WIDE-AREA AUGMENTATION SYSTEM PERFORMANCE ANALYSIS REPORT

Report #24

Reporting Period: January 1 to March 31, 2008

April 2008

FAA/William J. Hughes Technical Center
NSTB/WAAS T&E Team
Atlantic City International Airport, NJ 08405

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-fourth such WAAS quarterly report. This report covers WAAS performance during the period from January1, 2008 to March 31 2008.

The following table shows observations for accuracy and availability made during the reporting period. 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 below table 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	All Sites Site/Maximum	All Sites Site/Minimum
95% Horizontal Accuracy	Atlantic City 1.193	Oklahoma City 0.634 meters	Tapachula 1.253 meters	Fairbanks 0.465 meters
95% Vertical Accuracy	Miami 1.325 meters	Salt Lake City 0.724 meters	Tapachula 1.917 meters	Salt Lake City 0.724 meters
LPV Availability (HPL < 40 meters & VPL < 50 meters)	Jacksonville 99.999%	Oakland 99.28%	Jacksonville 99.999%	Puerto Vallarta 92.58%
LPV 200 Availability (HPL < 40 meters & VPL < 35 meters)	Minneapolis 99.996%	Oakland 95.37%	Minneapolis 99.996%	Puerto Vallarta 53.36%
95% HPL	Arcata 21.332 meters	Memphis 12.36 meters	Tapachula 57.53 meters	Memphis 12.36 meters
95% VPL	Oakland 33.738 meters	Chicago 21.10 meters	Taphachula 77.09 meters	Chicago 21.10 meters

Please note the following changes to this and all future reports. LNAV/VNAV will no longer be evaluated and will be replaced by LPV 200. Specific changes will be made to sections 2, 3, 4 where LNAV/VNAV accuracy, coverage and availability will be replaced by LPV 200 accuracy, coverage and availability, respectively. Additionally, two new sections will be added to the PAN report. These sections will include Section 12 – SQM performance and Section 13 – IGS SPS accuracy performance.

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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. Currently both CRW and CRE GEOs provide a ranging capability for enroute through NPA service, but not for 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 January 1, 2008 to March 31, 2008

Table 1-1 PA Sites

	Number of Days Evaluated	Number of Samples
NSTB:		
Arcata	86	7404552
Atlantic City	88	7624641
Oklahoma City	89	7705052
WAAS:		
Albuquerque	91	7837285
Anchorage	91	7836480
Atlanta	91	7839391
Barrow	90	7790855
Bethel	90	7804342
Billings	90	7758652
Boston	91	7840234
Chicago	91	7836986
Cleveland	91	7840928
Cold Bay	90	7778769
Dallas	91	7837404
Denver	91	7827011
Fairbanks	90	7800570
Gander	90	7752122
Goose Bay	89	7709778
Houston	89	7691250
Iqaluit	89	7723848
Jacksonville	91	7841787
Juneau	90	7739756
Kansas City	91	7837352
Kotzebue	90	7807115
Los Angeles	91	7839371
Memphis	91	7842448
Merida	91	7836141
Mexico City	91	7839640
Miami	91	7838597
Minneapolis	91	7841180
New York	90	7755990
Oakland	91	7840238
Puerto Vallarta	91	7834139
Salt Lake City	91	7832246
San Jose Del Cabo	91	7829079
Seattle	91	7828538
Tapachula	90	7806209
Washington DC	91	7840378
Winnipeg	91	7836462

Table 1-2 NPA Sites

Location	Number of Days Evaluated	Number of Samples
Albuquerque	89	7757798
Anchorage	90	7818105
Atlanta	90	7806108
Barrow	90	7889598
Bethel	82	7143873
Billings	90	7800919
Boston	89	7763311
Cleveland	90	7813020
Cold Bay	89	7753025
Fairbanks	89	7721328
Gander	89	7763159
Honolulu	88	7602260
Houston	88	7654638
Iqaluit	89	7707491
Juneau	89	7727102
Kansas City	90	7778073
Kotzebue	89	7756562
Los Angeles	90	7800526
Merida	83	7213638
Miami	90	7824900
Minneapolis	90	7800327
Oakland	90	7814797
Salt Lake City	90	7786679
San Jose Del Cabo	83	7187795
San Juan	90	7774239
Seattle	90	7802552
Tapachula	72	6230434
Washington DC	90	7774077

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

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
1460 day 3	1/2/08	All Sites	Per NANU 2008001, SV PRN 29 available as of 2041 Zulu.
1460 day 6 to 1461 day 2	1/5/08 to 1/8/08	Arcata	Arcata data outage.
1461 day 3	1/9/08	ZAU TCS Comm Node Sites	ZAU TCS Comm Node outage.
1461 day 3	1/9/08	Oklahoma City	Oklahoma City data outage.
1462 day 0	1/13/08	All WAAS Sites	WEI outage.
1462 day 2 to 1462 day 5	1/15/08 to 1/18/08	Honolulu	Honolulu data outage.
1462 day 3	1/16/08	All WAAS Sites	WEI outage.
1462 day 5	1/18/08	Arcata	Arcata data outage.
1463 day 0	1/20/08	Atlantic City	Atlantic City data outage.
1463 day 0	1/20/08	New York	New York data outage.
1463 day 1 to 1463 day 2	1/21/08 to 1/22/08	Atlantic City	Atlantic City data outage.
1463 day 2	1/22/08	Arcata	Arcata data outage.
1463 day 2	1/22/08	Oklahoma City	Oklahoma City data outage.
1466 day 3	2/13/08	ZLA & ZTL TCS Comm Node Sites	ZLA & ZTL TCS Comm Node outage.
1467 day 0	2/17/08	All Alaska Sites	See DR# 69, "Alaska Communications Outage Caused Loss of Alaska LPV Service."
1467 day 6	2/23/08	All WAAS Sites	WEI outage.
1468 day 1	2/25/08	All WAAS Sites	WEI outage.
1468 day 1	2/25/08	All Mexico Sites	Mexico City TCS Comm Node outage.
1468 day 2	2/26/08	All Sites	Per NANU 2008024, SV PRN 32 usable.
1468 day 4	2/28/08	Several Alaska Sites	See DR# 67, "GIVE Monitor Trips Set IGPs to Storm State in Alaska Region."
1469 day 4	3/6/08	All Sites	WAAS Release 8/9.1 deployment complete.
1469 day 6	3/8/08	Several Alaska Sites	Several IGP's went to storm state, causing loss of LPV service in northern Alaska.
1470 day 0	3/9/08	Several Alaska Sites	One IGP went to storm state, causing loss of LPV service in Western, Northern, and Central Alaska.
1470 day 3	3/12/08	All Sites	See DR# 70, "Selected C&V Source Switch Followed By Geo Initialization Caused Loss of LPV and NPA Service."
1471 day 1	3/17/08	All Sites	Per NANU 2008030, SV PRN 1 decommissioned.
1471 day 1	3/17/08	Houston	Houston data outage.
1471 day 2	3/18/08	All WAAS Sites	WEI outage.
1471 day 2 to 1471 day 3	3/18/08 to 3/19/08	Houston, Goose Bay	Houston & Goose Bay data outage.
1471 day 3	3/19/08	Juneau	Juneau data outage.
1472 day 1	3/24/08	All Sites	Per NANU 2008024, SV PRN 7 usable.
1472 day 5	3/28/08	Several Sites	See DR# 71, "Inconsistent Tracking of SV PRN 10 Following NANU 2008036 Caused Elevated UDRE's."
1473 day 1 to 1473 day 2	3/31/08 to 4/1/08	Arcata	Arcata data outage.

1.2 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 three receivers 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. Monthly 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 in Atlanta.

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.

Section 13 summarizes the GPS IGS SPS accuracy performance. It provides the 95% and 99.99% vertical and horizontal accuracy from data at a selection of high rate IGS stations.

Please note the following changes to this and all future reports. LNAV/VNAV is no longer be evaluated and is replaced by LPV 200. Specific changes are be made to sections 2, 3, 4 where LNAV/VNAV accuracy, coverage and availability are be replaced by LPV 200 accuracy, coverage and availability, respectively. Additionally, two new sections are be added to the PAN report. These sections include Section 12 and 13.

2.0 <u>WAAS POSITION ACCURACY</u>

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 all evaluated sites are less than 2 meters for both WAAS operational service levels. The maximum 95% horizontal and vertical LPV errors are 1.253 meters and 1.917 meters, both at Tapachula, respectively. The minimum 95% horizontal and vertical LPV errors are 0.465 meters at Fairbanks and 0.724 meters at Salt Lake City. The maximum 95% and 99.999% NPA horizontal errors are 2.608 meters at Hononulu and 8.108 meters at Minneapolis, respectively. The minimum 95% and 99.999% horizontal errors are 0.903 meters at Iqaluit and 2.130 meters at Kansas City.

Currently, both CRE and CRW GEO satellites provide a ranging capability for enroute through NPA service, but not for 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 2.17 show the distributions of the vertical and horizontal errors in triangle charts and 2-D histogram plots for the quarter at three locations, Kansas City, Washington DC and Seattle. The triangle charts 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 horizontal lines at various protection levels represent the various operational service levels as defined in Table 2.1. The 2-D histogram plots contain four histograms showing the distributions of vertical and horizontal position errors and normalized position errors. The left top and bottom histograms show 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 right top and bottom histograms 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)
Atlantic City	1.193	1.193	1.215	99.99738	*	*
Arcata	0.852	0.852	0.912	99.99603	*	*
Oklahoma City	0.664	0.664	1.009	99.99695	*	*
Albuquerque	0.643	0.643	0.757	99.99712	2.233	4.038
Anchorage	0.505	0.506	0.772	99.96967	*	*
Atlanta	0.717	0.717	0.990	99.99814	2.439	4.552
Barrow	0.608	0.611	1.428	99.98066	*	*
Bethel	0.524	0.524	0.789	99.99728	1.960	4.897
Billings	0.706	0.706	0.857	99.99710	2.277	4.205
Boston	0.718	0.718	0.831	99.99614	2.470	4.253
Chicago	0.735	0.735	0.791	99.99652	*	*
Cleveland	0.719	0.719	0.813	99.99636	2.502	4.334
Cold Bay	0.843	0.845	0.996	99.99654	*	*
Dallas	0.665	0.665	1.107	99.99698	*	*
Denver	0.665	0.665	0.824	99.99712	*	*
Fairbanks	0.465	0.465	0.919	99.99838	1.823	4.893
Gander	0.895	0.897	0.961	99.96394	*	*
Goose Bay	0.662	0.663	1.079	99.96368	*	*
Houston	0.691	0.691	1.224	99.99693	2.256	4.264
Iqaluit	0.733	0.736	1.641	99.96634	*	*
Jacksonville	0.707	0.707	1.234	99.99974	*	*
Juneau	0.580	0.580	0.960	99.99775	*	*
Kansas City	0.734	0.734	0.809	99.99670	2.407	4.414
Kotzebue	0.523	0.524	1.065	99.98108	1.856	4.946
Los Angeles	0.703	0.703	0.993	99.99729	2.218	4.651
Memphis	0.682	0.682	0.889	99.99670	*	*
Merida	0.812	0.812	1.239	99.99672	*	*
Mexico City	0.986	0.985	1.306	99.99700	*	*
Miami	0.764	0.764	1.325	99.99636	2.302	4.558
Minneapolis	0.689	0.689	0.846	99.99670	2.360	4.272
New York	0.743	0.743	0.871	99.99480	*	*
Oakland	0.678	0.678	0.945	99.99753	2.207	4.813
Puerto Vallarta	0.949	0.964	1.810	99.99714	*	*
Salt Lake City	0.659	0.659	0.724	99.99729	2.301	4.296
San Jose Del Cabo	0.910	0.914	1.829	99.99729	*	*
Seattle	0.879	0.880	0.801	99.99752	2.342	4.636
Tapachula	1.253	1.272	1.917	98.71394	*	*
Washington DC	0.721	0.721	0.822	99.99355	2.520	4.515
Winnipeg	0.719	0.719	1.070	99.99670	*	*

* 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	1.027	3.371	99.999100	3.496
Anchorage	1.073	2.562	99.999028	3.131
Atlanta	1.285	2.816	99.999028	2.927
Barrow	1.005	2.358	99.993265	9.543
Bethel	1.130	2.307	99.998921	2.440
Billings	1.271	2.236	99.998951	2.707
Boston	1.341	2.695	99.999022	2.587
Cleveland	1.334	2.348	99.999028	2.830
Cold Bay	1.374	2.220	99.999046	2.556
Fairbanks	0.990	2.963	99.999017	4.963
Gander	1.439	3.113	99.987489	3.353
Honolulu	2.608	6.065	99.998498	6.432
Houston	1.175	3.717	99.999088	3.917
Iqaluit	0.903	2.747	99.988478	7.989
Juneau	1.044	3.091	99.999005	3.628
Kansas City	1.248	2.130	99.998945	2.304
Kotzebue	1.006	2.747	99.993318	6.085
Los Angeles	1.034	3.464	99.999100	3.828
Merida	1.538	4.972	99.998987	5.174
Miami	1.142	3.183	99.999106	7.262
Minneapolis	1.298	8.108	99.998951	8.566
Oakland	1.080	3.361	99.999106	3.558
Salt Lake City	1.222	2.841	99.998945	3.151
San Jose Del Cabo	1.526	8.917	99.998987	9.224
San Juan	1.195	4.403	99.999034	9.435
Seattle	1.307	2.638	99.998951	3.081
Tapachula	2.184	7.865	99.998766	8.049
Washington DC	1.368	2.233	99.999022	2.366

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	3.581	0.195	0.195	5.386	0.132	0.233
Atlantic City	1.877	0.053	0.141	3.315	0.198	0.198
Oklahoma City	2.633	0.148	0.200	3.327	0.139	0.200
Albuquerque	2.065	0.073	0.136	2.855	0.084	0.107
Anchorage	2.978	0.157	0.157	2.772	0.070	0.089
Atlanta	1.753	0.125	0.150	2.646	0.080	0.143
Aurora	1.505	0.103	0.134	3.128	0.171	0.171
Barrow	4.686	0.247	0.261	6.510	0.236	0.236
Bethel	1.476	0.064	0.086	3.164	0.067	0.095
Billings	1.520	0.113	0.114	2.369	0.106	0.119
Boston	2.005	0.142	0.145	2.916	0.166	0.166
Cleveland	2.134	0.122	0.152	3.781	0.209	0.209
Cold Bay	2.257	0.080	0.106	2.807	0.060	0.097
Dallas	2.324	0.120	0.131	3.655	0.132	0.157
Denver	2.567	0.109	0.156	3.705	0.231	0.205
Fairbanks	4.100	0.127	0.197	4.376	0.093	0.135
Gander	2.181	0.068	0.118	3.324	0.132	0.132
Goose Bay	1.998	0.089	0.118	2.793	0.082	0.116
Houston	1.458	0.077	0.134	3.522	0.112	0.153
Iqaluit	4.449	0.182	0.189	5.813	0.147	0.203
Jacksonville	1.584	0.094	0.140	2.929	0.151	0.167
Juneau	1.660	0.100	0.135	3.620	0.079	0.145
Kansas City	1.588	0.096	0.148	2.100	0.079	0.118
Kotzebue	3.614	0.242	0.242	5.145	0.119	0.137
Los Angeles	1.692	0.146	0.146	3.581	0.152	0.152
Memphis	1.571	0.137	0.137	4.800	0.194	0.194
Merida	2.560	0.094	0.177	3.961	0.113	0.113
Mexico City	3.427	0.192	0.192	4.080	0.090	0.113
Miami	1.703	0.125	0.129	3.329	0.139	0.156
Minneapolis	3.768	0.296	0.296	4.223	0.196	0.216
New York	1.610	0.116	0.137	3.152	0.186	0.186
Oakland	1.817	0.069	0.103	3.443	0.129	0.129
Puerto Rico	2.329	0.059	0.092	4.469	0.095	0.120
Puerto Vallarta	4.428	0.142	0.195	4.414	0.104	0.140
Salt Lake City	2.534	0.069	0.132	3.163	0.085	0.129
San Jose Del Cabo	4.765	0.146	0.204	3.801	0.101	0.137
Seattle	2.674	0.167	0.167	4.273	0.207	0.208
Tapachula	4.381	0.199	0.199	7.347	0.166	0.166
Washington DC	1.531	0.130	0.133	3.209	0.195	0.195
Winnipeg	1.825	0.135	0.138	3.281	0.164	0.164

Figure 2-1 95% Horizontal Accuracy at LPV

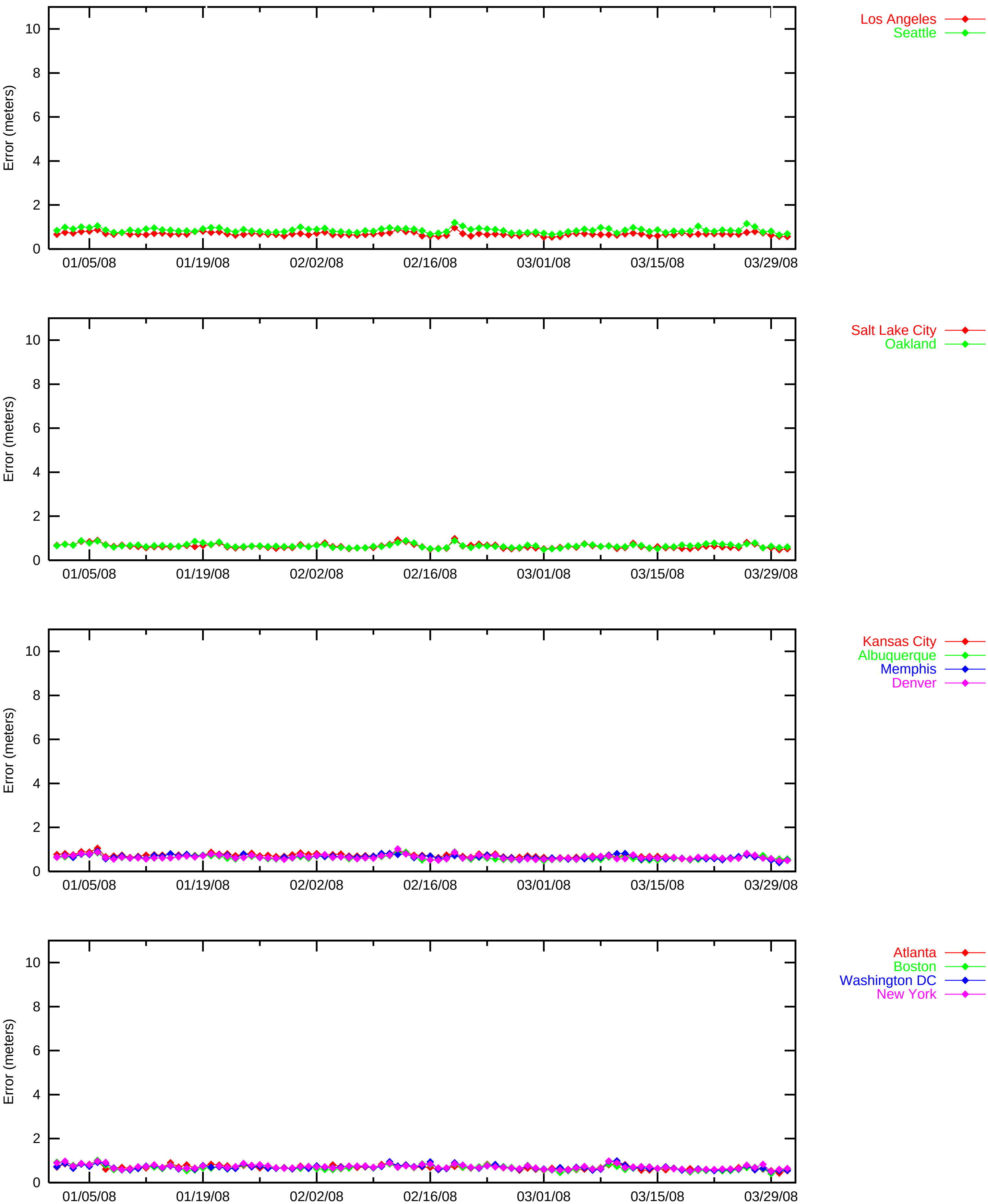


Figure 2-2 95% Horizontal Accuracy at LPV

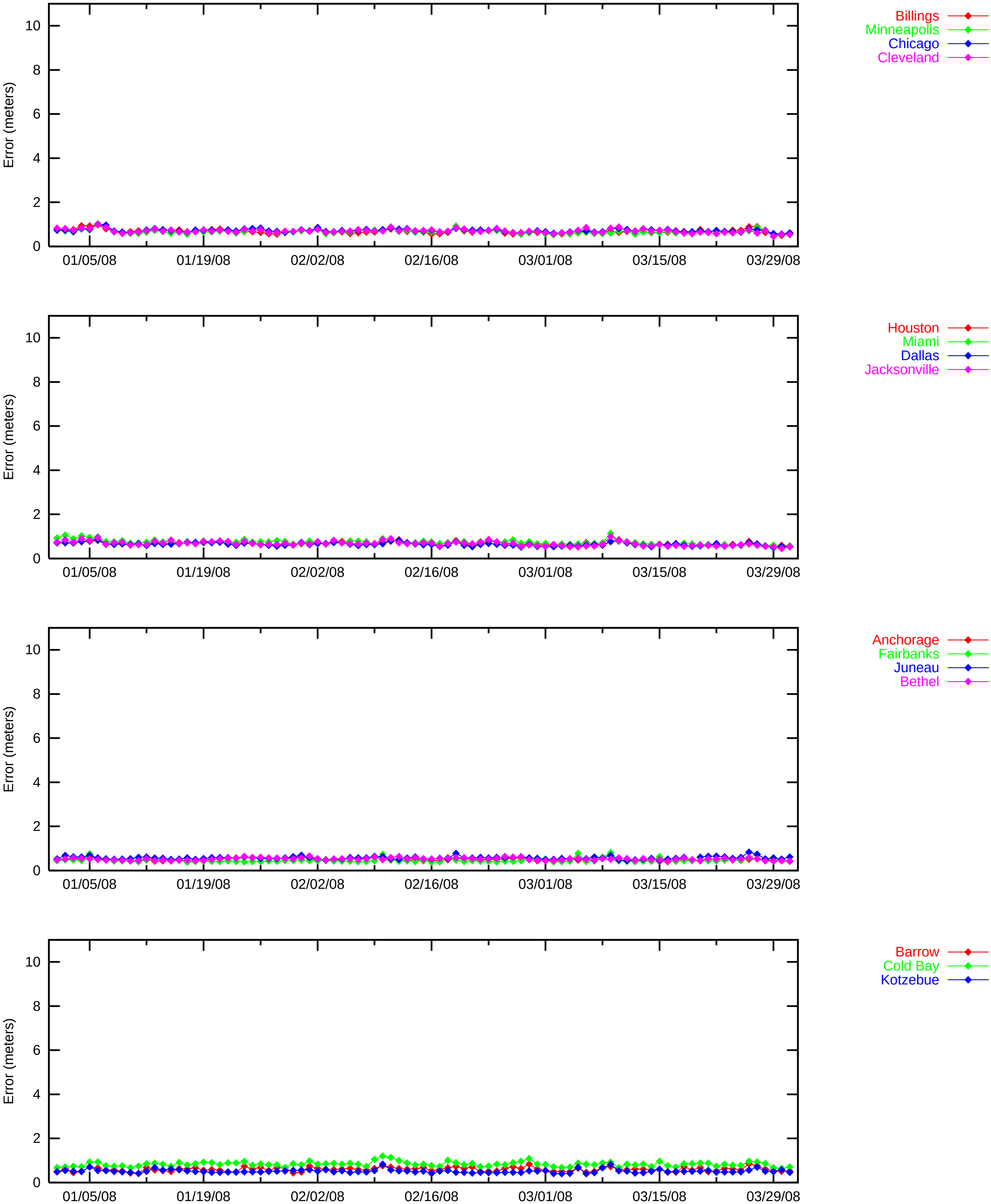


Figure 2-3 95% Horizontal Accuracy at LPV

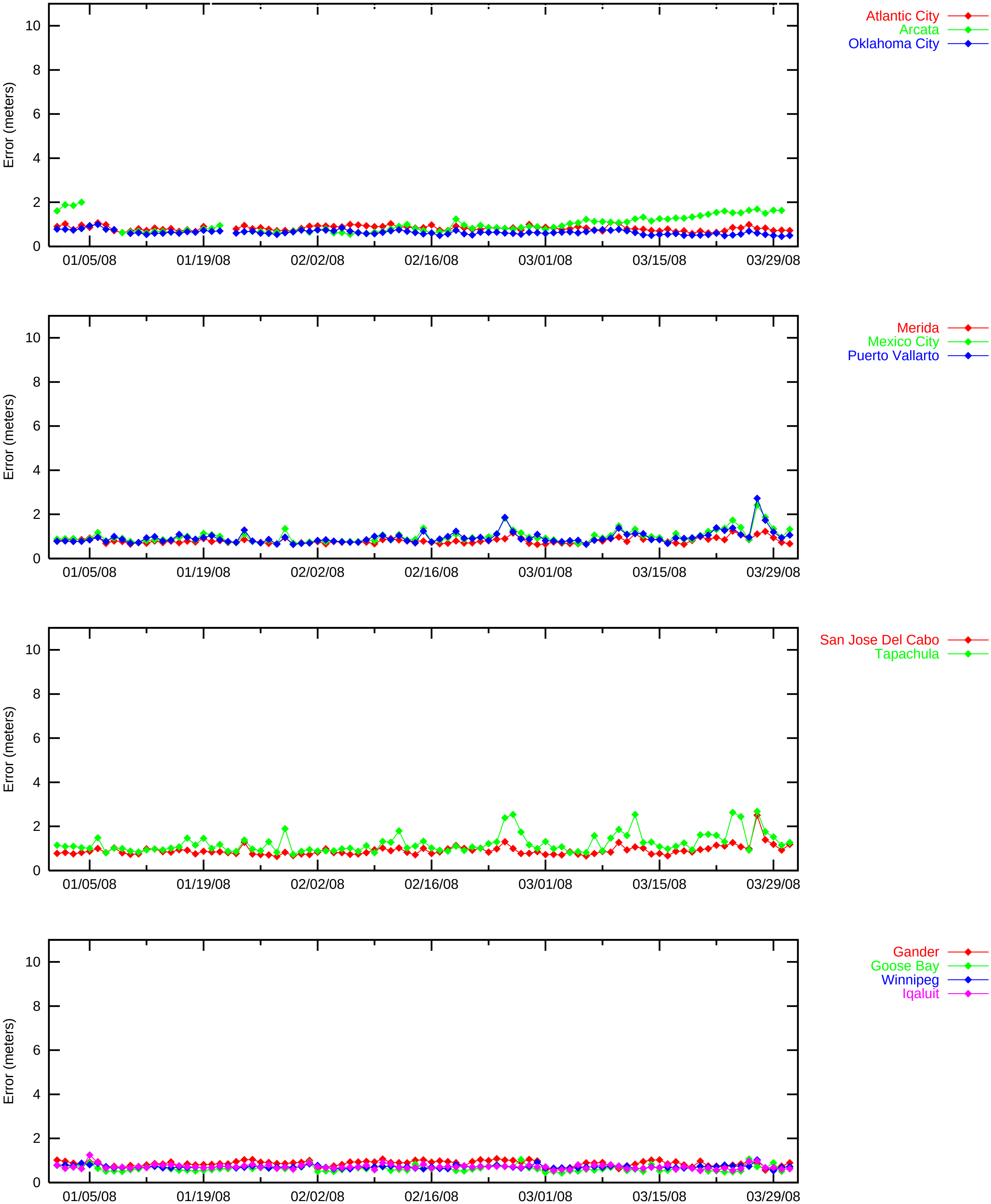


Figure 2-4 95% Vertical Accuracy at LPV

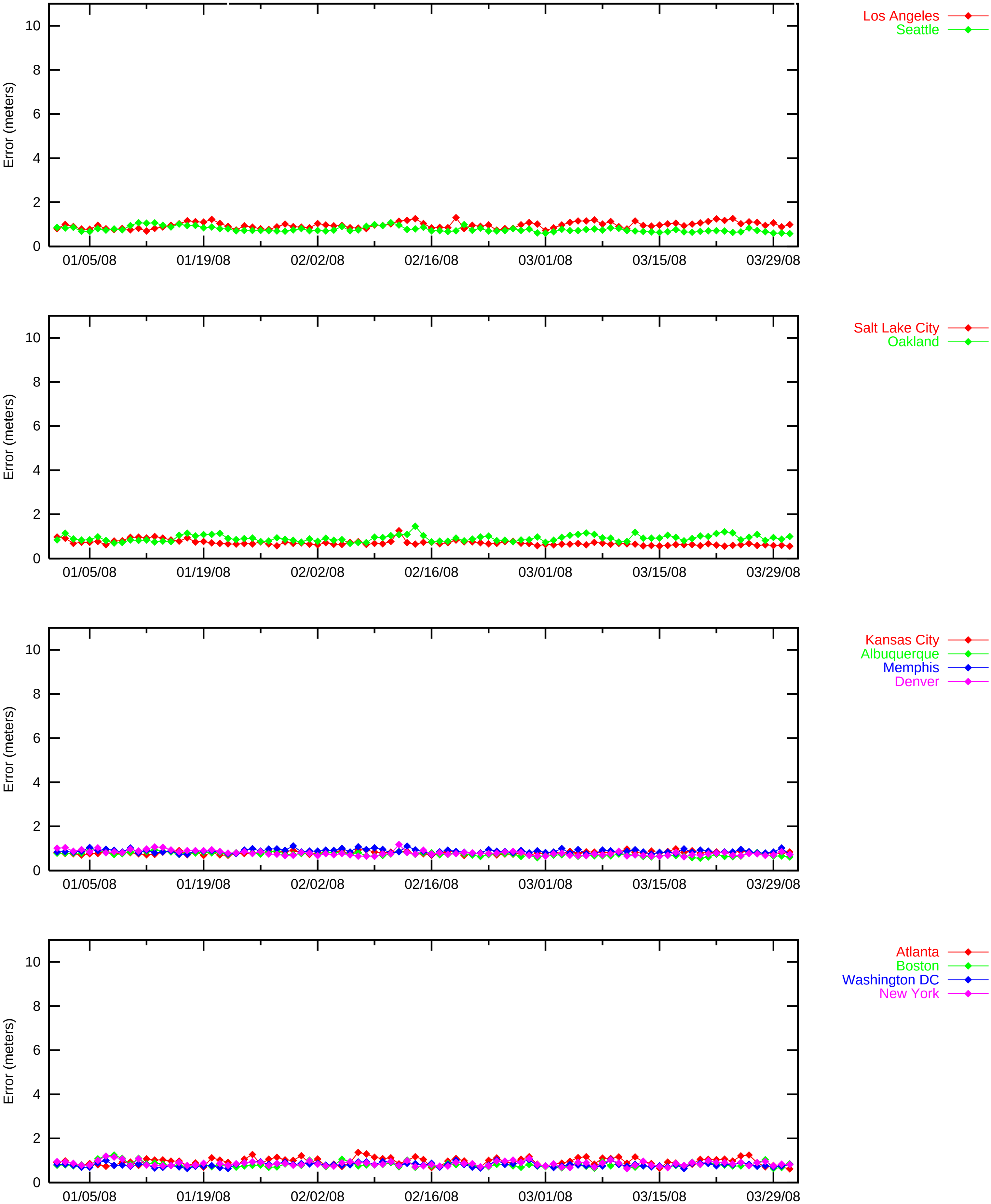


Figure 2-5 95% Vertical Accuracy at LPV

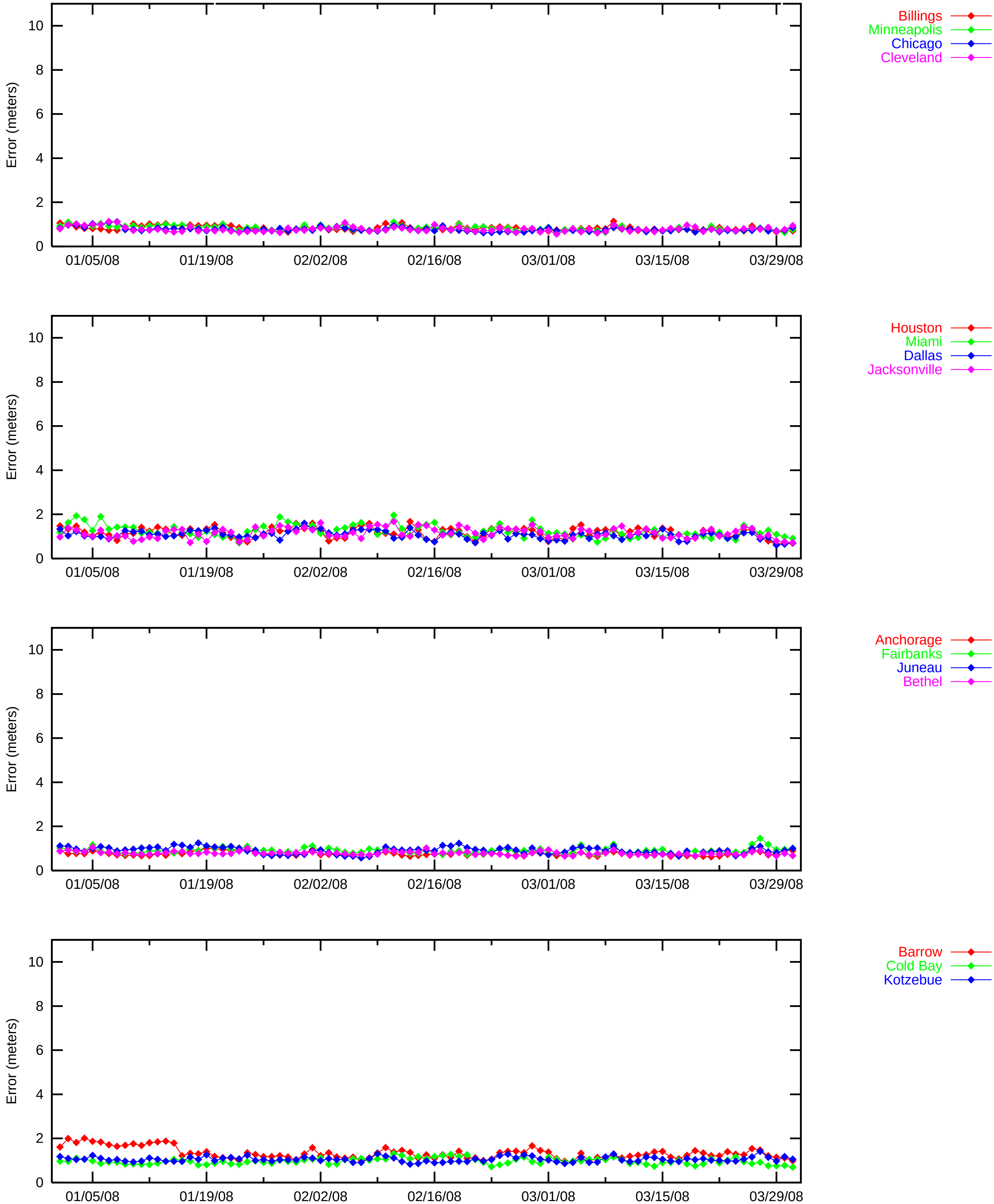


Figure 2-6 95% Vertical Accuracy at LPV

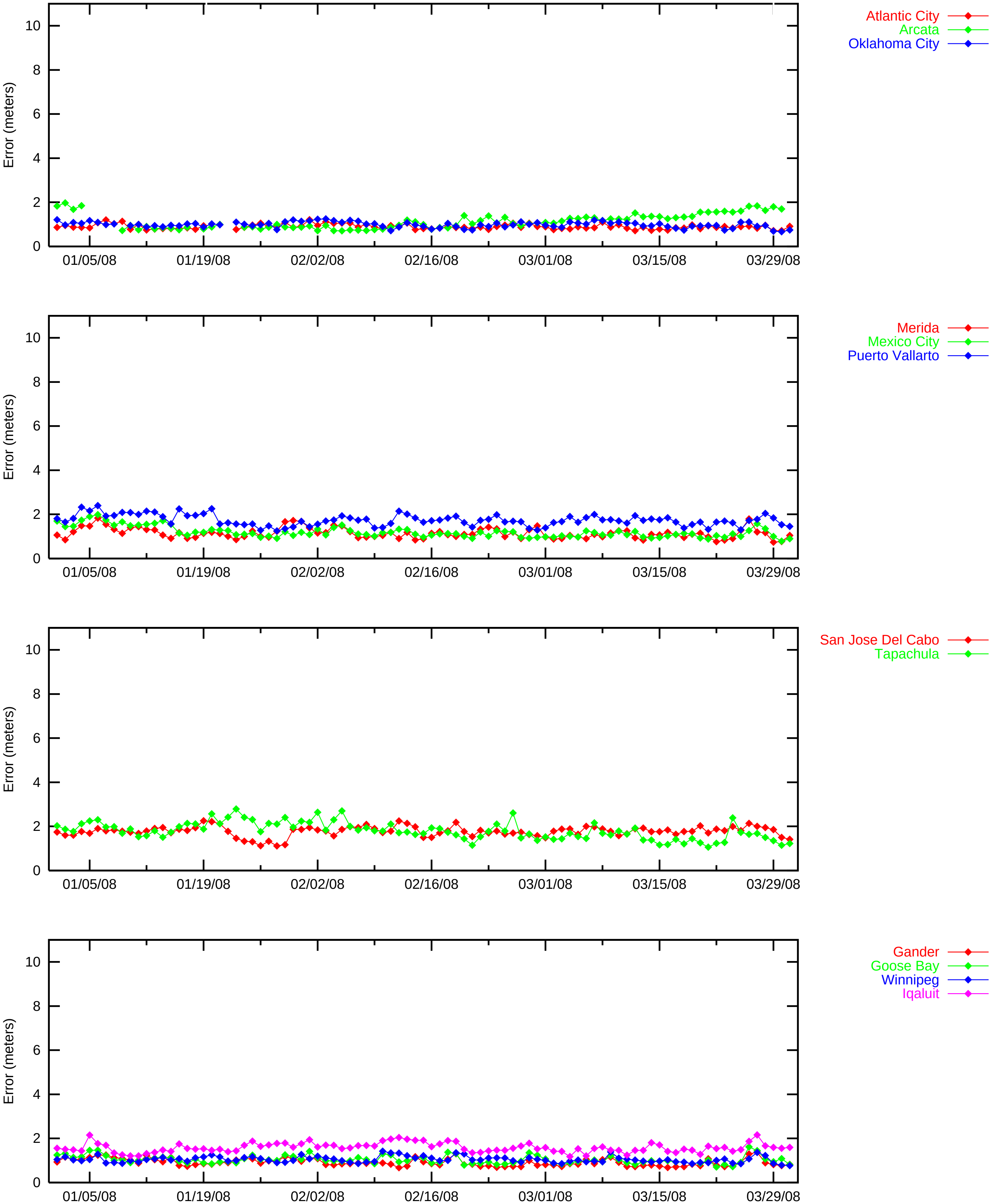
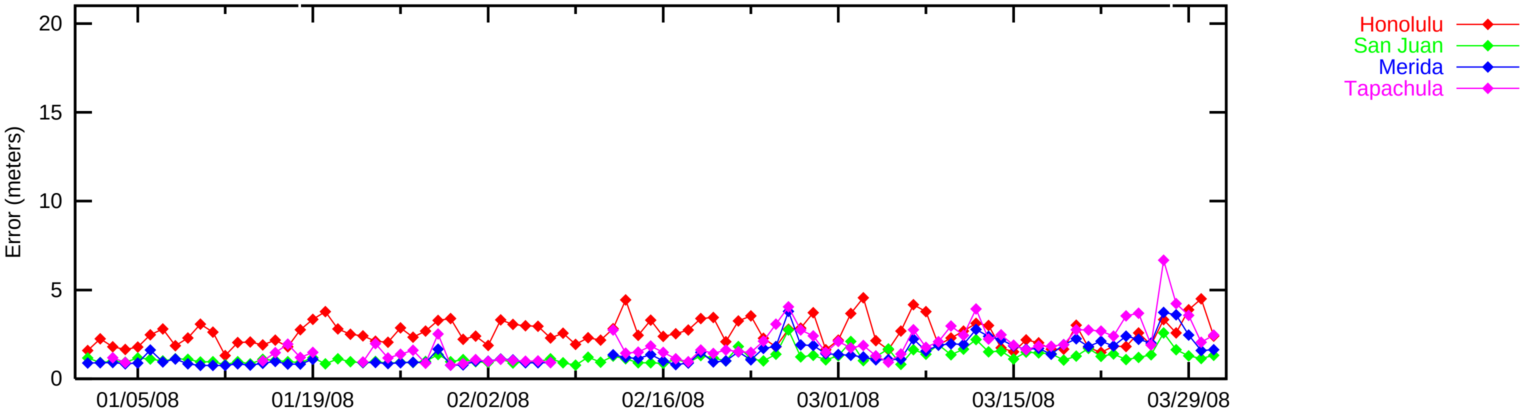
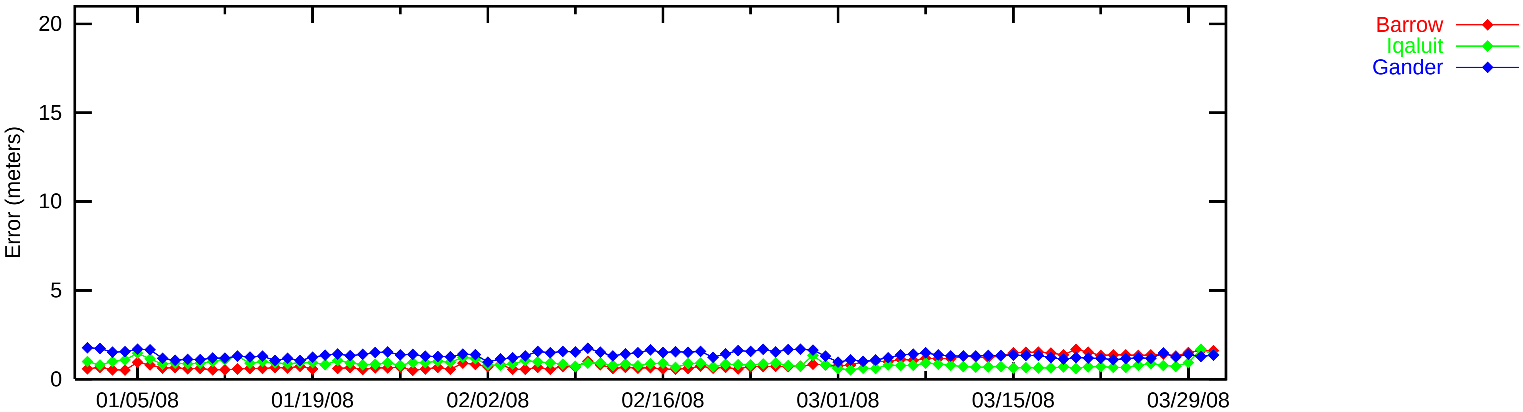
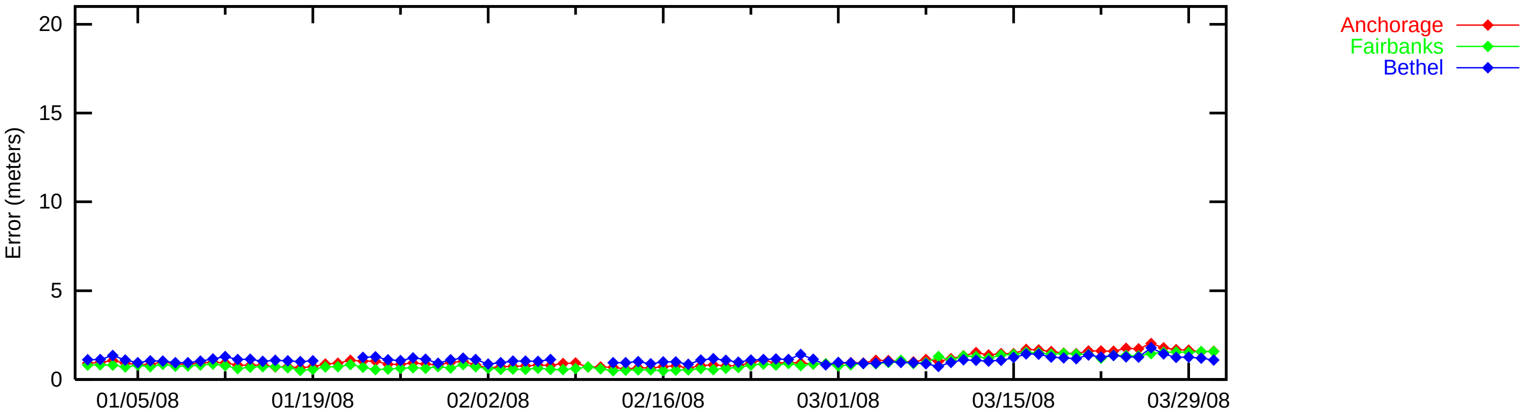


Figure 2-7 95% NPA Horizontal Accuracy







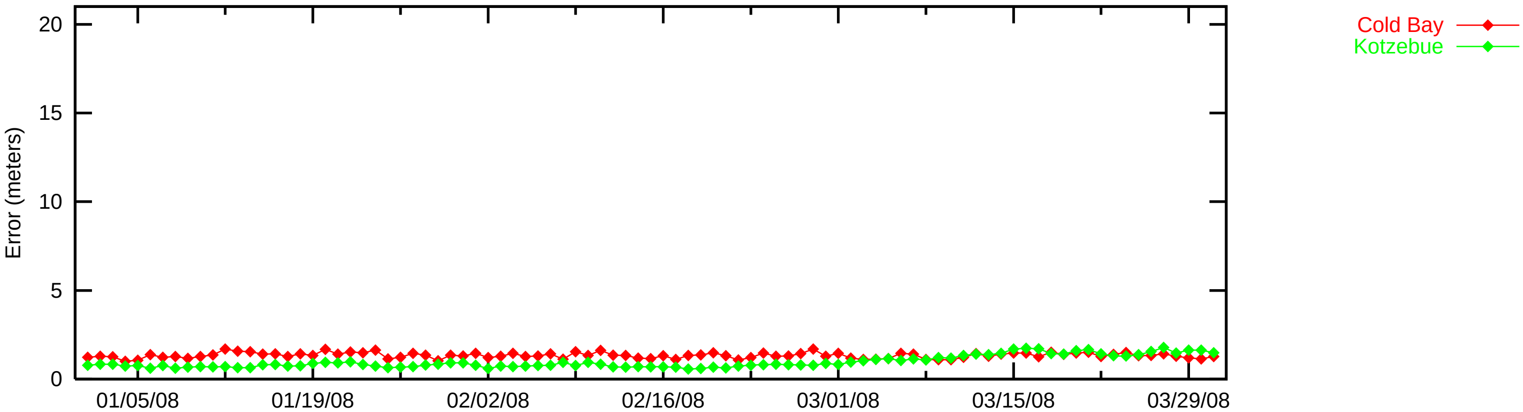


Figure 2-8 95% NPA Horizontal Accuracy

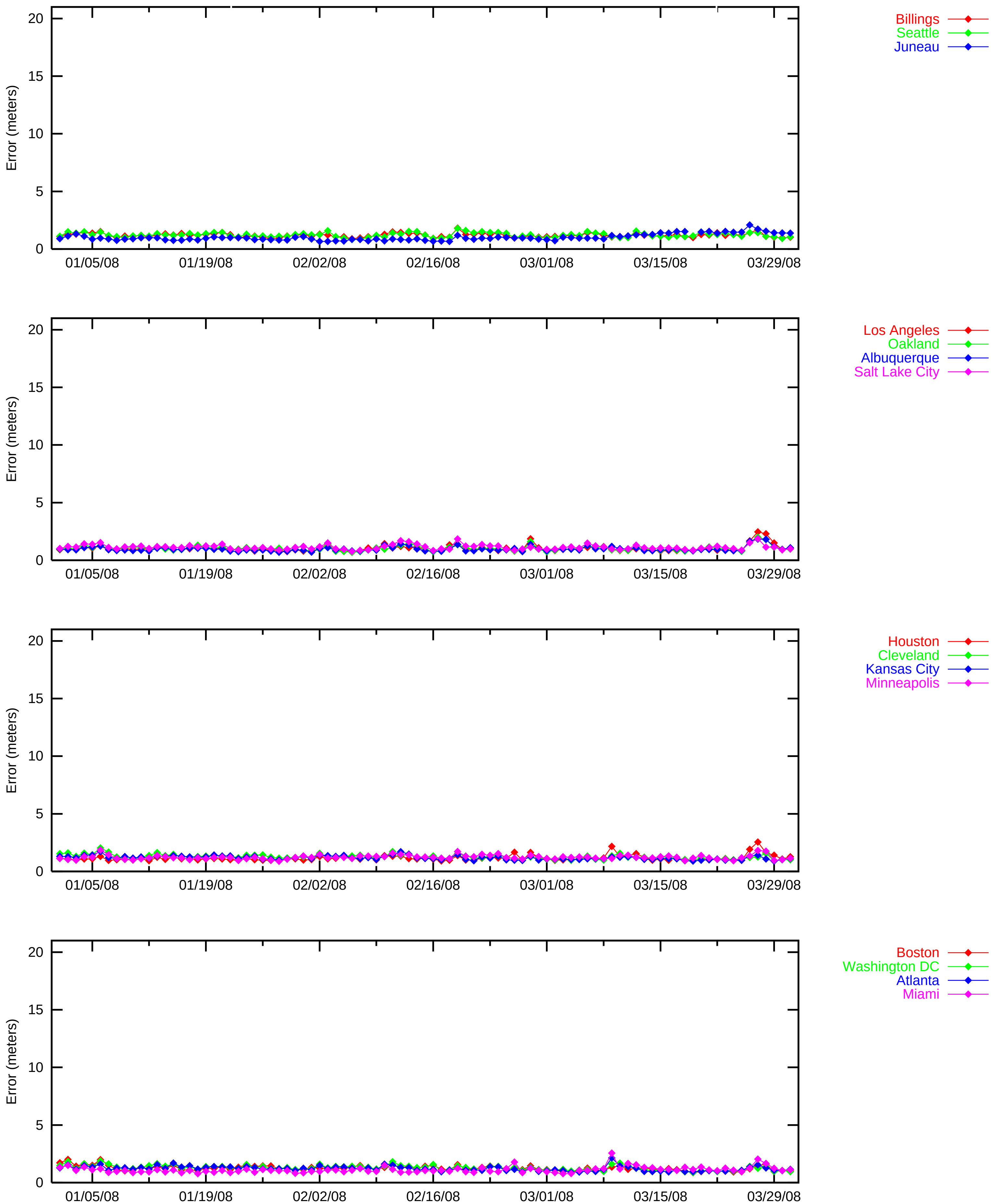


Figure 2-9 Horizontal Triangle Chart for Kansas City

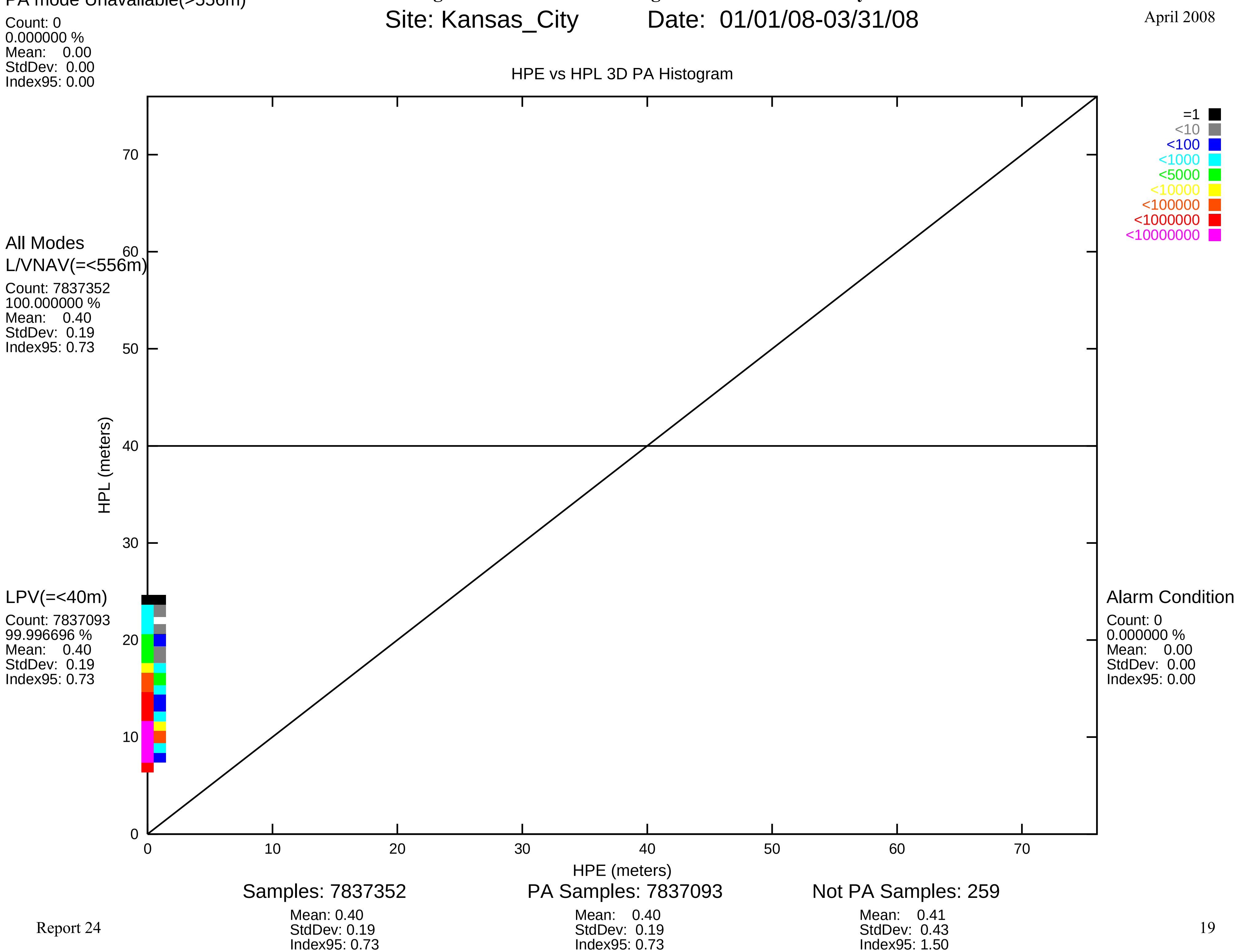


Figure 2-10 Vertical Triangle Chart for Kansas City

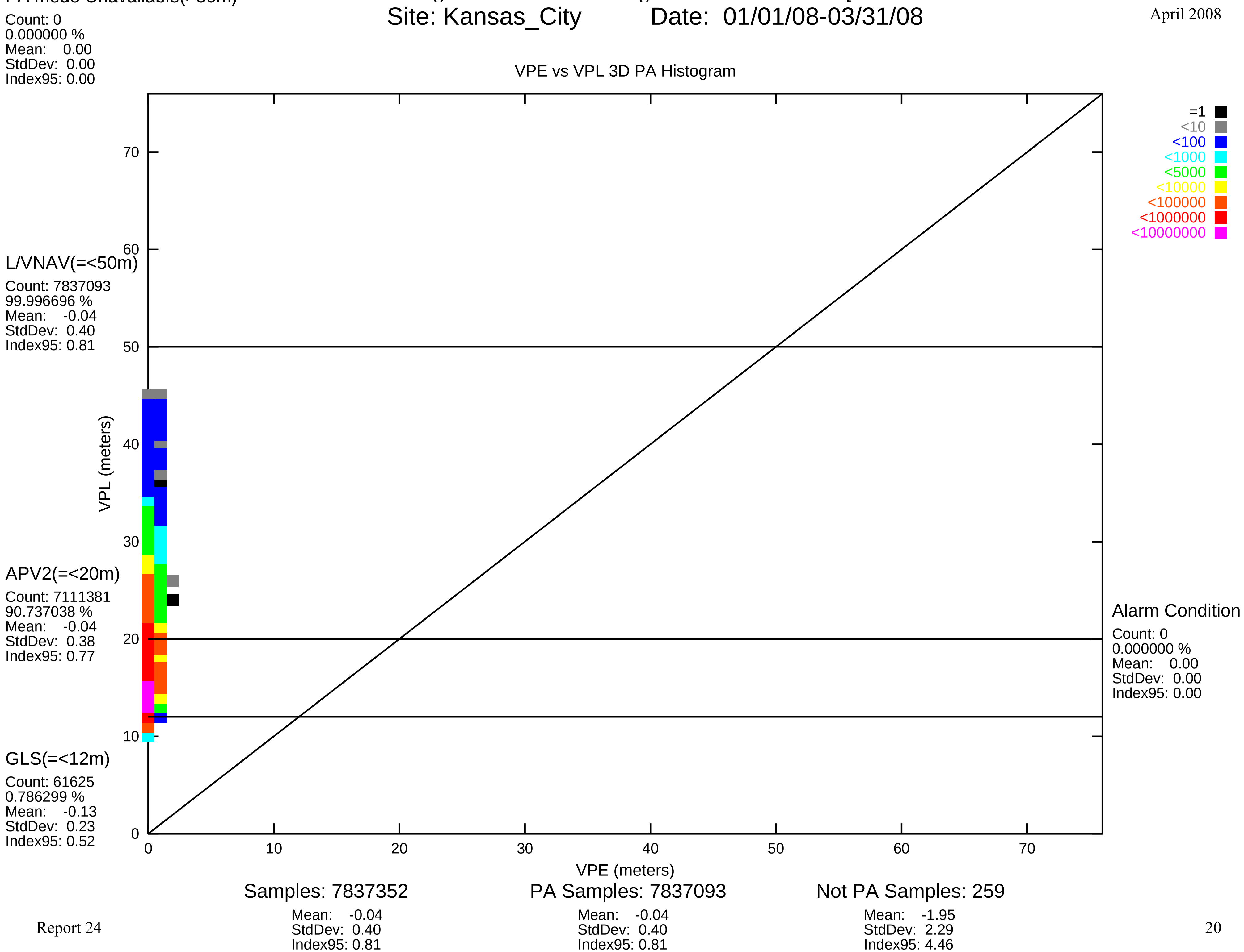
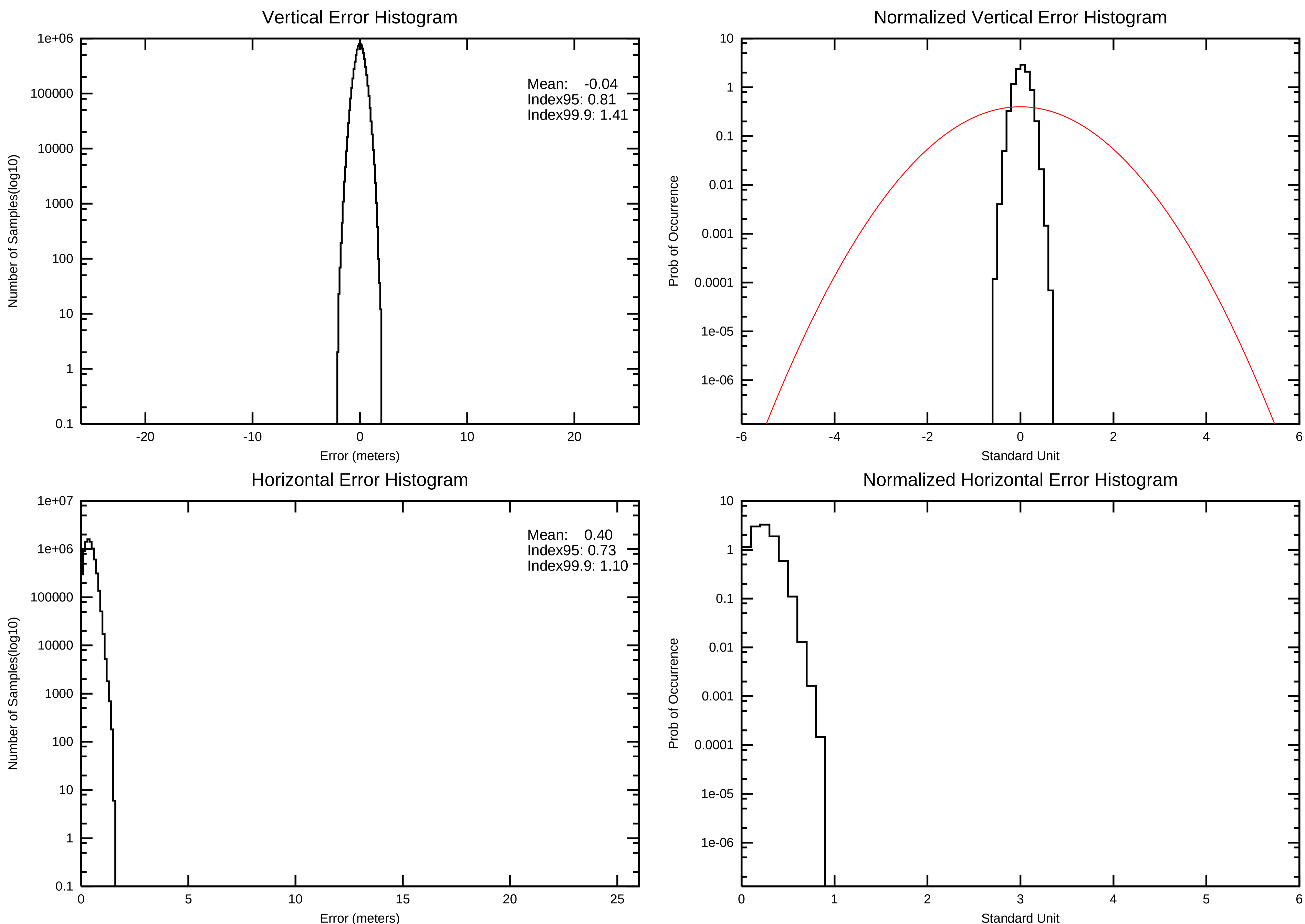


