WIDE-AREA AUGMENTATION SYSTEM PERFORMANCE ANALYSIS REPORT

Report #33

Reporting Period: April 1 to June 30, 2010

July 2010

FAA/William J. Hughes Technical Center
NSTB/WAAS T&E Team
Atlantic City International Airport, NJ 08405
Website: http://www.nstb.tc.faa.gov/

Executive Summary

Since 1999 the WAAS Test Team at the William J. Hughes Technical Center has reported GPS performance as measured against the GPS Standard Positioning Service (SPS) Signal Specification. These quarterly reports are known as the PAN (Performance Analysis Network) Report. In addition to that report, the WAAS Test Team reports on the performance of the Wide-Area Augmentation System (WAAS). This report is the thirty-third such WAAS quarterly report. This report covers WAAS performance during the period from April 1, 2010 to June 30, 2010.

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

Parameter	**CONUS Site/Maximum**	**CONUS Site/Minimum**	**Alaska Site/Maximum**	**Alaska Site/Minimum**
95% Horizontal Accuracy	Grand Forks 1.713 meters	Denver 0.547 meters	Juneau 0.633 meters	Bethel 0.532 meters
95% Vertical Accuracy	Arcata 1.931 meters	Billings 0.85 meters	Barrow 1.245 meters	Juneau 0.951 meters
LPV Availability (HPL < 40 meters & VPL < 50 meters)	Seattle 100%	Arcata 99.95%	Juneau 99.97%	Barrow 99.26%
LPV 200 Availability (HPL < 40 meters & VPL < 35 meters)	Salt Lake City 100%	Oakland 95.76%	Juneau 99.88%	Barrow 84.96%
95% HPL	Arcata 16.71 meters	Memphis 11.72 meters	Cold Bay 28.21 meters	Fairbanks 13.227 meters
95% VPL	Arcata 31.545 meters	Kansas City 19.01 meters	Barrow 39.95 meters	Juneau 22.81 meters

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX

1.0 INTRODUCTION

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

Objectives of this report are:

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

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

Table 1.1 and Table 1.2 list NSTB and WAAS reference station receivers used in Precision Approach (PA) and Non-Precision Approach (NPA) evaluation process, respectively. This report presents results from three months of data, collected from April 1, 2010 to June 30, 2010.

Table 1-1 PA Sites

	Number of Days Evaluated	Number of Samples
NSTB:		
Arcata	72	6225024
Grand Forks	51	4434937
Oklahoma City	82	7085031
WAAS:		
Albuquerque	89	7686347
Anchorage	90	7772548
Atlanta	91	7860730
Barrow	90	7766891
Bethel	90	7737432
Billings	91	7859569
Boston	91	7861201
Chicago	91	7861207
Cold Bay	90	7769502
Dallas	91	7858182
Denver	91	7856354
Fairbanks	90	7768495
Gander	91	7853825
Goose Bay	91	7847764
Houston	91	7854367
Iqaluit	91	7843188
Jacksonville	91	7859552
Juneau	90	7767018
Kansas City	91	7858911
Kotzebue	90	7765487
Los Angeles	91	7858752
Memphis	91	7857256
Merida	91	7850504
Mexico City	91	7825614
Miami	91	7860732
Minneapolis	91	7860775
New York	91	7860850
Oakland	90	7771697
Puerto Vallarta	91	7853990
Salt Lake City	91	7860511
San Jose Del Cabo	89	7732467
San Juan	90	7805052
Seattle	91	7859110
Tapachula	74	6375967
Washington DC	91	7861256
Winnipeg	91	7860516

Table 1-2 NPA Sites

Location	Number of Days Evaluated	Number of Samples
Albuquerque	91	7852411
Anchorage	91	7853114
Atlanta	91	7853054
Barrow	91	7849215
Bethel	90	7793375
Billings	91	7854063
Boston	91	7855119
Cleveland	91	7855117
Cold Bay	91	7848086
Fairbanks	91	7849335
Gander	91	7845440
Honolulu	90	7781582
Houston	91	7853726
Iqaluit	91	7838165
Juneau	91	7848563
Kansas City	91	7852194
Kotzebue	91	7847334
Los Angeles	91	7853187
Merida	91	7840063
Miami	91	7854760
Minneapolis	91	7854681
Oakland	91	7854303
Salt Lake City	91	7854861
San Jose Del Cabo	91	7852584
San Juan	91	7852288
Seattle	91	7854609
Tapachula	75	6443052
Washington DC	91	7855129

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

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

Table 1.3 lists the performance parameters evaluated for the WAAS in this report. Please note that these are the performance parameters associated with the WAAS IOC system. These requirements are extracted from the FAA Specification FAA-E-2892B Change 1 and 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 1.5 lists events related to Release 1 upgrades that happened this quarter.

Table 1-4 Test Events

Start Date	End Date	Location/Satellite	Service Affected	Event Description
04/02/10	04/02/10	PRN19	LPV CONUS, LPV200 CONUS, LPV200 Alaska	NANU 2010061 Planned Maintenance. Affected West Coast and Alaska LPV and LPV200 Coverage.
04/03/10	04/03/10	Washington D.C. (C&V)	None	C&V faulted due to broadcast message validation mis-compare. See DR # 91 CRE Reports High UDREs for CRW.
04/04/10	04/04/10	Littleton, PRN135	Alaska	GUS Switch after Littleton faulted.
04/05/10	04/05/10	Alaska	Alaska	Large geomagnetic storm caused scintillation at multiple Alaska sites, WAAS service outages, and higher than normal VPE. See DR # 93 Ionospheric Storm Caused Alaska coverage Drop.
04/06/10	04/06/10	PRN28	LPV Alaska, LPV200 Alaska	NANU 2010063.
04/07/10	04/07/10	PRN29	LPV Alaska, LPV200 Alaska	NANU 2010060.

Start Date	End Date	Location/Satellite	Service Affected	Event Description
04/09/10	04/09/10	PRN2	LPV Alaska, LPV200 Alaska	NANU 2010062. Delta V.
04/11/10	04/11/10	Napa, PRN135	RNP3 All, RNP1 All	GUS switch Napa L5 siggen fault.
04/12/10	04/12/10	Napa, Littleton, PRN135	LPV Alaska, LPV200 Alaska, RNP3 All, RNP1 All	2 MANUAL GUS switches. LTN to Napa and Napa to LTN.
04/13/10	04/13/10	Napa, Littleton, PRN135	LPV200 CONUS, RNP3 All, RNP1 All	A 31 min SIS GEO CRW outage due to a known WAAS C&V problem that left both GUSs in back-up mode caused a small drop in coverage.
04/14/10	04/14/10	PRN14	LPV200 Alaska	NANU 2010071. Planned Maintenance. This caused PDOP of 132.
04/19/10	04/19/10	Napa, Littleton, PRN135	Alaska	Manual Gus Switchover, NAPA to Littleton.
04/20/10	04/20/10	PRN13	LPV200 Alaska	NANU 2010075 Planned Maintenance.
04/21/10	04/21/10	PRN18	LPV200 Alaska	NANU 2010076 Planned Maintenance.
04/22/10	04/22/10	PRN23	LPV200 Alaska	NANU 2010079 Planned Maintenance that affected LPV200 Alaska Coverage down to 10% coverage.
04/27/10	04/27/10	PRN17	LPV CONUS, LPV Canada, LPV200 CONUS, LPV200 Canada	NANU 2010080 Planned Maintenance. Affected LPV and LPV200 coverage. See DR #94 PRN 17 NANU Affects WAAS Coverage.
04/28/10	04/28/10	Littleton, PRN135	Alaska	Manual GUS Switchover from Littleton to Napa. GUS receiver firmware update.
04/29/10	04/29/10	Napa, PRN135	Alaska	Manual GUS Switchover from Napa to Littleton.
04/29/10	04/29/10	PRN11	LPV200 CONUS, LPV200 Canada	NANU 2010083.
05/02/10	05/02/10	Alaska	Alaska	Solar Storm. KP of 6. Several IGPs over Alaska went to Storm state from 14:29 - 1500. Affected Alaska coverage.
05/03/10	05/03/10	PRN16	LPV Alaska, LPV200 Alaska	NANU 2010085 Planned Maintenance.
05/03/10	05/03/10	PRN135	Alaska	GEO 135 manually put into test mode for an hour and 45 minutes.
05/04/10	05/04/10	PRN5	LPV CONUS, LPV200 CONUS	NANU2010086 Planned Maintenance.
05/07/10	05/07/10	PRN9	None	NANU2010083.
05/07/10	05/07/10	PRN135	All	High range error on PRN135 as broadcast from PRN138 Geo stream caused high position errors and ratios. See DR #96 PRN 138 GEO Stream Caused Increased Position Errors and Ratios.
05/11/10	05/12/10	PRN13	None	NANU 2010092. DELTA-V on PRN13.

Start Date	End Date	Location/Satellite	Service Affected	Event Description
05/14/10	05/14/10	PRN22	LPV CONUS, LPV200 CONUS, RNP1 All	NANU 2010093. PRN22 Delta-V.
05/14/10	05/14/10	PRN27		Low SV PA Availability on PRN27. NO GPS NANU's.
05/15/10	05/17/10	Atlanta (C&V), PRN135, PRN138	None	PRN138 PA ranging intermittent from PRN135 GEO stream. ZTL was the selected source.
05/21/10	05/21/10	PRN16, PRN 32	LPV Alaska, LPV200 Alaska	NANU 2010094 thru NANU 2010097. Both PRN 32 and PRN 16 experienced unplanned outages. Satellites were not tracked by any receivers with no unhealthy ephemeris. Events were not overlapped. Affected LPV coverge. See DR #95 PRN 16 and PRN 32 Unplanned Outage.
05/29/10	05/29/10	Washington D.C. (C&V), Atlanta (C&V), Los Angeles (C&V)	Alaska	All 3 master stations GIVE monitors had IGP trips over Alaska. KP=5
06/04/10	07/10/10	PRN135	LPV Alaska, LPV200 Alaska	GEO 135 message type 28 bumping UDREI to 11. This is the new expected performance due to CRW orbit drift. UDRE starting to intermittently bump to 12 on W1591D3.
06/07/10	06/08/10	All Receivers	All	WAAS TCN ring 2 failure that resulted in data gaps.
06/08/10	06/08/10	Woodbine	Alaska, Canada, Mexico	Woodbine fault caused CRE GUS switchover to Brewster.
06/09/10	06/09/10	Napa, Littleton, PRN135	Alaska	Lightning Strike at Littleton caused failure of GUS. NAPA was reset just prior to Littleton faulting. This caused a CRW SIS outage for 314 seconds.
06/11/10	06/12/10	Washington D.C. (C&V), Atlanta (C&V), PRN135, PRN138	None	Release 1C software upgrade to C&Vs. Required C&Vs to be restarted. Day 5: Source select switch for CRW from ZDC to ZLA and for CRE from ZTL to ZLA. Day 6: Source select switch for CRW from ZLA to ZDC and for CRE from ZLA to ZTL.
06/16/10	06/16/10	Brewster, PRN138	Alaska, Canada	Phase noise caused loss of messages resulting in both GUSs in back-up mode.
06/23/10	06/27/10	Napa, PRN135	Alaska	Safety computer fault at Napa caused GUS switch over. NPA UDRE for days 3 and 4. Napa returned to service day 0.

Start Date	End Date	Location/Satellite	Service Affected	Event Description
06/24/10	06/24/10	PRN3, PRN6, PRN16	All	Unscheduled NANU's (2010100/2010101) on PRN3 & PRN16. SV Alert on PRN6 (UDRE 6-14).
06/25/10	06/25/10	CONUS	CONUS	LPV coverage anomaly in LA Gulf Area.
06/30/10	06/30/10	Woodbine, PRN138	CONUS, Alaska	Manual GUS Switchover from Woodbine to Brewster.
06/30/10	07/02/10	Oklahoma City	Local	FTI Comm Line Problem. Limited Data

Table 1-5 WAAS Release 1 Upgrades

Start Date	End Date	Event Description
06/11/2010	06/11/2010	Washington D.C C&V Release 1C software upgrade.
06/11/2010	06/11/2010	Atlanta C&V Release 1C software upgrade.
06/12/2010	06/12/2010	Los Angeles C&V Release 1C software upgrade.

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 the combined 38 WAAS receiver location within the WAAS service area.

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

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

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

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

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

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

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

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

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

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

2.0 <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 maximum 95% CONUS horizontal and vertical LPV errors are 1.85 meters at Arcata and 2.005 meters at Miami, respectively. The minimum 95% CONUS horizontal and vertical LPV errors are 0.547 meters at Denver and 0.85 meters at Billings, respectively. The maximum 95% and 99.999% NPA horizontal errors are 2.854 meters at Honolulu and 8.07 meters at Tapachula. The minimum 95% and 99.999% horizontal errors are .82 meters at Iqaluit and 2.18 meters both at Cleveland.

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

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

Table 2-2 PA 95% Horizontal and Vertical Accuracy

Location	Horizontal (HAL=40m) (Meters)	Horizontal (HAL=556m) (Meters)	Vertical (VAL=50m) (Meters)	Percentage in PA mode (%)	SPS Accuracy	
					95% Horizontal (Meters)	95% Vertical (Meters)
Arcata	1.702	1.702	1.931	100	*	*
Grand Forks	1.713	1.713	1.666	100	*	*
Oklahoma City	0.802	0.802	1.176	100	*	*
Albuquerque	0.595	0.595	1.018	99.99768	2.204	3.978
Anchorage	0.632	0.632	1.046	99.99464	*	*
Atlanta	0.628	0.628	1.051	100	2.206	3.987
Barrow	0.592	0.592	1.245	99.85537		
Bethel	0.532	0.532	0.975	99.99628	2.018	3.717
Billings	0.752	0.752	0.805	99.99711	1.960	3.732
Boston	0.641	0.641	1.090	100	2.013	3.714
Chicago	0.893	0.893	1.032	100	*	*
Cold Bay	0.630	0.631	1.114	99.99709	*	*
Dallas	0.739	0.739	1.038	100	*	*
Denver	0.547	0.547	0.938	99.99555	*	*
Fairbanks	0.582	0.582	1.067	99.99709	1.867	3.729
Gander	0.955	0.955	1.314	99.94146	*	*
Goose Bay	0.657	0.657	1.156	99.94183	*	*
Houston	0.679	0.679	1.014	100	2.633	3.778
Iqaluit	0.720	0.721	1.536	99.94701	*	*
Jacksonville	0.591	0.591	1.078	100	*	*
Juneau	0.633	0.633	0.951	99.99463	*	*
Kansas City	0.615	0.615	0.908	100	*	*
Kotzebue	0.617	0.618	1.156	99.85129	2.007	3.935
Los Angeles	0.773	0.773	1.417	99.99774	1.929	3.818
Memphis	0.564	0.564	0.971	99.99558	2.426	4.164
Merida	0.637	0.637	1.256	100	*	*
Mexico City	0.757	0.757	1.425	100	*	*
Miami	0.732	0.732	1.298	100	2.785	3.995
Minneapolis	0.649	0.649	0.976	100	1.942	3.709
New York	0.815	0.815	1.107	100	*	*
Oakland	0.893	0.893	1.453	99.99112	2.329	4.128
Puerto Vallarta	0.819	0.822	1.747	100	*	*
Salt Lake City	0.576	0.576	0.816	99.99757	1.994	3.973
San Jose Del Cabo	0.800	0.801	1.836	100	*	*
San Juan	1.050	1.247	1.720	99.99768	*	*
Seattle	0.755	0.755	0.854	99.99757	2.090	3.651
Tapachula	0.988	1.007	1.443	99.99998		
Washington DC	0.673	0.673	1.061	100	2.100	3.840
Winnipeg	0.610	0.610	0.976	100	*	*

*SPS Data not available.

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	1.205	3.444	100	4.627
Anchorage	1.584	3.279	99.998	3.598
Atlanta	1.274	3.586	100	3.742
Barrow	1.279	2.728	99.884	5.436
Bethel	1.430	3.712	99.998	4.249
Billings	1.522	3.274	100	4.665
Boston	1.197	2.987	100	3.236
Cleveland	1.133	2.181	100	2.719
Cold Bay	1.342	4.364	99.998	4.757
Fairbanks	1.574	3.172	99.998	8.534
Gander	1.185	3.733	99.956	3.918
Honolulu	2.854	7.373	100	7.615
Houston	1.843	4.352	100	4.602
Iqaluit	0.820	2.706	99.957	3.154
Juneau	1.482	2.945	99.998	3.328
Kansas City	1.191	3.016	100	3.477
Kotzebue	1.435	2.776	99.884	5.742
Los Angeles	1.554	3.529	100	5.095
Merida	2.134	6.616	100	6.817
Miami	1.843	4.416	100	4.612
Minneapolis	1.255	3.073	100	3.301
Oakland	1.603	3.930	99.998	5.426
Salt Lake City	1.127	3.050	100	4.477
San Jose Del Cabo	2.539	6.548	100	6.687
San Juan	1.849	7.206	100	7.620
Seattle	1.345	3.271	99.998	4.820
Tapachula	2.765	8.070	100	9.097
Washington DC	1.271	2.230	100	2.374

Table 2-4 Maximum Error Statistics

Location	Horizontal Error (m)	Horizontal Error/HPL	Horizontal Maximum Ratio	Vertical Error (m)	Vertical Error/VPL	Vertical Maximum Ratio
Arcata	4.588	0.176	0.262	7.460	0.164	0.220
Grand Forks	4.193	0.269	0.305	6.148	0.233	0.347
Oklahoma City	3.167	0.233	0.291	4.523	0.202	0.205
Albuquerque	2.836	0.298	0.298	4.132	0.138	0.156
Anchorage	2.346	0.127	0.204	3.873	0.145	0.202
Atlanta	2.145	0.238	0.238	3.934	0.155	0.184
Barrow	3.348	0.153	0.163	7.700	0.200	0.201
Bethel	2.747	0.181	0.182	3.633	0.107	0.137
Billings	2.737	0.273	0.273	3.341	0.138	0.152
Boston	2.170	0.143	0.154	3.236	0.199	0.199
Chicago	2.047	0.087	0.193	2.856	0.149	0.167
Cleveland	1.787	0.202	0.202	3.213	0.184	0.246
Cold Bay	2.191	0.073	0.130	3.462	0.100	0.119
Dallas	2.739	0.288	0.289	3.229	0.150	0.182
Denver	2.876	0.302	0.305	4.754	0.130	0.194
Fairbanks	2.764	0.156	0.228	4.429	0.094	0.198
Gander	2.903	0.095	0.110	3.985	0.081	0.106
Goose Bay	2.269	0.120	0.136	5.361	0.121	0.129
Houston	2.875	0.297	0.297	3.210	0.096	0.174
Iqaluit	2.896	0.096	0.200	7.631	0.160	0.182
Jacksonville	2.161	0.227	0.227	3.923	0.220	0.220
Juneau	2.582	0.241	0.244	3.350	0.131	0.167
Kansas City	2.527	0.292	0.292	2.625	0.133	0.160
Kotzebue	6.033	0.220	0.220	6.429	0.223	0.223
Los Angeles	3.044	0.272	0.272	3.359	0.112	0.169
Memphis	2.291	0.266	0.267	3.311	0.127	0.163
Merida	3.126	0.250	0.251	4.496	0.136	0.178
Mexico City	3.282	0.153	0.153	4.414	0.140	0.147
Miami	2.283	0.118	0.207	4.516	0.148	0.179
Minneapolis	2.156	0.247	0.247	3.230	0.114	0.201
New York	1.993	0.127	0.133	3.688	0.158	0.203
Oakland	3.395	0.296	0.299	3.681	0.135	0.177
Puerto Vallarta	3.389	0.218	0.220	5.589	0.126	0.151
Salt Lake City	2.801	0.294	0.294	2.936	0.126	0.180
San Jose Del Cabo	3.532	0.259	0.260	5.287	0.116	0.161
San Juan	2.828	0.095	0.096	5.629	0.114	0.154
Seattle	2.937	0.274	0.274	3.569	0.220	0.220
Tapachula	4.326	0.202	0.202	5.211	0.133	0.214
Washington DC	1.748	0.139	0.146	2.986	0.151	0.194
Winnipeg	2.281	0.103	0.217	4.404	0.160	0.186

