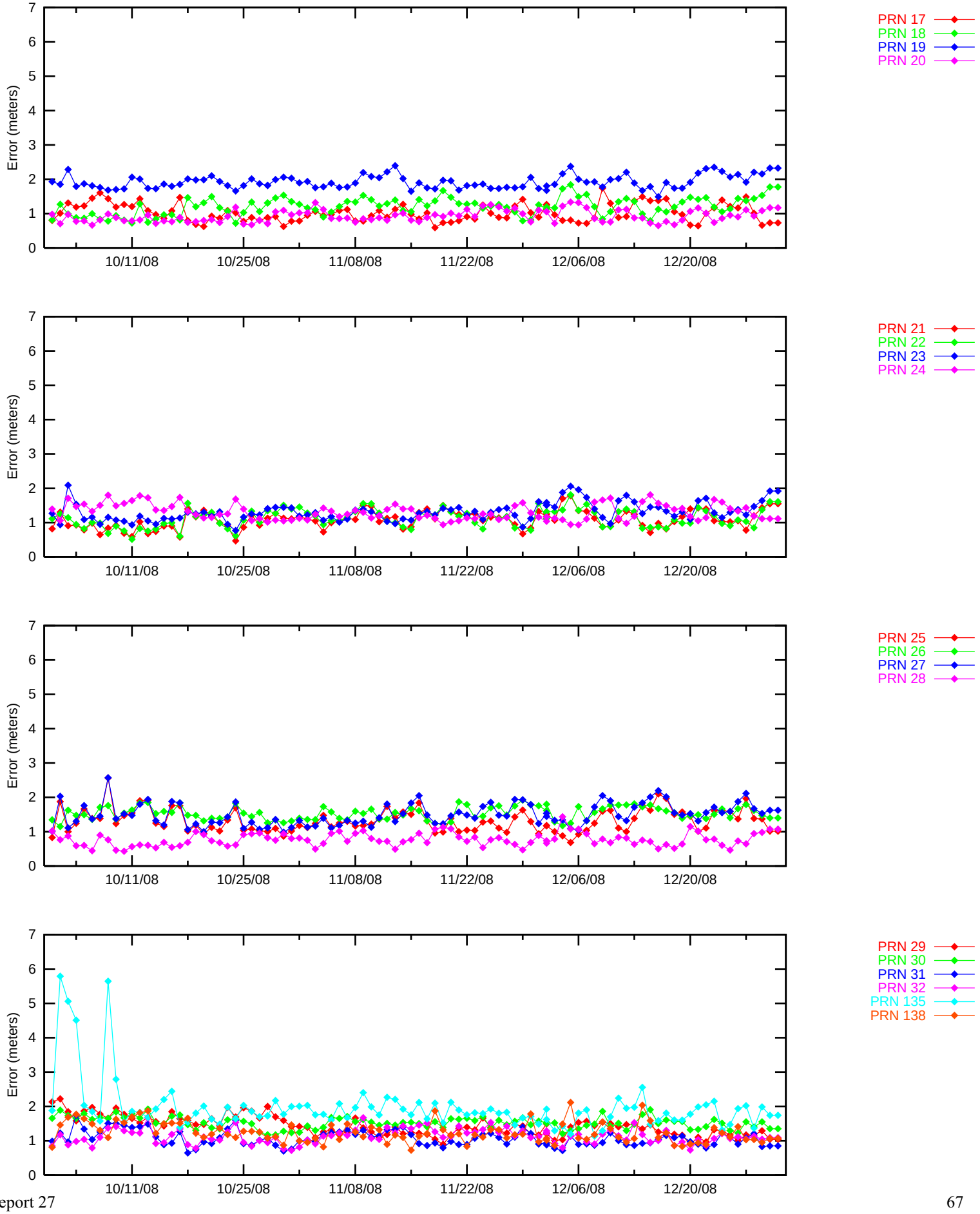


Figure 6-3 95% Ionospheric (PRN 1 - PRN 16) - Atlanta

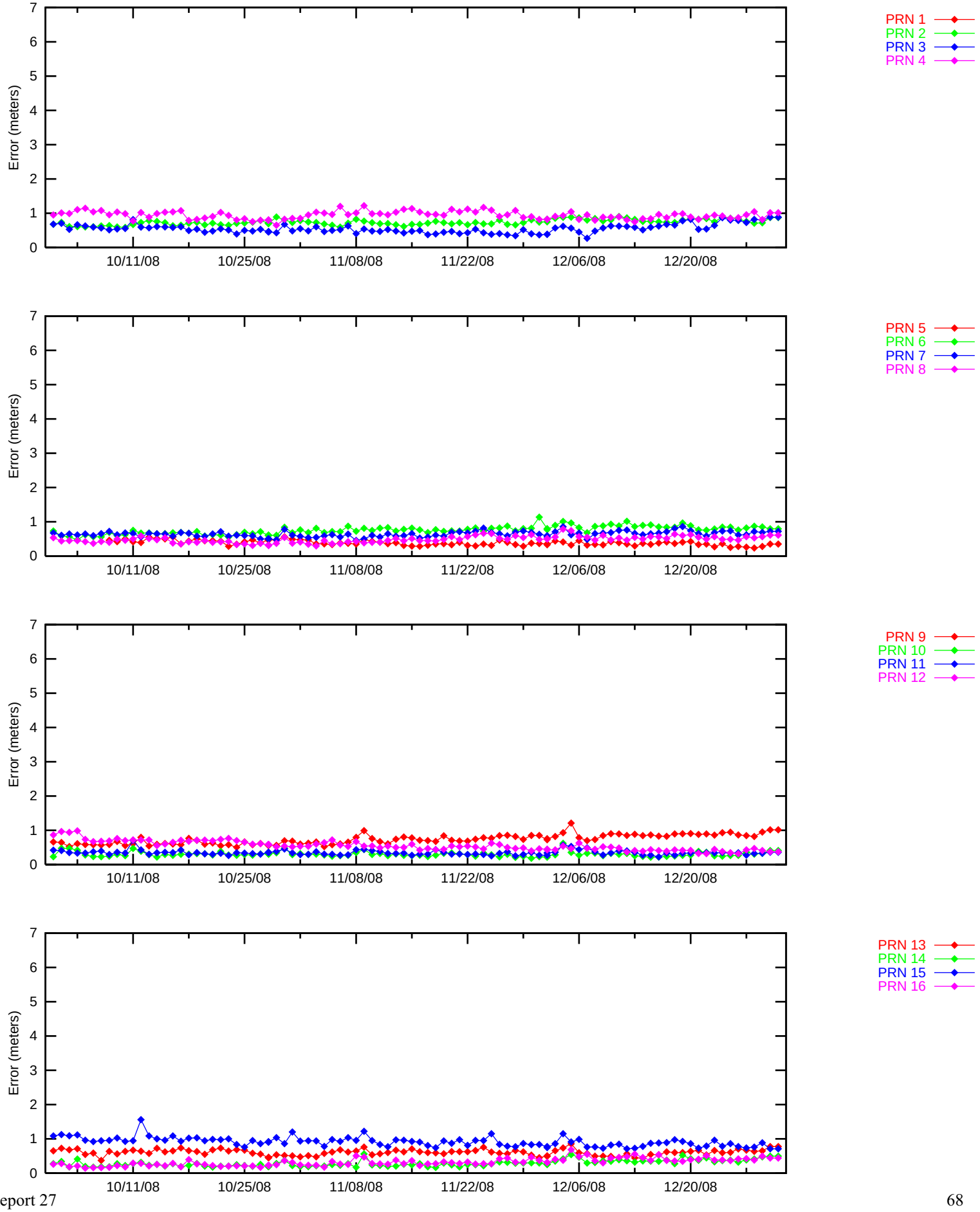
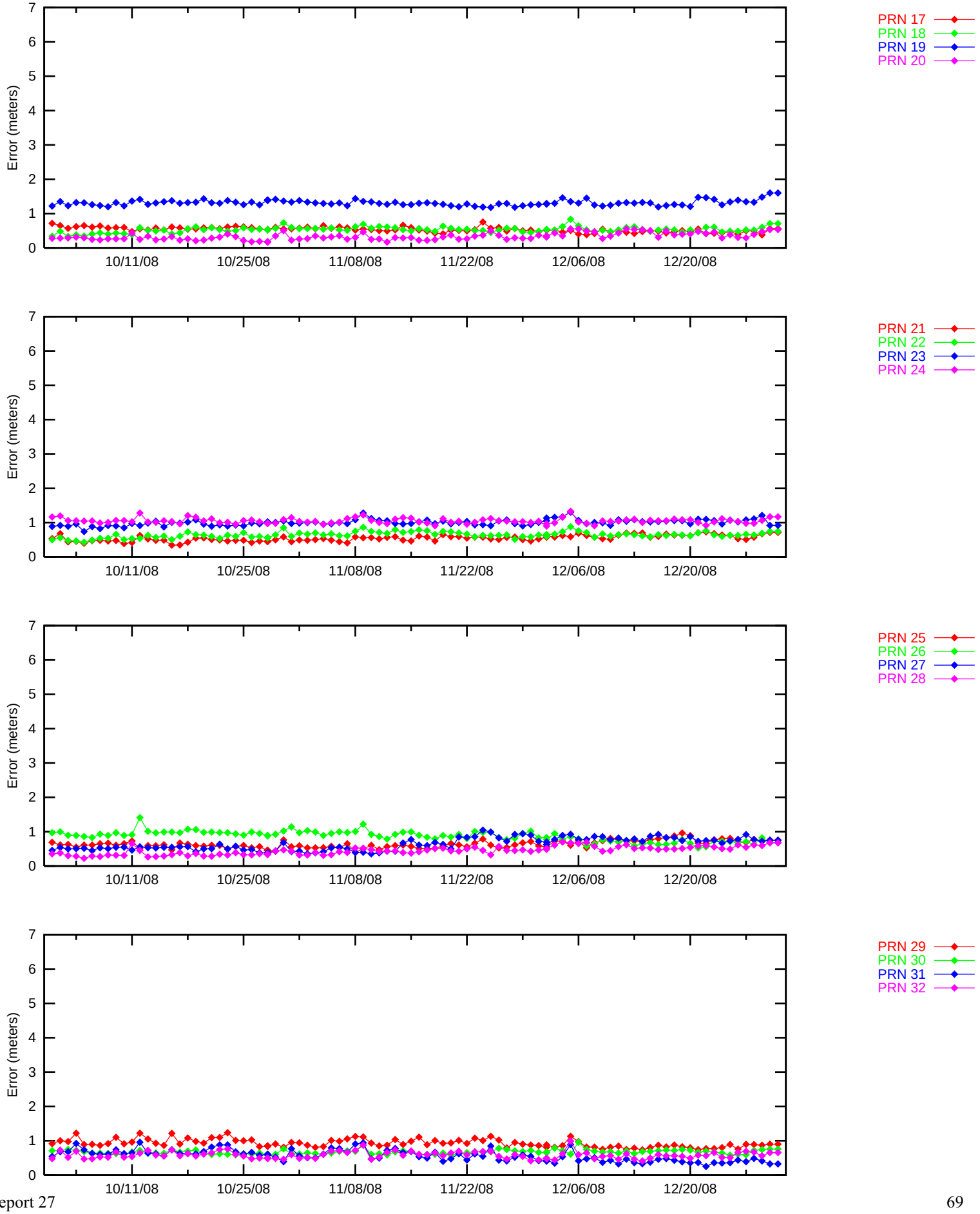


Figure 6-4 95% Ionospheric (PRN 17 - PRN 32) - Atlanta



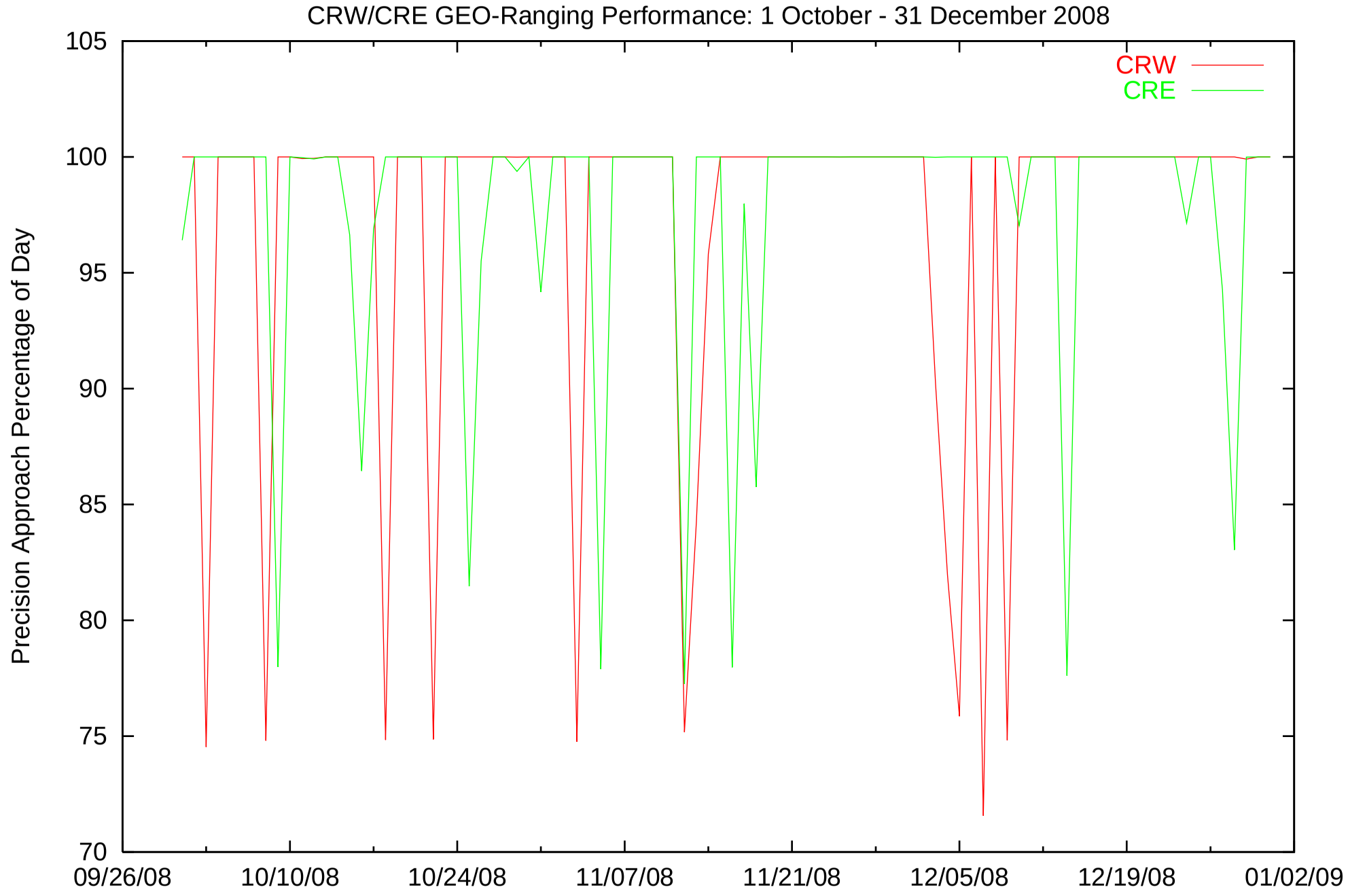
7.0 GEO RANGING PERFORMANCE

For the evaluation period, both CRW and CRE GEO satellites provide ranging capability for enroute through NPA and PA service. Table 7.1 shows the GEO-Ranging performance for CRE and CRW GEO satellites throughout the evaluation period. Figure 7.1 shows the trend of NPA Ranging Availability for the CRE and CRW GEO satellite.

Table 7-1 GEO Ranging Availability

GEO	PA (%)	NPA (%)	Not Monitored (%)	Do Not Use (%)
CRW	96.991	2.587	0.418	0
CRE	97.725	1.326	0.462	0.485

Figure 7-1 Daily PA GEO Ranging Availability Trend



8.0 WAAS PROBLEM SUMMARY

Events that adversely affected the WAAS service for this evaluation period are listed in Table 8.1. These events include any WAAS anomalies and problems that affected the WAAS performance. Detailed analyses of particular events are documented in the Discrepancy Reports (DR). The DRs are posted on the website http://www.nstb.tc.faa.gov under 'WAAS Technical Reports', and can also be accessed via hyperlink from Table 8.1 below.

Table 8-1 WAAS Problem Summary

Date	Events
10/5/08	See DR #76 – "False trip on PRN 24 with minimal effect on WAAS Coverage"
10/29/08 11/13/08 11/25/08 12/03/08 to 12/05/08 12/07/08	Changes in the downlink carrier frequency from the CRW caused reduced PA Ranging Availability. See DR #77 – "CRW Downlink Frequency Spikes".

9.0 WAAS AIRPORT AVAILABILITY

The WAAS airport availability evaluation determines the number and length LVP service outages at selected airports from the transmitted WAAS navigation message. The navigation messages transmitted from all GEO satellites are processed simultaneously, and WAAS protection levels (VPL and HPL) are computed at each airport once a second in accordance with the WAAS MOPS. Once the protection levels have been produced at each airport an LPV service evaluation is conducted to identify outages in service (i.e. when protection levels exceed alert limits). WAAS LPV service is available for a user when the vertical protection level (VPL) is less than or equal to vertical alert limit (VAL) of 50 meters and the horizontal protection level (HPL) is less than or equal to horizontal alert limit (HAL) of 40 meters. If both conditions are met at a specified airport location then WAAS LPV service is available at that airport. If either one of the conditions are not met at a specified airport location then WAAS LPV service at that airport is unavailable and an outage in LPV service is recorded with its duration. When the LPV service becomes unavailable it is not considered available again until protection levels are below or equal to alert limits for at least 15 minutes. Although this will reduce LPV service availability minimally, it substantially reduces the number of service outages and prevents excessive switching in and out of service availability. When computing LPV service availability, an extra two minutes of outage time was prefixed to each outage. The number of WAAS LPV service outages and the availability at selected airports for this evaluation period of WAAS operation is presented in Table 9.1. Figures 9.1 and 9.2 provide a graphical representation of WAAS LPV service availability and outage counts for the same period, respectively.

Table 9-1 WAAS LPV Outages and Availability

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PACD	COLD BAY	AK	52	0.997993	654	0.879924
PAGA	EDWARD G. PITKA SR	AK	0	1.00	17	0.999303
PAEM	EMMONAK	AK	0	1.00	155	0.984055
PAFA	FAIRBANKS INTL	AK	0	1.00	5	0.999729
PAGB	GALBRAITH LAKE	AK	0	1.00	92	0.994797
PAGK	GULKANA	AK	0	1.00	1	0.999895
PAHO	HOMER	AK	0	1.00	3	0.999861
PAHL	HUSLIA	AK	0	1.00	29	0.998887
PAEN	KENAI MUNICIPAL	AK	0	1.00	2	0.999880
PAKT	KETCHIKAN INTL	AK	0	1.00	1	0.999976
PAKN	KING SALMON	AK	1	0.999985	24	0.998811
PARY	RUBY	AK	0	1.00	11	0.999515
PASK	SELAWIK	AK	0	1.00	196	0.984428
PASM	ST MARY'S	AK	0	1.00	136	0.988221
PAMK	ST MICHAEL	AK	0	1.00	113	0.992508
PANC	TED STEVENS ANCHORAGE INTL	AK	0	1.00	2	0.999880
PAYA	YAKUTAT	AK	0	1.00	1	0.999895
8A0	ALBERTVILLE REGIONAL – THOMAS J BRUM	AL	0	1.00	3	0.999921
ANB	ANNISTON METROPOLITAN	AL	0	1.00	2	0.999939
AUO	AUBURN-OPELIKA ROBERT G PITTS	AL	0	1.00	3	0.999915
EKY	BESSEMER	AL	0	1.00	3	0.999902
BHM	BIRMINGHAM INTL	AL	0	1.00	2	0.999922
SEM	CRAIG FIELD	AL	0	1.00	2	0.999899
DHN	DOTHAN REGIONAL	AL	0	1.00	4	0.999818
HSV	HUNTSVILLE INTL-CARL T JONES F	AL	0	1.00	2	0.999928
JKA	JACK EDWARDS	AL	0	1.00	4	0.999769
MDQ	MADISON COUNTY EXECUTIVE/TOM S	AL	0	1.00	2	0.999933

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
BFM	MOBILE DOWNTOWN	AL	0	1.00	4	0.999774
MOB	MOBILE REGIONAL	AL	0	1.00	4	0.999793
MGM	MONTGOMERY REGIONAL (DANNELLY FIELD)	AL	0	1.00	2	0.999910
GAD	NORTHEAST ALABAMA REGIONAL	AL	0	1.00	3	0.999921
MSL	NORTHWEST ALABAMA REGIONAL	AL	0	1.00	1	0.999929
DCU	PRYOR FIELD REGIONAL	AL	0	1.00	2	0.999925
79J	SOUTH ALABAMA REGIONAL	AL	0	1.00	4	0.999812
PLR	ST CLAIR COUNTY	AL	0	1.00	2	0.999931
2R5	ST ELMO	AL	0	1.00	4	0.999774
ASN	TALLADEGA MUNICIPAL	AL	0	1.00	2	0.999935
TOI	TROY MUNICIPAL	AL	0	1.00	4	0.999876
TCL	TUSCALOOSA REGIONAL	AL	0	1.00	2	0.999904
LIT	ADAMS FIELD	AR	0	1.00	2	0.999967
M73	ALMYRA MUNICIPAL	AR	0	1.00	3	0.999900
BYH	ARKANSAS INTL	AR	0	1.00	1	0.999932
VBT	BENTONVILLE MUNICIPAL	AR	0	1.00	2	0.999967
HRO	BOONE COUNTY	AR	0	1.00	1	0.999984
FSM	FORT SMITH REGIONAL	AR	0	1.00	2	0.999967
PBF	GRIDER FIELD	AR	0	1.00	3	0.999902
JBR	JONESBORO MUNICIPAL	AR	0	1.00	2	0.999942
M19	NEWPORT MUNICIPAL	AR	0	1.00	2	0.999970
ORK	NORTH LITTLE ROCK MUNICIPAL	AR	0	1.00	2	0.999967
XNA	NORTHWEST ARKANSAS REGIONAL	AR	0	1.00	2	0.999967
BPK	OZARK REGIONAL	AR	0	1.00	1	0.999984
ROG	ROGERS MUNICIPAL-CARTER FIELD	AR	0	1.00	2	0.999969
RUE	RUSSELLVILLE REGIONAL	AR	0	1.00	2	0.999967
SUZ	SALINE COUNTY REGIONAL	AR	0	1.00	2	0.999967
SRC	SEARCY MUNICIPAL	AR	0	1.00	1	0.999984
SLG	SMITH FIELD	AR	0	1.00	2	0.999967
ELD	SOUTH ARKANSAS REGIONAL AT GOODWIN	AR	0	1.00	3	0.999912
ASG	SPRINGDALE MUNICIPAL	AR	0	1.00	2	0.999967
SGT	STUTTGART MUNICIPAL	AR	0	1.00	3	0.999906
ARG	WALNUT RIDGE REGIONAL	AR	0	1.00	1	0.999984
PRC	ERNEST A. LOVE FIELD	AZ	3	0.999910	46	0.997122
GEU	GLENDALE MUNICIPAL	AZ	9	0.999647	104	0.988381
GCN	GRAND CANYON NATIONAL PARK	AZ	0	1.00	5	0.999827
IFP	LAUGHLIN/BULLHEAD INTL	AZ	0	1.00	14	0.999386
PGA	PAGE MUNICIPAL	AZ	0	1.00	4	0.999851
DVT	PHOENIX DEER VALLEY	AZ	8	0.999736	105	0.989476
PHX	PHOENIX SKY HARBOR INTL	AZ	10	0.999653	104	0.988288
IWA	PHOENIX-MESA GATEWAY	AZ	10	0.999685	103	0.988274
SJN	ST JOHNS INDUSTRIAL AIR PARK	AZ	1	0.999955	97	0.995171
TUS	TUCSON INTL	AZ	57	0.998058	104	0.984880
APV	APPLE VALLEY	CA	0	1.00	73	0.995472
ACV	ARCATA	CA	1	0.999848	217	0.965472
DAG	BARSTOW-DAGGETT	CA	0	1.00	55	0.997259
C83	BYRON	CA	1	0.999885	330	0.962969
CMA	CAMARILLO	CA	2	0.999942	228	0.975008
CNO	CHINO	CA	1	0.999985	107	0.988281
FAT	FRESNO YOSEMITE INTL	CA	1	0.999930	216	0.979824