Figure 2-11 2-D Histogram for Kansas City

Site: Kansas_City   Date: 01/01/08-03/31/08



PA Samples: 7837093

Figure 2-12 Horizontal Triangle Chart for Washington, DC

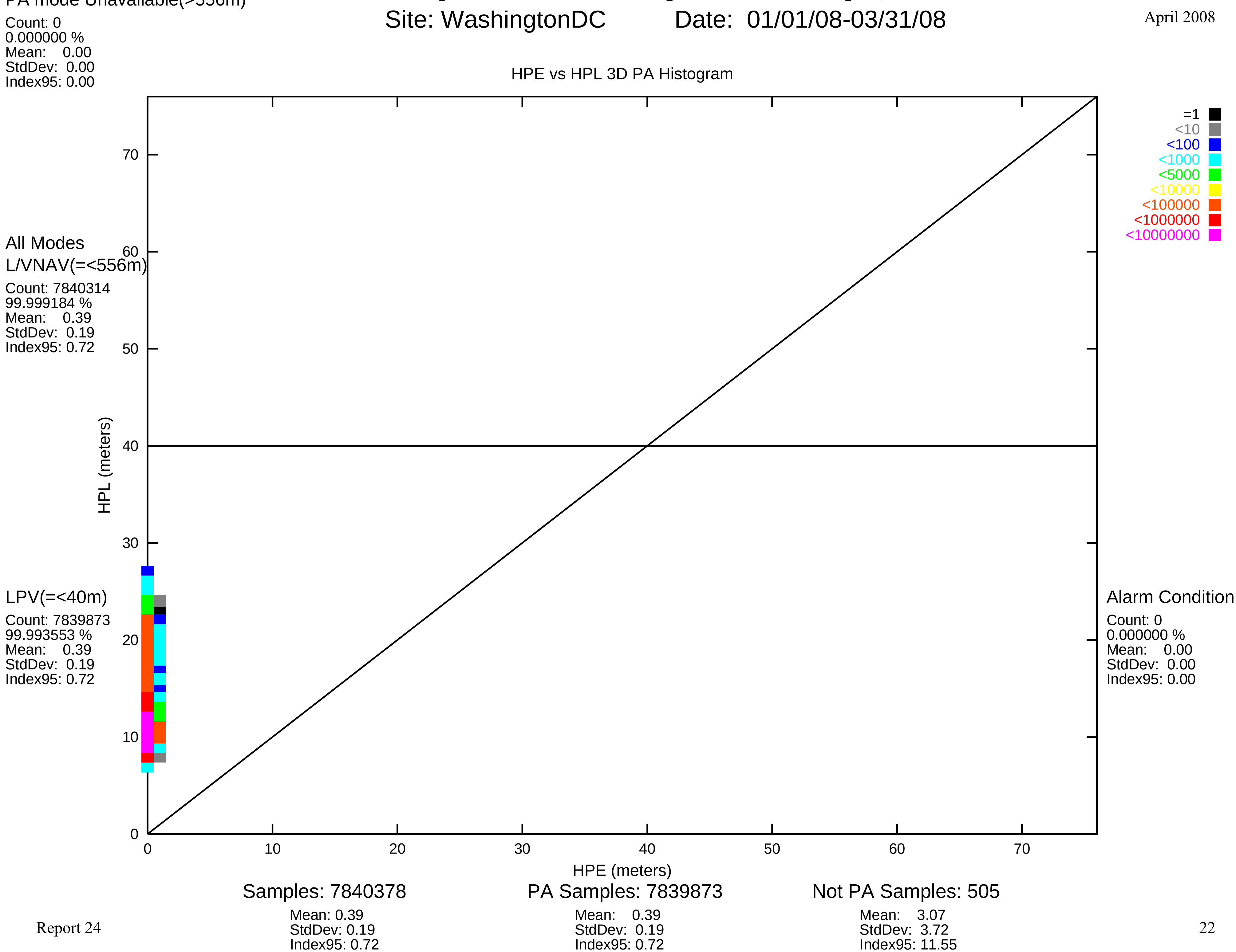


Figure 2-13 Vertical Triangle Chart for Washington, DC

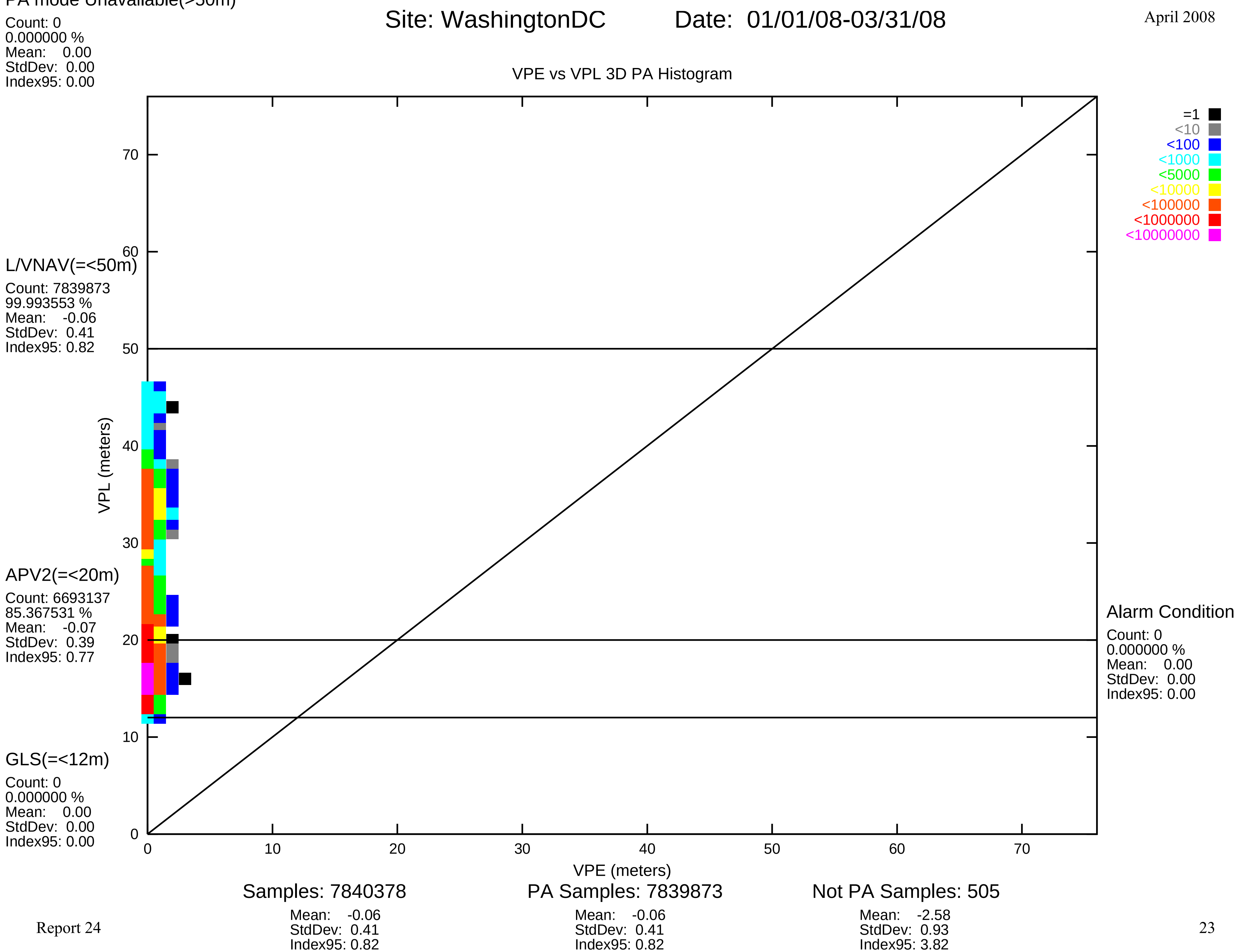


Figure 2-14 2-D Histogram for Washington, DC

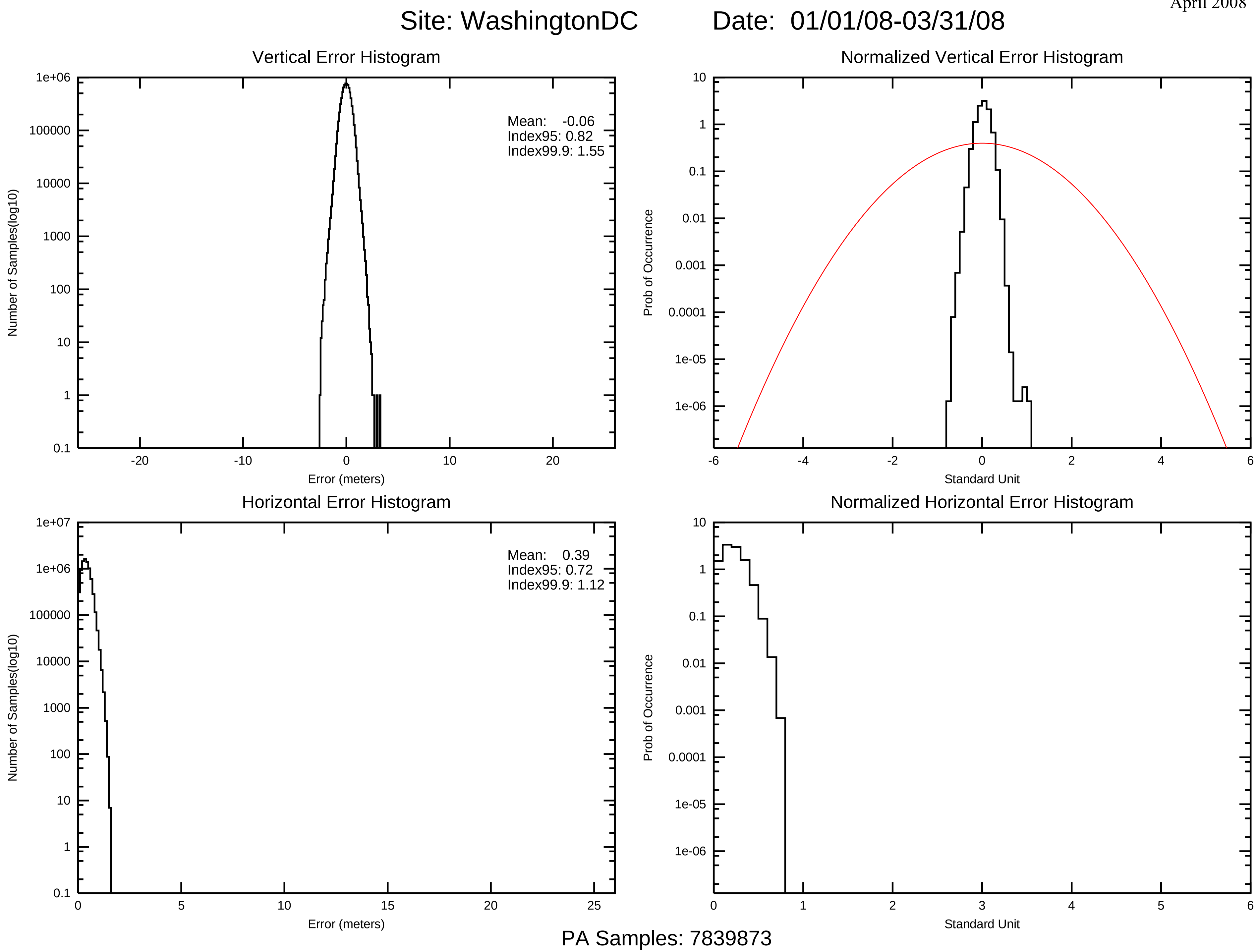


Figure 2-15 Horizontal Triangle Chart for Seattle

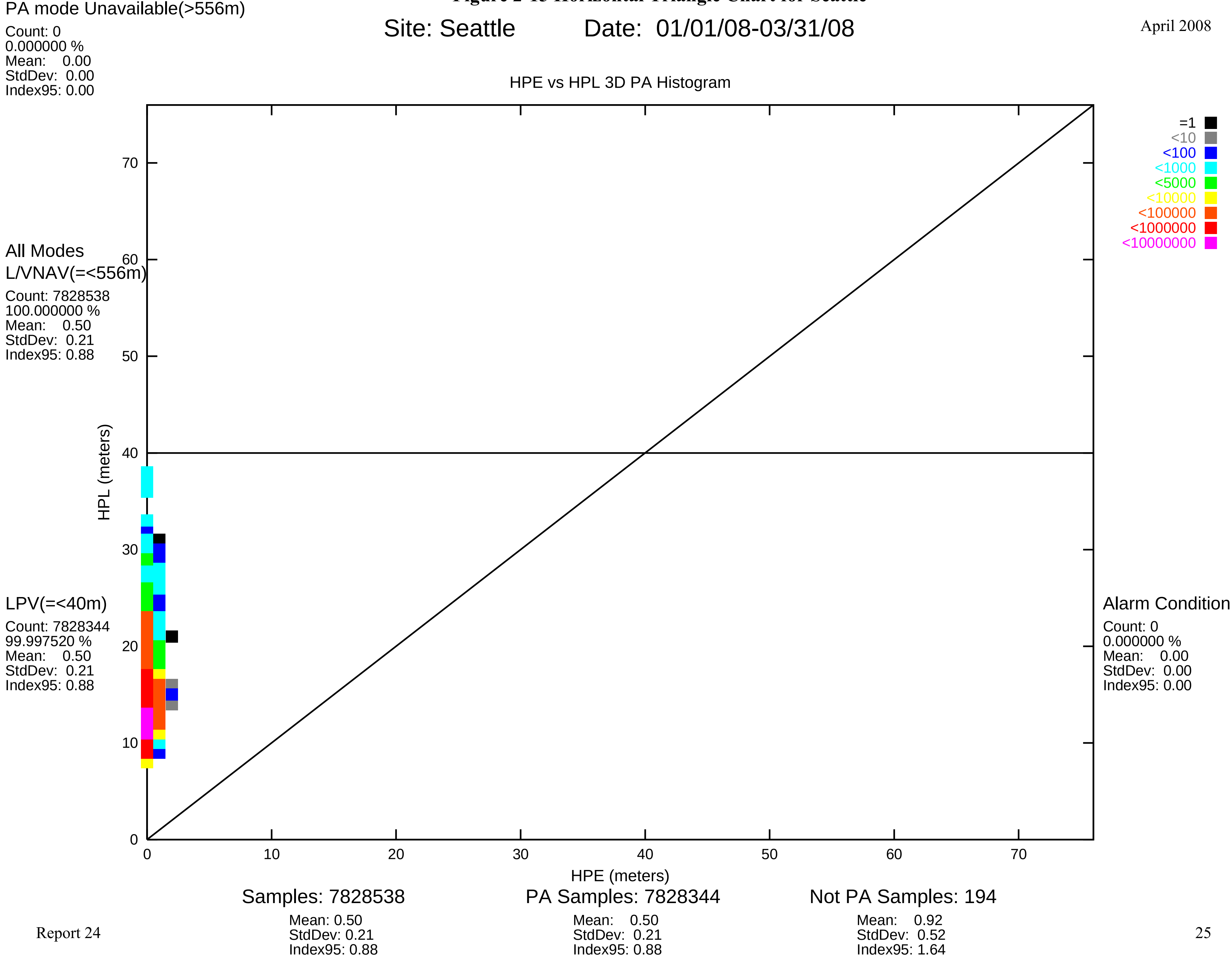


Figure 2-16 Vertical Triangle Chart for Seattle

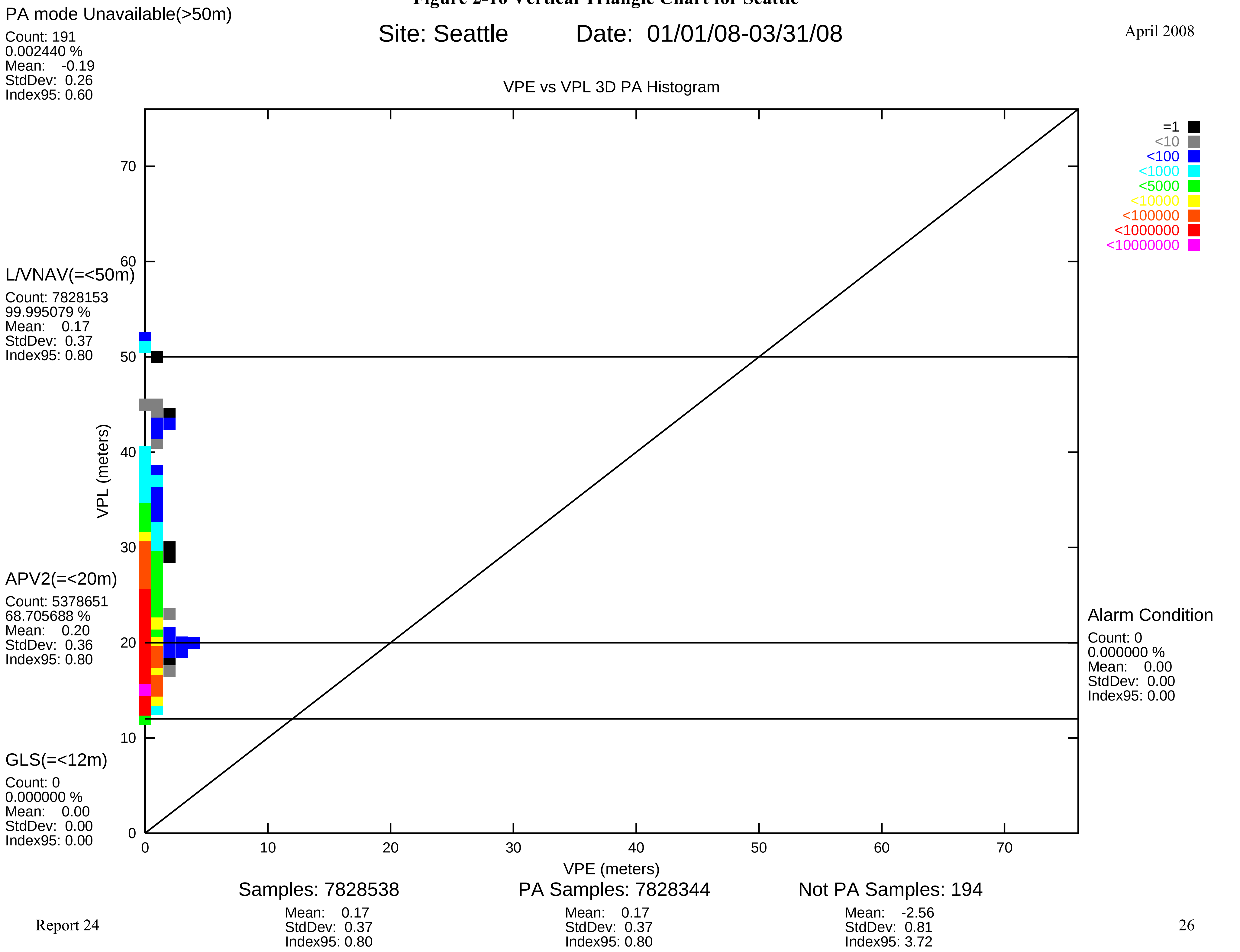
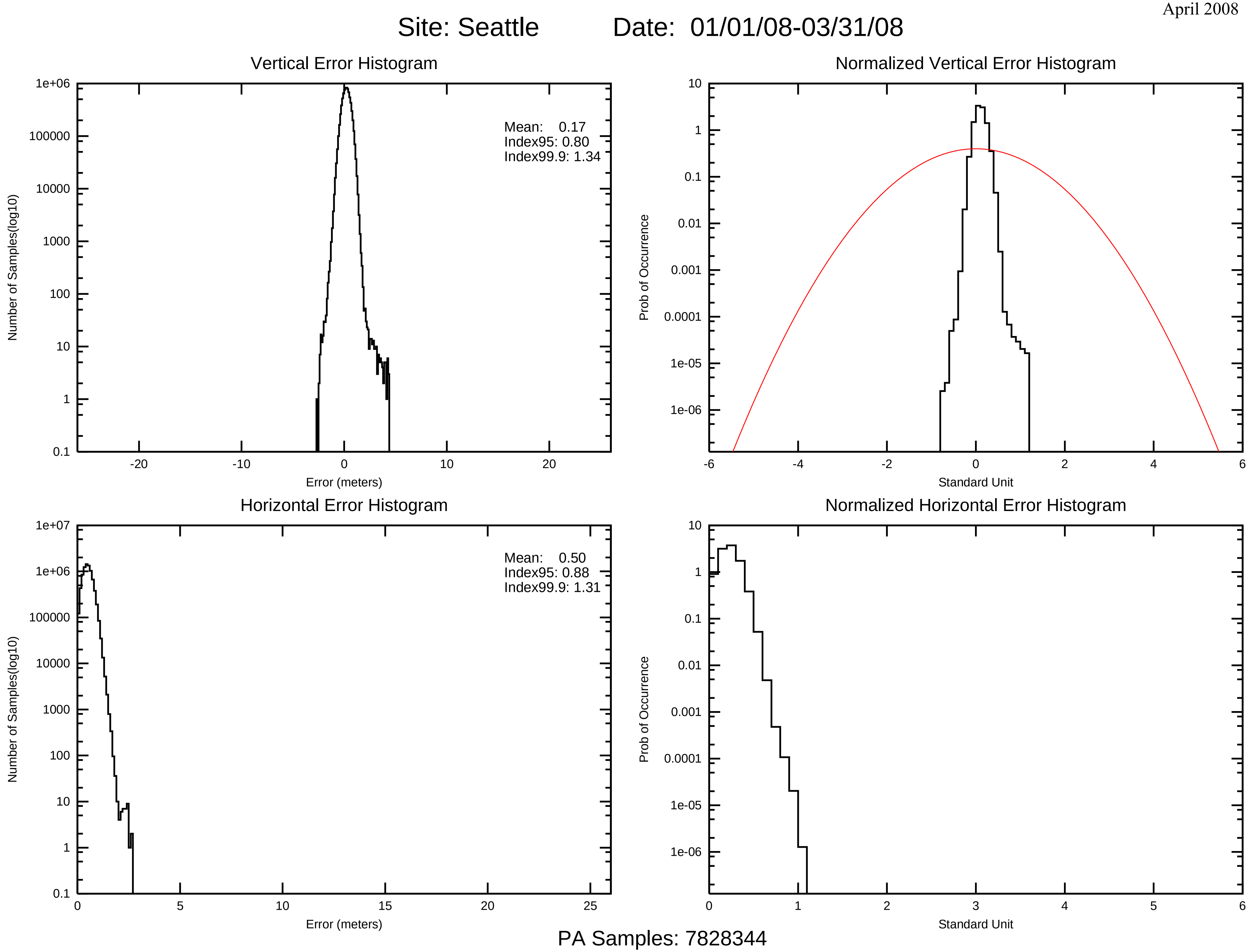


Figure 2-17 2-D Histogram for Seattle



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 for this evaluation period.

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	All Sites Site/Maximum	All Sites Site/Minimum
95% HPL	Arcata 21.332 meters	Memphis 12.36 meters	Tapachula 57.53 meters	Memphis 12.36 meters
95% VPL	Oakland 33.738 meters	Chicago 21.10 meters	Taphachula 77.09 meters	Chicago 21.10 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 = 40m) 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, a selected C&V source switched followed by GEO initialization caused a loss of LPV and NPA service (see DR#70). NPA outages at Iqaluit and Gander are due to CRE GUS switchovers and NPA outages at Barrow and Kotzedue are due to CRW switchovers.

Table 3-1 95% Protection Level

Location	95% HPL (meters)	95% VPL (meters)	Percentage in PA mode
Arcata	21.332	32.442	99.997375
Atlantic City	16.544	28.570	99.996025
Oklahoma City	12.970	21.931	99.996948
Albuquerque	14.033	23.238	99.997124
Anchorage	17.377	29.833	99.969666
Atlanta	12.918	22.187	99.998138
Barrow	20.648	50.634	99.980659
Bethel	20.532	35.470	99.997284
Billings	14.558	21.432	99.997101
Boston	16.721	24.605	99.996140
Chicago	13.372	21.105	99.996521
Cleveland	14.560	23.246	99.996361
Cold Bay	31.028	46.715	99.996544
Dallas	12.849	22.259	99.996979
Denver	13.275	21.140	99.997124
Fairbanks	16.607	30.880	99.998375
Gander	25.178	36.947	99.963936
Goose Bay	20.461	29.178	99.963684
Houston	13.323	22.986	99.996933
Iqaluit	27.656	37.446	99.966339
Jacksonville	14.225	26.587	99.999741
Juneau	16.647	27.131	99.997749
Kansas City	12.647	21.048	99.996696
Kotzebue	20.178	40.925	99.981079
Los Angeles	18.066	31.067	99.997292
Memphis	12.366	21.657	99.996696
Merida	21.890	34.369	99.996719
Mexico City	30.561	45.325	99.997002
Miami	16.815	31.825	99.996361
Minneapolis	13.925	21.147	99.996696
New York	16.099	24.182	99.994804
Oakland	20.506	33.738	99.997528
Puerto Vallarta	36.527	50.459	99.997139
Salt Lake City	14.028	22.423	99.997292
San Jose Del Cabo	31.931	47.576	99.997292
Seattle	17.505	24.903	99.997520
Tapachula	57.536	77.096	98.713943
Washington DC	15.234	24.575	99.993553
Winnipeg	16.245	22.628	99.996696

Table 3-2 Quarterly Availability Statistics

Location	**LPV WAAS *With 15 minute window***	**LPV 200 WAAS *With 15 minute window***
Arcata	0.99669780	0.97172458
Atlantic_City	0.99981011	0.96877253
Oklahoma_City	0.99995949	0.99899843
Albuquerque	0.99997128	0.99918140
Anchorage	0.99889429	0.98980438
Atlanta	0.99998137	0.99902936
Aurora	0.99996515	0.99993795
Barrow	0.94082287	0.75780334
Bethel	0.99325205	0.92621691
Billings	0.99997098	0.99993475
Boston	0.99991552	0.98675216
Cleveland	0.99996363	0.99585482
Cold Bay	0.96274521	0.73036210
Dallas	0.99993272	0.99970446
Denver	0.99997124	0.99973692
Fairbanks	0.99904415	0.97012517
Gander	0.99381041	0.89186735
Goose Bay	0.99957017	0.99450674
Houston	0.99987420	0.99905618
Iqaluit	0.97798661	0.90330386
Jacksonville	0.99999707	0.98923136
Juneau	0.99955038	0.99448951
Kansas City	0.99996694	0.99989302
Kotzebue	0.97925590	0.88022053
Los Angeles	0.99777204	0.97181089
Memphis	0.99938444	0.99830310
Merida	0.99867769	0.94739532
Mexico City	0.95946956	0.70385025
Miami	0.99987210	0.96951891
Minneapolis	0.99996695	0.99996695
New York	0.99988673	0.98409817
Oakland	0.99286292	0.95375137
Puerto Vallarta	0.92589555	0.53366188
Salt Lake City	0.99997292	0.99979113
San Jose Del Cabo	0.94430015	0.66009103
Seattle	0.99995079	0.99942532
Tapachula	0.35699774	0.04063981
Washington DC	0.99996133	0.97783718
Winnipeg	0.99996693	0.99996693

Table 3-3 NPA Availability

Location	NPA Availability (Excluding RAIM/FDE)
Albuquerque	0.99999097
Anchorage	0.99999028
Atlanta	0.99999026
Barrow	0.99993264
Bethel	0.99994495
Billings	0.99998948
Boston	0.99999021
Cleveland	0.99999027
Cold Bay	0.99999044
Fairbanks	0.99999015
Gander	0.99987485
Honolulu	0.99998987
Houston	0.99999085
Iqaluit	0.99988473
Juneau	0.99998976
Kansas City	0.99998945
Kotzebue	0.99993317
Los Angeles	0.99999102
Merida	0.99998988
Miami	0.99999105
Minneapolis	0.99998948
Oakland	0.99999104
Puerto Rico	0.99999048
Salt Lake City	0.99998946
Seattle	0.99998949
Tapachula	0.99998763
Washington DC	0.99999022

Table 3-4 LPV and LPV 200 Outage Rate

Location	LPV Outages	LPV Outage Rates	LPV 200 Outages	LPV 200 Outage Rates
Arcata	119	0.002420	335	0.006988
Atlantic City	5	0.000098	222	0.004511
Oklahoma City	4	0.000078	26	0.000507
Albuquerque	1	0.000019	10	0.000192
Anchorage	7	0.000134	142	0.002748
Atlanta	1	0.000019	11	0.000211
Aurora	1	0.000019	3	0.000057
Barrow	525	0.010751	1185	0.030128
Bethel	100	0.001936	488	0.010133
Billings	1	0.000019	3	0.000058
Boston	2	0.000038	151	0.002929
Cleveland	1	0.000019	85	0.001634
Cold Bay	360	0.007220	1007	0.026620
Dallas	2	0.000038	8	0.000153
Denver	1	0.000019	3	0.000058
Fairbanks	19	0.000366	363	0.007199
Gander	103	0.002007	867	0.018820
Goose Bay	13	0.000253	91	0.001781
Houston	2	0.000039	11	0.000215
Iqaluit	297	0.005901	694	0.014930
Jacksonville	2	0.000038	142	0.002747
Juneau	6	0.000116	107	0.002086
Kansas City	1	0.000019	2	0.000038
Kotzebue	297	0.005831	918	0.020050
Los Angeles	87	0.001669	276	0.005437
Memphis	6	0.000115	14	0.000268
Merida	8	0.000153	454	0.009178
Mexico City	348	0.006944	1180	0.032098
Miami	4	0.000077	161	0.003180
Minneapolis	1	0.000019	1	0.000019
New York	2	0.000039	152	0.002989
Oakland	94	0.001812	426	0.008550
Puerto Vallarta	352	0.007283	1185	0.042540
Salt Lake City	1	0.000019	4	0.000077
San Jose Del Cabo	438	0.008892	1057	0.030697
Seattle	2	0.000038	13	0.000249
Tapachula	1340	0.072601	232	0.110418
Washington DC	1	0.000019	154	0.003015
Winnipeg	1	0.000019	1	0.000019

Table 3-5 NPA Outage Rates

Location	NPA Outages	NPA Outage Rate
Albuquerque	1	0.00001934
Anchorage	1	0.00001919
Atlanta	1	0.00001922
Barrow	7	0.00013734
Bethel	2	0.00004203
Billings	1	0.00001924
Boston	1	0.00001933
Cleveland	1	0.00001921
Cold Bay	1	0.00001938
Fairbanks	1	0.00001944
Gander	12	0.00023226
Honolulu	1	0.00001923
Houston	1	0.00001960
Iqaluit	11	0.00021420
Juneau	1	0.00001945
Kansas City	1	0.00001929
Kotzebue	7	0.00013547
Los Angeles	1	0.00001924
Merida	1	0.00002080
Miami	1	0.00001918
Minneapolis	1	0.00001924
Oakland	1	0.00001920
Puerto Rico	2	0.00003861
Salt Lake City	1	0.00001927
Seattle	1	0.00001923
Tapachula	2	0.00004818
Washington DC	1	0.00001930

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

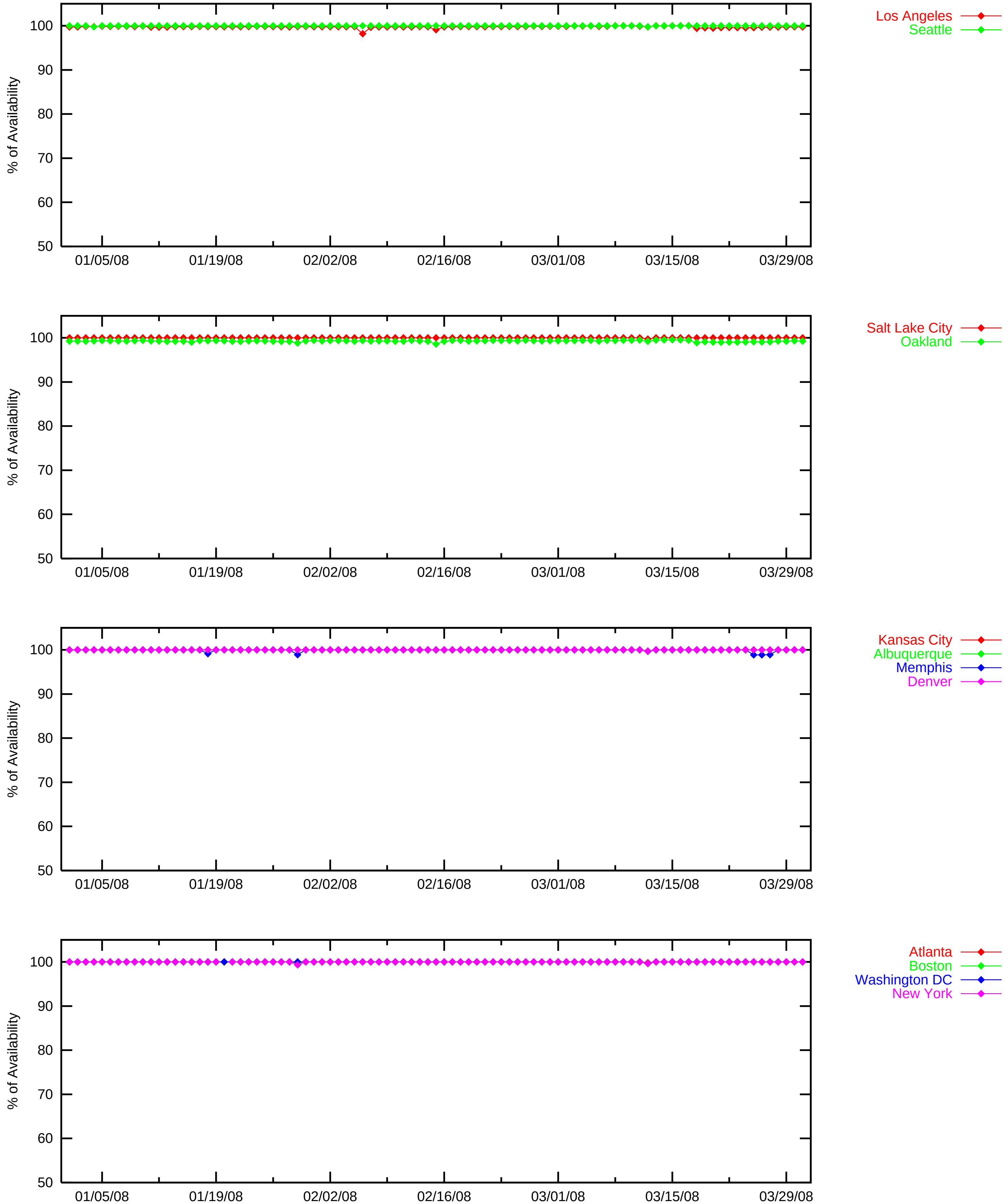


Figure 3-2 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

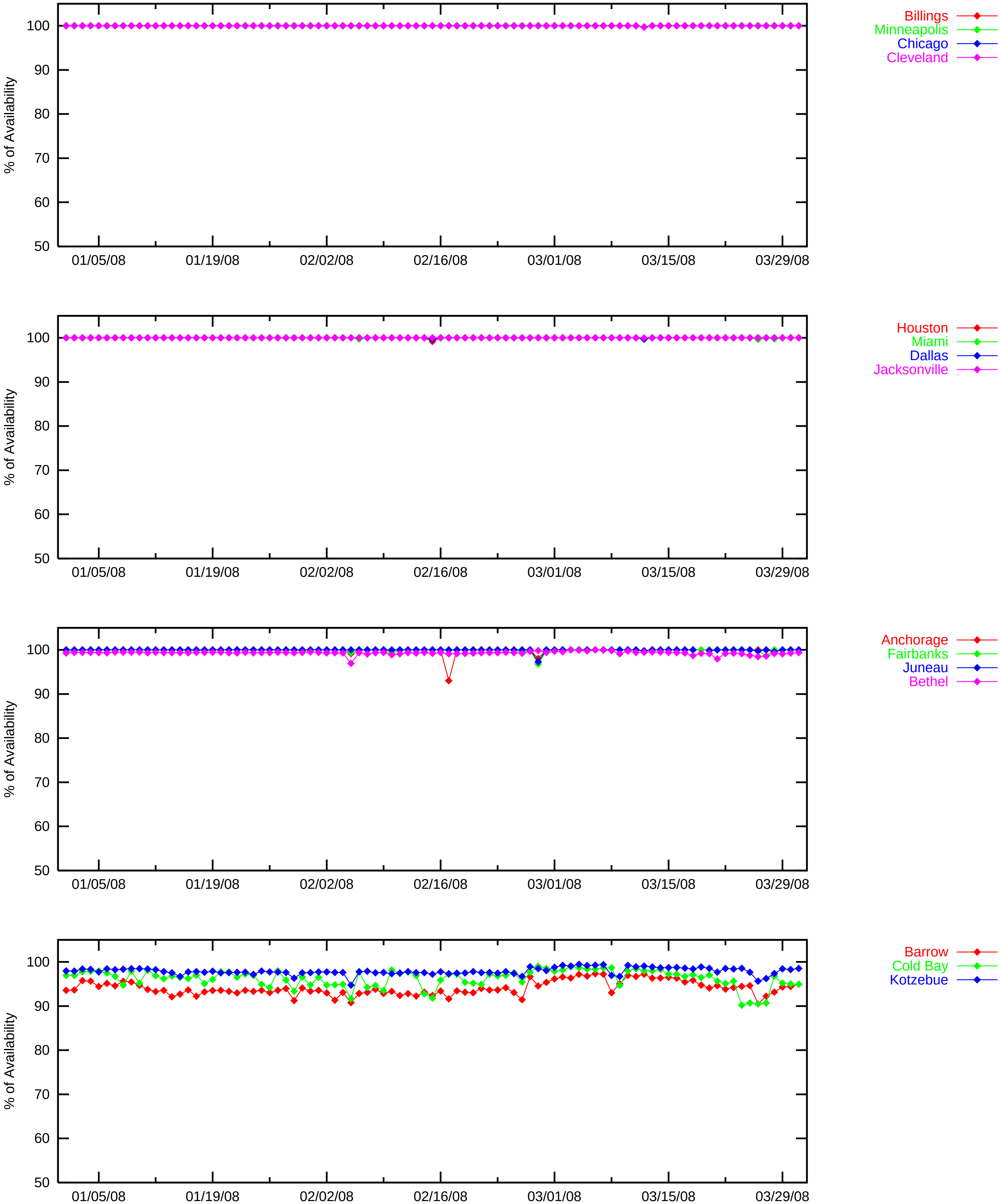


Figure 3-3 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

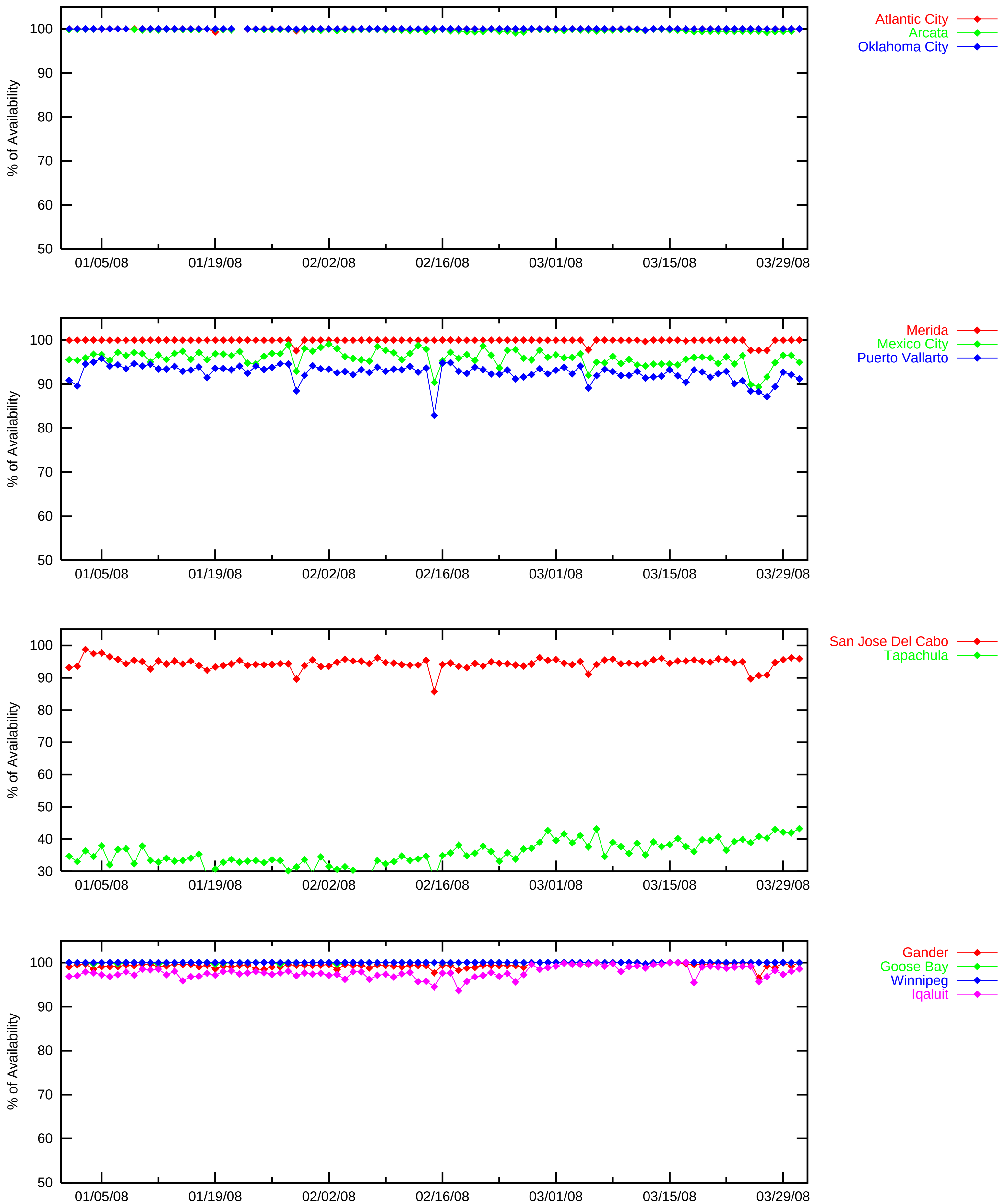


Figure 3-4 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

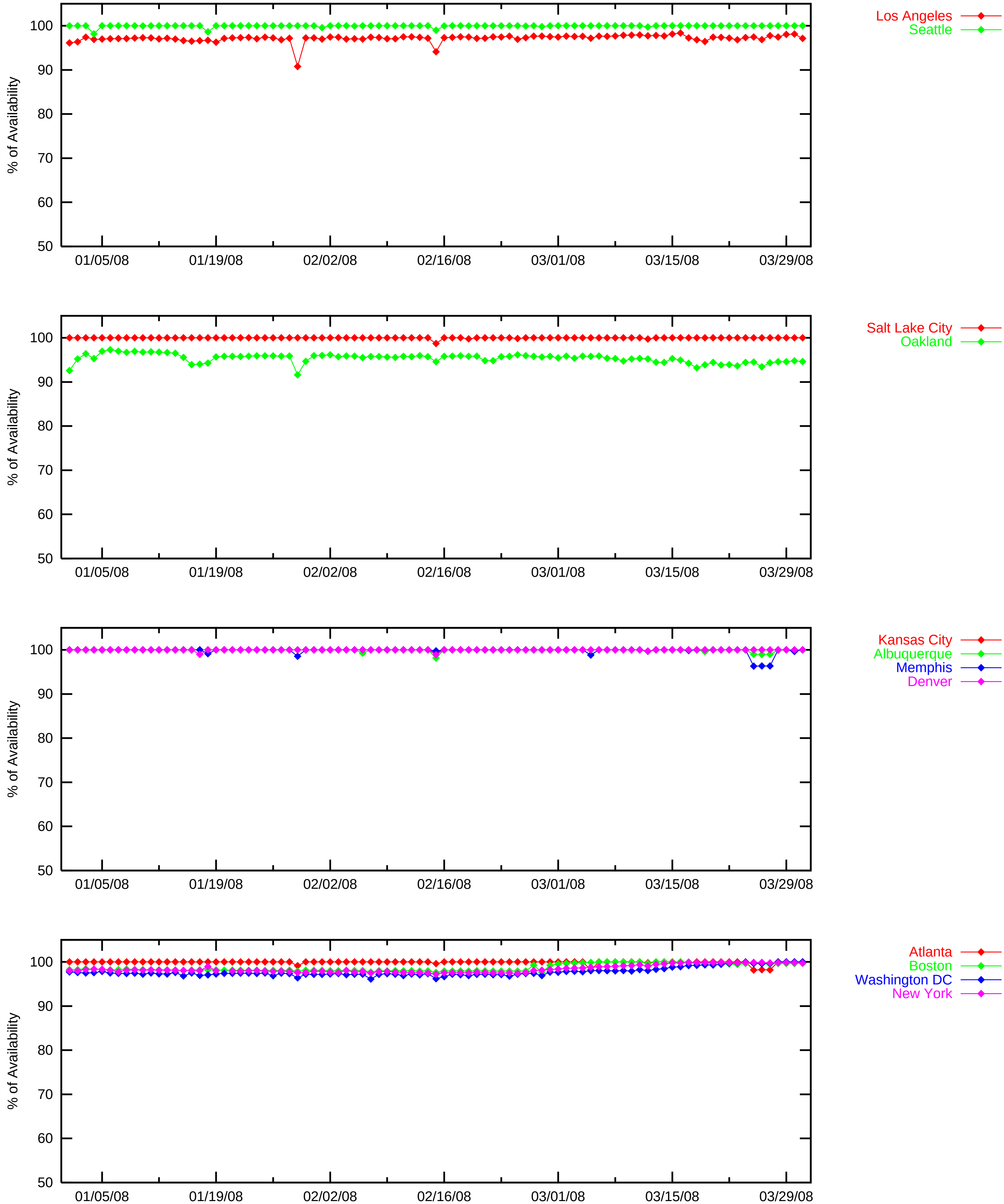


Figure 3-5 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

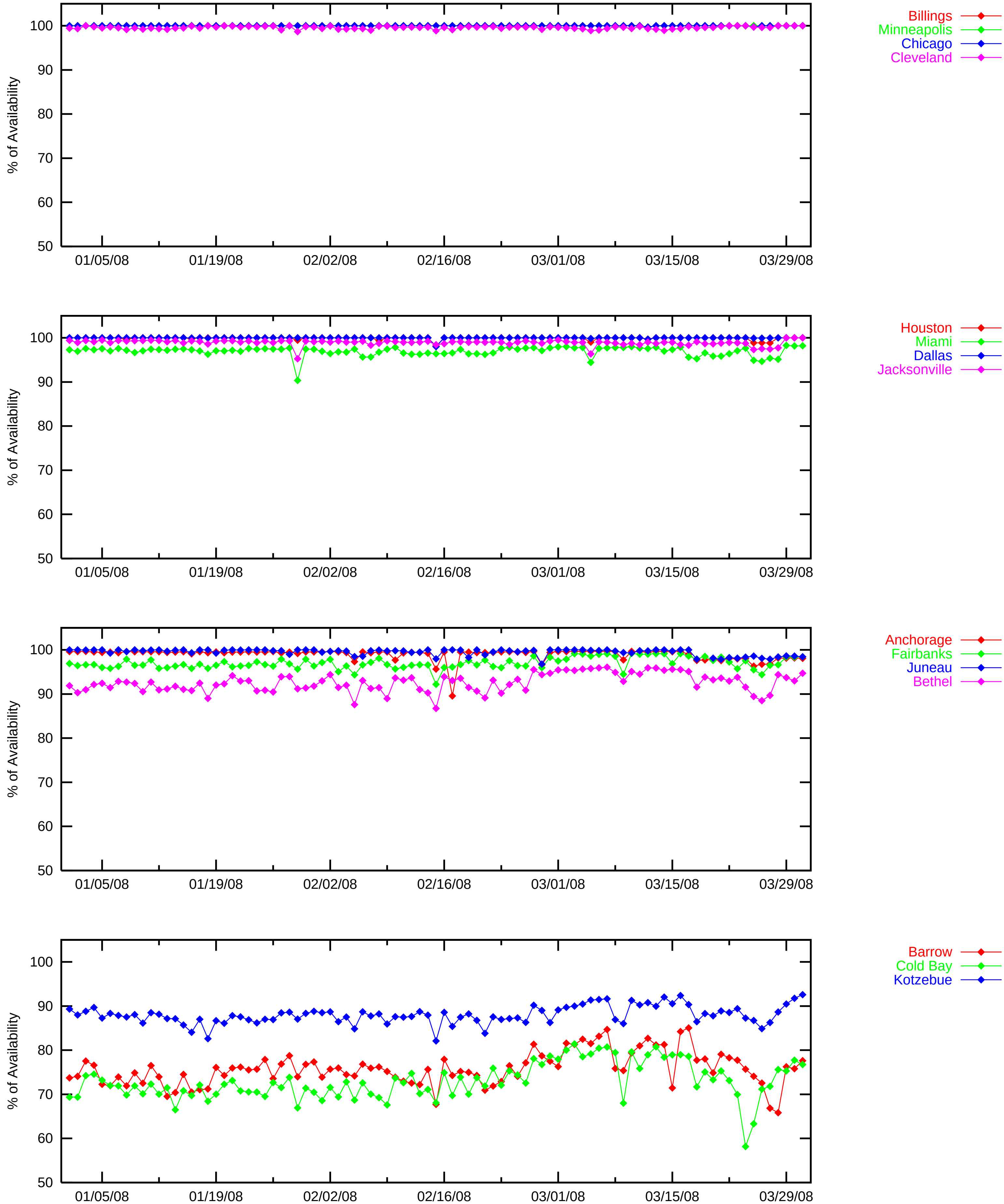


Figure 3-6 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

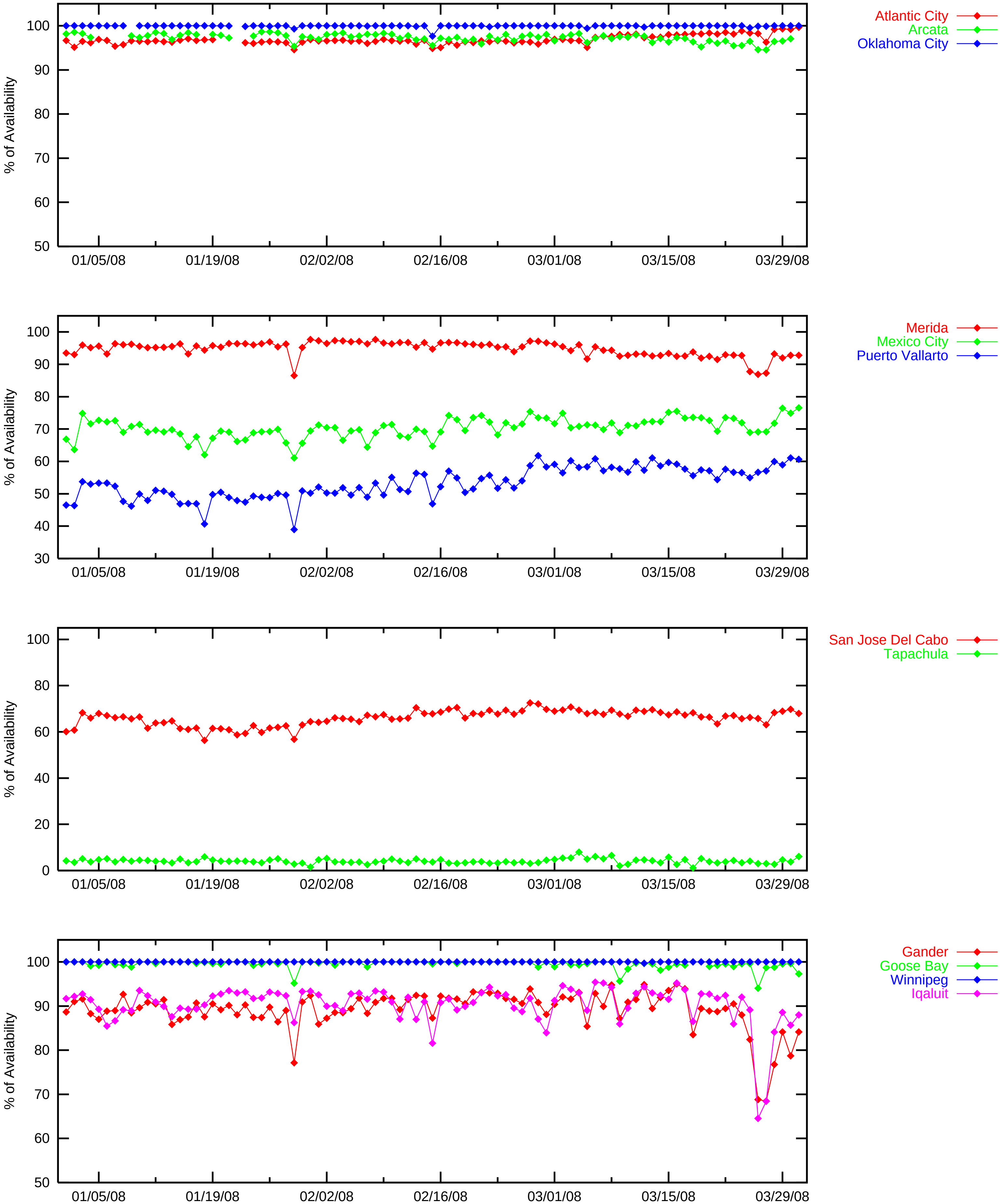


Figure 3-7 LPV Outages (HAL = 40m & VAL=50m)