Figure 2-1 95% Horizontal Accuracy at LPV

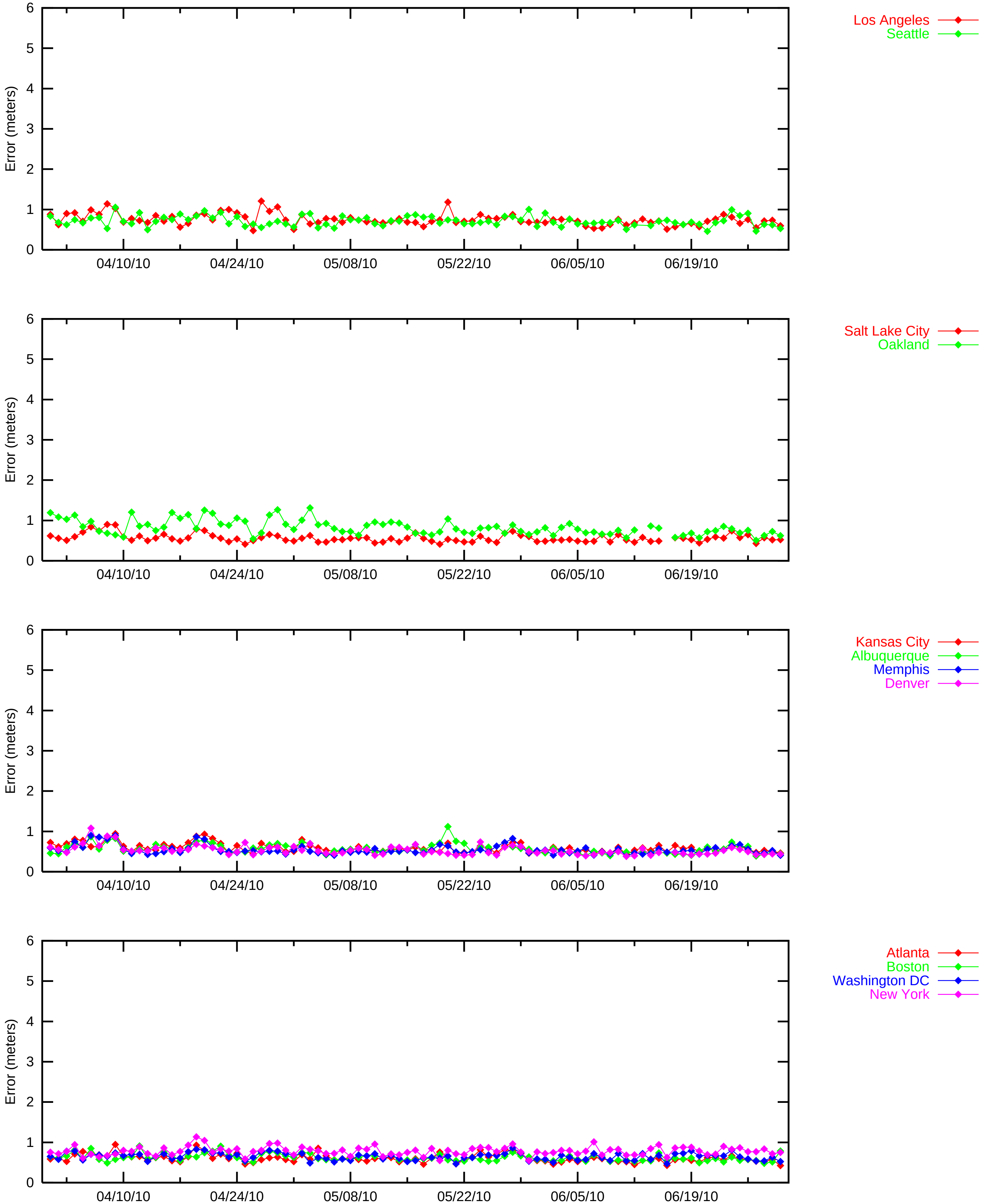


Figure 2-2 95% Horizontal Accuracy at LPV

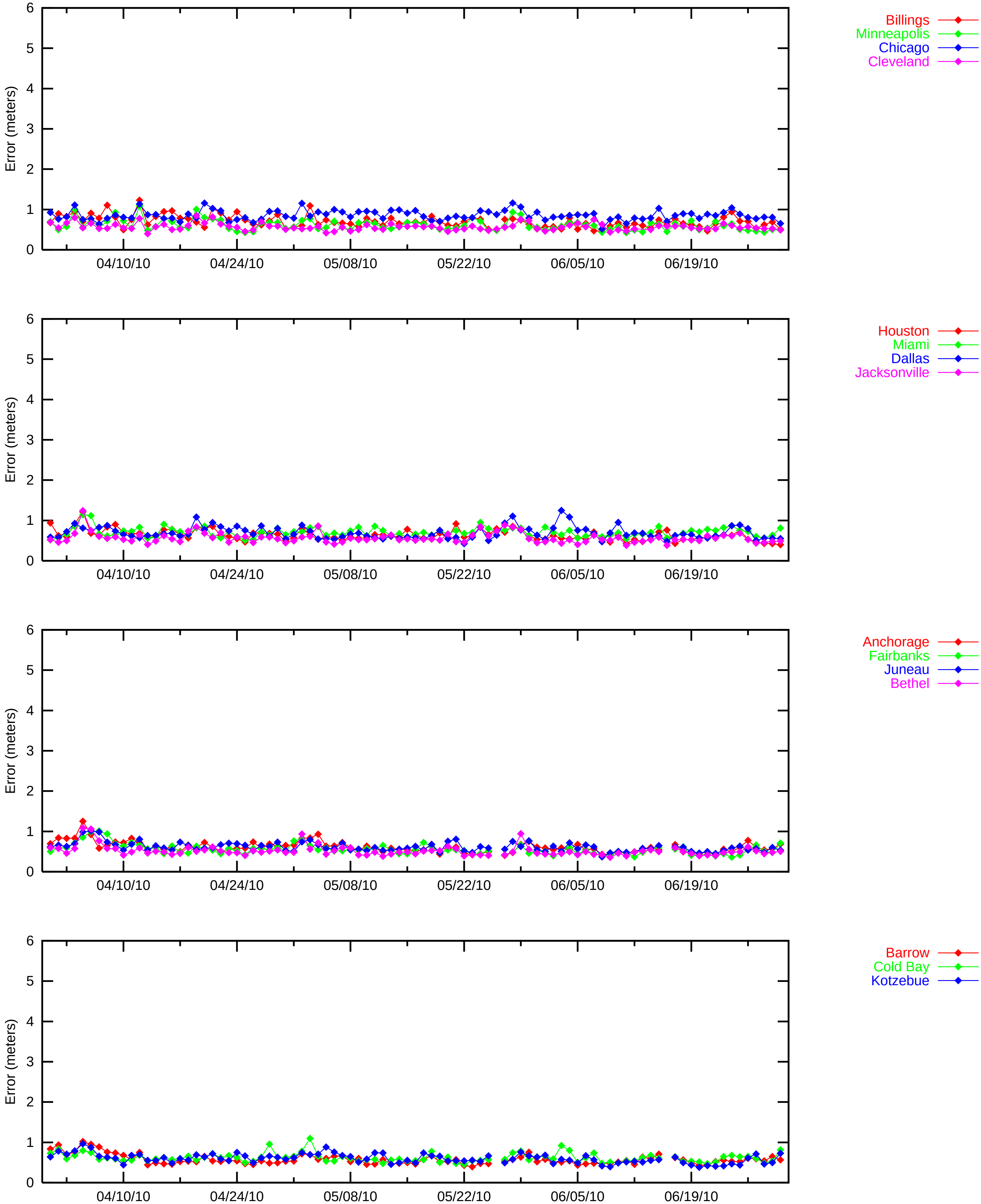


Figure 2-3 95% Horizontal Accuracy at LPV

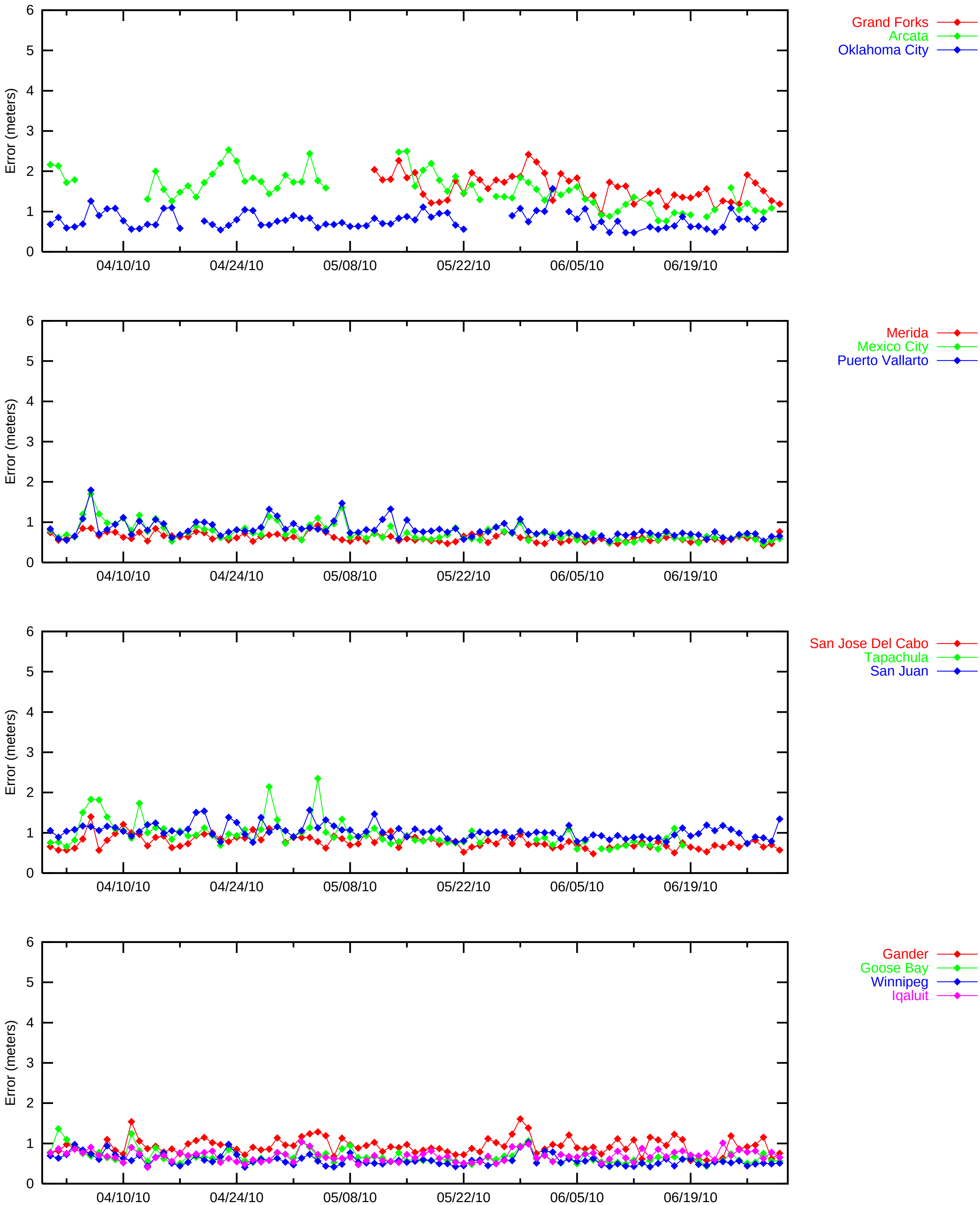
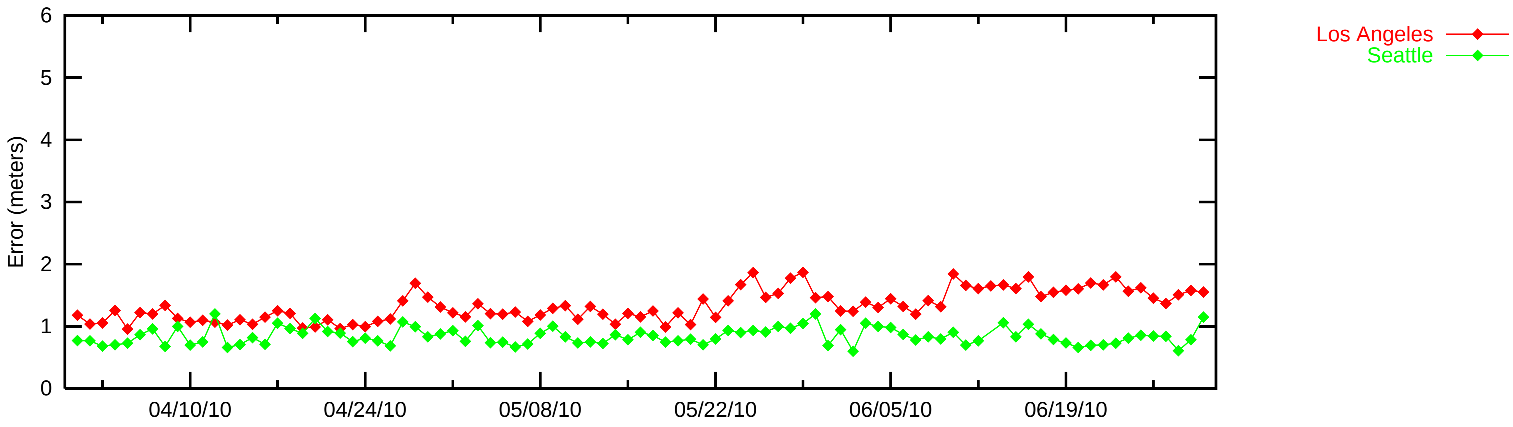
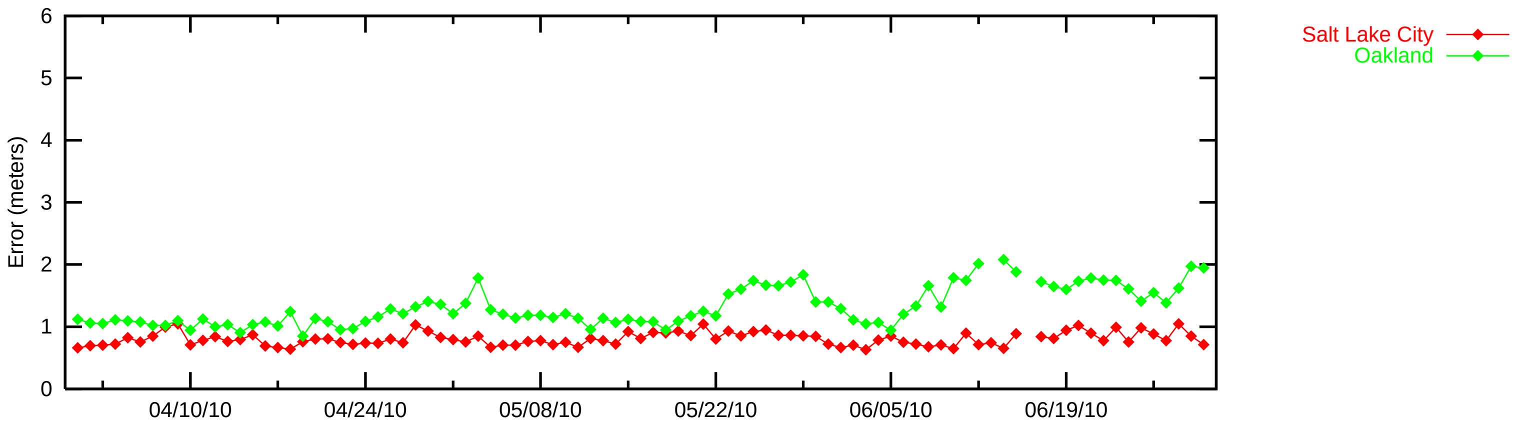
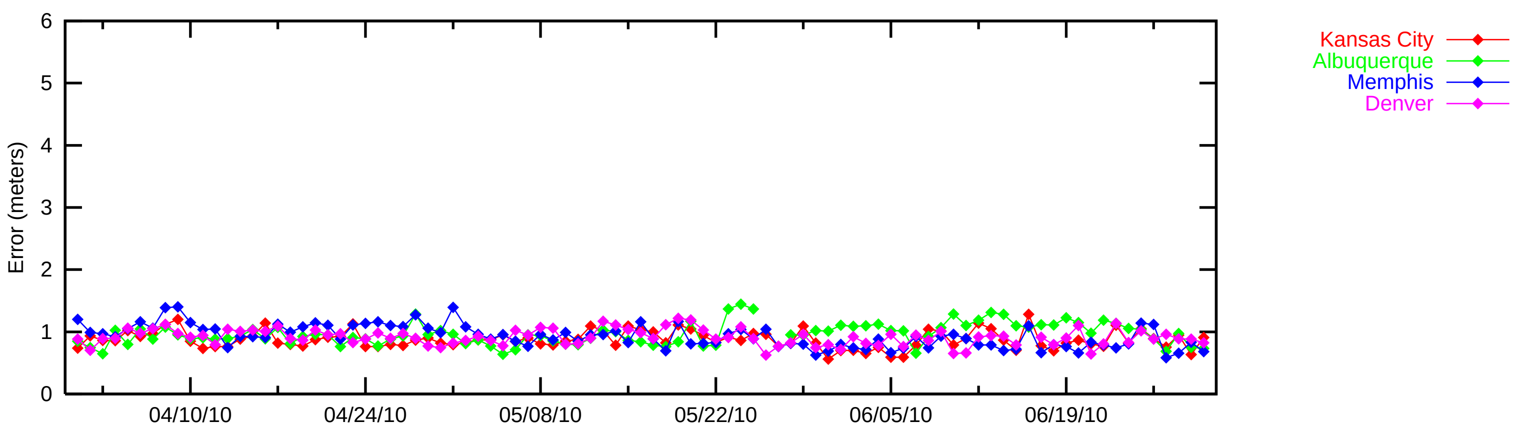