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
WJF	GENERAL WM J FOX AIRFIELD	CA	0	1.00	150	0.988234
HAF	HALF MOON BAY	CA	3	0.999817	446	0.942623
HWD	HAYWARD EXECUTIVE	CA	2	0.999851	343	0.955465
CVH	HOLLISTER MUNICIPAL	CA	3	0.999839	322	0.960463
SNA	JOHN WAYNE AIRPORT	CA	1	0.999985	117	0.985579
LGB	LONG BEACH /DAUGHERTY FIELD	CA	1	0.999984	148	0.984222
LAX	LOS ANGELES INTL	CA	0	1.00	172	0.982079
MAE	MADERA MUNICIPAL	CA	1	0.999916	234	0.976917
CRQ	MC CLELLAN-PALOMAR	CA	1	0.999985	120	0.984981
BFL	MEADOWS FIELD	CA	1	0.999967	212	0.981919
MCE	MERCED MUNICIPAL/MACREADY FIELD	CA	1	0.999907	256	0.973690
OAK	METROPOLITAN OAKLAND INTL	CA	2	0.999850	348	0.954203
MOD	MODESTO CITY-CO-HARRY SHAM FLD	CA	1	0.999899	294	0.970389
MRY	MONTEREY PENINSULA	CA	4	0.999808	351	0.951699
APC	NAPA COUNTY	CA	2	0.999861	358	0.956986
O02	NERVINO	CA	1	0.999958	107	0.990266
SJC	NORMAN Y. MINETA SAN JOSE INTL	CA	3	0.999837	335	0.956272
VCB	NUT TREE	CA	1	0.999889	343	0.963175
ONT	ONTARIO INTL	CA	1	0.999986	107	0.988901
OXR	OXNARD	CA	2	0.999932	251	0.973066
PMD	PALMDALE REGIONAL/USAF PLANT 42	CA	1	0.999985	137	0.989085
RBL	RED BLUFF MUNICIPAL	CA	1	0.999905	143	0.979971
RDD	REDDING MUNICIPAL	CA	1	0.999907	133	0.981720
RAL	RIVERSIDE MUNICIPAL	CA	0	1.00	107	0.988886
SMF	SACRAMENTO INTL	CA	1	0.999905	269	0.972229
MHR	SACRAMENTO MATHER	CA	1	0.999913	254	0.974603
SFO	SAN FRANCISCO INTL	CA	2	0.999844	382	0.950446
SBA	SANTA BARBARA MUNICIPAL	CA	2	0.999896	293	0.964822
TCY	TRACY MUNICIPAL	CA	1	0.999888	329	0.964248
APA	CENTENNIAL	CO	0	1.00	2	0.999945
COS	CITY OF COLORADO SPRINGS MUNICIPAL	CO	0	1.00	2	0.999956
AKO	COLORADO PLAINS REGIONAL	CO	0	1.00	1	0.999984
CEZ	CORTEZ MUNICIPAL	CO	0	1.00	12	0.999598
DEN	DENVER INTL	CO	0	1.00	2	0.999946
FTG	FRONT RANGE	CO	0	1.00	2	0.999951
RIL	GARFIELD COUNTY REGIONAL	CO	0	1.00	6	0.999761
GXY	GREELEY-WELD COUNTY	CO	0	1.00	2	0.999942
ITR	KIT CARSON COUNTY	CO	0	1.00	2	0.999959
LAA	LAMAR MUNICIPAL	CO	0	1.00	1	0.999984
PUB	PUEBLO MEMORIAL	CO	0	1.00	2	0.999967
ALS	SAN LUIS VALLEY REGIONAL	CO	0	1.00	5	0.999862
HDN	YAMPA VALLEY	CO	0	1.00	4	0.999813
BDL	BRADLEY INTL	CT	0	1.00	10	0.999777
GON	GROTON-NEW LONDON	CT	0	1.00	10	0.999755
HVN	TWEED-NEW HAVEN	CT	0	1.00	8	0.999831
OXC	WATERBURY-OXFORD	CT	0	1.00	7	0.999845
DCA	RONALD REAGAN WASHINGTON NATIONAL	DC	0	1.00	4	0.999943
EVY	SUMMIT	DE	0	1.00	5	0.999925
GED	SUSSEX COUNTY	DE	0	1.00	4	0.999937

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
AAF	APALACHICOLA MUNICIPAL	FL	0	1.00	4	0.999797
CEW	BOB SIKES	FL	0	1.00	4	0.999805
BCT	BOCA RATON	FL	0	1.00	29	0.998683
PGD	CHARLOTTE COUNTY	FL	0	1.00	9	0.999468
DAB	DAYTONA BEACH INTL	FL	0	1.00	7	0.999778
DED	DELAND MUNICIPAL – SIDNEY H TAYLOR FIELD	FL	0	1.00	7	0.999766
XFL	FLAGLER COUNTY	FL	0	1.00	7	0.999780
FXE	FORT LAUDERDALE EXECUTIVE	FL	0	1.00	30	0.998658
FLL	FORT LAUDERDALE/HOLLYWOOD INTL	FL	0	1.00	33	0.998584
GNV	GAINESVILLE REGIONAL	FL	0	1.00	6	0.999782
BKV	HERNANDO COUNTY	FL	0	1.00	6	0.999702
JAX	JACKSONVILLE INTL	FL	0	1.00	7	0.999789
TMB	KENDALL-TAMIAMI EXECUTIVE	FL	0	1.00	33	0.998628
EYW	KEY WEST INTL	FL	0	1.00	16	0.999125
ISM	KISSIMMEE GATEWAY	FL	0	1.00	8	0.999656
X14	LA BELLE MUNICIPAL	FL	0	1.00	10	0.999446
LCQ	LAKE CITY MUNICIPAL	FL	0	1.00	4	0.999825
LAL	LAKELAND LINDER REGIONAL	FL	0	1.00	7	0.999665
LEE	LEESBURG INTL	FL	0	1.00	7	0.999751
MLB	MELBOURNE INTL	FL	0	1.00	19	0.999454
COI	MERRITT ISLAND	FL	0	1.00	19	0.999489
MIA	MIAMI INTL	FL	0	1.00	33	0.998549
APF	NAPLES MUNICIPAL	FL	0	1.00	12	0.999374
EVB	NEW SMYRNA BEACH MUNICIPAL	FL	0	1.00	7	0.999780
OCF	OCALA INTL-JIM TAYLOR FIELD	FL	0	1.00	6	0.999771
MCO	ORLANDO INTL	FL	0	1.00	8	0.999666
SFB	ORLANDO SANFORD INTL	FL	0	1.00	7	0.999765
PHK	PALM BEACH CO GLADES	FL	0	1.00	24	0.999120
PBI	PALM BEACH INTL	FL	0	1.00	27	0.998749
PFN	PANAMA CITY-BAY CO INTL	FL	0	1.00	4	0.999791
PNS	PENSACOLA REGIONAL	FL	0	1.00	4	0.999777
PMP	POMPANO BEACH AIRPARK	FL	0	1.00	30	0.998629
SRQ	SARASOTA/BRADENTON INTL	FL	0	1.00	7	0.999617
RSW	SOUTHWEST FLORIDA INTL	FL	0	1.00	10	0.999448
FPR	ST LUCIE COUNTY INTL	FL	0	1.00	22	0.999104
PIE	ST PETERSBURG-CLEARWATER INTL	FL	0	1.00	6	0.999689
TLH	TALLAHASSEE REGIONAL	FL	0	1.00	4	0.999809
TPA	TAMPA INTL	FL	0	1.00	7	0.999671
MTH	THE FLORIDA KEYS MARATHON	FL	0	1.00	18	0.999058
VDF	VANDENBERG	FL	0	1.00	7	0.999670
GIF	WINTER HAVEN'S GILBERT	FL	0	1.00	8	0.999648
AGS	AUGUSTA REGIONAL AT BUSH FIELD	GA	0	1.00	4	0.999910
BQK	BRUNSWICK GOLDEN ISLES	GA	0	1.00	7	0.999809
VPC	CARTERSVILLE	GA	0	1.00	3	0.999941
47A	CHEROKEE COUNTY	GA	0	1.00	3	0.999947
RYY	COBB COUNTY-MC COLLUM FIELD	GA	0	1.00	3	0.999944
CSG	COLUMBUS METROPOLITAN	GA	0	1.00	4	0.999878
15J	COOK COUNTY	GA	0	1.00	4	0.999845
CKF	CRISP COUNTY-CORDELE	GA	0	1.00	4	0.999876
DNN	DALTON MUNICIPAL	GA	0	1.00	3	0.999945
SBO	EMANUEL COUNTY	GA	0	1.00	3	0.999916

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18A	FRANKLIN COUNTY	GA	0	1.00	0	1.00
FTY	FULTON COUNTY AIRPORT	GA	0	1.00	3	0.999945
ATL	HARTSFIELD - JACKSON ATLANTA	GA	0	1.00	3	0.999946
EZM	HEART OF GEORGIA REGIONAL	GA	0	1.00	3	0.999908
19A	JACKSON COUNTY	GA	0	1.00	0	1.00
GVL	LEE GILMER MEMORIAL	GA	0	1.00	0	1.00
MCN	MIDDLE GEORGIA REGIONAL	GA	0	1.00	4	0.999911
MGR	MOULTRIE MUNICIPAL	GA	0	1.00	4	0.999851
CCO	NEWNAN COWETA COUNTY	GA	0	1.00	3	0.999938
FFC	PEACHTREE CITY-FALCON FIELD	GA	0	1.00	3	0.999941
PXE	PERRY-HOUSTON COUNTY	GA	0	1.00	4	0.999899
JZP	PICKENS COUNTY	GA	0	1.00	3	0.999947
JYL	PLANTATION ARPK	GA	0	1.00	5	0.999883
SAV	SAVANNAH/HILTON HEAD INTL	GA	0	1.00	6	0.999849
ACJ	SOUTHER FIELD	GA	0	1.00	4	0.999874
ABY	SOUTHWEST GEORGIA REGIONAL	GA	0	1.00	4	0.999853
TBR	STATESBORO-BULLOCH COUNTY	GA	0	1.00	5	0.999882
MQW	TELFAIR-WHEELER	GA	0	1.00	3	0.999907
TVI	THOMASVILLE REGIONAL	GA	0	1.00	4	0.999827
TOC	TOCCOA RG LETOURNEAU FIELD	GA	0	1.00	0	1.00
VLD	VALDOSTA REGIONAL	GA	0	1.00	3	0.999857
VDI	VIDALIA REGIONAL	GA	0	1.00	3	0.999913
IIY	WASHINGTON-WILKES COUNTY	GA	0	1.00	2	0.999961
AYS	WAYCROSS-WARE COUNTY	GA	0	1.00	6	0.999828
CTJ	WEST GEORGIA REGIONAL	GA	0	1.00	2	0.999947
WDR	WINDER-BARROW	GA	0	1.00	1	0.999986
IKV	ANKENY REGIONAL	IA	0	1.00	1	0.999984
CBF	COUNCIL BLUFFS MUNICIPAL	IA	0	1.00	1	0.999984
DVN	DAVENPORT MUNICIPAL	IA	0	1.00	0	1.00
DNS	DENISON MUNICIPAL	IA	0	1.00	1	0.999984
DSM	DES MOINES INTL	IA	0	1.00	1	0.999984
DBQ	DUBUQUE REGIONAL	IA	0	1.00	0	1.00
EST	ESTHERVILLE MUNICIPAL	IA	0	1.00	1	0.999984
FFL	FAIRFIELD MUNICIPAL	IA	0	1.00	1	0.999984
GGI	GRINNELL REGIONAL	IA	0	1.00	1	0.999985
EOK	KEOKUK MUNICIPAL	IA	0	1.00	1	0.999984
MCW	MASON CITY MUNICIPAL	IA	0	1.00	1	0.999984
MXO	MONTICELLO REGIONAL	IA	0	1.00	1	0.999984
MUT	MUSCATINE MUNICIPAL	IA	0	1.00	1	0.999984
TNU	NEWTON MUNICIPAL	IA	0	1.00	1	0.999984
OTM	OTTUMWA INDUSTRIAL	IA	0	1.00	1	0.999984
PRO	PERRY MUNICIPAL	IA	0	1.00	1	0.999985
SDA	SHENANDOAH MUNICIPAL	IA	0	1.00	1	0.999984
SLB	STORM LAKE MUNICIPAL	IA	0	1.00	1	0.999984
CID	THE EASTERN IOWA	IA	0	1.00	1	0.999984
ALO	WATERLOO REGIONAL	IA	0	1.00	1	0.999984
BOI	BOISE AIR TERMINAL/GOWEN FLD	ID	0	1.00	0	1.00
EUL	CALDWELL INDUSTRIAL	ID	0	1.00	7	0.999863
GNG	GOODING MUNICIPAL	ID	0	1.00	0	1.00
IDA	IDAHO FALLS REGIONAL	ID	0	1.00	2	0.999941
LWS	LEWISTON-NEZ PERCE COUNTY	ID	0	1.00	0	1.00
S67	NAMPA MUNICIPAL	ID	0	1.00	5	0.999919

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PIH	POCATELLO REGIONAL	ID	0	1.00	2	0.999963
SPI	ABRAHAM LINCOLN CAPITAL	IL	0	1.00	0	1.00
FEP	ALBERTUS	IL	0	1.00	1	0.999972
ARR	AURORA MUNICIPAL	IL	0	1.00	1	0.999957
BMI	CENTRAL IL REGIONAL ARPT	IL	0	1.00	1	0.999973
ENL	CENTRALIA MUNICIPAL	IL	0	1.00	0	1.00
MDW	CHICAGO MIDWAY INTL	IL	0	1.00	1	0.999958
ORD	CHICAGO O'HARE INTL	IL	0	1.00	1	0.999963
RFD	CHICAGO/ROCKFORD INTL	IL	0	1.00	1	0.999956
DKB	DE KALB TAYLOR MUNICIPAL	IL	0	1.00	1	0.999953
DEC	DECATUR	IL	0	1.00	1	0.999973
FOA	FLORA MUNICIPAL	IL	0	1.00	1	0.999957
IKK	GREATER KANKAKEE	IL	0	1.00	1	0.999965
PIA	GREATER PEORIA REGIONAL	IL	0	1.00	0	1.00
IGQ	LANSING MUNICIPAL	IL	0	1.00	1	0.999961
LOT	LEWIS UNIVERSITY	IL	0	1.00	1	0.999961
3LF	LITCHFIELD MUNICIPAL	IL	0	1.00	0	1.00
C15	PEKIN MUNICIPAL	IL	0	1.00	0	1.00
PPQ	PITTSFIELD PENSTONE MUNICIPAL	IL	0	1.00	0	1.00
PNT	PONTIAC MUNICIPAL	IL	0	1.00	1	0.999956
MLI	QUAD CITY INTL	IL	0	1.00	0	1.00
UIN	QUINCY REGIONAL-BALDWIN FIELD	IL	0	1.00	1	0.999984
TIP	RANTOUL NATL AVN CNTR	IL	0	1.00	1	0.999961
RSV	ROBINSON MUNICIPAL	IL	0	1.00	1	0.999960
SLO	SALEM-LECKRONE	IL	0	1.00	1	0.999986
ALN	ST LOUIS REGIONAL	IL	0	1.00	0	1.00
DNV	VERMILION COUNTY	IL	0	1.00	1	0.999961
UGN	WAUKEGAN REGIONAL	IL	0	1.00	1	0.999963
MWA	WILLIAMSON COUNTY REGIONAL	IL	0	1.00	1	0.999947
BAK	COLUMBUS MUNICIPAL	IN	0	1.00	1	0.999978
GWB	DE KALB COUNTY	IN	0	1.00	0	1.00
MIE	DELAWARE COUNTY - JOHNSON FIELD	IN	0	1.00	1	0.999986
EYE	EAGLE CREEK AIRPARK	IN	0	1.00	1	0.999973
EKM	ELKHART MUNICIPAL	IN	0	1.00	1	0.999975
FWA	FORT WAYNE INTL	IN	0	1.00	0	1.00
SER	FREEMAN MUNICIPAL	IN	0	1.00	1	0.999978
RCR	FULTON COUNTY	IN	0	1.00	1	0.999973
GSH	GOSHEN MUNICIPAL	IN	0	1.00	1	0.999979
HFY	GREENWOOD MUNICIPAL	IN	0	1.00	1	0.999975
TYQ	INDIANAPOLIS EXECUTIVE	IN	0	1.00	1	0.999973
IND	INDIANAPOLIS INTL	IN	0	1.00	1	0.999972
GGP	LOGANSPORT/CASS COUNTY	IN	0	1.00	1	0.999971
IMS	MADISON MUNICIPAL	IN	0	1.00	1	0.999979
MZZ	MARION MUNICIPAL	IN	0	1.00	1	0.999980
CEV	METTEL FIELD	IN	0	1.00	1	0.999984
BMG	MONROE COUNTY	IN	0	1.00	1	0.999968
VPZ	PORTER COUNTY MUNICIPAL	IN	0	1.00	1	0.999968
LAF	PURDUE UNIVERSITY	IN	0	1.00	1	0.999969
4I7	PUTNAM COUNTY	IN	0	1.00	1	0.999965
GEZ	SHELBYVILLE MUNICIPAL	IN	0	1.00	1	0.999980
SBN	SOUTH BEND REGIONAL	IN	0	1.00	1	0.999971
OXI	STARKE COUNTY	IN	0	1.00	1	0.999972

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ANQ	TRI-STATE STEUBEN COUNTY	IN	0	1.00	0	1.00
PTS	ATKINSON MUNICIPAL	KS	0	1.00	1	0.999984
AAO	COLONEL JAMES JABARA	KS	0	1.00	2	0.999967
DDC	DODGE CITY REGIONAL	KS	0	1.00	3	0.999937
EMP	EMPORIA MUNICIPAL	KS	0	1.00	1	0.999984
FOE	FORBES FIELD	KS	0	1.00	1	0.999984
FSK	FORT SCOTT MUNICIPAL	KS	0	1.00	1	0.999984
GCK	GARDEN CITY REGIONAL	KS	0	1.00	4	0.999912
HYS	HAYS REGIONAL	KS	0	1.00	4	0.999925
HQG	HUGOTON MUNICIPAL	KS	0	1.00	3	0.999936
OJC	JOHNSON COUNTY EXECUTIVE	KS	0	1.00	1	0.999984
LWC	LAWRENCE MUNICIPAL	KS	0	1.00	1	0.999984
LBL	LIBERAL MID-AMERICA REGIONAL	KS	0	1.00	3	0.999942
MHK	MANHATTAN REGIONAL	KS	0	1.00	1	0.999984
MPR	MC PHERSON	KS	0	1.00	2	0.999968
IXD	NEW CENTURY AIRCENTER	KS	0	1.00	1	0.999984
EWK	NEWTON-CITY-COUNTY	KS	0	1.00	2	0.999967
OEL	OAKLEY MUNICIPAL	KS	0	1.00	4	0.999900
TOP	PHILIP BILLARD MUNICIPAL	KS	0	1.00	1	0.999984
PTT	PRATT INDUSTRIAL	KS	0	1.00	2	0.999967
GLD	RENNER FLD /GOODLAND MUNICIPAL	KS	0	1.00	3	0.999932
RSL	RUSSELL MUNICIPAL	KS	0	1.00	4	0.999937
SLN	SALINA MUNICIPAL	KS	0	1.00	1	0.999984
TQK	SCOTT CITY MUNICIPAL	KS	0	1.00	4	0.999904
CBK	SHALZ FIELD	KS	0	1.00	3	0.999920
WLD	STROTHER FIELD	KS	0	1.00	2	0.999967
PPF	TRI-CITY	KS	0	1.00	1	0.999984
ULS	ULYSSES	KS	0	1.00	4	0.999917
EGT	WELLINGTON MUNICIPAL	KS	0	1.00	2	0.999967
ICT	WICHITA MID-CONTINENT	KS	0	1.00	2	0.999967
EKX	ADDINGTON FIELD	KY	0	1.00	1	0.999971
PAH	BARKLEY REGIONAL	KY	0	1.00	0	1.00
K22	BIG SANDY REGIONAL	KY	0	1.00	0	1.00
LEX	BLUE GRASS	KY	0	1.00	1	0.999985
LOU	BOWMAN FIELD	KY	0	1.00	1	0.999975
CVG	CINCINNATI/NORTHERN KENTUCKY	KY	0	1.00	0	1.00
27K	GEORGETOWN SCOTT COUNTY	KY	0	1.00	0	1.00
GLW	GLASGOW MUNICIPAL	KY	0	1.00	1	0.999966
EHR	HENDERSON CITY-COUNTY	KY	0	1.00	1	0.999951
SME	LAKE CUMBERLAND REGIONAL	KY	0	1.00	1	0.999984
LOZ	LONDON-CORBIN ARPT-MAGEE FLD	KY	0	1.00	0	1.00
SDF	LOUISVILLE INTL-STANDIFORD FIE	KY	0	1.00	1	0.999974
OWB	OWENSBORO-DAVIESS COUNTY	KY	0	1.00	1	0.999957
DVK	STUART POWELL FIELD	KY	0	1.00	1	0.999982
W38	WILLIAMSBURG-WHITLEY COUNTY	KY	0	1.00	0	1.00
ARA	ACADIANA REGIONAL	LA	0	1.00	3	0.999847
AEX	ALEXANDRIA INTL	LA	0	1.00	3	0.999854
BTR	BATON ROUGE METROPOLITAN	LA	0	1.00	3	0.999817
DRI	BEAUREGARD REGIONAL	LA	0	1.00	3	0.999872
CWF	CHENNAULT INTL	LA	0	1.00	3	0.999872
ESF	ESLER REGIONAL	LA	0	1.00	3	0.999850
HZR	FALSE RIVER REGIONAL	LA	0	1.00	3	0.999835

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PTN	HARRY P WILLIAMS MEMORIAL	LA	0	1.00	3	0.999793
LFT	LAFAYETTE REGIONAL	LA	0	1.00	3	0.999848
LCH	LAKE CHARLES REGIONAL	LA	0	1.00	3	0.999875
NEW	LAKEFRONT	LA	0	1.00	4	0.999755
MSY	LOUIS ARMSTRONG NEW ORLEANS	LA	0	1.00	4	0.999755
BQP	MOREHOUSE MEMORIAL	LA	0	1.00	3	0.999888
DTN	SHREVEPORT DOWNTOWN	LA	0	1.00	3	0.999933
SHV	SHREVEPORT REGIONAL	LA	0	1.00	3	0.999935
GAO	SOUTH LAFOURCHE LEONARD MILLER	LA	0	1.00	4	0.999745
TVR	VICKSBURG TALLULAH REGIONAL	LA	0	1.00	3	0.999869
BAF	BARNES MUNICIPAL	MA	0	1.00	10	0.999796
HYA	BARNSTABLE MUNICIPAL-BOARDMAN/POLAN	MA	0	1.00	19	0.999455
BOS	GENERAL EDWARD LAWRENCE LOGAN	MA	0	1.00	17	0.999527
BED	LAURENCE G HANSCOM FIELD	MA	0	1.00	18	0.999570
MVY	MARTHAS VINEYARD	MA	0	1.00	19	0.999437
OWD	NORWOOD MEMORIAL	MA	0	1.00	20	0.999483
PVC	PROVINCETOWN MUNICIPAL	MA	0	1.00	20	0.999471
ORH	WORCESTER REGIONAL	MA	0	1.00	13	0.999729
BWI	BALTIMORE/WASHINGTON INTL	MD	0	1.00	4	0.999943
DMW	CARROLL COUNTY REGIONAL JACK B POA	MD	0	1.00	4	0.999943
ESN	EASTON/NEWNAM FIELD	MD	0	1.00	5	0.999923
FDK	FREDERICK MUNICIPAL	MD	0	1.00	4	0.999943
GAI	MONTGOMERY COUNTY AIRPARK	MD	0	1.00	4	0.999943
2W6	ST. MARY'S COUNTY REGIONAL	MD	0	1.00	5	0.999927
LEW	AUBURN/LEWISTON MUNICIPAL	ME	0	1.00	11	0.999695
AUG	AUGUSTA STATE	ME	0	1.00	13	0.999592
BGR	BANGOR INTL	ME	0	1.00	19	0.999111
BHB	HANCOCK COUNTY-BAR HARBOR	ME	0	1.00	19	0.998905
PQI	NORTHERN MAINE REGIONAL ARPT	ME	0	1.00	17	0.999369
PWM	PORTLAND INTL JETPORT	ME	0	1.00	12	0.999659
WVL	WATERVILLE ROBERT LAFLEUR	ME	0	1.00	14	0.999555
ARB	ANN ARBOR MUNICIPAL	MI	0	1.00	2	0.999951
ACB	ANTRIM COUNTY	MI	0	1.00	3	0.999913
FNT	BISHOP INTL	MI	0	1.00	2	0.999961
OEB	BRANCH COUNTY MEMORIAL	MI	0	1.00	0	1.00
CVX	CHARLEVOIX MUNICIPAL	MI	0	1.00	3	0.999888
CIU	CHIPPEWA COUNTY INTL	MI	0	1.00	2	0.999843
TTF	CUSTER	MI	0	1.00	2	0.999959
DTW	DETROIT METROPOLITAN	MI	0	1.00	2	0.999953
FFX	FREMONT MUNICIPAL	MI	0	1.00	2	0.999944
GRR	GERALD R. FORD INTL	MI	0	1.00	2	0.999942
CMX	HOUGHTON COUNTY MEMORIAL	MI	0	1.00	2	0.999849
BAX	HURON COUNTY MEMORIAL	MI	0	1.00	2	0.999940
AZO	KALAMAZOO/BATTLE CREEK INTL	MI	0	1.00	1	0.999980
ADG	LENAWEE COUNTY	MI	0	1.00	2	0.999958
OZW	LIVINGSTON COUNTY	MI	0	1.00	2	0.999953
LDM	MASON COUNTY	MI	0	1.00	2	0.999940
MBS	MBS INTL	MI	0	1.00	3	0.999946
MKG	MUSKEGON COUNTY	MI	0	1.00	2	0.999934
RNP	OWOSSO COMMUNICIPALTY	MI	0	1.00	2	0.999959