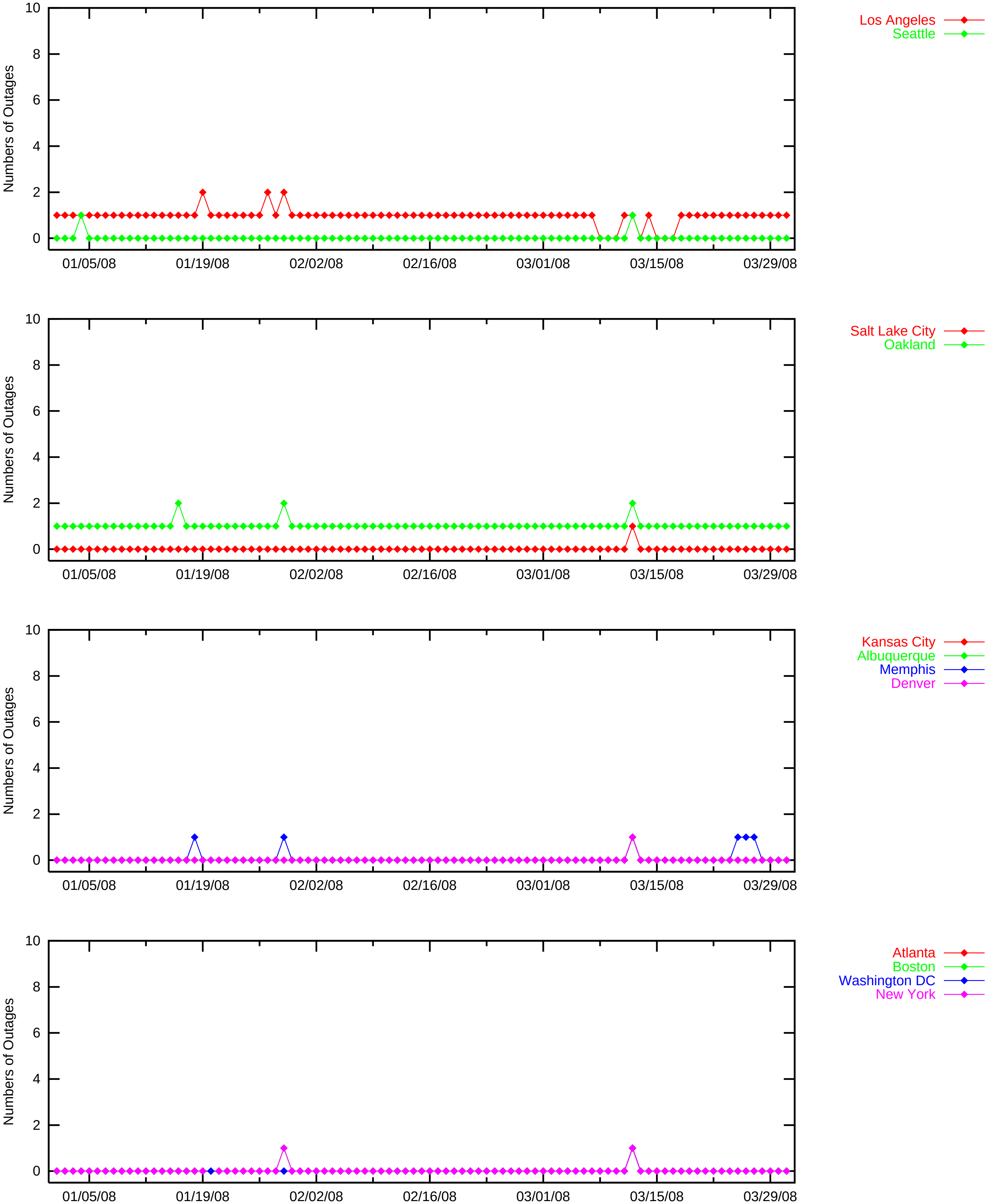


Figure 3-8 LPV Outages (HAL = 40m & VAL=50m)

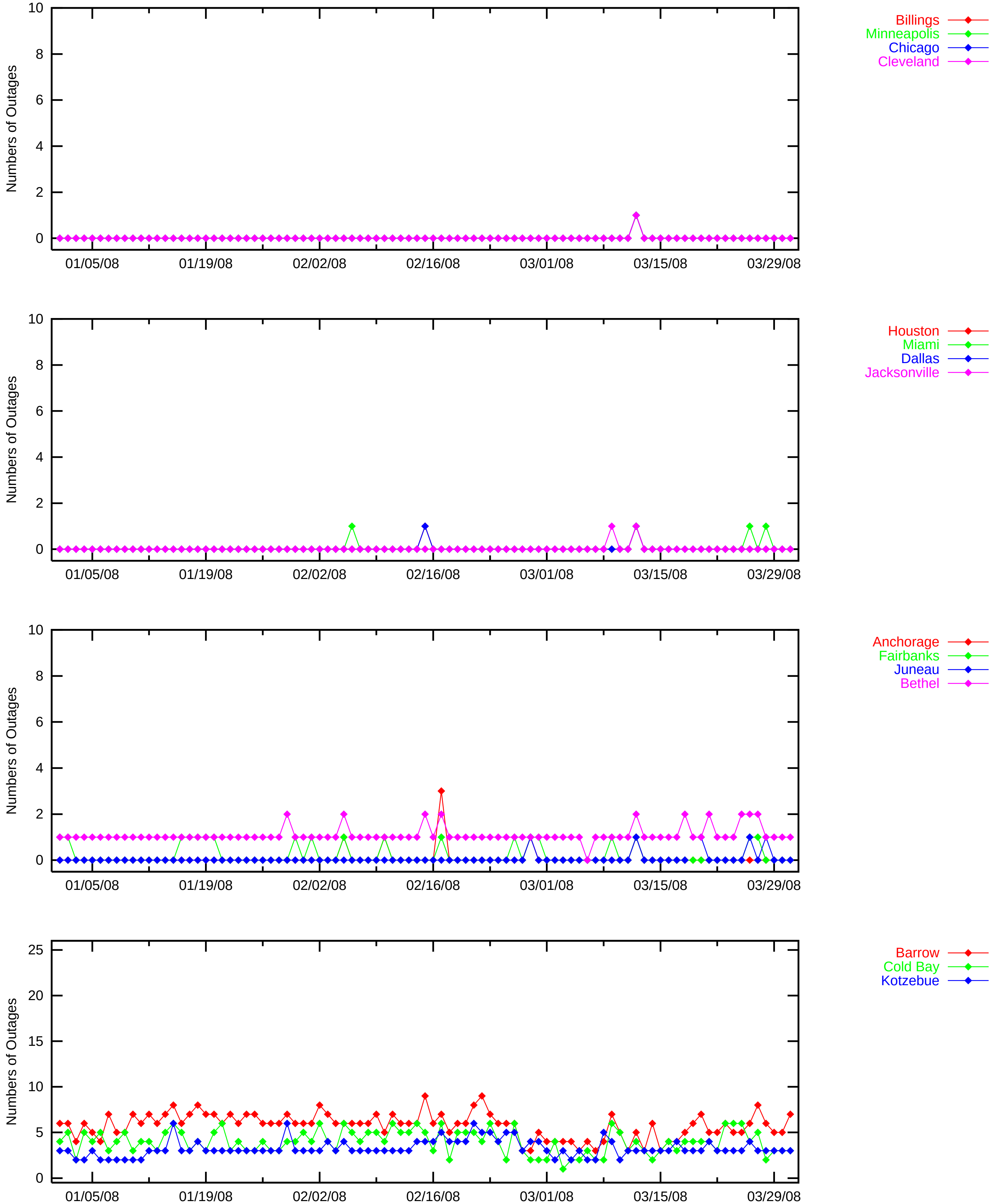


Figure 3-9 LPV Outages (HAL = 40m & VAL=50m)

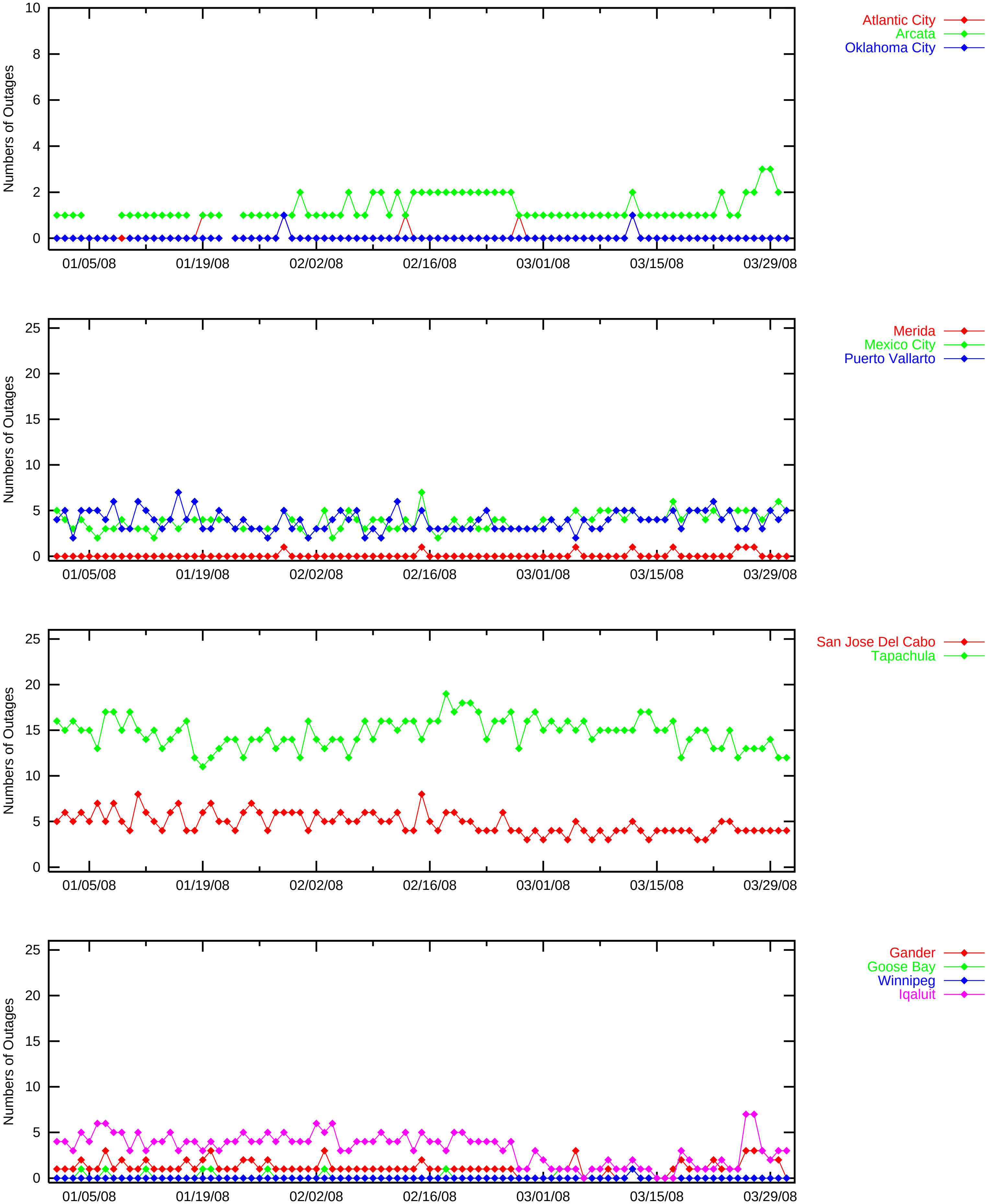


Figure 3-10 LPV 200 Outages (HAL = 40m & VAL=35m)

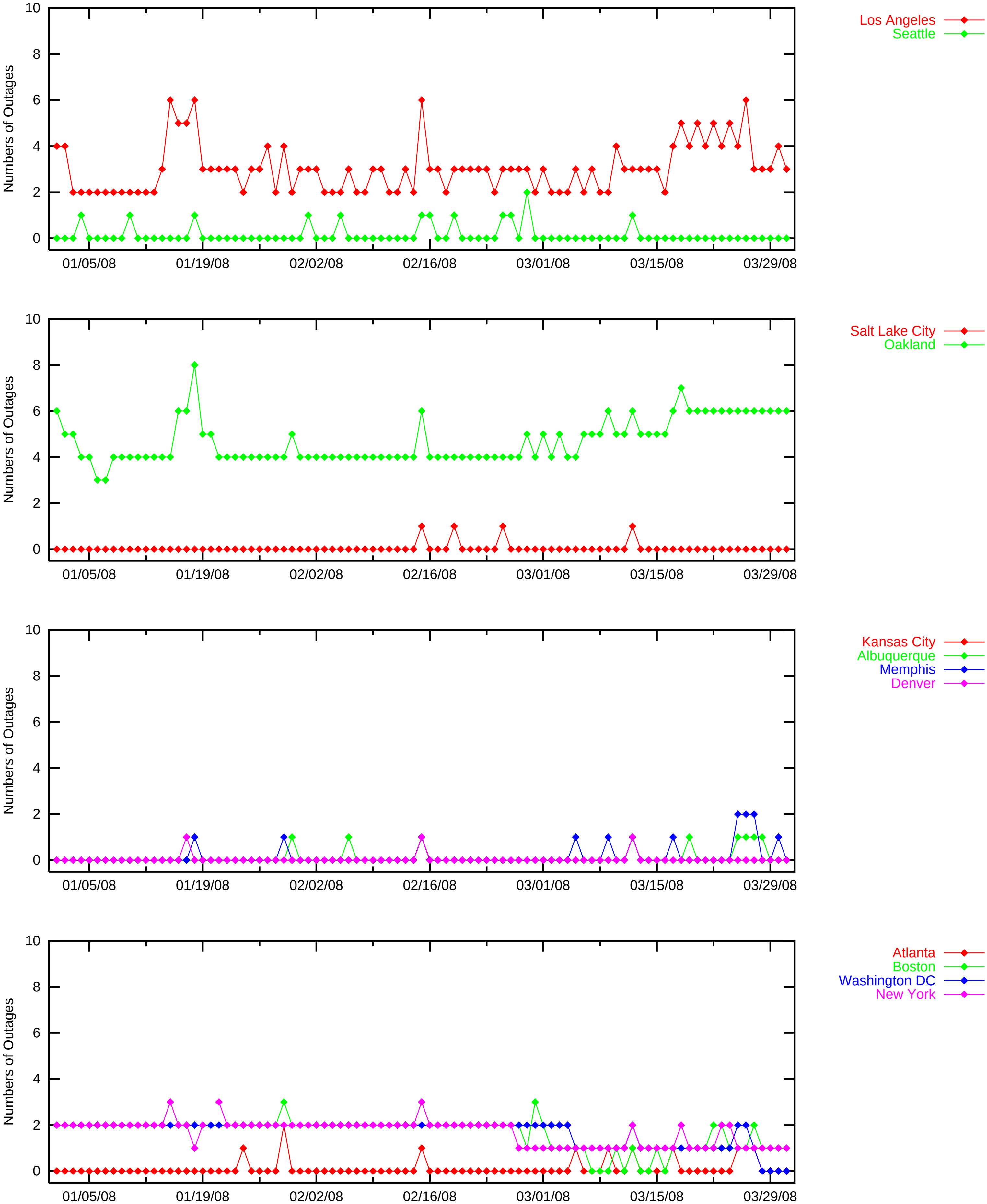


Figure 3-11 LPV 200 Outages (HAL = 40m & VAL=35m)

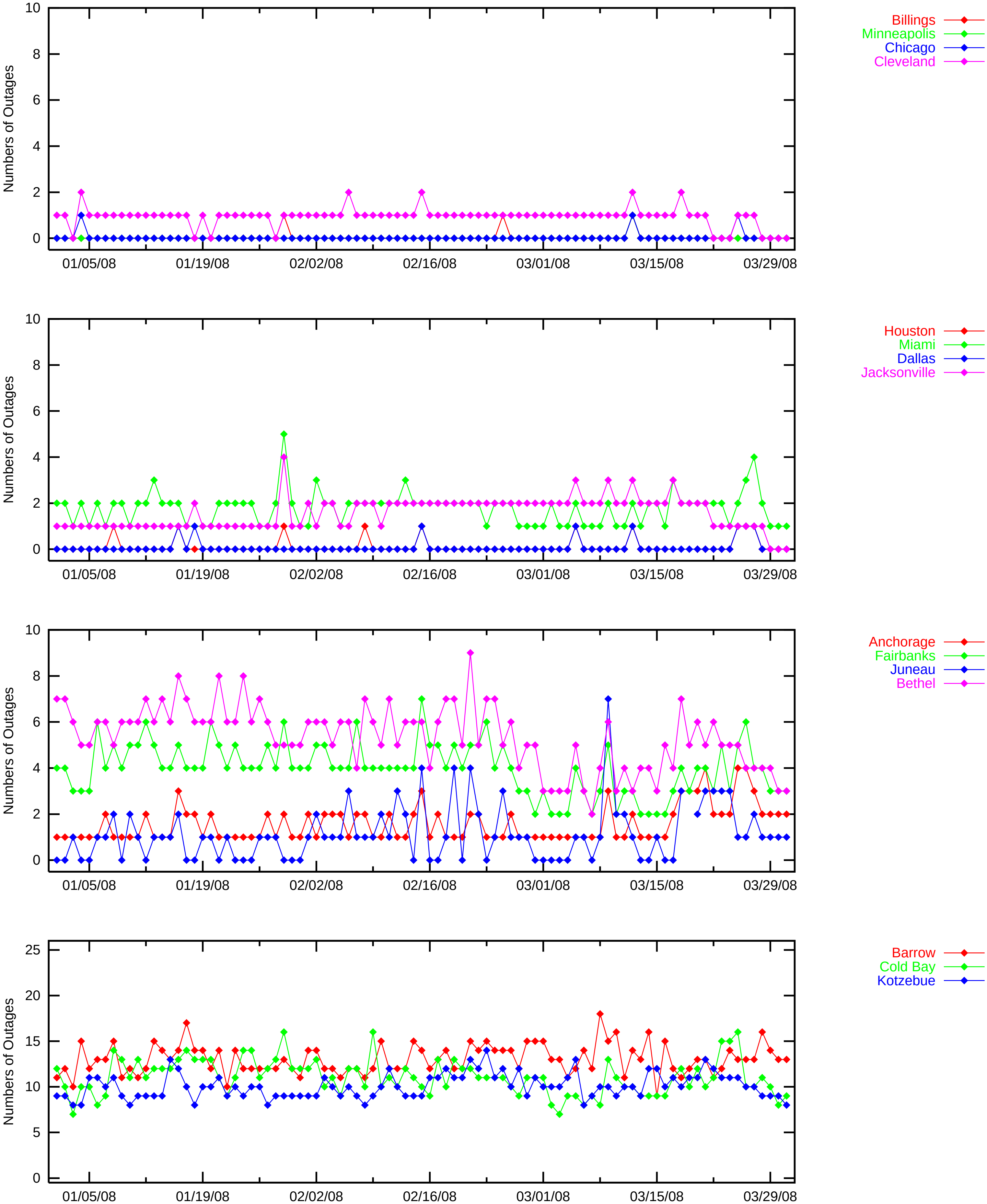
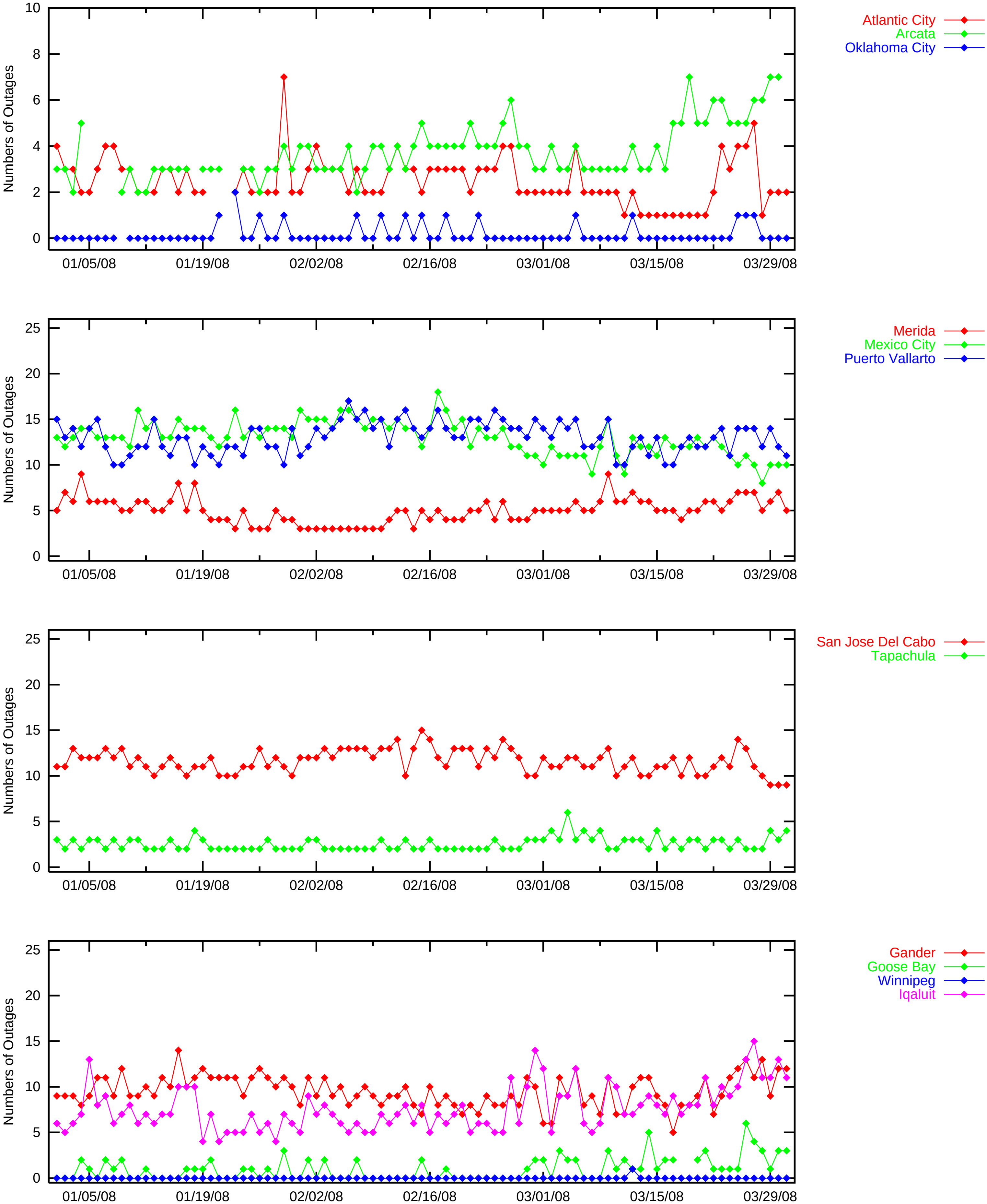


Figure 3-12 LPV 200 Outages (HAL = 40m & VAL=35m)



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. Monthly coverage are shown as followed: LPV CONUS coverage in Figures 4.1 to 4.3, LPV Alaska coverage in Figures 4.5 to 4.7, LPV 200 CONUS coverage in Figures 4.9 to 4.11, and LPV 200 CONUS coverage in Figures 4.13 to 4.15. Figure 4.4, 4.8, 4.12, and 4.16 show the rollup LPV and LPV 200 for the quarter. Figure 4.21 shows the daily LPV and LPV 200 CONUS coverage, and Figure 4.19 shows the daily LPV Alaska coverage at 99% availability and ionosphere KP index values for this quarter.

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 4.17 to 4.19 show the NPA coverage area of each month and Figure 4.20 shows the rollup NPA coverage for the quarter. Figure 4.23 shows the daily NPA coverage at 99.9% availability and ionosphere Kp index values for this quarter.

During this evaluation period, low LPV and LPV 200 coverage are mainly due to satellites out for service. Low coverage on 1/29/2008 and 1/30/2008 are due to PRN 4 out for service. Low coverage on 2/15/2008 is due to PRN 23 out for service. Low coverage on 3/05/2008 is due to PRN 10 out for service. Low coverage from 3/25/2008 to 3/27/2008 are due to PRN 10 out for service. The commissioning of PRN 32 and PRN 7, and the decommissioning of PRN 1 also affected coverage. PRN 32 started broadcasting on 2/26/2008; PRN 7 started broadcasting on 3/24/2008; and the decommissioning of SV 1 was on 3/17/2008.

Low NPA coverage on 3/12/2008 is due to a selected C&V source switched followed by GEO initialization that caused a loss of LPV and NPA service (see DR#70).