Figure 2-4 95% Vertical Accuracy at LPV







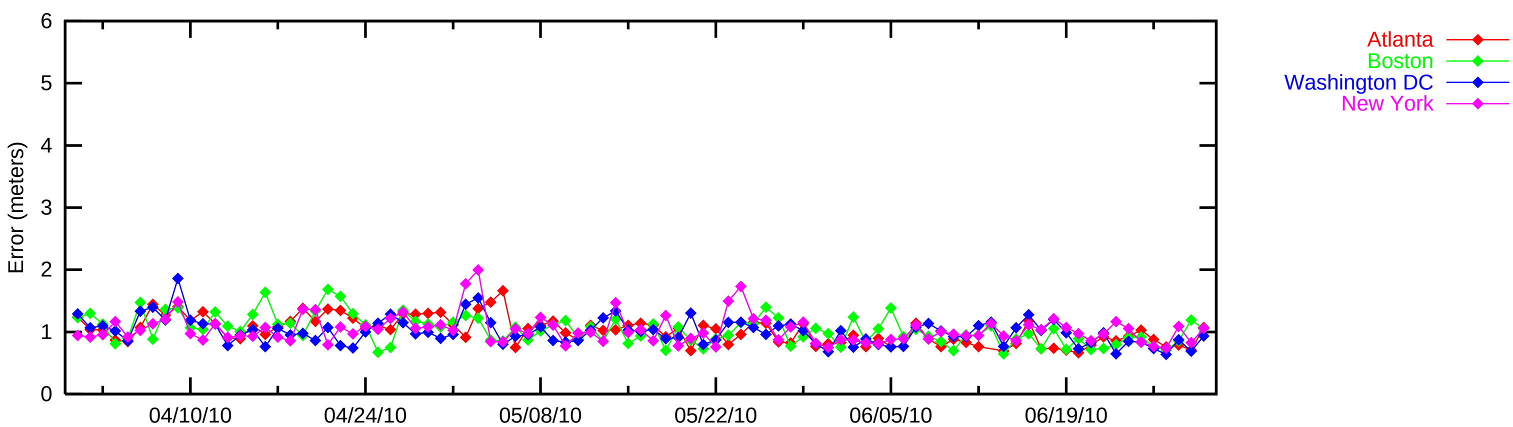


Figure 2-5 95% Vertical Accuracy at LPV

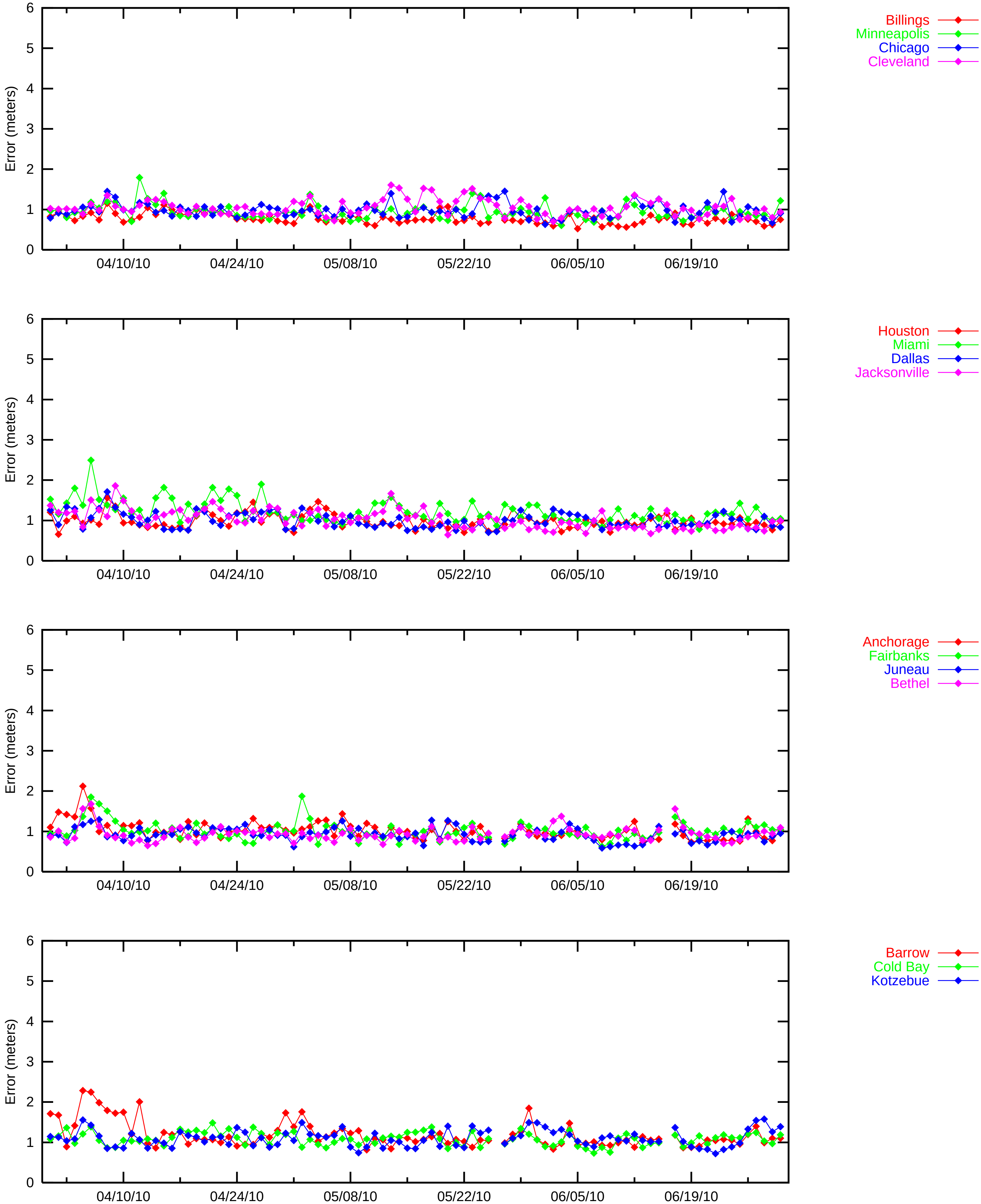
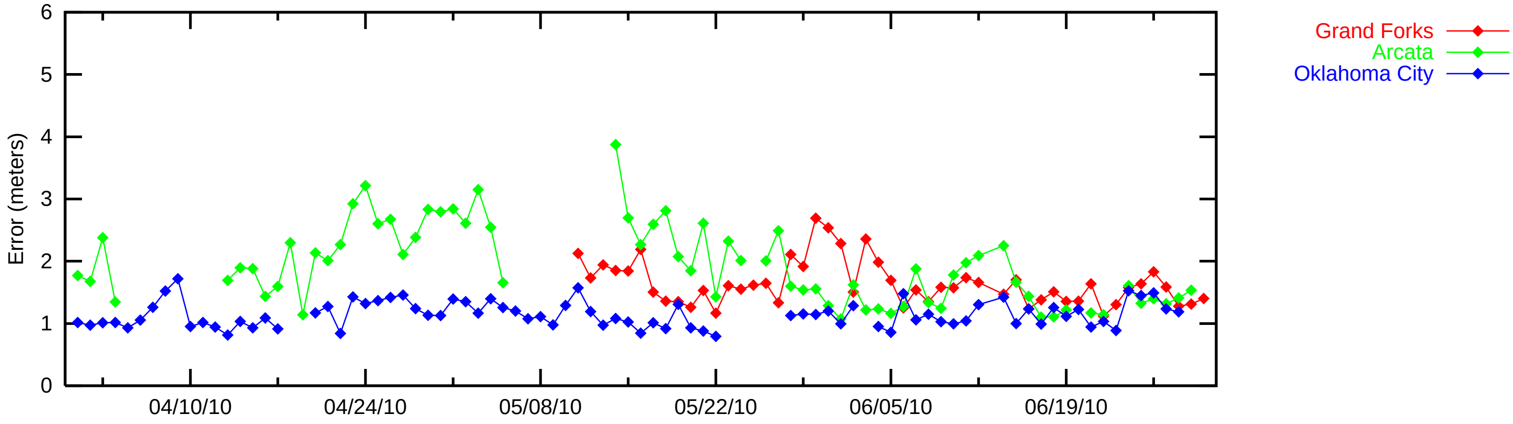
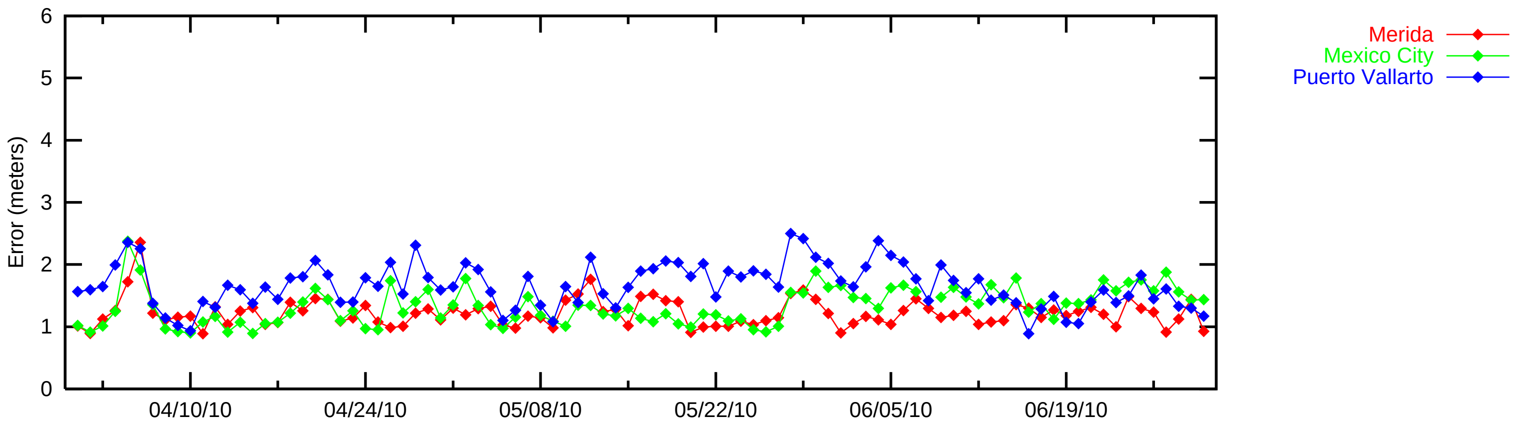
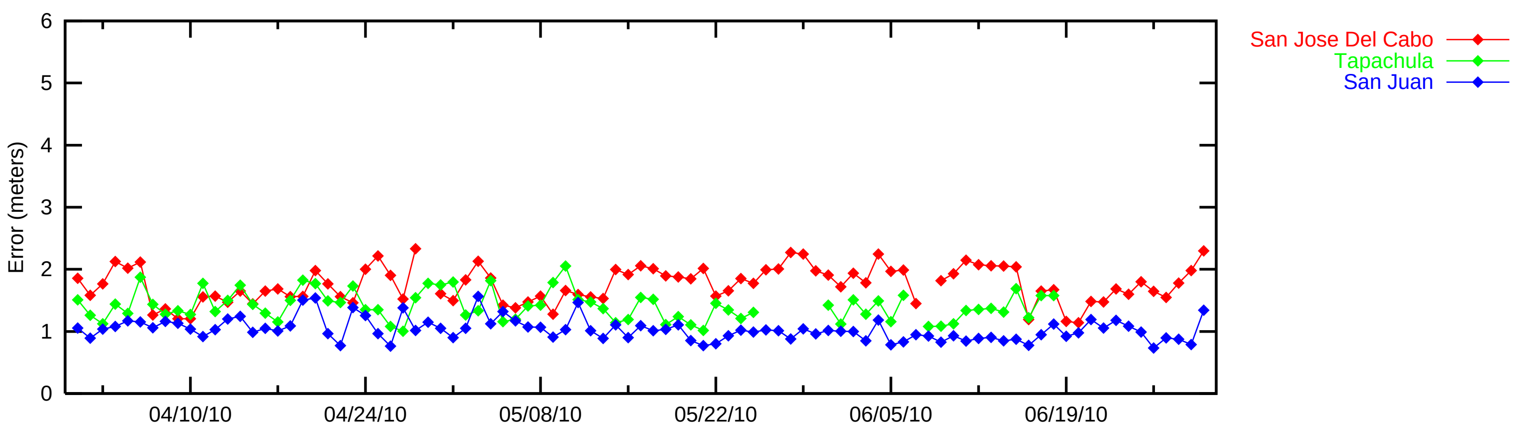


Figure 2-6 95% Vertical Accuracy at LPV







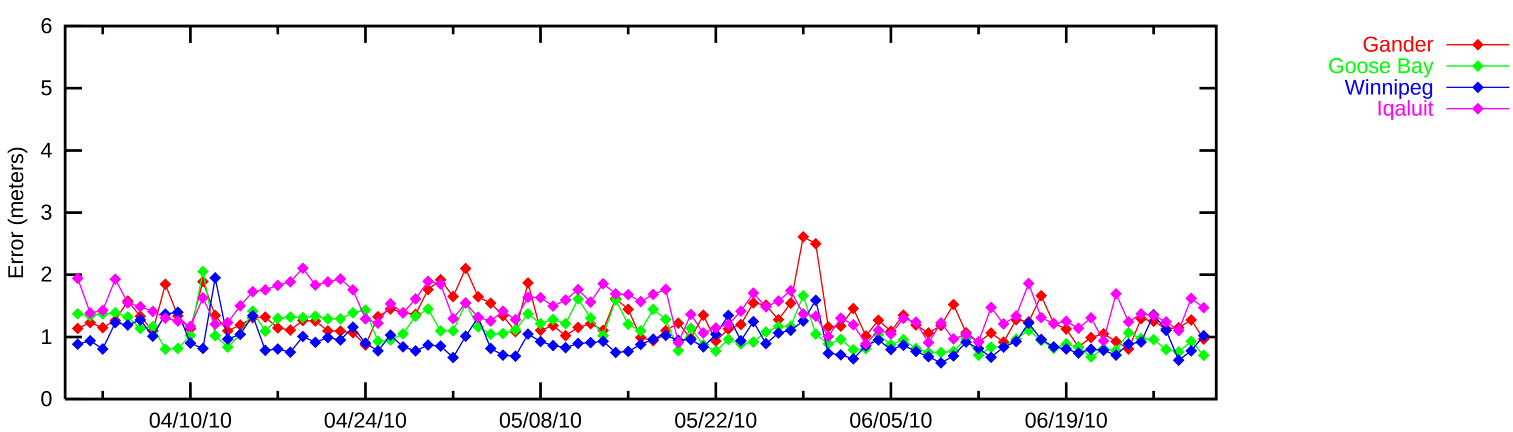
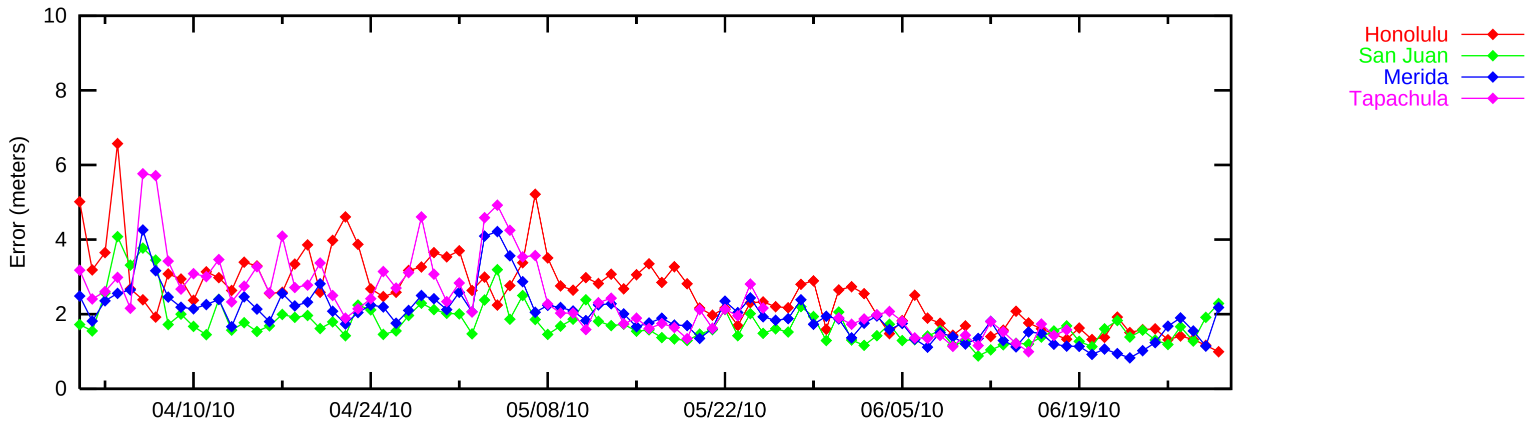
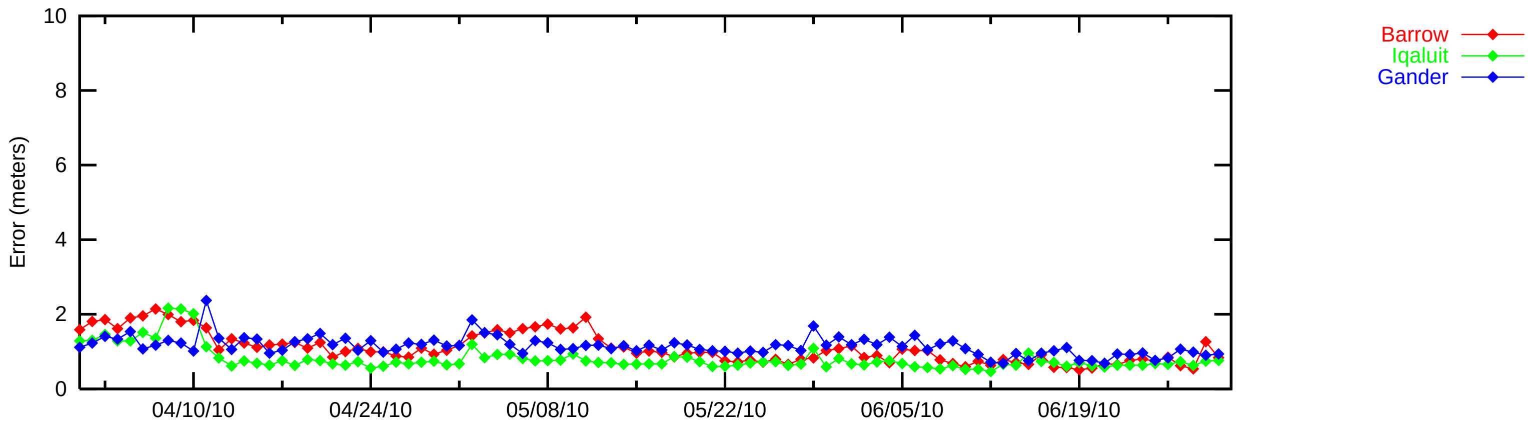
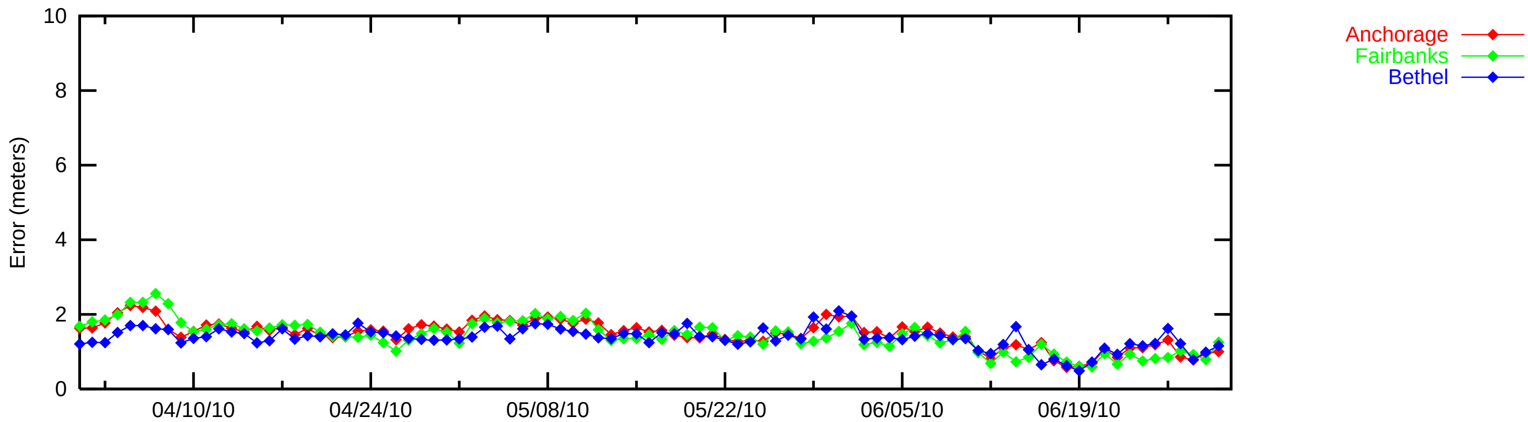


Figure 2-7 95% NPA Horizontal Accuracy







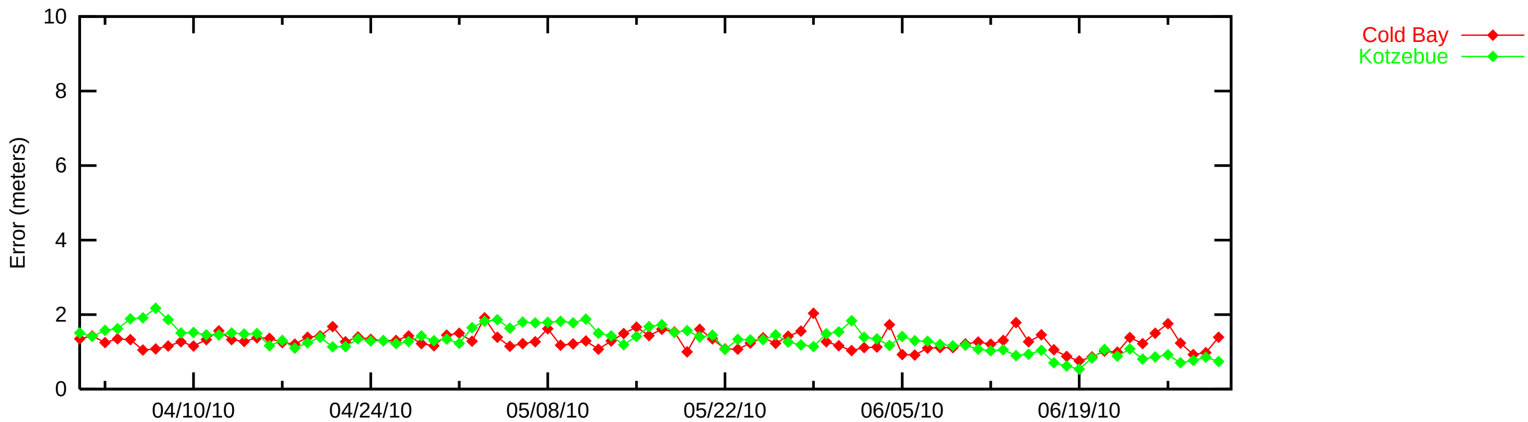
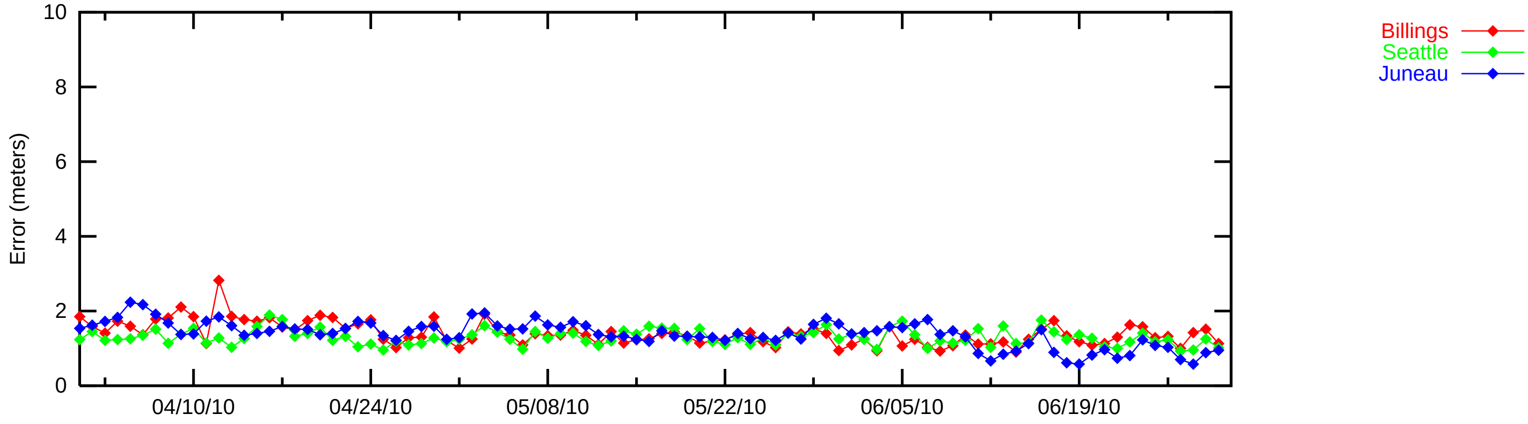
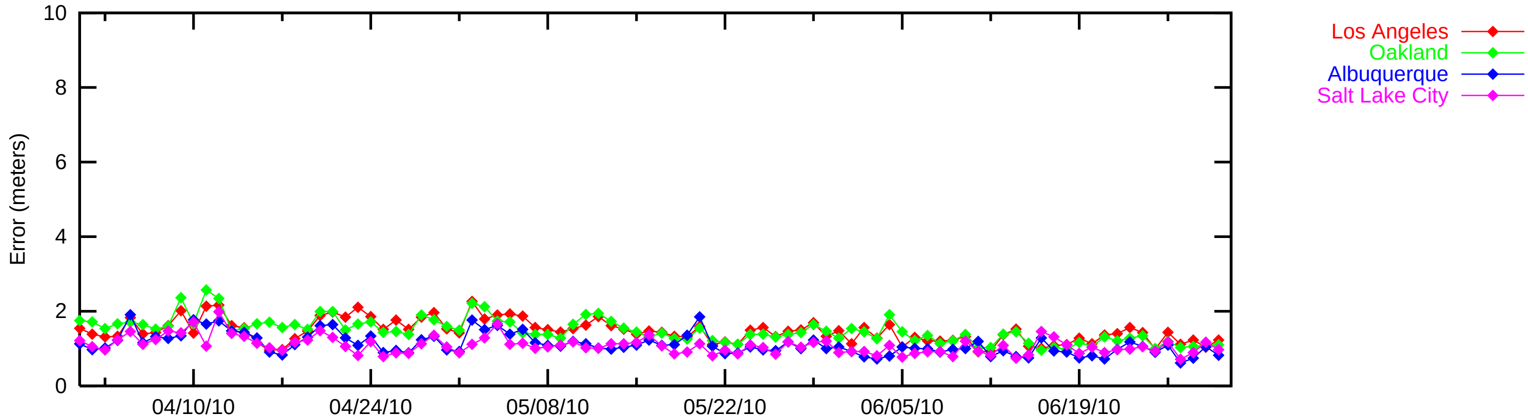
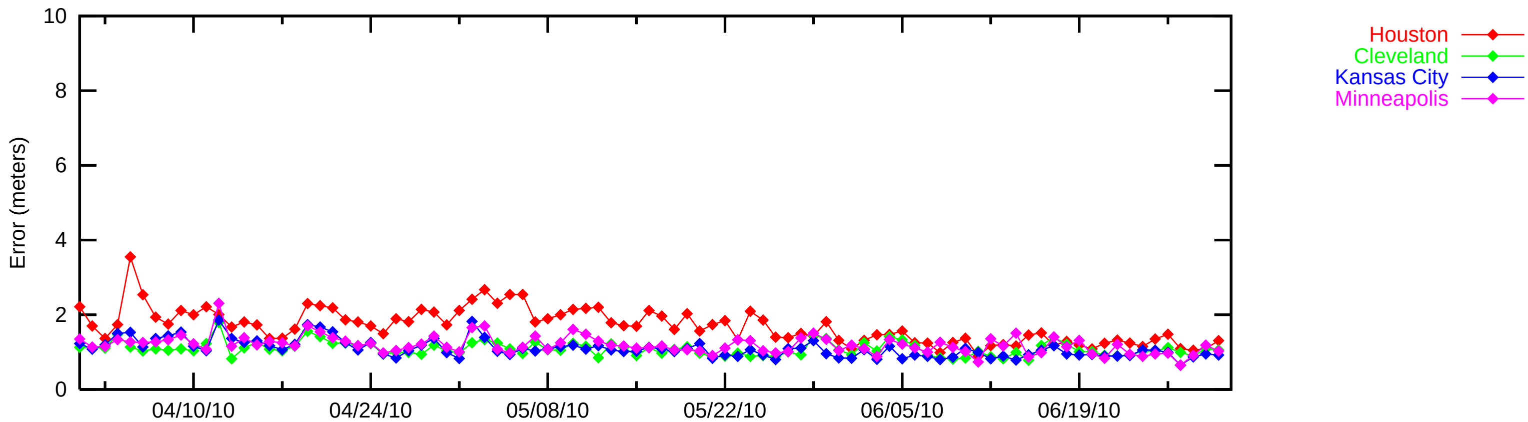