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
HYX	SAGINAW COUNTY H.W. BROWNE	MI	0	1.00	3	0.999949
BIV	TULIP CITY	MI	0	1.00	2	0.999933
YIP	WILLOW RUN	MI	0	1.00	2	0.999952
AEL	ALBERT LEA MUNICIPAL	MN	0	1.00	1	0.999984
ANE	ANOKA COUNTY-BLAINE ARPT	MN	0	1.00	1	0.999984
AUM	AUSTIN MUNICIPAL	MN	0	1.00	1	0.999984
BDE	BAUDETTE INTL	MN	0	1.00	2	0.999785
BRD	BRAINERD LAKES REGIONAL	MN	0	1.00	3	0.999931
AXN	CHANDLER FIELD	MN	0	1.00	2	0.999960
HIB	CHISHOLM-HIBBING	MN	0	1.00	3	0.999863
CKN	CROOKSTON MUNICIPAL KIRKWOOD FIELD	MN	0	1.00	2	0.999834
DTL	DETROIT LAKES-WETHING FIELD	MN	0	1.00	3	0.999920
DLH	DULUTH INTL	MN	0	1.00	4	0.999844
INL	FALLS INTL	MN	0	1.00	2	0.999788
MSP	MINNEAPOLIS-ST PAUL INTL	MN	0	1.00	1	0.999984
RGK	RED WING REGIONAL	MN	0	1.00	1	0.999984
RST	ROCHESTER INTL	MN	0	1.00	1	0.999984
ROX	ROSEAU MUNICIPAL RUDY BILLBERG FIELD	MN	0	1.00	1	0.999820
MML	SOUTHWEST MINNESOTA REGIONAL	MN	0	1.00	1	0.999985
STC	ST CLOUD REGIONAL	MN	0	1.00	1	0.999984
JYG	ST JAMES MUNICIPAL	MN	0	1.00	1	0.999984
STP	ST PAUL DOWNTOWN HOLMAN FLD	MN	0	1.00	1	0.999984
RRT	WARROAD INTL MEMORIAL	MN	0	1.00	2	0.999797
BDH	WILLMAR MUNICIPAL JOHN L RICE FIELD	MN	0	1.00	1	0.999984
M17	BOLIVAR MUNICIPAL	MO	0	1.00	1	0.999984
CGI	CAPE GIRARDEAU REGIONAL	MO	0	1.00	1	0.999958
M05	CARUTHERSVILLE MEMORIAL	MO	0	1.00	1	0.999928
MKC	CHARLES B. WHEELER DOWNTOWN	MO	0	1.00	1	0.999984
COU	COLUMBIA REGIONAL	MO	0	1.00	1	0.999984
1H0	CREVE COEUR	MO	0	1.00	0	1.00
DXE	DEXTER MUNICIPAL	MO	0	1.00	1	0.999962
LBO	FLOYD W. JONES LEBANON	MO	0	1.00	1	0.999984
K57	GOULD PETERSON MUNICIPAL	MO	0	1.00	1	0.999984
HIG	HIGGINSVILLE INDUSTRIAL MUNICIPAL	MO	0	1.00	1	0.999984
JEF	JEFFERSON CITY MEMORIAL	MO	0	1.00	1	0.999984
VER	JESSE VIERTEL MEMORIAL	MO	0	1.00	1	0.999984
JLN	JOPLIN REGIONAL	MO	0	1.00	1	0.999984
MCI	KANSAS CITY INTL	MO	0	1.00	1	0.999984
TKX	KENNETT MEMORIAL	MO	0	1.00	1	0.999945
IRK	KIRKSVILLE REGIONAL	MO	0	1.00	1	0.999984
STL	LAMBERT-ST LOUIS INTL	MO	0	1.00	0	1.00
LRY	LAWRENCE SMITH MEMORIAL	MO	0	1.00	1	0.999984
AIZ	LEE C FINE MEMORIAL	MO	0	1.00	1	0.999984
LXT	LEE'S SUMMIT MUNICIPAL	MO	0	1.00	1	0.999984
6M6	LEWIS COUNTY REGIONAL	MO	0	1.00	1	0.999984
MHL	MARSHALL MEMORIAL MUNICIPAL	MO	0	1.00	1	0.999984
MYJ	MEXICO MEMORIAL	MO	0	1.00	1	0.999984
GPH	MIDWEST NATIONAL AIR CENTER	MO	0	1.00	1	0.999984

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
M58	MONETT MUNICIPAL	MO	0	1.00	1	0.999984
EOS	NEOSHO HUGH ROBINSON	MO	0	1.00	1	0.999984
POF	POPLAR BLUFF MUNICIPAL	MO	0	1.00	0	1.00
STJ	ROSECRANS MEMORIAL	MO	0	1.00	1	0.999984
DMO	SEDALIA MEMORIAL	MO	0	1.00	1	0.999984
SIK	SIKESTON MEMORIAL MUNICIPAL	MO	0	1.00	1	0.999946
RCM	SKYHAVEN	MO	0	1.00	1	0.999984
SGF	SPRINGFIELD-BRANSON NATIONAL	MO	0	1.00	1	0.999984
TBN	WAYNESVILLE REGIONAL ARPT AT FORNE	MO	0	1.00	1	0.999984
UNO	WEST PLAINS MUNICIPAL	MO	0	1.00	1	0.999984
STF	GEORGE M BRYAN	MS	0	1.00	2	0.999883
GTR	GOLDEN TRIANGLE REGIONAL	MS	0	1.00	2	0.999887
GWO	GREENWOOD-LEFLORE	MS	0	1.00	2	0.999863
GNF	GRENADA MUNICIPAL	MS	0	1.00	2	0.999874
GPT	GULFPORT-BILOXI INTL	MS	0	1.00	3	0.999782
HEZ	HARDY-ANDERS FIELD NATCHEZ-ADA	MS	0	1.00	3	0.999878
HBG	HATTIESBURG MUNICIPAL	MS	0	1.00	3	0.999861
PIB	HATTIESBURG-LAUREL REGIONAL	MS	0	1.00	3	0.999861
LUL	HESLER-NOBLE FIELD	MS	0	1.00	3	0.999862
JAN	JACKSON-EVERS INTL	MS	0	1.00	2	0.999872
M16	JOHN BELL WILLIAMS	MS	0	1.00	3	0.999853
MEI	KEY FIELD	MS	0	1.00	3	0.999861
MCB	MC COMB/PIKE COUNTY	MS	0	1.00	3	0.999863
M40	MONROE COUNTY	MS	0	1.00	1	0.999907
OLV	OLIVE BRANCH	MS	0	1.00	1	0.999904
MJD	PICAYUNE MUNICIPAL	MS	0	1.00	3	0.999775
M43	PRENTISS JEFFERSON DAVIS COUNTY	MS	0	1.00	3	0.999865
CRX	ROSCOE TURNER	MS	0	1.00	1	0.999917
HSA	STENNIS INTL	MS	0	1.00	3	0.999778
PQL	TRENT LOTT INTL	MS	0	1.00	3	0.999788
UTA	TUNICA MUNICIPAL	MS	0	1.00	1	0.999908
UOX	UNIVERSITY-OXFORD	MS	0	1.00	1	0.999897
BTM	BERT MOONEY	MT	0	1.00	2	0.999904
BIL	BILLINGS LOGAN INTL	MT	0	1.00	2	0.999802
MLS	FRANK WILEY FIELD	MT	0	1.00	3	0.999821
GPI	GLACIER PARK INTL	MT	0	1.00	1	0.999940
GTF	GREAT FALLS INTL	MT	0	1.00	2	0.999863
HLN	HELENA REGIONAL	MT	0	1.00	2	0.999887
LWT	LEWISTOWN MUNICIPAL	MT	0	1.00	2	0.999790
OAJ	ALBERT J ELLIS	NC	0	1.00	7	0.999833
AFP	ANSON COUNTY	NC	0	1.00	5	0.999912
HBI	ASHEBORO REGIONAL	NC	0	1.00	4	0.999937
AVL	ASHEVILLE REGIONAL	NC	0	1.00	0	1.00
CLT	CHARLOTTE/DOUGLAS INTL	NC	0	1.00	3	0.999955
JQF	CONCORD REGIONAL	NC	0	1.00	4	0.999942
EWN	CRAVEN COUNTY REGIONAL	NC	0	1.00	8	0.999809
ECG	ELIZABETH CITY CG AIR STATION/	NC	0	1.00	3	0.999902
FAY	FAYETTEVILLE REGIONAL	NC	0	1.00	6	0.999864
LHZ	FRANKLIN COUNTY	NC	0	1.00	6	0.999877
AKH	GASTONIA MUNICIPAL	NC	0	1.00	2	0.999971

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GWW	GOLDSBORO-WAYNE MUNICIPAL	NC	0	1.00	6	0.999856
HRJ	HARNETT REGIONAL JETPORT	NC	0	1.00	6	0.999870
HNZ	HENDERSON-OXFORD	NC	0	1.00	5	0.999908
ISO	KINSTON REGIONAL JETPORT	NC	0	1.00	7	0.999834
EQY	MONROE REGIONAL	NC	0	1.00	4	0.999934
EDE	NORTHEASTERN REGIONAL	NC	0	1.00	3	0.999881
GSO	PIEDMONT TRIAD INTL	NC	0	1.00	3	0.999956
PGV	PITT-GREENVILLE	NC	0	1.00	7	0.999834
RDU	RALEIGH-DURHAM INTL	NC	0	1.00	6	0.999885
RWI	ROCKY MOUNT-WILSON REGIONAL	NC	0	1.00	6	0.999864
RUQ	ROWAN COUNTY	NC	0	1.00	3	0.999957
TTA	SANFORD-LEE COUNTY REGIONAL	NC	0	1.00	6	0.999883
SVH	STATESVILLE REGIONAL	NC	0	1.00	2	0.999971
ILM	WILMINGTON INTL	NC	0	1.00	7	0.999827
BIS	BISMARCK MUNICIPAL	ND	0	1.00	2	0.999838
5N8	CASSELTON ROBERT MILLER REGIONAL	ND	0	1.00	2	0.999929
DVL	DEVILS LAKE REGIONAL	ND	0	1.00	2	0.999801
DIK	DICKINSON - THEODORE ROOSEVELT	ND	0	1.00	2	0.999894
GFK	GRAND FORKS INTL	ND	0	1.00	2	0.999823
FAR	HECTOR INTL	ND	0	1.00	2	0.999926
JMS	JAMESTOWN REGIONAL	ND	0	1.00	2	0.999917
MOT	MINOT INTL	ND	0	1.00	2	0.999788
ANW	AINSWORTH MUNICIPAL	NE	0	1.00	1	0.999984
BVN	ALBION MUNICIPAL	NE	0	1.00	1	0.999984
AIA	ALLIANCE MUNICIPAL	NE	0	1.00	2	0.999954
AUH	AURORA MUNICIPAL AL POTTER FIELD	NE	0	1.00	1	0.999984
BIE	BEATRICE MUNICIPAL	NE	0	1.00	1	0.999984
FNB	BRENNER FIELD	NE	0	1.00	1	0.999984
HDE	BREWSTER FIELD	NE	0	1.00	3	0.999943
BBW	BROKEN BOW MUNICIPAL	NE	0	1.00	2	0.999969
GRI	CENTRAL NEBRASKA REGIONAL	NE	0	1.00	1	0.999984
CDR	CHADRON MUNICIPAL	NE	0	1.00	3	0.999933
OLU	COLUMBUS MUNICIPAL	NE	0	1.00	1	0.999984
CZD	COZAD MUNICIPAL	NE	0	1.00	3	0.999934
CEK	CRETE MUNICIPAL	NE	0	1.00	1	0.999984
OMA	EPPLEY AIRFIELD	NE	0	1.00	1	0.999984
FBY	FAIRBURY MUNICIPAL	NE	0	1.00	1	0.999984
FET	FREMONT MUNICIPAL	NE	0	1.00	1	0.999984
OKS	GARDEN COUNTY	NE	0	1.00	3	0.999934
GRN	GORDON MUNICIPAL	NE	0	1.00	1	0.999984
GGF	GRANT MUNICIPAL	NE	0	1.00	3	0.999925
HSI	HASTINGS MUNICIPAL	NE	0	1.00	2	0.999970
IML	IMPERIAL MUNICIPAL	NE	0	1.00	3	0.999925
LXN	JIM KELLY FIELD	NE	0	1.00	3	0.999935
OFK	KARL STEFAN MEMORIAL	NE	0	1.00	1	0.999984
EAR	KEARNEY REGIONAL	NE	0	1.00	2	0.999961
IBM	KIMBALL MUNICIPAL	NE	0	1.00	2	0.999958
LNK	LINCOLN	NE	0	1.00	1	0.999984
MCK	MC COOK REGIONAL	NE	0	1.00	3	0.999916
MLE	MILLARD	NE	0	1.00	1	0.999984

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
VTN	MILLER FIELD	NE	0	1.00	1	0.999984
AFK	NEBRASKA CITY MUNICIPAL	NE	0	1.00	1	0.999984
LBF	NORTH PLATTE REGIONAL AIRPORT	NE	0	1.00	3	0.999923
PMV	PLATTSMOUTH MUNICIPAL	NE	0	1.00	1	0.999984
SCB	SCRIBNER STATE	NE	0	1.00	1	0.999984
OGA	SEARLE FIELD	NE	0	1.00	3	0.999925
SWT	SEWARD MUNICIPAL	NE	0	1.00	1	0.999984
SNY	SIDNEY MUNICIPAL LLOYD W. CARR FIELD	NE	0	1.00	2	0.999961
ONL	THE O'NEILL MUNICIPAL	NE	0	1.00	1	0.999984
AHQ	WAHOO MUNICIPAL	NE	0	1.00	1	0.999984
LCG	WAYNE MUNICIPAL	NE	0	1.00	1	0.999984
BFF	WESTERN NEB. REGIONAL	NE	0	1.00	3	0.999936
JYR	YORK MUNICIPAL	NE	0	1.00	1	0.999984
ASH	BOIRE FIELD	NH	0	1.00	18	0.999599
CON	CONCORD MUNICIPAL	NH	0	1.00	13	0.999703
EEN	DILLANT-HOPKINS	NH	0	1.00	9	0.999806
LCI	LACONIA MUNICIPAL	NH	0	1.00	13	0.999676
MHT	MANCHESTER	NH	0	1.00	14	0.999653
PSM	PORTSMOUTH INTL AT PEASE	NH	0	1.00	16	0.999570
ACY	ATLANTIC CITY INTL	NJ	0	1.00	4	0.999937
WWD	CAPE MAY COUNTY	NJ	0	1.00	4	0.999937
MIV	MILLVILLE MUNICIPAL	NJ	0	1.00	4	0.999937
EWR	NEWARK LIBERTY INTL	NJ	0	1.00	6	0.999913
TEB	TETERBORO	NJ	0	1.00	6	0.999912
ABQ	ALBUQUERQUE INTL SUNPORT	NM	0	1.00	34	0.999243
CVN	CLOVIS MUNICIPAL	NM	0	1.00	2	0.999925
AEG	DOUBLE EAGLE II	NM	0	1.00	37	0.999157
FMN	FOUR CORNERS REGIONAL	NM	0	1.00	17	0.999512
SVC	GRANT COUNTY	NM	1	0.999955	102	0.992988
LRU	LAS CRUCES INTL	NM	1	0.999960	91	0.996645
ROW	ROSWELL INTL AIR CENTER	NM	0	1.00	2	0.999925
LAS	MC CARRAN INTL	NV	0	1.00	7	0.999626
4SD	RENO/STEAD	NV	1	0.999967	102	0.992513
RNO	RENO/TAHOE INTL	NV	1	0.999970	103	0.992821
WMC	WINNEMUCCA MUNICIPAL	NV	0	1.00	11	0.999439
9G3	AKRON	NY	0	1.00	2	0.999971
ALB	ALBANY INTL	NY	0	1.00	7	0.999846
HWV	BROOKHAVEN	NY	0	1.00	7	0.999843
BUF	BUFFALO NIAGARA INTL	NY	0	1.00	1	0.999986
OLE	CATTARAUGUS COUNTY-OLEAN	NY	0	1.00	2	0.999971
JHW	CHAUTAUQUA COUNTY/JAMESTOWN	NY	0	1.00	2	0.999968
ELM	ELMIRA/CORNING REGIONAL	NY	0	1.00	3	0.999957
FOK	FRANCIS S GABRESKI	NY	0	1.00	7	0.999829
BGM	GREATER BINGHAMTON	NY	0	1.00	4	0.999943
ROC	GREATER ROCHESTER INTL	NY	0	1.00	3	0.999957
JFK	JOHN F KENNEDY INTL	NY	0	1.00	6	0.999851
LGA	LA GUARDIA	NY	0	1.00	6	0.999852
MSS	MASSENA INTL-RICHARDS FIELD	NY	0	1.00	11	0.999744
N66	ONEONTA MUNICIPAL	NY	0	1.00	5	0.999928
PEO	PENN YAN	NY	0	1.00	3	0.999957
PBG	PLATTSBURGH INTL	NY	0	1.00	7	0.999849

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44N	SKY ACRES	NY	0	1.00	5	0.999912
SWF	STEWART INTL	NY	0	1.00	5	0.999865
SYR	SYRACUSE HANCOCK INTL	NY	0	1.00	4	0.999943
ELZ	WELLSVILLE MUNICIPAL ARPT`TARANTINE	NY	0	1.00	4	0.999943
HPN	WESTCHESTER COUNTY	NY	0	1.00	6	0.999850
SDC	WILLIAMSON-SODUS	NY	0	1.00	3	0.999957
HAO	BUTLER CO REGIONAL	OH	0	1.00	0	1.00
CXY	CAPITAL CITY	OH	0	1.00	4	0.999943
LUK	CINCINNATI MUNICIPAL AIRPORT	OH	0	1.00	0	1.00
CLE	CLEVELAND-HOPKINS INTL	OH	0	1.00	0	1.00
MGY	DAYTON-WRIGHT BROTHERS	OH	0	1.00	0	1.00
DLZ	DELAWARE MUNICIPAL	OH	0	1.00	1	0.999986
LHQ	FAIRFIELD COUNTY	OH	0	1.00	0	1.00
FDY	FINDLAY	OH	0	1.00	1	0.999986
PMH	GREATER PORTSMOUTH REGIONAL	OH	0	1.00	0	1.00
I19	GREENE COUNTY-LEWIS A. JACKSON	OH	0	1.00	1	0.999986
DAY	JAMES M COX DAYTON INTL	OH	0	1.00	0	1.00
1G3	KENT STATE UNIV	OH	0	1.00	0	1.00
I68	LEBANON-WARREN COUNTY	OH	0	1.00	0	1.00
UYF	MADISON COUNTY	OH	0	1.00	1	0.999986
MNN	MARION MUNICIPAL	OH	0	1.00	1	0.999986
AXV	NEIL ARMSTRONG	OH	0	1.00	0	1.00
OSU	OHIO STATE UNIVERSITY	OH	0	1.00	1	0.999986
UNI	OHIO UNIVERSITY SNYDER FIELD	OH	0	1.00	1	0.999986
CMH	PORT COLUMBUS INTL	OH	0	1.00	1	0.999986
RZT	ROSS COUNTY	OH	0	1.00	1	0.999986
TOL	TOLEDO EXPRESS	OH	0	1.00	1	0.999986
1G0	WOOD COUNTY	OH	0	1.00	1	0.999986
YNG	YOUNGSTOWN-WARREN REGIONAL	OH	0	1.00	0	1.00
AVK	ALVA REGIONAL	OK	0	1.00	2	0.999967
BVO	BARTLESVILLE MUNICIPAL	OK	0	1.00	2	0.999967
CQB	CHANDLER REGIONAL	OK	0	1.00	2	0.999967
CHK	CHICKASHA MUNICIPAL	OK	0	1.00	2	0.999967
GCM	CLAREMORE REGIONAL	OK	0	1.00	2	0.999967
F29	CLARENCE E PAGE MUNICIPAL	OK	0	1.00	2	0.999967
1K4	DAVID JAY PERRY	OK	0	1.00	2	0.999967
MKO	DAVIS FIELD	OK	0	1.00	2	0.999967
DUA	EAKER FIELD	OK	0	1.00	2	0.999967
ELK	ELK CITY REGIONAL BUSINESS	OK	0	1.00	2	0.999967
GMJ	GROVE MUNICIPAL	OK	0	1.00	2	0.999967
GOK	GUTHRIE-EDMOND REGIONAL	OK	0	1.00	2	0.999967
2O8	HINTON MUNICIPAL	OK	0	1.00	2	0.999967
HBR	HOBART REGIONAL	OK	0	1.00	2	0.999967
MLC	MC ALESTER REGIONAL	OK	0	1.00	2	0.999967
MIO	MIAMI MUNICIPAL	OK	0	1.00	1	0.999984
MDF	MOORELAND MUNICIPAL	OK	0	1.00	2	0.999967
OKM	OKMULGEE REGIONAL	OK	0	1.00	2	0.999967
PVJ	PAULS VALLEY MUNICIPAL	OK	0	1.00	2	0.999967
PNC	PONCA CITY REGIONAL	OK	0	1.00	2	0.999967
RVS	RICHARD LLOYD JONES JR	OK	0	1.00	2	0.999967
2K4	SCOTT FIELD	OK	0	1.00	2	0.999967

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SNL	SHAWNEE REGIONAL	OK	0	1.00	2	0.999967
SWO	STILLWATER REGIONAL	OK	0	1.00	2	0.999967
TQH	TAHLEQUAH MUNICIPAL	OK	0	1.00	2	0.999967
TUL	TULSA INTL	OK	0	1.00	2	0.999967
OUN	UNIVERSITY OF OKLAHOMA	OK	0	1.00	2	0.999967
OKC	WILL ROGERS WORLD	OK	0	1.00	2	0.999967
UAO	AURORA STATE	OR	1	0.999973	96	0.991548
BDN	BEND MUNICIPAL	OR	0	1.00	75	0.995047
LMT	KLAMATH FALLS	OR	1	0.999966	113	0.989367
LGD	LA GRANDE/UNION COUNTY	OR	0	1.00	5	0.999649
EUG	MAHLON SWEET FIELD	OR	1	0.999965	110	0.986668
MMV	MC MINNVILLE MUNICIPAL	OR	1	0.999966	104	0.989991
SLE	MCNARY FLD	OR	1	0.999970	105	0.989409
ONP	NEWPORT MUNICIPAL	OR	1	0.999949	113	0.984940
ONO	ONTARIO MUNICIPAL	OR	0	1.00	8	0.999741
PDX	PORTLAND INTL	OR	1	0.999977	79	0.993630
AGC	ALLEGHENY COUNTY	PA	0	1.00	1	0.999986
AOO	ALTOONA-BLAIR COUNTY	PA	0	1.00	1	0.999986
LBE	ARNOLD PALMER REGIONAL	PA	0	1.00	1	0.999986
BFD	BRADFORD REGIONAL	PA	0	1.00	1	0.999986
BTP	BUTLER COUNTY	PA	0	1.00	0	1.00
MQS	CHESTER COUNTY G O CARLSON	PA	0	1.00	5	0.999927
AXQ	CLARION COUNTY	PA	0	1.00	1	0.999986
9D4	DECK	PA	0	1.00	4	0.999943
DUJ	DUBOIS REGIONAL	PA	0	1.00	1	0.999986
WAY	GREENE COUNTY	PA	0	1.00	1	0.999986
HZL	HAZLETON MUNICIPAL	PA	0	1.00	3	0.999957
JST	JOHN MURTHA JOHNSTOWN-CAMBRIA	PA	0	1.00	1	0.999986
LNS	LANCASTER	PA	0	1.00	4	0.999943
ABE	LEHIGH VALLEY INTL	PA	0	1.00	4	0.999943
RVL	MIFFLIN COUNTY	PA	0	1.00	3	0.999957
UCP	NEW CASTLE MUNICIPAL	PA	0	1.00	0	1.00
PNE	NORTHEAST PHILADELPHIA	PA	0	1.00	4	0.999937
PHL	PHILADELPHIA INTL	PA	0	1.00	3	0.999951
PIT	PITTSBURGH INTL	PA	0	1.00	0	1.00
FWQ	ROSTRAVER	PA	0	1.00	1	0.999986
2G9	SOMERSET COUNTY	PA	0	1.00	1	0.999986
OYM	ST MARYS MUNICIPAL	PA	0	1.00	1	0.999986
UNV	UNIVERSITY PARK	PA	0	1.00	3	0.999957
FKL	VENANGO REGIONAL	PA	0	1.00	0	1.00
BID	BLOCK ISLAND STATE	RI	0	1.00	13	0.999710
OQU	QUONSET STATE	RI	0	1.00	17	0.999596
PVD	THEODORE FRANCIS GREEN STATE	RI	0	1.00	19	0.999559
AIK	AIKEN MUNICIPAL	SC	0	1.00	4	0.999913
AND	ANDERSON REGIONAL	SC	0	1.00	0	1.00
CHS	CHARLESTON AFB/INTL	SC	0	1.00	6	0.999849
JZI	CHARLESTON EXECUTIVE	SC	0	1.00	6	0.999846
CAE	COLUMBIA METROPOLITAN	SC	0	1.00	5	0.999898
UDG	DARLINGTON COUNTY JETPORT	SC	0	1.00	6	0.999867
GYH	DONALDSON CENTER	SC	0	1.00	0	1.00
GGE	GEORGETOWN COUNTY	SC	0	1.00	6	0.999847
GSP	GREENVILLE SPARTANBURG INTL	SC	0	1.00	0	1.00