Figure 4-1 LPV CONUS Coverage - January

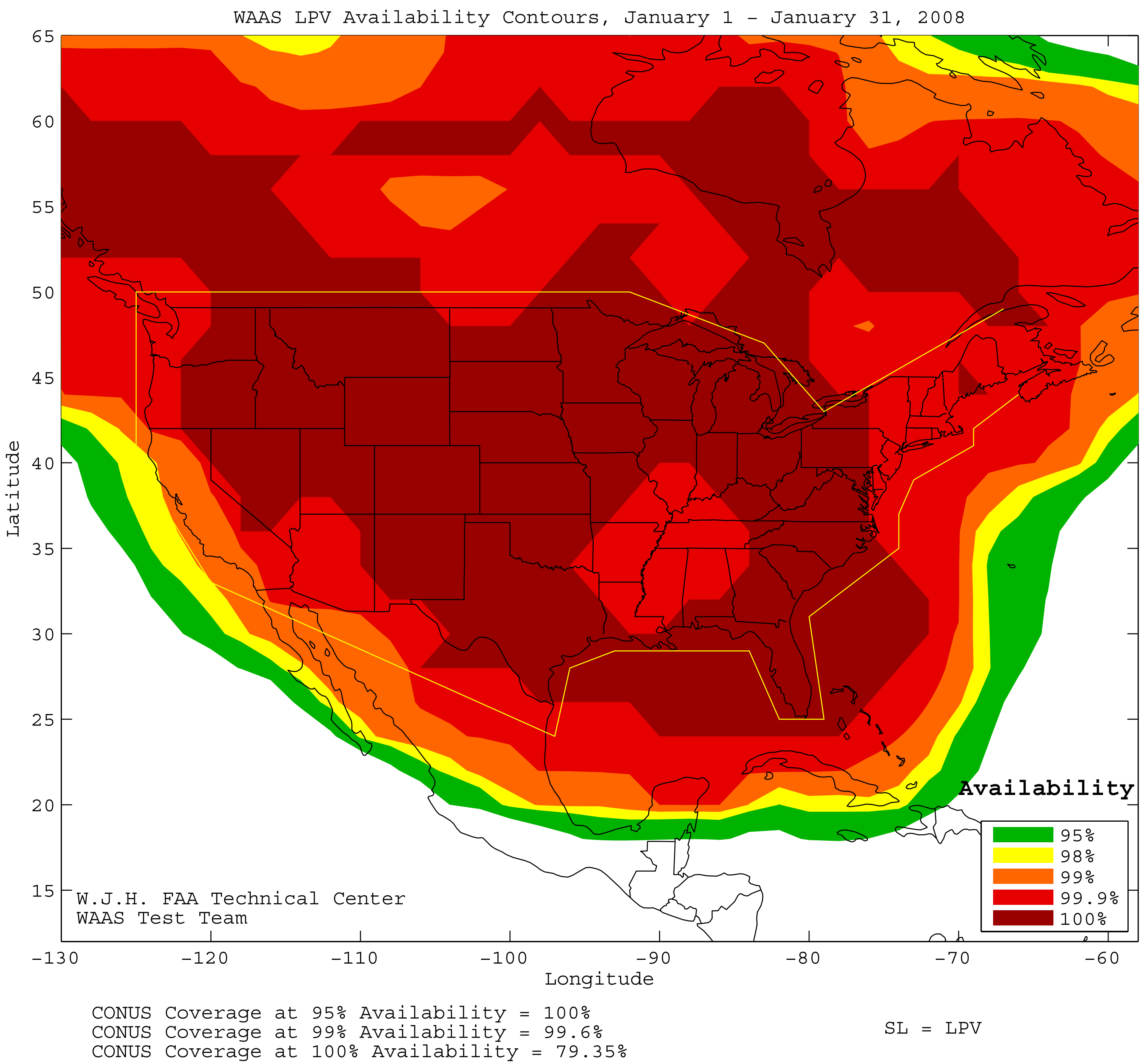


Figure 4-2 LPV CONUS Coverage - February

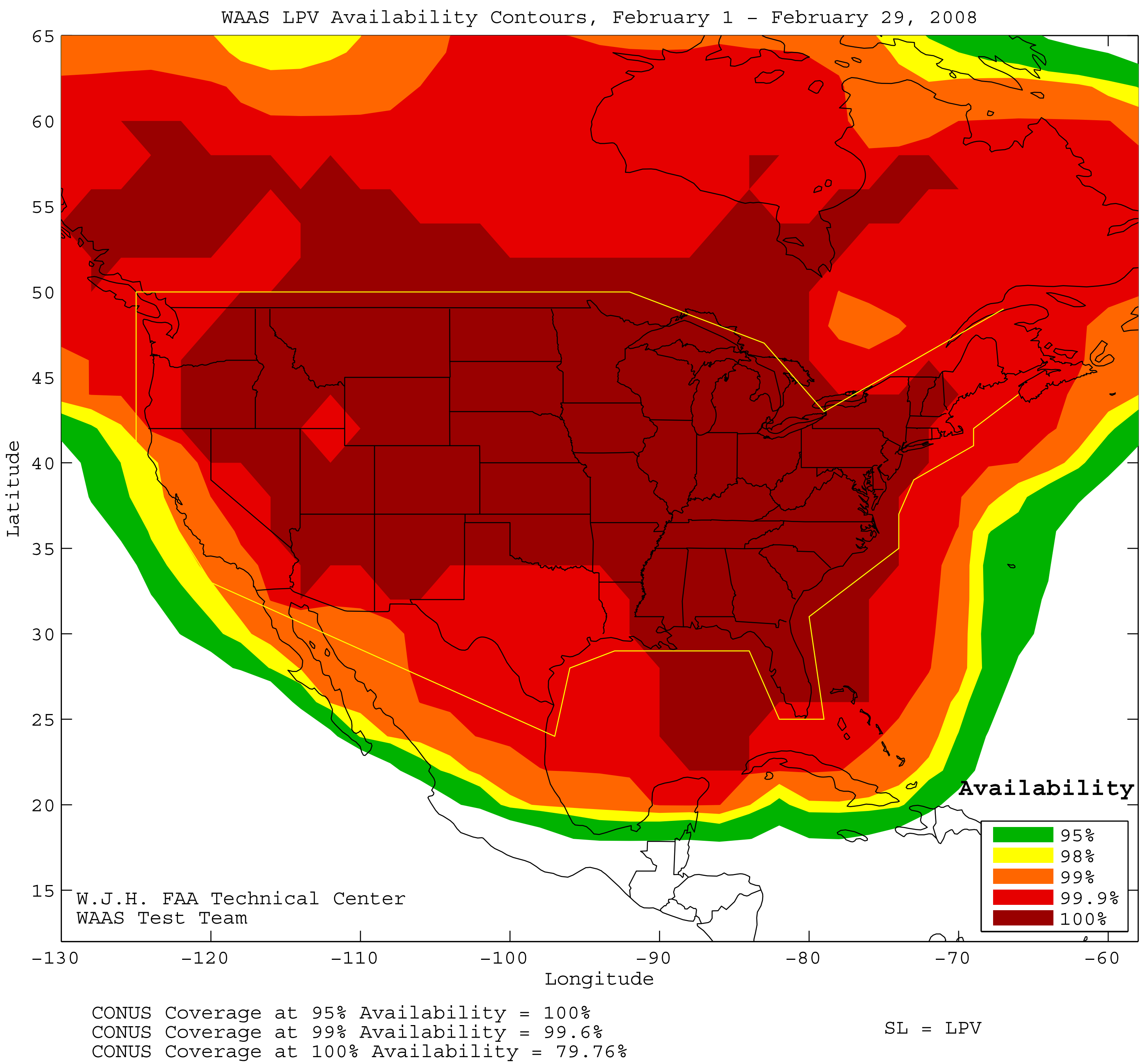


Figure 4-3 LPV CONUS Coverage - March

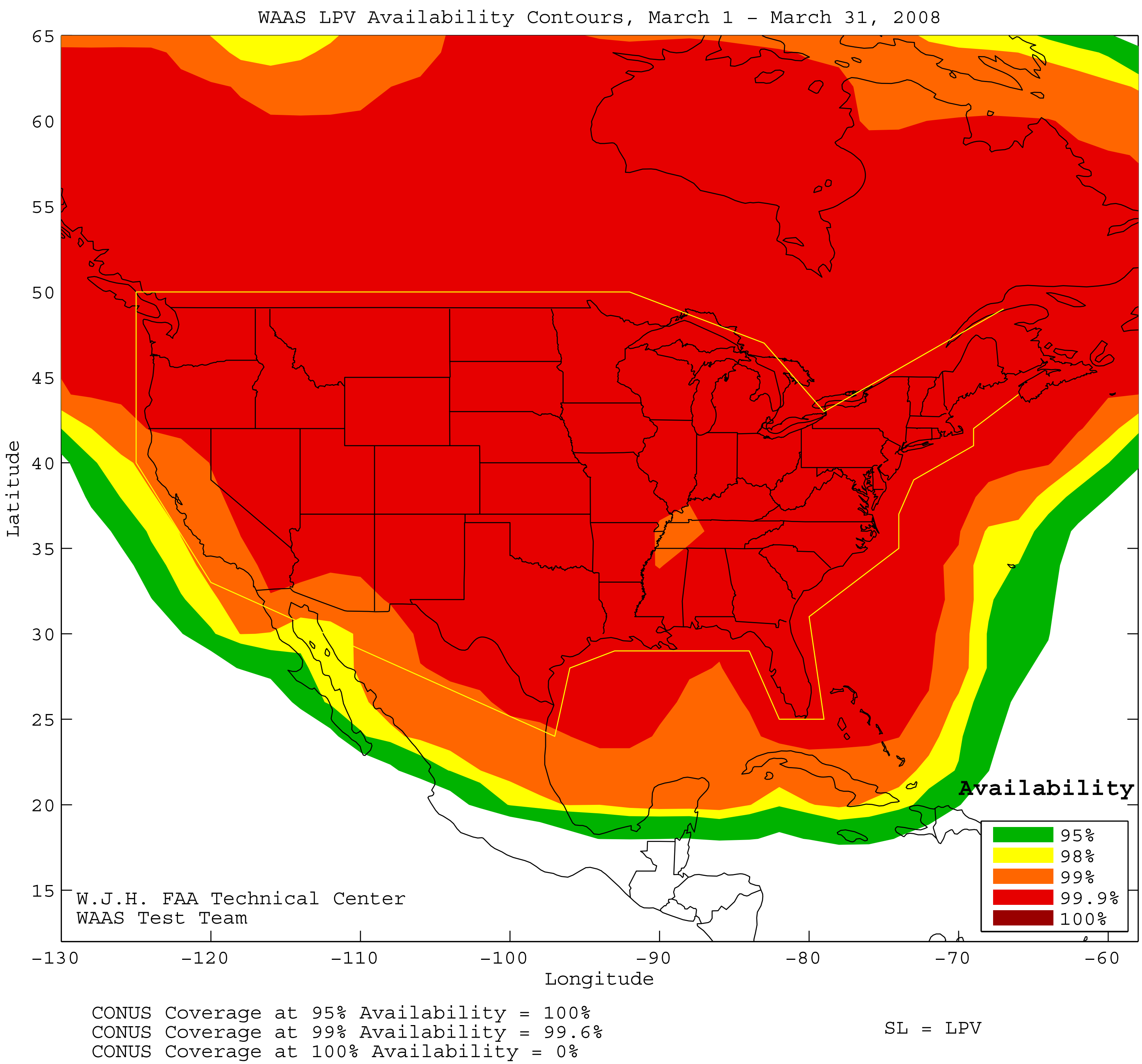


Figure 4-4 LPV CONUS Coverage for the Quarter

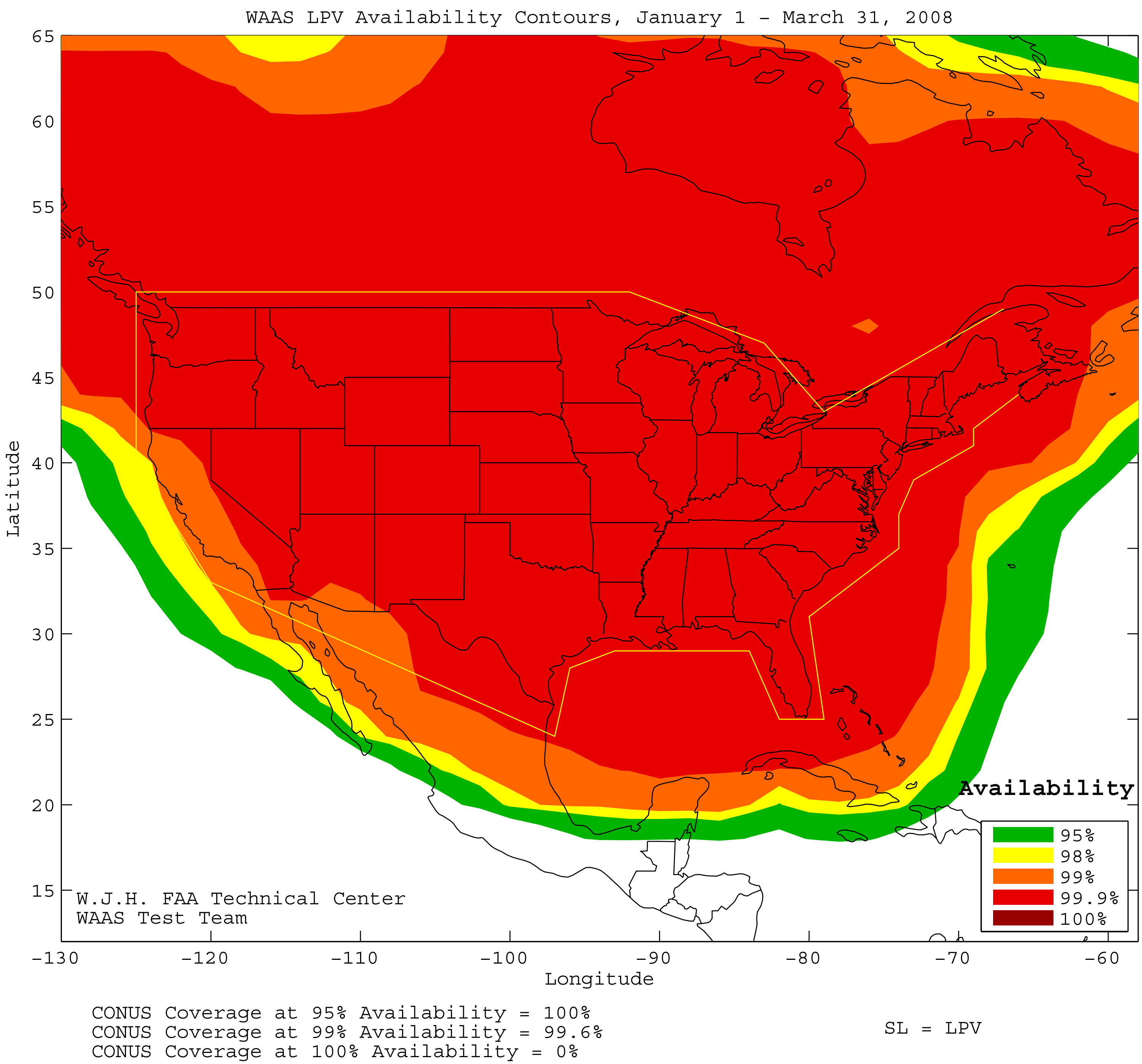


Figure 4-5 LPV Alaska Coverage - January

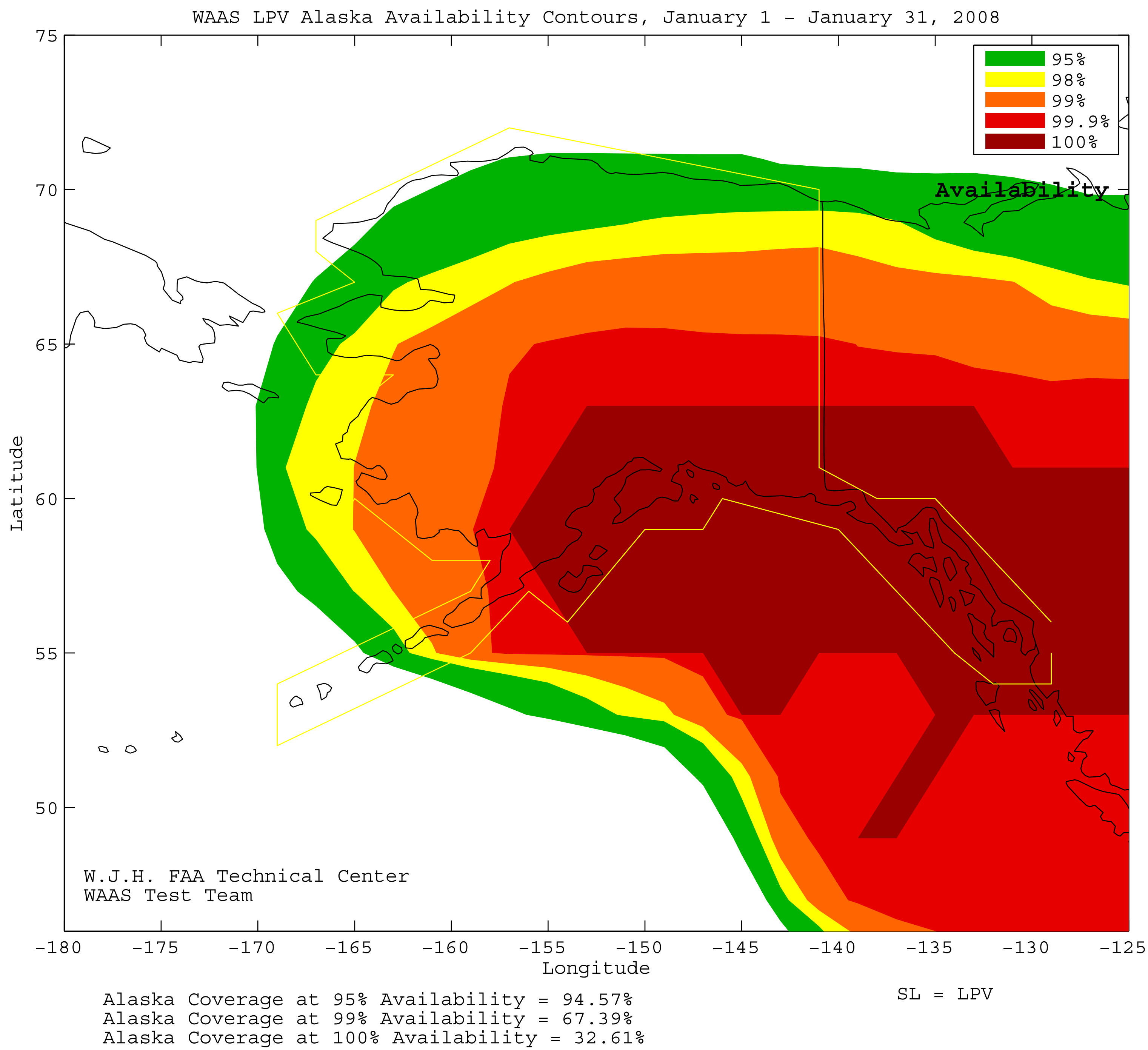


Figure 4-6 LPV Alaska Coverage - February

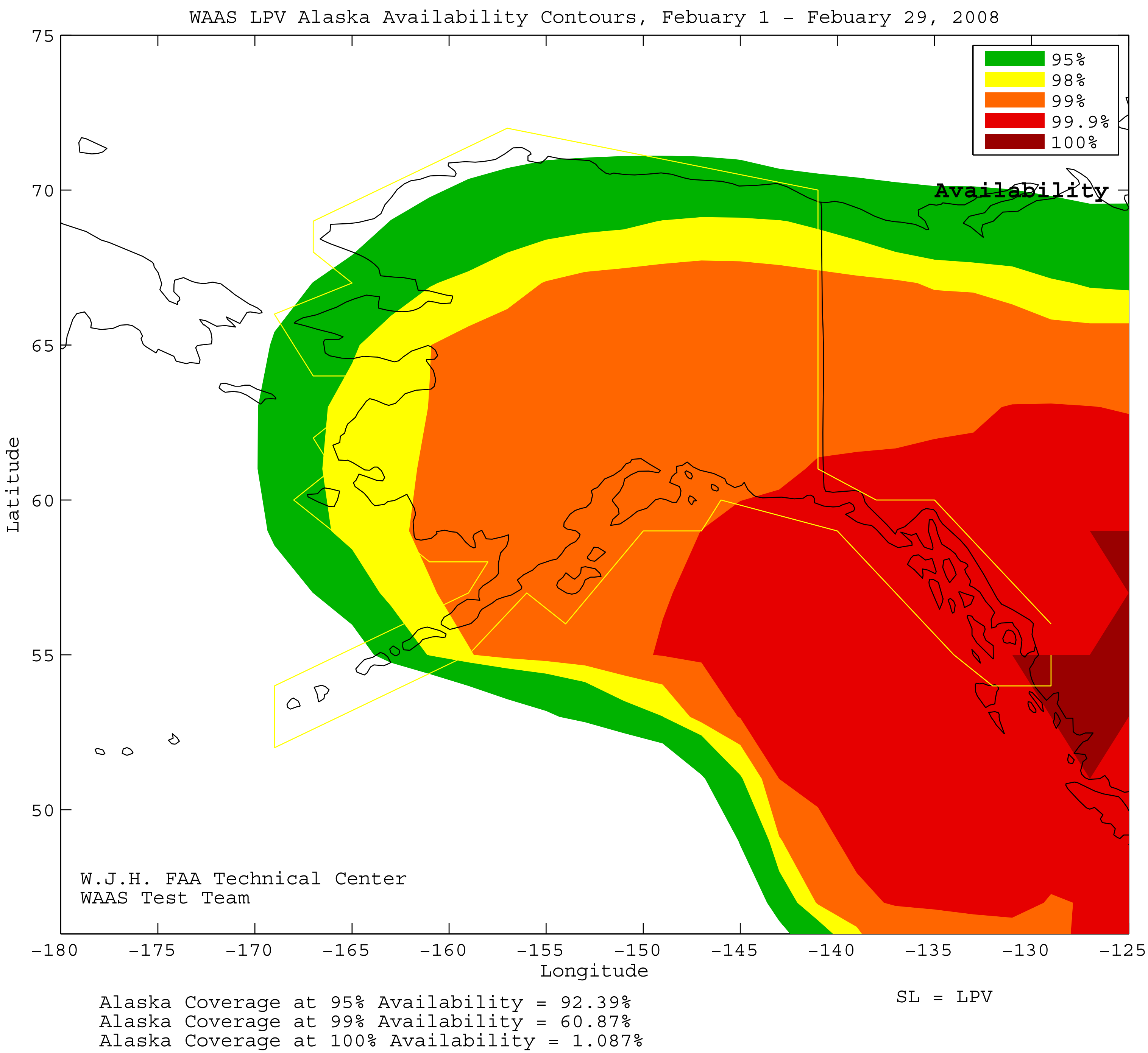


Figure 4-7 LPV Alaska Coverage - March

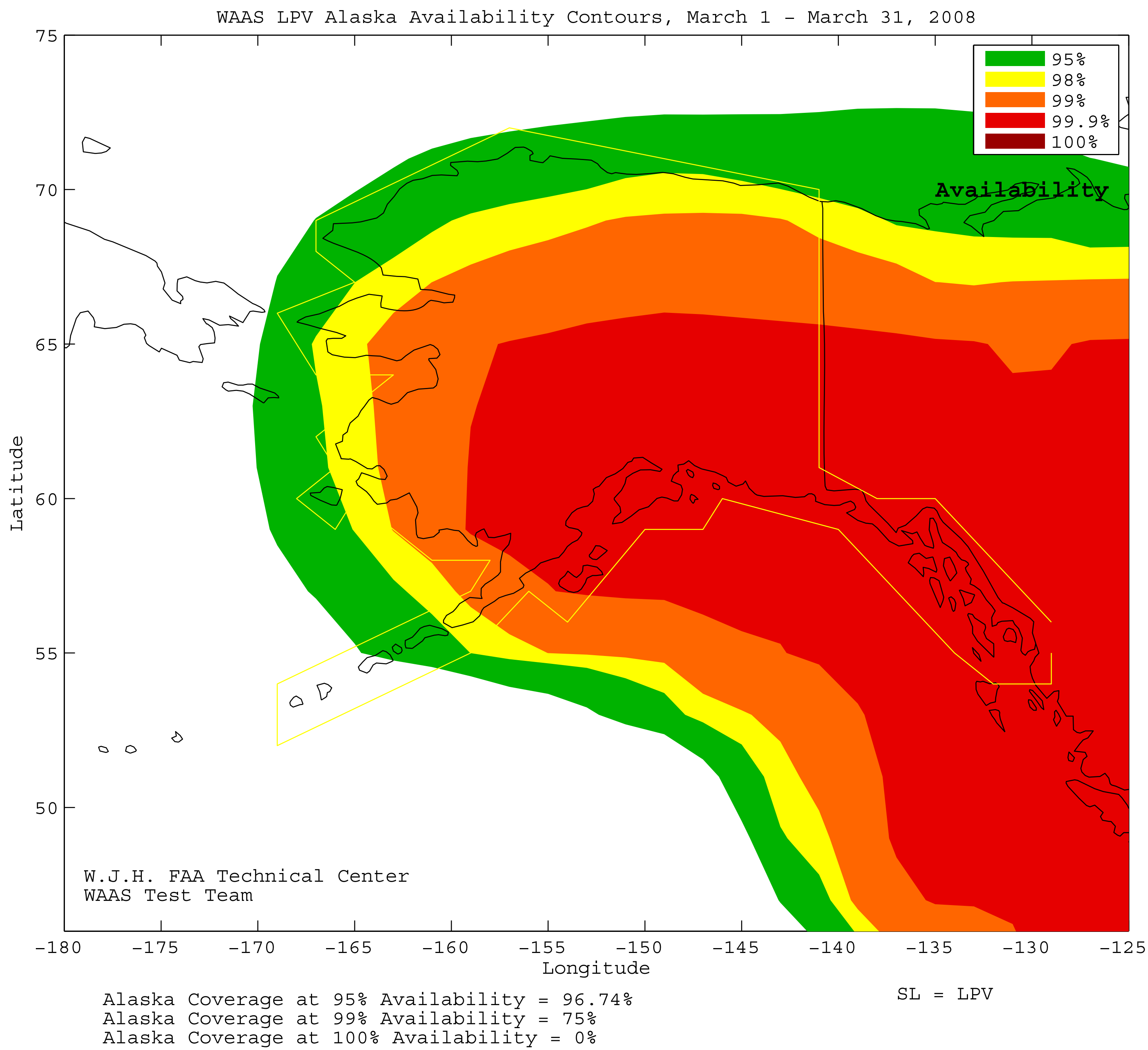


Figure 4-8 LPV Alaska Coverage for the Quarter

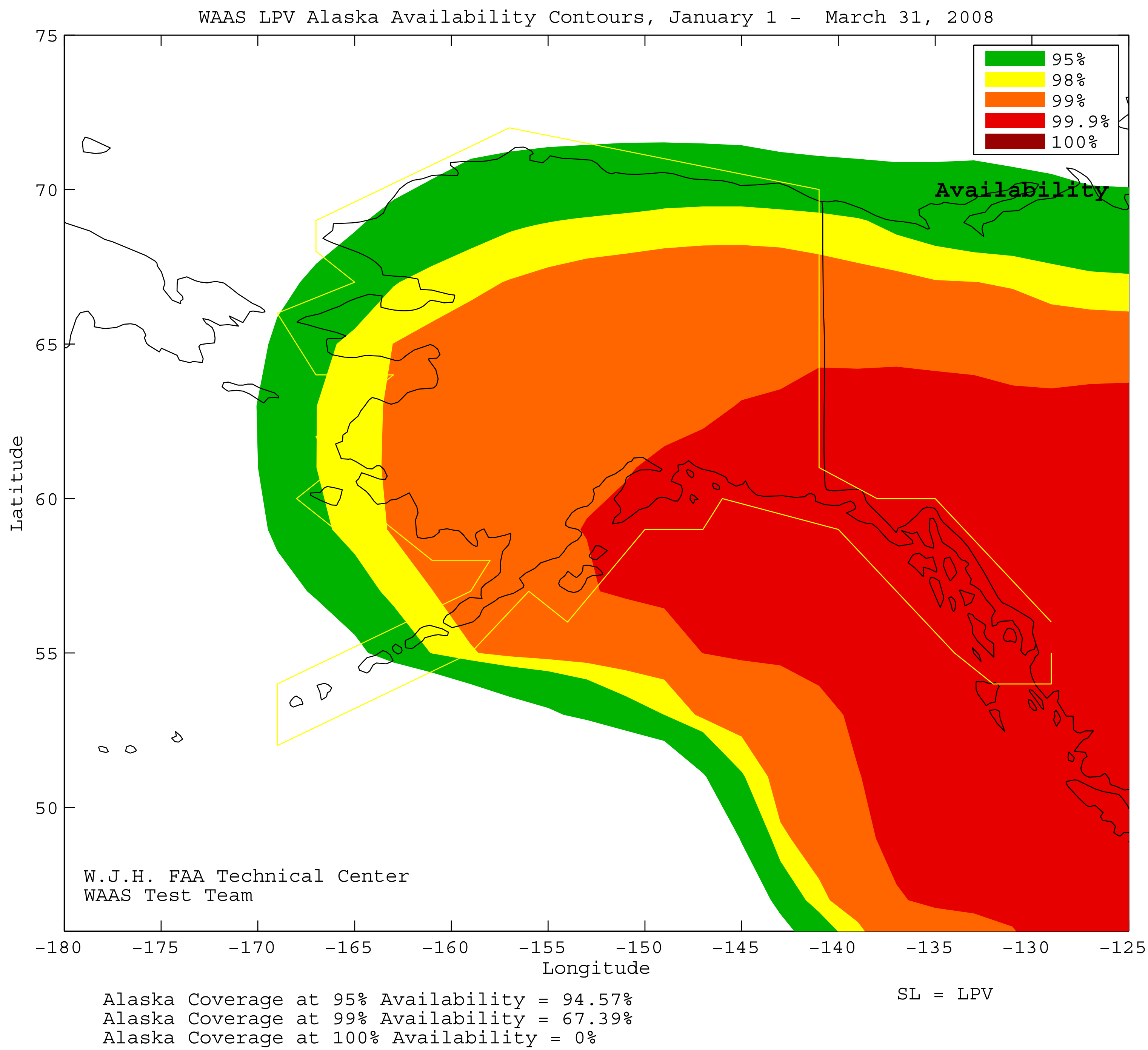


Figure 4-9 LPV 200 CONUS Coverage - January

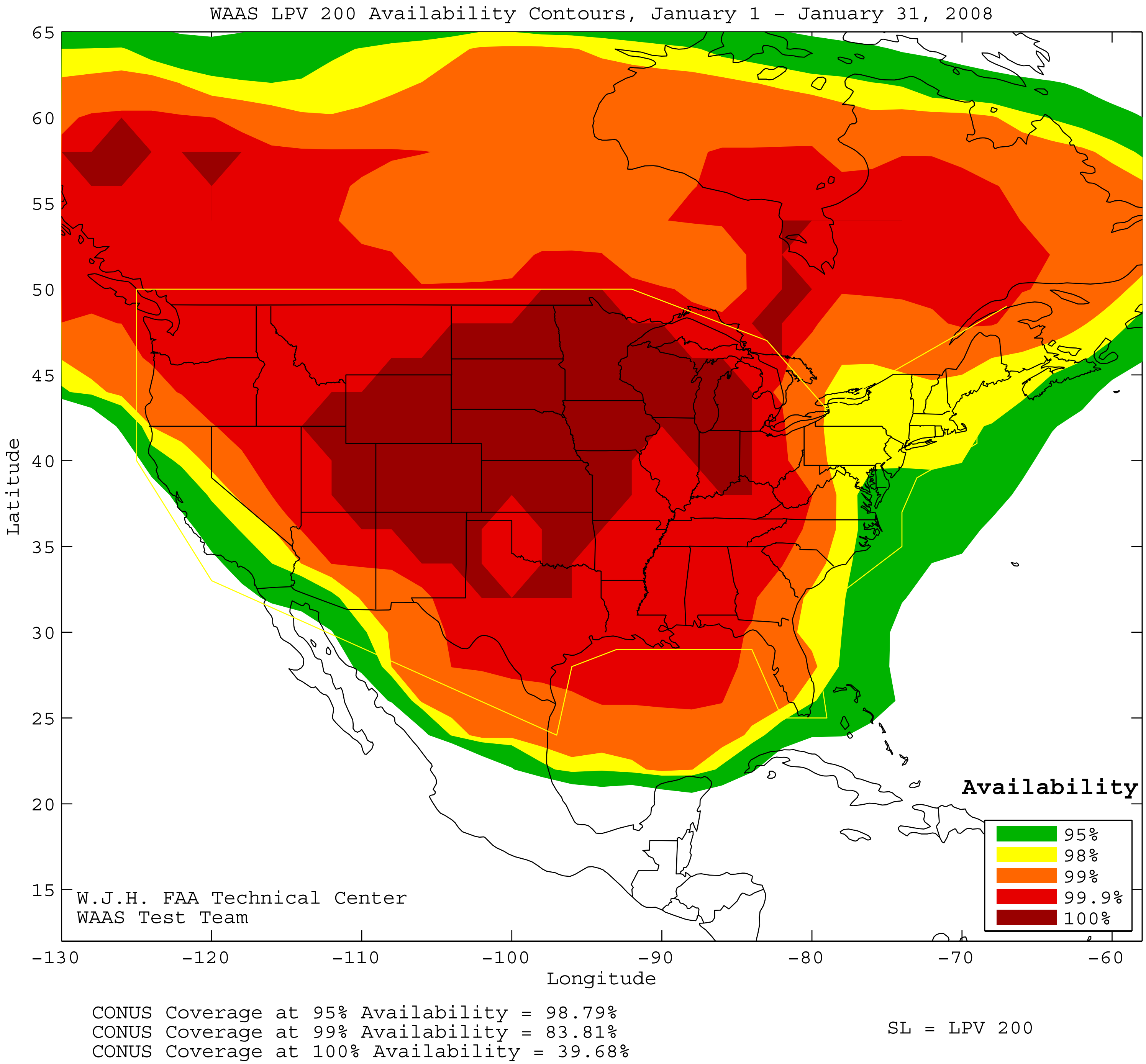


Figure 4-10 LPV 200 CONUS Coverage - February

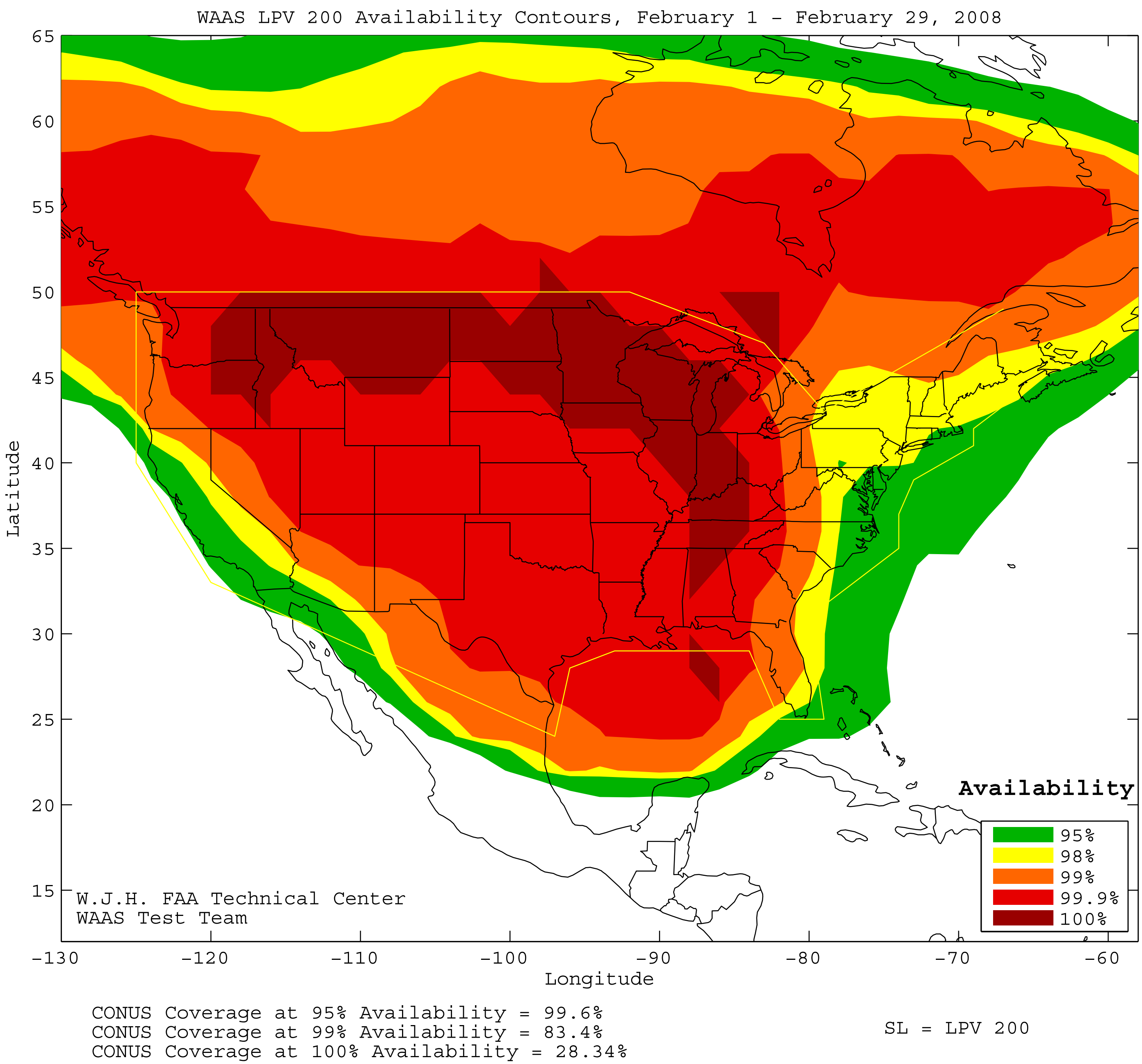


Figure 4-11 LPV 200 CONUS Coverage - March

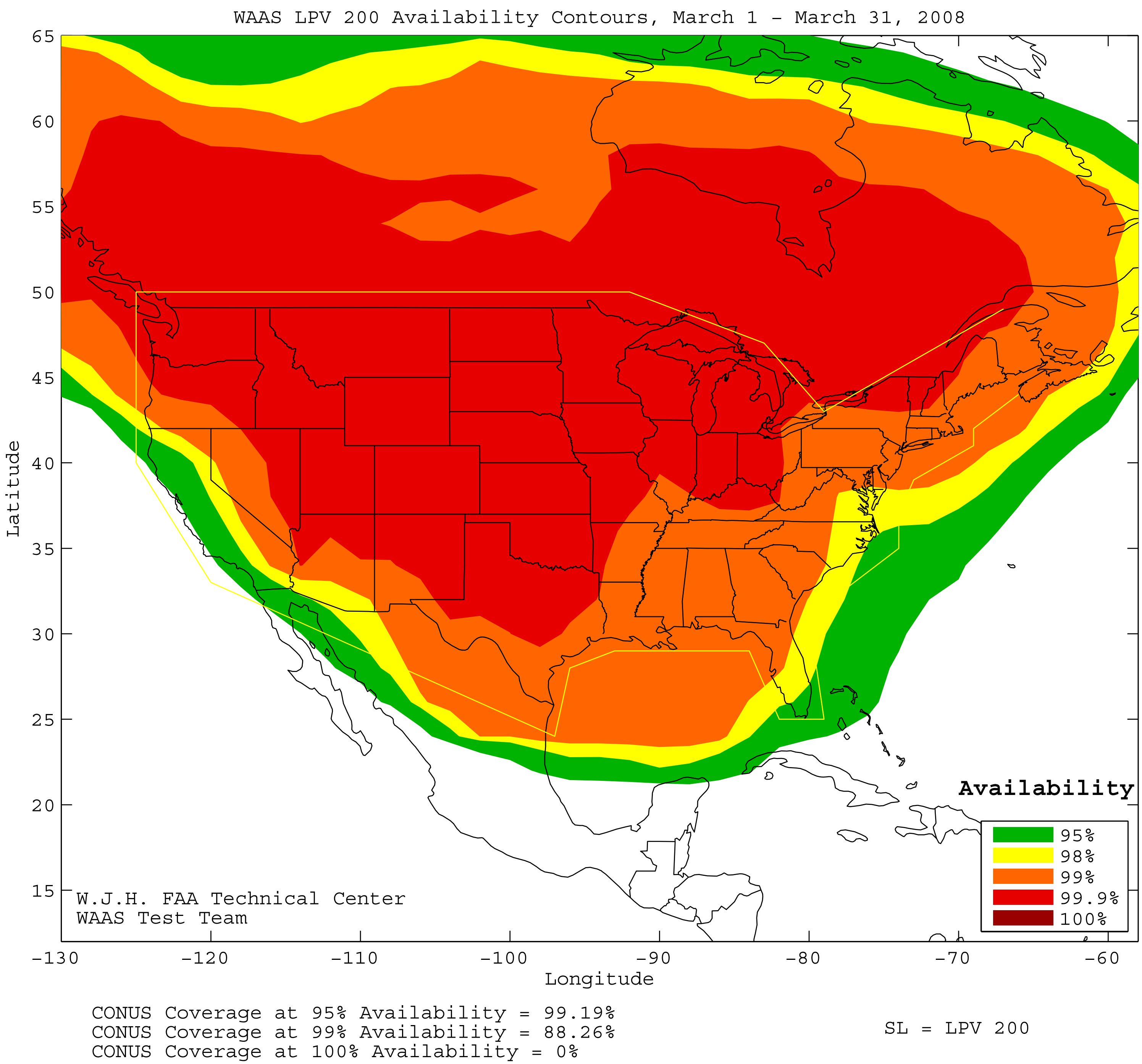
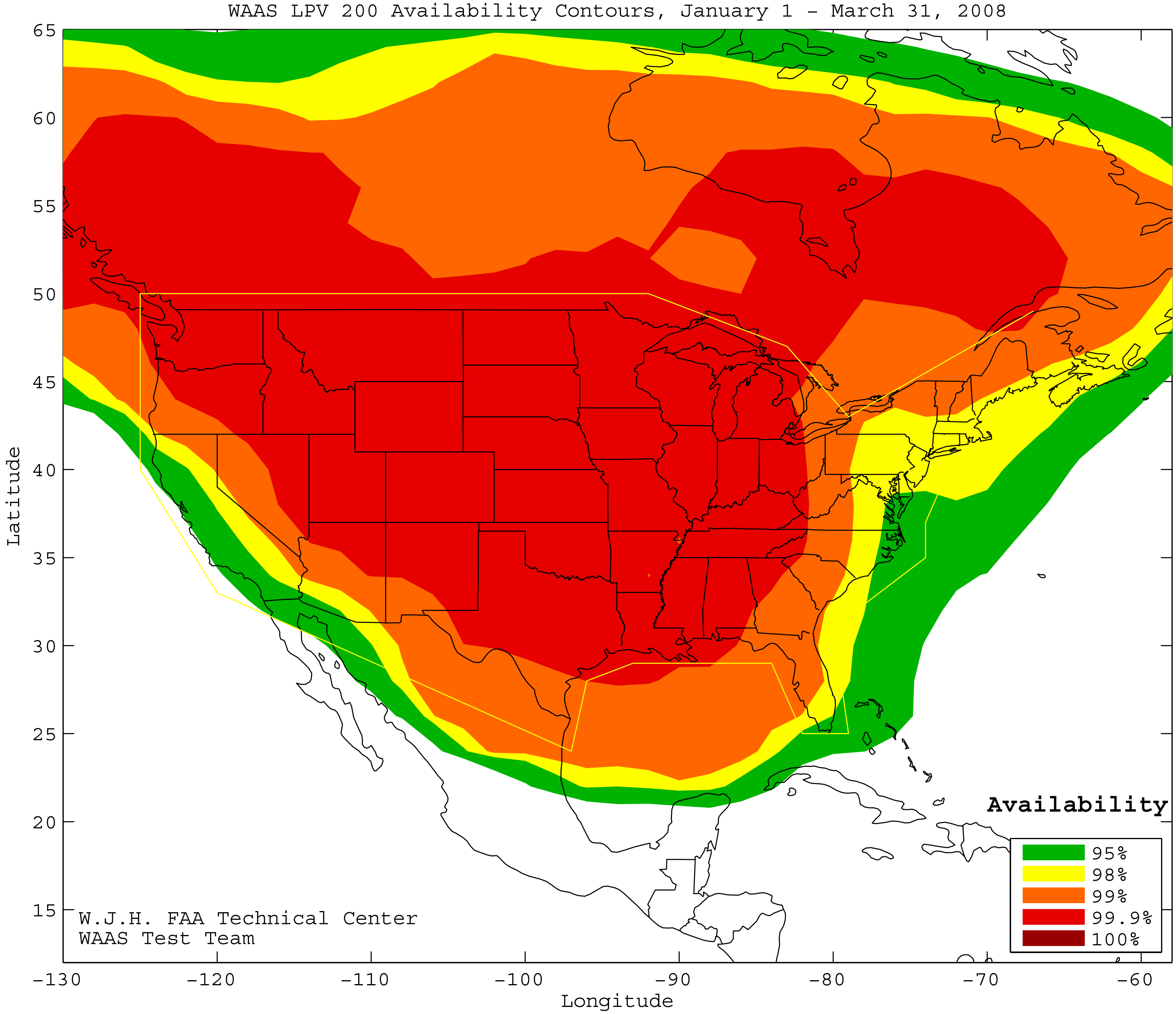


Figure 4-12 LPV 200 CONUS Coverage for the Quarter



CONUS Coverage at 95% Availability = 99.19%
CONUS Coverage at 99% Availability = 84.21%
CONUS Coverage at 100% Availability = 0%

SL = LPV 200

Figure 4-13 LPV 200 Alaska Coverage - January

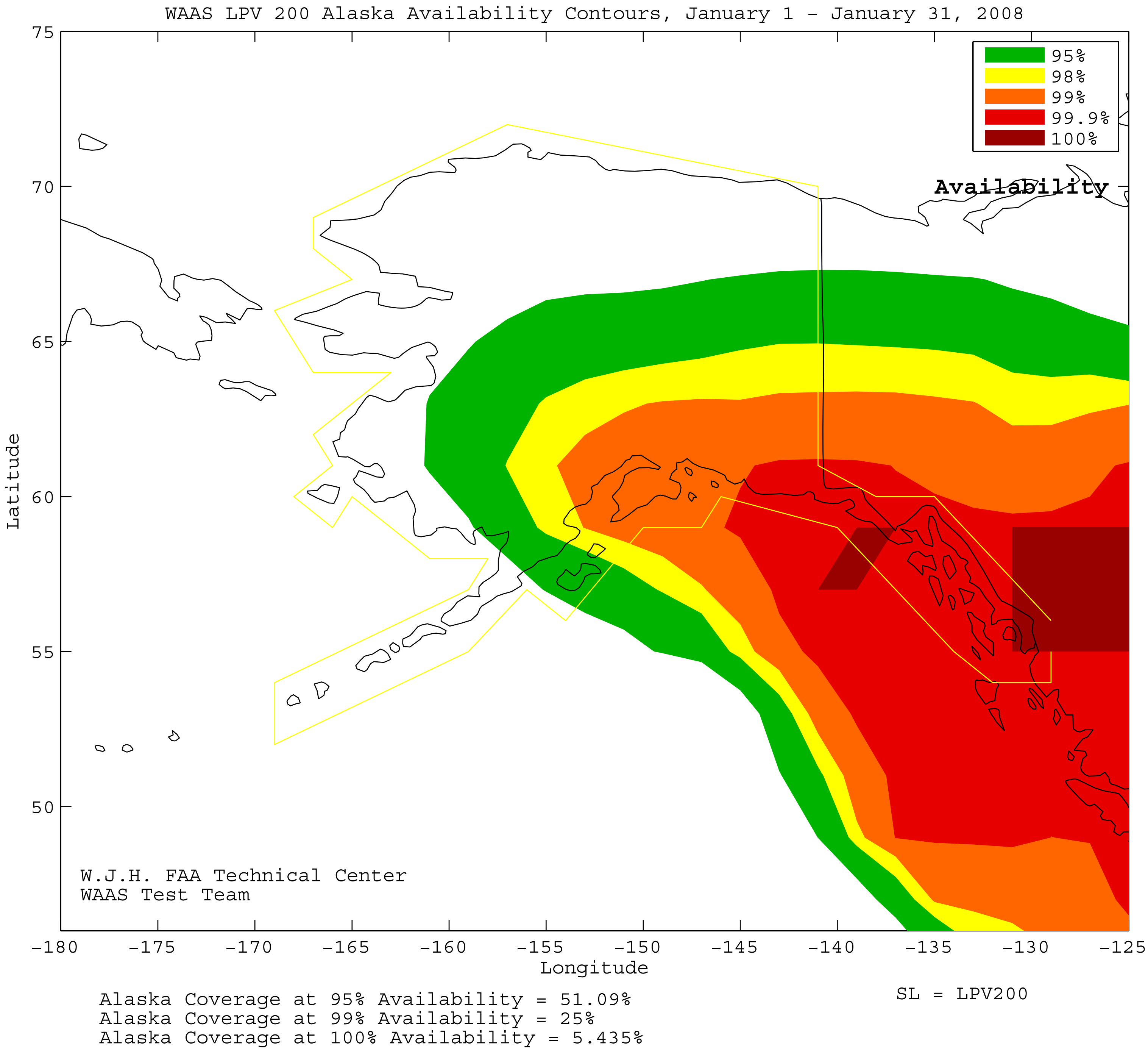


Figure 4-14 LPV 200 Alaska Coverage - February

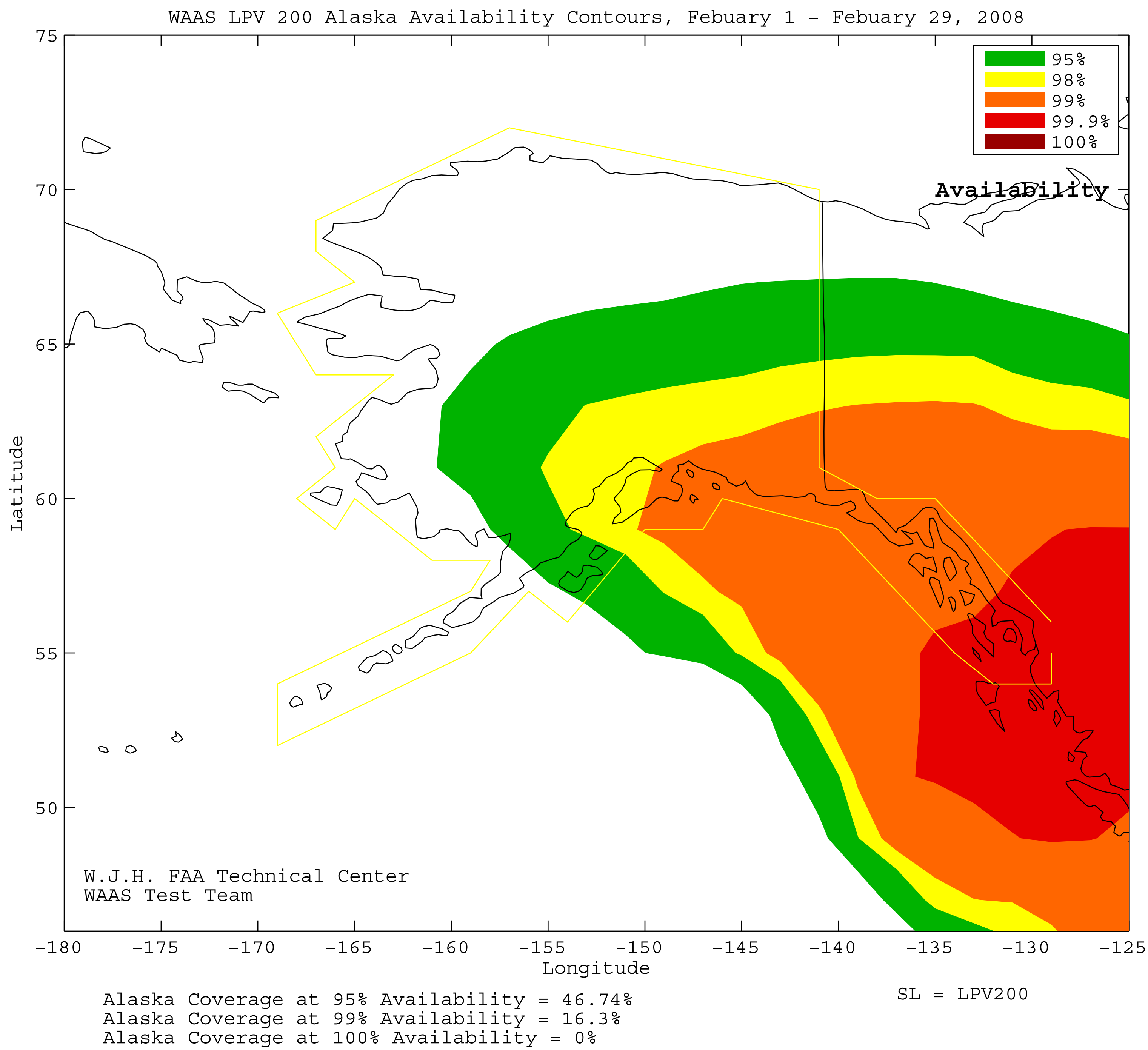


Figure 4-15 LPV 200 Alaska Coverage - March

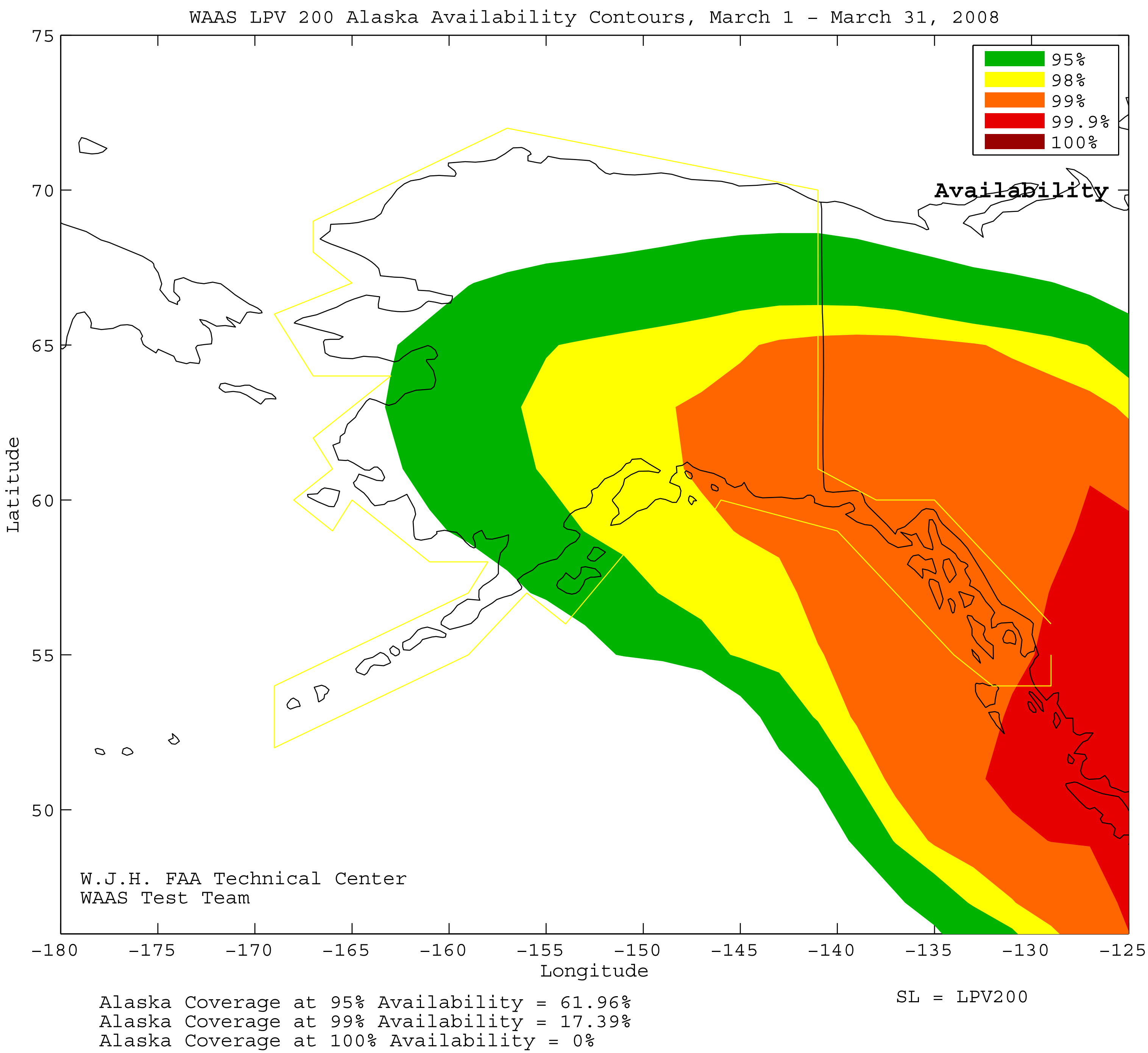


Figure 4-16 LPV 200 Alaska Coverage for the Quarter

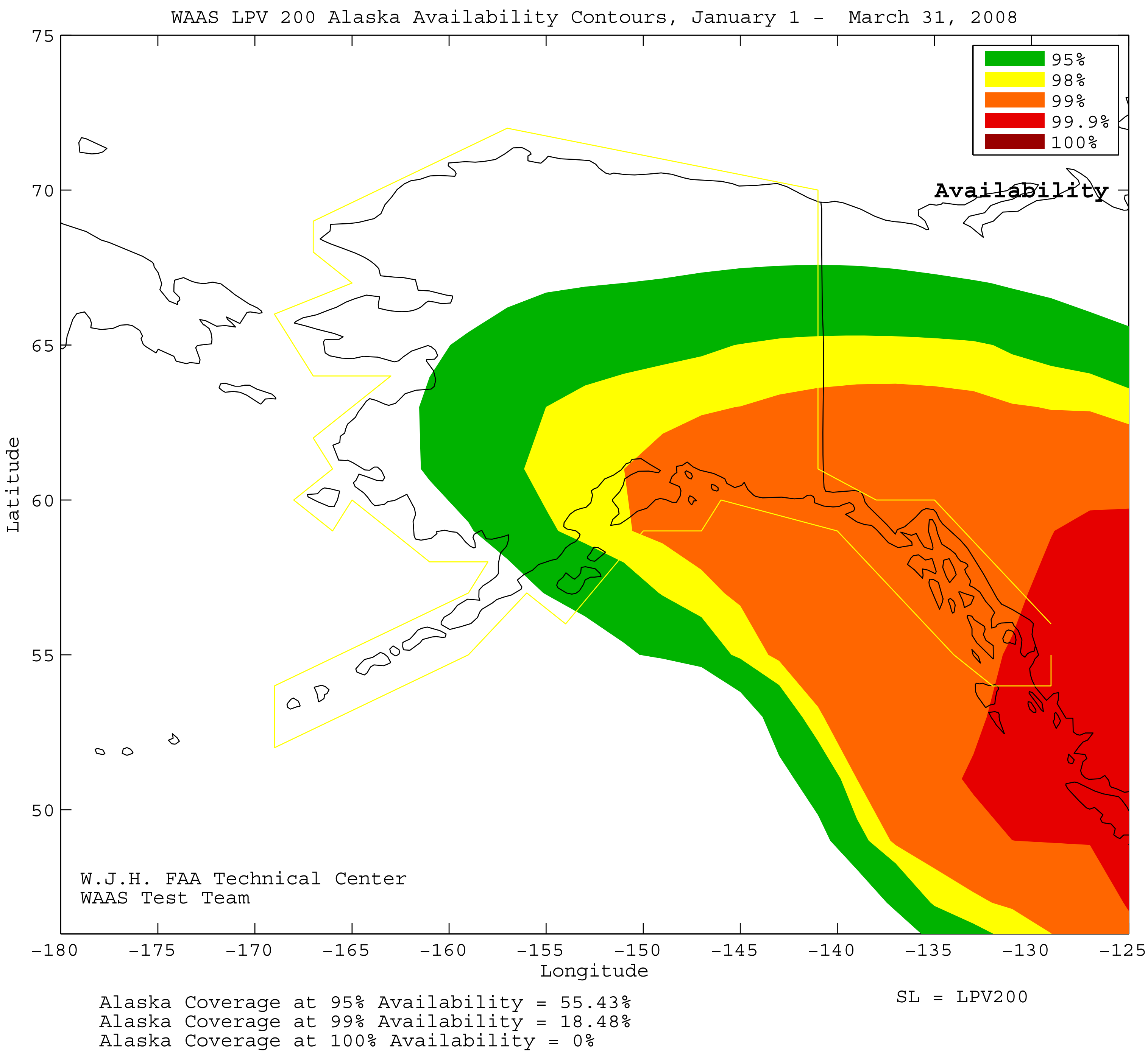
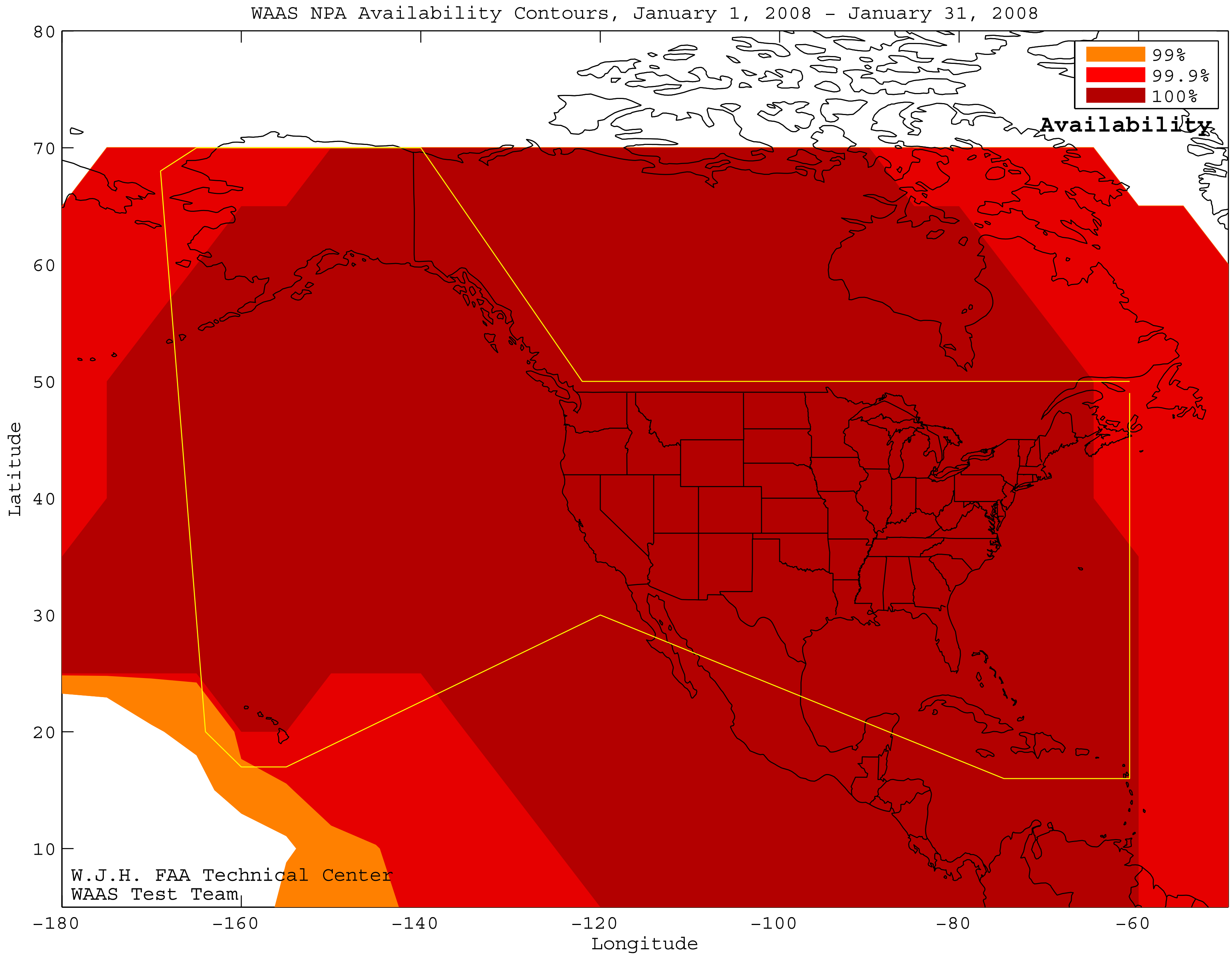


Figure 4-17 NPA Coverage - January



WAAS Coverage at 99% Availability = 100%
WAAS Coverage at 99.9% Availability = 100%
WAAS Coverage at 100% Availability = 98.53%

SL = NPA

Figure 4-18 NPA Coverage - February

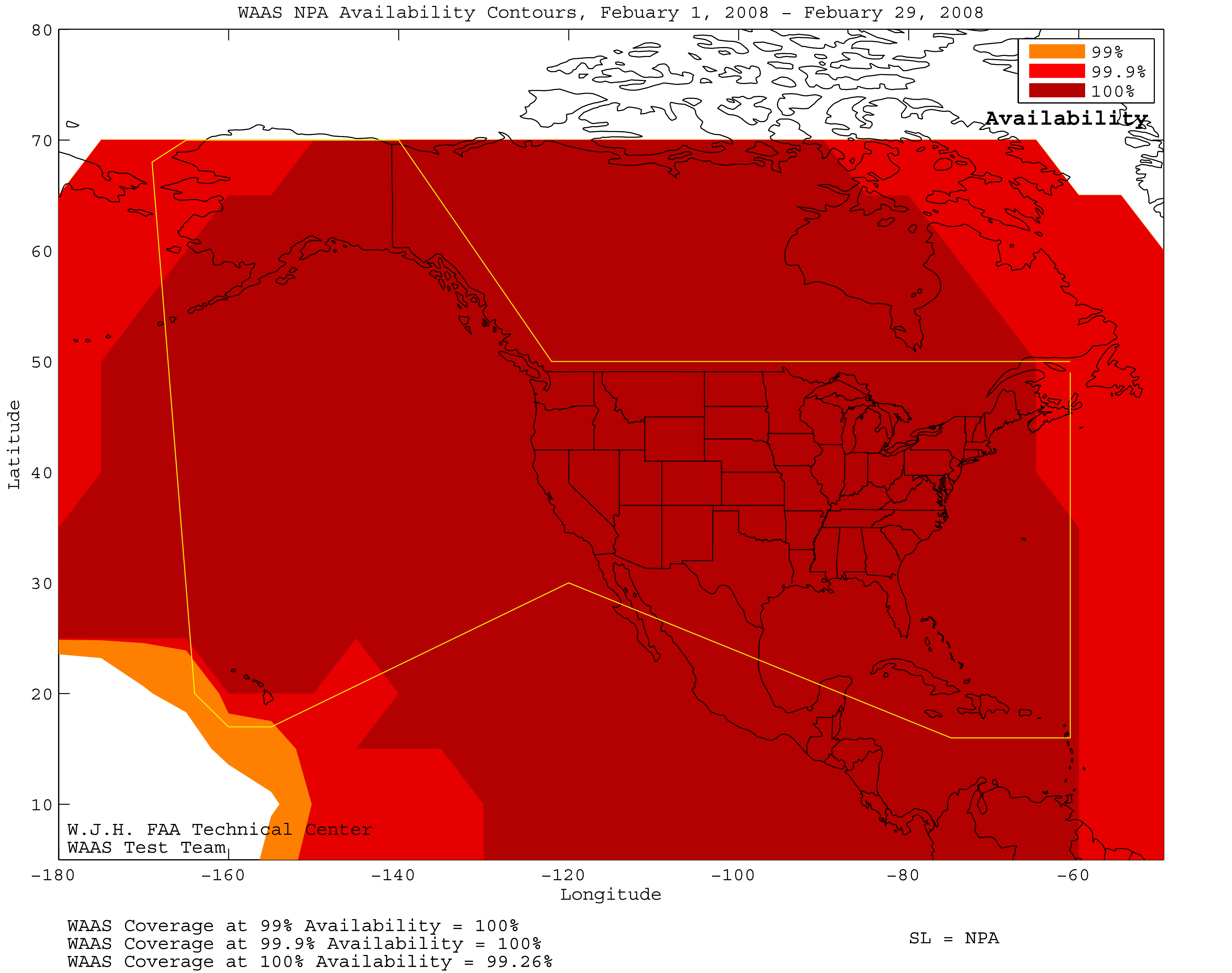


Figure 4-19 NPA Coverage - March

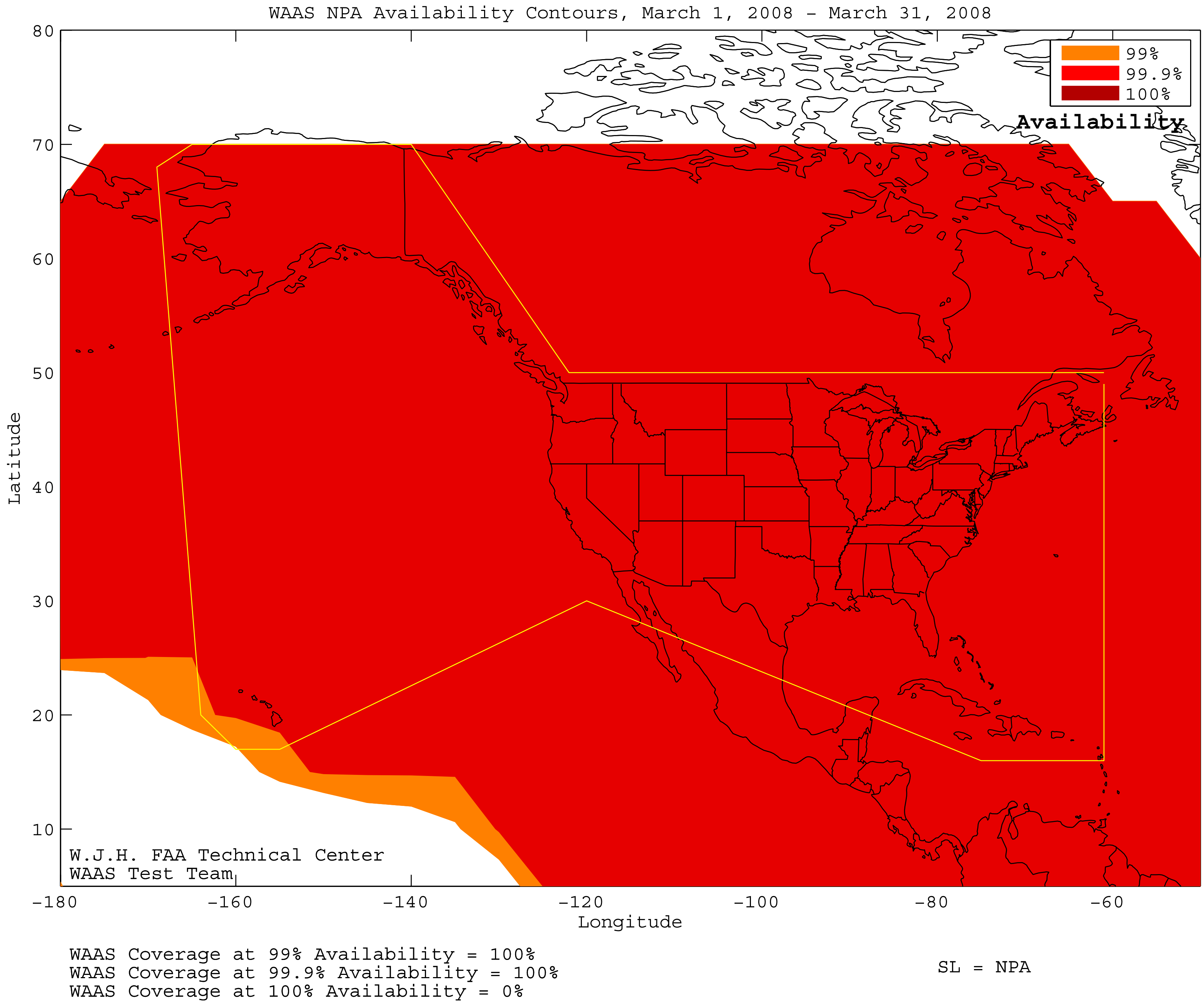


Figure 4-20 NPA Coverage for the Quarter

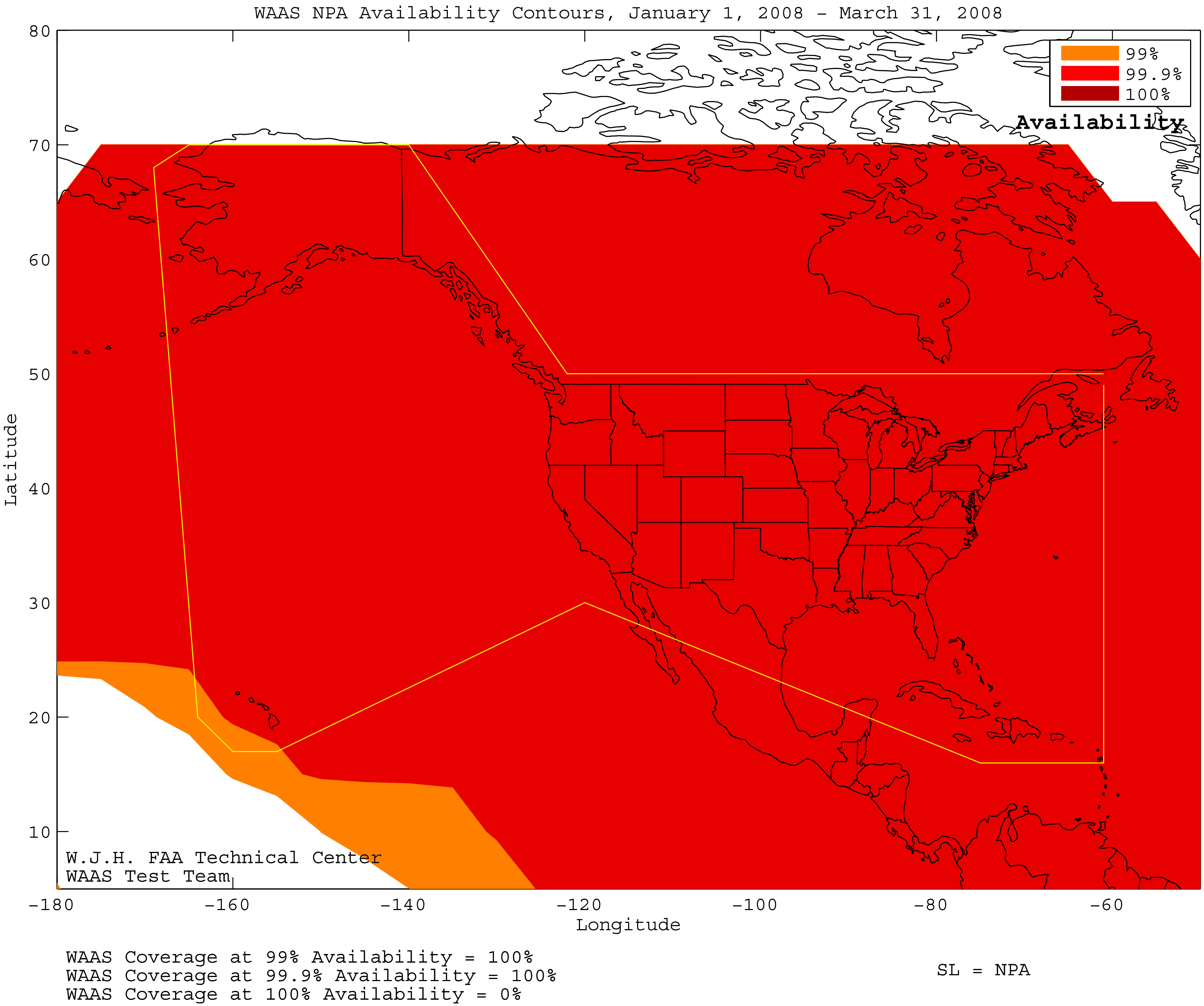


Figure 4-21 Daily LPV and LPV 200 CONUS Coverage

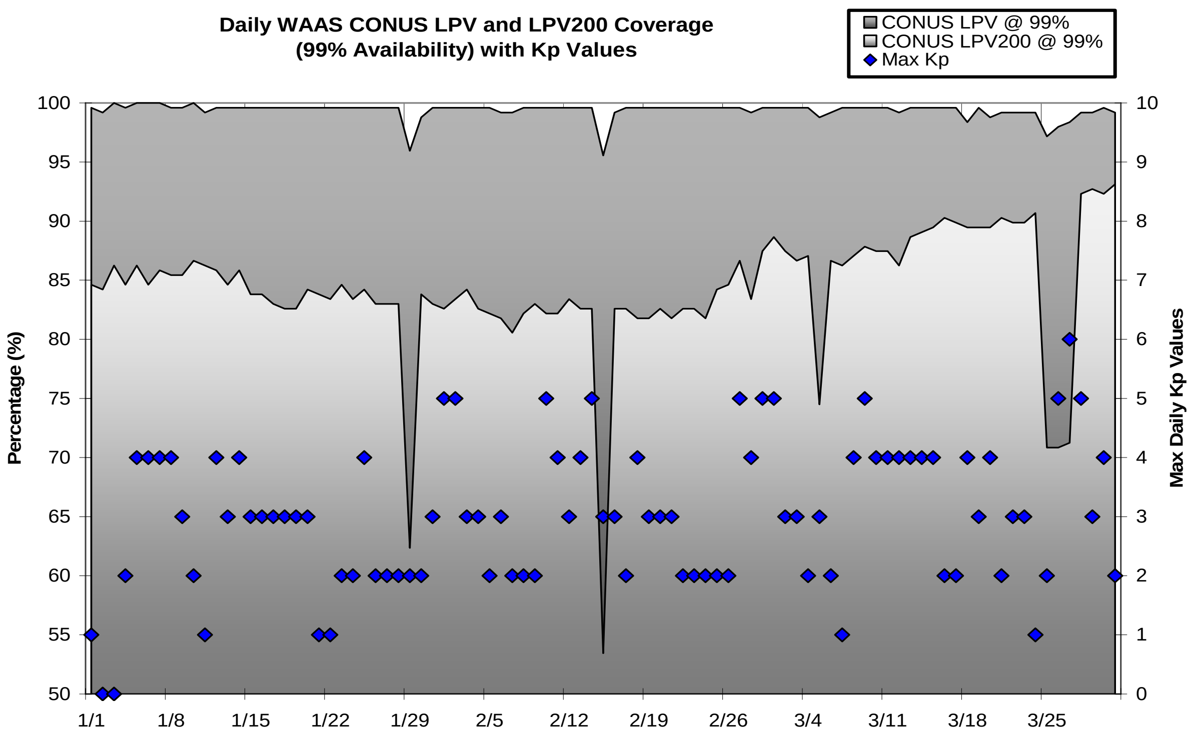


Figure 4-22 Daily LPV Alaska Coverage

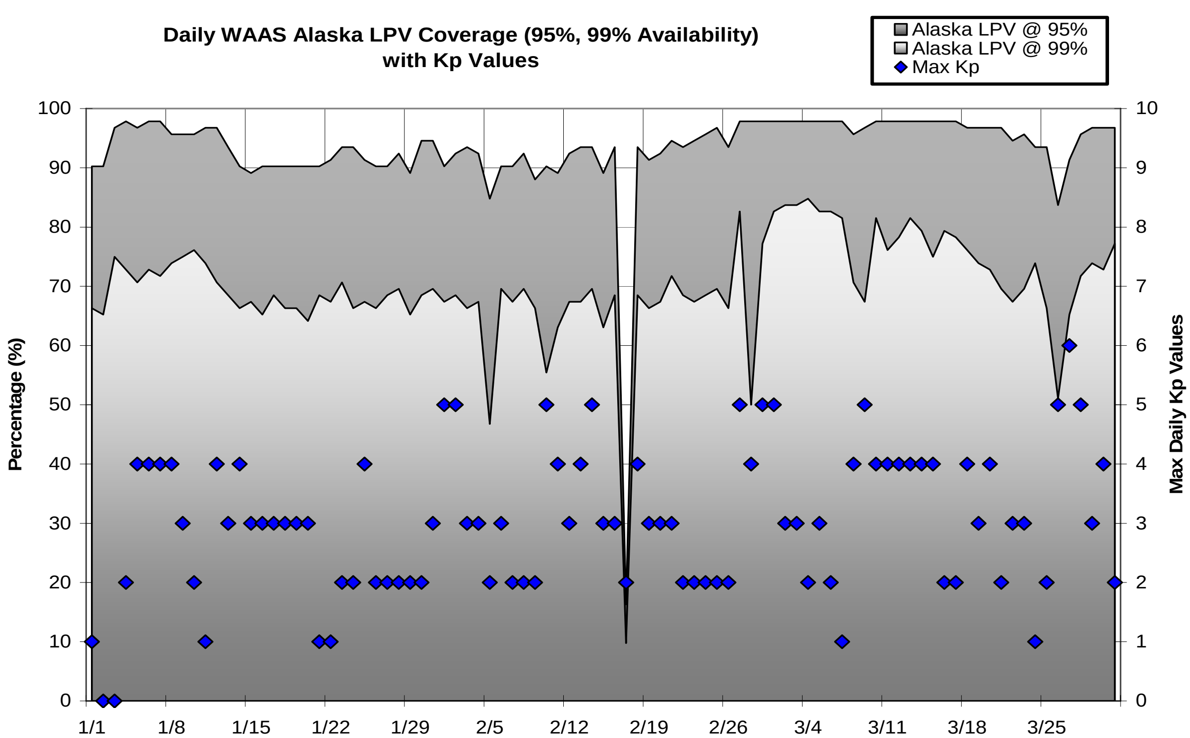
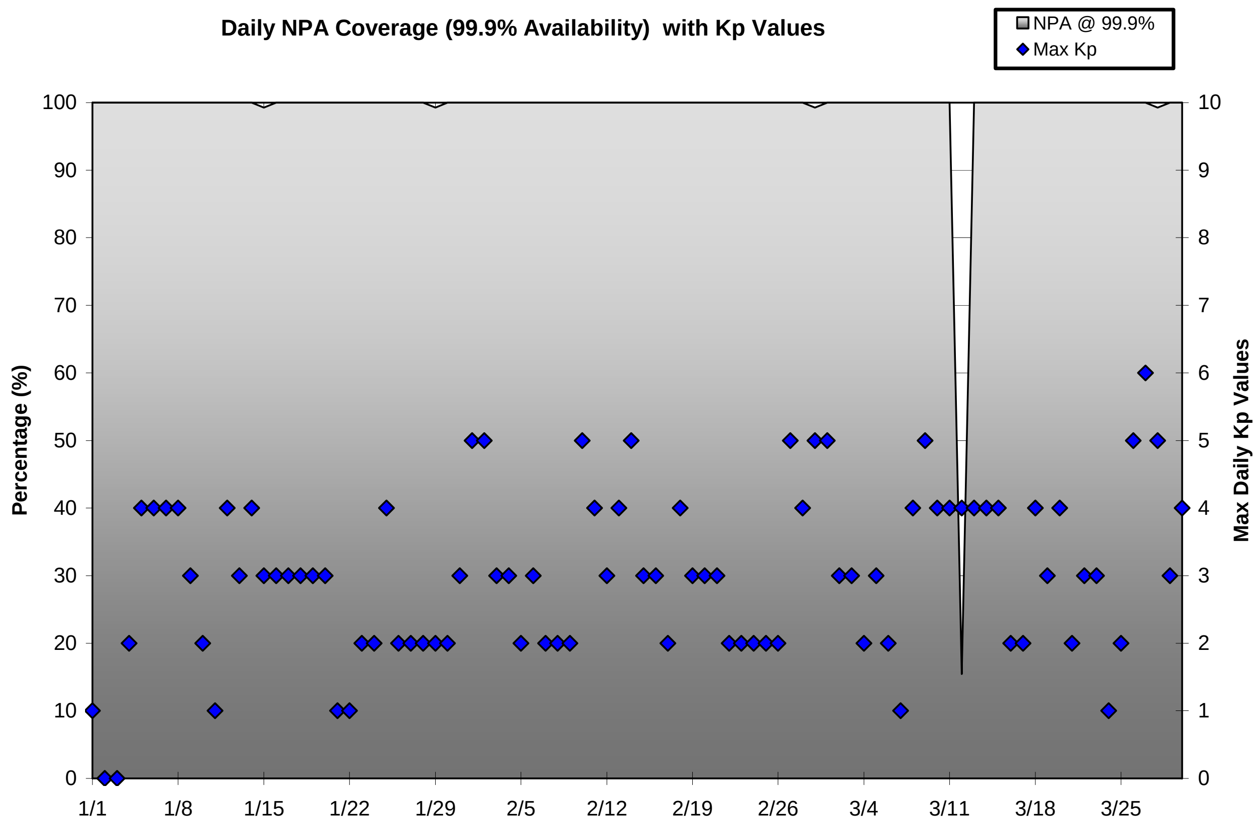


Figure 4-23 Daily NPA Coverage



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. The process for determining this index involves normalizing the largest error observed at a site. This is accomplished by dividing this maximum observed error by the WAAS estimated standard deviation of the error. The safety margin requirement, 5.33 standard units for vertical and 6 standard units for horizontal, is then divided by this maximum normalized 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 1.97 at Tapachula. There was no HMI event. Since WAAS was made available to the public in August 2000 there has not been an HMI event. Note that the FAA commissioned WAAS for safety of life services in July 2003.