Figure 2-8 95% NPA Horizontal Accuracy







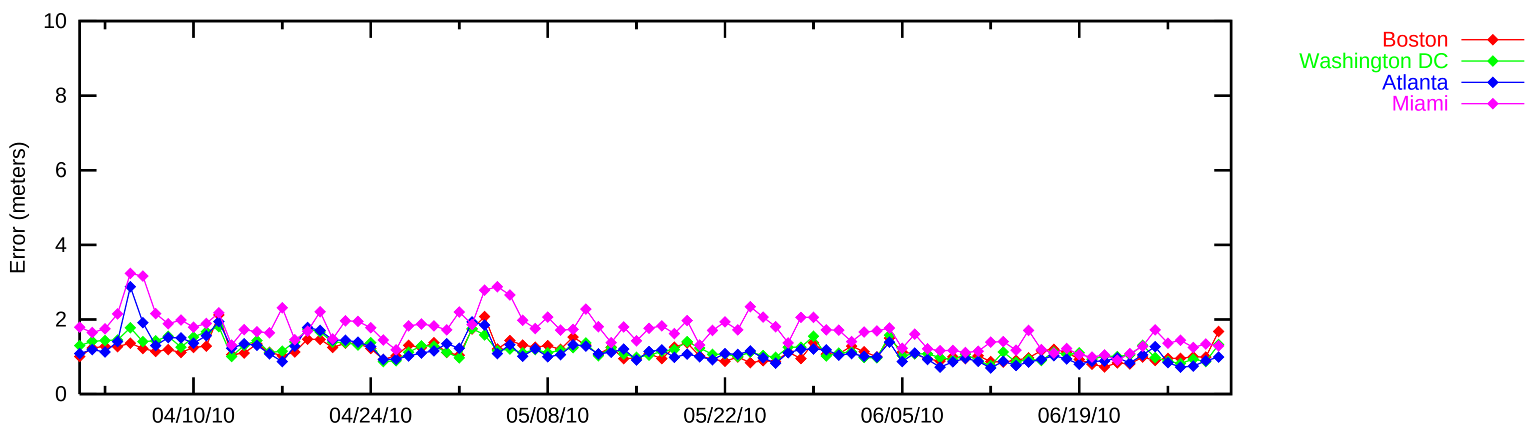


Figure 2-9 Horizontal Triangle Chart for the Quarter

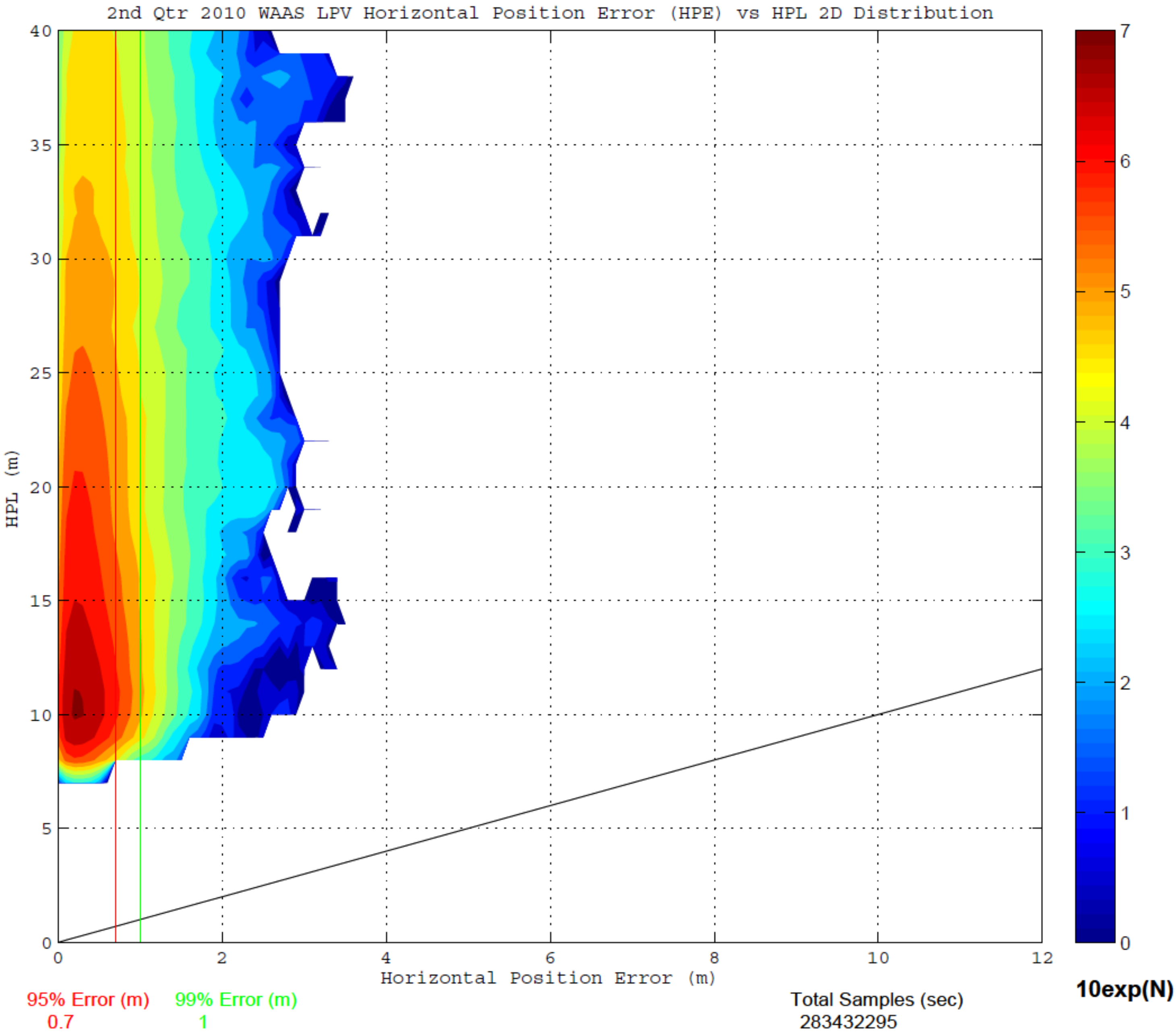


Figure 2-10 Vertical Triangle Chart for the Quarter

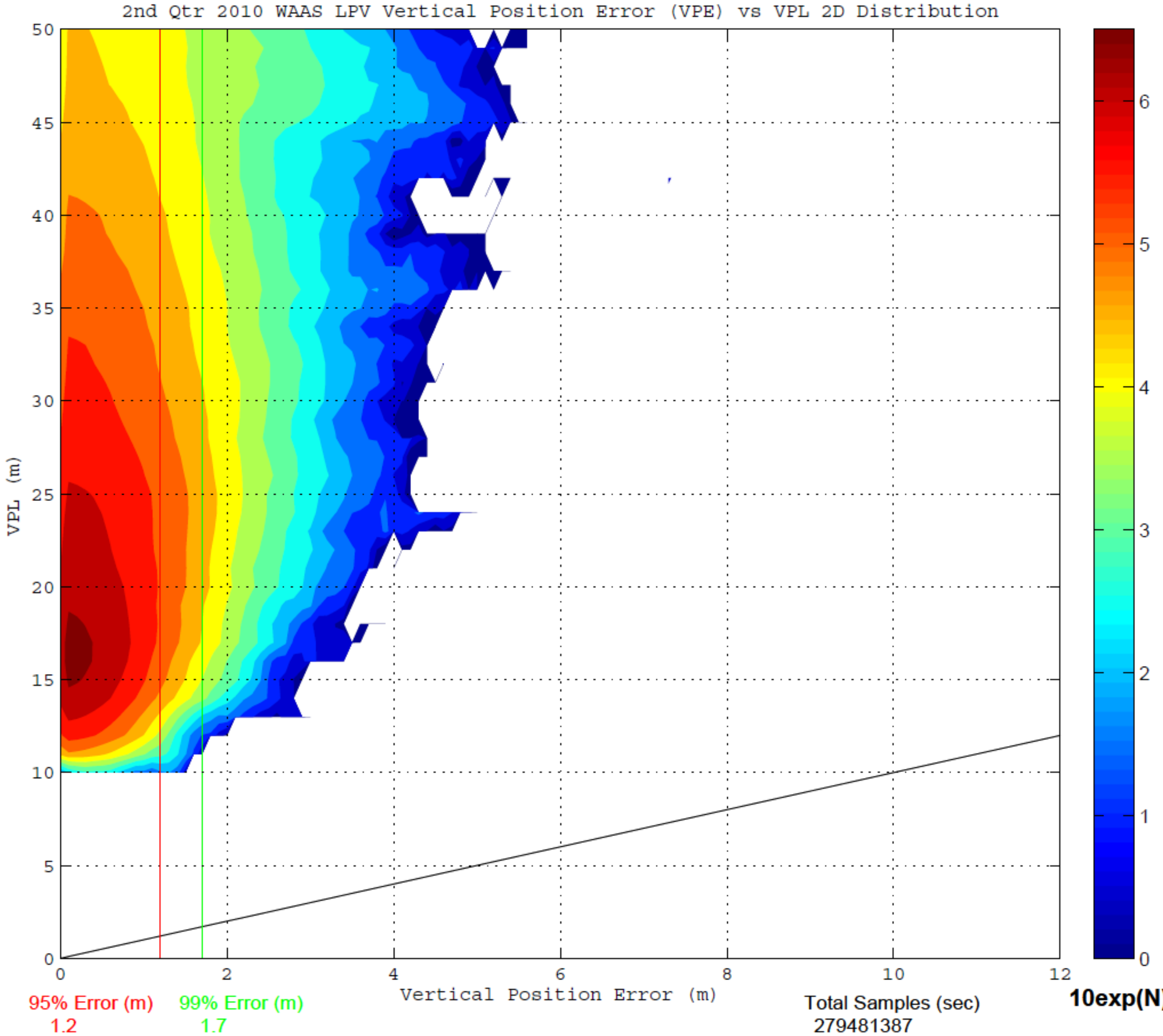


Figure 2-11 2-D Horizontal Histogram for the Quarter

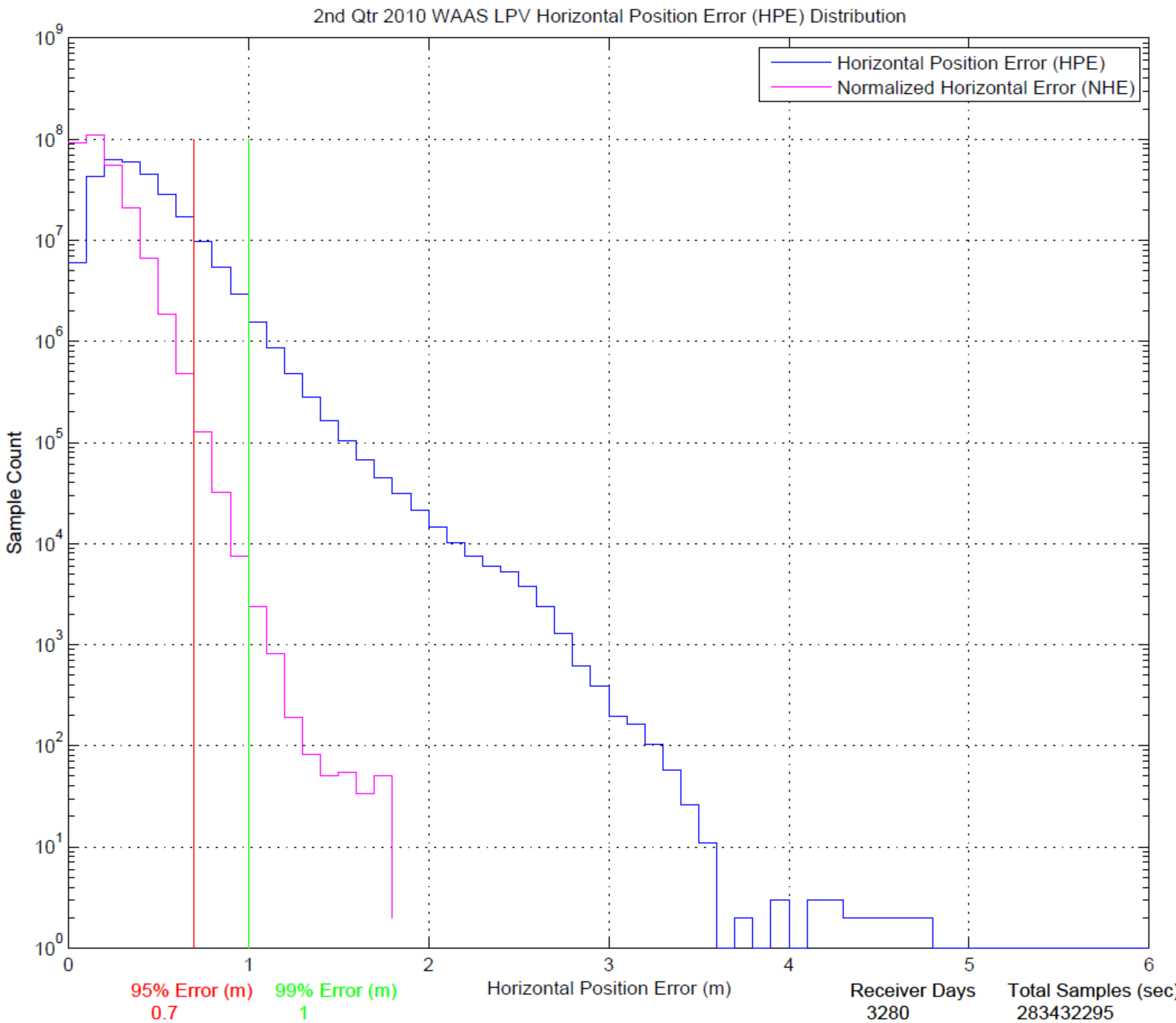
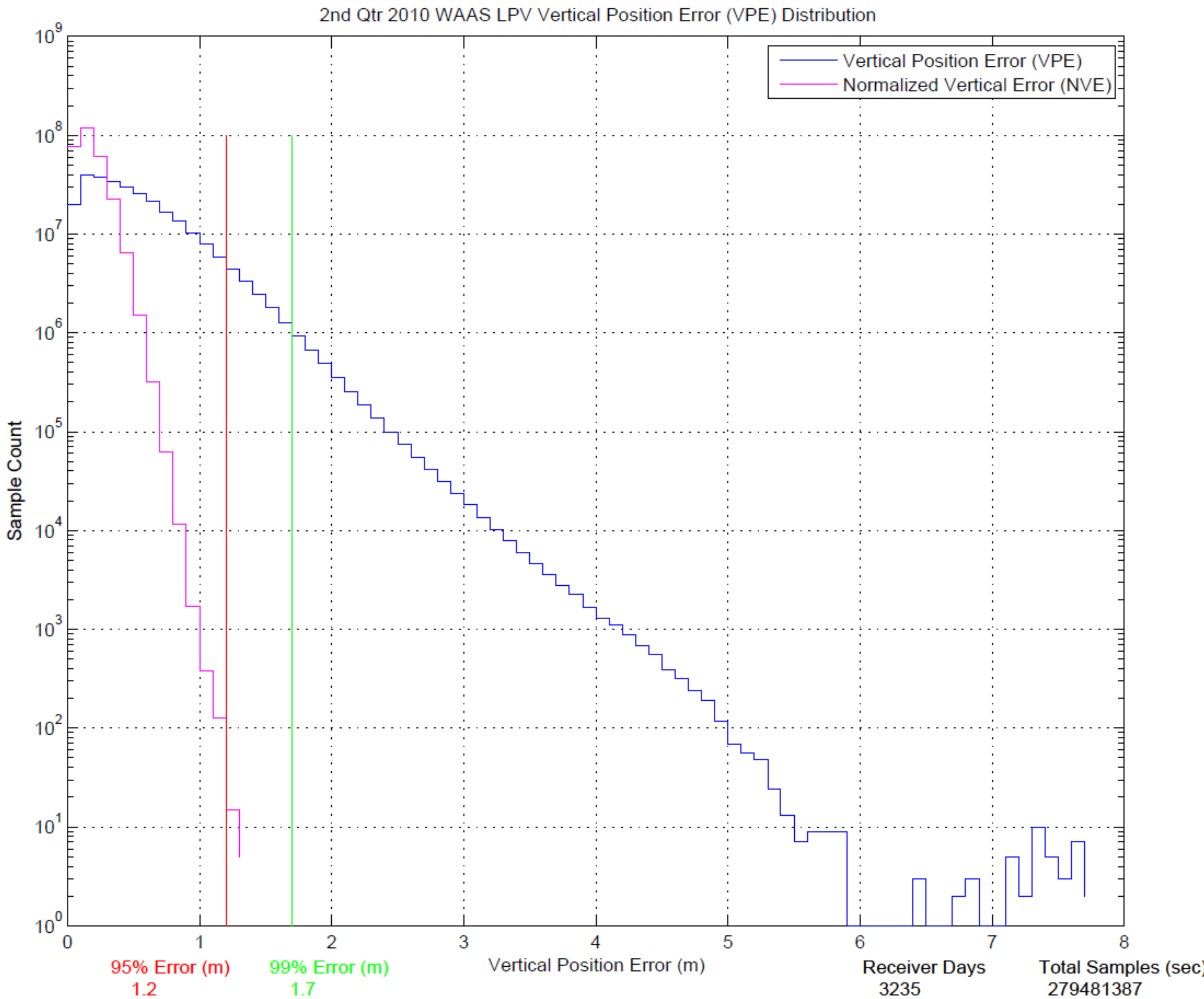


Figure 2-12 2-D Vertical Histogram for the Quarter



3.0 AVAILABILITY

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

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

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

Parameter	CONUS Site/Maximum	CONUS Site/Minimum	Alaska Site/Maximum	Alaska Site/Minimum
95% HPL	Arcata 16.71 meters	Memphis 11.72 meters	Cold Bay 28.21 meters	Fairbanks 13.227 meters
95% VPL	Arcata 31.545 meters	Kansas City 19.01 meters	Barrow 39.95 meters	Juneau 22.81 meters

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

During this evaluation period, reduced PA and NPA availability are mainly due to satellite outages and GUS switchovers. Please refer to Table 1.4 for events that affected availability. NPA outages at Iqaluit and Gander are due to CRE GUS switchovers; NPA outages at Barrow and Kotzebue are due to CRW GUS switchovers. GUS switchovers on 4/4/10, 4/11/10, 4/19/10, 4/22/10, 4/27/10, 4/28/10, 4/29/10, 6/23/10, and 6/30/10 reduced Alaska and RNP availability. PRN 23 outage on 4/22/10 reduced Alaska PA availability. PRN 17 outage on 4/27/10 reduced both CONUS and Alaska PA availability (see DR #94). PRN 5 outage on 5/4/10 reduced both CONUS and Alaska PA availability slightly. PRN 9 outage on 5/7/10 reduced both CONUS and Alaska availability (see DR #96). PRN 16 outage on 5/21/10 and PRN 32 outage from 5/21/10 to 5/25/10 reduced mostly Alaska PA availability (see DR #95). PRN 16 outage on 6/24/10 reduced PA availability slightly in both CONUS and Alaska region.