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
MYR	MYRTLE BEACH INTL	SC	0	1.00	6	0.999847
CEU	OCONEE COUNTY REGIONAL	SC	0	1.00	0	1.00
CDN	WOODWARD FIELD	SC	0	1.00	6	0.999884
ABR	ABERDEEN REGIONAL	SD	0	1.00	2	0.999948
BKX	BROOKINGS REGIONAL	SD	0	1.00	1	0.999984
YKN	CHAN GURNEY MUNICIPAL	SD	0	1.00	1	0.999984
HON	HURON REGIONAL	SD	0	1.00	1	0.999984
FSD	JOE FOSS FIELD	SD	0	1.00	1	0.999984
MHE	MITCHELL MUNICIPAL	SD	0	1.00	1	0.999984
PIR	PIERRE REGIONAL	SD	0	1.00	2	0.999960
RAP	RAPID CITY REGIONAL	SD	0	1.00	3	0.999902
ATY	WATERTOWN REGIONAL	SD	0	1.00	2	0.999968
PVE	BEECH RIVER REGIONAL	TN	0	1.00	1	0.999928
SYI	BOMAR FIELD SHELBYVILLE MUNICIPAL	TN	0	1.00	1	0.999952
UCY	EVERETT-STEWART REGIONAL	TN	0	1.00	1	0.999930
CHA	LOVELL FIELD	TN	0	1.00	3	0.999940
TYS	MC GHEE TYSON	TN	0	1.00	2	0.999971
MEM	MEMPHIS INTL	TN	0	1.00	1	0.999908
NQA	MILLINGTON REGIONAL JETPORT	TN	0	1.00	1	0.999914
BNA	NASHVILLE INTL	TN	0	1.00	1	0.999952
SZY	ROBERT SIBLEY	TN	0	1.00	1	0.999921
TRI	TRI-CITIES REGIONAL TN/VA	TN	0	1.00	0	1.00
BGF	WINCHESTER MUNICIPAL	TN	0	1.00	2	0.999943
ABI	ABILENE REGIONAL	TX	0	1.00	2	0.999915
ADS	ADDISON	TX	0	1.00	2	0.999917
ALI	ALICE INTL	TX	0	1.00	3	0.999828
LFK	ANGELINA COUNTY	TX	0	1.00	2	0.999915
GKY	ARLINGTON MUNICIPAL	TX	0	1.00	2	0.999915
AUS	AUSTIN-BERGSTROM INTL	TX	0	1.00	2	0.999915
LBX	BRAZORIA COUNTY	TX	0	1.00	2	0.999915
BWD	BROWNWOOD REGIONAL	TX	0	1.00	2	0.999915
E30	BRUCE FIELD	TX	0	1.00	2	0.999915
TKI	COLLIN COUNTY REGIONAL AT MC KINNE	TX	0	1.00	2	0.999917
CRP	CORPUS CHRISTI INTL	TX	0	1.00	3	0.999834
CFD	COULTER FIELD	TX	0	1.00	2	0.999915
PRX	COX FIELD	TX	0	1.00	2	0.999967
BBD	CURTIS FIELD	TX	0	1.00	2	0.999915
RBD	DALLAS EXECUTIVE	TX	0	1.00	2	0.999915
DAL	DALLAS LOVE FIELD	TX	0	1.00	2	0.999915
DFW	DALLAS/FORT WORTH INTL	TX	0	1.00	2	0.999915
DWH	DAVID WAYNE HOOKS MEMORIAL	TX	0	1.00	2	0.999915
LUD	DECATUR MUNICIPAL	TX	0	1.00	2	0.999915
DRT	DEL RIO INTL	TX	0	1.00	3	0.999834
TPL	DRAUGHON-MILLER CENTRAL TEXAS	TX	0	1.00	2	0.999915
GGG	EAST TEXAS REGIONAL	TX	0	1.00	2	0.999917
CLL	EASTERWOOD FIELD	TX	0	1.00	2	0.999915
ELP	EL PASO INTL	TX	1	0.999969	56	0.998620
AFW	FORT WORTH ALLIANCE	TX	0	1.00	2	0.999915
FWS	FORT WORTH SPINKS	TX	0	1.00	2	0.999915
IAH	GEORGE BUSH INTERCONTINENTAL/H	TX	0	1.00	2	0.999915

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PVW	HALE COUNTY	TX	0	1.00	2	0.999915
INJ	HILLSBORO MUNICIPAL	TX	0	1.00	2	0.999915
TME	HOUSTON EXECUTIVE	TX	0	1.00	2	0.999915
AXH	HOUSTON-SOUTHWEST	TX	0	1.00	2	0.999915
ERV	KERRVILLE MUNICIPAL LOUIS SCHREINER	TX	0	1.00	3	0.999849
LNC	LANCASTER	TX	0	1.00	2	0.999915
LRD	LAREDO INTL	TX	0	1.00	3	0.999828
CXO	LONE STAR EXECUTIVE	TX	0	1.00	2	0.999915
LBB	LUBBOCK PRESTON SMITH INTL	TX	0	1.00	2	0.999915
GVT	MAJORS	TX	0	1.00	2	0.999917
5T9	MAVERICK COUNTY MEMORIAL INTL	TX	0	1.00	3	0.999828
MFE	MC ALLEN MILLER INTL	TX	1	0.999985	4	0.999617
HQZ	MESQUITE METRO	TX	0	1.00	2	0.999915
MAF	MIDLAND INTL	TX	0	1.00	3	0.999898
OSA	MOUNT PLEASANT REGIONAL	TX	0	1.00	2	0.999967
RAS	MUSTANG BEACH	TX	0	1.00	3	0.999834
BAZ	NEW BRAUNFELS MUNICIPAL	TX	0	1.00	3	0.999900
PIL	PORT ISABEL-CAMERON COUNTY	TX	0	1.00	4	0.999587
AMA	RICK HUSBAND AMARILLO INTL	TX	0	1.00	2	0.999929
SJT	SAN ANGELO REGIONAL MATHIS FIELD	TX	0	1.00	3	0.999900
SAT	SAN ANTONIO INTL	TX	0	1.00	3	0.999848
HYI	SAN MARCOS MUNICIPAL	TX	0	1.00	2	0.999915
GLS	SCHOLES INTL AT GALVESTON	TX	0	1.00	2	0.999915
SPS	SHEPPARD AFB/WICHITA FALLS MUN	TX	0	1.00	2	0.999917
EBG	SOUTH TEXAS INTL AT EDINBURG	TX	0	1.00	4	0.999624
SGR	SUGAR LAND REGIONAL	TX	0	1.00	2	0.999915
TFP	T P MC CAMPBELL	TX	0	1.00	3	0.999834
TRL	TERRELL MUNICIPAL	TX	0	1.00	2	0.999917
TYR	TYLER POUNDS REGIONAL	TX	0	1.00	2	0.999917
HRL	VALLEY INTL	TX	1	0.999985	4	0.999602
IWS	WEST HOUSTON	TX	0	1.00	2	0.999915
HOU	WILLIAM P HOBBY	TX	0	1.00	2	0.999915
CDC	CEDAR CITY REGIONAL	UT	0	1.00	3	0.999952
KNB	KANAB MUNICIPAL	UT	0	1.00	4	0.999916
LGU	LOGAN-CACHE	UT	0	1.00	2	0.999970
OGD	OGDEN-HINCKLEY	UT	0	1.00	1	0.999984
PVU	PROVO MUNICIPAL	UT	0	1.00	1	0.999984
SLC	SALT LAKE CITY INTL	UT	0	1.00	1	0.999984
SGU	ST GEORGE MUNICIPAL	UT	0	1.00	3	0.999950
MFV	ACCOMACK COUNTY	VA	0	1.00	3	0.999943
MTV	BLUE RIDGE	VA	0	1.00	3	0.999956
CHO	CHARLOTTESVILLE-ALBEMARLE	VA	0	1.00	3	0.999942
FCI	CHESTERFIELD COUNTY	VA	0	1.00	4	0.999920
CJR	CULPEPER REGIONAL	VA	0	1.00	5	0.999911
PTB	DINWIDDIE COUNTY	VA	0	1.00	4	0.999920
OFP	HANOVER COUNTY MUNICIPAL	VA	0	1.00	4	0.999920
JYO	LEESBURG EXECUTIVE	VA	0	1.00	4	0.999943
LNP	LONESOME PINE	VA	0	1.00	0	1.00
LYH	LYNCHBURG REGIONAL	VA	0	1.00	3	0.999954
HEF	MANASSAS REGIONAL	VA	0	1.00	4	0.999943

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
MKJ	MOUNTAIN EMPIRE	VA	0	1.00	2	0.999971
PSK	NEW RIVER VALLEY	VA	0	1.00	2	0.999971
PHF	NEWPORT NEWS/WILLIAMSBURG INTL	VA	0	1.00	7	0.999882
ORF	NORFOLK INTL	VA	0	1.00	2	0.999946
RIC	RICHMOND INTL	VA	0	1.00	4	0.999917
RMN	STAFFORD REGIONAL	VA	0	1.00	5	0.999923
XSA	TAPPAHANNOCK-ESSEX COUNTY	VA	0	1.00	5	0.999928
BCB	VIRGINIA TECH/MONTGOMERY EXECU	VA	0	1.00	2	0.999971
IAD	WASHINGTON DULLES INTL	VA	0	1.00	4	0.999943
BTV	BURLINGTON INTL	VT	0	1.00	9	0.999827
FSO	FRANKLIN COUNTY STATE	VT	0	1.00	8	0.999831
BLI	BELLINGHAM INTL	WA	0	1.00	15	0.999131
HQM	BOWERMAN	WA	1	0.999948	64	0.995563
PWT	BREMERTON NATIONAL	WA	1	0.999973	25	0.998417
DEW	DEER PARK	WA	0	1.00	0	1.00
FHR	FRIDAY HARBOR	WA	0	1.00	19	0.998899
MWH	GRANT CO INTL	WA	0	1.00	4	0.999810
OLM	OLYMPIA	WA	1	0.999969	49	0.997294
PUW	PULLMAN/MOSCOW REGIONAL	WA	0	1.00	0	1.00
RLD	RICHLAND	WA	0	1.00	5	0.999513
SEA	SEATTLE-TACOMA INTL	WA	1	0.999981	18	0.998793
BVS	SKAGIT REGIONAL	WA	0	1.00	18	0.999059
PAE	SNOHOMISH COUNTY (PAINE FLD)	WA	0	1.00	0	1.00
GEG	SPOKANE INTL	WA	0	1.00	0	1.00
TIW	TACOMA NARROWS	WA	1	0.999976	29	0.998340
PSC	TRI-CITIES	WA	0	1.00	5	0.999549
ALW	WALLA WALLA REGIONAL	WA	0	1.00	5	0.999737
CLM	WILLIAM R FAIRCHILD INTL	WA	1	0.999979	22	0.998495
GRB	AUSTIN STRAUBEL INTL	WI	0	1.00	2	0.999919
DLL	BARABOO WISCONSIN DELLS	WI	0	1.00	1	0.999956
OVS	BOSCOBEL	WI	0	1.00	0	1.00
CWA	CENTRAL WISCONSIN	WI	0	1.00	2	0.999895
EAU	CHIPPEWA VALLEY REGIONAL	WI	0	1.00	2	0.999957
MSN	DANE COUNTY REGIONAL	WI	0	1.00	1	0.999952
UNU	DODGE COUNTY	WI	0	1.00	1	0.999951
SUE	DOOR COUNTY CHERRYLAND	WI	0	1.00	2	0.999926
EGV	EAGLE RIVER UNION	WI	0	1.00	2	0.999897
FLD	FOND DU LAC COUNTY	WI	0	1.00	2	0.999938
MKE	GENERAL MITCHELL INTL	WI	0	1.00	1	0.999961
ASX	JOHN F KENNEDY MEMORIAL	WI	0	1.00	2	0.999877
LSE	LA CROSSE MUNICIPAL	WI	0	1.00	1	0.999984
MTW	MANITOWOC COUNTY	WI	0	1.00	2	0.999927
MFI	MARSHFIELD MUNICIPAL	WI	0	1.00	2	0.999906
LUM	MENOMONIE MUNICIPAL-SCORE FIELD	WI	0	1.00	1	0.999984
RRL	MERRILL MUNICIPAL	WI	0	1.00	2	0.999896
C29	MIDDLETON MUNICIPAL	WI	0	1.00	1	0.999956
ATW	OUTAGAMIE COUNTY REGIONAL	WI	0	1.00	2	0.999912
PBH	PRICE COUNTY	WI	0	1.00	2	0.999875
RHI	RHINELANDER-ONEIDA COUNTY	WI	0	1.00	2	0.999892
RPD	RICE LAKE REGIONAL - CARL'S FIELD	WI	0	1.00	3	0.999898
HYR	SAWYER COUNTY	WI	0	1.00	3	0.999869
SBM	SHEBOYGAN COUNTY MEMORIAL	WI	0	1.00	2	0.999923

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
JVL	SOUTHERN WISCONSIN REGIONAL	WI	0	1.00	1	0.999956
TKV	TOMAHAWK REGIONAL	WI	0	1.00	2	0.999883
LNR	TRI-COUNTY REGIONAL	WI	0	1.00	1	0.999972
OSH	WITTMAN REGIONAL	WI	0	1.00	2	0.999922
MRB	EASTERN WV REGIONAL	WV	0	1.00	3	0.999957
PKB	MID-OHIO VALLEY REGIONAL	WV	0	1.00	0	1.00
HTS	TRI-STATE/MILTON J. FERGUSON F	WV	0	1.00	0	1.00
CYS	CHEYENNE REGIONAL/JERRY OLSON FIELD	WY	0	1.00	2	0.999930
EVW	EVANSTON-UINTA COUNTY	WY	0	1.00	3	0.999933
GCC	GILLETTE-CAMPBELL COUNTY	WY	0	1.00	3	0.999813
JAC	JACKSON HOLE	WY	0	1.00	3	0.999877
LAR	LARAMIE REGIONAL	WY	0	1.00	3	0.999888
CPR	NATRONA COUNTY INTL	WY	0	1.00	3	0.999823
RIW	RIVERTON REGIONAL	WY	0	1.00	3	0.999825
RKS	ROCK SPRINGS SWEETWATER COUNTY	WY	0	1.00	3	0.999837
SHR	SHERIDAN COUNTY	WY	0	1.00	3	0.999785
COD	YELLOWSTONE REGIONAL	WY	0	1.00	3	0.999817

Figure 9-1 WAAS LPV Availability

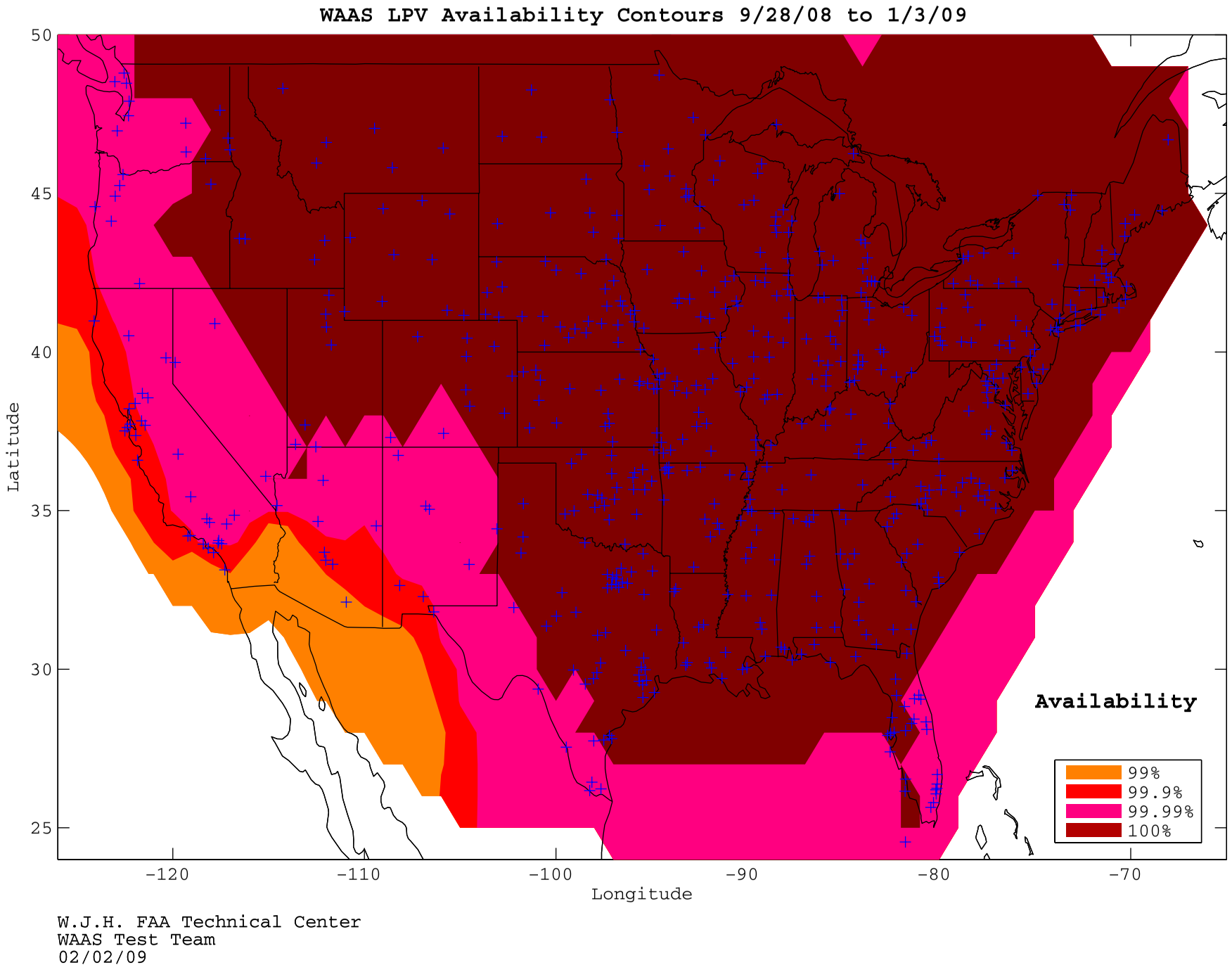
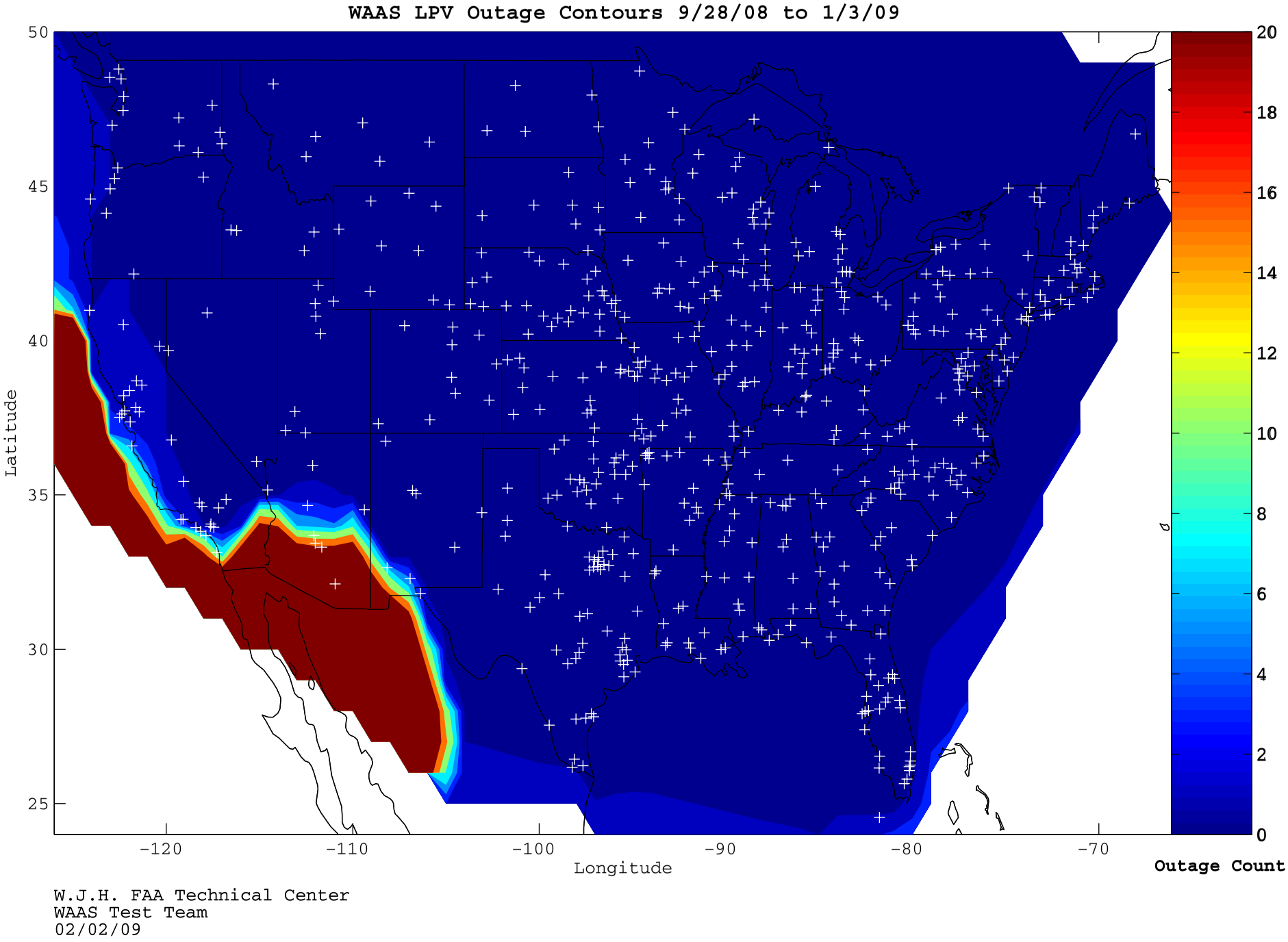


Figure 9-2 WAAS LPV Outage



10.0 WAAS DETERMINISTIC CODE NOISE AND MULTIPATH BOUNDING ANALYSIS

WAAS utilizes a deterministic model to estimate the residual CNMP noise after the application of standard dual frequency carrier smoothing techniques to minimize the effects of multipath and code noise. This analysis performs an assessment of how well that deterministic model bounds the actual errors. This analysis is periodically performed as part of the WAAS Test Team's off-line monitoring to ensure that there are no drastic detrimental changes to the multipath environment at the WAAS Reference Stations (WRSs). This analysis also ensures that WAAS system is not indefinitely exposed to conspiring receiver failure symptoms that would invalidate the CNMP bounding estimate in a manner that would exceed the assumption that no more than one receiver is conspiring to deceive the WAAS monitors at any time by underestimating the residual measurement noise the safety monitors. Although some failures mechanisms that cause CNMP bounding issues are occasionally seen, no "conspiring" errors have ever been detected. That is, data has caused the safety monitors to trip unnecessarily versus missing a necessary trip.

The analysis post processes measurement data to estimate the pseudorange code to carrier ambiguity for each entire arc of measurements for each satellite pass. The ambiguity estimate is then used to level the carrier measurement. The leveled carrier is then used as a multipath free truth estimate. The WAAS real time deterministic CNMP smoothing algorithm is then applied to the original measurements. The difference between the smoothed measurements and the leveled truth measurements is compared to the deterministic noise estimates. Only arcs with continuous carrier phase greater in length than 7200 seconds are utilized for this analysis to minimize the impacts of non-zero mean multipath biasing the truth estimates. The WAAS dual frequency cycle slip detector algorithm is used to detect any discontinuities in the carrier phase.

Statistics are calculated on how well the 0.1 multiples of the deterministically estimated standard deviation bounds the difference between the leveled truth and the real time smoothed measurements. Those statistics are then compared to a theoretical gaussian distribution and an extensive set of plots are generated and manually reviewed. Table 10.1 recaps the results of that manual analysis.