Table 5-1 Safety Margin Index and HMI Statistics

Location	Safety Index		Number of HMIs
	Horizontal	Vertical	
Arcata	5.45	4.44	0
Atlantic City	7.50	4.85	0
Oklahoma City	5.00	4.85	0
Albuquerque	7.50	8.88	0
Anchorage	6.67	10.66	0
Atlanta	7.50	6.66	0
Barrow	4.00	4.10	0
Bethel	12.00	10.66	0
Billings	10.00	8.88	0
Boston	7.50	5.92	0
Chicago	7.50	5.92	0
Cleveland	6.67	4.85	0
Cold Bay	10.00	8.88	0
Dallas	8.57	6.66	0
Denver	6.67	4.85	0
Fairbanks	5.45	7.61	0
Gander	8.57	7.61	0
Goose Bay	8.57	8.88	0
Houston	7.50	6.66	0
Iqaluit	5.45	4.85	0
Jacksonville	7.50	5.92	0
Juneau	7.50	6.66	0
Kansas City	7.50	8.88	0
Kotzebue	4.29	6.66	0
Los Angeles	7.50	6.66	0
Memphis	7.50	5.33	0
Merida	6.00	8.88	0
Mexico City	5.45	8.88	0
Miami	8.57	6.66	0
Minneapolis	3.53	4.44	0
New York	7.50	5.33	0
Oakland	10.00	7.61	0
Puerto Vallarta	5.45	7.61	0
Salt Lake City	8.57	7.61	0
San Jose Del Cabo	5.00	7.61	0
Seattle	6.00	4.85	0
Tapachula	5.45	1.97	0
Washington DC	8.57	5.33	0
Winnipeg	7.50	5.92	0

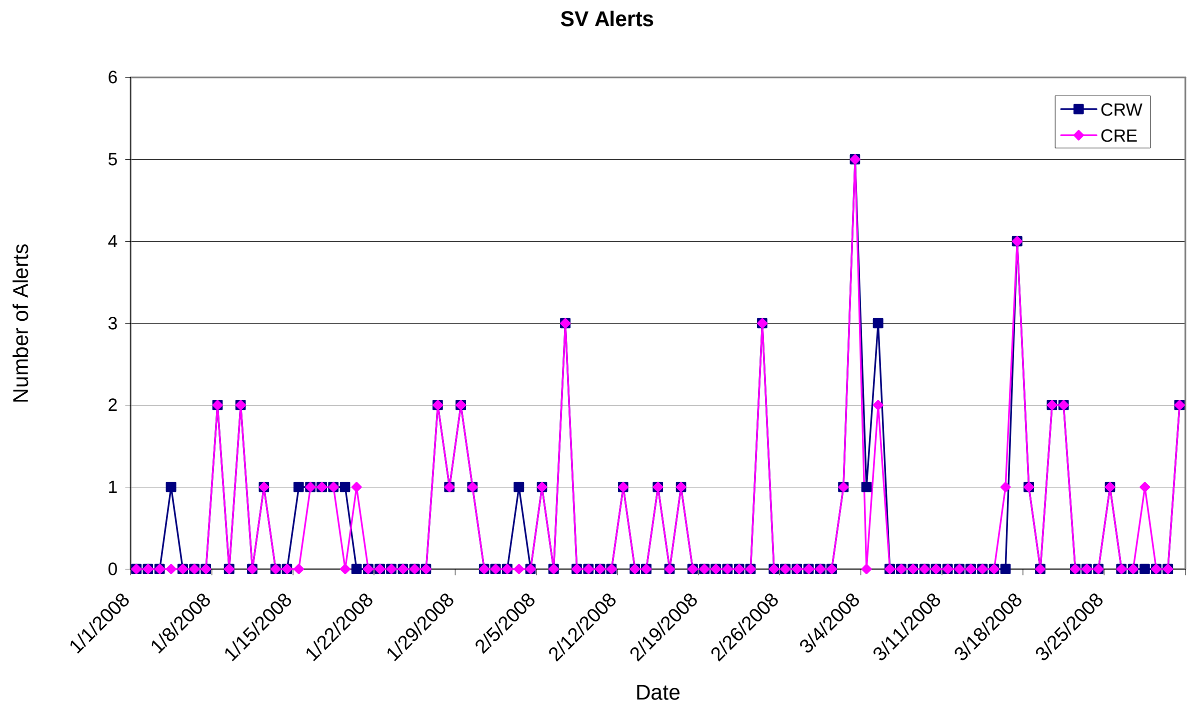
5.2 Broadcast Alerts

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	14	14	0.1538	0.1538
3	17	17	0.1868	0.1868
4	18	16	0.1978	0.1758
5	0	0	0	0
6	1	0	0.0109	0
24	0	0	0	0
26	0	0	0	0
Total Alerts	50	47	0.5493	0.5164

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	116574	24	174
2	1310373	37	23
3	1310396	31	19
4	1310405	31	19
7	105028	82	156
9	92137	0	0
10	105005	72	174
17	31950	7	359

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

SV	On Time	Late	Max Late Length (seconds)
1	42446	0	0
2	48591	0	0
3	54242	0	0
4	49393	0	0
5	54036	0	0
6	51552	0	0
7	3588	0	0
8	48471	0	0
9	53954	0	0
10	47688	0	0
11	56000	0	0
12	51304	0	0
13	49008	0	0
14	49966	0	0
15	51326	0	0
16	50437	0	0
17	49541	0	0
18	49184	0	0
19	52280	0	0
20	52895	0	0
21	48111	0	0
22	49589	0	0
23	48208	0	0
24	49685	0	0
25	48888	0	0
26	51541	1	179
27	48785	1	168
28	49942	0	0
29	47775	0	0
30	54821	0	0
31	49833	0	0
32	17868	0	0

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

SV	On Time	Late	Max Late Length (seconds)
1	39647	0	0
2	45622	0	0
3	50738	1	130
4	46138	0	0
5	50561	1	149
6	48062	1	154
7	3328	0	0
8	45432	1	192
9	50452	0	0
10	44567	0	0
11	52451	0	0
12	47926	0	0
13	45737	0	0
14	46434	0	0
15	47763	0	0
16	46930	0	0
17	45384	0	0
18	45135	0	0
19	47331	0	0
20	47443	1	192
21	43174	2	184
22	44417	0	0
23	43256	0	0
24	44564	1	130
25	43777	0	0
26	46156	0	0
27	43659	0	0
28	44755	0	0
29	42856	0	0
30	49148	0	0
31	44692	0	0
32	16033	1	183
135	82394	0	0
138	81990	1	171

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27246	26	488
0	1	27246	42	479
0	2	27241	32	482
0	3	27253	28	481
1	0	27248	33	484
1	1	27250	35	477
1	2	27258	34	576
1	3	27237	32	495
1	4	27249	33	489
2	0	27237	37	482
2	1	27243	32	376
2	2	27262	28	515
2	3	27239	30	560
2	4	27257	33	533
2	5	27249	41	510
3	0	27237	37	509
3	1	27251	32	377
3	2	27250	33	353
9	0	27254	33	384
9	1	27267	28	377
9	2	27249	30	377
9	3	27235	35	400
9	4	27260	30	371

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

Band	On Time	Late	Max Late Length (seconds)
0	81940	0	0
1	81897	0	0
2	81958	0	0
3	81862	0	0
9	81821	0	0

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

Message Type	On Time	Late	Max Late Length (seconds)
1	116533	30	168
2	1310366	35	28
3	1310394	26	24
4	1310385	34	24
7	105306	65	168
9	92125	3	356
10	105365	73	188
17	31958	12	359

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

SV	On Time	Late	Max Late Length (seconds)
1	42444	0	0
2	48593	0	0
3	54238	0	0
4	49390	0	0
5	54028	0	0
6	51553	0	0
7	3587	0	0
8	48471	0	0
9	53965	1	180
10	47687	1	166
11	56008	1	166
12	51304	0	0
13	49006	0	0
14	49970	0	0
15	51333	0	0
16	50436	0	0
17	49544	0	0
18	49182	0	0
19	52286	0	0
20	52892	0	0
21	48109	0	0
22	49601	0	0
23	48215	0	0
24	49680	1	180
25	48896	1	166
26	51527	1	177
27	48785	1	166
28	49943	0	0
29	47773	0	0
30	54817	0	0
31	49817	0	0
32	17870	0	0

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

SV	On Time	Late	Max Late Length (seconds)
1	39647	0	0
2	45620	1	166
3	50737	0	0
4	46137	0	0
5	50563	0	0
6	48061	0	0
7	3328	0	0
8	45434	0	0
9	50450	0	0
10	44570	0	0
11	52450	0	0
12	47925	0	0
13	45732	0	0
14	46431	0	0
15	47762	1	184
16	46924	0	0
17	45384	0	0
18	45131	1	174
19	47327	0	0
20	47451	0	0
21	43176	2	184
22	44410	1	137
23	43248	0	0
24	44556	1	194
25	43778	0	0
26	46158	1	184
27	43654	0	0
28	44757	0	0
29	42860	0	0
30	49156	0	0
31	44689	0	0
32	16037	0	0
135	82402	1	191
138	81992	0	0

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27249	29	511
0	1	27268	22	535
0	2	27239	28	389
0	3	27252	27	408
1	0	27250	32	453
1	1	27255	35	460
1	2	27241	33	482
1	3	27245	30	484
1	4	27246	35	576
2	0	27250	40	488
2	1	27233	45	465
2	2	27239	39	495
2	3	27240	34	560
2	4	27248	31	578
2	5	27265	22	580
3	0	27262	25	480
3	1	27257	30	480
3	2	27256	35	480
9	0	27232	43	449
9	1	27260	27	462
9	2	27263	28	456
9	3	27259	27	498
9	4	27256	26	536

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

Band	On Time	Late	Max Late Length (seconds)
0	81887	0	0
1	81876	0	0
2	81773	0	0
3	81837	0	0
9	81860	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	
SV ↓	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	3.2% Sigma Bounding
1	1.586	100.00	1.303	100.00	1.152	100.00	0.733	100.00	1.134	100.00	0.866	100.00
2	1.054	100.00	1.458	100.00	1.130	100.00	1.403	100.00	3.468	100.00	1.403	100.00
3	1.462	100.00	1.280	100.00	1.153	100.00	1.066	100.00	1.371	100.00	1.015	100.00
4	1.747	100.00	1.586	100.00	1.595	100.00	0.967	100.00	1.690	100.00	1.327	100.00
5	1.252	100.00	0.893	100.00	0.901	100.00	0.844	100.00	1.309	100.00	0.931	100.00
6	1.836	100.00	1.500	100.00	1.329	100.00	1.088	100.00	1.161	100.00	1.357	100.00
7	1.418	100.00	1.905	100.00	1.912	100.00	2.426	100.00	2.350	100.00	2.229	100.00
8	1.332	100.00	0.949	100.00	1.193	100.00	0.913	100.00	0.961	100.00	0.884	100.00
9	1.443	100.00	1.326	100.00	1.231	100.00	0.912	100.00	1.260	100.00	1.353	100.00
10	0.879	100.00	1.171	100.00	0.886	100.00	1.482	100.00	1.128	100.00	1.188	100.00
11	1.010	100.00	0.991	100.00	0.921	100.00	1.468	100.00	1.129	100.00	1.065	100.00
12	1.569	100.00	1.347	100.00	1.266	100.00	0.859	100.00	0.979	100.00	1.448	100.00
13	1.511	100.00	1.072	100.00	0.986	100.00	0.640	100.00	1.116	100.00	1.212	100.00
14	1.048	100.00	0.956	100.00	0.735	100.00	1.449	100.00	1.015	100.00	1.899	100.00
15	1.633	100.00	1.312	100.00	1.081	100.00	1.449	100.00	1.090	100.00	1.265	100.00
16	0.810	100.00	1.077	100.00	0.914	100.00	1.053	100.00	1.681	100.00	1.090	100.00
17	2.770	100.00	1.200	100.00	1.306	100.00	0.822	100.00	1.022	100.00	1.376	100.00
18	0.659	100.00	0.806	100.00	1.185	100.00	1.588	100.00	1.772	100.00	1.638	100.00
19	1.780	100.00	2.161	100.00	1.993	100.00	2.435	100.00	3.046	100.00	2.378	100.00
20	0.798	100.00	0.844	100.00	1.409	100.00	1.215	100.00	1.875	100.00	1.134	100.00
21	0.908	100.00	1.232	100.00	1.296	100.00	1.490	100.00	1.650	100.00	1.288	100.00
22	0.754	100.00	0.884	100.00	1.358	100.00	1.598	100.00	1.404	100.00	1.249	100.00
23	1.380	100.00	1.404	100.00	1.637	100.00	1.850	100.00	2.189	100.00	1.702	100.00
24	1.701	100.00	1.979	100.00	2.166	100.00	0.971	100.00	1.038	100.00	1.177	100.00
25	1.789	100.00	1.261	100.00	1.814	100.00	0.855	100.00	0.909	100.00	1.236	100.00
26	1.515	100.00	1.622	100.00	1.683	100.00	1.202	100.00	1.464	100.00	1.357	100.00
27	1.176	100.00	1.040	100.00	1.039	100.00	0.977	100.00	0.871	100.00	1.195	100.00
28	0.721	100.00	0.717	100.00	0.793	100.00	1.299	100.00	1.610	100.00	1.165	100.00
29	2.294	100.00	1.895	100.00	1.832	100.00	1.587	100.00	1.426	100.00	1.658	100.00
30	2.228	100.00	1.533	100.00	1.992	100.00	1.091	100.00	1.167	100.00	1.205	100.00
31	1.284	100.00	1.289	100.00	0.788	100.00	0.644	100.00	1.080	100.00	2.015	100.00
32	1.093	100.00	0.956	100.00	1.072	100.00	0.740	100.00	0.915	100.00	0.823	100.00
135	-	-	-	-	-	-	-	-	-	-	-	-
138	-	-	-	-	-	-	-	-	-	-	-	-

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

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
SV ↓	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	0.737	100.00	0.806	100.00	0.968	100	1.068	100.00	0.866	100.00	1.267	100.00
2	1.702	100.00	1.601	100.00	1.429	100	1.275	100.00	1.504	100.00	1.079	100.00
3	0.834	100.00	0.937	100.00	0.985	100	1.546	100.00	1.084	100.00	1.423	100.00
4	1.364	100.00	1.685	100.00	2.642	100	1.526	100.00	1.432	100.00	1.890	100.00
5	1.524	100.00	1.020	100.00	1.408	100	1.238	100.00	0.943	100.00	1.102	100.00
6	0.961	100.00	1.127	100.00	1.402	100	1.496	100.00	1.274	100.00	1.701	100.00
7	2.649	100.00	1.777	100.00	3.967	100	1.755	100.00	2.269	100.00	1.507	100.00
8	0.694	100.00	1.025	100.00	1.052	100	1.455	100.00	0.851	100.00	1.473	100.00
9	1.226	100.00	1.264	100.00	0.913	100	1.170	100.00	1.077	100.00	1.428	100.00
10	1.039	100.00	0.810	100.00	1.191	100	0.811	100.00	0.856	100.00	1.069	100.00
11	1.873	100.00	1.077	100.00	0.84	100	1.074	100.00	1.089	100.00	0.936	100.00
12	0.887	100.00	0.982	100.00	1.766	100	1.621	100.00	1.136	100.00	1.455	100.00
13	0.706	100.00	0.843	100.00	1.498	100	1.239	100.00	1.119	100.00	1.553	100.00
14	0.888	100.00	0.917	100.00	0.982	100	1.123	100.00	1.061	100.00	0.910	100.00
15	1.062	100.00	1.024	100.00	0.935	100	1.402	100.00	1.374	100.00	1.859	100.00
16	1.424	100.00	1.122	100.00	1.484	100	0.749	100.00	1.131	100.00	0.798	100.00
17	1.108	100.00	1.228	100.00	1.089	100	1.051	100.00	0.931	100.00	1.347	100.00
18	1.418	100.00	1.717	100.00	1.745	100	0.978	100.00	1.257	100.00	0.796	100.00
19	2.994	100.00	2.303	100.00	2.271	100	1.814	100.00	2.497	100.00	1.995	100.00
20	1.224	100.00	1.134	100.00	1.493	100	0.947	100.00	1.037	100.00	0.717	100.00
21	1.665	100.00	1.292	100.00	2.034	100	0.972	100.00	1.407	100.00	0.726	100.00
22	1.344	100.00	1.204	100.00	1.795	100	0.974	100.00	1.344	100.00	0.809	100.00
23	1.825	100.00	1.500	100.00	1.845	100	1.293	100.00	1.714	100.00	1.037	100.00
24	1.605	100.00	1.622	100.00	0.96	100	1.812	100.00	1.161	100.00	1.950	100.00
25	0.719	100.00	1.171	100.00	1.657	100	1.444	100.00	1.050	100.00	1.905	100.00
26	1.451	100.00	1.562	100.00	1.598	100	1.613	100.00	1.498	100.00	2.253	100.00
27	0.744	100.00	0.945	100.00	0.974	100	1.274	100.00	1.001	100.00	1.684	100.00
28	1.033	100.00	0.700	100.00	1.991	100	0.740	100.00	1.125	100.00	1.023	100.00
29	1.457	100.00	1.704	100.00	1.762	100	1.821	100.00	1.560	100.00	2.241	100.00
30	1.047	100.00	1.184	100.00	1.791	100	1.470	100.00	1.353	100.00	1.733	100.00
31	1.047	100.00	0.772	100.00	1.084	100	0.940	100.00	0.903	100.00	1.390	100.00
32	0.641	100.00	0.819	100.00	0.925	100	0.855	100.00	0.804	100.00	1.499	100.00
135	-	-	-	-	-	-	-	-	-	-	-	-
138	-	-	-	-	-	-	-	-	-	-	-	-

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

Site →	Billings		Albuquerque		Boston		Washington DC		Houston		Kansas City	
SV ↓	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	1.041	100.00	0.803	100.00	0.766	100.00	0.442	100.00	0.603	100.00	0.483	100.00
2	0.874	100.00	1.107	100.00	0.873	100.00	1.138	100.00	1.918	100.00	1.035	100.00
3	0.707	100.00	0.552	100.00	0.575	100.00	0.421	100.00	0.807	100.00	0.401	100.00
4	1.135	100.00	1.074	100.00	1.193	100.00	0.638	100.00	1.356	100.00	0.917	100.00
5	0.410	100.00	0.484	100.00	0.328	100.00	0.319	100.00	0.554	100.00	0.303	100.00
6	0.995	100.00	0.910	100.00	0.660	100.00	0.490	100.00	0.559	100.00	0.663	100.00
7	1.274	100.00	1.396	100.00	1.477	100.00	1.942	100.00	1.634	100.00	1.665	100.00
8	0.748	100.00	0.534	100.00	0.573	100.00	0.390	100.00	0.525	100.00	0.477	100.00
9	0.741	100.00	0.696	100.00	0.699	100.00	0.481	100.00	0.511	100.00	0.621	100.00
10	0.471	100.00	0.545	100.00	0.423	100.00	0.649	100.00	0.577	100.00	0.728	100.00
11	0.360	100.00	0.527	100.00	0.386	100.00	0.709	100.00	0.672	100.00	0.584	100.00
12	0.770	100.00	0.647	100.00	0.573	100.00	0.335	100.00	0.416	100.00	0.528	100.00
13	0.961	100.00	0.651	100.00	0.596	100.00	0.384	100.00	0.787	100.00	0.535	100.00
14	0.853	100.00	0.259	100.00	0.420	100.00	0.549	100.00	0.647	100.00	0.677	100.00
15	1.075	100.00	0.837	100.00	0.559	100.00	0.769	100.00	0.650	100.00	0.703	100.00
16	0.495	100.00	0.504	100.00	0.475	100.00	0.632	100.00	0.836	100.00	0.461	100.00
17	1.918	100.00	0.691	100.00	0.876	100.00	0.439	100.00	0.609	100.00	0.652	100.00
18	0.385	100.00	0.481	100.00	0.712	100.00	0.935	100.00	0.838	100.00	0.908	100.00
19	1.285	100.00	1.443	100.00	1.389	100.00	1.735	100.00	2.067	100.00	1.577	100.00
20	0.407	100.00	0.489	100.00	0.925	100.00	0.612	100.00	0.760	100.00	0.536	100.00
21	0.673	100.00	0.753	100.00	1.091	100.00	1.022	100.00	1.026	100.00	0.702	100.00
22	0.391	100.00	0.520	100.00	0.850	100.00	1.052	100.00	0.730	100.00	0.756	100.00
23	1.038	100.00	1.127	100.00	1.362	100.00	1.549	100.00	1.427	100.00	1.240	100.00
24	1.189	100.00	1.178	100.00	1.265	100.00	0.773	100.00	0.773	100.00	0.804	100.00
25	1.140	100.00	0.765	100.00	0.861	100.00	0.451	100.00	0.675	100.00	0.578	100.00
26	0.953	100.00	0.979	100.00	0.914	100.00	0.572	100.00	0.928	100.00	0.768	100.00
27	0.650	100.00	0.610	100.00	0.535	100.00	0.414	100.00	0.519	100.00	0.531	100.00
28	0.509	100.00	0.439	100.00	0.435	100.00	0.841	100.00	0.917	100.00	0.770	100.00
29	1.466	100.00	1.349	100.00	1.200	100.00	0.978	100.00	1.219	100.00	1.252	100.00
30	1.103	100.00	0.811	100.00	1.035	100.00	0.548	100.00	0.595	100.00	0.562	100.00
31	0.750	100.00	0.900	100.00	0.417	100.00	0.358	100.00	0.846	100.00	0.653	100.00
32	0.686	100.00	0.572	100.00	0.531	100.00	0.374	100.00	0.484	100.00	0.478	100.00

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

Site →	Los Angeles		Salt Lake City		Miami		Minneapolis		Atlanta		Juneau	
SV ↓	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	0.416	100.00	0.476	100.00	0.630	100.00	0.456	100.00	0.543	100.00	0.706	100.00
2	1.224	100.00	1.197	100.00	0.849	100.00	1.021	100.00	0.886	100.00	0.713	100.00
3	0.376	100.00	0.403	100.00	0.640	100.00	0.576	100.00	0.610	100.00	0.662	100.00
4	0.814	100.00	0.989	100.00	1.427	100.00	0.799	100.00	0.958	100.00	0.914	100.00
5	0.554	100.00	0.647	100.00	0.444	100.00	0.311	100.00	0.264	100.00	0.480	100.00
6	0.602	100.00	0.620	100.00	0.799	100.00	0.600	100.00	0.593	100.00	0.936	100.00
7	1.695	100.00	1.466	100.00	2.895	100.00	1.579	100.00	1.534	100.00	1.189	100.00
8	0.454	100.00	0.480	100.00	0.674	100.00	0.440	100.00	0.551	100.00	0.628	100.00
9	0.590	100.00	0.536	100.00	0.643	100.00	0.467	100.00	0.697	100.00	0.713	100.00
10	0.595	100.00	0.410	100.00	0.528	100.00	0.325	100.00	0.354	100.00	0.417	100.00
11	0.928	100.00	0.508	100.00	0.432	100.00	0.426	100.00	0.464	100.00	0.597	100.00
12	0.507	100.00	0.392	100.00	0.843	100.00	0.539	100.00	0.455	100.00	0.561	100.00
13	0.574	100.00	0.421	100.00	0.829	100.00	0.565	100.00	0.707	100.00	0.767	100.00
14	0.500	100.00	0.415	100.00	0.632	100.00	0.408	100.00	0.285	100.00	0.399	100.00
15	0.444	100.00	0.548	100.00	0.658	100.00	0.719	100.00	0.855	100.00	0.853	100.00
16	0.828	100.00	0.638	100.00	0.503	100.00	0.329	100.00	0.380	100.00	0.289	100.00
17	0.698	100.00	0.649	100.00	0.655	100.00	0.391	100.00	0.460	100.00	0.684	100.00
18	0.742	100.00	0.982	100.00	1.075	100.00	0.654	100.00	0.556	100.00	0.336	100.00
19	1.730	100.00	1.538	100.00	1.383	100.00	1.296	100.00	1.421	100.00	1.368	100.00
20	0.508	100.00	0.700	100.00	0.842	100.00	0.446	100.00	0.422	100.00	0.305	100.00
21	0.982	100.00	0.800	100.00	1.389	100.00	0.693	100.00	0.731	100.00	0.389	100.00
22	0.887	100.00	0.789	100.00	1.208	100.00	0.652	100.00	0.703	100.00	0.442	100.00
23	1.180	100.00	1.180	100.00	1.507	100.00	1.014	100.00	0.992	100.00	0.857	100.00
24	0.992	100.00	1.045	100.00	0.922	100.00	0.918	100.00	0.835	100.00	1.159	100.00
25	0.557	100.00	0.701	100.00	0.950	100.00	0.604	100.00	0.688	100.00	0.961	100.00
26	0.869	100.00	0.790	100.00	0.932	100.00	0.689	100.00	0.840	100.00	1.169	100.00
27	0.511	100.00	0.474	100.00	0.707	100.00	0.475	100.00	0.564	100.00	0.736	100.00
28	0.510	100.00	0.540	100.00	1.113	100.00	0.520	100.00	0.555	100.00	0.392	100.00
29	1.020	100.00	1.240	100.00	1.306	100.00	1.210	100.00	1.268	100.00	1.521	100.00
30	0.559	100.00	0.613	100.00	0.859	100.00	0.664	100.00	0.565	100.00	1.043	100.00
31	0.414	100.00	0.347	100.00	0.830	100.00	0.476	100.00	0.520	100.00	0.577	100.00
32	0.469	100.00	0.404	100.00	0.627	100.00	0.381	100.00	0.495	100.00	0.677	100.00

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

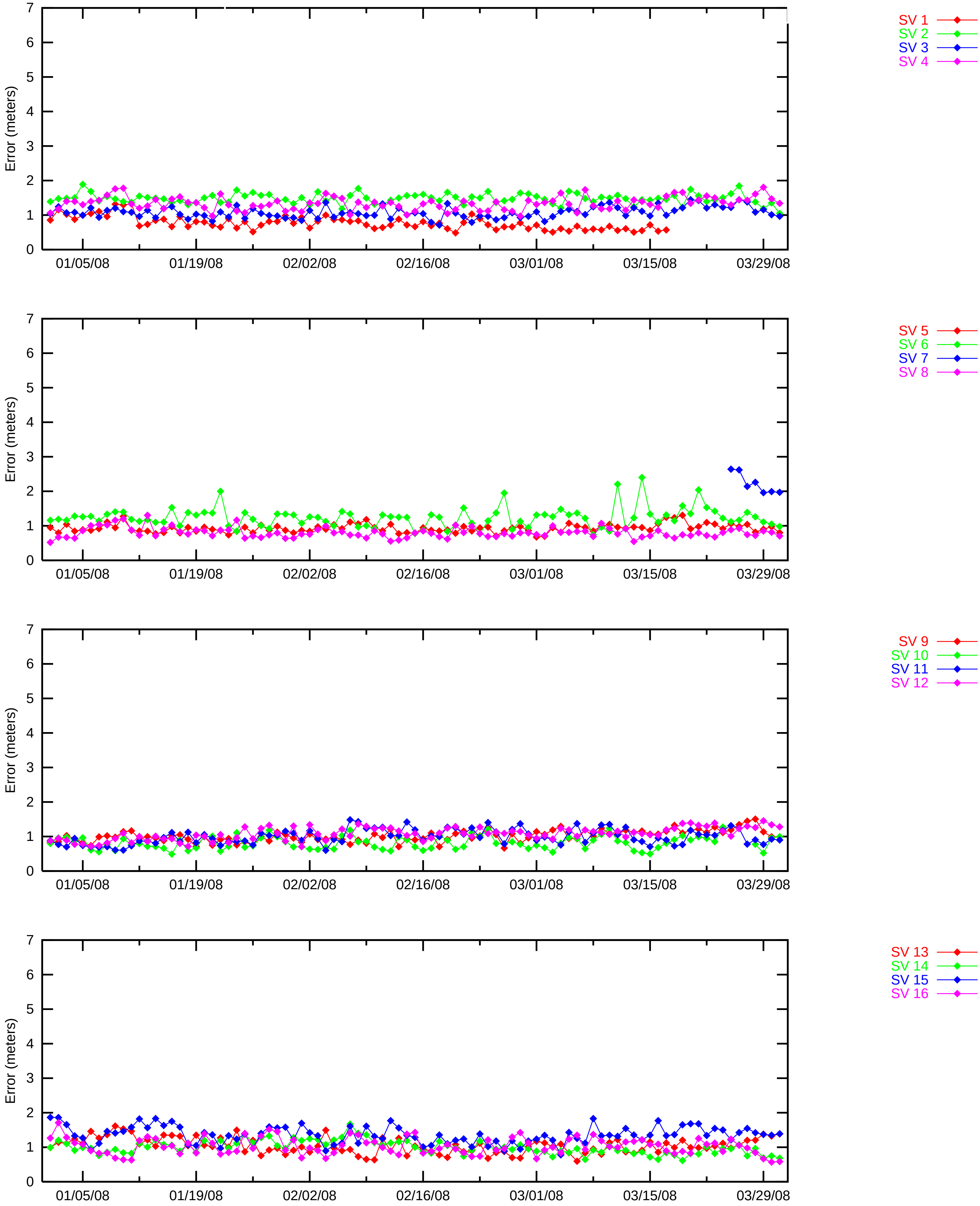


Figure 6-2 95% Range Error (SV17 - SV 32) - Atlanta

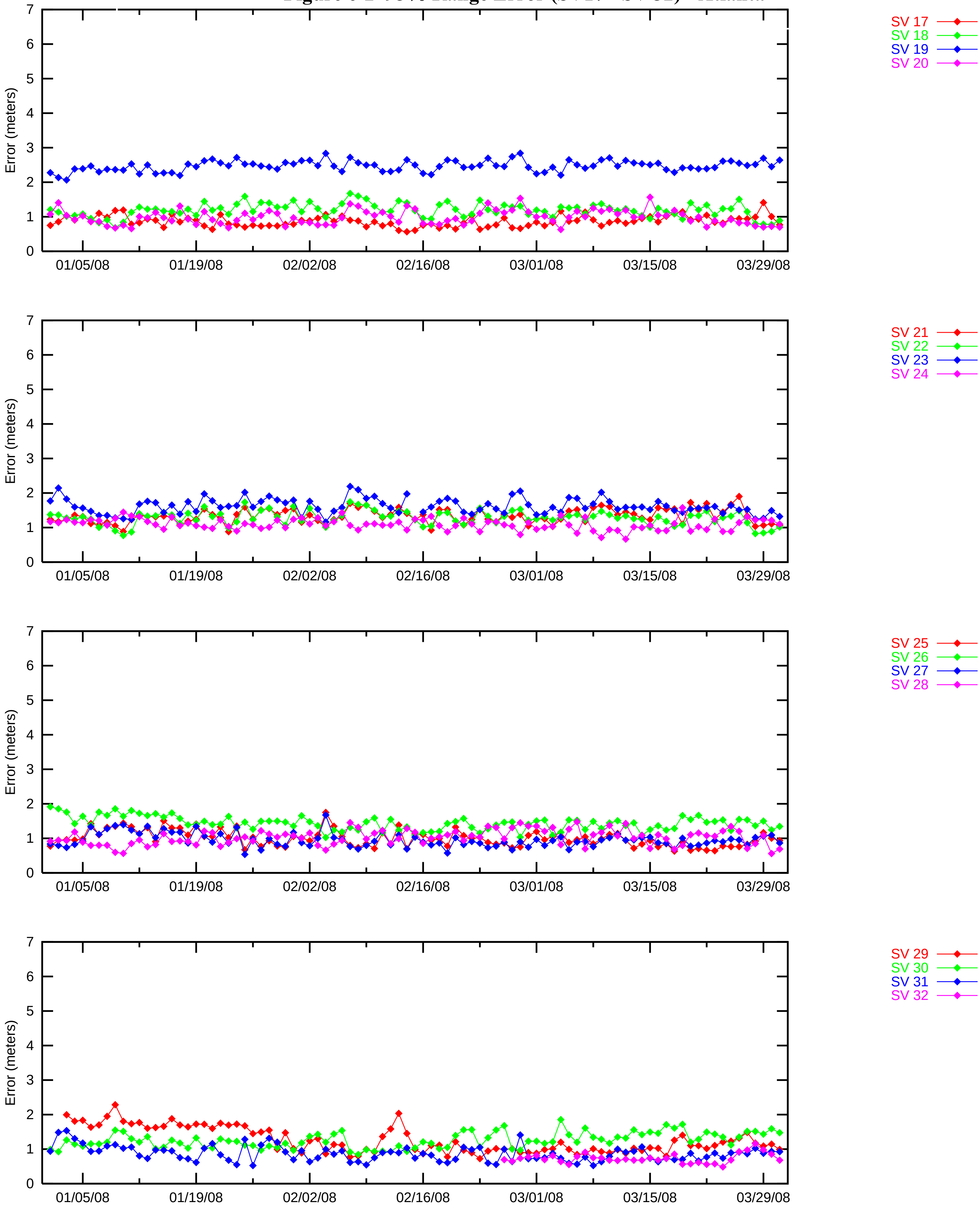


Figure 6-3 95% Ionospheric (SV 1 - SV 16) - Atlanta

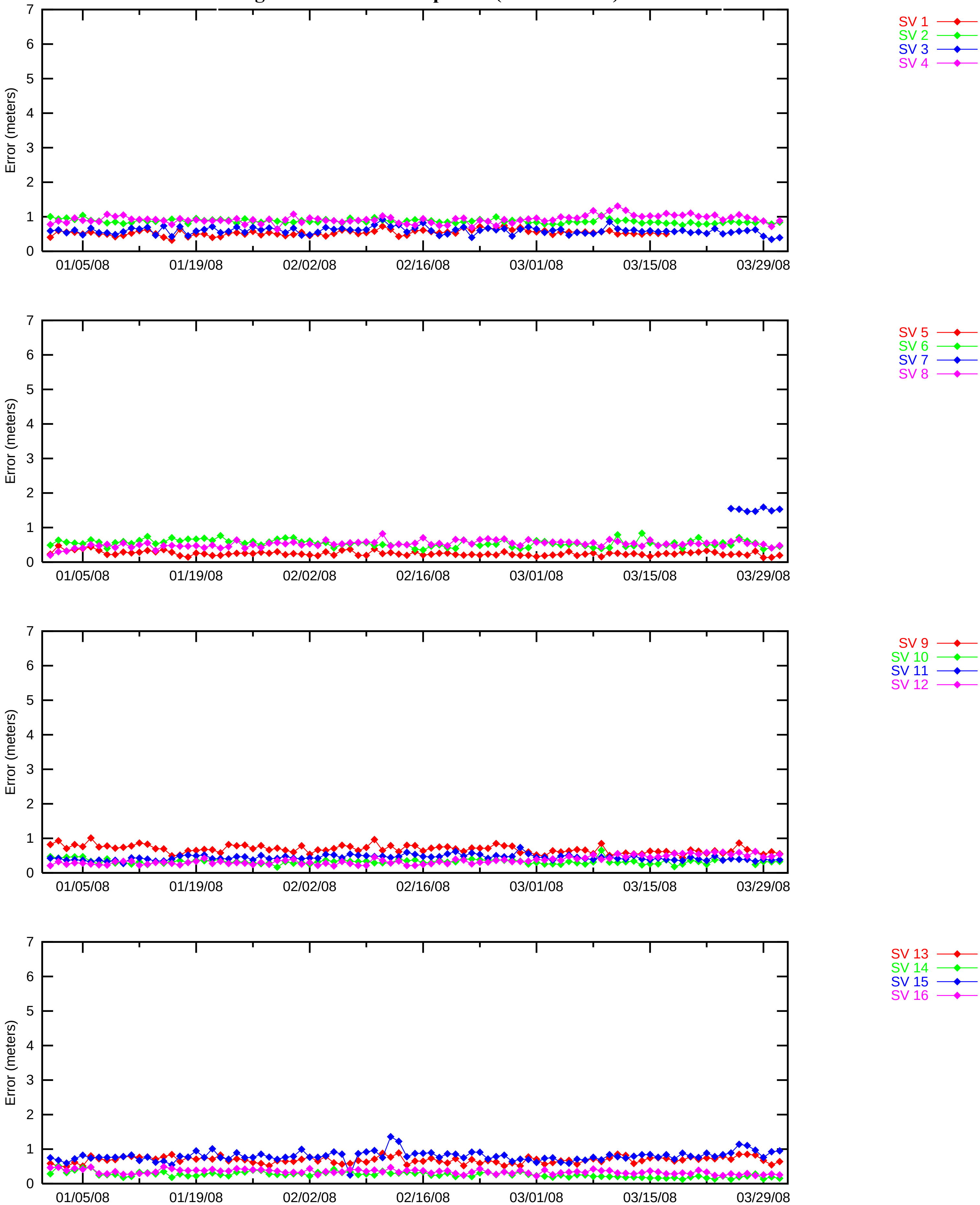
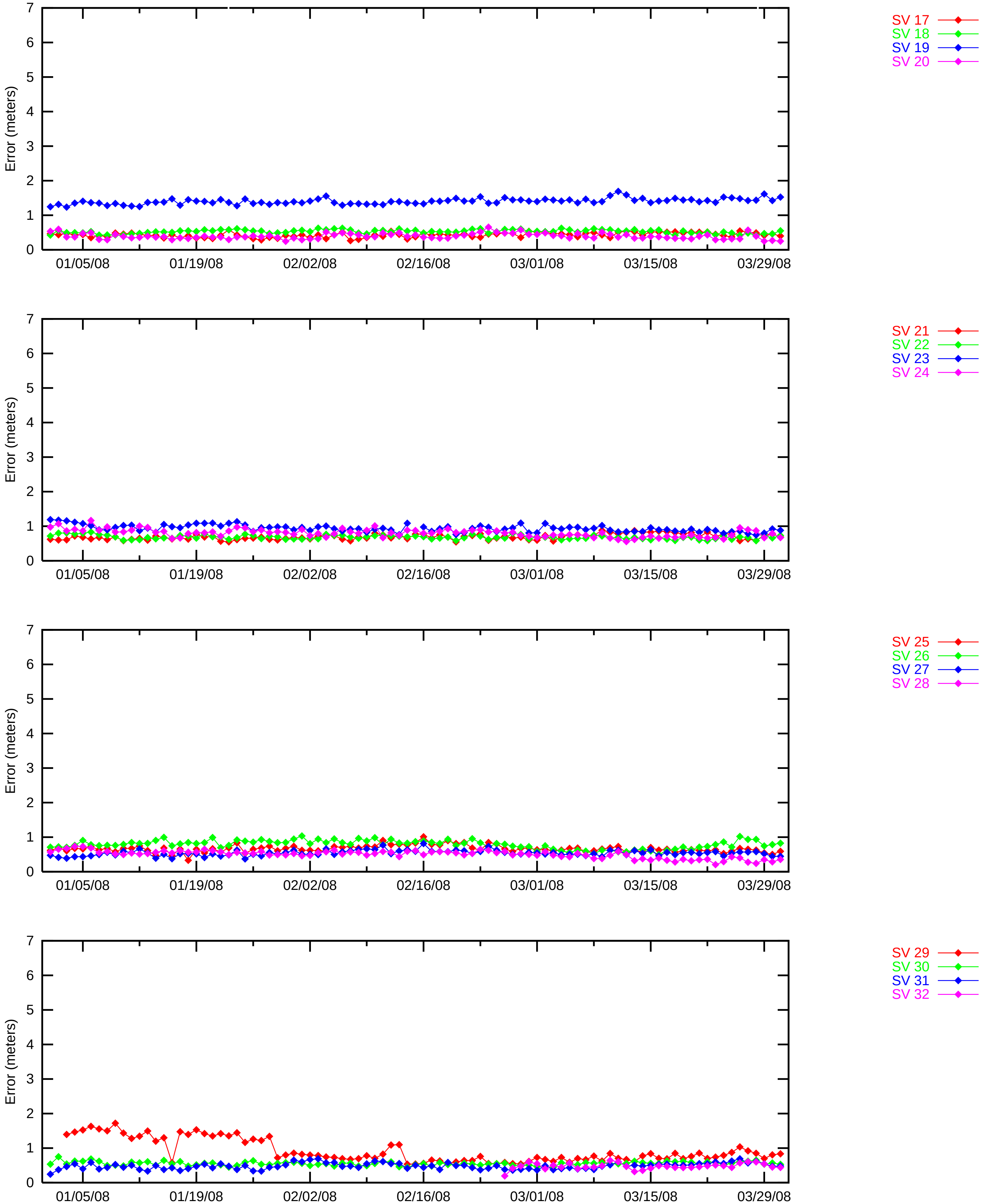


Figure 6-4 95% Ionospheric (SV 17 - SV 32) - Atlanta



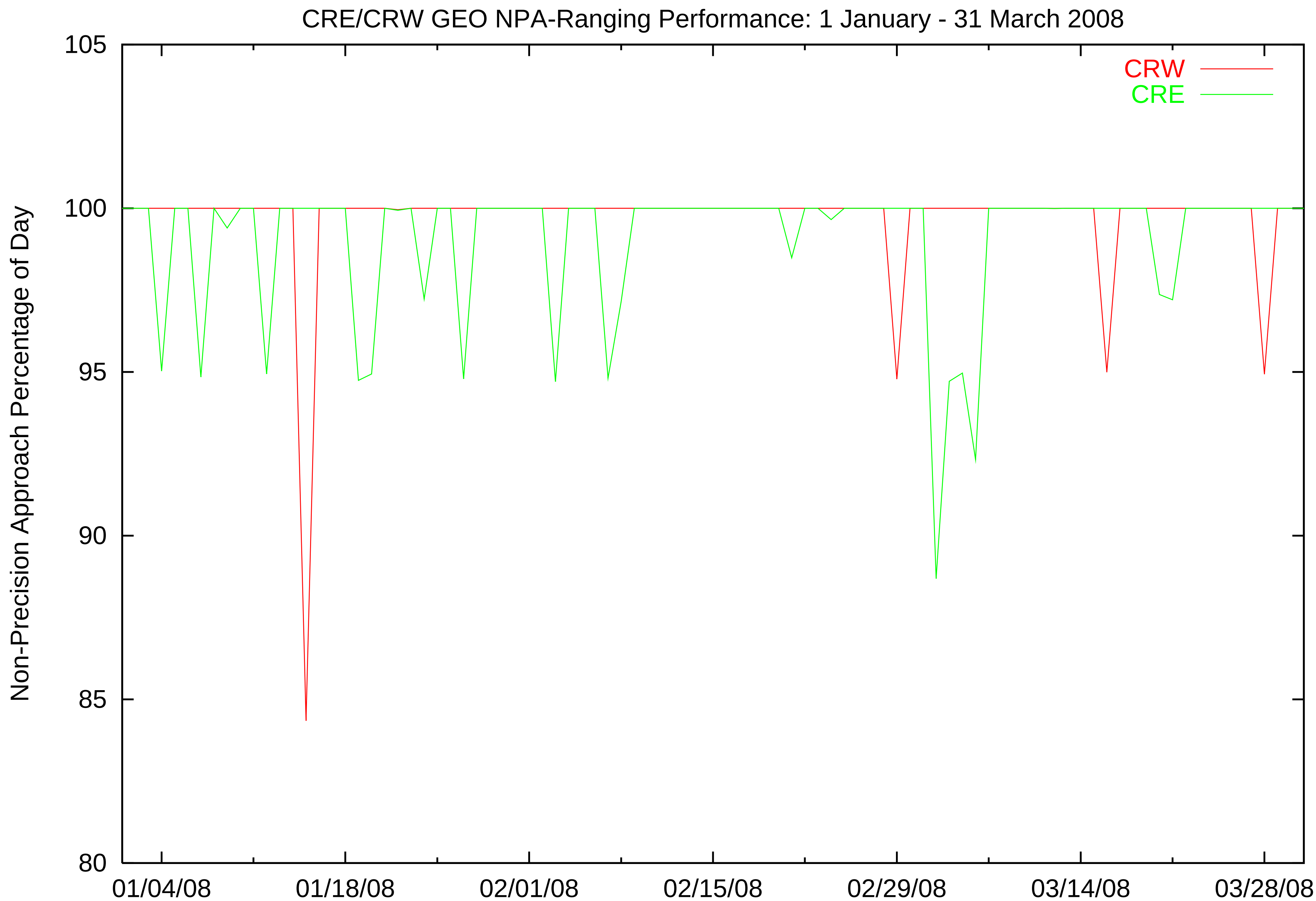
7.0 GEO RANGING PERFORMANCE

For the evaluation period, both CRW and CRE GEO satellites provide ranging capability for enroute through NPA service, but not for 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	0	99.659	0.339	0
CRE	0	99.075	0.792	0.132

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
2/17/2008	See DR# 69, "Alaska Communications Outage Caused Loss of Alaska LPV Service."
2/28/2008	See DR# 67, "GIVE Monitor Trips Set IGPs to Storm State in Alaska Region."
3/08/2008	Several IGPs went to storm state, causing loss of LPV service in northern Alaska (see Figure 8.1).
3/09/2008	One IGP went to storm state causing loss of PA service in Western, Northern, and Central Alaska (see Figure 8.2).
3/12/2008	See DR# 70, "Selected C&V Source Switch Followed By Geo Initialization Caused Loss of LPV and NPA Service."
3/28/2008	See DR# 71, "Inconsistent Tracking of SV PRN 10 Following NANU 2008036 Caused Elevated UDRE's."

Figure 8-1 Loss of LPV Service in Northern Alaska on 3/08/2008

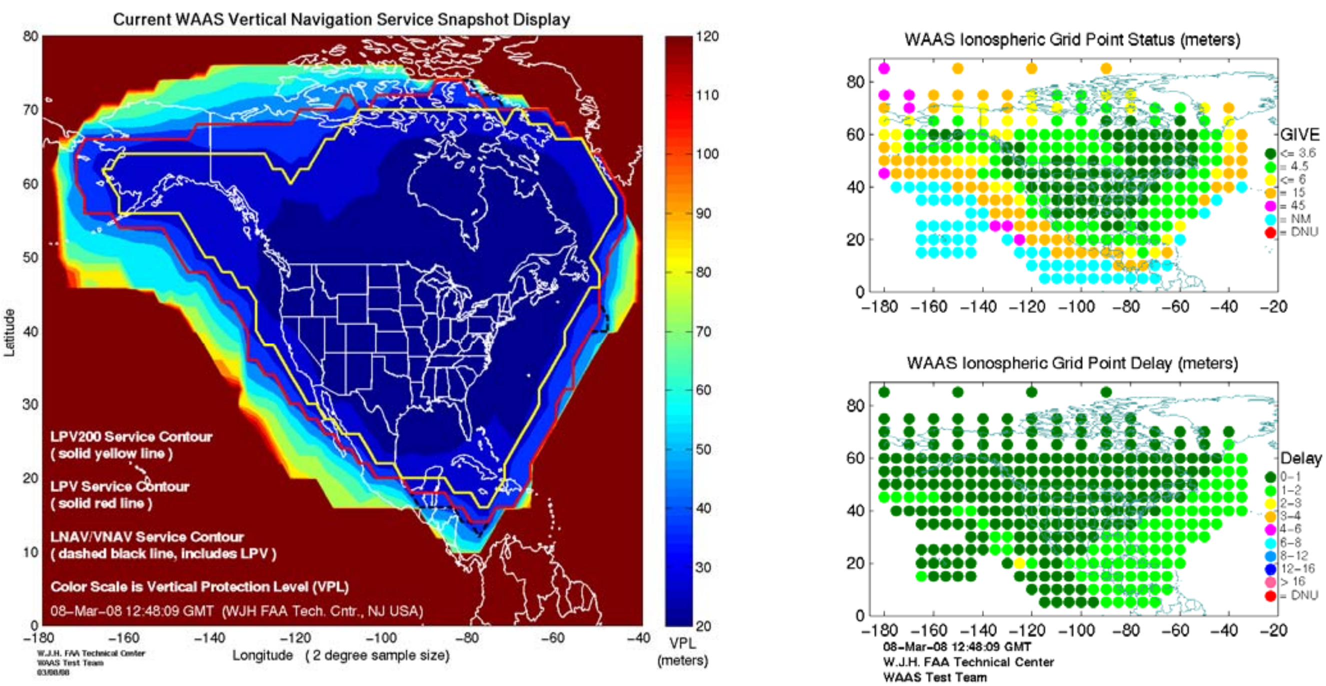
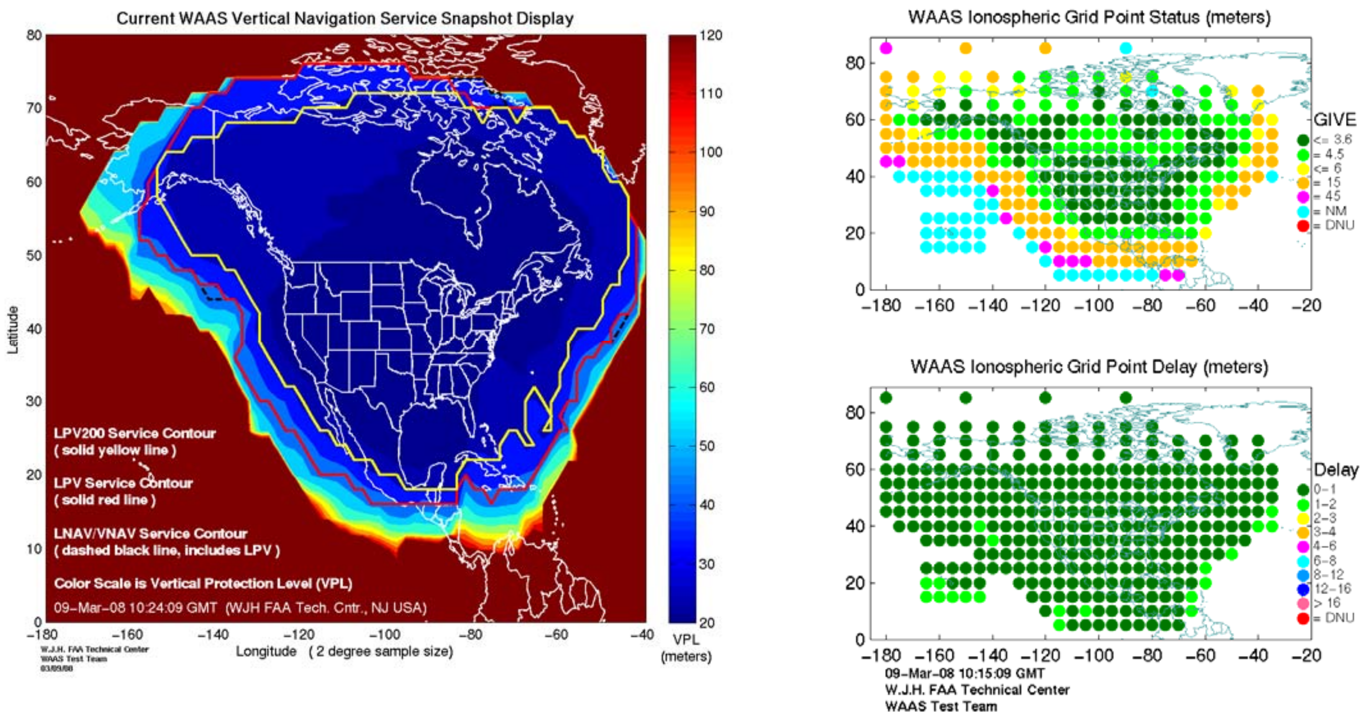


Figure 8-2 Loss of LPV Service in Alaska on 3/09/2008



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	Outages	Availability
PANC	ANCHORAGE INTL	AK	6	0.998771
PAEN	EMMONAK	AK	9	0.998550
PAFA	FAIRBANKS INTL	AK	14	0.998084
PAHO	HOMER	AK	6	0.998886
PAEN	KENAI MUNICIPAL	AK	9	0.998550
PASK	SELAWIK	AK	203	0.983981
PAMK	ST MICHAEL	AK	96	0.990445
AUO	AUBURN-OPELIKA ROBERT G. PITTS	AL	1	0.999950
EKY	BESSEMER	AL	9	0.999728
BHM	BIRMINGHAM INTL	AL	6	0.999808
SEM	CRAIG FIELD	AL	5	0.999750
DHN	DOTHAN RGNL	AL	5	0.999756
HSV	HUNTSVILLE INTL - CARL T. JONES FIELD	AL	5	0.999682
JKA	JACK EDWARDS	AL	5	0.999715
MDQ	MADISON COUNTY EXECUTIVE/TOM SHARP JR FIELD	AL	5	0.999673
BFM	MOBILE DOWNTOWN	AL	5	0.999765
MOB	MOBILE RGNL	AL	5	0.999781
MGM	MONTGOMERY RGNL (DANNELLY FIELD)	AL	5	0.999756
MSL	NORTHWEST ALABAMA REGIONAL	AL	5	0.999579
DCU	PRYOR FIELD RGNL	AL	5	0.999661
79J	SOUTH ALABAMA RGNL AT BILL BENTON FIELD	AL	5	0.999686
PLR	ST CLAIR COUNTY	AL	2	0.999929
8A0	THE ALBERTVILLE MUNICIPAL-THOMAS J. BRUMLIK FIELD	AL	5	0.999792
LIT	ADAMS FIELD	AR	5	0.999620
M73	ALMYRA MUNICIPAL	AR	5	0.999559
BYH	ARKANSAS INTL	AR	5	0.999392
VBT	BENTONVILLE MUNICIPAL/LOUISE M. THADEN FIELD	AR	1	0.999952
HRO	BOONE COUNTY	AR	1	0.999952

Airport Id	Airport Name	State	Outages	Availability
FSM	FORT SMITH RGNL	AR	1	0.999952
PBF	GRIDER FIELD	AR	5	0.999603
XNA	NORTHWEST ARKANSAS RGNL	AR	1	0.999952
BPK	OZARK RGNL	AR	1	0.999952
ROG	ROGERS MUNICIPAL-CARTER FIELD	AR	1	0.999952
RUE	RUSSELLVILLE RGNL	AR	1	0.999952
SRC	SEARCY MUNICIPAL	AR	5	0.999559
SLG	SMITH FIELD	AR	1	0.999952
ELD	SOUTH ARKANSAS RGNL AT GOODWIN FIELD	AR	5	0.999691
ASG	SPRINGDALE MUNICIPAL	AR	1	0.999952
SGT	STUGGART MUNICIPAL	AR	5	0.999563
ARG	WALNUT RIDGE RGNL	AR	5	0.999468
PRC	ERNEST A. LOVE FIELD	AZ	2	0.999868
GEU	GLENDALE MUNICIPAL	AZ	2	0.999840
GCN	GRAND CANYON NATIONAL PARK	AZ	2	0.999905
IFP	LAUGHLIN/BULLHEAD INTL	AZ	2	0.999905
DVT	PHOENIX DEER VALLEY	AZ	2	0.999840
PHX	PHOENIX SKY HARBOR INTL	AZ	2	0.999834
SJN	ST JOHNS INDUSTRIAL AIRPARK	AZ	1	0.999956
TUS	TUCSON INTL	AZ	39	0.997878
IWA	WILLIAMS GATEWAY	AZ	2	0.999826
APV	APPLE VALLEY	CA	30	0.999122
ACV	ARCATA	CA	119	0.995100
BFL	BAKERSFIELD/MEADOWS FIELD	CA	89	0.995606
DAG	BARSTOW-DAGGETT	CA	11	0.999677
C83	BYRON	CA	93	0.993006
CMA	CAMARILLO	CA	92	0.993637
CNO	CHINO	CA	81	0.997023
FAT	FRESNO YOSEMITE INTL	CA	85	0.996135
WJF	GENERAL WM J FOX AIRFIELD	CA	83	0.996731
HAF	HALF MOON BAY	CA	94	0.990298
SNA	JOHN WAYNE AIRPORT-ORANGE COUNTY	CA	89	0.995910
LGB	LONG BEACH (DAUGHERTY FIELD)	CA	90	0.995421
LAX	LOS ANGELES INTL	CA	92	0.994967
CRQ	MCCLELLAN-PALOMAR	CA	84	0.996439
OAK	METROPOLITAN OAKLAND INTL	CA	94	0.991289
MRY	MONTEREY PENINSULA	CA	94	0.990304
APC	NAPA COUNTY	CA	94	0.991996
O02	NERVINO	CA	62	0.998392
SJC	NORMAN Y. MINETA SAN JOSE INTL	CA	93	0.991455
VCB	NUT TREE	CA	93	0.993002
ONT	ONTARIO INTL	CA	80	0.997216
OXR	OXNARD	CA	92	0.993309
PMD	PALMDALE PRODUCTION FLIGHT	CA	81	0.996903
RDD	REDDING MUNICIPAL	CA	85	0.996903
RAL	RIVERSIDE MUNICIPAL	CA	80	0.997418
SMF	SACRAMENTO INTL	CA	93	0.994391
MHR	SACRAMENTO MATHER	CA	91	0.994964
SFO	SAN FRANCISCO INTL	CA	94	0.990752
TCY	TRACY MUNICIPAL	CA	93	0.993282
COS	CITY OF COLORADO SPRINGS MUNICIPAL	CO	1	0.999956
AKO	COLORADO PLAINS RGNL	CO	1	0.999955

Airport Id	Airport Name	State	Outages	Availability
CEZ	CORTEZ MUNICIPAL	CO	1	0.999956
DEN	DENVER INTL	CO	1	0.999956
GXY	GREELEY-WELD COUNTY	CO	1	0.999956
ITR	KIT CARSON COUNTY	CO	1	0.999955
LAA	LAMAR MUNICIPAL	CO	1	0.999955
PUB	PUEBLO MEMORIAL	CO	1	0.999956
ALS	SAN LUIS VALLEY RGNL/BERGMAN FIELD	CO	1	0.999956
HDN	YAMPA VALLEY	CO	1	0.999956
BDL	BRADLEY INTL	CT	2	0.999874
GON	GROTON-NEW LONDON	CT	2	0.999879
HVN	TWEED-NEW HAVEN	CT	2	0.999866
OXC	WATERBURY-OXFORD	CT	2	0.999865
DCA	RONALD REAGAN WASHINGTON NATIONAL	DC	1	0.999946
EVY	SUMMIT	DE	3	0.999912
GED	SUSSEX COUNTY	DE	2	0.999923
AAF	APALACHICOLA MUNICIPAL	FL	5	0.999667
CEW	BOB SIKES	FL	5	0.999651
BCT	BOCA RATON	FL	2	0.999918
BKV	BROOKSVILLE	FL	5	0.999772
DAB	DAYTONA BEACH INTL	FL	5	0.999828
DED	DELAND MUNICIPAL-SIDNEY H. TAYLOR FIELD	FL	5	0.999810
FXE	FORT LAUDERDALE EXECUTIVE	FL	2	0.999900
FLL	FORT LAUDERDALE-HOLLYWOOD INTL	FL	2	0.999900
GNV	GAINESVILLE RGNL	FL	5	0.999783
JAX	JACKSONVILLE INTL	FL	1	0.999949
TMB	KENDALL-TAMIAMI EXECUTIVE	FL	4	0.999849
EYW	KEY WEST INTL	FL	6	0.999607
ISM	KISSIMMEE GATEWAY	FL	5	0.999828
LAL	LAKELAND LINDER RGNL	FL	5	0.999796
LEE	LEESBURG INTL	FL	5	0.999804
MLB	MELBOURNE INTL	FL	3	0.999890
COI	MERRITT ISLAND	FL	3	0.999890
MIA	MIAMI INTL	FL	4	0.999864
APF	NAPLES MUNICIPAL	FL	5	0.999776
EVB	NEW SMYRNA BEACH MUNICIPAL	FL	5	0.999831
OCF	OCALA INTL-JIM TAYLOR FIELD	FL	5	0.999771
MCO	ORLANDO INTL	FL	5	0.999831
PBI	PALM BEACH INTL	FL	2	0.999919
PFN	PANAMA CITY-BAY COUNTY INTL	FL	5	0.999659
PNS	PENSACOLA RGNL	FL	5	0.999678
PMP	POMPANO BEACH AIRPARK	FL	2	0.999900
SRQ	SARASOTA/BRADENTON INTL	FL	5	0.999758
RSW	SOUTHWEST FLORIDA INTL	FL	5	0.999778
PIE	ST PETERSBURG-CLEARWATER INTL	FL	5	0.999764
TLH	TALLAHASSEE RGNL	FL	5	0.999743
TPA	TAMPA INTL	FL	5	0.999770
MTH	THE FLORIDA KEYS MARATHON	FL	7	0.999635
VDF	VANDENBURG	FL	5	0.999778
GIF	WINTER HAVEN'S GILBERT	FL	5	0.999801
AGS	AUGUSTA RGNL AT BUSH FIELD	GA	1	0.999949
BQK	BRUNSWICK GOLDEN ISLE	GA	1	0.999949
VPC	CARTERSVILLE	GA	1	0.999950