Other events that affected availability this quarter include geomagnetic storm, SIS outage, and elevated UDRE. From 4/5/10 to 4/7/10, a combination of geomagnetic storm and satellite outage caused a significant drop in PA availability (see DR #93). On 5/2/10, a geomagnetic storm affected mostly Alaska availability. Two SIS outages due to a known WAAS C&V problem that left the GEO with both GUSs in backup/backup mode occurred this quarter. A CRW SIS outage on 4/13/10 caused a small drop in CONUS availability and a CRE SIS outage on 6/16/20 caused a small drop in Alaska availability. Elevated UDRE due to a GIVE monitor trip on 5/29/10 reduced Alaska availability. Elevated UDRE for PRN 32 on 6/4/10 and PRN 135 on 6/8/10 reduced Alaska availability on both days.

Table 3-1 95% Protection Level

Location	95% HPL (meters)	95% VPL (meters)	Percentage in PA mode
Arcata	16.713	31.545	100
Grand Forks	13.083	21.326	100
Oklahoma City	12.498	21.475	100
Albuquerque	13.372	24.191	99.997680
Anchorage	15.075	24.050	99.994640
Atlanta	12.387	21.721	100
Barrow	19.326	39.956	99.855370
Bethel	18.619	29.324	99.996280
Billings	12.495	21.221	99.997110
Boston	15.970	22.769	100
Chicago	12.495	19.153	100
Cold Bay	28.213	38.031	99.997090
Dallas	12.392	21.708	100
Denver	11.956	22.566	99.995550
Fairbanks	14.227	25.188	99.997090
Gander	29.969	48.635	99.941460
Goose Bay	23.389	34.563	99.941830
Houston	12.477	21.777	100
Iqaluit	31.540	43.692	99.947010
Jacksonville	13.032	23.549	100
Juneau	14.269	22.812	99.994630
Kansas City	11.737	19.010	100
Kotzebue	17.943	35.879	99.851290
Los Angeles	16.600	28.085	99.997740
Memphis	11.720	19.377	99.995580
Merida	19.086	35.320	100
Mexico City	25.260	36.781	100
Miami	15.033	28.026	100
Minneapolis	12.396	19.392	100
New York	15.148	22.249	100
Oakland	16.676	31.937	99.991120
Puerto Vallarta	27.983	40.338	100
Salt Lake City	12.378	21.943	99.997570
San Jose Del Cabo	26.569	39.267	100
San Juan	67.484	100.803	99.997680
Seattle	14.694	24.014	99.997570
Tapachula	37.713	63.171	99.999980
Washington DC	13.926	21.338	100
Winnipeg	13.621	21.449	100

Table 3-2 Quarterly Availability Statistics

Location	**LPV WAAS *With 15 minute window***	**LPV 200 WAAS *With 15 minute window***
Arcata	0.9995315	0.9734237
Grand Forks	1	1
Oklahoma City	1	0.9999880
Albuquerque	0.9999859	0.9945633
Anchorage	0.9995105	0.9981336
Atlanta	0.9999981	0.9998124
Barrow	0.9920602	0.8496949
Bethel	0.9993230	0.9903918
Billings	1	0.9999950
Boston	0.9999258	0.9998919
Chicago	1	0.9999929
Cleveland	1	1
Cold Bay	0.9959589	0.8705688
Dallas	1	0.9999962
Denver	1	0.9998004
Fairbanks	0.9996707	0.9982771
Gander	0.9526642	0.5166574
Goose Bay	0.9985472	0.9325674
Houston	1	0.9999272
Iqaluit	0.9707440	0.7767970
Jacksonville	1	0.9998501
Juneau	0.9997146	0.9988384
Kansas City	1	1
Kotzebue	0.9969596	0.9232642
Los Angeles	0.9999866	0.9880253
Memphis	0.9999556	0.9997229
Merida	0.9934268	0.9372445
Mexico City	0.9770919	0.9104014
Miami	0.9999925	0.9952475
Minneapolis	1	0.9999386
New York	1	0.9999358
Oakland	0.9997194	0.9576100
Puerto Vallarta	0.9825550	0.8768061
Salt Lake City	1	1
San Jose Del Cabo	0.9861240	0.8659755
San Juan	0.1525002	0.0040367
Seattle	1	0.9961559
Tapachula	0.8452459	0.3914237
Washington DC	1	0.9999883
Winnipeg	1	0.9998860

Table 3-3 NPA Availability

Location	NPA Availability (Excluding RAIM/FDE)
Albuquerque	1
Anchorage	1
Atlanta	1
Barrow	0.99884828
Bethel	1
Billings	1
Boston	1
Cleveland	1
Cold Bay	1
Fairbanks	1
Gander	0.99956286
Honolulu	1
Houston	1
Iqaluit	0.99957472
Juneau	1.00000000
Kansas City	1
Kotzebue	0.99884801
Los Angeles	1
Merida	1
Miami	1
Minneapolis	1
Oakland	1
Salt Lake City	1
San Jose Del Cabo	1
San Juan	1
Seattle	1
Tapachula	1
Washington DC	1

Table 3-4 LPV and LPV 200 Outage Rate

Location	LPV Outages	LPV Outage Rates	LPV 200 Outages	LPV 200 Outage Rates
Arcata	3	0.000071	155	0.003784
Grand Forks	0	0	0	0
Oklahoma City	0	0	1	0.000021
Albuquerque	1	0.000020	102	0.002001
Anchorage	2	0.000039	13	0.000254
Atlanta	1	0.000019	4	0.000076
Barrow	110	0.002165	822	0.018893
Bethel	6	0.000118	111	0.002194
Billings	0	0	1	0.000019
Boston	1	0.000019	1	0.000019
Chicago	0	0	1	0.000019
Cleveland	0	0	1	0.000019
Cold Bay	41	0.000804	645	0.014464
Dallas	0	0	1	0.000019
Denver	0	0	4	0.000077
Fairbanks	3	0.000059	19	0.000372
Gander	367	0.007358	1004	0.037116
Goose Bay	20	0.000383	454	0.009305
Houston	0	0	2	0.000038
Iqaluit	223	0.004394	1107	0.027257
Jacksonville	0	0	4	0.000076
Juneau	1	0.000020	8	0.000156
Kansas City	0	0	0	0
Kotzebue	43	0.000843	583	0.012335
Los Angeles	1	0.000019	167	0.003226
Memphis	1	0.000019	3	0.000057
Merida	99	0.001904	402	0.008196
Mexico City	106	0.002080	548	0.011541
Miami	1	0.000019	71	0.001361
Minneapolis	0	0	2	0.000038
New York	0	0	1	0.000019
Oakland	3	0.000059	322	0.006563
Puerto Vallarta	194	0.003772	586	0.012766
Salt Lake City	0	0	1	0.000019
San Jose Del Cabo	190	0.003725	580	0.012948
San Juan	618	0.081724	55	0.274771
Seattle	0	0	50	0.000958
Tapachula	635	0.017690	963	0.057931
Washington DC	0	0	1	0.000019
Winnipeg	0	0	2	0.000038

Table 3-5 NPA Outage Rates

Location	NPA Outages	NPA Outage Rate
Albuquerque	0	0
Anchorage	0	0
Atlanta	0	0
Barrow	11	0.00020836
Bethel	0	0
Billings	0	0
Boston	0	0
Cleveland	0	0
Cold Bay	0	0
Fairbanks	0	0
Gander	5	0.00009469
Honolulu	0	0
Houston	0	0
Iqaluit	5	0.00009477
Juneau	0	0
Kansas City	0	0
Kotzebue	11	0.00020841
Los Angeles	0	0
Merida	0	0
Miami	0	0
Minneapolis	0	0
Oakland	0	0
Salt Lake City	0	0
San Jose Del Cabo	0	0
San Juan	0	0
Seattle	0	0
Tapachula	0	0
Washington DC	0	0