Table 10-1 CNMP Bounding Statistics

WAAS Site	WRE	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08
Albuquerque	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Anchorage	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Atlanta	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Barrow	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Bethel	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Billings	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Boston	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Chicago	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Cleveland	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Cold Bay	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Dallas	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Denver	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Fairbanks	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Gander	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Goose Bay	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Honolulu	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Houston	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Iqaluit	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Jacksonville	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●

● **Excellent** - 3.29σ bounded 100%
● **Good** - 4σ bounded 100%
● **Fair** - 4σ bounded 100% with one worst satellite excluded (Requires manual review if symptoms repeat from month to month)
● **Poor** – Requires manual review
– No data available

WAAS Site	WRE	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08
Juneau	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Kansas City	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Kotzebue	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Los Angeles	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Memphis	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Merida	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Mexico City	A	●	●	●	●	●	●	●	●	–	●	●	●
	B	●	●	●	●	●	●	●	●	–	●	●	●
	C	●	●	●	●	●	●	●	●	–	●	●	●
Miami	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Minneapolis	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
New York	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Oakland	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Puerto Vallarta	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Salt Lake City	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
San Jose Del Cabo	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
San Juan	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Seattle	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Tapachula	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Washington, DC	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Winnipeg	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●

● **Excellent** - 3.29σ bounded 100%
● **Good** - 4σ bounded 100%
● **Fair** - 4σ bounded 100% with one worst satellite excluded (Requires manual review if symptoms repeat from month to month)
● **Poor** – Requires manual review
– No data available

11.0 WAAS REFERENCE STATION SURVEY VALIDATION

The precisely surveyed location of each WAAS WRS is updated occasionally. This update requires a change to the WAAS software. To ensure there is no large (> 10cm RSS) change in the WAAS reference station position between software updates, a new survey is calculated each quarter. The RSS difference between the current survey location and the newly calculated survey location is shown in this section.

The surveys calculate the L1 phase center positions (ECEF X, Y, and Z) of each WRS antenna in IRTF-2000. The latitude, longitude, and height are in WGS-84 computed from the IRTF ECEF using a GraftNet utility after interpolation. The results are cross-checked against OPUS (USA and Mexico) or CSRS (Canada) using 24 hours worth of data.

OPUS antenna position surveys were performed for the WAAS antennas using a 24 hour set of data from 12/5/08. 30 second RINEX data was created from recorded WAAS binary data. The overall RMS qualities reported by OPUS were all less than 2.5 cm.

The positions were then compared to the positions in WAAS software Release 8/9.2a. The Release 8/9 positions have been interpolated forward to 6/30/09 to account for tectonic plate movement in order to minimize how often the software needs to be updated.

MMX is the only outlier at 31 cm. Except for Mexico City, all sites are well under the 10 cm goal and the 25 cm take action thresholds.

Mexico City is a known issue because of the rapid subsidence in the Mexico City area due to water being depleted from an underground lake. The .2a version of Release 8/9 pre-displaced Mexico City lower so that the error will be maintained to a minimal level until the next scheduled release of WAAS software in the early part of 2010. The WAAS Integrity Performance Panel (WIPP) authorized this deviation from the 25 cm take action threshold requirement.

Table 11.1 lists the WAAS antenna positions as of 12/5/08. The positions are in IRTF-2000 and are based on the CORS published positions. All WAAS thread A antennas, ZAB-B and ZOA-B antennas have CORS published positions except Billings. B and C antennas positions were computed using GraftNet Traverse solutions with the collocated CORS site as the control point. Billings used the MTEI Billings CORS site as the control point.

Figure 11.1 to 11.3 show the difference between the WRS locations in the current software and the latest OPUS survey. Each reference station has three independent strings of equipment, and a surveyed location is required for each string. All three strings of a reference station are shown in the three figures. For example, BET1 identifies the RSS delta for the Bethel WRS string 1. The next two bars in the chart are Bethel string 2 and Bethel string 3. Figure 11.4 shows the OPUS overall RMS.

Table 11-1 WAAS Survey Positions as of 12/5/08

WRE	X (m)	Y (m)	Z (m)	Latitude	Longitude	Height (m)
BET1	-2965384.966	-972576.627	5543892.966	60.78791635	-161.8417244	52.206
BET2	-2965385.734	-972580.348	5543891.907	60.78789691	-161.8416639	52.204
BET3	-2965388.302	-972577.48	5543891.039	60.787881	-161.8417286	52.201
BIL1	-1416445.822	-4223577.023	4550862.174	45.80370707	-108.5397223	1112.25
BIL2	-1416449.898	-4223574.885	4550862.904	45.80371636	-108.5397808	1112.264
BIL3	-1416441.518	-4223574.289	4550866.025	45.80375676	-108.539681	1112.25
BRW1	-1886758.829	-809058.687	6018494.53	71.28276573	-156.7899231	15.598
BRW2	-1886756.245	-809055.942	6018495.711	71.28279847	-156.7899651	15.607
BRW3	-1886755.154	-809059.727	6018495.536	71.28279381	-156.789856	15.598
CDB1	-3483634.751	-1083799.446	5214187.701	55.20033465	-162.7184721	53.647
CDB2	-3483629.883	-1083796.776	5214191.488	55.2003942	-162.7184894	53.651
CDB3	-3483631.897	-1083788.429	5214191.89	55.20040036	-162.718624	53.663
FAI1	-2304741.698	-1448715.267	5748843.698	64.80963089	-147.8473398	149.904
FAI2	-2304741.232	-1448706.461	5748846.1	64.80968129	-147.8474915	149.915
FAI3	-2304732.692	-1448707.393	5748849.235	64.80974792	-147.8473793	149.885
HNL1	-5508637.066	-2234493.562	2303722.07	21.31298904	-157.9208251	24.684
HNL2	-5508656.221	-2234483.872	2303686.825	21.31264617	-157.9209811	25.017
HNL3	-5508647.637	-2234497.814	2303693.92	21.31271478	-157.9208255	25.067
JNU1	-2354254.802	-2388549.648	5407043.085	58.36257497	-134.5857059	16.041
JNU2	-2354252.717	-2388565.761	5407036.916	58.36246939	-134.5854873	16.041
JNU3	-2354239.501	-2388568.612	5407041.374	58.36254578	-134.5852923	16.035
MMD1	35070.46	-5959686.683	2264365.76	20.93190915	-89.6628403	29.132
MMD2	35065.531	-5959687.061	2264364.979	20.93190144	-89.66288771	29.179
MMD3	35065.195	-5959685.275	2264369.635	20.93194649	-89.66289084	29.172
MMX1	-948701.211	-5943936.474	2109212.979	19.43165323	-99.0683894	2236.511
MMX2	-948696.784	-5943936.293	2109215.407	19.43167654	-99.06834806	2236.492
MMX3	-948705.639	-5943936.663	2109210.552	19.4316299	-99.06843074	2236.538
MPR1	-1570142.185	-5759530.635	2238184.761	20.6790033	-105.2492028	10.999
MPR2	-1570139.365	-5759530.145	2238188.813	20.67904142	-105.2491779	11.294
MPR3	-1570143.468	-5759528.018	2238190.575	20.67905941	-105.2492213	11.006
MSD1	-1979519.577	-5523223.146	2493106.712	23.16044611	-109.7176464	104.29
MSD2	-1979521.146	-5523225.481	2493100.312	23.16038329	-109.7176532	104.28
MSD3	-1979525.593	-5523222.214	2493103.987	23.1604194	-109.7177048	104.278
MTP1	-254854.348	-6162909.189	1617805.088	14.79136614	-92.36799913	54.97
MTP2	-254850.737	-6162910.228	1617801.655	14.79133409	-92.36796521	54.953
MTP3	-254855.495	-6162910.319	1617800.126	14.79132007	-92.36800934	54.84
OTZ1	-2396055.937	-750356.173	5843502.596	66.88733308	-162.6113721	10.93
OTZ2	-2396052.764	-750354.346	5843504.125	66.88736794	-162.6113902	10.933
OTZ3	-2396052.752	-750358.282	5843503.639	66.88735662	-162.6113044	10.943

WRE	X (m)	Y (m)	Z (m)	Latitude	Longitude	Height (m)
YFB1	1035381.532	-2634289.64	5696539.515	63.73149018	-68.54318183	10.018
YFB2	1035372.306	-2634296.036	5696538.148	63.73146401	-68.543403	9.933
YFB3	1035366.237	-2634306.791	5696534.374	63.73138637	-68.54359698	9.997
YQX1	2430424.697	-3419640.415	4788223.807	48.96648949	-54.59763164	146.896
YQX2	2430432.655	-3419639.06	4788220.744	48.96644763	-54.59753233	146.887
YQX3	2430440.566	-3419637.701	4788217.751	48.96640639	-54.59743352	146.91
YWG1	-520164.294	-4083475.896	4855842.985	49.90057439	-97.25939657	222.024
YWG2	-520150.43	-4083468.841	4855850.363	49.90067729	-97.25921755	222.031
YWG3	-520152.292	-4083477.954	4855842.543	49.90056823	-97.25922723	222.024
YYR1	1885341.487	-3321428.37	5091171.609	53.30864657	-60.41946755	37.833
YYR2	1885344.449	-3321419.89	5091176.025	53.30871288	-60.41936611	37.841
YYR3	1885340.16	-3321413.063	5091182.022	53.30880311	-60.41937151	37.837
ZAB1	-1488636.772	-5003946.544	3654557.706	35.17357546	-106.567349	1620.111
ZAB2	-1488631.445	-5003948.237	3654557.686	35.17357478	-106.5672877	1620.185
ZAB3	-1488632.227	-5003950.814	3654553.832	35.17353241	-106.5672878	1620.166
ZAN1	-2659536.531	-1549114.828	5567750.774	61.22920243	-149.7802489	80.675
ZAN2	-2659548.289	-1549110.872	5567746.28	61.22911876	-149.7804227	80.668
ZAN3	-2659541.241	-1549106.75	5567750.76	61.22920233	-149.780423	80.665
ZAU1	138704.186	-4761244.176	4227763.94	41.78265789	-88.33133586	195.921
ZAU2	138704.44	-4761248.782	4227758.769	41.78259551	-88.33133442	195.914
ZAU3	138711.147	-4761248.517	4227758.847	41.78259645	-88.33125368	195.914
ZBW1	1490299.292	-4448983.194	4306010.475	42.73572009	-71.48042512	39.133
ZBW2	1490304.402	-4448981.17	4306010.811	42.73572412	-71.4803581	39.144
ZBW3	1490306.111	-4448984.8	4306006.512	42.73567135	-71.48035239	39.153
ZDC1	1069125.834	-4839599.014	4001126.501	39.10159562	-77.5427458	80.092
ZDC2	1069128.229	-4839603.647	4001120.295	39.1015236	-77.54273031	80.09
ZDC3	1069124.127	-4839602.742	4001122.491	39.101549	-77.54277436	80.102
ZDV1	-1273628.56	-4711375.608	4094890.121	40.18730323	-105.1272237	1541.377
ZDV2	-1273622.856	-4711377.108	4094890.131	40.18730353	-105.1271544	1541.352
ZDV3	-1273624.865	-4711380.3	4094885.855	40.18725317	-105.1271674	1541.347
ZFW1	-659983.155	-5324060.795	3438276.479	32.83064972	-97.0664713	155.633
ZFW2	-659988.423	-5324063.35	3438271.479	32.83059628	-97.06652378	155.598
ZFW3	-659983.448	-5324063.881	3438271.69	32.83059829	-97.06647035	155.641
ZHU1	-513864.428	-5506451.775	3166720.498	29.96189626	-95.33142576	10.919
ZHU2	-513867.077	-5506455.173	3166714.337	29.96183175	-95.33144981	10.986
ZHU3	-513873.354	-5506457.811	3166708.734	29.9617735	-95.33151202	10.969
ZJX1	772646.487	-5434462.226	3237231.74	30.69885944	-81.90818472	2.172
ZJX2	772649.813	-5434463.769	3237228.329	30.69882379	-81.90815261	2.146
ZJX3	772645.757	-5434466.193	3237225.216	30.69879123	-81.90819809	2.13

WRE	X (m)	Y (m)	Z (m)	Latitude	Longitude	Height (m)
ZKC1	-415247.453	-4954556.41	3982161.111	38.88015929	-94.79083308	305.907
ZKC2	-415231.058	-4954557.731	3982161.175	38.88016003	-94.79064353	305.906
ZKC3	-415237.186	-4954561.077	3982155.969	38.88010178	-94.79071069	305.632
ZLA1	-2474409.848	-4637294.728	3602183.486	34.60351781	-118.0838941	763.508
ZLA2	-2474404.572	-4637297.537	3602183.495	34.6035179	-118.083829	763.508
ZLA3	-2474411.173	-4637297.225	3602179.522	34.60347393	-118.0838941	763.583
ZLC1	-1808273.141	-4486410.833	4145303.022	40.78604342	-111.9521767	1287.421
ZLC2	-1808274.529	-4486414.433	4145298.528	40.78599009	-111.952176	1287.406
ZLC3	-1808270.331	-4486416.147	4145298.53	40.78598999	-111.9521223	1287.423
ZMA1	966042.34	-5662999.859	2761581.484	25.82461191	-80.31918946	-7.556
ZMA2	966029.356	-5662999.135	2761585.962	25.82465968	-80.3193159	-8.213
ZMA3	966037.442	-5662997.978	2761586.321	25.82466174	-80.31923446	-7.86
ZME1	4070.95	-5226189.309	3644028.413	35.06739398	-89.95536935	68.607
ZME2	4070.985	-5226186.755	3644032.523	35.06743753	-89.95536895	68.878
ZME3	4064.784	-5226186.632	3644032.679	35.06743934	-89.95543693	68.863
ZMP1	-249978.311	-4539297.524	4458955.06	44.63746319	-93.15208458	262.674
ZMP2	-249972.512	-4539297.862	4458955.06	44.63746307	-93.15201137	262.688
ZMP3	-249973.611	-4539302.137	4458950.581	44.63740702	-93.15202224	262.621
ZNY1	1406144.709	-4627344	4144322.044	40.78432828	-73.0971649	6.469
ZNY2	1406146.509	-4627347.05	4144317.276	40.78427552	-73.09715501	5.96
ZNY3	1406140.947	-4627348.689	4144317.301	40.78427598	-73.0972237	5.94
ZOA1	-2684436.777	-4293337.541	3865351.808	37.54305313	-122.0159461	-3.484
ZOA2	-2684433.764	-4293341.601	3865349.386	37.5430257	-122.0158928	-3.496
ZOA3	-2684438.139	-4293342.494	3865345.528	37.54298124	-122.0159294	-3.408
ZOB1	650770.257	-4754715.686	4187420.748	41.29715429	-82.20644389	223.698
ZOB2	650777.933	-4754714.865	4187422.766	41.29716659	-82.20635176	225.2
ZOB3	650776.266	-4754719.686	4187414.975	41.29708685	-82.20637928	223.477
ZSE1	-2308930.212	-3668169.695	4663526.494	47.28699346	-122.188372	82.101
ZSE2	-2308934.611	-3668175.254	4663520.09	47.28690781	-122.1883821	82.177
ZSE3	-2308935.672	-3668179.522	4663516.145	47.28685614	-122.1883639	82.112
ZSU1	2462589.353	-5529371.577	2003724.589	18.43133827	-65.99347541	-28.566
ZSU2	2462587.274	-5529377.339	2003711.594	18.43121427	-65.99351558	-28.483
ZSU3	2462593.906	-5529375.129	2003709.536	18.43119469	-65.99344972	-28.49
ZTL1	529840.461	-5305248.815	3489342.834	33.37968842	-84.29672539	261.135
ZTL2	529846.838	-5305247.978	3489343.123	33.37969158	-84.29665631	261.128
ZTL3	529847.52	-5305251.412	3489337.892	33.37963491	-84.29665269	261.16