Airport Id	Airport Name	State	Outages	Availability
RYY	COBB COUNTY-MCCOLLUM FIELD	GA	1	0.999950
CSG	COLUMBUS METROPOLITAN	GA	1	0.999950
CKF	CRISP COUNTY-CORDELE	GA	1	0.999949
DNN	DALTON MUNICIPAL	GA	5	0.999861
SBO	EMANUEL COUNTY	GA	1	0.999949
FTY	FULTON COUNTY AIRPORT-BROWN FIELD	GA	1	0.999950
ATL	HARTSFIELD-JACKSON ATLANTA INTL	GA	1	0.999950
EZM	HEART OF GEORGIA RGNL	GA	1	0.999949
19A	JACKSON COUNTY	GA	1	0.999949
GVL	LEE GILMER MEMORIAL	GA	1	0.999949
MCN	MIDDLE GEORGIA RGNL	GA	1	0.999949
MGR	MOULTRIE MUNICIPAL	GA	1	0.999949
CCO	NEWNAN COWETA COUNTY	GA	1	0.999950
FFC	PEACHTREE CITY-FALCON FIELD	GA	1	0.999950
PXE	PERRY-HOUSTON COUNTY	GA	1	0.999949
JZP	PICKENS COUNTY	GA	1	0.999950
JYL	PLANTATION AIRPARK	GA	1	0.999949
SAV	SAVANNAH INTL	GA	1	0.999949
ACJ	SOUTHER FIELD	GA	1	0.999950
ABY	SOUTHWEST GEORGIA RGNL	GA	1	0.999950
TBR	STATESBORO-BULLOCH COUNTY	GA	1	0.999949
TOC	TOCCOA RG LETOURNEAU FIELD	GA	1	0.999949
VLD	VALDOSTA RGNL	GA	1	0.999949
AYS	WAYCROSS-WARE COUNTY	GA	1	0.999949
CTJ	WEST GEORGIA RGNL-O V GRAY FIELD	GA	1	0.999950
WDR	WINDER-BARROW	GA	1	0.999949
IKV	ANKENY	IA	1	0.999952
DVN	DAVENPORT MUNICIPAL	IA	1	0.999950
DSM	DES MOINES INTL	IA	1	0.999952
DBQ	DUBUQUE RGNL	IA	1	0.999950
EST	ESTHERVILLE MUNICIPAL	IA	1	0.999952
FFL	FAIRFIELD MUNICIPAL	IA	1	0.999950
EOK	KEOKUK MUNICIPAL	IA	1	0.999950
MCW	MASON CITY MUNICIPAL	IA	1	0.999952
MXO	MONTICELLO RGNL	IA	1	0.999950
MUT	MUSCATINE MUNICIPAL	IA	1	0.999950
TNU	NEWTON MUNICIPAL	IA	1	0.999952
OTM	OTTUMWA INDUSTRIAL	IA	1	0.999952
SDA	SHENANDOAH MUNICIPAL	IA	1	0.999952
SLB	STORM LAKE MUNICIPAL	IA	1	0.999952
CID	THE EASTERN IOWA	IA	1	0.999950
ALO	WATERLOO MUNICIPAL	IA	1	0.999952
BOI	BOISE AIR TERMINAL/GOWEN FIELD	ID	1	0.999958
IDA	IDAHO FALLS RGNL	ID	2	0.999929
LWS	LEWISTON-NEZ PERCE COUNTY	ID	1	0.999957
S67	NAMPA MUNICIPAL	ID	1	0.999958
PIH	POCATELLO RGNL	ID	2	0.999924
SPI	ABRAHAM LINCOLN CAPITAL	IL	1	0.999950
FEP	ALBERTUS	IL	1	0.999950
ARR	AURORA MUNICIPAL	IL	1	0.999950
BMI	CENTRAL IL RGNL ARPT AT BLOOMINGTON-NORMAL	IL	1	0.999950
ENL	CENTRALIA MUNICIPAL	IL	5	0.999466

Airport Id	Airport Name	State	Outages	Availability
MDW	CHICAGO MIDWAY	IL	1	0.999950
ORD	CHICAGO O'HARE INTL	IL	1	0.999950
RFD	CHICAGO/ROCKFORD INTL	IL	1	0.999950
DEC	DECATUR	IL	1	0.999950
FOA	FLORA MUNICIPAL	IL	5	0.999740
IKK	GREATER KANKAKEE	IL	1	0.999950
PIA	GREATER PEORIA RGNL	IL	1	0.999950
IGQ	LANSING MUNICIPAL	IL	1	0.999950
LOT	LEWIS UNIVERSITY	IL	1	0.999950
3LF	LITCHFIELD MUNICIPAL	IL	5	0.999761
PPQ	PITTSFILED-PENSTONE MUNICIPAL	IL	1	0.999950
MLI	QUAD CITY INTL	IL	1	0.999950
UIN	QUINCY RGNL-BALDWIN FIELD	IL	1	0.999950
TIP	RANTOUL NATL AVIATION CENTER-FRANK ELLIOT FIELD	IL	1	0.999950
SLO	SALEM-LECKRONE	IL	5	0.999569
ALN	ST LOUIS RGNL	IL	5	0.999791
DNV	VERMILLION COUNTY	IL	1	0.999950
UGN	WAUKEGAN RGNL	IL	1	0.999950
MWA	WILLIAMSON COUNTY RGNL	IL	5	0.999258
BAK	COLUMBUS MUNICIPAL	IN	1	0.999949
GWB	DEKALB COUNTY	IN	1	0.999949
MIE	DELAWARE COUNTY-JOHNSON FIELD	IN	1	0.999949
EKM	ELKHART MUNICIPAL	IN	1	0.999949
FWA	FORT WAYNE	IN	1	0.999949
SER	FREEMAN MUNICIPAL	IN	1	0.999949
HFY	GREENWOOD MUNICIPAL	IN	1	0.999949
IND	INDIANAPOLIS INTL	IN	1	0.999950
GGP	LOGANSPORT/CASS COUNTY	IN	1	0.999950
MZZ	MARION MUNICIPAL	IN	1	0.999949
CEV	METTEL FIELD	IN	1	0.999949
BMG	MONROE COUNTY	IN	1	0.999950
LAF	PURDUE UNIVERSITY	IN	1	0.999950
GEZ	SHELBYVILLE MUNICIPAL	IN	1	0.999949
SBN	SOUTH BEND	IN	1	0.999950
ANQ	TRI-STATE STEUBEN COUNTY	IN	1	0.999949
PTS	ATKINSON MUNICIPAL	KS	1	0.999952
AAO	COLONEL JAMES JABARA	KS	1	0.999952
DDC	DODGE CITY RGNL	KS	1	0.999955
EMP	EMPORIA MUNICIPAL	KS	1	0.999952
FOE	FORBES FIELD	KS	1	0.999952
FSK	FORT SCOTT MUNICIPAL	KS	1	0.999952
GCK	GARDEN CITY REGIONAL	KS	1	0.999955
HYS	HAYS RGNL	KS	1	0.999955
HQG	HUGOTON MUNICIPAL	KS	1	0.999955
OJC	JOHNSON COUNTY EXECUTIVE	KS	1	0.999952
LWC	LAWRENCE MUNICIPAL	KS	1	0.999952
LBL	LIBERAL MID-AMERICA RGNL	KS	1	0.999955
MHK	MANHATTAN RGNL	KS	1	0.999952
MPR	MCPHERSON	KS	1	0.999952
IXD	NEW CENTURY AIRCENTER	KS	1	0.999952
EWK	NEWTON-CITY-COUNTY	KS	1	0.999952

Airport Id	Airport Name	State	Outages	Availability
OEL	OAKLEY MUNICIPAL	KS	1	0.999955
TOP	PHILIP BILLARD MUNICIPAL	KS	1	0.999952
GLD	RENNER FIELD/GOODLAND MUNICIPAL	KS	1	0.999955
RSL	RUSSELL MUNICIPAL	KS	1	0.999952
SLN	SALINA MUNICIPAL	KS	1	0.999952
TQK	SCOTT CITY MUNICIPAL	KS	1	0.999955
CBK	SHALZ FIELD	KS	1	0.999955
WLD	STROTHER FIELD	KS	1	0.999952
ULS	ULYSSES	KS	1	0.999955
EGT	WELLINGTON MUNICIPAL	KS	1	0.999952
ICT	WICHITA MID-CONTINENT	KS	1	0.999952
EKX	ADDINGTON FIELD	KY	1	0.999949
PAH	BARKLEY RGNL	KY	3	0.993228
K22	BIG SANDY RGNL	KY	1	0.999949
LEX	BLUE GRASS	KY	1	0.999949
LOU	BOWMAN FIELD	KY	1	0.999949
CVG	CINCINNATI/NORTHERN KENTUCKY INTL	KY	1	0.999949
LOZ	LONDON-CORBIN AIRPORT-MAGEE FIELD	KY	1	0.999949
SDF	LOUISVILLE INTL-STANDIFORD FIELD	KY	1	0.999949
OWB	OWENSBORO-DAVIESS COUNTY	KY	5	0.999739
SME	SOMERSET-PULASKI COUNTY-J.T. WILSON FIELD	KY	1	0.999950
W38	WILLIAMSBURG-WHITLEY COUNTY	KY	1	0.999950
ARA	ACADIANA RGNL	LA	2	0.999936
AEX	ALEXANDRIA INTL	LA	6	0.999771
BTR	BATON ROUGE METROPOLITAN	LA	5	0.999807
DRI	BEAUREGARD RGNL	LA	2	0.999908
CWF	CHENNAULT INTL	LA	2	0.999908
ESF	ESLER RGNL	LA	5	0.999741
LFT	LAFAYETTE RGNL	LA	5	0.999889
LCH	LAKE CHARLES RGNL	LA	2	0.999904
NEW	LAKEFRONT	LA	3	0.999920
MSY	NEW ORLEANS INTL	LA	1	0.999952
PTN	PATTERSON	LA	1	0.999952
DTN	SHREVEPORT DOWNTOWN	LA	6	0.999753
SHV	SHREVEPORT RGNL	LA	6	0.999763
TVR	VICKSBURG TALLULAH RGNL	LA	5	0.999557
BAF	BARNES MUNICIPAL	MA	2	0.999876
HYA	BARNSTABLE MUNICIPAL-BOARDMAN/POLANDO FIELD	MA	3	0.999837
BOS	GEN EDWARD LAWRENCE LOGAN INTL	MA	2	0.999887
BED	LAURENCE G. HANSCOM FIELD	MA	2	0.999887
MVY	MARTHAS VINEYARD	MA	3	0.999868
OWD	NORWOOD	MA	2	0.999886
PVC	PROVINCETOWN MUNICIPAL	MA	3	0.999842
ORH	WORCESTER RGNL	MA	2	0.999888
BWI	BALTIMORE-WASHINGTON INTL	MD	1	0.999946
DMW	CARROLL COUNTY RGNL/JACK B POAGE FIELD	MD	1	0.999946
ESN	EASTON/NEWNAM FIELD	MD	1	0.999946
FDK	FREDERICK	MD	1	0.999946
GAI	MONTGOMERY COUNTY AIRPARK	MD	1	0.999946
2W6	ST MARY'S COUNTY RGNL	MD	1	0.999946
LEW	AUBURN/LEWISTON MUNICIPAL	ME	2	0.999909
AUG	AUGUSTA STATE	ME	3	0.999900

Airport Id	Airport Name	State	Outages	Availability
BHB	HANCOCK COUNTY-BAR HARBOR	ME	4	0.999844
PQI	NORTHERN MAINE RGNL ARPT AT PRESQUE IS	ME	4	0.999839
PWM	PORTLAND INTL JETPORT	ME	2	0.999907
WVL	WATERVILLE ROBERT LAFLEUR	ME	3	0.999906
ARB	ANN ARBOR MUNICIPAL	MI	1	0.999949
ACB	ANTRIM COUNTY	MI	1	0.999949
FNT	BISHOP INTL	MI	1	0.999949
CIU	CHIPPEWA COUNTY INTL	MI	1	0.999949
DTW	DETROIT METRO WAYNE COUNTY	MI	1	0.999949
3FM	FREMONT MUNICIPAL	MI	1	0.999949
GRR	GERALD R. FORD INTL	MI	1	0.999949
CMX	HOUGHTON COUNTY MEMORIAL	MI	1	0.999950
BAX	HURON COUNTY	MI	1	0.999949
AZO	KALAMAZOO/BATTLE CREEK INTL	MI	1	0.999949
ADG	LENAWEE COUNTY	MI	1	0.999949
OZW	LIVINGSTON COUNTY SPENCER J. HARDY	MI	1	0.999949
MBS	MBS INTL	MI	1	0.999949
MKG	MUSKEGON COUNTY	MI	1	0.999949
HYX	SAGINAW CO H.W. BROWNE	MI	1	0.999949
BIV	TULIP CITY	MI	1	0.999949
YIP	WILLOW RUN	MI	1	0.999949
AEL	ALBERT LEA MUNICIPAL	MN	1	0.999952
ANE	ANOKA CO-BLAINE ARPT (JANES FIELD)	MN	1	0.999952
BDE	BAUDETTE INTL	MN	1	0.999952
BRD	BRAINERD LAKES RGNL	MN	1	0.999952
AXN	CHANDLER FIELD	MN	1	0.999952
HIB	CHISHOLM-HIBBING	MN	1	0.999950
CKN	CROOKSTON MUNICIPAL KIRKWOOD FIELD	MN	1	0.999952
DTL	DETROIT LAKES-WETHING FIELD	MN	1	0.999952
DLH	DULUTH INTL	MN	1	0.999950
MSP	MINNEAPOLIS-ST PAUL INTL	MN	1	0.999952
RGK	RED WING RGNL	MN	1	0.999950
RST	ROCHESTER INTL	MN	1	0.999952
ROX	ROSEAU MUNICIPAL/RUDY BILLBERG FIELD	MN	1	0.999952
STC	ST CLOUD RGNL	MN	1	0.999952
JYG	ST JAMES MUNICIPAL	MN	1	0.999952
STP	ST PAUL DOWNTOWN HOLMAN FIELD	MN	1	0.999952
BDH	WILLMAR MUNICIPAL	MN	1	0.999952
M17	BOLIVAR MUNICIPAL	MO	1	0.999952
CGI	CAPE GIRARDEAU RGNL	MO	5	0.999326
MKC	CHARLES B. WHEELER DOWNTOWN	MO	1	0.999952
COU	COLUMBIA RGNL	MO	1	0.999952
1H0	CREVE COEUR	MO	2	0.999917
LBO	FLOYD W. JONES LEBANON	MO	1	0.999952
HIG	HIGGINSVILLE INDUSTRIAL MUNICIPAL	MO	1	0.999952
JEF	JEFFERSON CITY MEMORIAL	MO	1	0.999952
VER	JESSE VIERTEL MEMORIAL	MO	1	0.999952
JLN	JOPLIN RGNL	MO	1	0.999952
MCI	KANSAS CITY INTL	MO	1	0.999952
TKX	KENNETT MEMORIAL	MO	5	0.999393
IRK	KIRKSVILLE RGNL	MO	1	0.999952
STL	LAMBERT-ST LOUIS INTL	MO	2	0.999905

Airport Id	Airport Name	State	Outages	Availability
AIZ	LEE C FINE MEMORIAL	MO	1	0.999952
LXT	LEE'S SUMMIT MUNICIPAL	MO	1	0.999952
6M6	LEWIS COUNTY RGNL	MO	1	0.999950
MYJ	MEXICO MEMORIAL	MO	1	0.999950
GPH	MIDWEST NATIONAL AIR CENTER	MO	1	0.999952
M58	MONETT MUNICIPAL	MO	1	0.999952
EOS	NEOSHO HUGH ROBINSON	MO	1	0.999952
POF	POPLAR BLUFF MUNICIPAL	MO	5	0.999402
STJ	ROSECRANS MEMORIAL	MO	1	0.999952
DMO	SEDALIA	MO	1	0.999952
SIK	SIKESTON MEMORIAL MUNICIPAL	MO	5	0.999335
RCM	SKYHAVEN	MO	1	0.999952
SGF	SPRINGFIELD-BRANSON NATIONAL	MO	1	0.999952
TBN	WAYNESVILLE RGNL ARPT AT FORNEY FIELD	MO	1	0.999952
UNO	WEST PLAINS MUNICIPAL	MO	1	0.999952
STF	GEORGE M BRYAN	MS	5	0.999623
GTR	GOLDEN TRIANGLE RGNL	MS	6	0.999634
GWO	GREENWOOD-LEFLORE	MS	5	0.999489
GNF	GRENADA MUNICIPAL	MS	5	0.999474
GPT	GULFPORT-BILOXI INTL	MS	5	0.999834
HEZ	HARDY-ANDERS FLD NATCHEZ-ADAMS COUNTY	MS	5	0.999611
HBG	HATTIESBURG BOBBY L CHAIN MUNICIPAL	MS	4	0.999884
PIB	HATTIESBURG-LAUREL RGNL	MS	7	0.999809
LUL	HESLER-NOBLE FIELD	MS	7	0.999797
JAN	JACKSON-EVERS INTL	MS	5	0.999638
M16	JOHN BELL WILLIAMS	MS	5	0.999601
MEI	KEY FIELD	MS	8	0.999730
M40	MONROE COUNTY	MS	6	0.999586
OLV	OLIVE BRANCH	MS	5	0.999397
CRX	ROSCOE TURNER	MS	5	0.999448
PQL	TRENT LOTT INTL	MS	5	0.999797
UTA	TUNICA MUNICIPAL	MS	5	0.999452
UOX	UNIVERSITY-OXFORD	MS	5	0.999434
BTM	BERT MOONEY	MT	1	0.999956
BIL	BILLINGS LOGAN INTL	MT	1	0.999956
MLS	FRANK WILEY FIELD	MT	1	0.999956
GPI	GLACIER PARK INTL	MT	1	0.999956
GTF	GREAT FALLS INTL	MT	1	0.999956
HLN	HELENA RGNL	MT	1	0.999956
LWT	LEWISTOWN MUNICIPAL	MT	1	0.999956
HBI	ASHEBORO MUNICIPAL	NC	1	0.999946
AVL	ASHEVILLE RGNL	NC	1	0.999949
CLT	CHARLOTTE/DOUGLAS INTL	NC	1	0.999949
JQF	CONCORD RGNL	NC	1	0.999949
EWN	CRAVEN COUNTY RGNL	NC	1	0.999946
ECG	ELIZABETH CITY CG AIR STATION/RGNL	NC	1	0.999946
FAY	FAYETTEVILLE RGNL/GRANNIS FIELD	NC	1	0.999946
LHZ	FRANKLIN COUNTY	NC	1	0.999946
AKH	GASTONIA MUNICIPAL	NC	1	0.999949
GWW	GOLDSBORO-WAYNE MUNICIPAL	NC	1	0.999946
HRJ	HARNETT RGNL JETPORT	NC	1	0.999946
ISO	KINSTON RGNL JETPORT AT STALLINGS FLD	NC	1	0.999946

Airport Id	Airport Name	State	Outages	Availability
EQY	MONROE RGNL	NC	1	0.999949
EDE	NORTHEASTERN RGNL	NC	1	0.999946
GSO	PIEDMONT-TRIAD INTL	NC	1	0.999946
PGV	PITT-GREENVILLE	NC	1	0.999946
RDU	RALEIGH-DURHAM INTL	NC	1	0.999946
RWI	ROCKY MOUNT-WILSON RGNL	NC	1	0.999946
RUQ	ROWAN COUNTY	NC	1	0.999949
TTA	SANFORD-LEE COUNTY RGNL	NC	1	0.999946
SVH	STATESVILLE RGNL	NC	1	0.999949
ILM	WILMINGTON INTL	NC	1	0.999946
BIS	BISMARCK MUNICIPAL	ND	1	0.999955
DIK	DICKINSON MUNICIPAL	ND	1	0.999955
GFK	GRAND FORKS INTL	ND	1	0.999952
FAR	HECTOR INTL	ND	1	0.999952
JMS	JAMESTOWN RGNL	ND	1	0.999952
MOT	MINOT INTL	ND	1	0.999955
ANW	AINSWORTH MUNICIPAL	NE	1	0.999952
AIA	ALLIANCE MUNICIPAL	NE	1	0.999955
BIE	BEATRICE MUNICIPAL	NE	1	0.999952
FNB	BRENNER FIELD	NE	1	0.999952
HDE	BRESWTER FIELD	NE	1	0.999952
GRI	CENTRAL NEBRASKA RGNL	NE	1	0.999952
CDR	CHADRON MUNICIPAL	NE	1	0.999955
OLU	COLUMBUS MUNICIPAL	NE	1	0.999952
OMA	EPPLEY AIRFIELD	NE	1	0.999952
FET	FREMONT MUNICIPAL	NE	1	0.999952
HSI	HASTINGS MUNICIPAL	NE	1	0.999952
IML	IMPERIAL MUNICIPAL	NE	1	0.999955
LXN	JIM KELLY FIELD	NE	1	0.999952
OFK	KARL STEFAN MEMORIAL	NE	1	0.999952
EAR	KEARNEY MUNICIPAL	NE	1	0.999952
IBM	KIMBALL MUNICIPAL/ROBERT E. ARRAJ FIELD	NE	1	0.999955
LNK	LINCOLN MUNICIPAL	NE	1	0.999952
MCK	MCCOOK MUNICIPAL	NE	1	0.999955
MLE	MILLARD	NE	1	0.999952
VTN	MILLER FIELD	NE	1	0.999955
LBF	NORTH PLATTE RGNL AIRPORT LEE BIRD FIELD	NE	1	0.999955
PMV	PLATTSMOUTH MUNICIPAL	NE	1	0.999952
SCB	SCRIBNER STATE	NE	1	0.999952
OGA	SEARLE FIELD	NE	1	0.999955
SNY	SIDNEY MUNICIPAL	NE	1	0.999955
ONL	THE O'NEILL MUNICIPAL-JOHN L BAKER FIELD	NE	1	0.999952
LCG	WAYNE MUNICIPAL	NE	1	0.999952
BFF	WESTERN NEB. RGNL/WILLIAM B. HEILIG FIELD	NE	1	0.999955
JYR	YORK MUNICIPAL	NE	1	0.999952
ASH	BOIRE FIELD	NH	2	0.999897
CON	CONCORD MUNICIPAL	NH	2	0.999901
LCI	LACONIA MUNICIPAL	NH	2	0.999905
PSM	PORTSMOUTH INTL AT PEASE	NH	2	0.999898
ACY	ATLANTIC CITY INTL	NJ	3	0.999882
WWD	CAPE MAY COUNTY	NJ	3	0.999902
MIV	MILLVILLE MUNICIPAL	NJ	3	0.999904

Airport Id	Airport Name	State	Outages	Availability
EWR	NEWARK LIBERTY INTL	NJ	2	0.999883
ABQ	ALBUQUERQUE INTL SUNPORT	NM	1	0.999956
CVN	CLOVIS MUNICIPAL	NM	1	0.999955
AEG	DOUBLE EAGLE II	NM	1	0.999956
FMN	FOUR CORNERS RGNL	NM	1	0.999956
SVC	GRANT COUNTY	NM	1	0.999956
LRU	LAS CRUCES INTL	NM	1	0.999956
ROW	ROSWELL INTL AIR CENTER	NM	2	0.999940
LAS	MCCARRAN INTL	NV	2	0.999929
4SD	RENO/STEAD	NV	14	0.999480
WMC	WINNEMUCCA MUNICIPAL	NV	2	0.999942
9G3	AKRON	NY	1	0.999946
ALB	ALBANY INTL	NY	2	0.999869
HWV	BROOKHAVEN	NY	2	0.999863
BUF	BUFFALO NIAGARA INTL	NY	1	0.999946
OLE	CATTARAUGUS COUNTY-OLEAN	NY	1	0.999946
JHW	CHAUTAUQUA COUNTY/JAMESTOWN	NY	1	0.999946
ELM	ELMIRA/CORNING RGNL	NY	1	0.999946
BGM	GREATER BINGHAMTON/EDWIN A LINK FIELD	NY	2	0.999930
ROC	GREATER ROCHESTER INTL	NY	1	0.999946
JFK	JOHN F. KENNEDY INTL	NY	2	0.999858
LGA	LA GUARDIA	NY	2	0.999858
MSS	MASSENA INTL-RICHARDS FIELD	NY	4	0.999866
PBG	PLATTSBURGH INTL	NY	2	0.999912
SWF	STEWART INTL	NY	2	0.999860
SYR	SYRACUSE HANCOCK INTL	NY	1	0.999946
ELZ	WELLSVILLE MUNICIPAL/TARANTINE FIELD	NY	1	0.999946
HPN	WESTCHESTER COUNTY	NY	2	0.999858
FOK	WESTHAMPTON	NY	2	0.999867
HAO	BUTLER COUNTY RGNL	OH	1	0.999949
CXY	CAPITAL CITY	OH	1	0.999946
LUK	CINCINNATI MUNICIPAL ARPT-LUNKEN FIELD	OH	1	0.999949
CLE	CLEVELAND-HOPKINS INTL	OH	1	0.999949
MGY	DAYTON-WRIGHT BROTHERS	OH	1	0.999949
FDY	FINDLAY	OH	1	0.999949
I19	GREENE COUNTY-LEWIS A. JACKSON RGNL	OH	1	0.999949
DAY	JAMES M COX DAYTON INTL	OH	1	0.999949
1G3	KENT STATE UNIVERSITY	OH	1	0.999949
I68	LEBANON-WARREN COUNTY	OH	1	0.999949
MNN	MARION MUNICIPAL	OH	1	0.999949
OSU	OHIO STATE UNIVERSITY	OH	1	0.999949
UNI	OHIO UNIVERSITY SNYDER FIELD	OH	1	0.999949
CMH	PORT COULMBUS INTL	OH	1	0.999949
RZT	ROSS COUNTY	OH	1	0.999949
TOL	TOLEDO EXPRESS	OH	1	0.999949
1G0	WOOD COUNTY	OH	1	0.999949
AVK	ALVA RGNL	OK	1	0.999955
BVO	BARTLESVILLE MUNICIPAL	OK	1	0.999952
CQB	CHANDLER MUNICIPAL	OK	1	0.999952
CHK	CHICKASHA	OK	1	0.999955
GCM	CLAREMORE RGNL	OK	1	0.999952
F29	CLARENCE E. PAGE MUNICIPAL	OK	1	0.999955

Airport Id	Airport Name	State	Outages	Availability
1K4	DAVID J PERRY	OK	1	0.999955
MKO	DAVIS FIELD	OK	2	0.999934
DUA	EAKER FIELD	OK	2	0.999918
2O8	HINTON MUNICIPAL	OK	1	0.999955
HBR	HOBART	OK	1	0.999955
MLC	MCALESTER RGNL	OK	2	0.999924
MIO	MIAMI	OK	1	0.999952
MDF	MOORELAND MUNICIPAL	OK	1	0.999955
OKM	OKMULGEE RGNL	OK	1	0.999952
PVJ	PAULS VALLEY MUNICIPAL	OK	1	0.999955
PNC	PONCA CITY RGNL	OK	1	0.999952
RVS	RICHARD LLOYD JONES JR	OK	1	0.999952
2K4	SCOTT FIELD	OK	1	0.999955
SNL	SHAWNEE	OK	1	0.999954
SWO	STILLWATER RGNL	OK	1	0.999952
TQH	TAHLEQUAH	OK	2	0.999934
TUL	TULSA INTL	OK	1	0.999952
OUN	UNIVERSITY OF OKALAHOMA WESTHEIMER	OK	1	0.999955
OKC	WILL ROGERS WORLD	OK	1	0.999955
UAO	AURORA STATE	OR	2	0.999944
LMT	KLAMATH FALLS	OR	1	0.999958
LGD	LA GRANDE/UNION COUNTY	OR	1	0.999957
EUG	MAHLON SWEET FIELD	OR	1	0.999960
SLE	MCNARY FIELD	OR	2	0.999936
ONP	NEWPORT MUNICIPAL	OR	4	0.999769
PDX	PORTLAND INTL	OR	3	0.999920
AGC	ALLEGHENY COUNTY	PA	1	0.999946
ABE	ALLENTOWN	PA	2	0.999925
AOO	ALTOONA-BLAIR COUNTY	PA	1	0.999946
LBE	ARNOLD PLAMER RGNL	PA	1	0.999946
BFD	BRADFORD RGNL	PA	1	0.999946
BTP	BUTLER COUNTY/K W SCHOLTER FIELD	PA	1	0.999946
9D4	DECK	PA	1	0.999946
HZL	HAZELTON MUNICIPAL	PA	2	0.999930
JST	JOHN MURTHA JOHNSTOWN-CAMBRIA COUNTY	PA	1	0.999946
LNS	LANCASTER	PA	1	0.999946
UCP	NEW CASTLE MUNICIPAL	PA	1	0.999949
PNE	NORTHEAST PHILADELPHIA	PA	2	0.999919
PHL	PHILADELPHIA INTL	PA	2	0.999922
PIT	PITTSBURGH INTL	PA	1	0.999946
FWQ	ROSTRAVER	PA	1	0.999946
2G9	SOMERSET COUNTY	PA	1	0.999946
OYM	ST MARYS MUNICIPAL	PA	1	0.999946
UNV	UNIVERSITY PARK	PA	1	0.999946
FKL	VENANGO RGNL	PA	1	0.999946
BID	BLOCK ISLAND STATE	RI	3	0.999854
OQU	OUONSET STATE	RI	2	0.999878
PVD	THEODORE FRANCIS GREEN STATE	RI	2	0.999879
AIK	AIKEN MUNICIPAL	SC	1	0.999949
AND	ANDERSON RGNL	SC	1	0.999949
CHS	CHARLESTON AFB/INTL	SC	1	0.999949
JZI	CHARLESTON EXECUTIVE	SC	1	0.999949

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CAE	COLUMBIA METROPOLITAN	SC	1	0.999949
UDG	DARLINGTON COUNTY JETPORT	SC	1	0.999949
GYH	DONALDSON CENTER	SC	1	0.999949
GSP	GREENVILLE-SPARTANBURG INTL-ROGER MILLIKEN	SC	1	0.999949
MYR	MYRTLE BEACH INTL	SC	1	0.999949
CEU	OCONEE COUNTY RGNL	SC	1	0.999949
CDN	WOODWARD FIELD	SC	1	0.999949
ABR	ABERDEEN RGNL	SD	1	0.999952
BKX	BROOKINGS MUNICIPAL	SD	1	0.999952
YKN	CHAN GURNEY MUNICIPAL	SD	1	0.999952
HON	HURON RGNL	SD	1	0.999952
MHE	MITCHELL MUNICIPAL	SD	1	0.999952
PIR	PIERRE RGNL	SD	1	0.999955
RAP	RAPID CITY RGNL	SD	1	0.999955
FSD	SIOUX FALLS	SD	1	0.999952
ATY	WATERTOWN RGNL	SD	1	0.999952
PVE	BEECH RIVER RGNL	TN	5	0.999393
UCY	EVERETT-STEWART	TN	5	0.999292
CHA	LOVELL FIELD	TN	5	0.999785
TYS	MCGHEE TYSON	TN	1	0.999949
MEM	MEMPHIS INTL	TN	5	0.999412
NQA	MILLINGTON MUNICIPAL	TN	5	0.999401
BNA	NASHVILLE INTL	TN	5	0.999488
TRI	TRI-CITIES RGNL TN/VA	TN	1	0.999949
ABI	ABILENE RGNL	TX	2	0.999896
ADS	ADDISON	TX	2	0.999908
ALI	ALICE	TX	2	0.999815
AMA	AMARILLO INTL	TX	1	0.999955
LFK	ANGELINA COUNTY	TX	2	0.999881
GKY	ARLINGTON MUNICIPAL	TX	2	0.999906
AUS	AUSTIN-BERGSTROM INTL	TX	2	0.999866
LBX	BRAZORIA COUNTY	TX	2	0.999829
BWD	BROWNWOOD RGNL	TX	2	0.999893
E30	BRUCE FIELD	TX	2	0.999892
TKI	COLLIN COUNTY RGNL AT MCKINNEY	TX	2	0.999915
CRP	CORPUS CHRISTI INTL	TX	2	0.999815
CFD	COULTER FIELD	TX	2	0.999865
PRX	COX FIELD	TX	2	0.999905
RBD	DALLAS EXECUTIVE	TX	2	0.999906
DAL	DALLAS LOVE FIELD	TX	2	0.999907
DFW	DALLAS/FORT WORTH INTL	TX	2	0.999908
DWH	DAVID WAYNE HOOKS MEMORIAL	TX	2	0.999845
DRT	DEL RIO INTL	TX	2	0.999850
TPL	DRAUGHTON-MILLER CENTRAL TEXAS RGNL	TX	2	0.999875
GGG	EAST TEXAS RGNL	TX	2	0.999893
CLL	EASTERWOOD FIELD	TX	2	0.999863
EBG	EDINGBURG INTL	TX	2	0.999790
ELP	EL PASO INTL	TX	6	0.999801
AFW	FORT WORTH ALLIANCE	TX	2	0.999908
FWS	FORT WORTH SPINKS	TX	2	0.999905
IAH	GEORGE BUSH INTERCONTINENTAL/HOUSTON	TX	2	0.999847
PVW	HALE COUNTY	TX	1	0.999955

Airport Id	Airport Name	State	Outages	Availability
TME	HOUSTON EXECUTIVE	TX	2	0.999842
AXH	HOUSTON-SOUTHWEST	TX	2	0.999838
ERV	KERRVILLE MUNICIPAL/LOUIS SCHREINER FIELD	TX	2	0.999864
LNC	LANCASTER	TX	2	0.999893
LRD	LAREDO INTL	TX	2	0.999816
CXO	LONE STAR EXECUTIVE	TX	2	0.999848
LBB	LUBBOCK INTL	TX	2	0.999938
GVT	MAJORS	TX	2	0.999892
MFE	MCALLEN MILLER INTL	TX	2	0.999787
HQZ	MESQUITE METRO	TX	2	0.999893
MAF	MIDLAND INTL	TX	2	0.999894
OSA	MOUNT PLEASANT MUNICIPAL	TX	2	0.999895
RAS	MUSTANG BEACH	TX	2	0.999814
BAZ	NEW BRAUNFELS	TX	2	0.999848
GRK	ROBERT GRAY AAF	TX	2	0.999876
SJT	SAN ANGELO RGNL/MATHIS FIELD	TX	2	0.999886
SAT	SAN ANTONIO INTL	TX	2	0.999846
HYI	SAN MARCOS	TX	2	0.999852
GLS	SCHOLES INTL AT GALVESTON	TX	2	0.999847
SPS	SHEPPARD AFB/WICHITA FALLS MUNICIPAL	TX	1	0.999955
SGR	SUGARLAND MUNICIPAL/HULL FIELD	TX	2	0.999836
TFP	T P MCCAMPBELL	TX	2	0.999815
TRL	TERRELL MUNICIPAL	TX	2	0.999889
TYR	TYLER POUNDS FIELD	TX	2	0.999877
HRL	VALLEY INTL	TX	2	0.999796
IWS	WEST HOUSTON	TX	2	0.999840
HOU	WILLIAM P HOBBY	TX	2	0.999845
CDC	CEDAR CITY RGNL	UT	1	0.999958
KNB	KANAB MUNICIPAL	UT	2	0.999933
LGU	LOGAN-CACHE	UT	2	0.999929
OGD	OGDEN-HINCKLEY	UT	2	0.999939
PVU	PROVO MUNICIPAL	UT	1	0.999958
SGU	SAINT GEORGE MUNICIPAL	UT	2	0.999942
SLC	SALT LAKE CITY INTL	UT	1	0.999958
MFV	ACCOMACK COUNTY	VA	2	0.999930
MTV	BLUE RIDGE	VA	1	0.999946
CHO	CHARLOTTESVILLE-ALBEMARLE	VA	1	0.999946
FCI	CHESTERFIELD COUNTY	VA	1	0.999946
CJR	CULPEPER RGNL	VA	1	0.999946
PTB	DINWIDDIE COUNTY	VA	1	0.999946
OFP	HANOVER COUNTY MUNICIPAL	VA	1	0.999946
HEF	HARRY P. DAVIS FIELD	VA	1	0.999946
JYO	LEESBURG EXECUTIVE	VA	1	0.999946
LNP	LONESOME PINE	VA	1	0.999949
LYH	LYNCHBURG RGNL/PRESTON GLENN FLD	VA	1	0.999946
MKJ	MOUNTAIN EMPIRE	VA	1	0.999949
PSK	NEW RIVER VALLEY	VA	1	0.999949
PHF	NEWPORT NEWS/WMSBURG INTL	VA	1	0.999946
ORF	NORFOLK INTL	VA	1	0.999946
RIC	RICHMOND	VA	1	0.999946
RMN	STAFFORD RGNL	VA	1	0.999946
BCB	VIRGINIA RECH/MONTGOMERY EXECUTIVE	VA	1	0.999949

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IAD	WASHINGTON DULLES INTL	VA	1	0.999946
BTV	BURLINGTON INTL	VT	2	0.999913
FSO	FRANKLIN COUNTY STATE	VT	2	0.999898
BLI	BELLINGHAM INTL	WA	6	0.999758
HQM	BOWERMAN	WA	6	0.999796
FHR	FRIDAY HARBOR	WA	6	0.999682
MWH	GRANT CO INTL	WA	1	0.999958
OLM	OLYMPIA	WA	2	0.999936
PUW	PULLMAN/MOSCOW RGNL	WA	1	0.999956
RLD	RICHLAND	WA	1	0.999958
SEA	SEATTLE-TACOMA INTL	WA	2	0.999917
BVS	SKAGIT RGNL	WA	4	0.999863
PAE	SNOHOMISH COUNTY (PAINE FIELD)	WA	0	1.000000
GEG	SPOKANE INTL	WA	1	0.999958
PSC	TRI-CITIES	WA	1	0.999958
ALW	WALLA WALLA RGNL	WA	1	0.999956
CLM	WILLIAM R FAIRCHILD INTL	WA	6	0.999680
GRB	AUSTIN STRAUBLE INTL	WI	1	0.999950
DLL	BARABOO WISCONSIN DELLS	WI	1	0.999950
OVS	BOSCOBEL	WI	1	0.999950
CWA	CENTRAL WISCONSIN	WI	1	0.999950
MSN	DANE COUNTY RGNL-TRAUX FIELD	WI	1	0.999950
SUE	DOOR COUNTY CHERRYLAND	WI	1	0.999950
EGV	EAGLE RIVER UNION	WI	1	0.999950
FLD	FOND DU LAC COUNTY	WI	1	0.999950
MKE	GENERAL MITCHELL INTL	WI	1	0.999950
MTW	MANITOWOC COUNTY	WI	1	0.999950
MFI	MARSHFIELD MUNICIPAL	WI	1	0.999950
LUM	MENOMONIE MUNICIPAL-SCORE FIELD	WI	1	0.999950
RRL	MERRILL MUNICIPAL	WI	1	0.999950
C29	MIDDLETON MUNICIPAL-MOREY FIELD	WI	1	0.999950
ATW	OUTGAMIE COUNTY RGNL	WI	1	0.999950
PBH	PRICE COUNTY	WI	1	0.999950
RHI	RHINELANDER - ONEIDA COUNTY	WI	1	0.999950
RPD	RICE LAKE RGNL-CARL'S FIELD	WI	1	0.999950
HYR	SAWYER COUNTY	WI	1	0.999950
SBM	SHEBOYGAN COUNTY MEMORIAL	WI	1	0.999950
JVL	SOUTHERN WISCONSIN RGNL	WI	1	0.999950
OSH	WITTMAN RGNL	WI	1	0.999950
PKB	MID-OHIO VALLEY RGNL	WV	1	0.999949
HTS	TRI-STATE/MILTON J. FERGUSON FIELD	WV	1	0.999949
CYS	CHEYENNE RGNL/JERRY OLSON FIELD	WY	1	0.999955
EVW	EVANSTON-UINTA COUNTY BURNS FIELD	WY	1	0.999956
GCC	GILLETTE-CAMPBELL COUNTY	WY	1	0.999956
JAC	JACKSON HOLE	WY	1	0.999956
LAR	LARAMIE RGNL	WY	1	0.999956
CPR	NATRONA COUNTY INTL	WY	1	0.999956
RIW	RIVERTON RGNL	WY	1	0.999956
RKS	ROCK SPRINGS-SWEETWATER COUNTY	WY	1	0.999956
SHR	SHERIDAN COUNTY	WY	1	0.999956
COD	YELLOWSTONE RGNL	WY	1	0.999956

Figure 9-1 WAAS LPV Availability

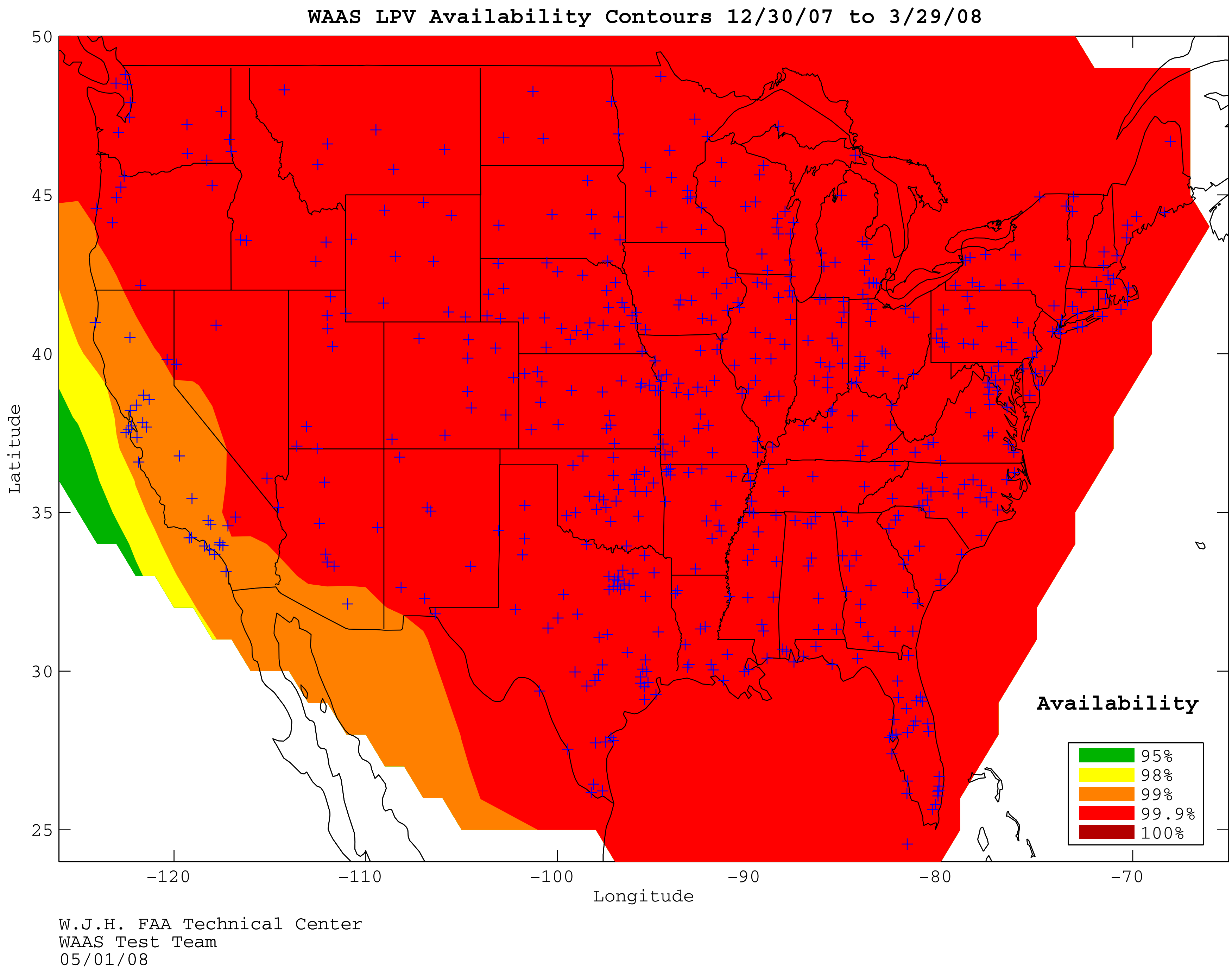
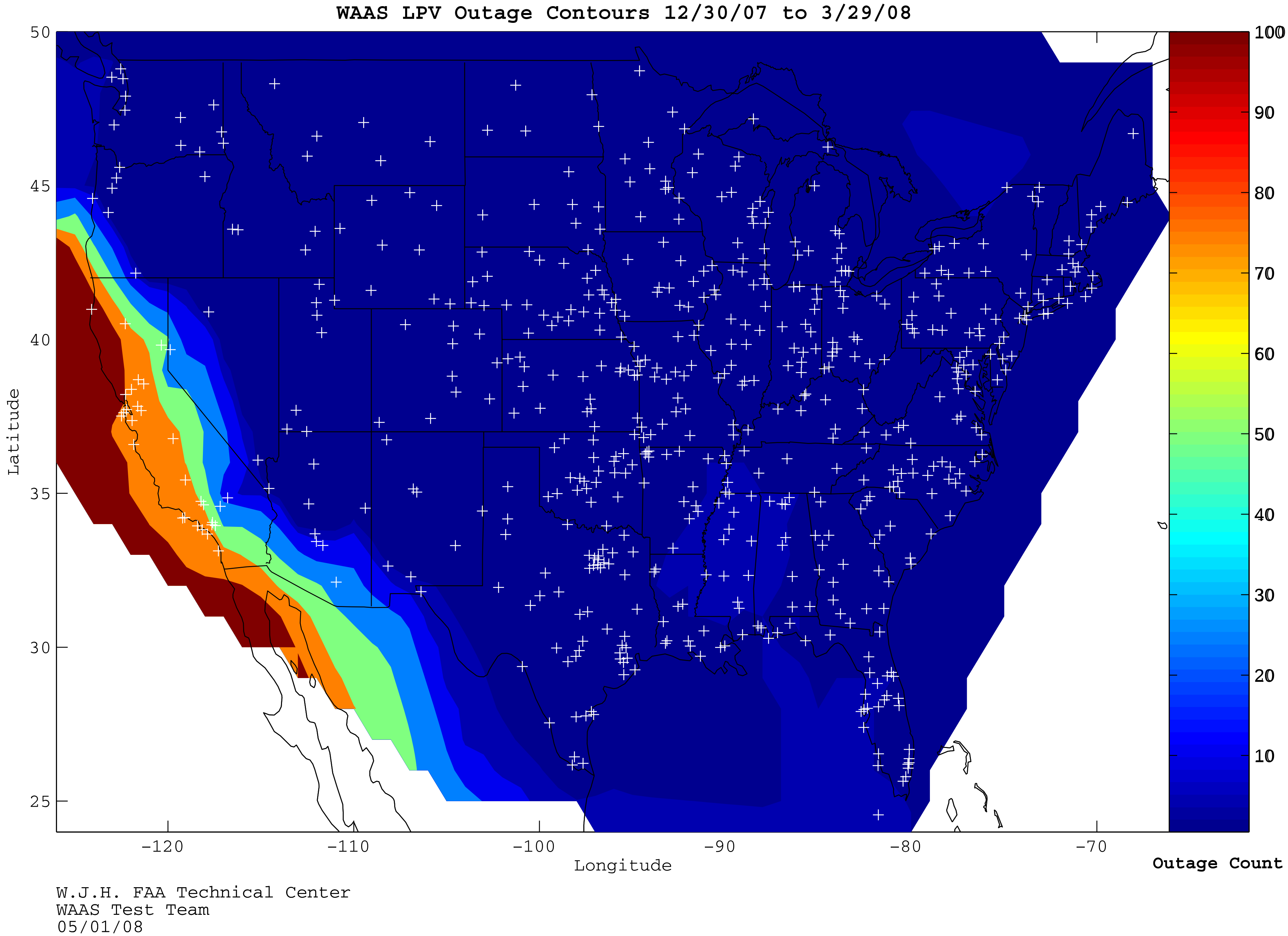


Figure 9-2 WAAS LPV Outage



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	Apr 07	May 07	Jun 07	Jul 07	Aug 07	Sep 07	Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08
Albuquerque	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent
	B	Excellent	Fair	Excellent	Good	Fair	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Good
	C	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Good	Excellent	Excellent
Anchorage	A	Poor	Good	Good	Good	Excellent	Excellent	Fair	–	–	Good	Good	Excellent
	B	Poor	Fair	Fair	Good	Excellent	Good	Good	–	Excellent	Excellent	Good	Good
	C	Good	Good	Good	Fair	Excellent	Fair	Fair	–	–	Good	Excellent	Excellent
Atlanta	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Barrow	A	*	*	*	*	*	*	Excellent	Excellent	Fair	Good	Excellent	Good
	B							Good	Excellent	Excellent	Good	Excellent	Excellent
	C							Excellent	Excellent	Excellent	Fair	Good	Excellent
Bethel	A	*	*	*	*	*	*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B							Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C							Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Billings	A	Excellent	Fair	Excellent	Good	Good	Excellent	Fair	Excellent	Excellent	Excellent	Fair	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Fair	Good	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Excellent	Fair	Excellent	Good	Good	Excellent	Excellent	Good	Good	Good	Excellent
Boston	A	Excellent	Good	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Fair	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good
	C	Excellent	Fair	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair
Chicago	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Good	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Fair	Fair	Excellent	Excellent	Excellent	Poor	Excellent	Excellent	Excellent	Excellent	Excellent
Cleveland	A	Good	Fair	Excellent	Good	Excellent	Fair	Fair	Excellent	Excellent	Fair	Excellent	Good
	B	Fair	Good	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Fair	Excellent	Fair	Excellent
	C	Good	Fair	Excellent	Fair	Good	Excellent	Fair	Good	Excellent	Excellent	Excellent	Fair
Cold Bay	A	Fair	Fair	Poor	Fair	Excellent	Good	Fair	Good	Excellent	Excellent	Fair	Excellent
	B	Fair	Poor	Poor	Poor	Good	Fair	Excellent	Fair	Excellent	Excellent	Excellent	Fair
	C	Excellent	Good	Poor	Good	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent
Dallas	A	Good	Poor	Poor	Fair	Fair	Excellent	Fair	Excellent	Good	Fair	Excellent	Excellent
	B	Poor	Fair	Poor	Fair	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Denver	A	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Fair	Fair
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Fairbanks	A	*	*	*	*	*	*	Excellent	Excellent	–	Good	Excellent	Excellent
	B							Excellent	Excellent	Excellent	Good	Excellent	Excellent
	C							Excellent	Excellent	–	Excellent	Fair	Fair
Gander	A	*	*	*	*	*	*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B							Excellent	Excellent	Excellent	Fair	Good	Excellent
	C							Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Goose Bay	A	*	*	*	*	*	*	Excellent	Excellent	Excellent	Excellent	Excellent	Fair
	B							Fair	Excellent	Excellent	Excellent	Excellent	Excellent
	C							Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Honolulu	A	Good	Good	Fair	Fair	Excellent	Excellent	Poor	Fair	Excellent	Excellent	Fair	Fair
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Poor	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Houston	A	Fair	Good	Good	Fair	Good	Excellent	Excellent	Excellent	Fair	Fair	Excellent	Good
	B	Excellent	Good	Poor	Good	Fair	Excellent	Excellent	Excellent	Good	Fair	Poor	Fair
	C	Fair	Fair	Good	Good	Fair	Good	Good	Good	Good	Fair	Fair	Good
Iqaluit	A	*	*	*	*	*	*	Excellent	–	–	Excellent	Excellent	Excellent
	B							Excellent	Good	Good	Excellent	Excellent	Excellent
	C							Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Jacksonville	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent

- • **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

Shaded receivers represent legacy receivers (non-G2). These receivers are predominantly the trouble receivers, with over 95% of their failures occurring on the L2 frequency.
* International sites' data is not shown prior to their addition into the WAAS system.
\- Thread was not evaluated due to receiver or network issues.

WAAS Site	WRE	Apr 07	May 07	Jun 07	Jul 07	Aug 07	Sep 07	Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08
Juneau	A	red	green	green	green	blue	yellow	green	blue	blue	blue	blue	blue
	B	red	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	yellow	blue	blue	green	blue	green	blue	blue	blue	blue	blue	blue
Kansas City	A	red	red	yellow	yellow	blue	yellow	yellow	blue	blue	blue	yellow	green
	B	blue	blue	yellow	blue	yellow	blue	blue	blue	green	blue	yellow	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	green	blue	blue	blue
Kotzebue	A	*	*	*	*	*	*	blue	blue	blue	blue	blue	blue
	B							blue	blue	blue	blue	blue	green
	C							green	blue	blue	blue	blue	blue
Los Angeles	A	blue	yellow	red	blue	yellow	blue	blue	blue	yellow	green	yellow	green
	B	blue	blue	yellow	blue	green	blue	blue	yellow	yellow	yellow	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Memphis	A	blue	yellow	blue	blue	green	blue	green	blue	blue	yellow	yellow	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	yellow	yellow	blue	blue	blue	blue	blue
Merida	A	*	*	*	*	*	*	blue	blue	blue	blue	blue	blue
	B							blue	blue	blue	blue	blue	blue
	C							blue	blue	blue	blue	blue	blue
Mexico City	A	*	*	*	*	*	*	red	blue	blue	yellow	green	green
	B							yellow	red	green	red	yellow	green
	C							red	yellow	yellow	blue	blue	blue
Miami	A	red	blue	green	yellow	yellow	yellow	green	green	green	blue	blue	yellow
	B	blue	blue	green	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	red	blue	yellow	green	blue	green	green	yellow	green	blue	blue	blue
Minneapolis	A	red	red	red	blue	yellow	blue	blue	blue	blue	blue	blue	blue
	B	red	red	yellow	yellow	yellow	blue	blue	green	blue	blue	blue	blue
	C	green	red	red	yellow	blue	blue	yellow	yellow	blue	yellow	green	blue
New York	A	green	blue	blue	yellow	blue	blue	blue	blue	blue	blue	blue	blue
	B	yellow	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	red	green	green	green	green	green	blue	green	green	green	blue	blue
Oakland	A	yellow	yellow	blue	red	blue	blue	green	blue	green	yellow	blue	blue
	B	blue	green	blue	yellow	yellow	yellow	blue	red	yellow	red	yellow	blue
	C	yellow	red	red	red	red	red	red	red	red	yellow	red	yellow
Puerto Vallarta	A	*	*	*	*	*	*	blue	green	blue	yellow	green	yellow
	B							blue	yellow	green	yellow	yellow	yellow
	C							blue	yellow	red	red	red	red
Salt Lake City	A	red	blue	blue	blue	yellow	blue	blue	blue	blue	yellow	blue	blue
	B	green	red	yellow	yellow	red	blue	yellow	blue	yellow	yellow	yellow	yellow
	C	yellow	blue	yellow	blue	yellow	blue	yellow	blue	blue	red	blue	green
San Jose Del Cabo	A	*	*	*	*	*	*	red	red	red	red	red	yellow
	B							red	yellow	red	yellow	yellow	yellow
	C							green	red	red	red	red	red
San Juan	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	yellow	blue	blue	blue	blue	green	green	blue	blue	yellow	blue
	C	blue	blue	blue	blue	green	blue	blue	green	blue	blue	blue	blue
Seattle	A	yellow	blue	blue	yellow	blue	blue	blue	blue	blue	blue	blue	blue
	B	red	blue	green	green	blue	blue	blue	blue	blue	blue	blue	blue
	C	yellow	yellow	blue	red	yellow	blue	blue	blue	blue	green	blue	blue
Tapachula	A	*	*	*	*	*	*	red	blue	yellow	yellow	yellow	red
	B							red	yellow	yellow	yellow	red	red
	C							red	red	red	red	yellow	yellow
Washington, DC	A	yellow	blue	yellow	green	yellow	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Winnipeg	A	*	*	*	*	*	*	blue	blue	blue	blue	blue	blue
	B							blue	blue	blue	blue	blue	blue
	C							blue	blue	blue	blue	blue	blue

• **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

Shaded receivers represent legacy receivers (non-G2). These receivers are predominantly the trouble receivers, with over 95% of their failures occurring on the L2 frequency.
* International sites' data is not shown prior to their addition into the WAAS system.
- Thread was not evaluated due to receiver or network issues.

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 (US and Mexico) and CSRS (Canada) antenna position surveys were performed for the WAAS antennas using a 24 hour set of data from 4/29/08. YYR-A and ZOB-B were not available in that data set so data from 5/2/08 was used for YYR-A and data from 4/20/08 was used for ZOB-B. 30 second RINEX data was created from recorded WAAS binary data. Table 11.1 shows the WAAS antenna positions as of 4/29/08 (US and MX are IRTF-2000 from OPUS, Canadian sites are IRTF 2005 from CSRS, for WAAS purposes the difference between IRTF-2000 and IRTF-2005 is negligible).