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

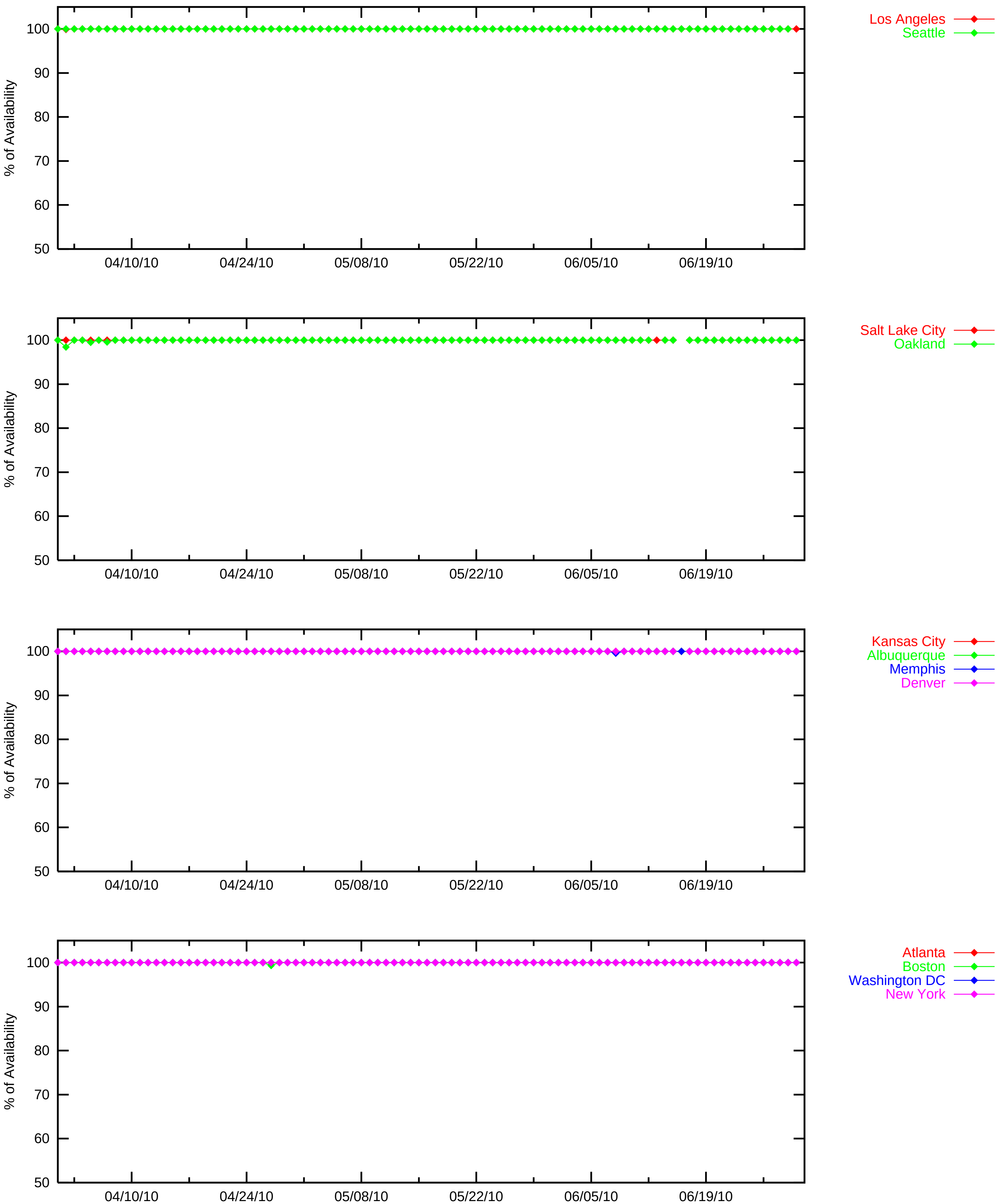


Figure 3-2 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

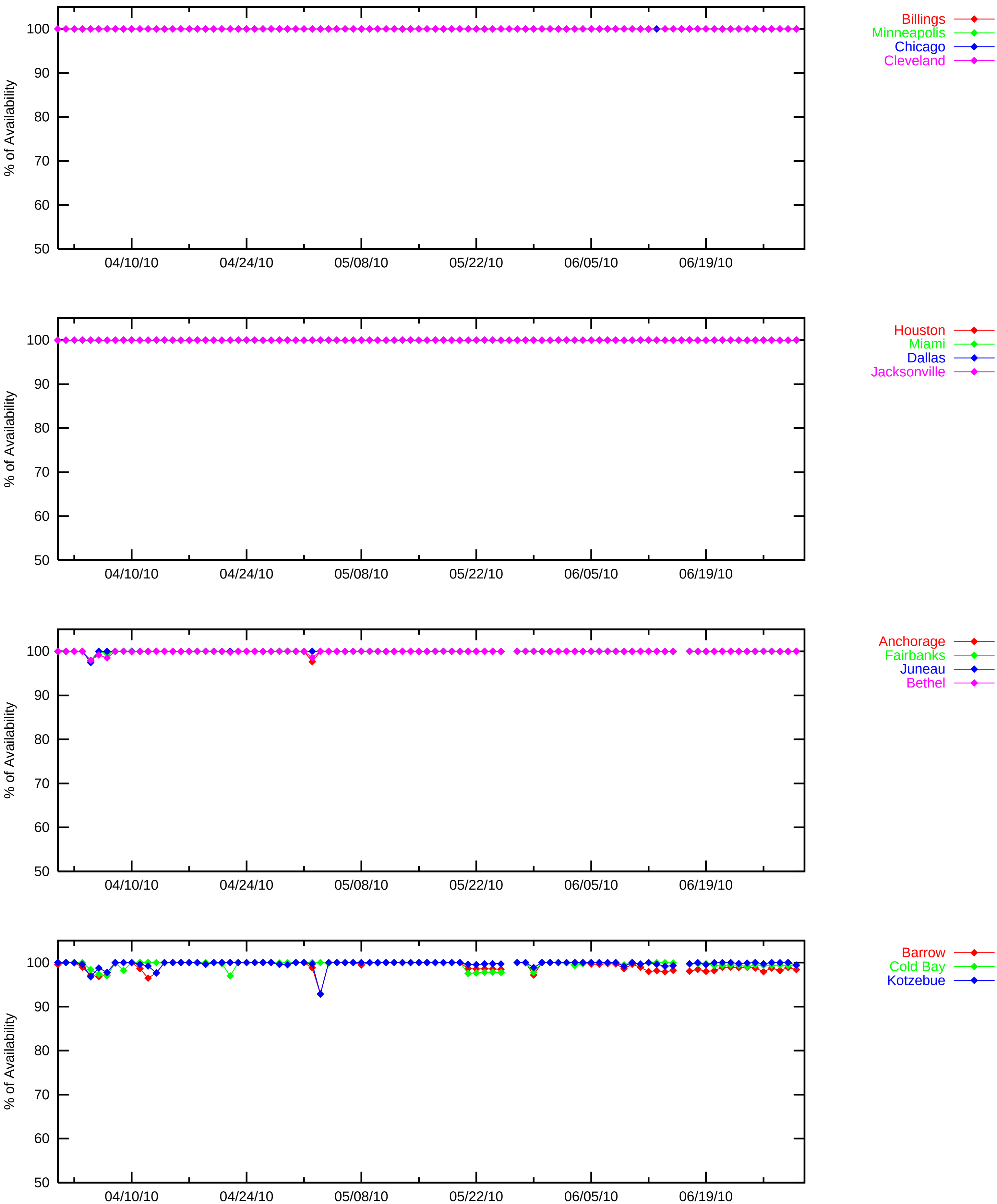


Figure 3-3 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

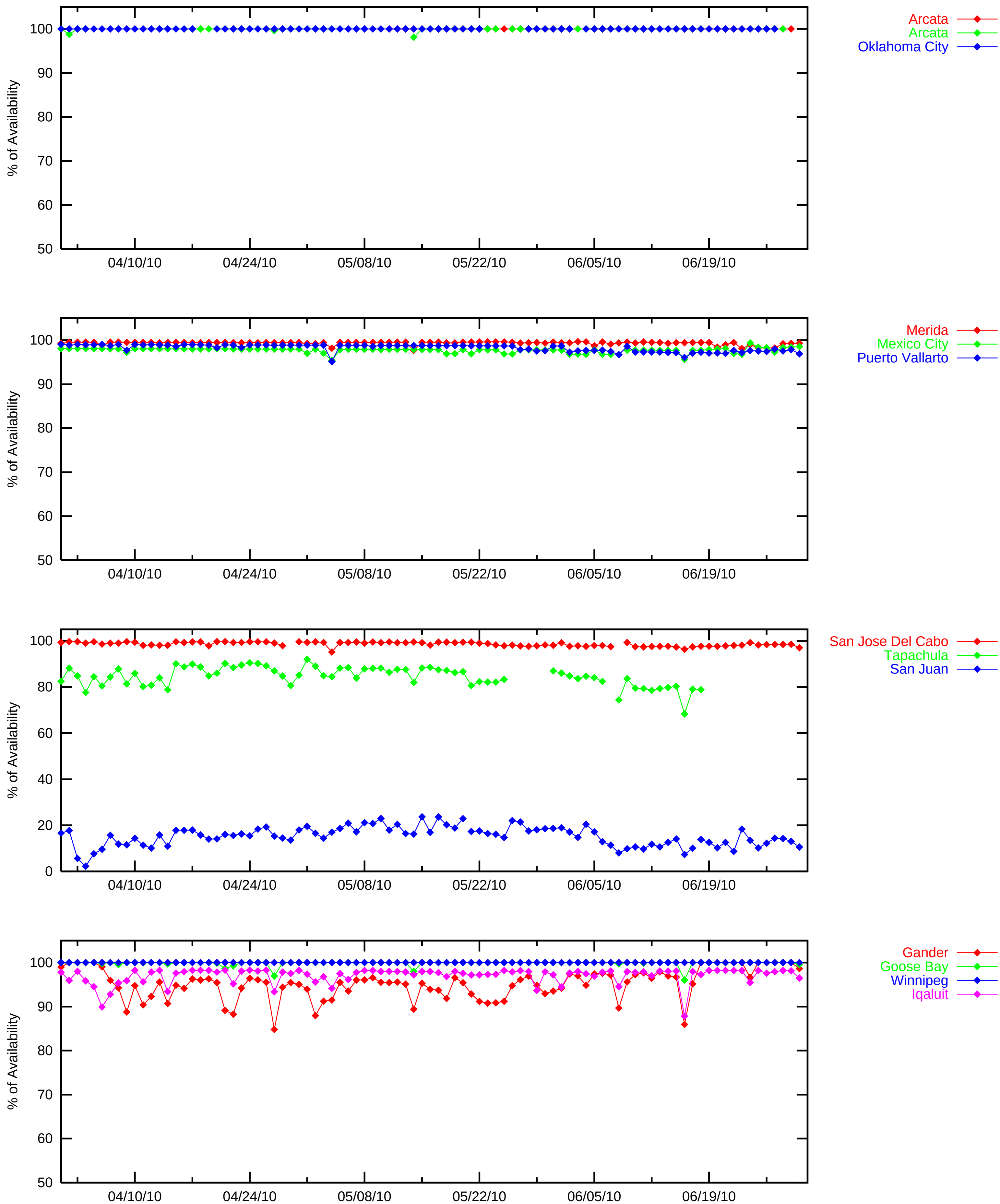


Figure 3-4 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

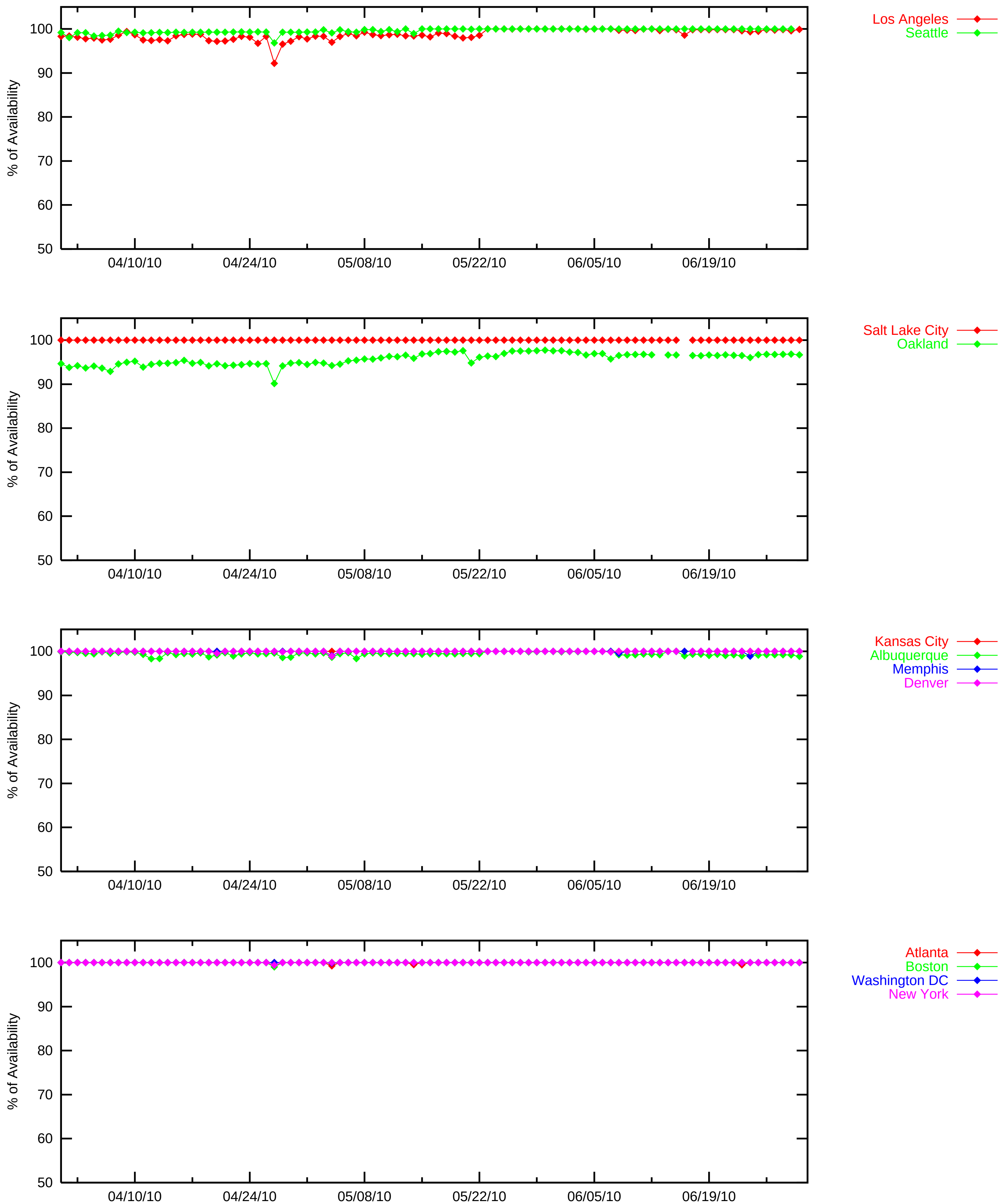


Figure 3-5 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

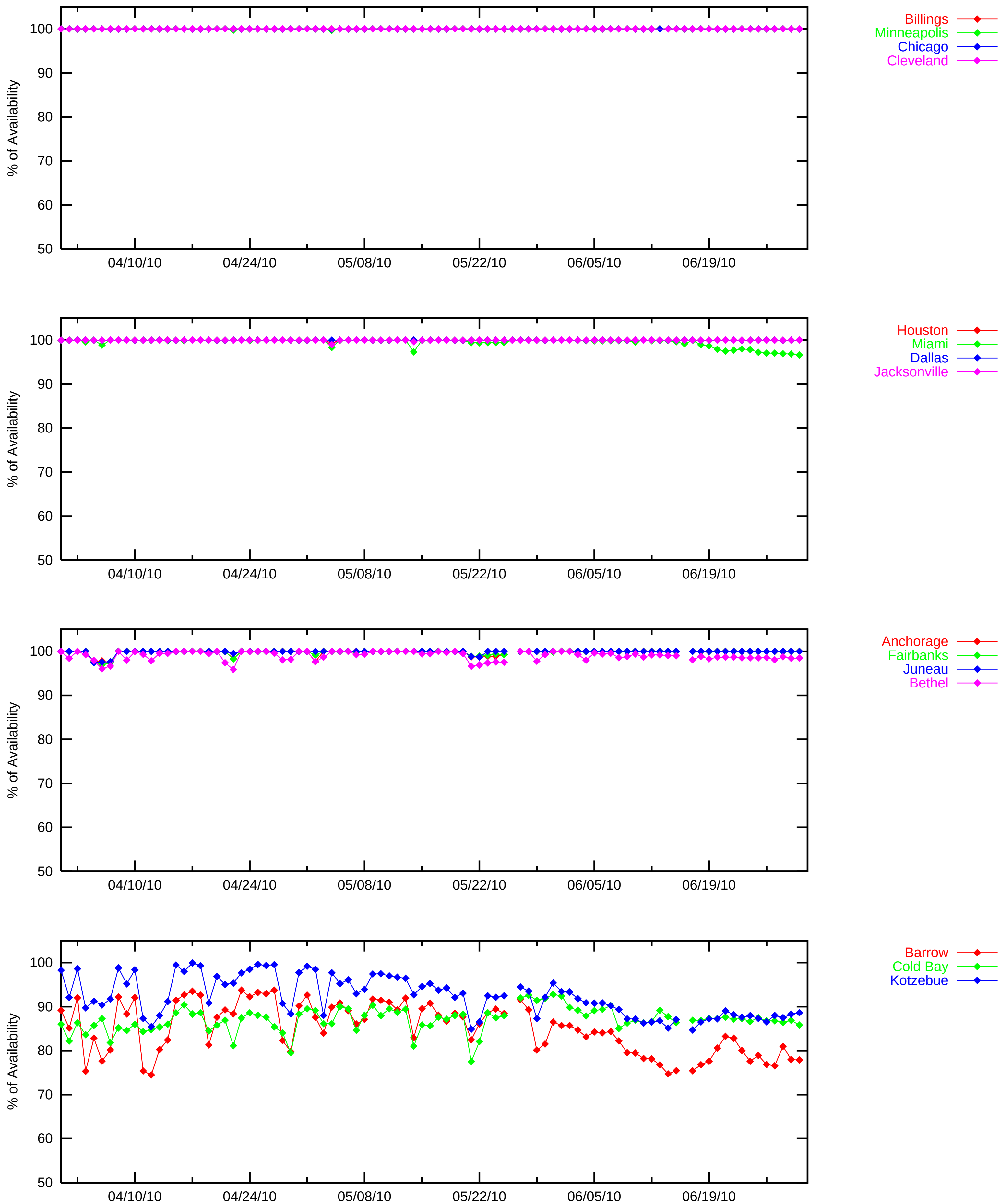


Figure 3-6 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

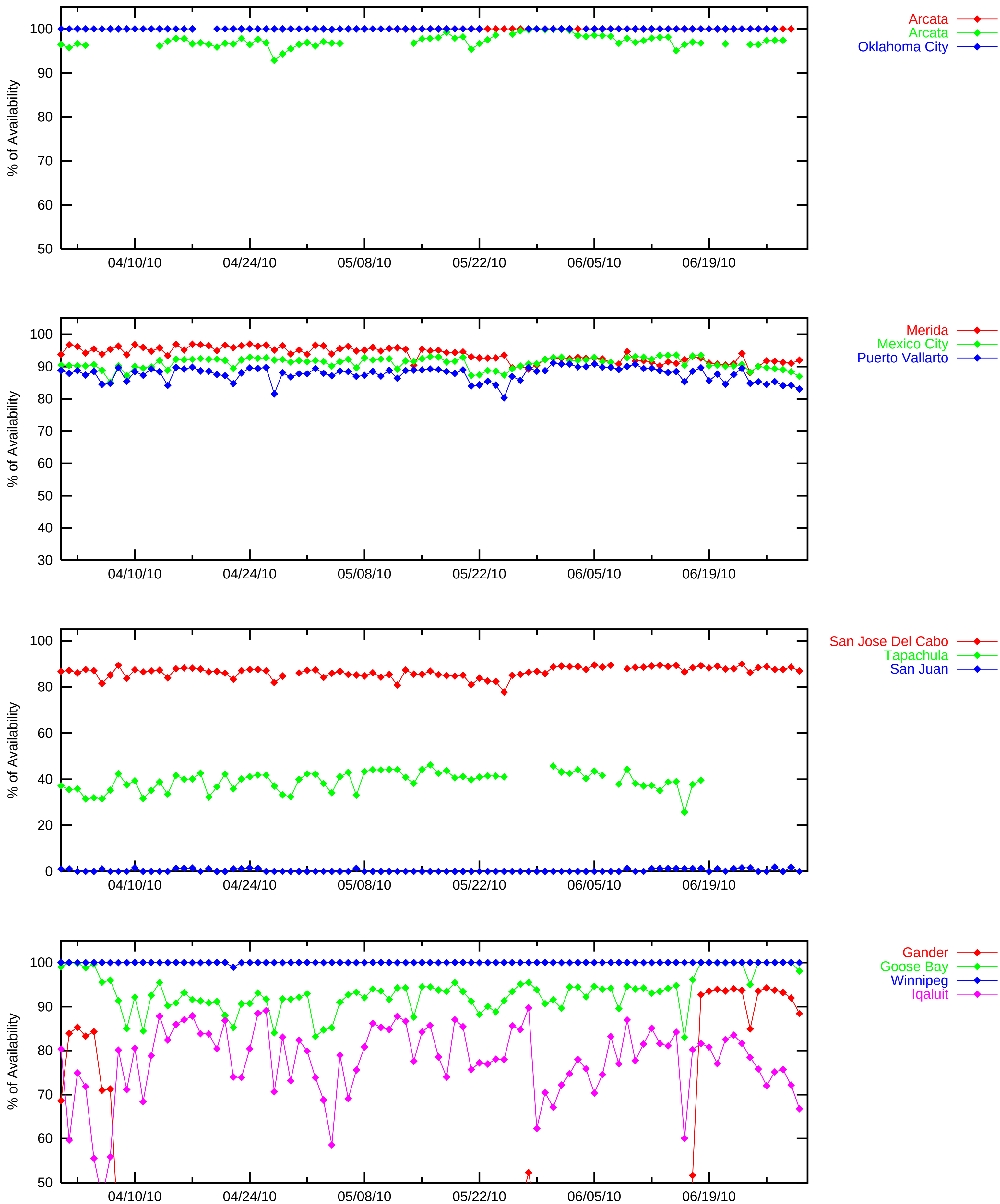
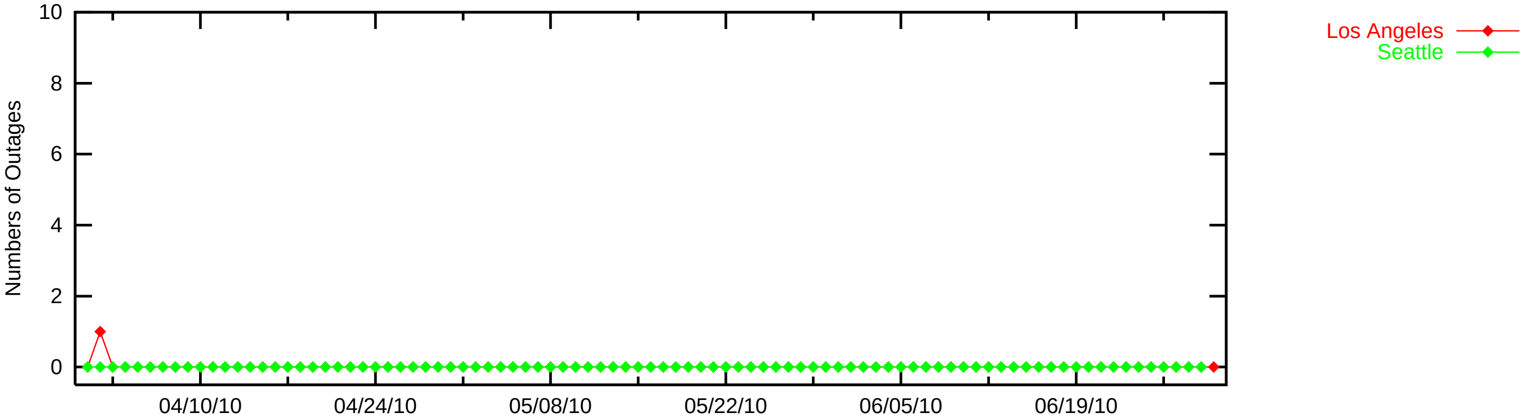
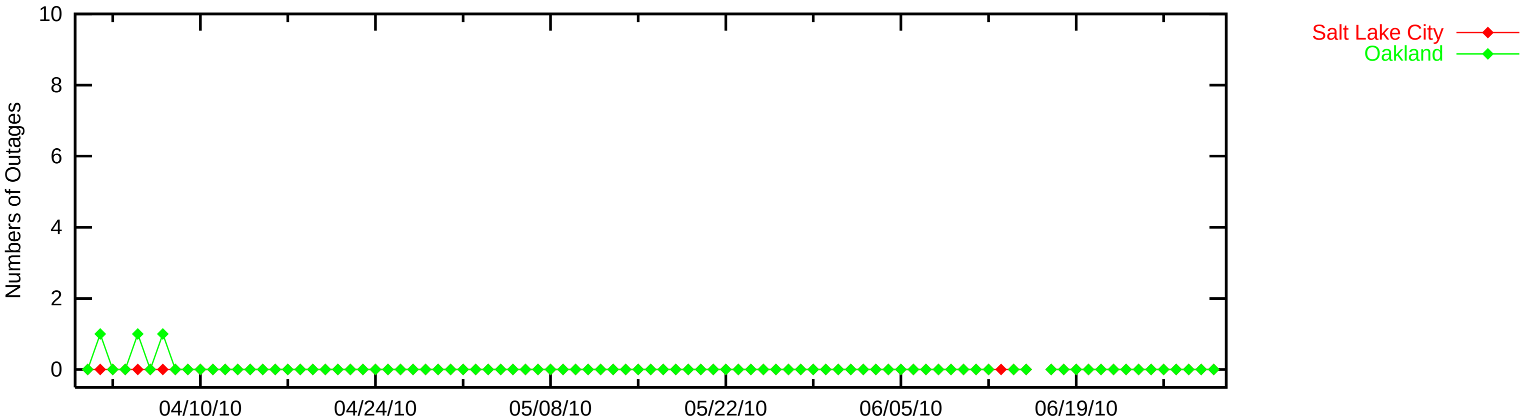
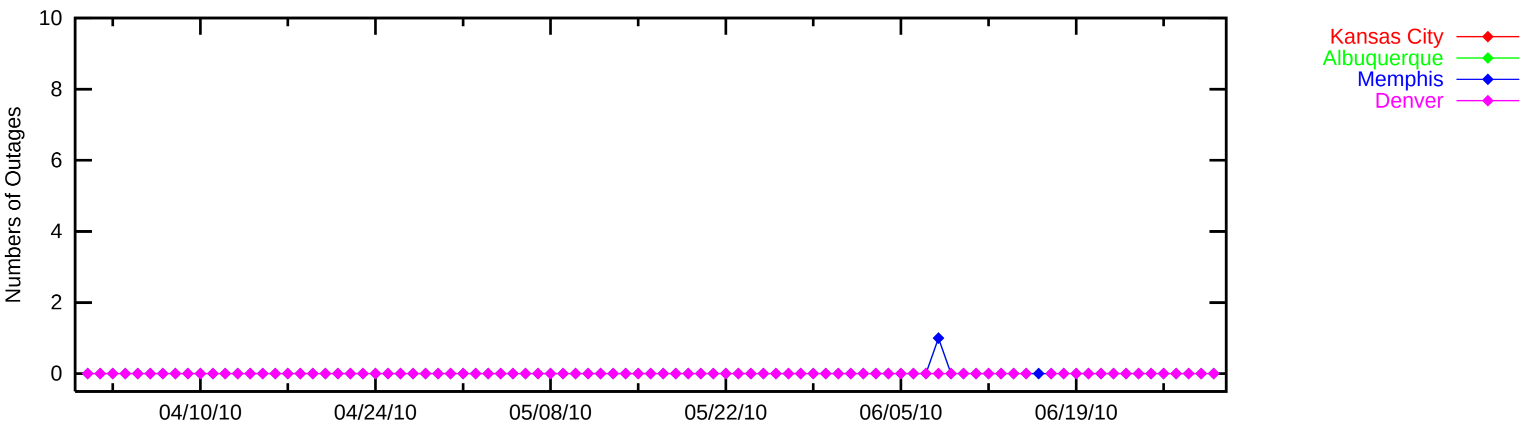


Figure 3-7 LPV Outages (HAL = 40m & VAL=50m)







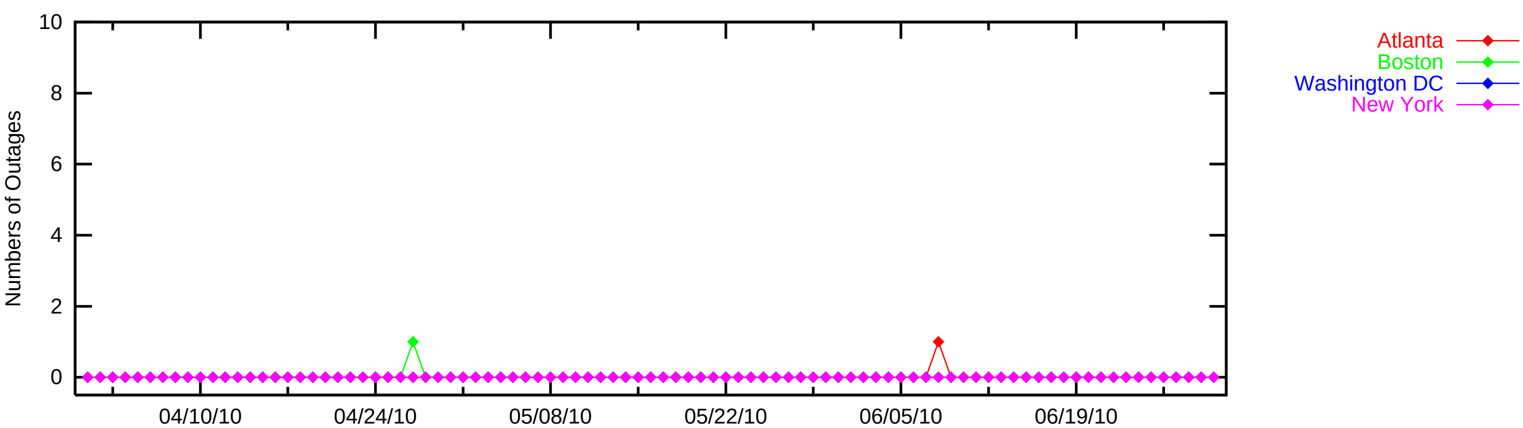


Figure 3-8 LPV Outages (HAL = 40m & VAL=50m)

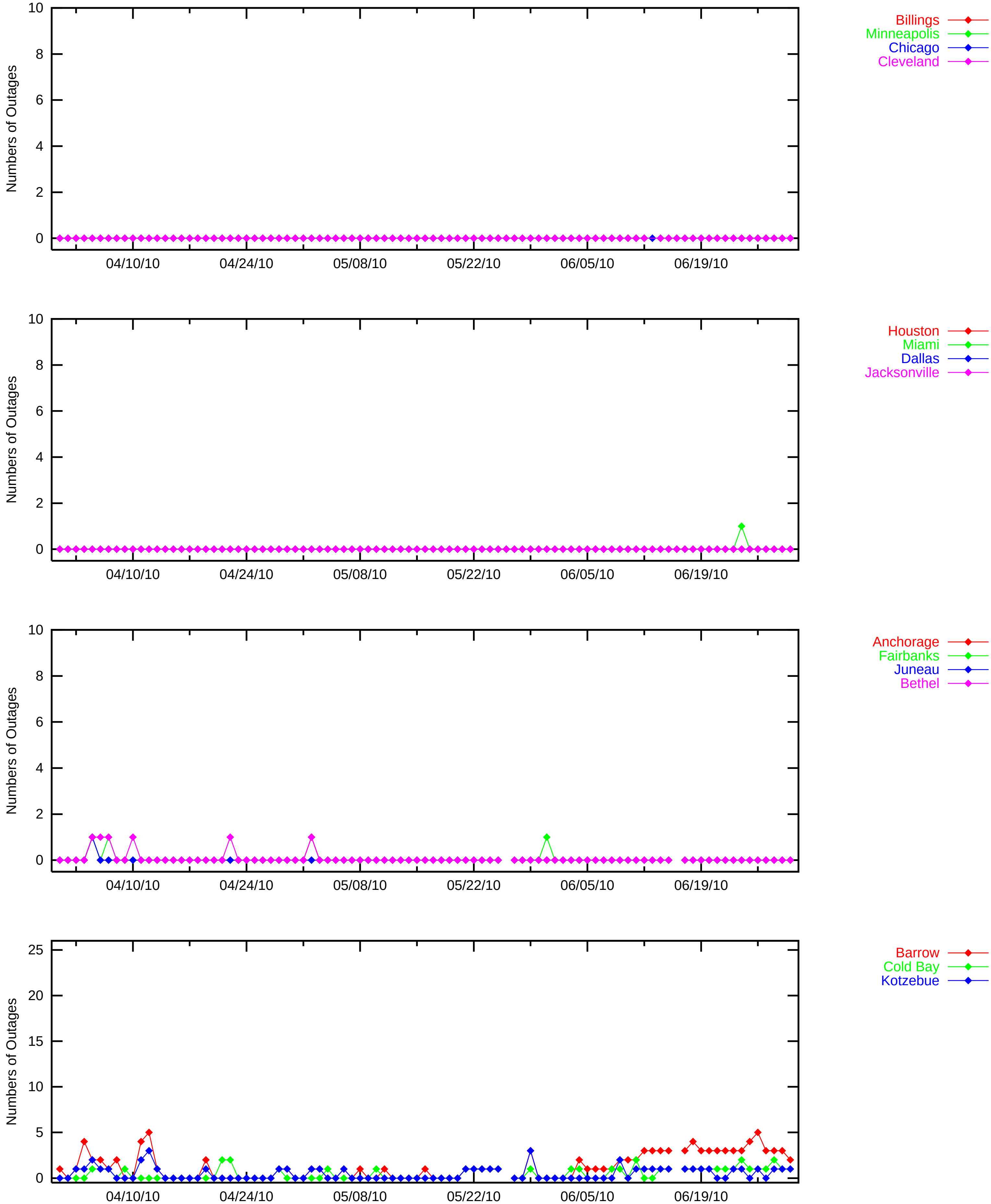


Figure 3-9 LPV Outages (HAL = 40m & VAL=50m)