Figure 11-1 Survey Delta for OPUS

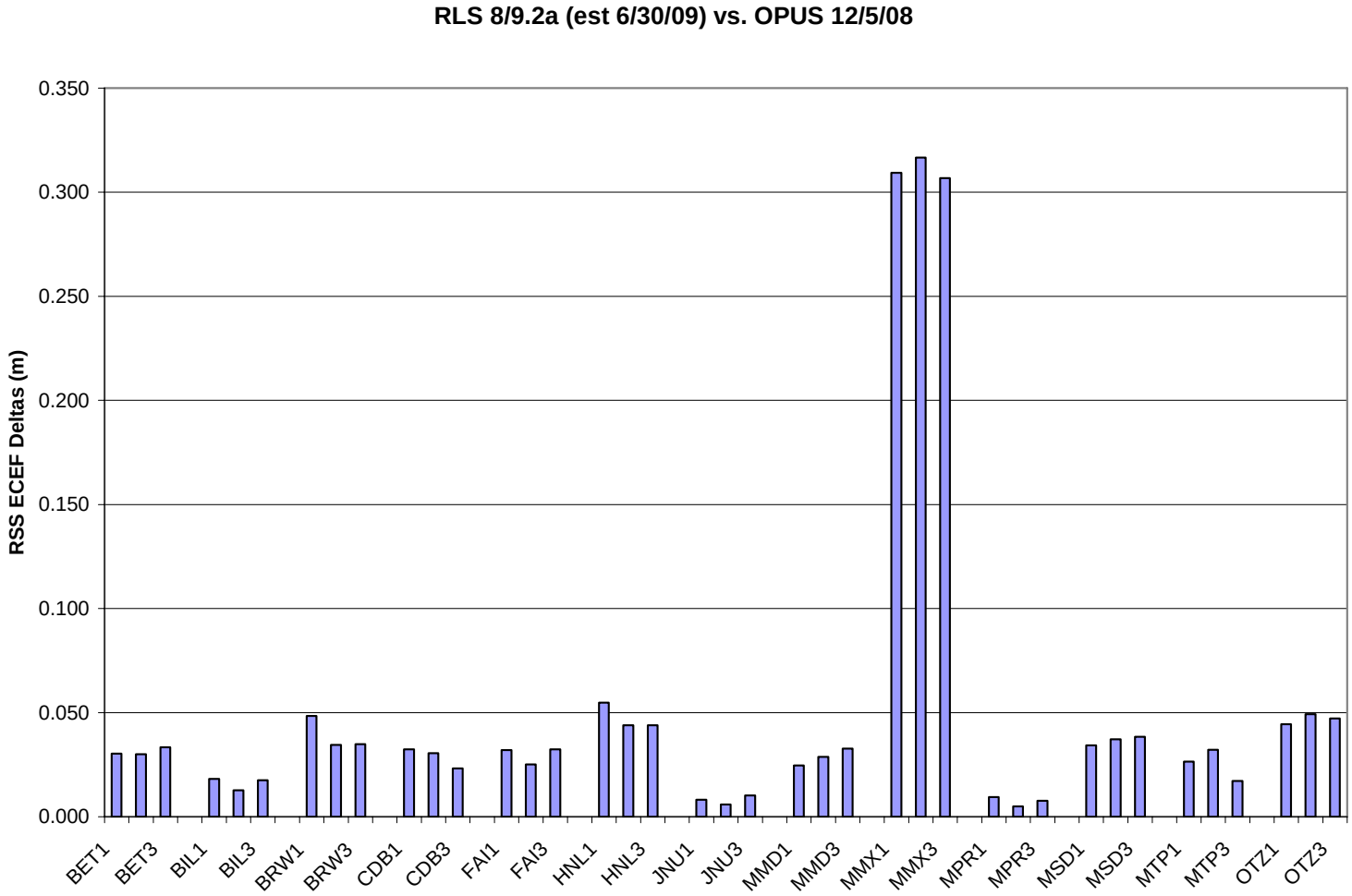


Figure 11-2 Survey Delta for CSRS and OPUS

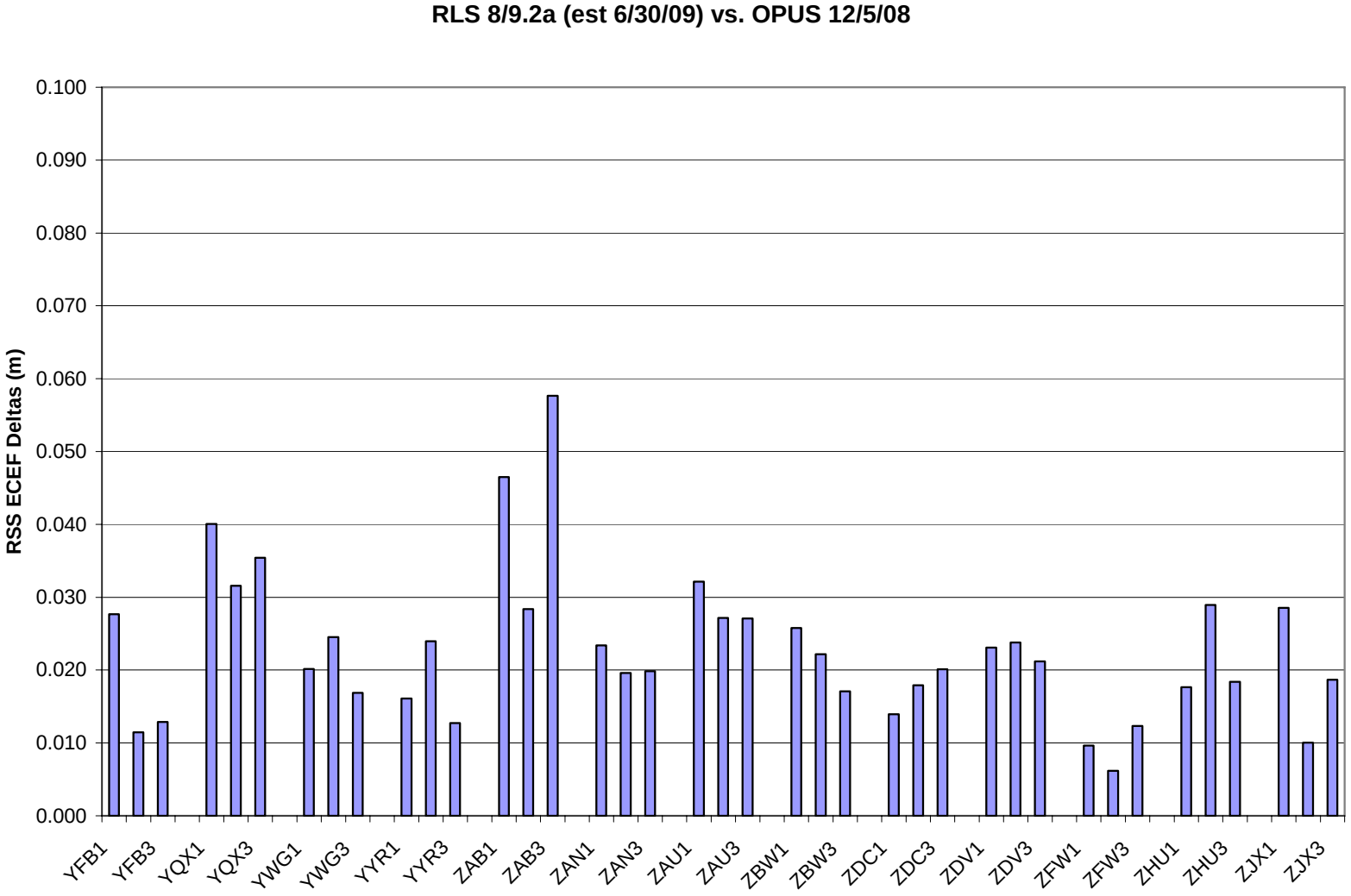


Figure 11-3 Survey Delta for OPUS

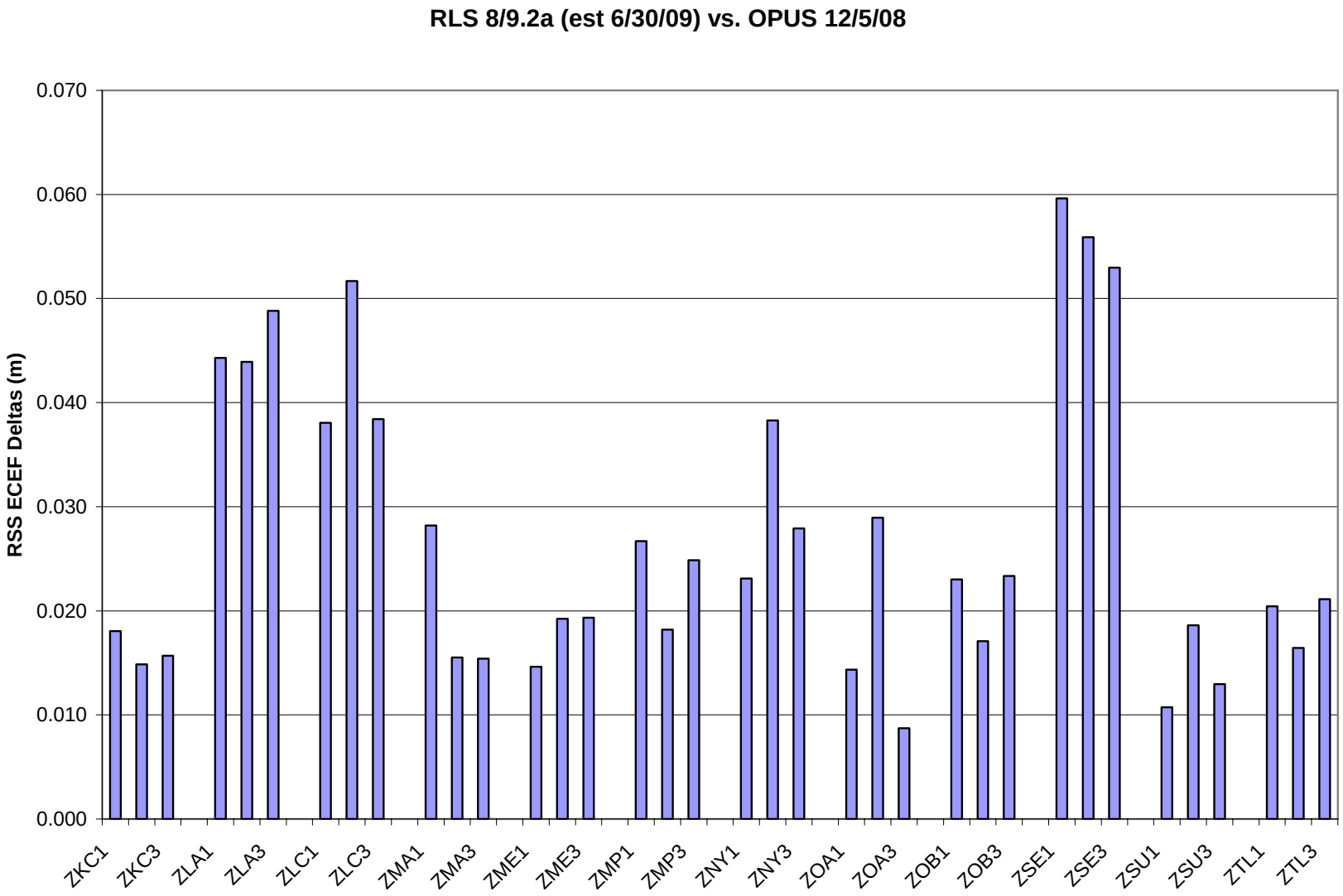
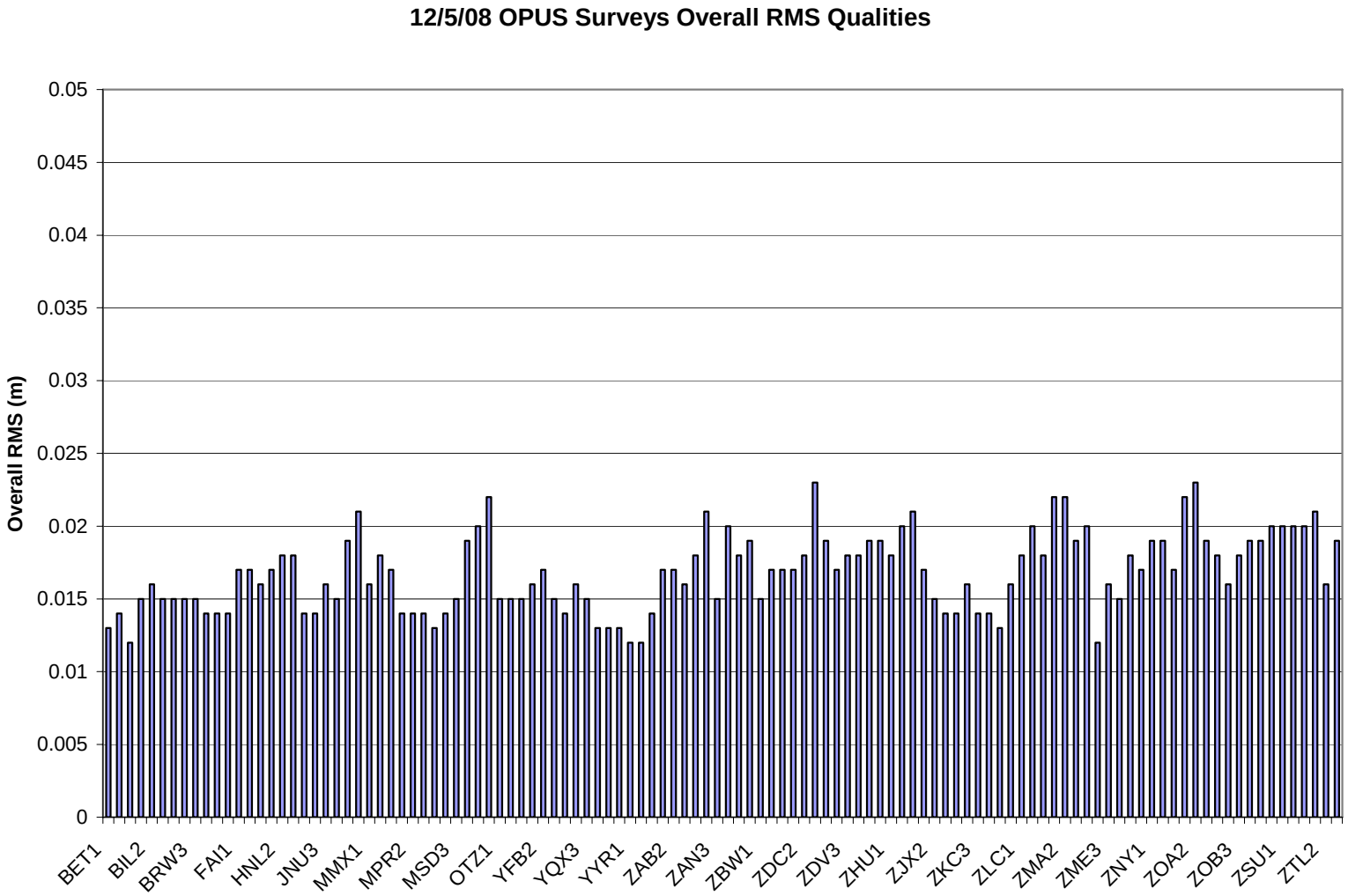


Figure 11-4 Survey RMS for OPUS



12.0 SIGNAL QUALITY MONITOR (SQM)

The Signal Quality Monitor (SQM) is designed to detect signal deformations that originate in the GPS or GEO satellites and ensures that the UDREs are sufficiently inflated to protect given the monitor's current observations. SQM processes correlator measurements produced at the reference station receivers forming four detection metrics for each receiver channel and calculates statistics based on the observed performance against "ideal" signal correlation peaks. This results in an estimate of the overall deformation per satellite. The deformation level calculated is then compared against threshold values, which includes the acceptable error levels per UDRE. If the estimated deformation exceeds threshold, the monitor trips for the given satellite, the UDRE is set to 'Don't use'. The monitor depends on the entire ground network in order to ensure that the satellite is the source of any problem detected rather than a localized affect. Currently all 114 receivers are being used in the SQM computations.

WAAS SQM offline monitoring effort includes the monitoring of the PRN type biases, trips, and the estimated deformation for each satellite that will be referred to as PRN bias in this report.

12.1 Alpha Metrics

The alpha metrics values are pre-determined by offline integrity analysis and are defined as constants in the SQM algorithm. These values remained unchanged for this reporting period and are listed in Table 12.1. Currently there are 4 sets of alpha metrics in the WAAS SQM algorithm that form four detection metrics for each receiver channel. For this report, the four detection metrics will be referred to as: DM1, DM2, DM3, and DM4.

Table 12-1 Alpha Metrics

Correlator Spacing	DM1	DM2	DM3	DM4
-0.1	0	0.43407318	0	-0.36110353
-0.075	0	0.48570652	-0.0058771682	-0.74860302
-0.05	-0.4071265	-0.69931105	-0.011382325	0.23726003
-0.025	1	-0.010099034	0.00037033029	-0.0076011735
0	0	0	0	0
0.025	-0.25	0.13317879	0.99991788	-0.062414070
0.05	1.008525	-0.22851782	0	0.25177272
0.075	0	0.10209042	0	0.42875623
0.1	0	0.078436452	0	0.41602138

12.2 Event Summary

For this reporting period, there were no significant events that affected the SQM statistics.

12.3 Type Bias

PRN Type biases are evaluated as part of the WAAS SQM offline monitoring effort. Depending on the PRN number of any given satellite, it can be classified into three categories of correlation function shapes: skinny (Type 0), nominal (Type 1), and broad (Type 2). Wideband geostationary satellites are considered a different type (Type 3). PRN-type estimates are computed at each epoch and daily averages are computed for each type, for four detection metrics.

For this reporting period, geostationary satellites type biases are not evaluated. Table12.2 shows the rollup average for the quarter. Table 12.3 shows the rollup average since January 1, 2008. Figure 12.1 shows the daily average for the four detection metrics. As expected, the type biases are consistent from day to day.

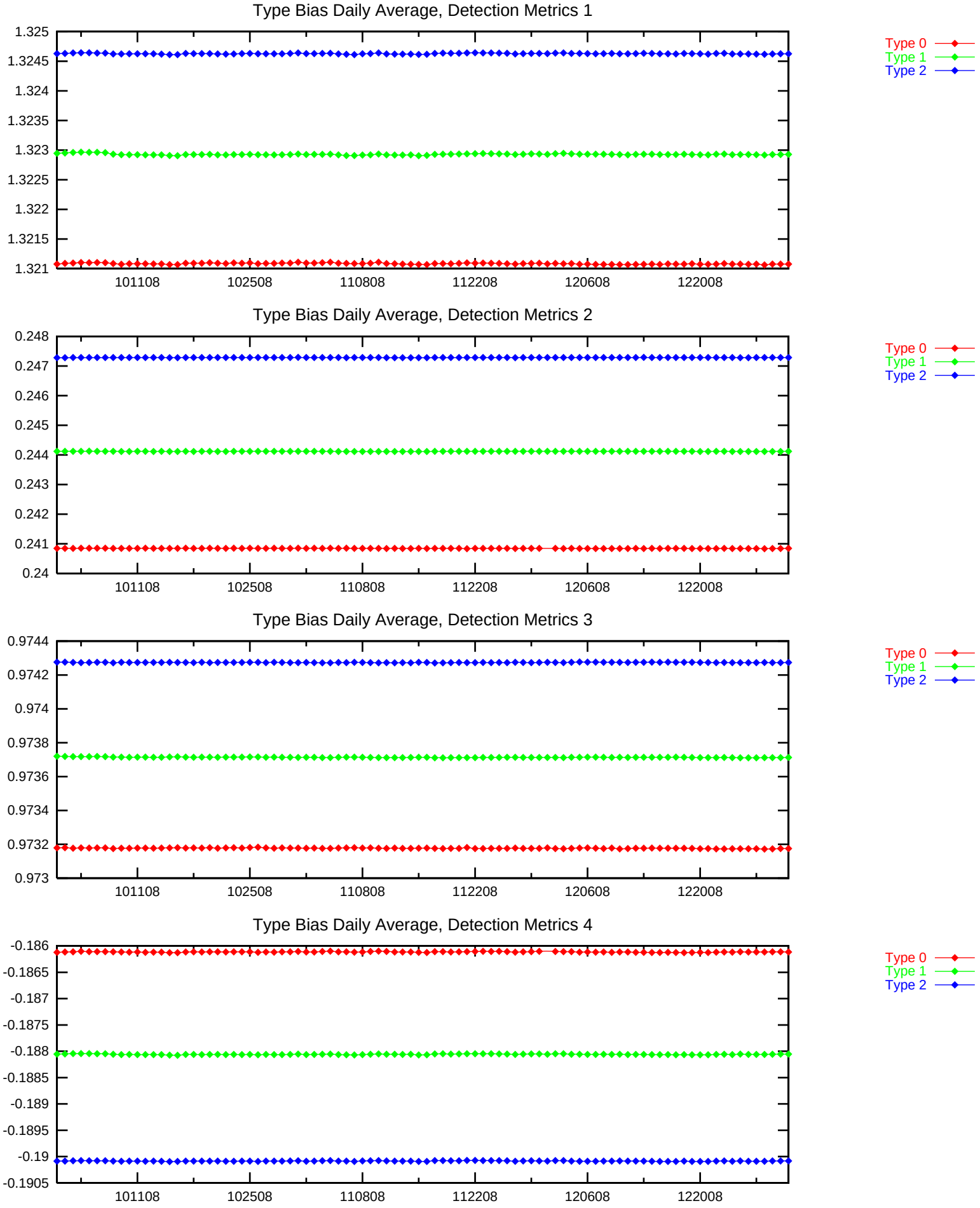
Table 12-2 Type Bias Average for the Quarter

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32108	1.32293	1.32463
DM 2	0.240845	0.244118	0.247285
DM 3	0.973177	0.973714	0.974274
DM 4	-0.186115	-0.188058	-0.190084

Table 12-3 Type Bias Average Since January 1, 2008

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32109	1.32293	1.32463
DM 2	0.240844	0.244115	0.247286
DM 3	0.973178	0.973713	0.974275
DM 4	0.186109	0.188054	-0.190085

Figure 12-1 PRN Type Bias Average Trend



12.4 PRN Bias

PRN biases are evaluated as part of the WAAS SQM offline monitoring effort. PRN bias is the overall estimated deformation per satellite across receivers. Detection metrics are adjusted for inter-receiver bias, corrected for PRN type bias, and combined across receivers for each satellite. Relying on the assertion that the majority of the SV signals are healthy and normal, detection metrics are normalized over all the satellites on orbit resulting in an overall PRN bias for each satellite. PRN biases are collected at each epoch and daily averages are computed for each satellite, for four detection metrics.

For this reporting period, geostationary satellite biases are not evaluated. Please refer to Table 1.4 for events such as satellite out for service that may have an impact on PRN bias statistics.

Table 12.4 and Figure 12.2 show the rollup PRN bias average for the quarter. Table 12.5 shows the rollup PRN bias average since January 1, 2008. The maximum average for DM1 for this quarter is PRN 23 at 0.00096201. The maximum average for DM2 is PRN 21 at 0.00018608. The maximum average for DM3 is PRN 10 at 0.00027292 and the maximum average for DM4 is PRN 23 at 0.00042592.

Figure 12.3 to 12.10 show the PRN bias average trend for each SV. PRN biases, for the majority of SVs, are highest for DM1 than the other DMs.

Table 12-4 PRN Bias Average for the Quarter

PRN	DM1	DM2	DM3	DM4
2	0.00019175	0.00005819	0.00002215	0.00009558
3	0.00021381	0.00005411	0.00008713	0.00034873
4	0.00022732	0.00004527	0.00007276	0.00012835
5	0.00039440	0.00006451	0.00011305	0.00014751
6	0.00016311	0.00005283	0.00004488	0.00012407
7	0.00012974	0.00009548	0.00003652	0.00012088
8	0.00014067	0.00012485	0.00004489	0.00010946
9	0.00022483	0.00005273	0.00007043	0.00010771
10	0.00064922	0.00007372	0.00027292	0.00009115
11	0.00092189	0.00018425	0.00006508	0.00022858
12	0.00022789	0.00008403	0.00010534	0.00007709
13	0.00052925	0.00005875	0.00005916	0.00016497
14	0.00068736	0.00013233	0.00011551	0.00013382
15	0.00011658	0.00007069	0.00002733	0.00013513
16	0.00014806	0.00007316	0.00011175	0.00033491
17	0.00011504	0.00007804	0.00003144	0.00011937
18	0.00060123	0.00009774	0.00003883	0.00020782
19	0.00036806	0.00012742	0.00003356	0.00008551
20	0.00014890	0.00004709	0.00004475	0.00010193
21	0.00063178	0.00018608	0.00020025	0.00008477
22	0.00013299	0.00009425	0.00009918	0.00009963
23	0.00096201	0.00013695	0.00003427	0.00042592
24	0.00028269	0.00004687	0.00003367	0.00009866
25	0.00015414	0.00011044	0.00008183	0.00029627
26	0.00025804	0.00009279	0.00015266	0.00009446
27	0.00043912	0.00007821	0.00006929	0.00029917
28	0.00026342	0.00005376	0.00003308	0.00009351
29	0.00024255	0.00006415	0.00010529	0.00029866
30	0.00030773	0.00009080	0.00002782	0.00012597
31	0.00046191	0.00016025	0.00003916	0.00024147
32	0.00030335	0.00004496	0.00011267	0.00009528

Table 12-5 PRN Bias Average Since January 1, 2008

PRN	DM1	DM2	DM3	DM4
2	0.00018197	0.00005943	0.00002195	0.00009582
3	0.00021241	0.00005341	0.00008571	0.00034122
4	0.00023801	0.00004575	0.00007402	0.00012890
5	0.00042588	0.00006607	0.00011560	0.00015942
6	0.00016542	0.00005465	0.00004633	0.00011745
7	0.00012820	0.00009526	0.00003598	0.00012593
8	0.00015341	0.00012104	0.00004416	0.00010310
9	0.00023586	0.00005332	0.00006964	0.00011099
10	0.00064525	0.00007281	0.00026896	0.00009372
11	0.00092098	0.00018440	0.00006547	0.00023186
12	0.00023990	0.00008527	0.00010489	0.00008036
13	0.00051811	0.00006014	0.00005941	0.00016441
14	0.00067429	0.00013178	0.00011500	0.00013096
15	0.00012023	0.00006993	0.00002760	0.00013364
16	0.00015745	0.00007674	0.00010908	0.00033492
17	0.00011526	0.00008050	0.00003033	0.00011623
18	0.00059245	0.00009795	0.00004009	0.00020622
19	0.00037666	0.00013140	0.00003319	0.00008709
20	0.00015678	0.00004849	0.00004531	0.00010324
21	0.00062648	0.00018666	0.00020183	0.00008519
22	0.00015289	0.00008591	0.00010260	0.00010052
23	0.00095402	0.00013748	0.00003520	0.00042551
24	0.00029748	0.00004517	0.00003478	0.00010082
25	0.00015468	0.00010954	0.00008206	0.00030410
26	0.00026392	0.00009293	0.00015370	0.00009303
27	0.00045388	0.00007774	0.00007015	0.00030666
28	0.00025218	0.00005323	0.00003178	0.00009102
29	0.00023035	0.00006548	0.00010608	0.00029575
30	0.00029373	0.00009511	0.00002836	0.00011857
31	0.00046874	0.00015736	0.00003851	0.00025076
32	0.00032274	0.00004795	0.00011400	0.00010410

Figure 12-2 PRN Bias Average for the Quarter

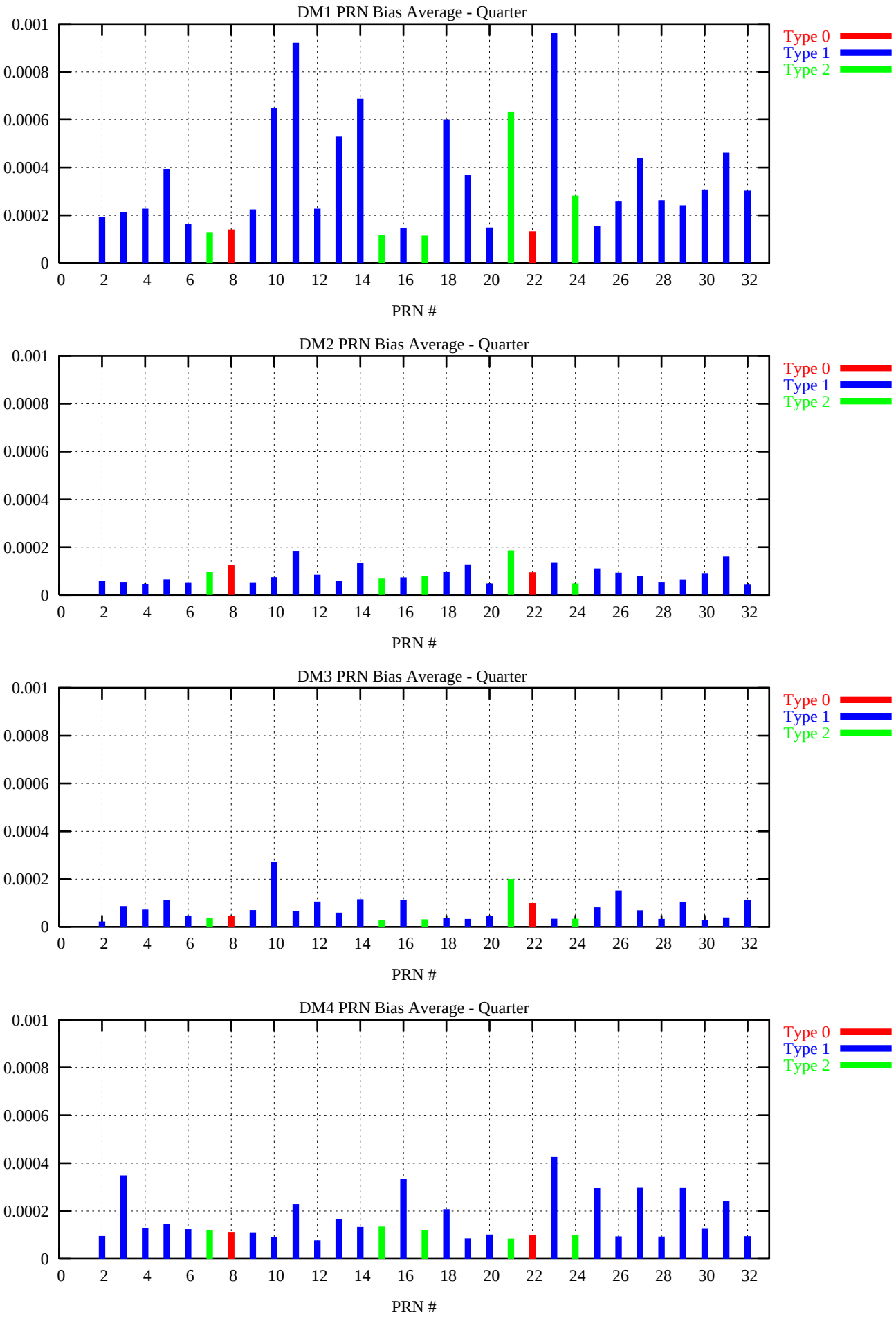


Figure 12-3 PRN Bias Average Trend (PRN 1 - PRN 4)

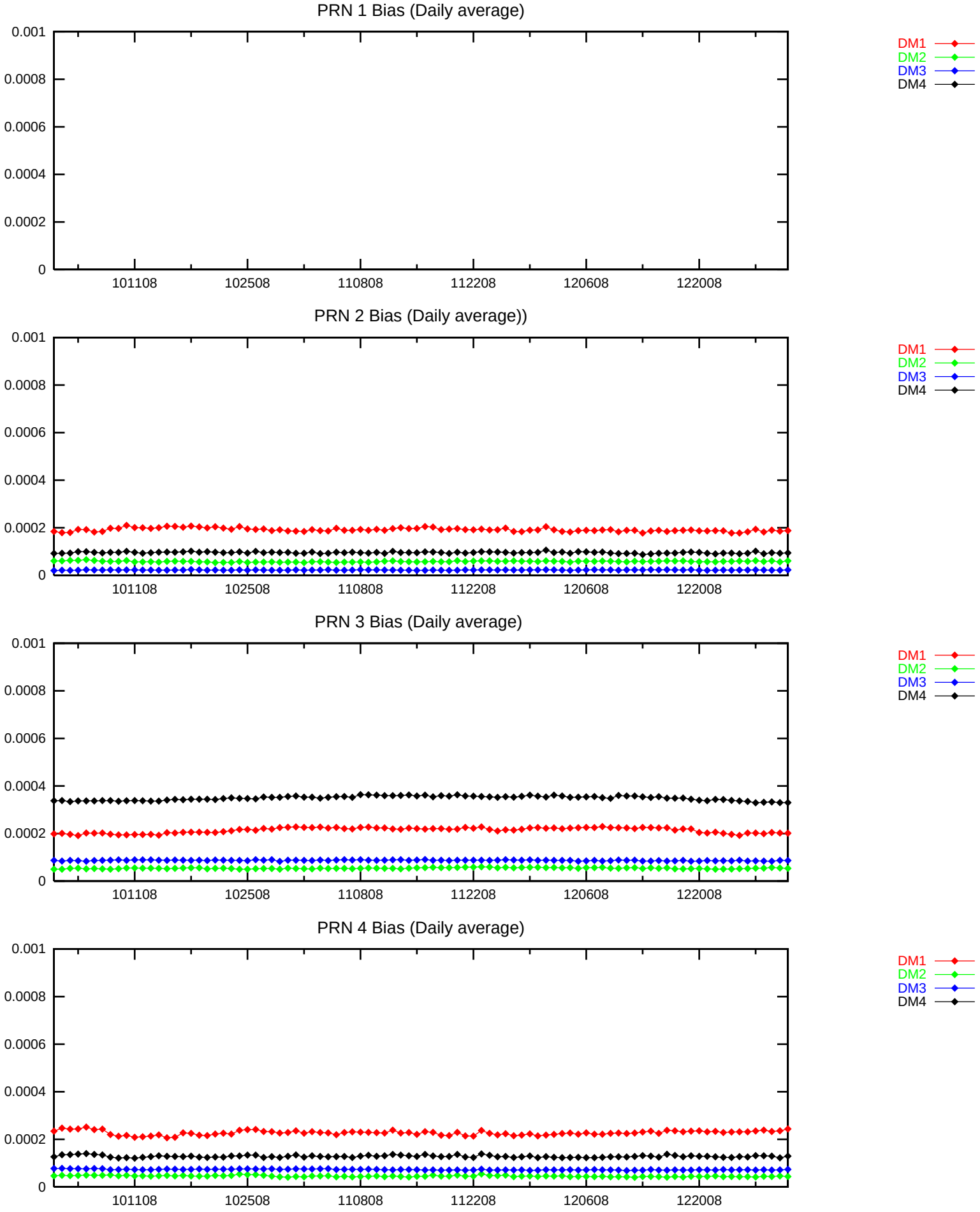


Figure 12-4 PRN Bias Average Trend (PRN 5 - PRN 8)