Figure 11.1 to 11.3 show the difference between the WRS locations in the current software and the latest 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 two 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.

The survey from the current software is from the 'Release 8/9' version of the WAAS operational software. 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. Outliers above 5 cm (total RSS position delta) are HNL, MMX, MSD, ZLA, ZSE, and ZAB-C.

HNL, MSD, ZLA, ZSE are the quickest moving sites and are outliers because of the interpolation forward to 6/9/09. This was verified by cross checking against the un-interpolated positions which differed 4 cm for HNL, 3 cm for MSD, 2.5 cm for ZSE, and 1.5 cm for ZLA. The XYZ difference was consistent for each WRE at a WRS.

MMX is the largest outlier at 18 cm. This is a known issue with the rapid subsidence in the Mexico City area due to water being depleted from an underground lake. This issue is being addressed by the WAAS Integrity Performance Panel (WIPP) and will probably require the MMX antenna positions to be updated more often and out of cycle.

The ZAB-C outlier was investigated by comparing the un-interpolated positions to the current positions and performing another OPUS survey using data from 4/20/08. There may have been a 2 cm displacement of the ZAB-C antenna in the X axis between 10/21/07 and 4/20/08. This is smaller than the accuracy of the surveys and below the 10 cm "take action" threshold. This issue will be continued to be investigated, but no action is required at this time.

Table 11-1 WAAS Survey Positions as of 4/29/2008

WRE	X	Y	Z	Lat	Long	H (m)
BET1	-2965384.952	-972576.623	5543892.971	60.787916486	-161.841724416	52.203
BET2	-2965385.719	-972580.346	5543891.915	60.787897064	-161.841663857	52.204
BET3	-2965388.288	-972577.477	5543891.043	60.787881127	-161.841728605	52.198
BIL1	-1416445.82	-4223577.03	4550862.184	45.803707088	-108.539722283	1112.261
BIL2	-1416449.888	-4223574.888	4550862.908	45.803716383	-108.539780649	1112.266
BIL3	-1416441.513	-4223574.29	4550866.033	45.803756811	-108.539680968	1112.255
BRW1	-1886758.812	-809058.669	6018494.516	71.282765883	-156.789923397	15.577
BRW2	-1886756.23	-809055.928	6018495.698	71.282798595	-156.789965306	15.589
BRW3	-1886755.14	-809059.713	6018495.52	71.282793925	-156.789856228	15.577
CDB1	-3483634.74	-1083799.447	5214187.71	55.200334771	-162.718472052	53.648
CDB2	-3483629.871	-1083796.776	5214191.497	55.200394330	-162.718489390	53.652
CDB3	-3483631.881	-1083788.429	5214191.893	55.200400493	-162.718623936	53.657
FAI1	-2304741.684	-1448715.26	5748843.691	64.809630987	-147.847339789	149.891
FAI2	-2304741.211	-1448706.454	5748846.091	64.809681435	-147.847491409	149.897
FAI3	-2304732.678	-1448707.387	5748849.232	64.809748030	-147.847379206	149.876
HNL1	-5508637.055	-2234493.586	2303722.057	21.312988930	-157.920824884	24.678
HNL2	-5508656.221	-2234483.908	2303686.805	21.312645960	-157.920980760	25.022
HNL3	-5508647.632	-2234497.846	2303693.9	21.312714586	-157.920825156	25.067
JNU1	-2354254.792	-2388549.638	5407043.073	58.362575024	-134.585705943	16.024
JNU2	-2354252.708	-2388565.753	5407036.909	58.362469451	-134.585487326	16.029
JNU3	-2354239.484	-2388568.602	5407041.368	58.362545895	-134.585292259	16.020
MMD1	35070.455	-5959686.685	2264365.758	20.931909130	-89.662840352	29.133
MMD2	35065.528	-5959687.055	2264364.972	20.931901399	-89.662887739	29.171
MMD3	35065.195	-5959685.271	2264369.633	20.931946482	-89.662890840	29.168
MMX1	-948701.237	-5943936.592	2109213.018	19.431653203	-99.068389471	2236.638
MMX2	-948696.808	-5943936.418	2109215.444	19.431676477	-99.068348099	2236.625
MMX3	-948705.664	-5943936.768	2109210.589	19.431629899	-99.068430820	2236.652
MPR1	-1570142.185	-5759530.608	2238184.758	20.679003359	-105.249202871	10.973
MPR2	-1570139.363	-5759530.12	2238188.809	20.679041461	-105.249177972	11.269
MPR3	-1570143.471	-5759528	2238190.574	20.679059454	-105.249221363	10.990
MSD1	-1979519.559	-5523223.167	2493106.697	23.160445938	-109.717646195	104.297
MSD2	-1979521.124	-5523225.5	2493100.298	23.160383141	-109.717652895	104.285
MSD3	-1979525.573	-5523222.23	2493103.967	23.160419201	-109.717704568	104.277
MTP1	-254854.344	-6162909.184	1617805.079	14.791366074	-92.367999089	54.962
MTP2	-254850.727	-6162910.227	1617801.649	14.791334042	-92.367965119	54.950
MTP3	-254855.507	-6162910.336	1617800.119	14.791319966	-92.368009440	54.855
OTZ1	-2396055.921	-750356.171	5843502.582	66.887333160	-162.611372024	10.911
OTZ2	-2396052.748	-750354.342	5843504.106	66.887368005	-162.611390215	10.909
OTZ3	-2396052.728	-750358.277	5843503.617	66.887356742	-162.611304386	10.913
YFB1	1035381.544	-2634289.638	5696539.518	63.731490169	-68.543181586	10.022
YFB2	1035372.331	-2634296.039	5696538.169	63.731464001	-68.543402553	9.957
YFB3	1035366.254	-2634306.793	5696534.389	63.731386362	-68.543596671	10.014
YQX1	2430424.722	-3419640.39	4788223.803	48.966489496	-54.597631164	146.888
YQX2	2430432.674	-3419639.049	4788220.744	48.966447606	-54.597532034	146.887
YQX3	2430440.591	-3419637.674	4788217.743	48.966406383	-54.597433025	146.899
YWG1	-520164.268	-4083475.888	4855843.018	49.900574663	-97.259396222	222.042
YWG2	-520150.405	-4083468.832	4855850.399	49.900677586	-97.259217224	222.051
YWG3	-520152.267	-4083477.952	4855842.575	49.900568446	-97.259226893	222.045
YYR1	1885341.503	-3321428.349	5091171.613	53.308646665	-60.419467188	37.830
YYR2	1885344.468	-3321419.868	5091176.036	53.308713007	-60.419365697	37.844
YYR3	1885340.184	-3321413.051	5091182.04	53.308803193	-60.419371104	37.853
ZAB1	-1488636.786	-5003946.545	3654557.709	35.173575457	-106.567349162	1620.117
ZAB2	-1488631.452	-5003948.23	3654557.686	35.173574799	-106.567287780	1620.181
ZAB3	-1488632.23	-5003950.814	3654553.827	35.173532365	-106.567287878	1620.164
ZAN1	-2659536.522	-1549114.821	5567750.763	61.229202467	-149.780248917	80.660
ZAN2	-2659548.278	-1549110.866	5567746.27	61.229118812	-149.780422686	80.653
ZAN3	-2659541.23	-1549106.741	5567750.748	61.229202391	-149.780423003	80.648

ZAU1	138704.178	-4761244.175	4227763.937	41.782657876	-88.331335953	195.918
ZAU2	138704.438	-4761248.786	4227758.775	41.782595526	-88.331334442	195.921
ZAU3	138711.141	-4761248.525	4227758.856	41.782596464	-88.331253756	195.926
ZBW1	1490299.296	-4448983.182	4306010.474	42.735720140	-71.480425027	39.125
ZBW2	1490304.41	-4448981.172	4306010.817	42.735724128	-71.480358015	39.151
ZBW3	1490306.118	-4448984.796	4306006.505	42.735671312	-71.480352294	39.147
ZDC1	1069125.838	-4839599.008	4001126.495	39.101595603	-77.542745736	80.084
ZDC2	1069128.23	-4839603.64	4001120.288	39.101523590	-77.542730286	80.080
ZDC3	1069124.131	-4839602.734	4001122.483	39.101548982	-77.542774296	80.092
ZDV1	-1273628.549	-4711375.622	4094890.143	40.187303318	-105.127223496	1541.399
ZDV2	-1273622.844	-4711377.141	4094890.158	40.187303552	-105.127154188	1541.391
ZDV3	-1273624.856	-4711380.332	4094885.868	40.187253096	-105.127167214	1541.377
ZFW1	-659983.143	-5324060.782	3438276.472	32.830649739	-97.066471191	155.617
ZFW2	-659988.409	-5324063.332	3438271.47	32.830596303	-97.066523654	155.576
ZFW3	-659983.439	-5324063.862	3438271.683	32.830598335	-97.066470282	155.620
ZHU1	-513864.426	-5506451.764	3166720.497	29.961896297	-95.331425748	10.908
ZHU2	-513867.07	-5506455.161	3166714.334	29.961831785	-95.331449752	10.974
ZHU3	-513873.351	-5506457.799	3166708.735	29.961773563	-95.331512004	10.958
ZJX1	772646.499	-5434462.208	3237231.723	30.698859379	-81.908184568	2.149
ZJX2	772649.825	-5434463.762	3237228.326	30.698823791	-81.908152480	2.140
ZJX3	772645.764	-5434466.197	3237225.218	30.698791217	-81.908198025	2.135
ZKC1	-415247.455	-4954556.406	3982161.112	38.880159315	-94.790833106	305.904
ZKC2	-415231.063	-4954557.73	3982161.171	38.880160009	-94.790643592	305.903
ZKC3	-415237.18	-4954561.079	3982155.974	38.880101810	-94.790710614	305.636
ZLA1	-2474409.838	-4637294.744	3602183.496	34.603517830	-118.083893947	763.521
ZLA2	-2474404.563	-4637297.554	3602183.5	34.603517881	-118.083828796	763.520
ZLA3	-2474411.173	-4637297.244	3602179.524	34.603473855	-118.083893956	763.598
ZLC1	-1808273.143	-4486410.821	4145303.035	40.786043564	-111.952176782	1287.421
ZLC2	-1808274.54	-4486414.43	4145298.542	40.785990178	-111.952176149	1287.416
ZLC3	-1808270.33	-4486416.141	4145298.537	40.785990067	-111.952122320	1287.423
ZMA1	966042.346	-5662999.834	2761581.48	25.824611968	-80.319189364	-7.579
ZMA2	966029.371	-5662999.137	2761585.967	25.824659706	-80.319315758	-8.207
ZMA3	966037.45	-5662997.975	2761586.322	25.824661752	-80.319234381	-7.861
ZME1	4070.955	-5226189.309	3644028.417	35.067394005	-89.955369299	68.609
ZME2	4070.986	-5226186.758	3644032.527	35.067437537	-89.955368937	68.883
ZME3	4064.79	-5226186.636	3644032.687	35.067439374	-89.955436864	68.871
ZMP1	-249978.309	-4539297.528	4458955.063	44.637463181	-93.152084552	262.679
ZMP2	-249972.504	-4539297.867	4458955.063	44.637463059	-93.152011267	262.693
ZMP3	-249973.601	-4539302.144	4458950.585	44.637407004	-93.152022108	262.628
ZNY1	1406144.71	-4627343.993	4144322.033	40.784328238	-73.097164869	6.457
ZNY2	1406146.509	-4627347.028	4144317.254	40.784275495	-73.097154931	5.930
ZNY3	1406140.951	-4627348.689	4144317.294	40.784275925	-73.097223653	5.936
ZOA1	-2684436.759	-4293337.54	3865351.799	37.543053122	-122.015945899	-3.497
ZOA2	-2684433.758	-4293341.635	3865349.378	37.543025498	-122.015892540	-3.481
ZOA3	-2684438.134	-4293342.511	3865345.526	37.542981164	-122.015929270	-3.400
ZOB1	650770.253	-4754715.681	4187420.741	41.297154278	-82.206443927	223.689
ZOB2	650777.934	-4754714.855	4187422.757	41.297166589	-82.206351733	225.187
ZOB3	650776.263	-4754719.681	4187414.967	41.297086827	-82.206379312	223.468
ZSE1	-2308930.219	-3668169.698	4663526.504	47.286993478	-122.188372098	82.112
ZSE2	-2308934.607	-3668175.239	4663520.092	47.286907917	-122.188382169	82.168
ZSE3	-2308935.668	-3668179.512	4663516.147	47.286856213	-122.188363949	82.105
ZSU1	2462589.316	-5529371.561	2003724.59	18.431338366	-65.993475669	-28.594
ZSU2	2462587.236	-5529377.314	2003711.592	18.431214363	-65.993515810	-28.520
ZSU3	2462593.881	-5529375.099	2003709.533	18.431194772	-65.993449821	-28.526
ZTL1	529840.463	-5305248.818	3489342.834	33.379688402	-84.296725378	261.138
ZTL2	529846.838	-5305247.979	3489343.119	33.379691546	-84.296656313	261.126
ZTL3	529847.521	-5305251.418	3489337.885	33.379634831	-84.296652682	261.161

Figure 11-1 Survey Delta for OPUS

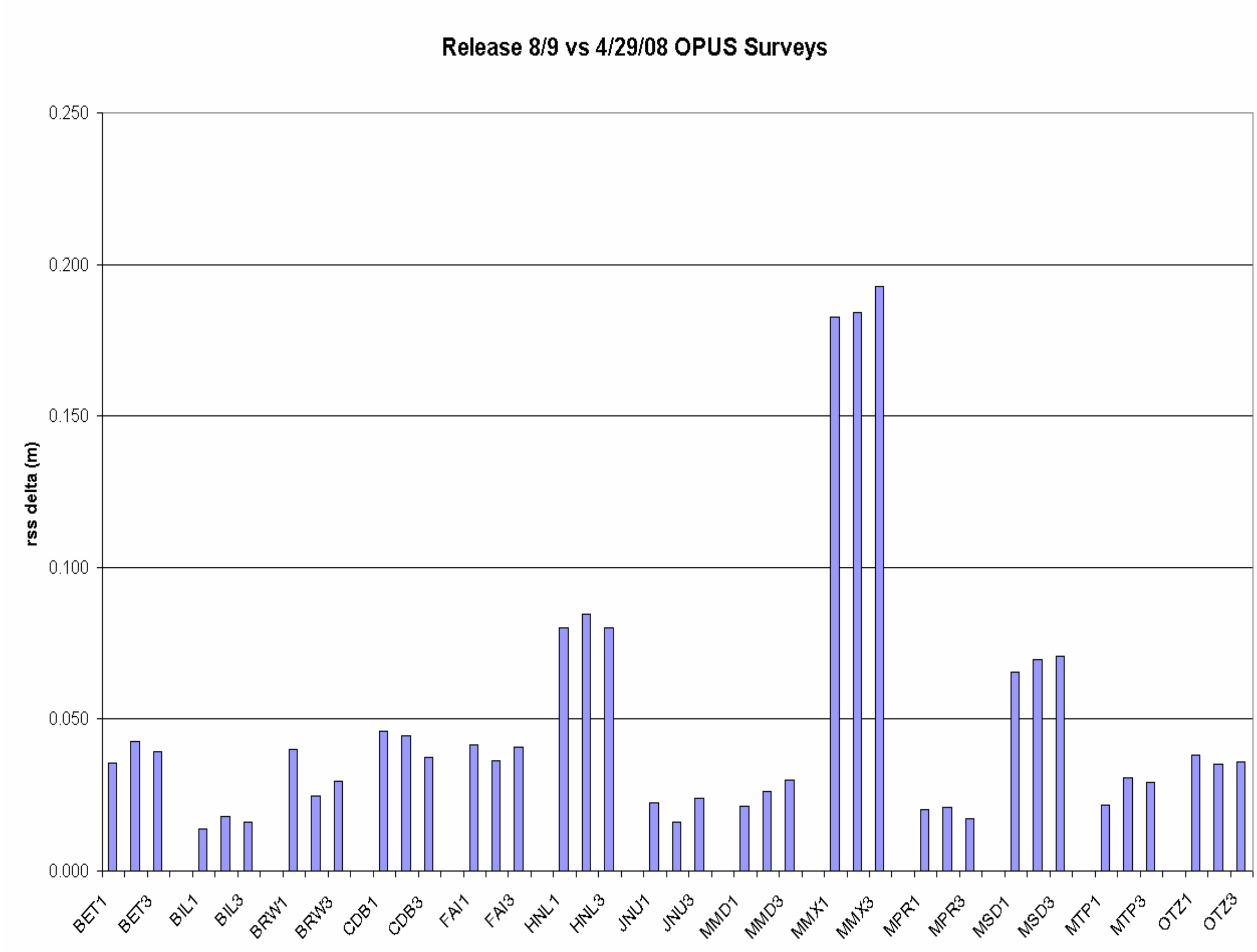


Figure 11-2 Survey Delta for CSRS and OPUS

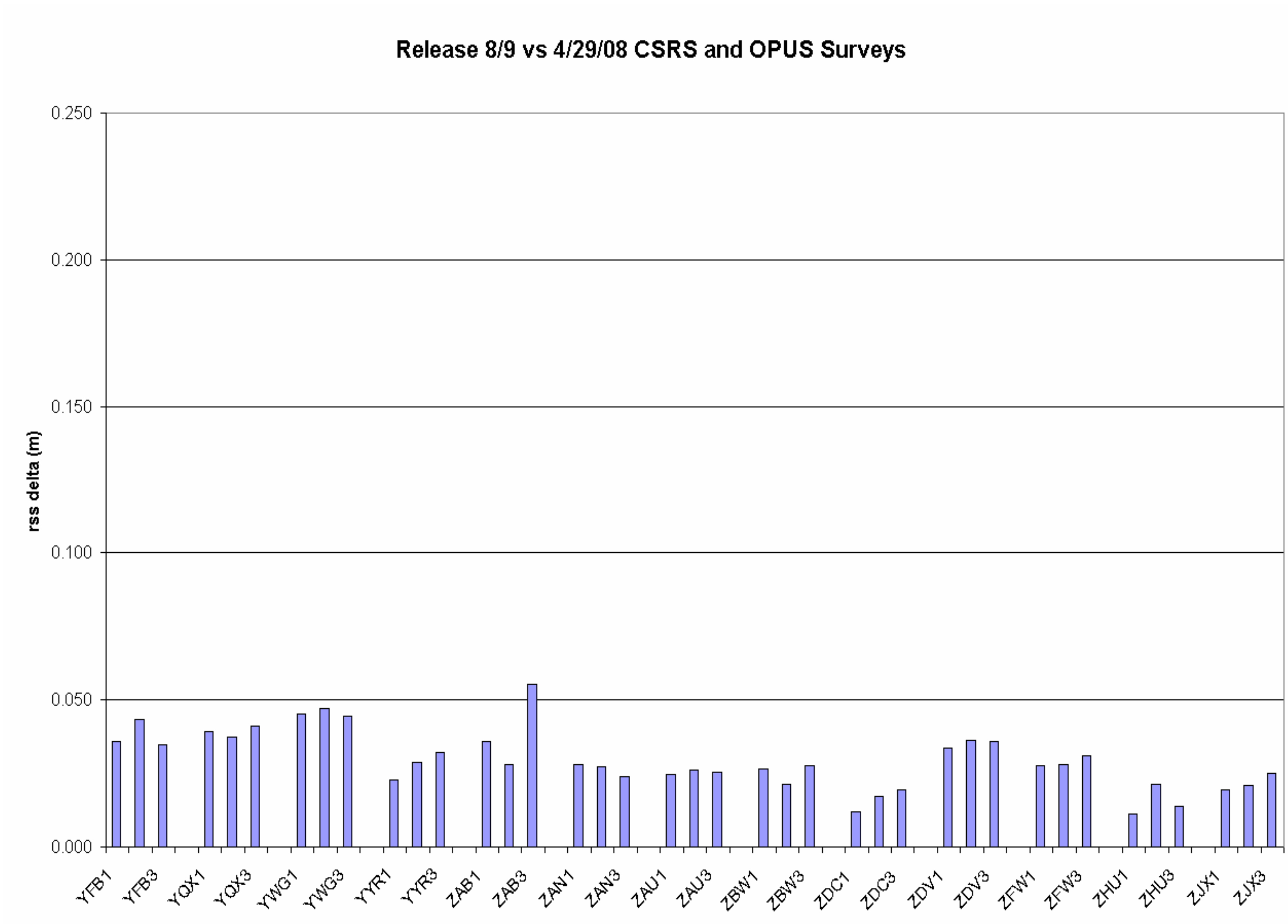
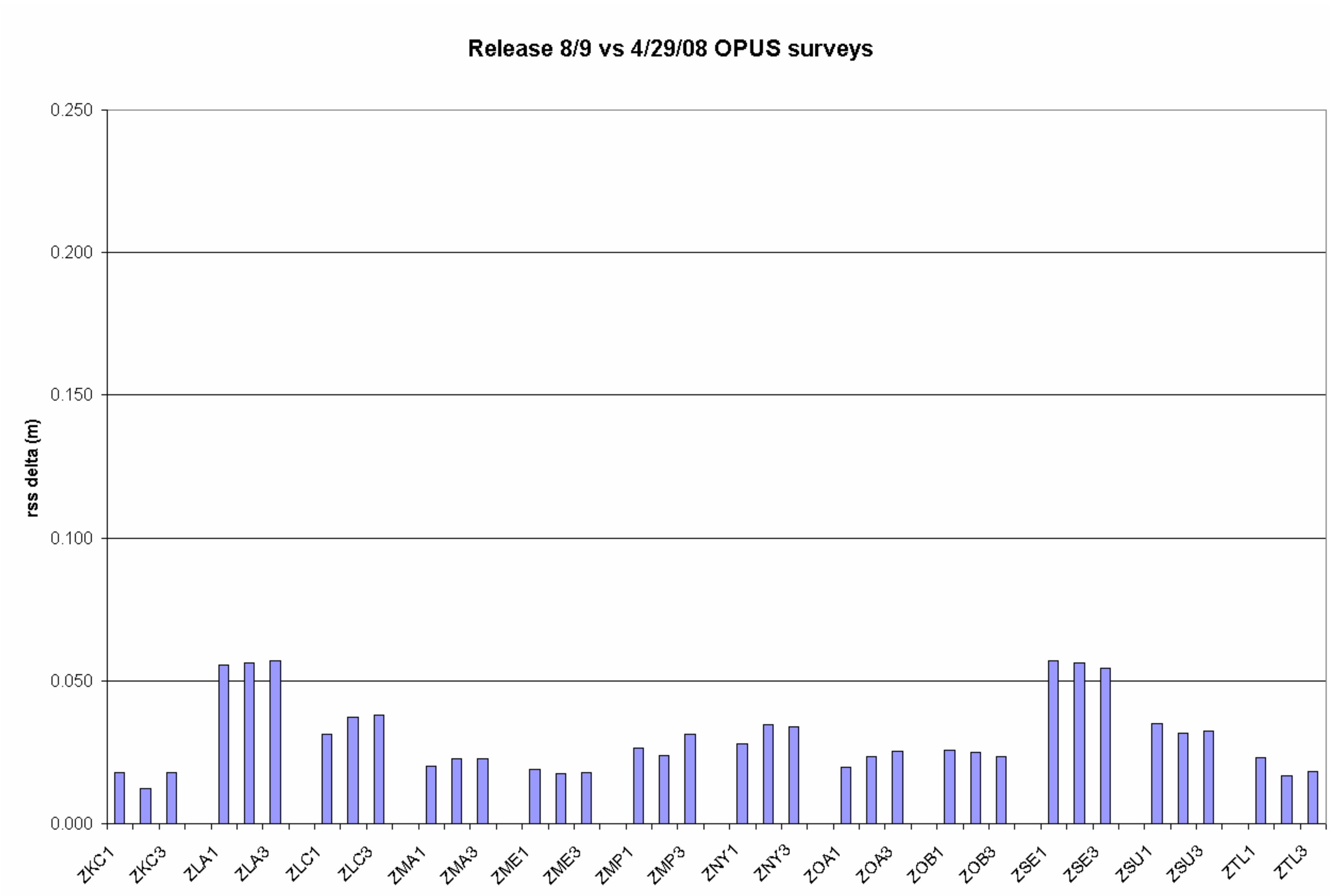


Figure 11-3 Survey Delta for OPUS



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

Table 12.2 lists the events that occurred during the reporting period that affected the SQM statistics.

Table 12-2 Event Summary

GPS Week	Date	Events
1463 day 0 to 1463 day 2	1/20/08 to 1/22/08	Scheduled power outage at the Technical Center caused a loss of data.
1470 day 0 to 1470 day 4	3/9/08 to 3/13/08	Hard-drive went bad at Technical Center caused the loss of data.
1471 day 0	3/16/08	SQM software restarted to add in PRN 32. Partial data for this day is not evaluated
1471 day 1	3/17/08	PRN 32 commissioned.
1471 day 2	3/18/08	PRN 1 decommissioned.
1472 day 2	3/25/08	PRN 7 commissioned.

12.3 Type Bias

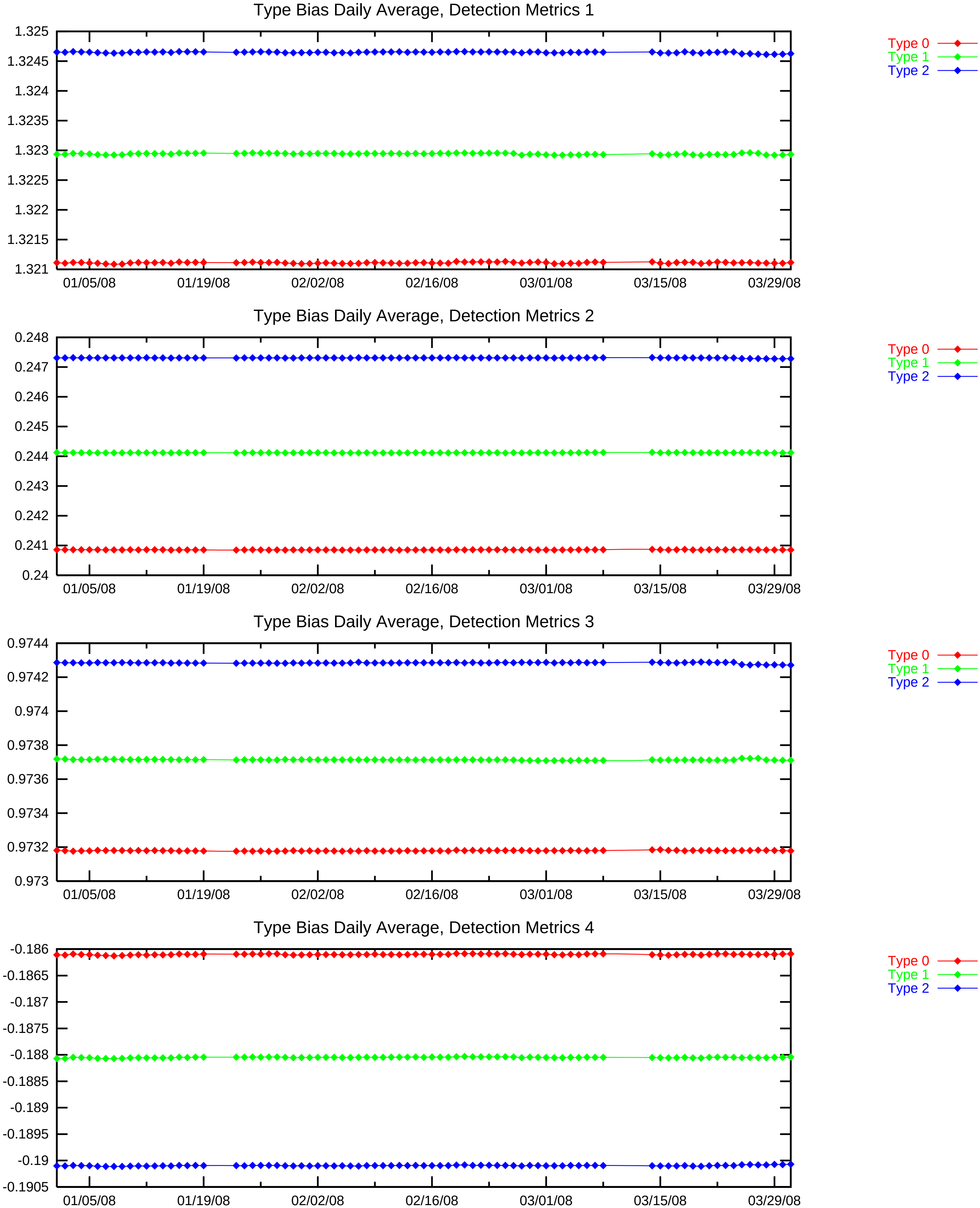
PRN Type biases were evaluated as part of the WAAS SQM offline monitoring effort. Depending on the PRN number of any given satellite, it can be classified into three categories of correlation function shapes: skinny (Type 0), nominal (Type 1), and broad (Type 2). Wideband geostationary satellites are 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. Table12.3 shows the rollup average for the quarter. Figure 12.1 shows the daily average for the four detection metrics. As expected, the type biases are consistent from day to day.

Table 12-3 Type Bias Average for the Quarter

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32111	1.32294	1.32465
DM 2	0.240853	0.244119	0.247307
DM 3	0.973179	0.973714	0.974284
DM 4	-0.186101	-0.188049	-0.190095

Figure 12-1 PRN Type Bias Average Trend



12.4 PRN Bias

PRN biases were 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. Figure 12.2 shows the average trend for each PRN, for the four detection metrics.

Table 12.4 and Figure 12.2 show the rollup PRN bias average for the quarter. The maximum average for DM1 is PRN 23 at 0.000938571. The maximum average for DM2 is PRN 21 at 0.000184184. The maximum average for DM3 is PRN 10 at 0.000268713. The maximum average for DM4 is PRN 23 at 0.000422844.

Figure 12.3 to 12.10 show the PRN bias average trend for each SV. Please refer to Table 12.2 for events that affected data availability. Please also note that PRN 1 was decommissioned on March 18, 2008; PRN 7 was commissioned on March 25, 2008 and PRN 32 on March 16, 2008. 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
1	0.00013865	0.00004367	0.00007289	0.00008097
2	0.00016933	0.00006072	0.00002266	0.00009856
3	0.00021022	0.00005066	0.00008516	0.00032706
4	0.00025144	0.00004481	0.00007206	0.00012947
5	0.00044712	0.00007183	0.00011628	0.00016157
6	0.00019003	0.00006371	0.00005708	0.00009146
7	0.00012666	0.00009696	0.00003717	0.00012413
8	0.00015126	0.00011801	0.00004482	0.00010537
9	0.00023200	0.00005550	0.00006615	0.00010883
10	0.00065116	0.00007694	0.00026871	0.00008952
11	0.00090671	0.00018136	0.00006740	0.00022914
12	0.00025278	0.00008388	0.00010142	0.00008570
13	0.00049312	0.00006324	0.00005859	0.00016117
14	0.00066286	0.00013240	0.00011587	0.00012587
15	0.00011513	0.00006922	0.00002639	0.00013109
16	0.00016556	0.00008093	0.00010613	0.00032370
17	0.00011871	0.00008834	0.00002965	0.00011502
18	0.00058135	0.00009572	0.00004119	0.00019810
19	0.00037522	0.00013201	0.00003434	0.00008707
20	0.00016255	0.00005016	0.00004486	0.00010643
21	0.00061879	0.00018418	0.00020507	0.00008318
22	0.00016042	0.00007688	0.00010719	0.00009326
23	0.00093857	0.00013686	0.00003593	0.00042284
24	0.00029744	0.00004613	0.00003409	0.00009275
25	0.00015992	0.00009844	0.00007995	0.00029553
26	0.00026809	0.00009506	0.00015413	0.00009012
27	0.00045184	0.00007353	0.00007063	0.00029471
28	0.00024260	0.00005372	0.00003193	0.00008874
29	0.00020925	0.00007106	0.00010846	0.00029697
30	0.00029333	0.00009241	0.00002810	0.00012402
31	0.00047667	0.00015365	0.00003751	0.00025637
32	0.00033818	0.00005107	0.00011329	0.00011726

Figure 12-2 PRN Bias Average for the Quarter

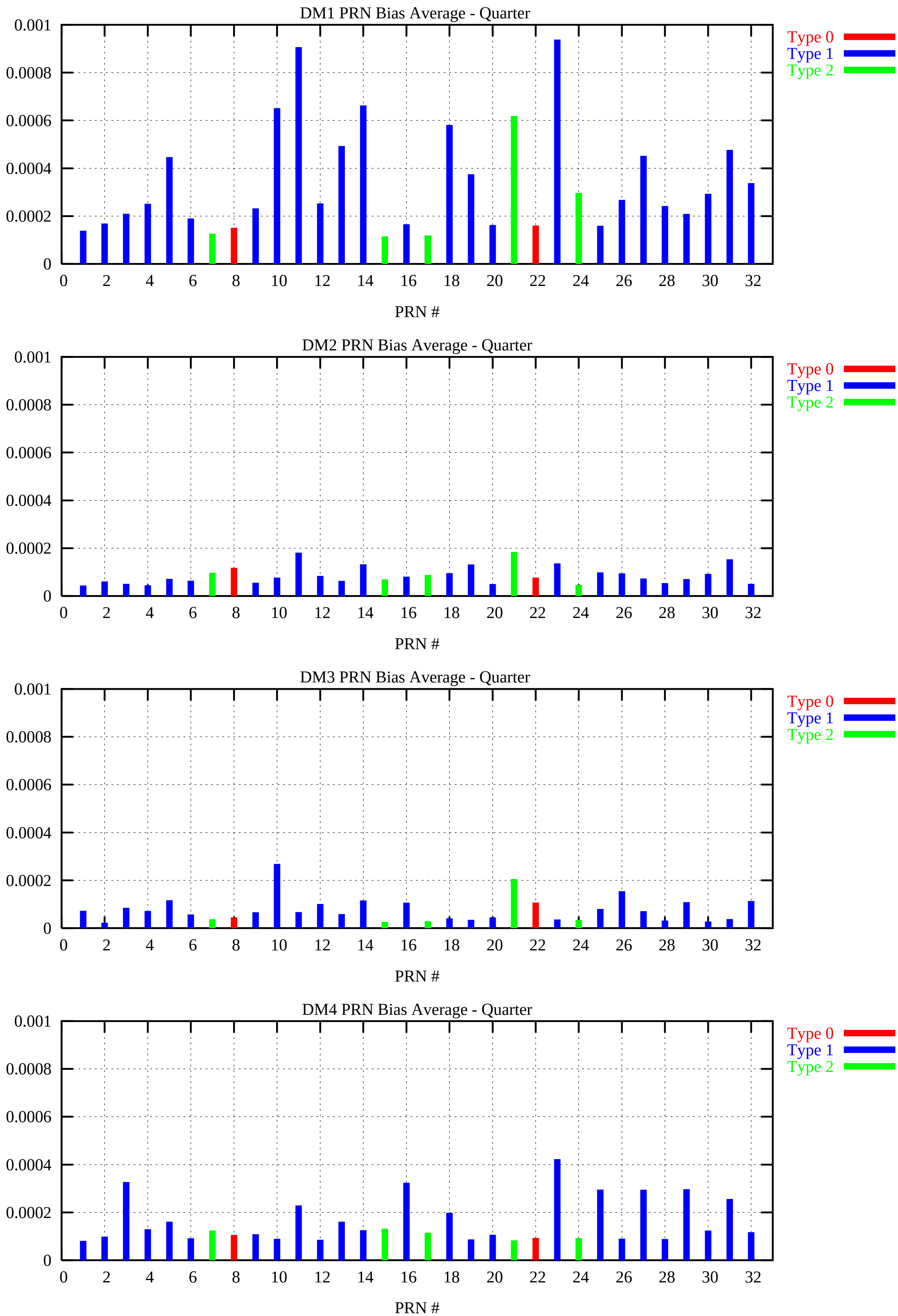
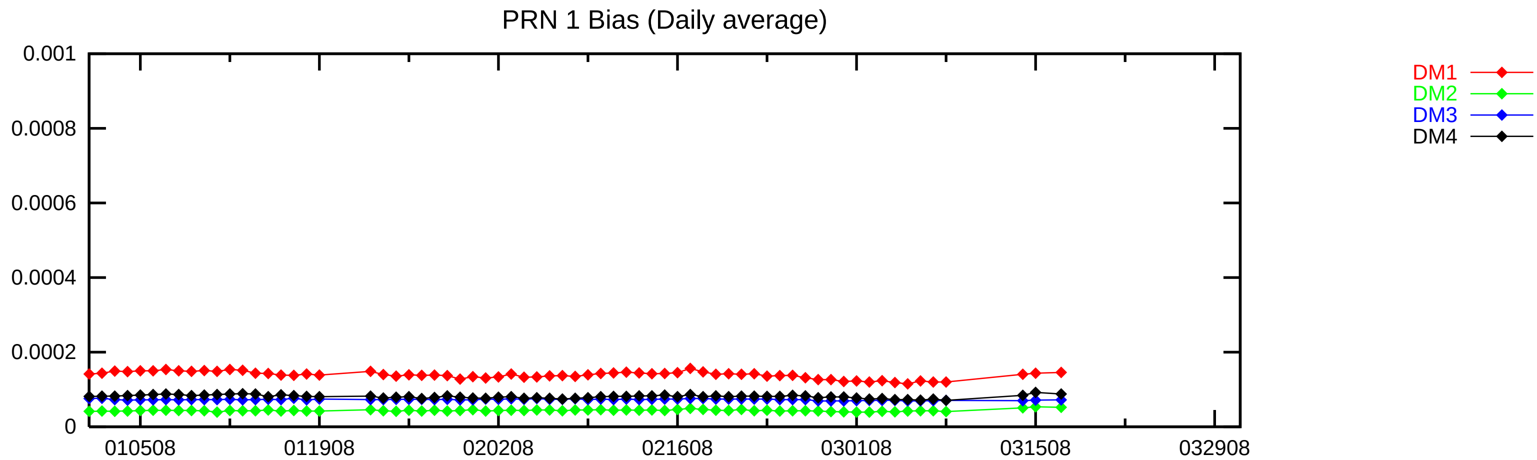
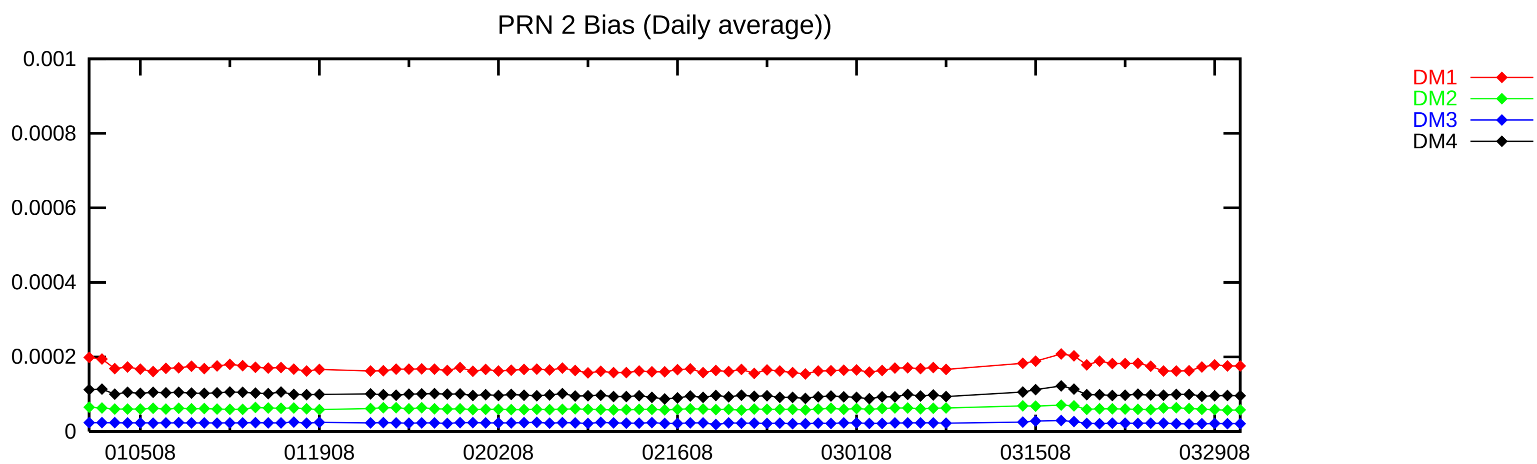
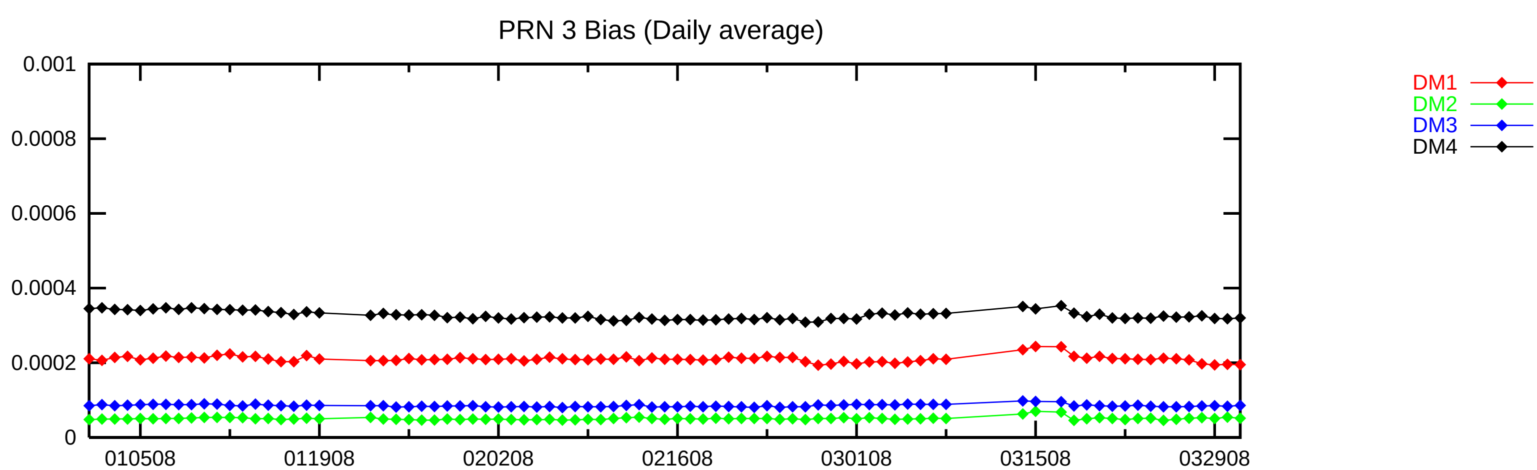


Figure 12-3 PRN Bias Average Trend (PRN 1 - PRN 4)







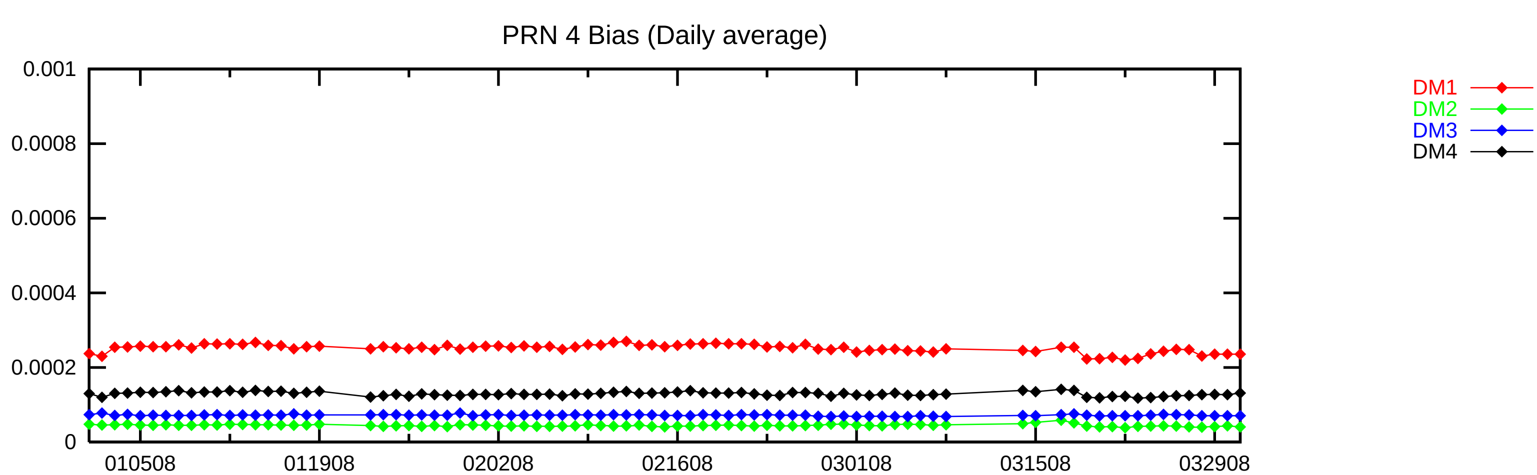


Figure 12-4 PRN Bias Average Trend (PRN 5 - PRN 8)

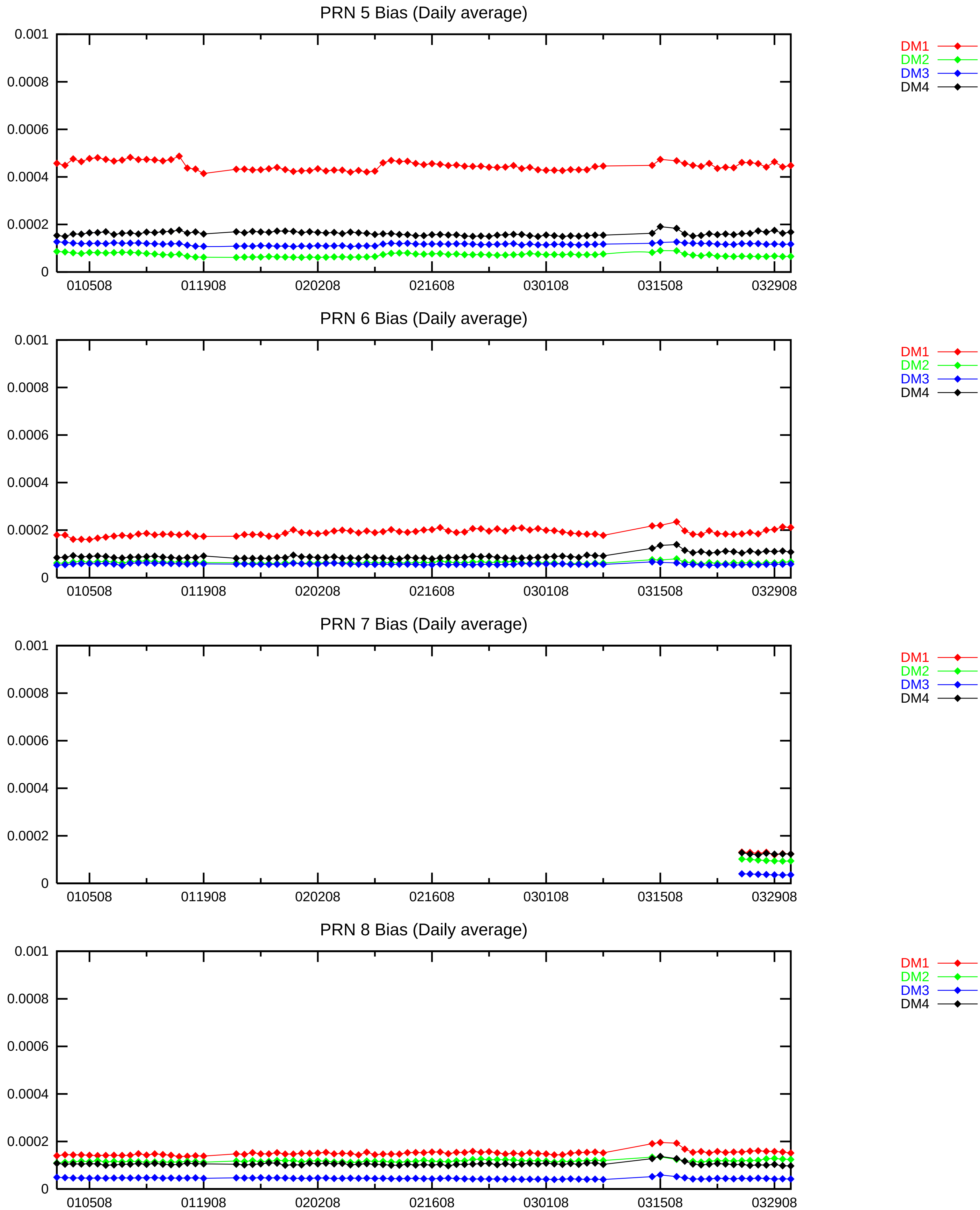
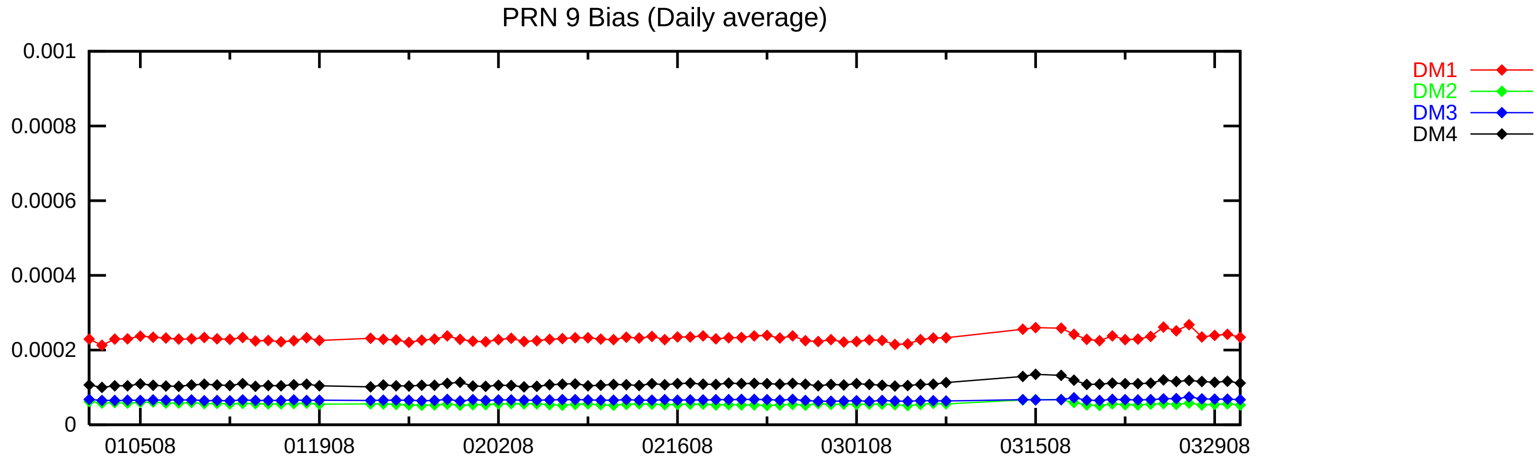
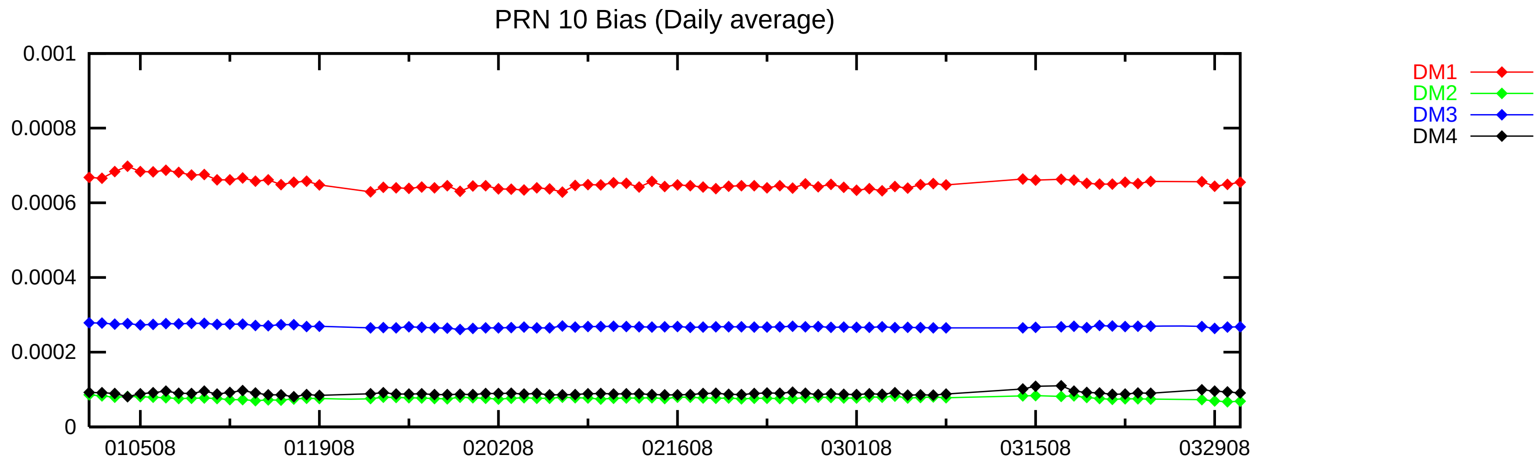
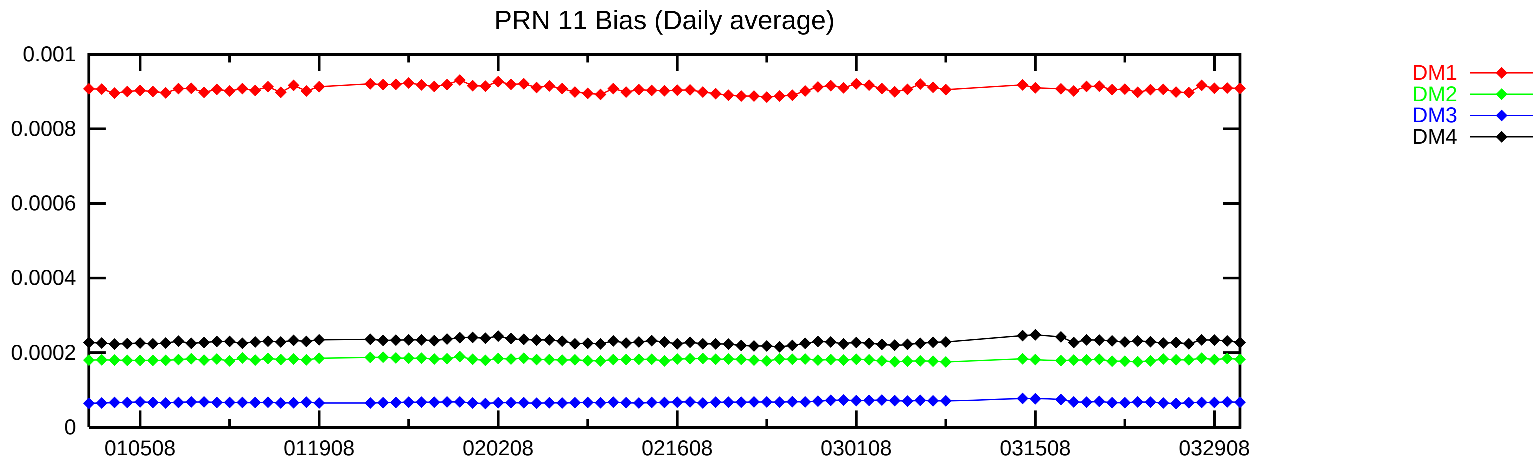


Figure 12-5 PRN Bias Average Trend (PRN 9 - PRN 12)







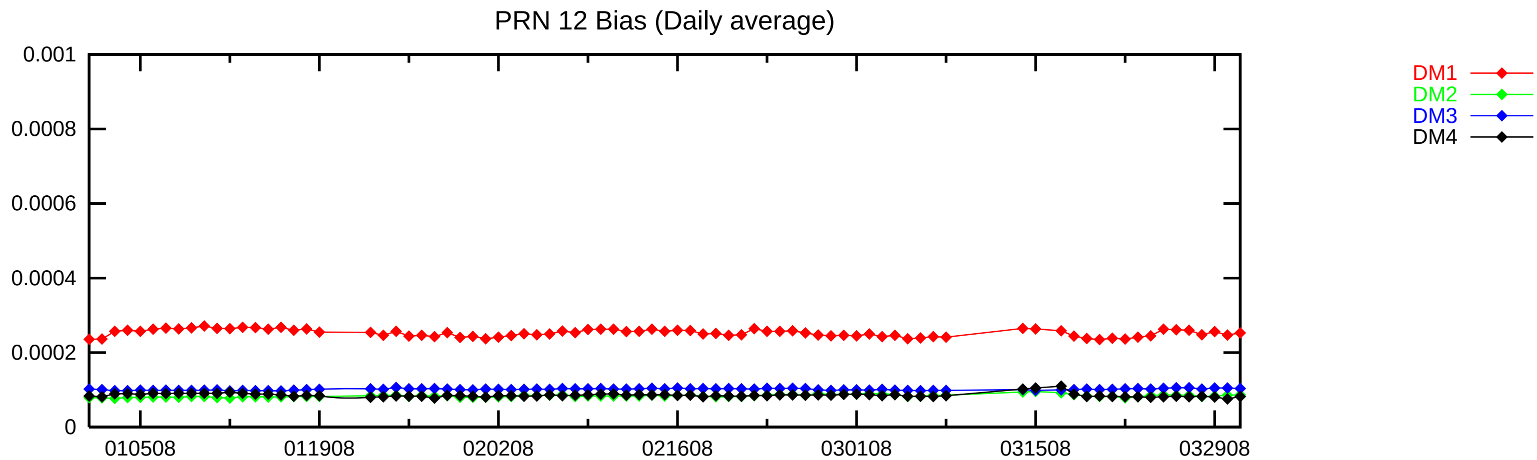


Figure 12-6 PRN Bias Average Trend (PRN 13 - PRN 16)