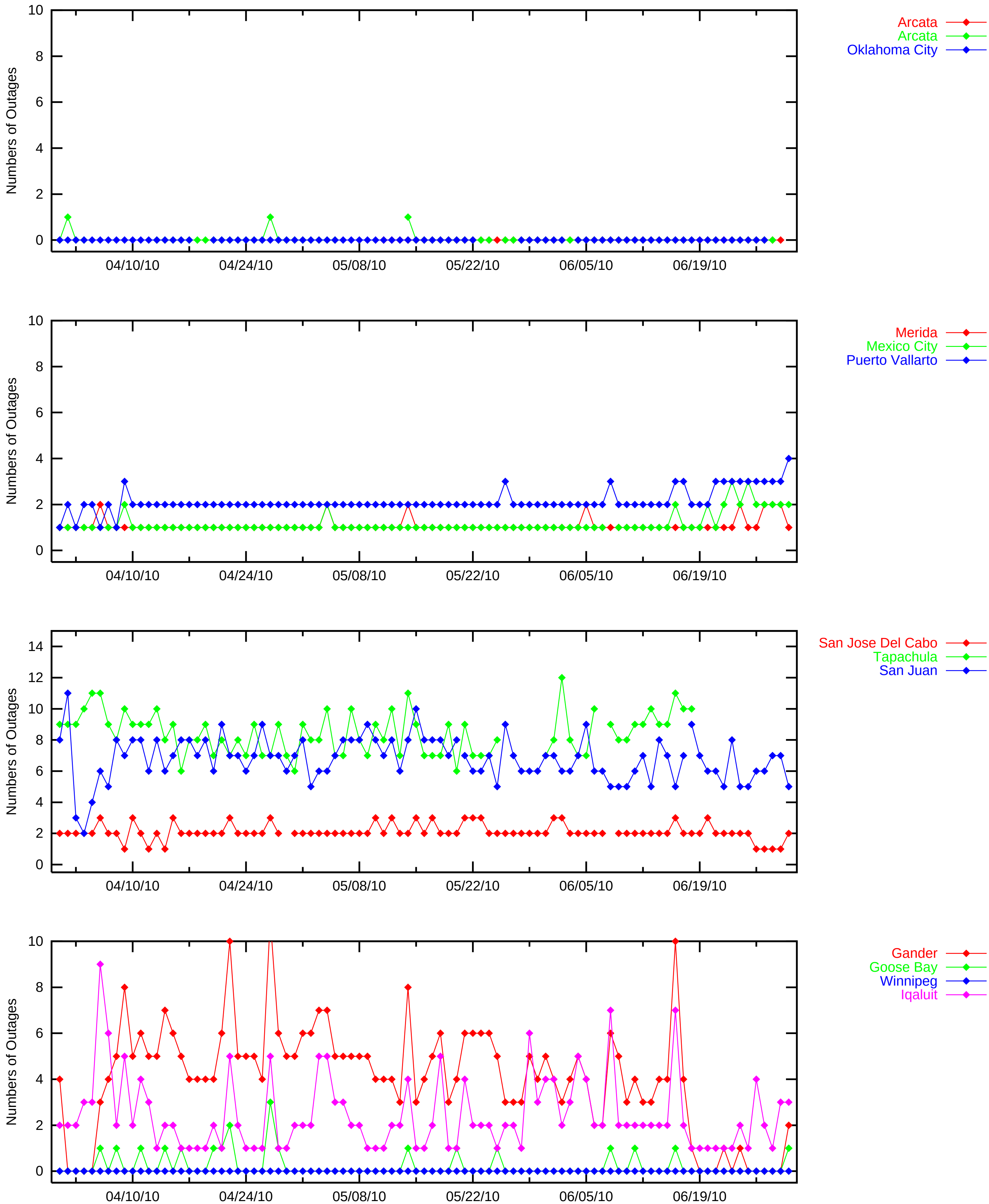


Figure 3-10 LPV 200 Outages (HAL = 40m & VAL=35m)

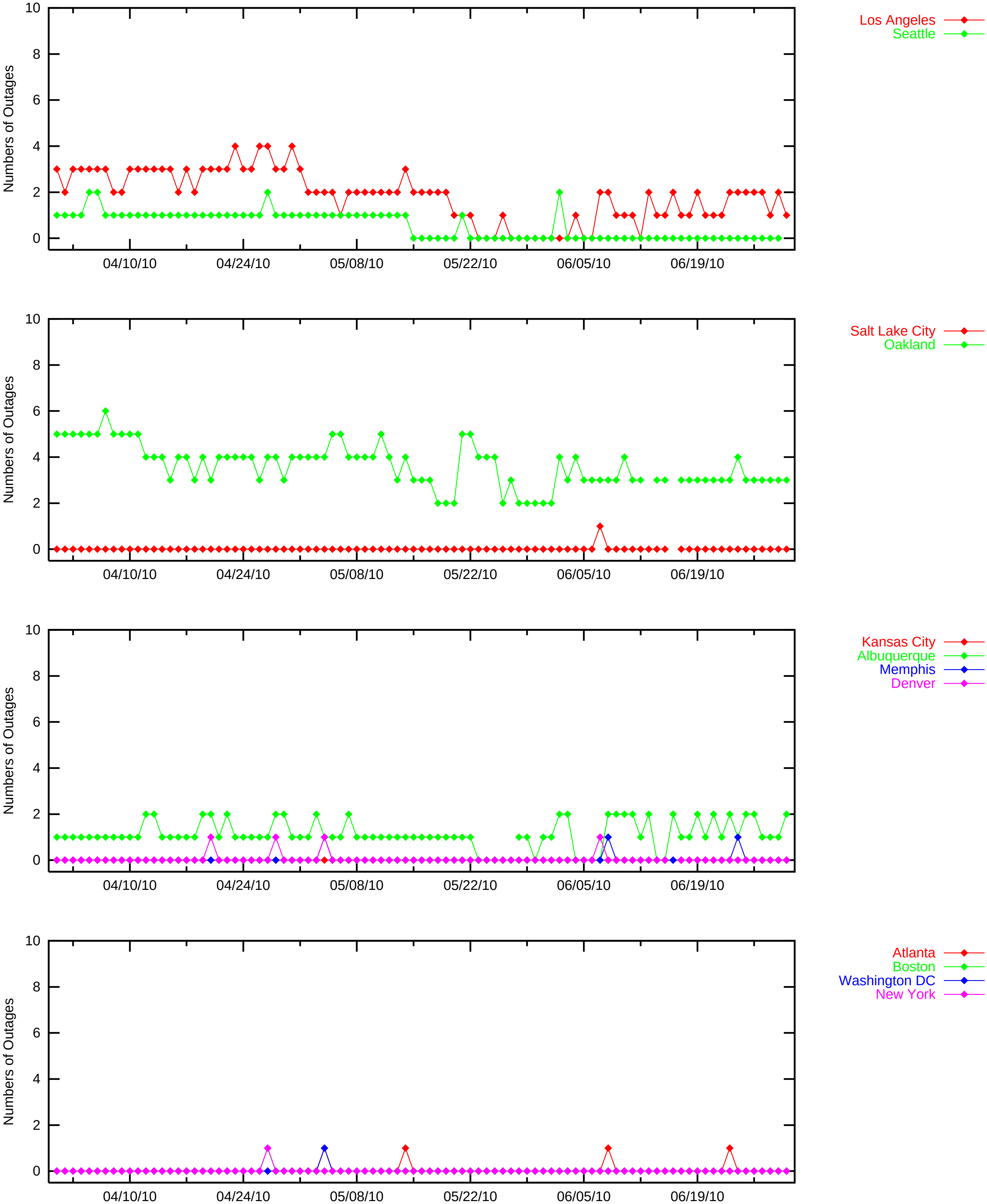


Figure 3-11 LPV 200 Outages (HAL = 40m & VAL=35m)

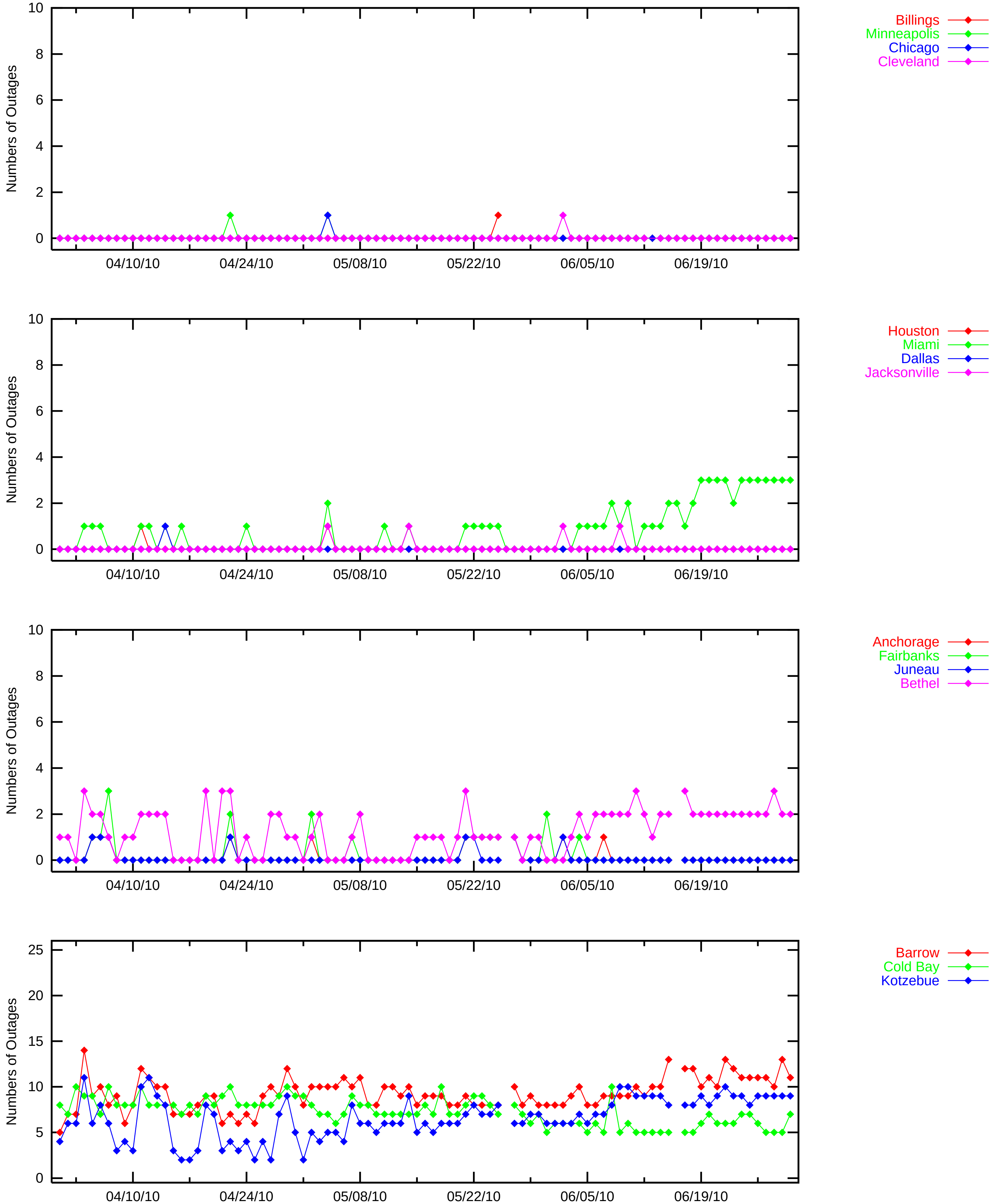
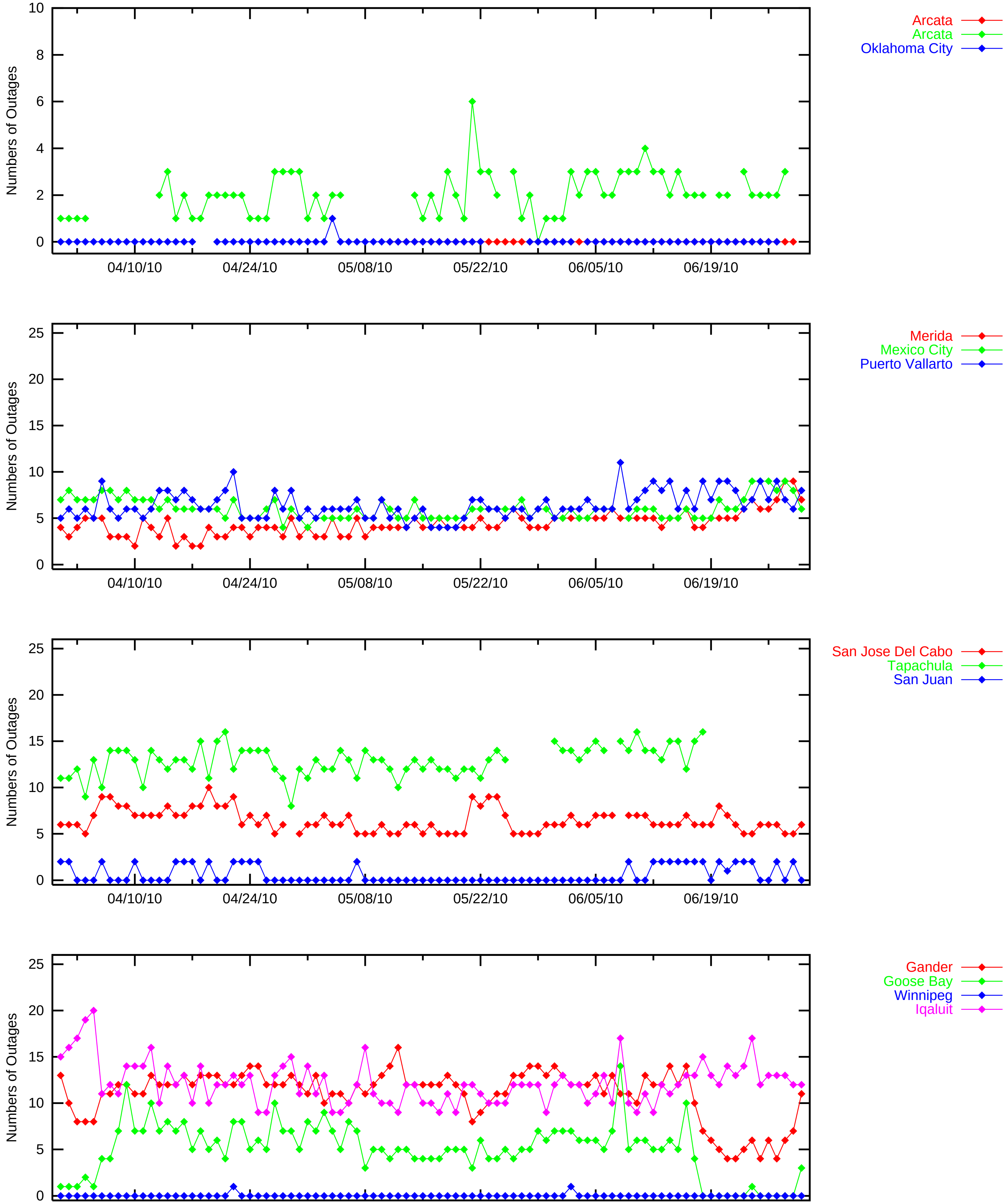


Figure 3-12 LPV 200 Outages (HAL = 40m & VAL=35m)



4.0 COVERAGE

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

Daily analysis for PA was conducted for LP, LPV and LPV 200 service levels. LP service is available when HPL is less than 40 meters. LPV service is available when HPL is less than 40 metes and VPL is less than 50 meters. LPV 200 service is available when HPL is less than 40 metes and VPL is less than 35 meters. The coverage plots provide 100, 99.9, 99, 98 and 95% availability contours. Figure 4.1 shows the rollup LP North America coverage. Figure 4.2 shows the rollup LPV North America coverage. Figure 4.3 shows the rollup LPV 200 North America coverage. Figure 4.6 shows the daily LPV and LPV 200 CONUS coverage, and Figure 4.7 shows the daily LPV Alaska coverage at 99% availability and ionosphere KP index values for this quarter. Please see Appendix B for coverage plots of 99% LPV 200 availability contour and 98% LPV availability contour.

Daily analysis for NPA was conducted for RNP 0.1 and RNP 0.3 service levels based on a 100% availability requirement. RNP 0.1 service is available when HPL is less than 185 meters and RNP 0.3 service is available when HPL is less than 556 meters. The NPA coverage plots provide 100, 99.9 and 99% availability contours. Figure 4.4 shows the rollup RNP 0.1 coverage and Figure 4.5 shows the rollup RNP 0.3 coverage for the quarter. Figure 4.8 shows the daily RNP coverage at 100% availability and ionosphere Kp index values for this quarter.

During this evaluation period, low PA and NPA coverage are mainly due to satellite outages and GUS switchovers. Please refer Table 1.4 for events that affected coverage. GUS switchovers on 4/4/10, 4/11/10, 4/19/10, 4/22/10, 4/27/10, 4/28/10, 4/29/10, 6/23/10, and 6/30/10 affected Alaska and RNP coverage. PRN 23 outage on 4/22/10 reduced coverage down to 10% availability. PRN 5 outage on 5/4/10 and PRN 16 outage on 6/24/10 reduced LPV 200 coverage slightly. PRN 17 outage on 4/27/10 reduced CONUS and Alaska LPV 200 coverage (see DR #94). PRN 9 outage on 5/7/10 reduced LPV 200 coverage (see DR #96). PRN 16 outage on 5/21/10 and PRN 32 outage from 5/21/10 to 5/25/10 reduced Alaska coverage (see DR #95).

Other events that affected coverage this quarter include geomagnetic storm, SIS outage, and elevated UDRE. From 4/5/10 to 4/7/10, a combination of geomagnetic storm and satellite outage caused a significant drop in LPV and LPV 200 coverage (see DR #93). On 5/2/10, a geomagnetic storm affected mostly Alaska coverage. Two SIS outages due to a known WAAS C&V problem that left the GEO with both GUSs in backup/backup mode occurred this quarter. A CRW SIS outage on 4/13/10 caused a small drop in CONUS LPV coverage and a CRE SIS outage on 6/16/20 caused a small drop in Alaska coverage. Elevated UDRE due to a GIVE monitor trip on 5/29/10 reduced Alaska coverage. Elevated UDRE for PRN 32 on 6/4/10 and PRN 135 on 6/8/10 reduced Alaska LPV 200 coverage on both days.