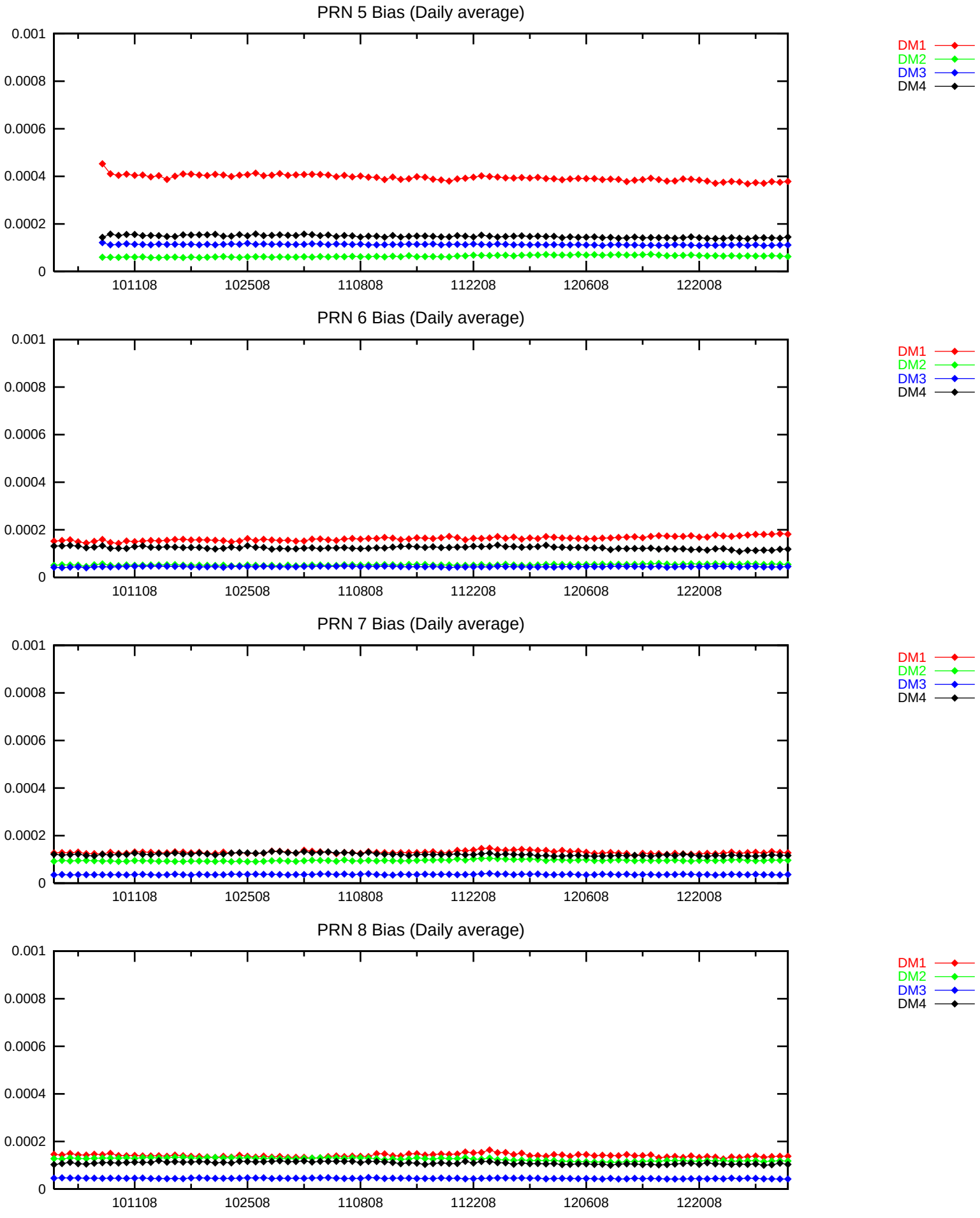


Figure 12-5 PRN Bias Average Trend (PRN 9 - PRN 12)

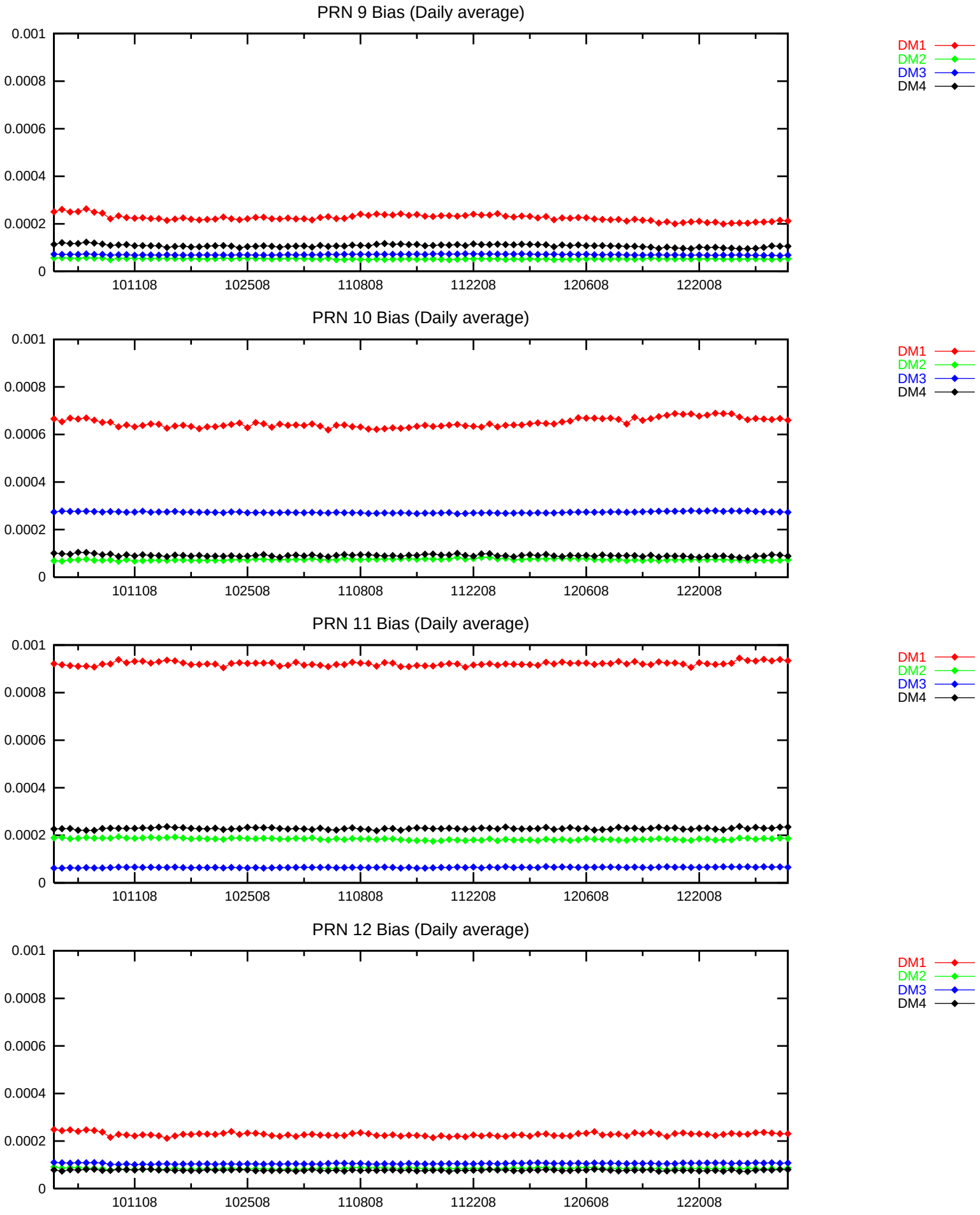


Figure 12-6 PRN Bias Average Trend (PRN 13 - PRN 16)

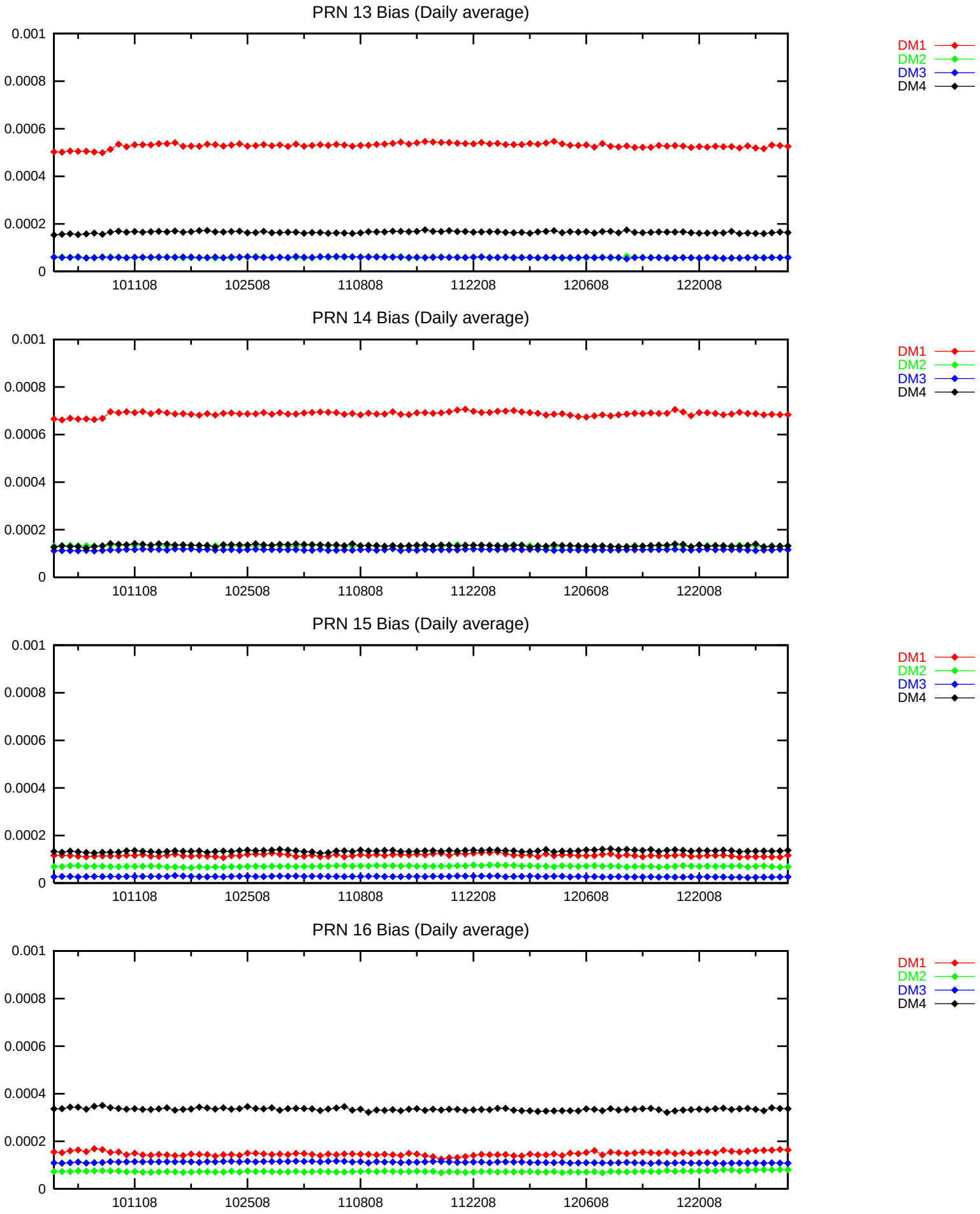


Figure 12-7 PRN Bias Average Trend (PRN 17 - PRN 20)

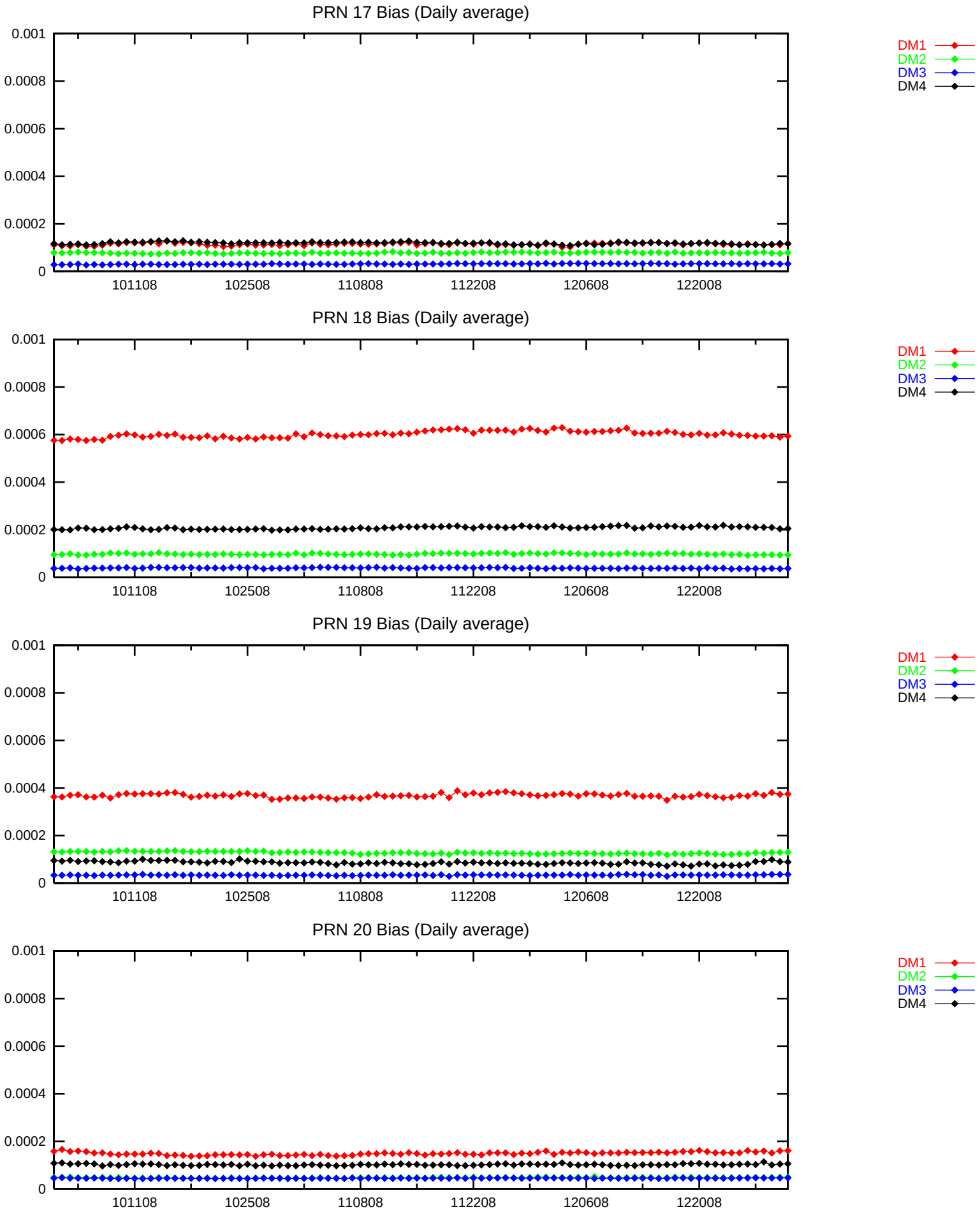


Figure 12-8 PRN Bias Average Trend (PRN 21 - PRN 24)

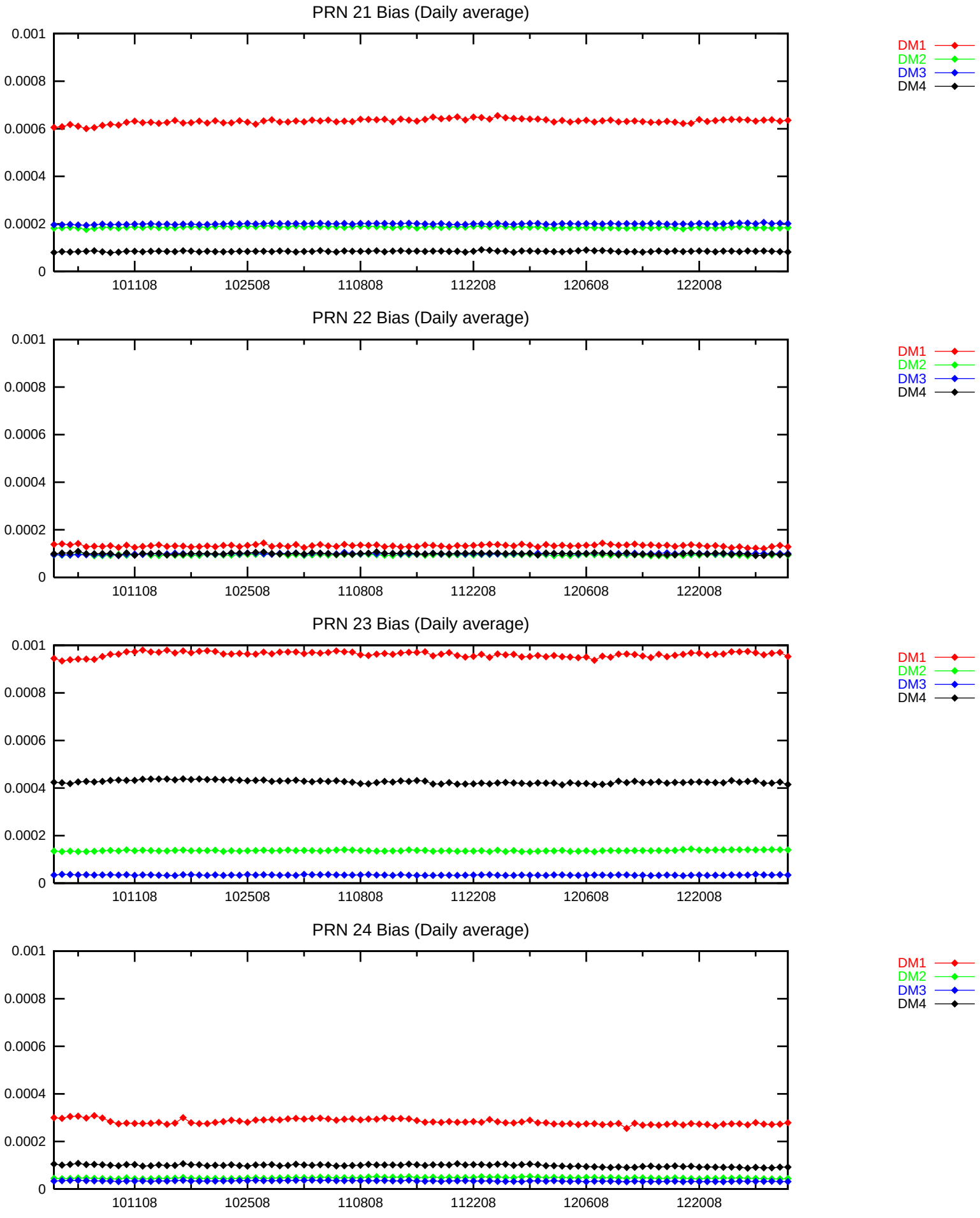


Figure 12-9 PRN Bias Average Trend (PRN 25 - PRN 28)

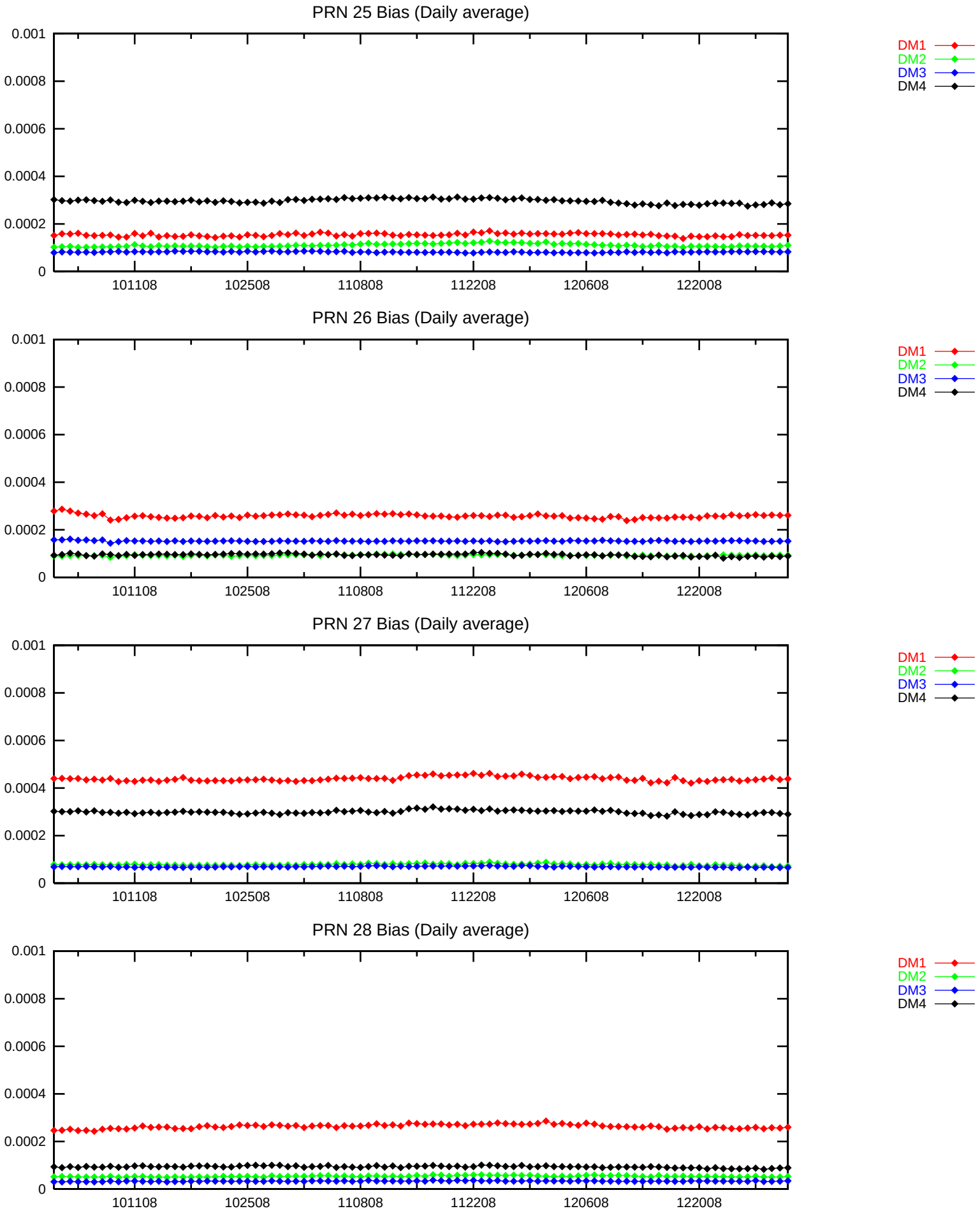
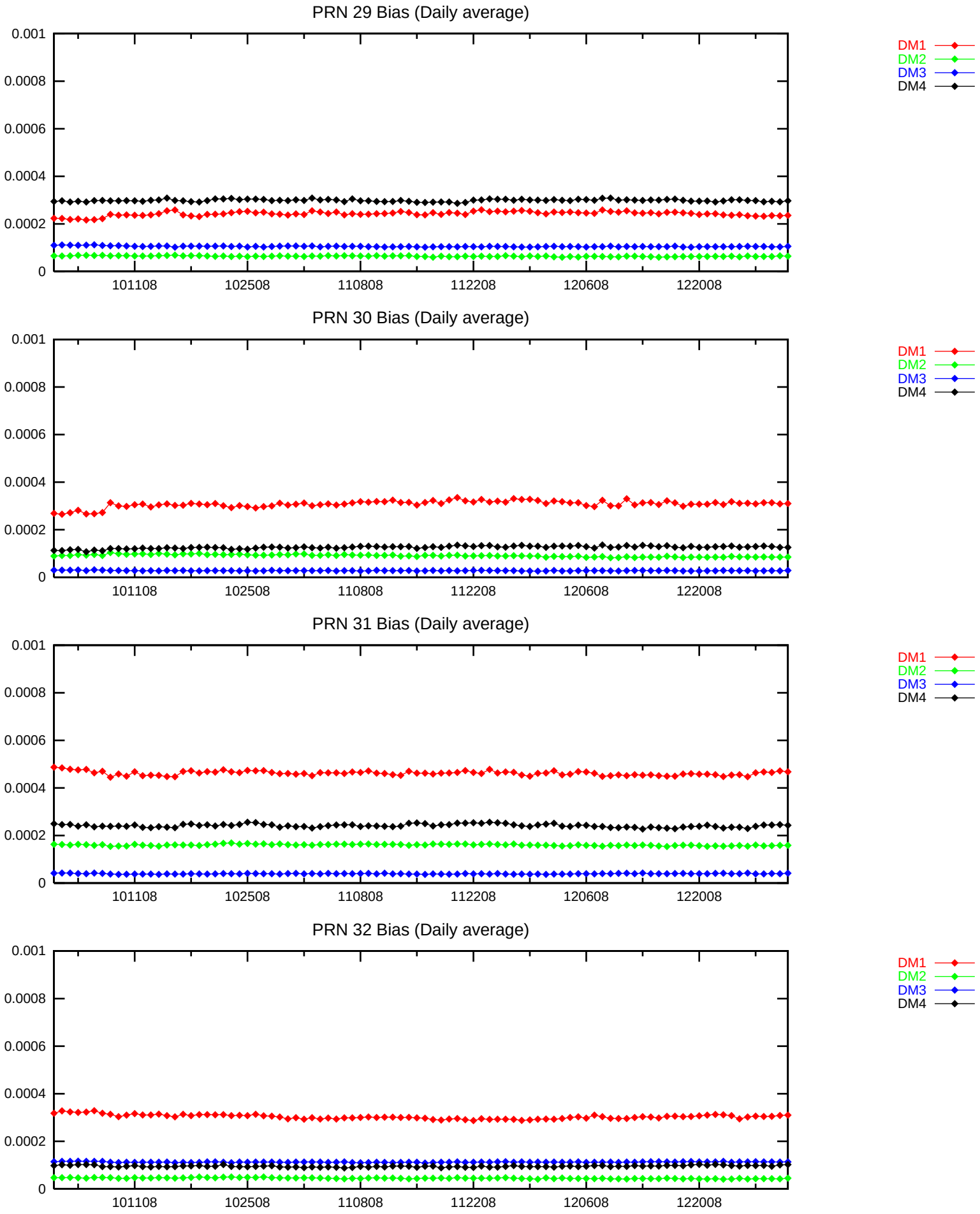


Figure 12-10 PRN Bias Average Trend (PRN 29 - PRN 32)



12.5 SQM Trips

SQM trip occurs when the estimated deformation exceeds threshold. There are no SQM trips for this quarter.