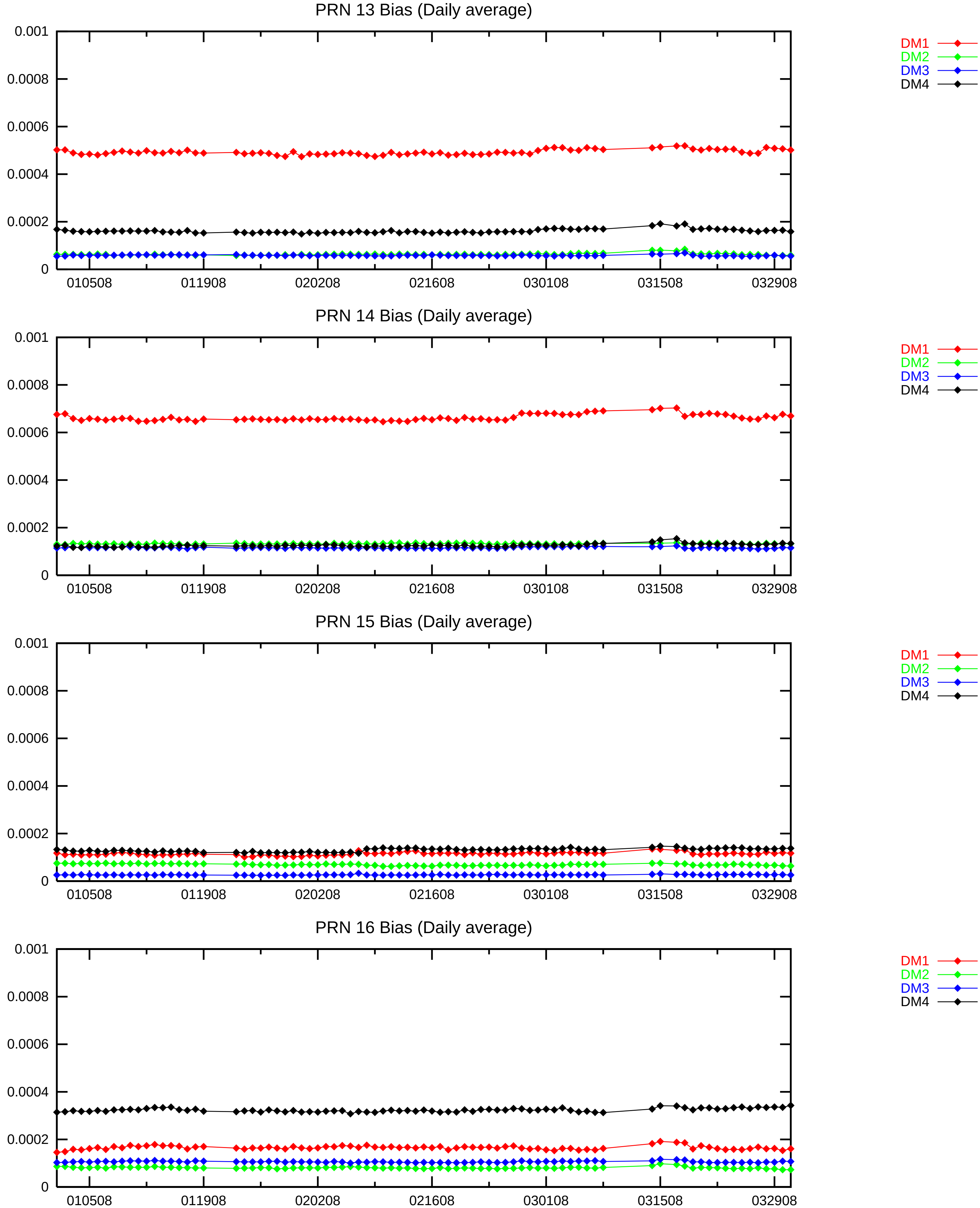
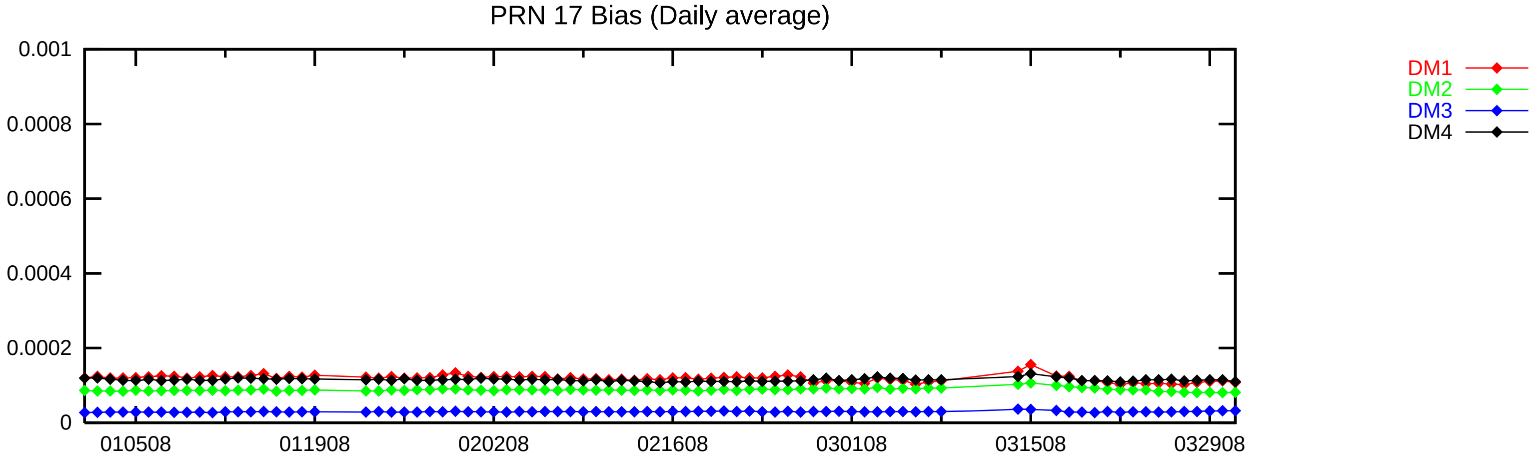
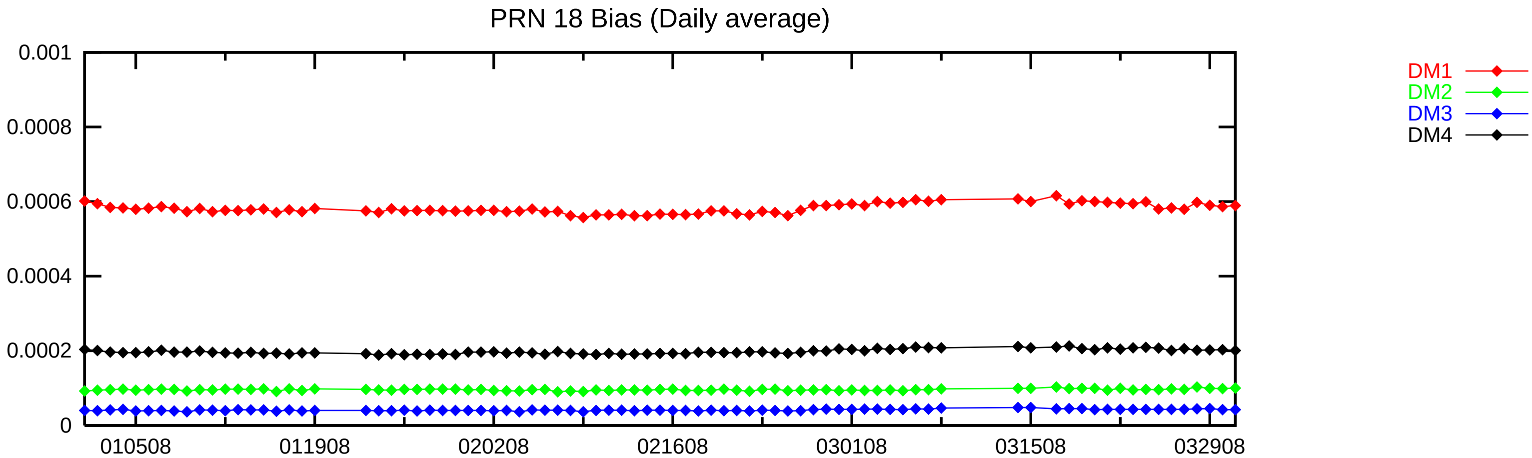
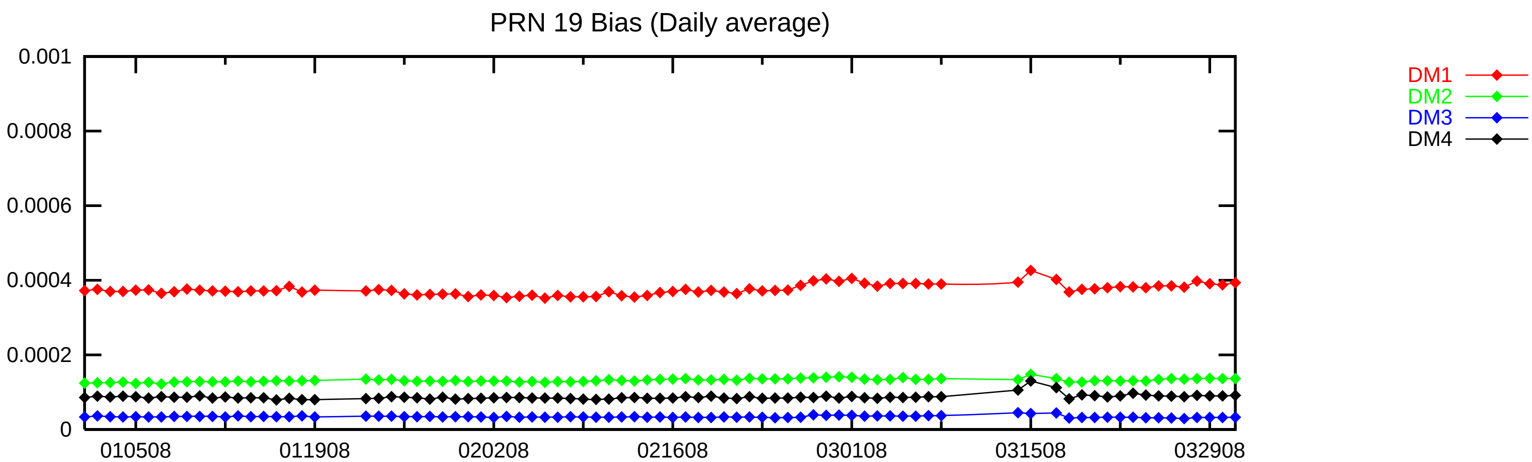


Figure 12-7 PRN Bias Average Trend (PRN 17 - PRN 20)







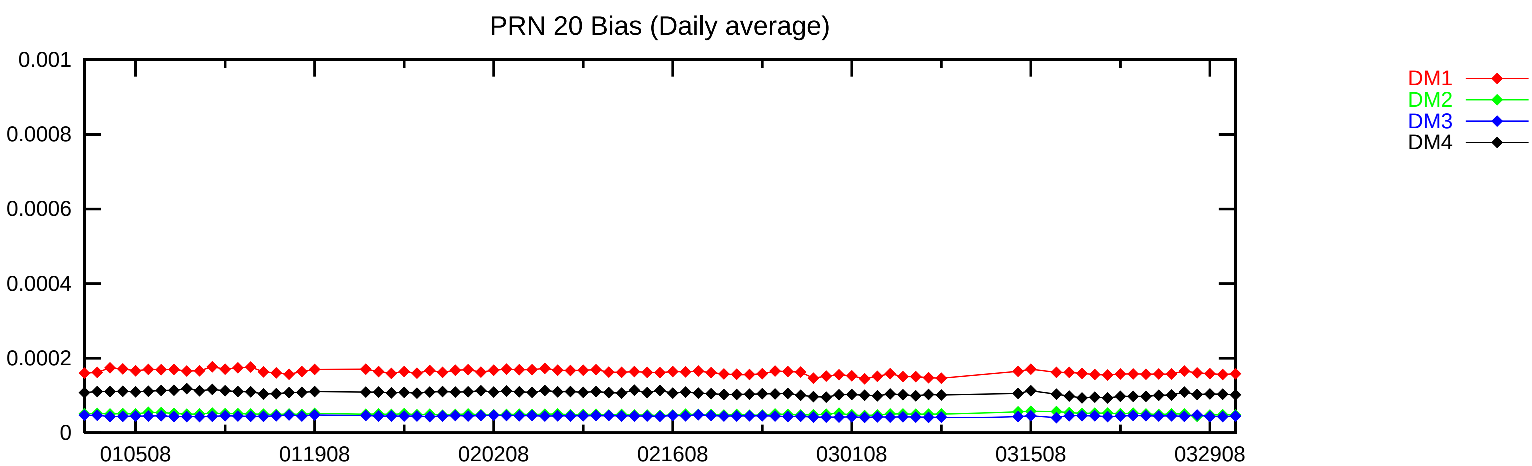
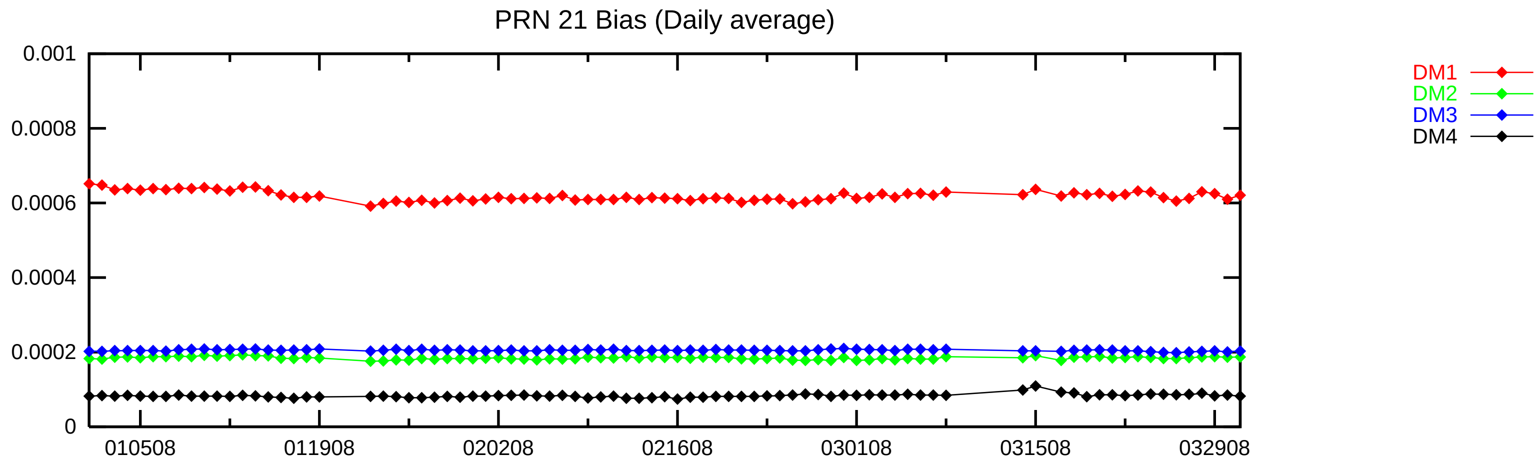
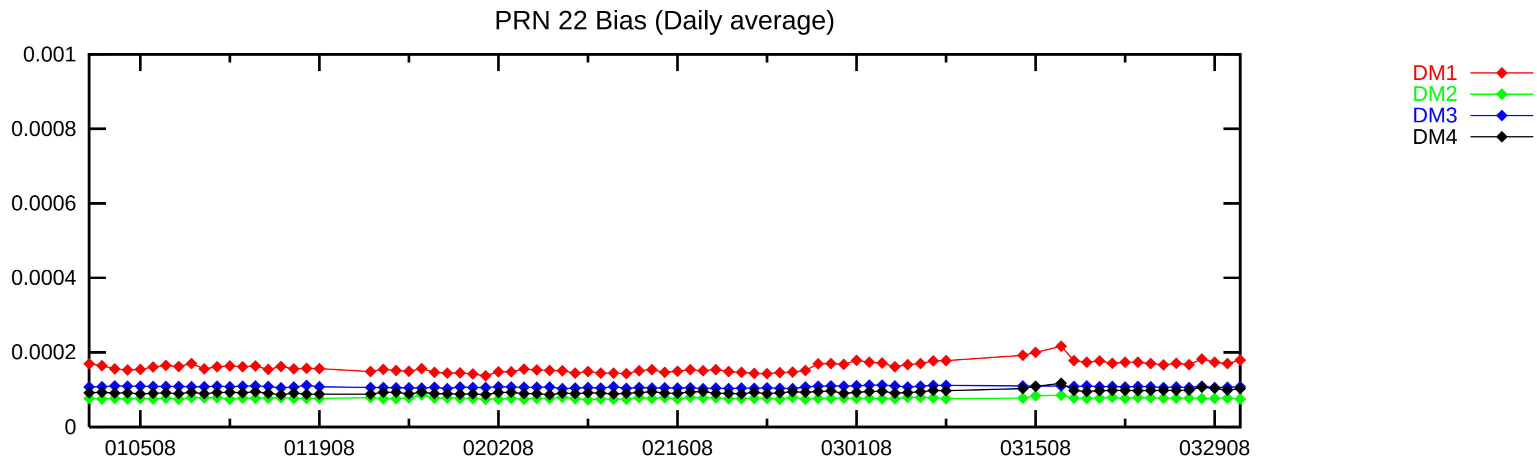
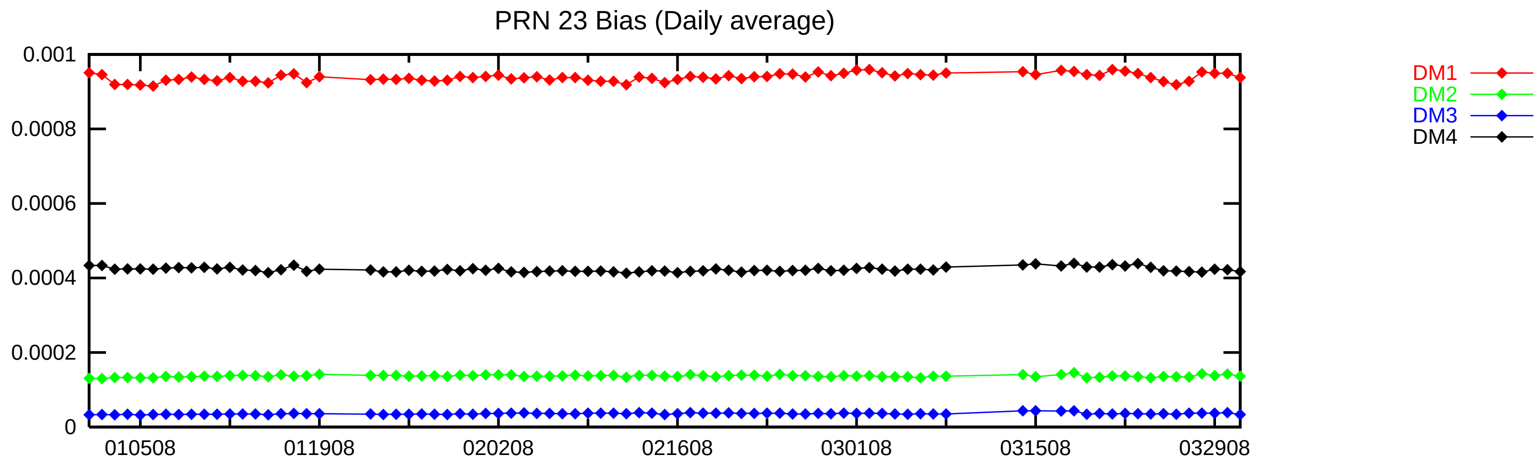


Figure 12-8 PRN Bias Average Trend (PRN 21 - PRN 24)







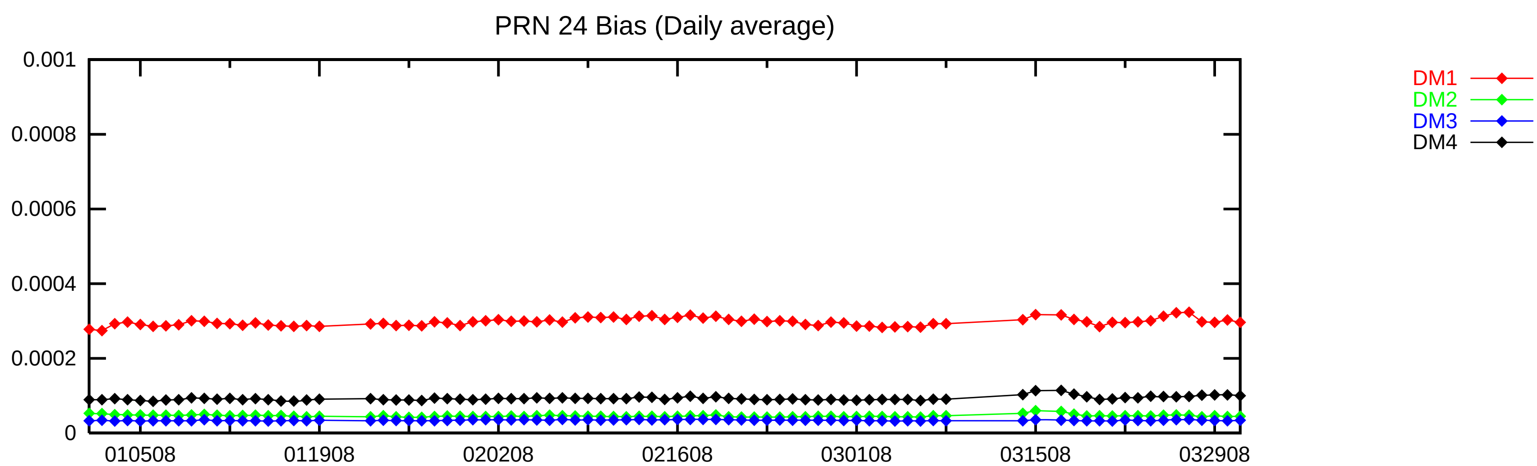
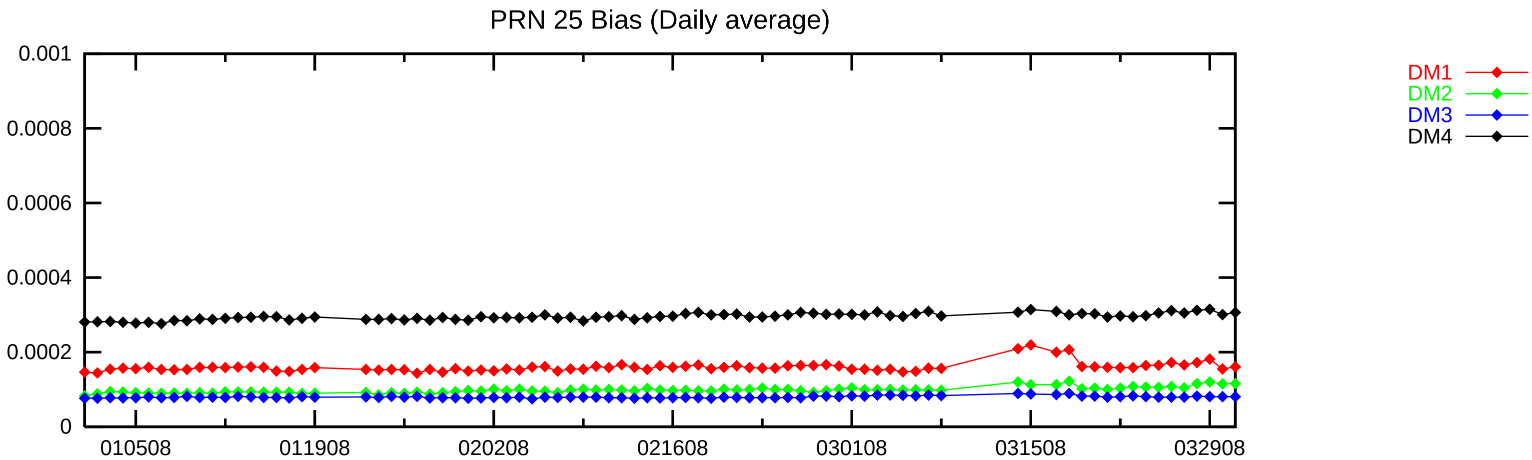
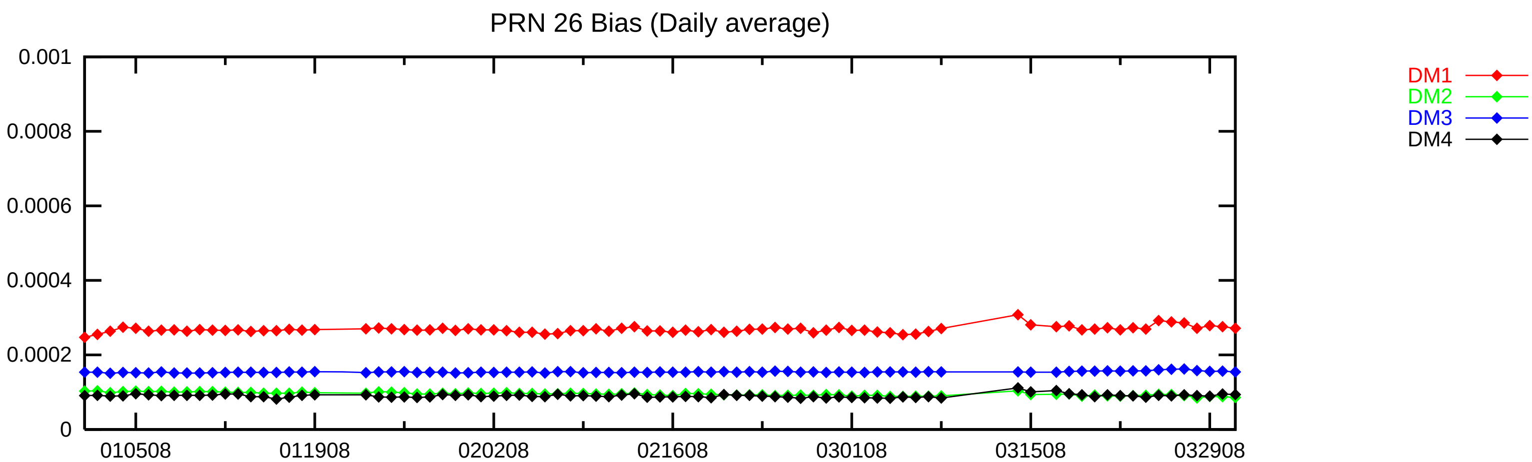
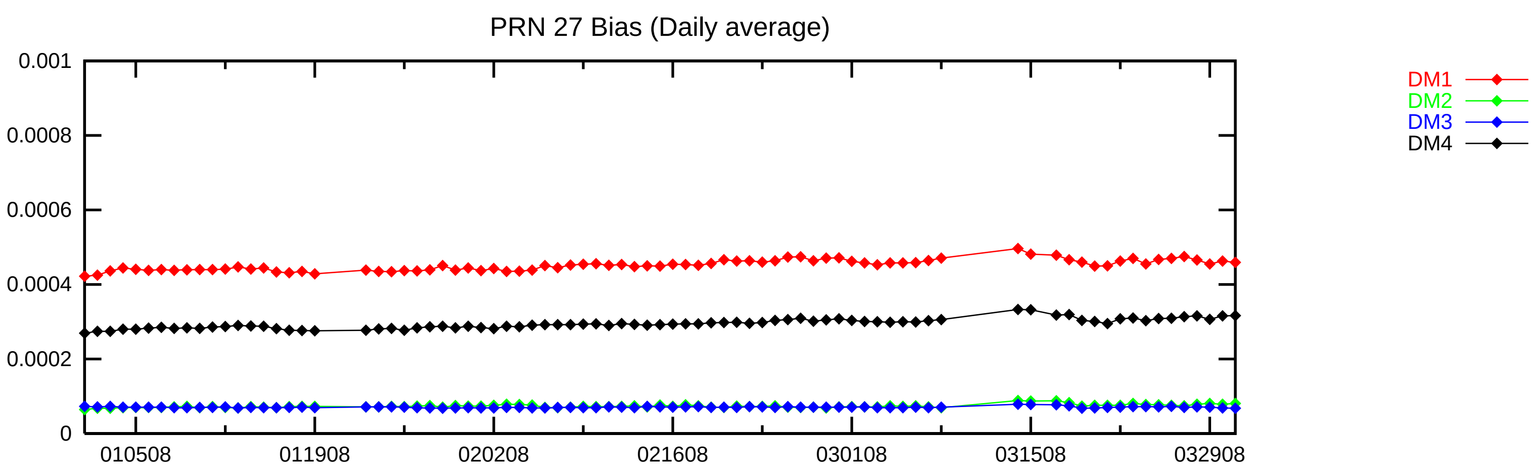


Figure 12-9 PRN Bias Average Trend (PRN 25 - PRN 28)







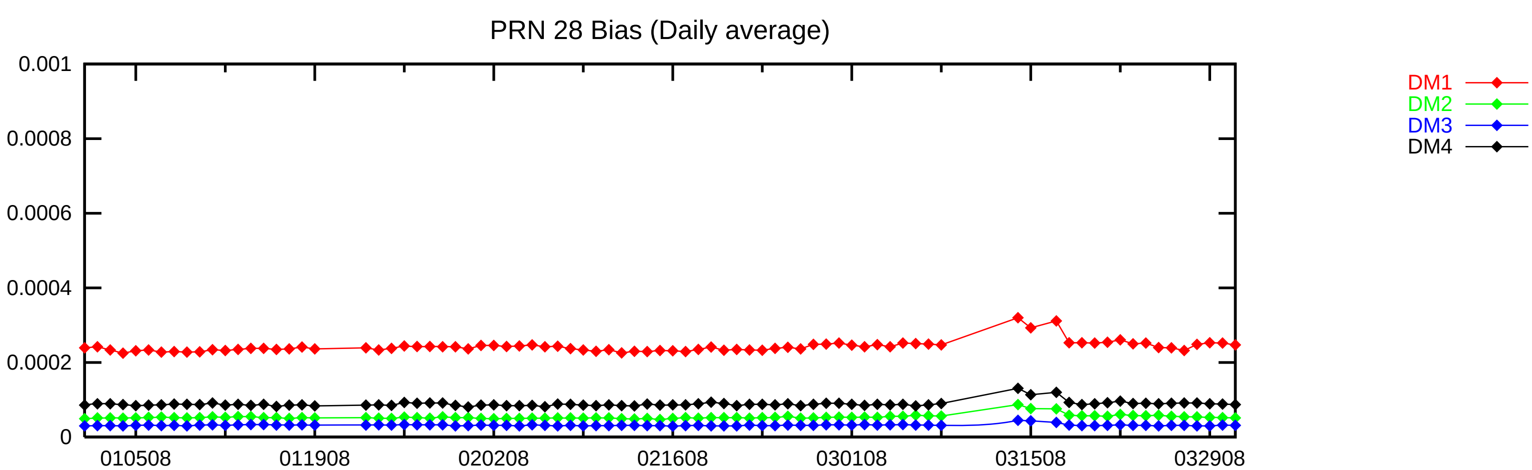
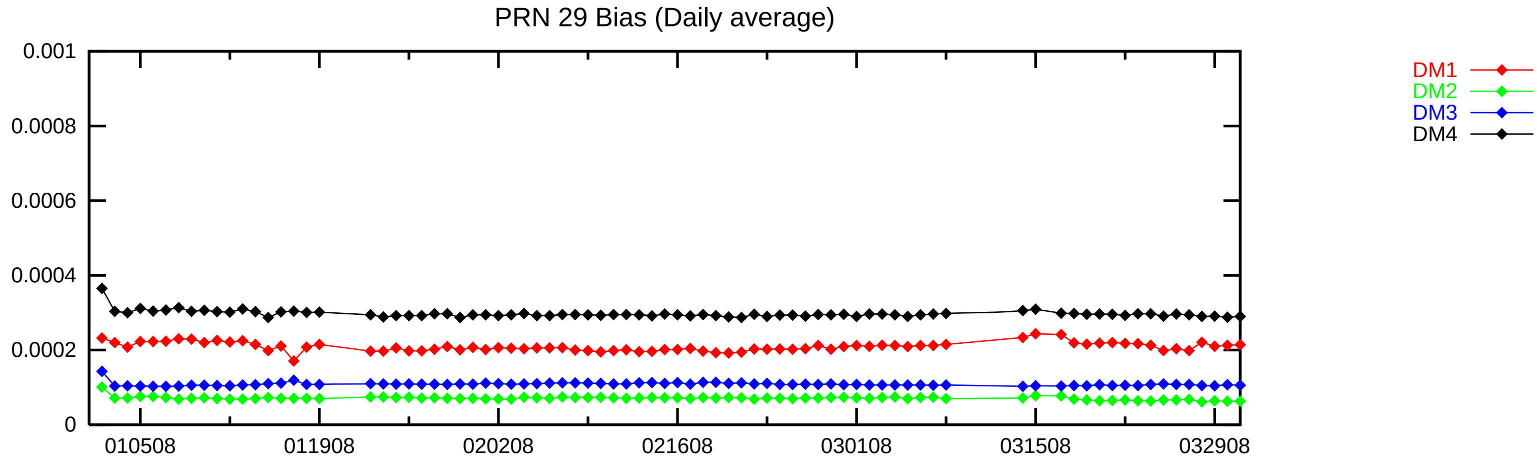
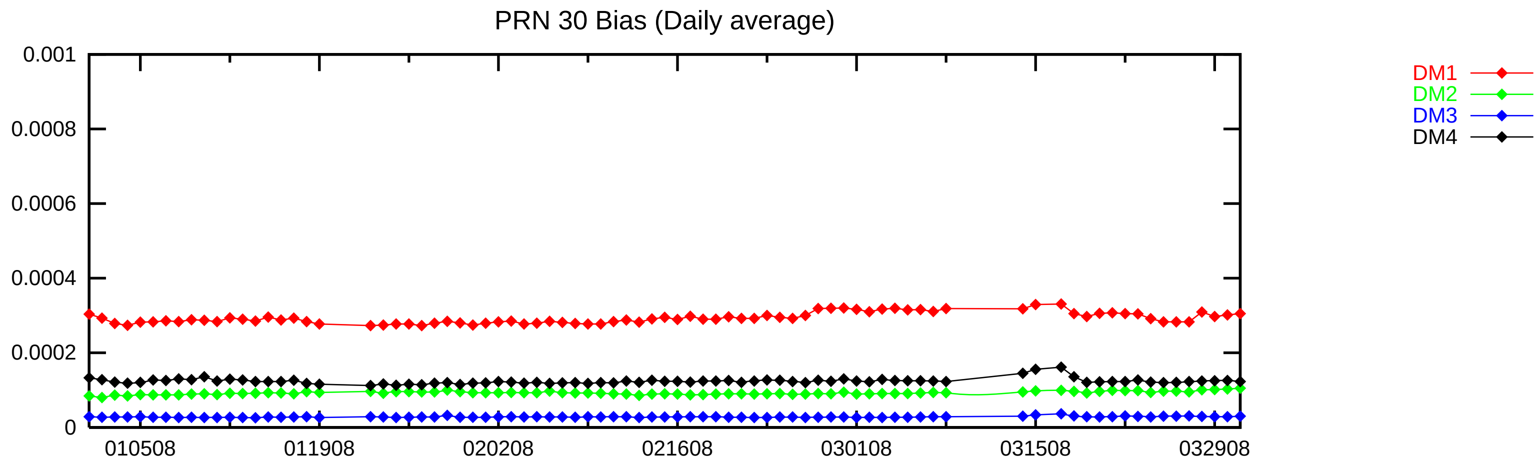
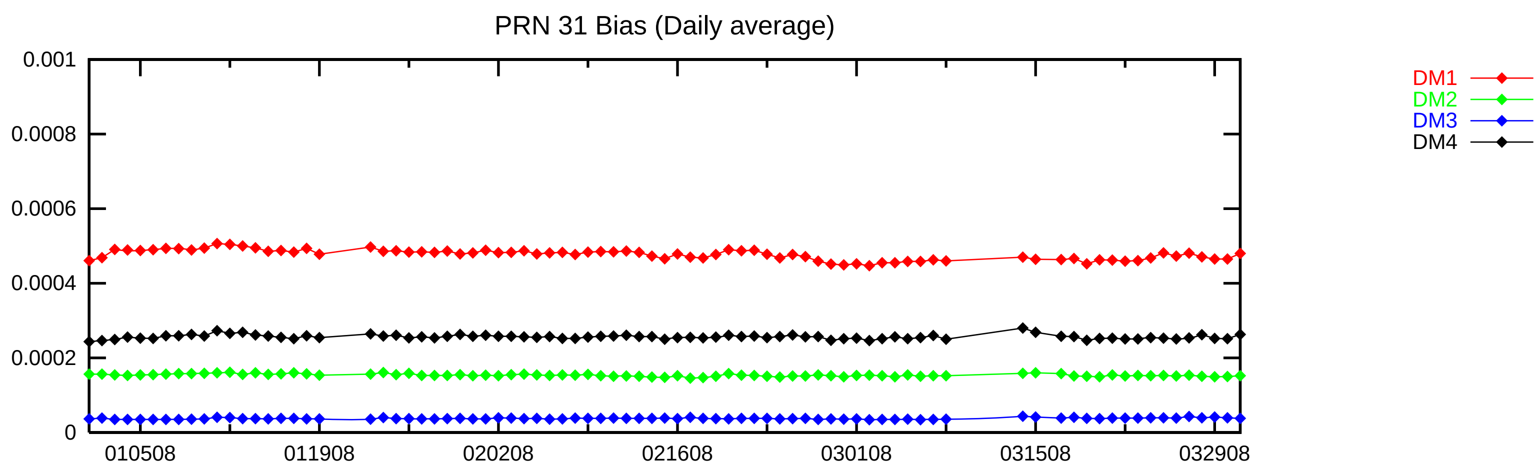
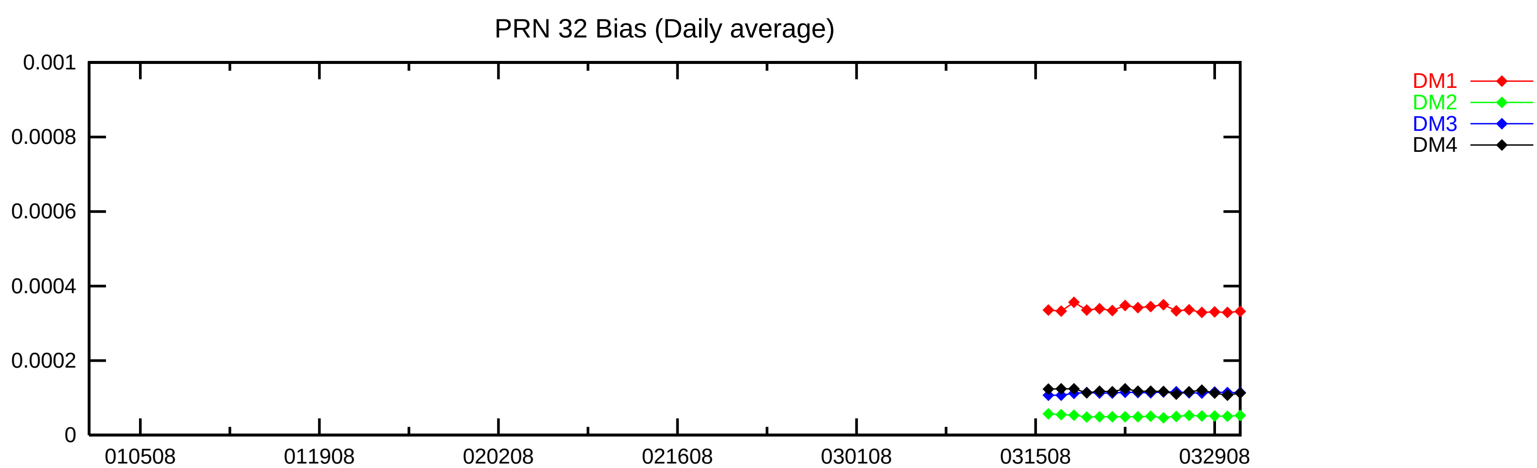


Figure 12-10 PRN Bias Average Trend (PRN 29 - PRN









12.5 SQM Trips

SQM trip occurs when the estimated deformation exceeds threshold. Table 12.5 lists all the trips monitored for this reporting period. All are false trips caused by data gap, partial data, or noisy data on rising satellite.

Table 12-5 SQM Trip Summary

GPS Week	Date	PRN#	DM#	Decription
Week 1470 day 5	3/14/2008	31	3	False trip occurred at the start of rising satellite with noisy data.
Week 1470 day 5	3/14/2008	31	4	False trip occurred at the start of rising satellite with noisy data.
Week 1470 day 6	3/15/2008	20	4	False trip occurred at the start of rising satellite with noisy data.
Week 1471 day 1	3/17/2008	24	4	False trip caused by a 1-sec data gap followed by 1-sec partial data (data from only 5 WREs instead of 105 WREs).
Week 1471 day 2	3/18/2008	3	4	False trip occurred at the start of rising satellite with noisy data.
Week 1471 day 2	3/18/2008	25	4	False trip occurred at the start of rising satellite with noisy data.

13.0 IGS SPS ACCURACY

GPS SPS accuracy performance was evaluated at a selection of high rate IGS stations [1]. The IGS is a voluntary federation of many worldwide agencies that pool resources and permanent GNSS station data to generate precise GNSS products. High data rate (1 Hz) sites that had high availability in 2006, were outside of the WAAS service area, and provided a good geographic distribution were selected. To facilitate differentiating between GPS accuracy issues and receiver tracking problem, an automatic data screening function excluded errors greater than 500 meters and or times when VDOP or HDOP were greater than 10. The remaining receiver tracking issues are still included in the statistics and are believed to influence the outliers in the 99.99% statistics.

Table 13.1 and Figure 13.1 show the IGS site information and locations. Table 13.2 shows the GPS SPS Accuracy Performance observed at a selection of High Rate IGS sites. Figure 13.2 shows the 95% horizontal accuracy at these sites. Figure 13.3 shows the 95% vertical accuracy at these sites.

During the evaluation period, the maximum 95% horizontal and vertical SPS errors are 3.95 meters at Maspalomas and 5.43 meters at Usuda, respectively. The minimum 95% horizontal and vertical SPS errors are 1.82 meters at Norilsk and 4.29 meters at Kourou, respectively. The maximum 99.99% horizontal and vertical SPS errors are 17.85 meters and 32.92 meters, both at Kourou, respectively. The minimum 99.99% horizontal and vertical SPS errors are 3.86 meters at Dededo and 8.07 meters at Bangolore, respectively.

[1] J.M. Dow, R.E. Neilan, G. Gendt, "The International GPS Service (IGS): Celebrating the 10th Anniversary and Looking to the Next Decade," Adv. Space Res. 36 vol. 36, no. 3, pp. 320-326, 2005. doi:10.1016/j.asr.2005.05.125

Table 13-1 Selected IGS Site Information

ID	City	Country
GLPS	Puerto Ayora	Ecuador
GUAM	Dededo	Guam
IISC	Bangalore	India
KIRU	Kiruna	Sweden
KOUR	Kourou	French Guyana
MADR	Robledo	Spain
MALI	Malindi	Kenya
MAS1	Maspalomas	Spain
MOBN	Obninsk	Russian Federation
NNOR	New Norcia	Australia
NRIL	Norilsk	Russian Federation
PETS	Petropavlovsk-Kamchatka	Russian Federation
POL2	Bishkek	Kyrghyzstan
SANT	Santiago	Chile
SUTM	Sutherland	South Africa
TIDB	Tidbinbilla	Australia
USUD	Usuda	Japan

Figure 13-1 Selected IGS Site Locations

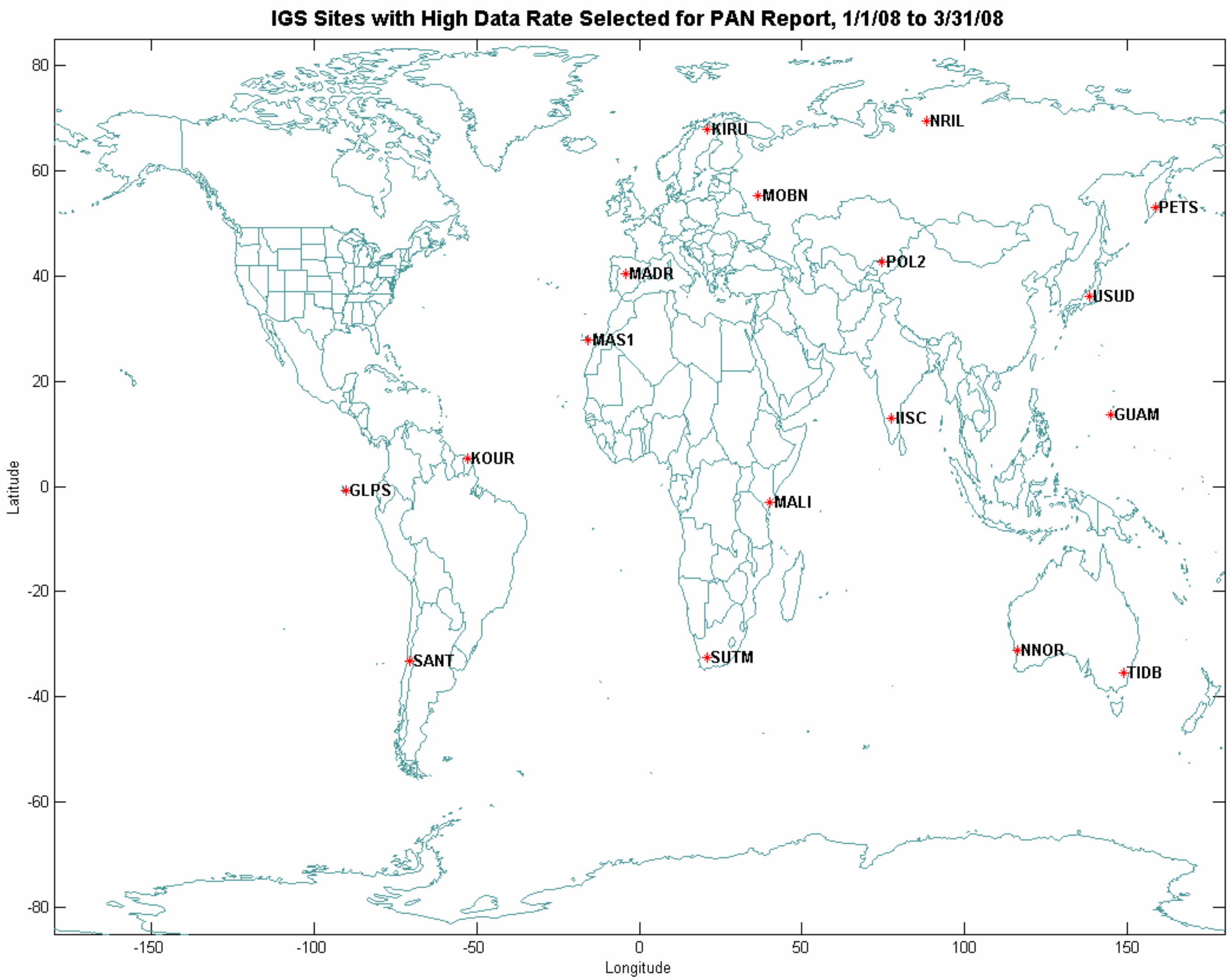


Table 13-2 GPS SPS Performance at a Selection of High Rate IGS Sites

Site	95% Horizontal Error (m)	95% Vertical Error(m)	99.99% Horizontal Error (m)	99.99% Vertical Error (m)	total 1 Hz samples	Percent Data Processed
GLPS	2.33	4.7	4.88	10.68	3894052	49.53%
GUAM	2.08	4.88	3.86	17.55	7745049	98.51%
IISC	2.12	4.49	4.46	8.07	454068	5.78%
KIRU	2.01	5.06	6.26	12.77	7410222	94.25%
KOUR	2.6	4.29	17.85	32.92	7118009	90.53%
MADR	2.17	4.53	6.23	12.18	7715785	98.14%
MALI	2.28	4.9	8.72	11.87	7853821	99.89%
MAS1	3.95	4.88	8.35	13.76	7859008	99.96%
MOBN	2.68	5.26	8.62	11.42	7858479	99.95%
NNOR	2.58	5.37	7.15	26.76	7817758	99.43%
NRIL	1.82	5.34	5.41	16.12	6871156	87.39%
PETS	2.74	5.19	8.7	13.46	7850131	99.84%
POL2	2.27	4.89	4.15	9.98	7397781	94.09%
SANT	3.57	4.72	8.74	10.84	7857508	99.94%
SUTM	2.37	4.54	8.36	13.88	7745722	98.52%
TIDB	2.68	4.61	9.51	17.77	7682029	97.71%
USUD	2.94	5.43	10.46	16.51	7767504	98.79%

Figure 13-2 95% Horizontal Accuracy Trend at Selected IGS Sites

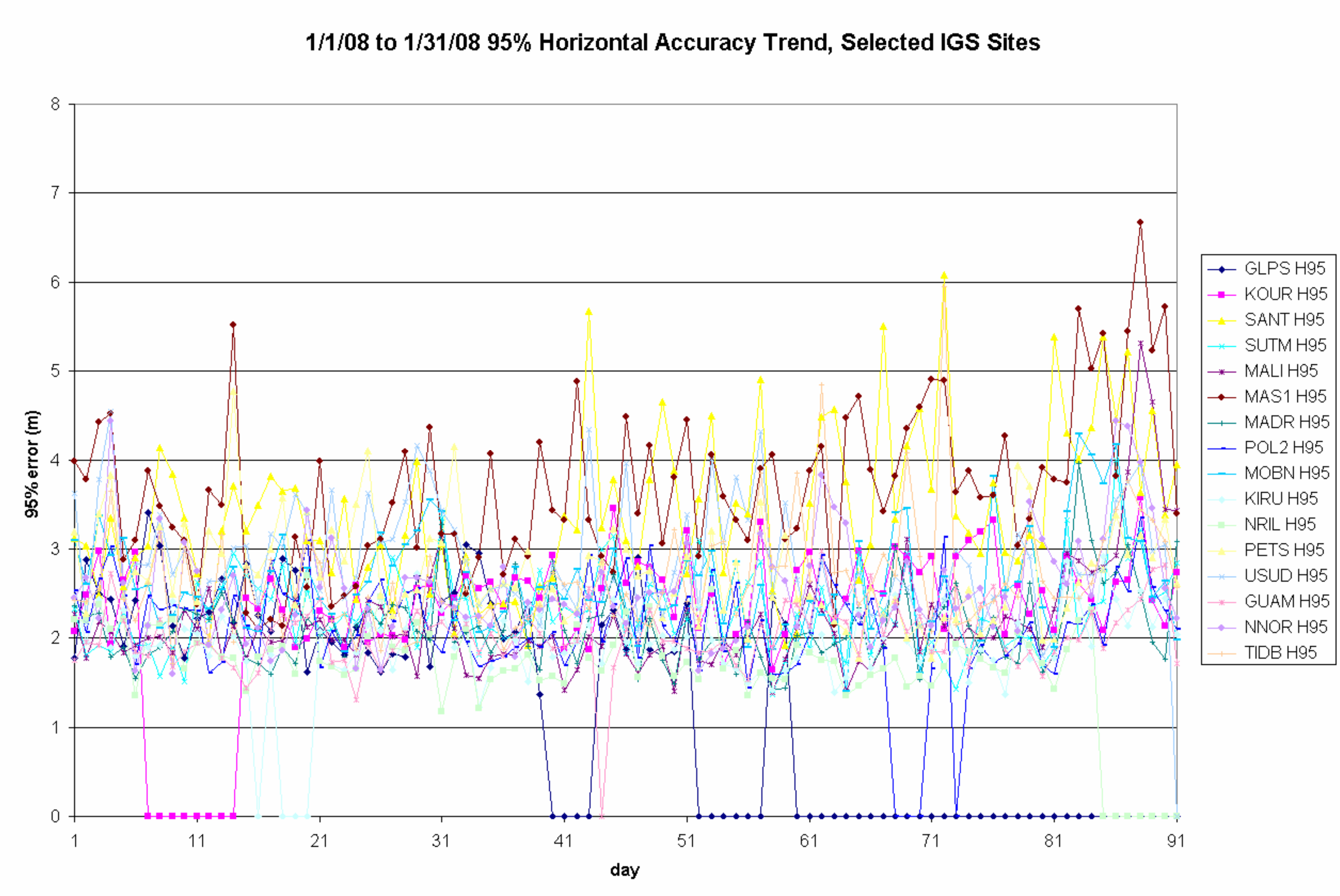
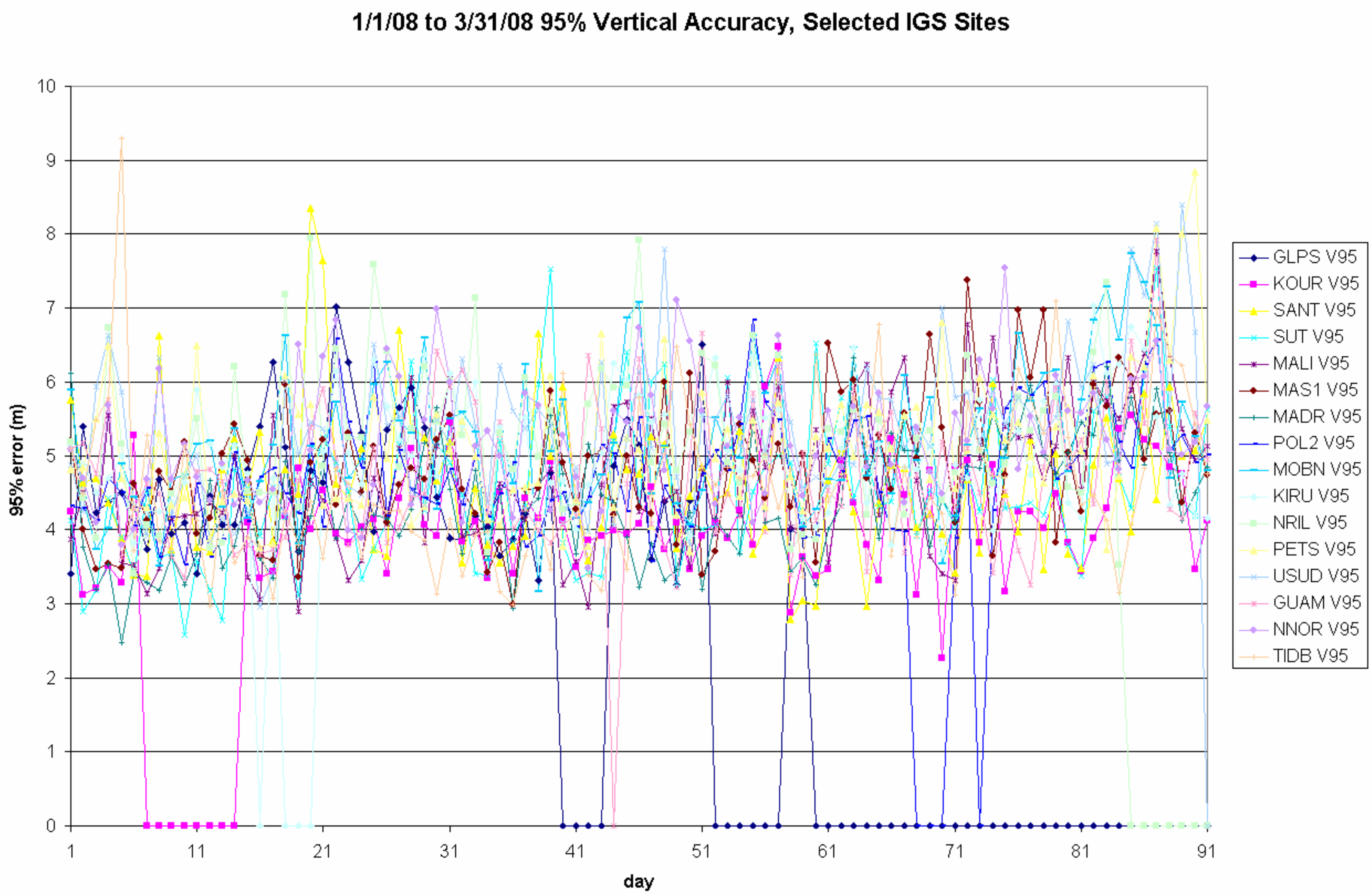


Figure 13-3 95% Vertical Accuracy Trend at Selected IGS Sites



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.