Appendix A: Glossary

General Terms and Definitions

Alert. An alert is an indication provided by the GPS/WAAS equipment to inform the user when the positioning performance achieved by the equipment does not meet the integrity requirements.

Availability. The availability of a navigation system is the ability of the system to provide the required function and performance at the initiation of the intended operation. Availability is an indication of the ability of the system to provide usable service within the specified coverage area.

CONUS. Continental United States.

Continuity. The continuity of a system is the ability of the total system (comprising all elements necessary to maintain aircraft position within the defined airspace) to perform its function without interruption during the intended operation. More specifically, continuity is the probability that the specified system performance will be maintained for the duration of a phase of operation, presuming that the system was available at the beginning of that phase of operation.

Coverage. The coverage provided by a radio navigation system is that surface area or space volume in which the signals are adequate to permit the user to determine position to a specified level of accuracy. Coverage is influenced by system geometry, signal power levels, receiver sensitivity, atmospheric noise conditions, and other factors that affect signal availability.

Dilution of Precision (DOP). The magnifying effect on GPS position error induced by mapping GPS ranging errors into position through the position solution. The DOP may be represented in any user local coordinate desired. Examples are HDOP for local horizontal, VDOP for local vertical, PDOP for all three coordinates, and TDOP for time.

DR. Discrepancy Report

Fault Detection and Exclusion (FDE). Fault detection and exclusion is a receiver processing scheme that autonomously provides integrity monitoring for the position solution, using redundant range measurements. The FDE consists of two distinct parts: fault detection and fault exclusion. The fault detection part detects the presence of an unacceptably large position error for a given mode of flight. Upon the detection, fault exclusion follows and excludes the source of the unacceptably large position error, thereby allowing navigation to return to normal performance without an interruption in service.

GEO. Geostationary Satellite.

Global Positioning System (GPS). A space-based positioning, velocity, and time system composed of space, control, and user segments. The space segment, when fully operational, will be composed of 24 satellites in six orbital planes. The control segment consists of five monitor stations, three ground antennas, and a master control station. The user segment consists of antennas and receiver-processors that provide positioning, velocity, and precise timing to the user.

Grid Ionospheric Vertical Error (GIVE). GIVEs indicate the accuracy of ionospheric vertical delay correction at a geographically defined ionospheric grid point (IGP). WAAS transmits one GIVE for each IGP in the mask.

Hazardous Misleading Information (HMI). Hazardous misleading information is any position data, that is output, that has an error larger than the current protection level (HPL/VPL), without any indication of the error (e.g., alert message sequence).

Horizontal Alert Limit (HAL). The Horizontal Alert Limit (HAL) is the radius of a circle in the horizontal plane (the local plane tangent to the WGS-84 ellipsoid), with its center being at the true position, which describes the region that is required to contain the indicated horizontal position with a probability of $1\text{-}10^{-7}$ per flight hour, for a particular

navigation mode, assuming the probability of a GPS satellite integrity failure being included in the position solution is less than or equal to 10^{-4} per hour.

Horizontal Protection Level (HPL). The Horizontal Protection Level is the radius of a circle in the horizontal plane (the plane tangent to the WGS-84 ellipsoid), with its center being at the true position, which describes the region that is assured to contain the indicated horizontal position. It is based upon the error estimates provided by WAAS.

IGS. International GPS Service.

Ionospheric Grid Point (IGP). IGP is a geographically defined point for which the WAAS provides the vertical ionospheric delay.

LNAV. Lateral Navigation.

LPV. Localizer Precision with Vertical Guidance. LPV is a WAAS operational service level with a HAL equal to 40 meters and a VAL equal to 50 meters.

LPV 200. Localizer Precision with Vertical Guidance to 200 ft decision height. LPV 200 is a WAAS operational service level with a HAL equal to 40 meters and a VAL equal to 35 meters.

MOPS. Minimum Operational Performance Standards.

Navigation Message. Message structure designed to carry navigation data.

Non-Precision Approach (NPA) Navigation Mode. The Non-Precision Approach navigation mode refers to the navigation solution operating with a minimum of four satellites with fast and long term WAAS corrections (no WAAS ionospheric corrections) available.

Position Solution. The use of ranging signal measurements and navigation data from at least four satellites to solve for three position coordinates and a time offset.

Precision Approach (PA) Navigation Mode. The Precision Approach navigation mode refers to the navigation solution operating with a minimum of four satellites with all WAAS corrections (fast, long term, and ionospheric) available.

Selective Availability. Protection technique employed by the DOD to deny full system accuracy to unauthorized users.

Signal Quality Monitor (SQM). SQM monitors correlator measurements to detect signal deformations that originate in the GPS or GEO satellites and ensures that the UDREs are sufficiently inflated to protect given the monitor's current observations.

Standard Positioning Service (SPS). Three-dimensional position and time determination capability provided to a user equipped with a minimum capability GPS SPS receiver in accordance with GPS national policy and the performance specifications.

SV. Space Vehicle.

User Differential Range Error (UDRE). UDRE's indicate the accuracy of combined fast and slow error corrections. WAAS transmits one UDRE for each satellite in the mask.

Vertical Alert Limit (VAL). The Vertical Alert Limit is half the length of a segment on the vertical axis (perpendicular to the horizontal plane of WGS-84 ellipsoid), with its center being at the true position, which describes the region that is required to contain the indicated vertical position with a probability of $1\text{-}10^{-7}$ per flight hour, for a particular navigation mode, assuming the probability of a GPS satellite integrity failure being included in the position solution is less than or equal to 10^{-4} per hour.

Vertical Protection Level (VPL). The Vertical Protection Level is half the length of a segment on the vertical axis (perpendicular to the horizontal plane of WGS-84 ellipsoid), with its center being at the true position, which describes the region that is assured to contain the indicated vertical position. It is based upon the error estimates provided by WAAS.

VNAV. Vertical Navigation.

Wide Area Augmentation System (WAAS). The WAAS is made up of an integrity reference monitoring network, processing facilities, geostationary satellites, and control facilities. Wide area reference stations and integrity monitors are widely dispersed data collection sites that contain GPS/WAAS ranging receivers that monitor all signals from the GPS, as well as the WAAS geostationary satellites. The reference stations collect measurements from the GPS and WAAS satellites so that differential corrections, ionospheric delay information, GPS/WAAS accuracy, WAAS network time, GPS time, and UTC can be determined. The wide area reference station and integrity monitor data are forwarded to the central data processing sites. These sites process the data in order to determine differential corrections, ionospheric delay information, and GPS/WAAS accuracy, as well as verify residual error bounds for each monitored satellite. The central data processing sites also generate navigation messages for the geostationary satellites and WAAS messages. This information is modulated on the GPS-like signal and broadcast to the users from geostationary satellites.

Appendix B: Additional Coverage Plots

This section includes coverage plots with 99% LPV 200 availability contour and 98% LPV availability contours for the quarter. Figure B-1 shows CONUS coverage with 98% LPV availability contour. Figure B-2 shows Alaska coverage with 98% LPV availability contour. Figure B-3 shows CONUS coverage with 99% LPV 200 availability contour. Figure B-4 shows Alaska coverage with 99% LPV 200 availability contour.

Figure B-1 98% CONUS LPV Availability Contour for the Quarter

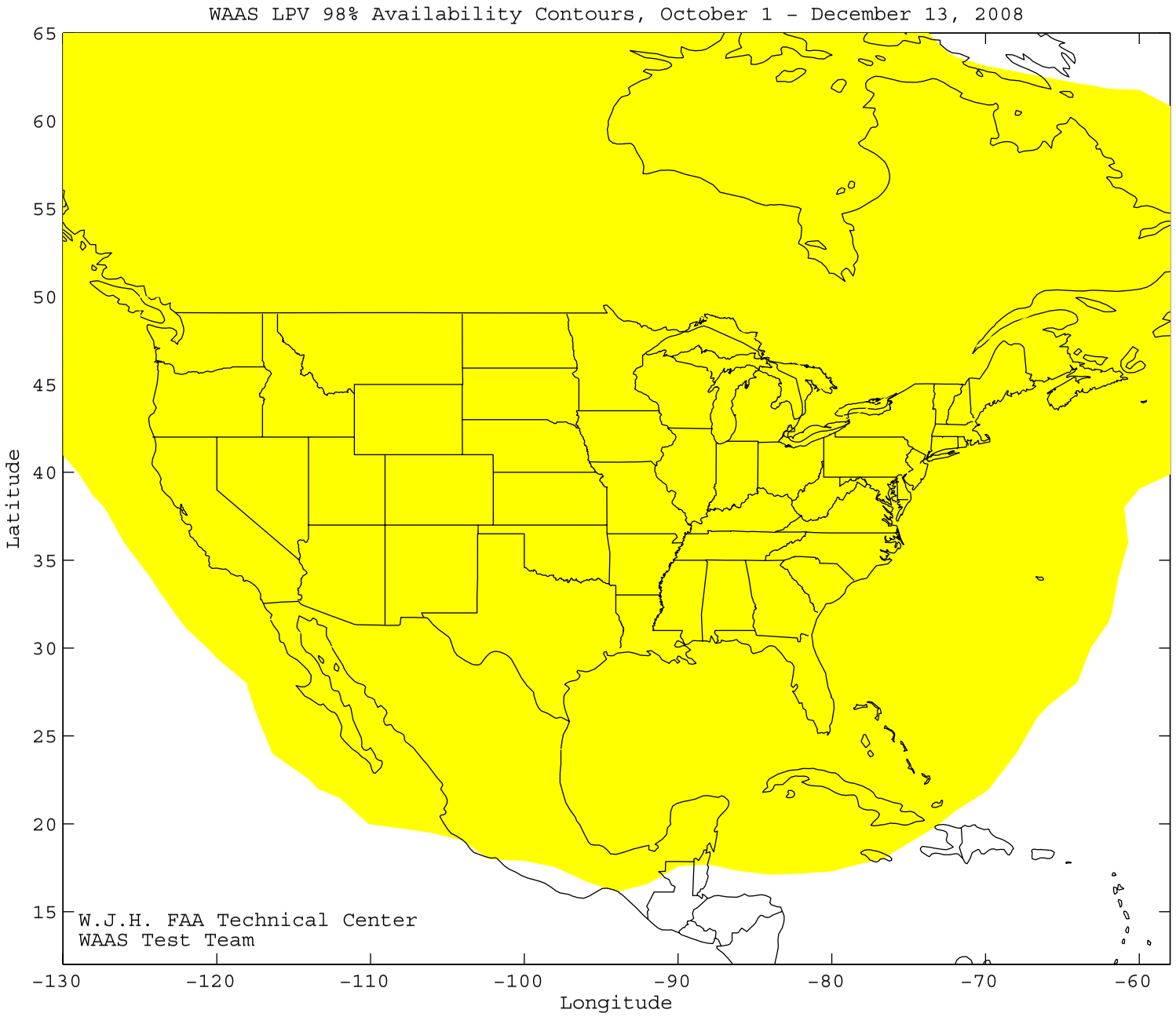
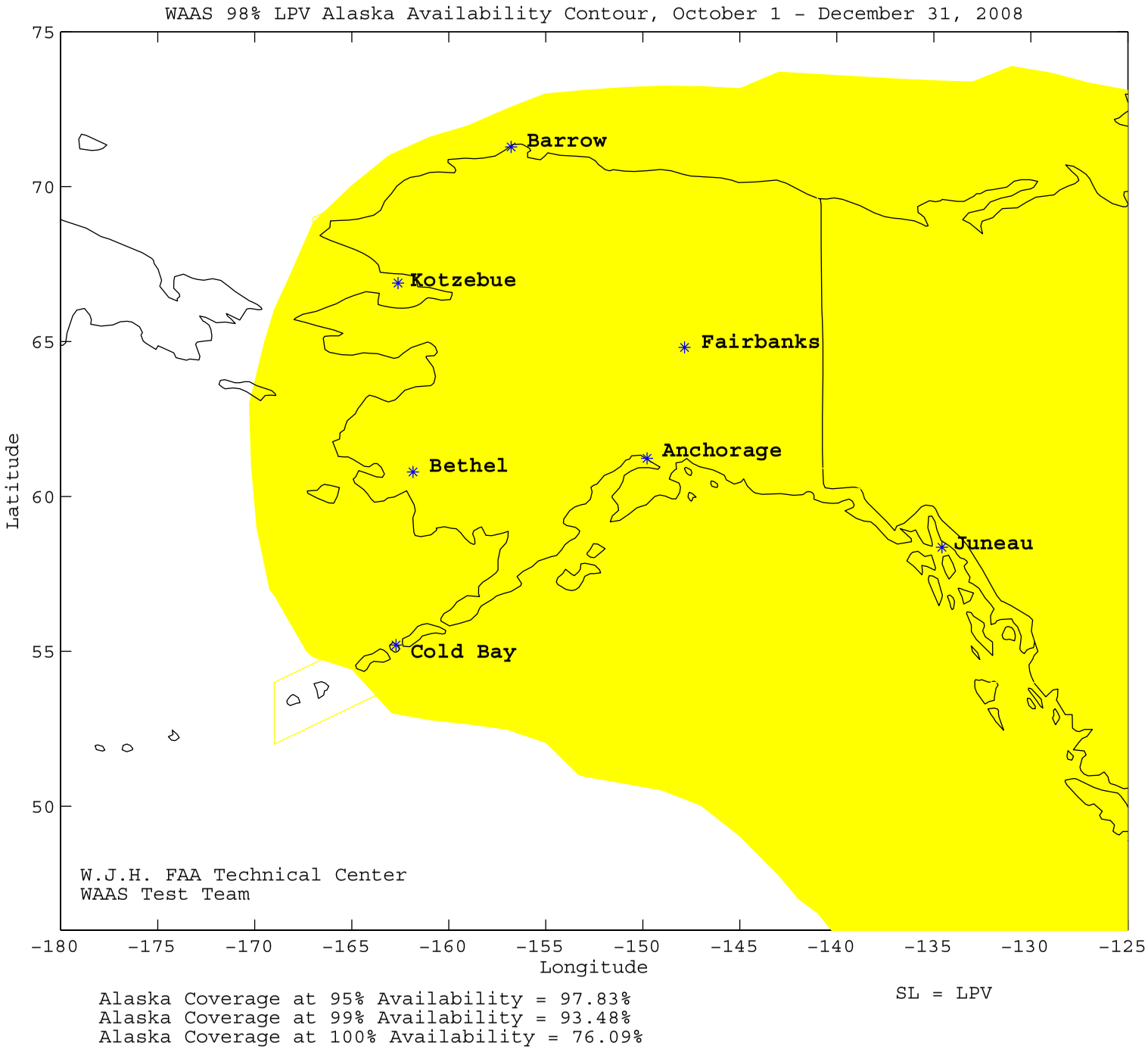


Figure B-2 98% Alaska LPV Availability Contour for the Quarter



Alaska Coverage at 95% Availability = 97.83%
Alaska Coverage at 99% Availability = 93.48%
Alaska Coverage at 100% Availability = 76.09%

Figure B-3 99% CONUS LPV 200 Availability Contour for the Quarter

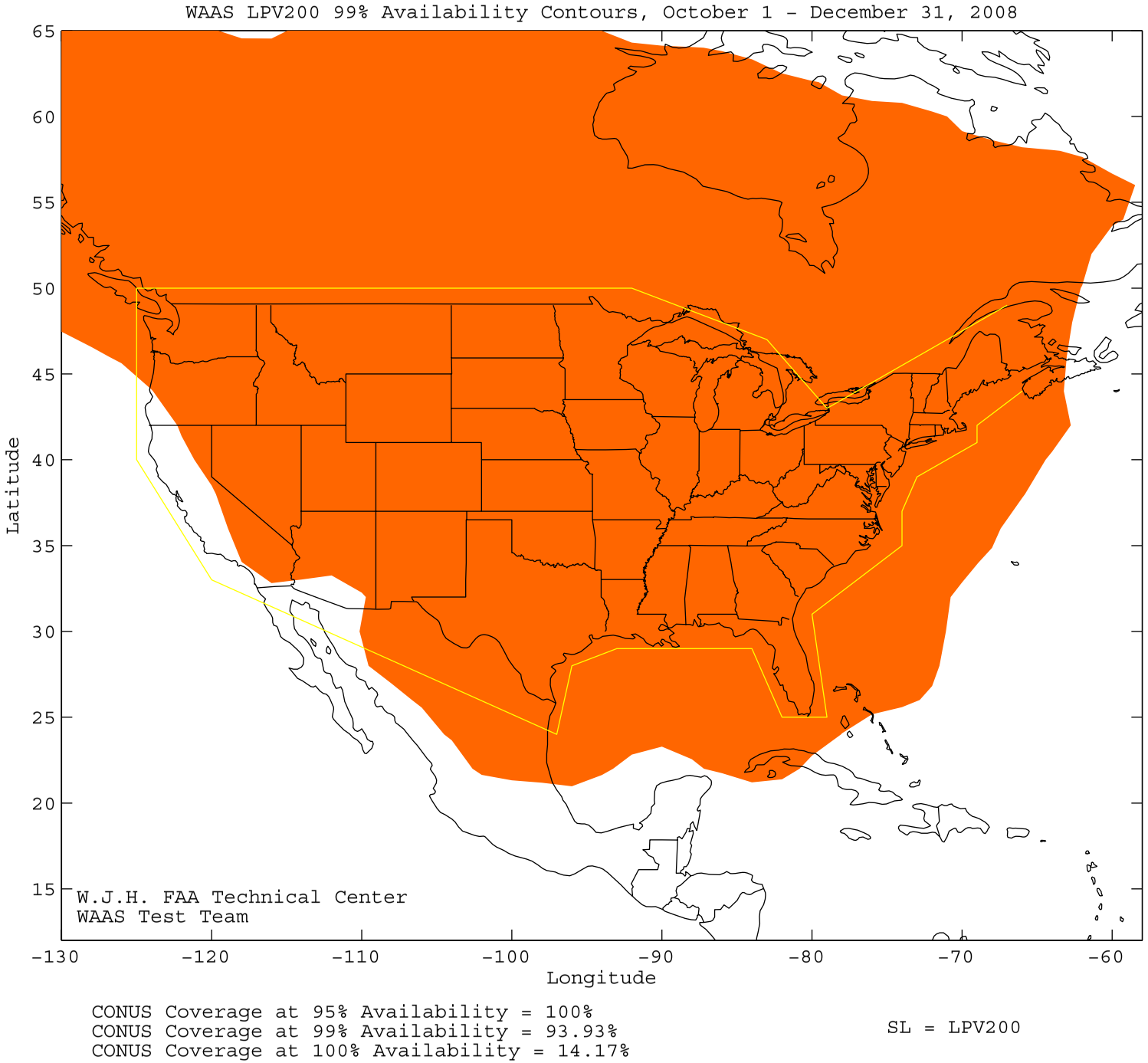
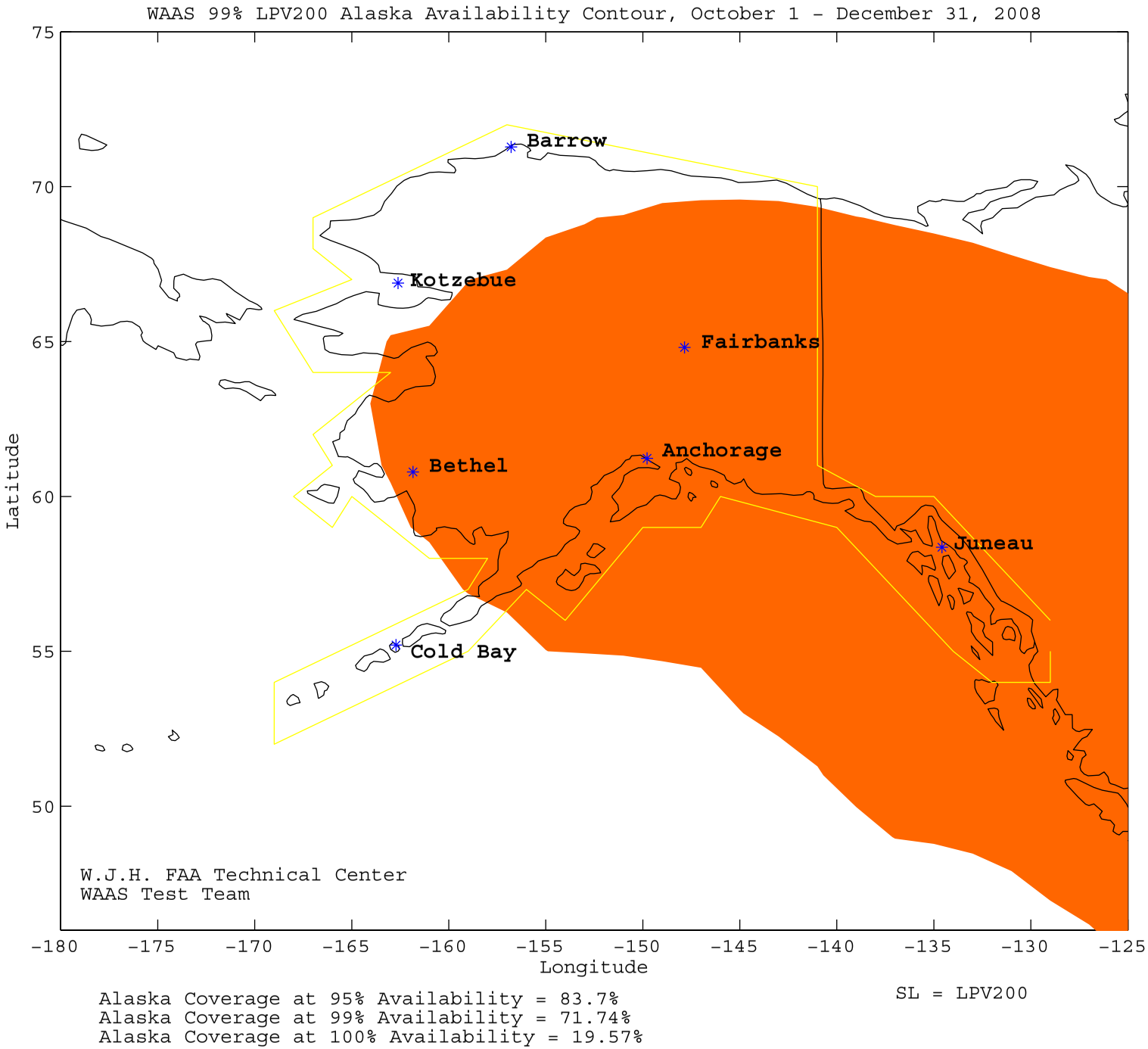


Figure B-4 99% Alaska LPV 200 Availability Contour for the Quarter



Alaska Coverage at 95% Availability = 83.7%
Alaska Coverage at 99% Availability = 71.74%
Alaska Coverage at 100% Availability = 19.57%