Figure 4-1 LP North America Coverage for the Quarater

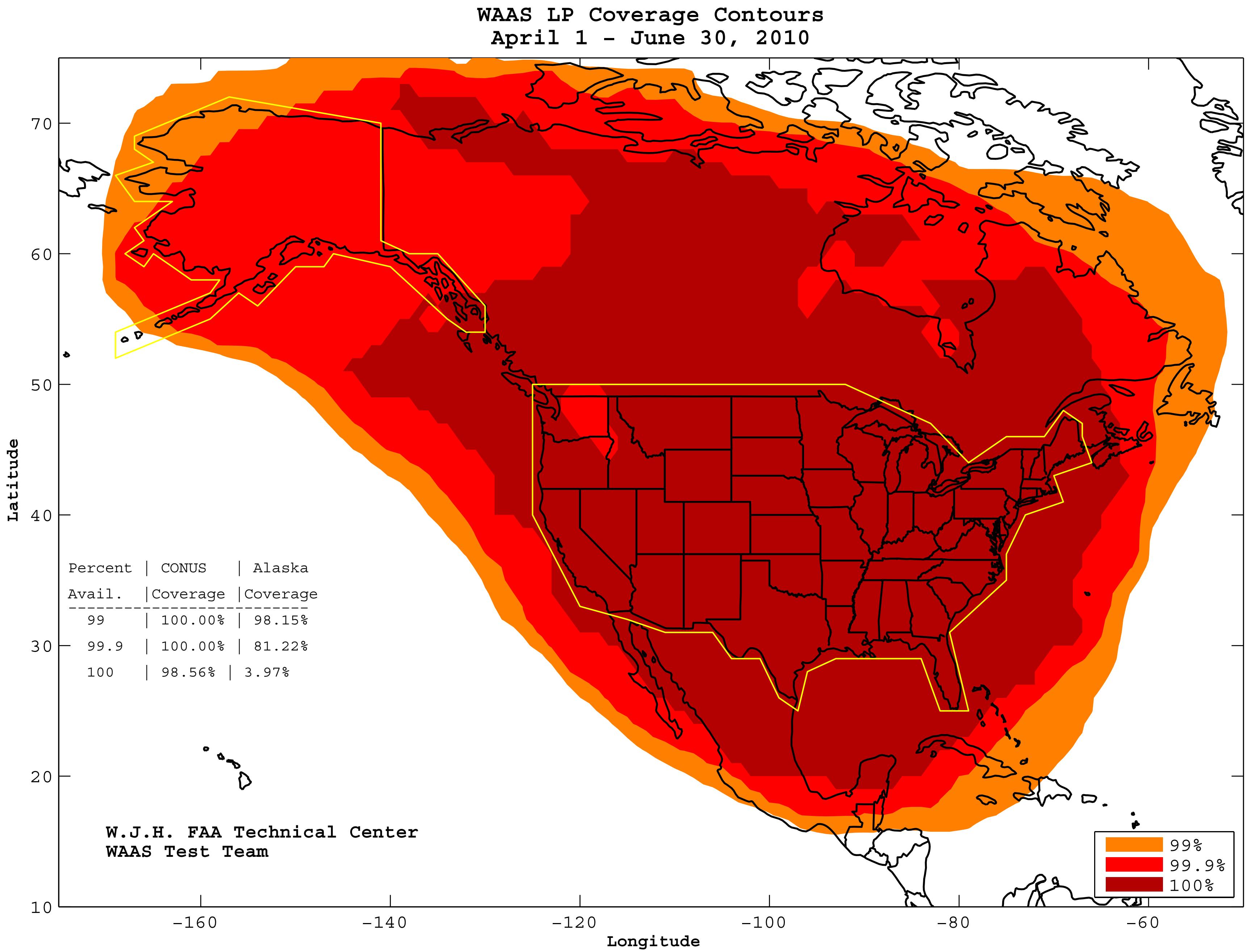


Figure 4-2 LPV North America Coverage for the Quarter

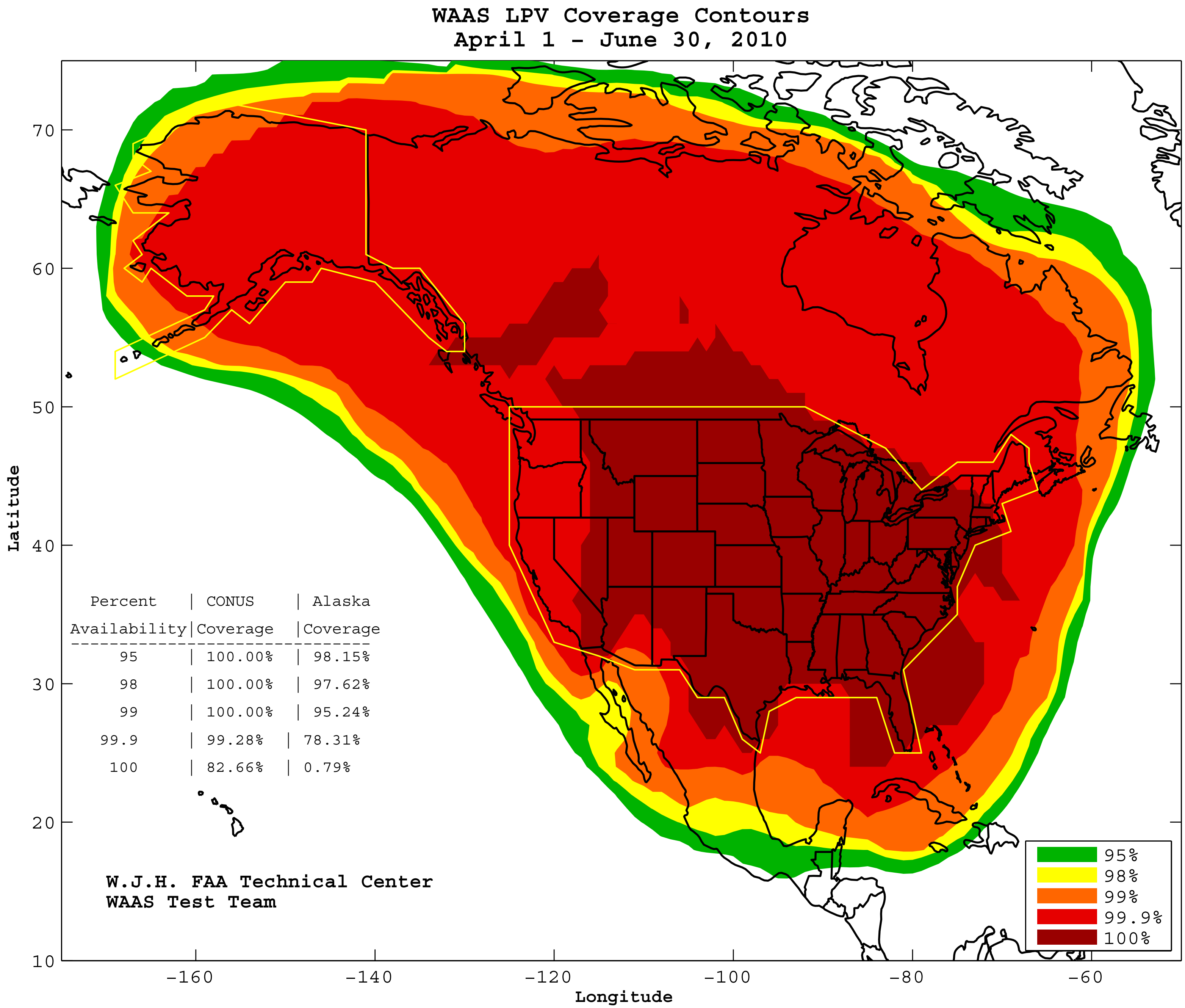


Figure 4-3 LPV 200 North America Coverage for the Quarter

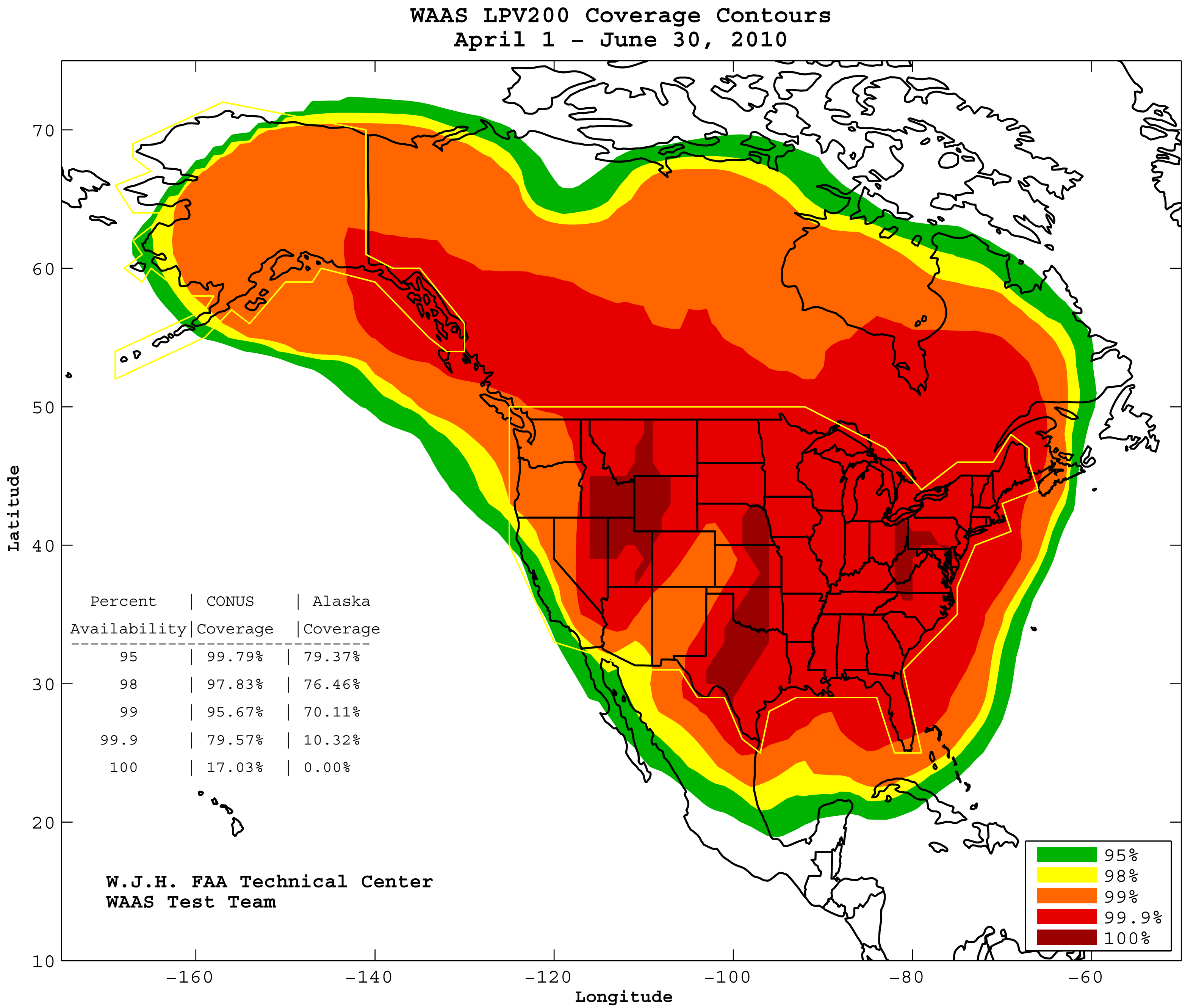


Figure 4-4 RNP 0.1 World Coverage for the Quarter

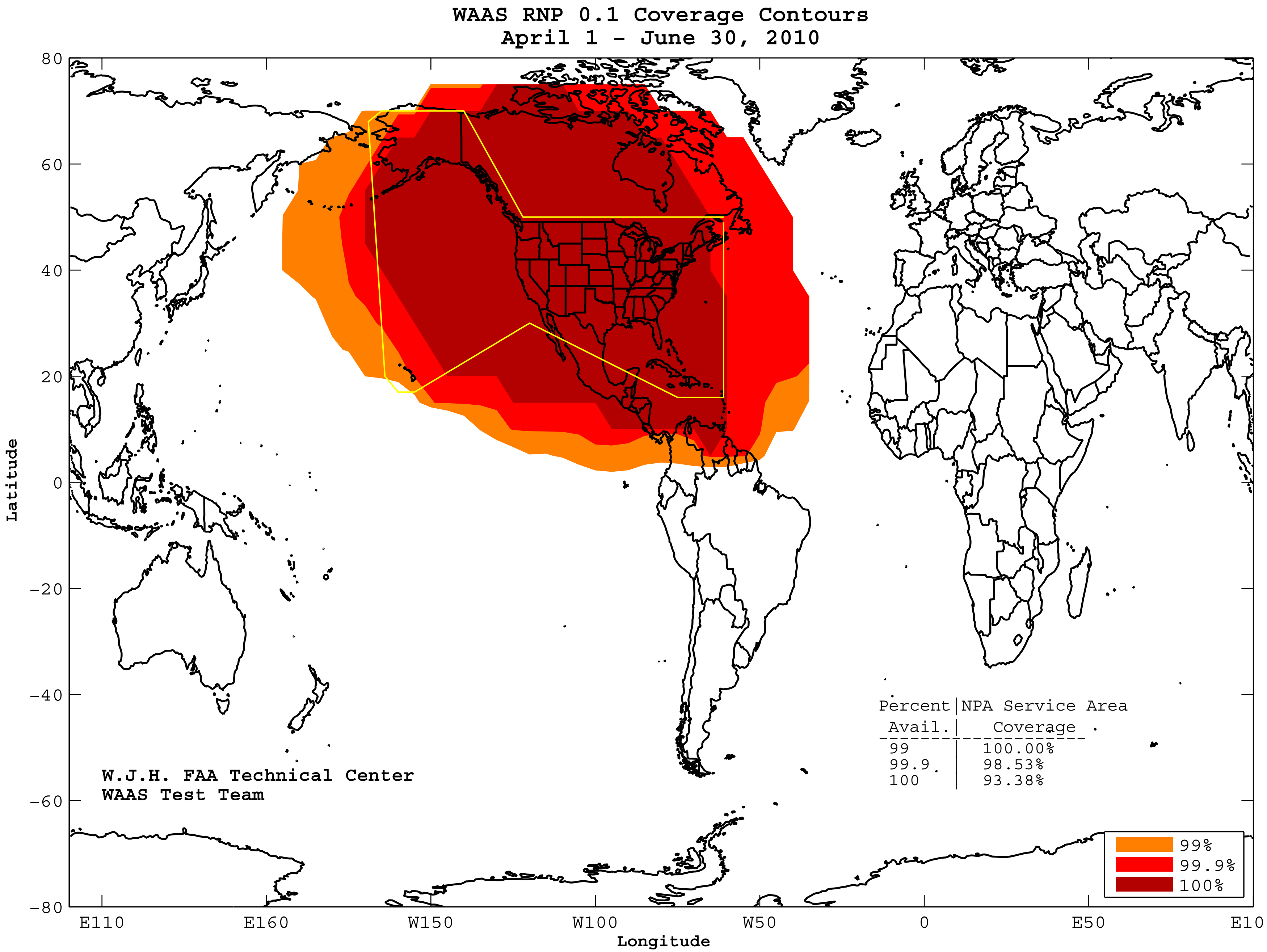


Figure 4-5 RNP 0.3 World Coverage for the Quarter

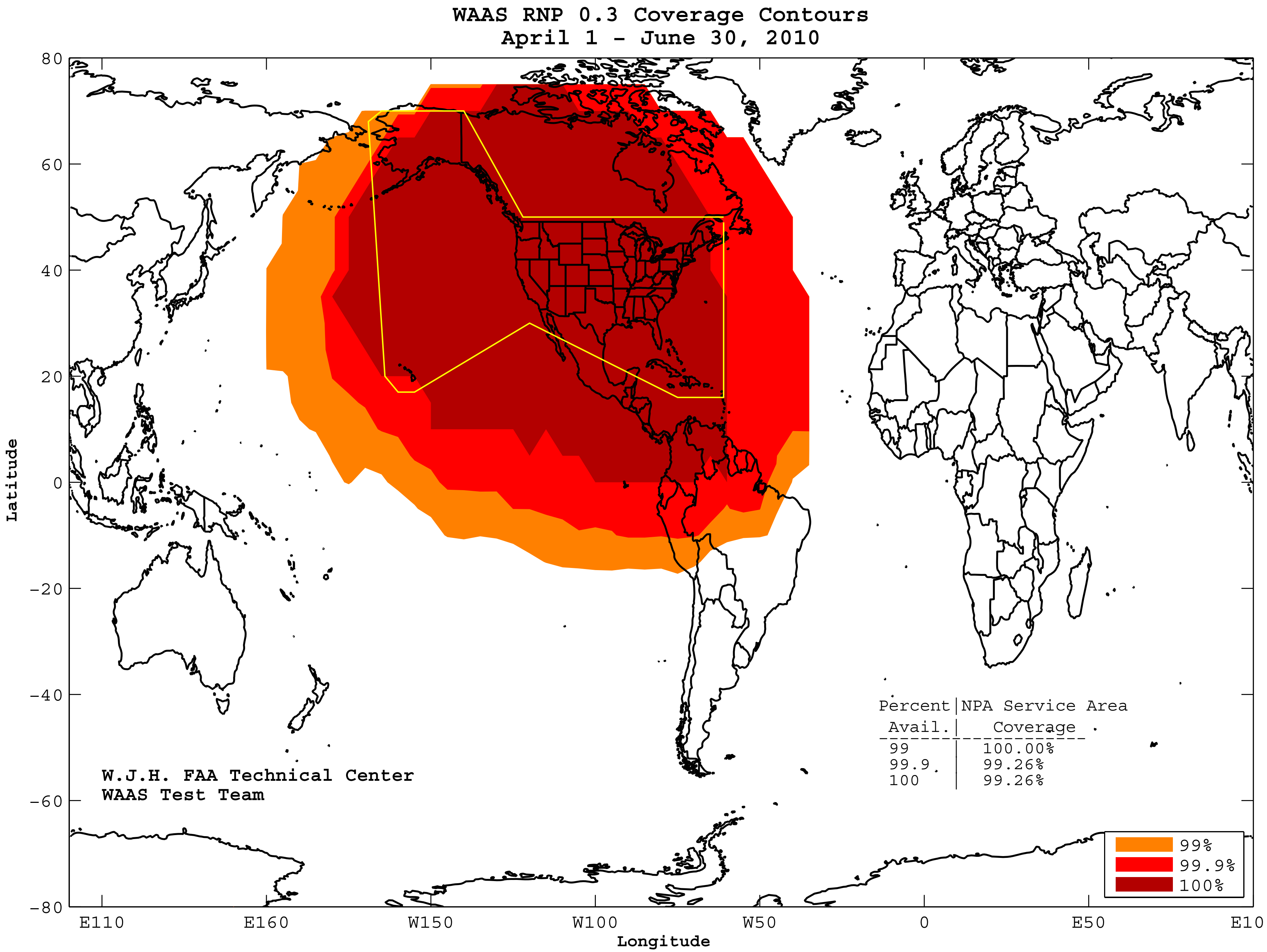


Figure 4-6 Daily LPV and LPV 200 CONUS Coverage

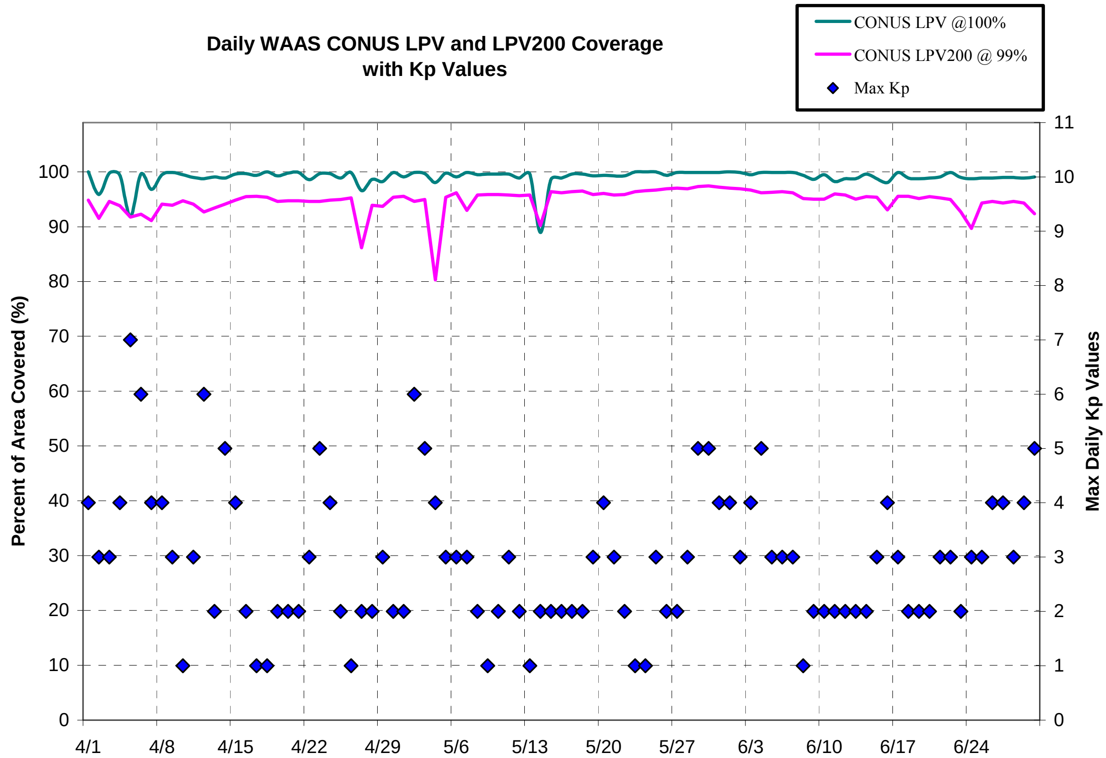


Figure 4-7 Daily LPV Alaska Coverage

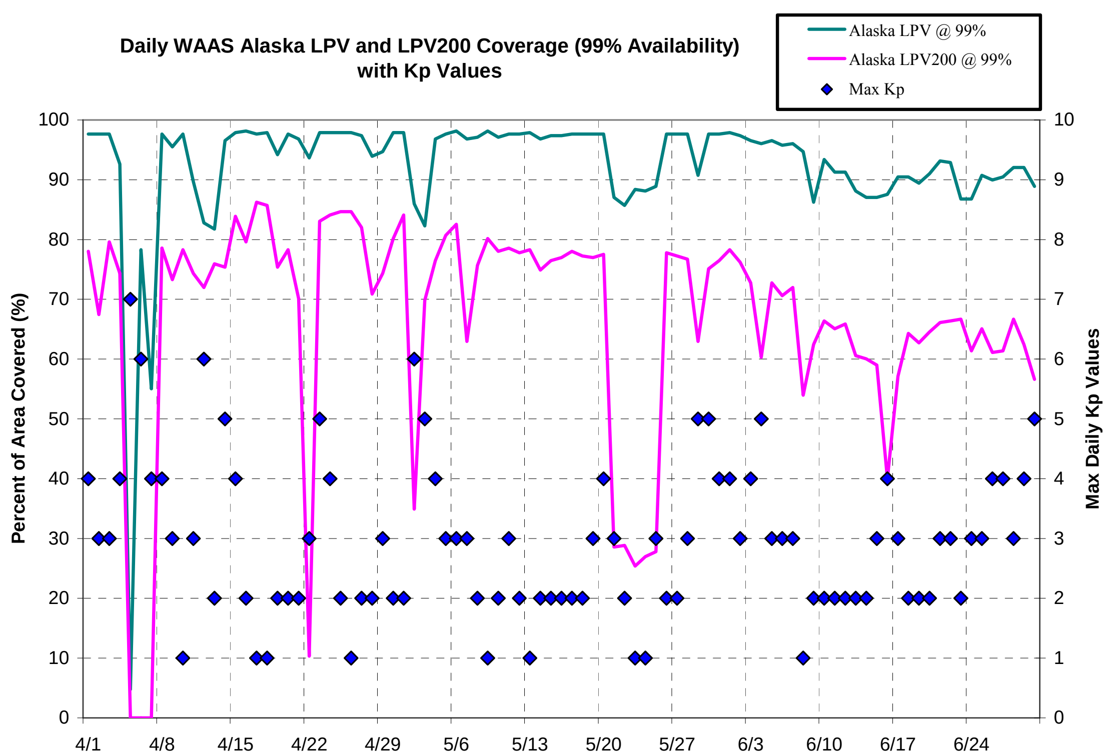
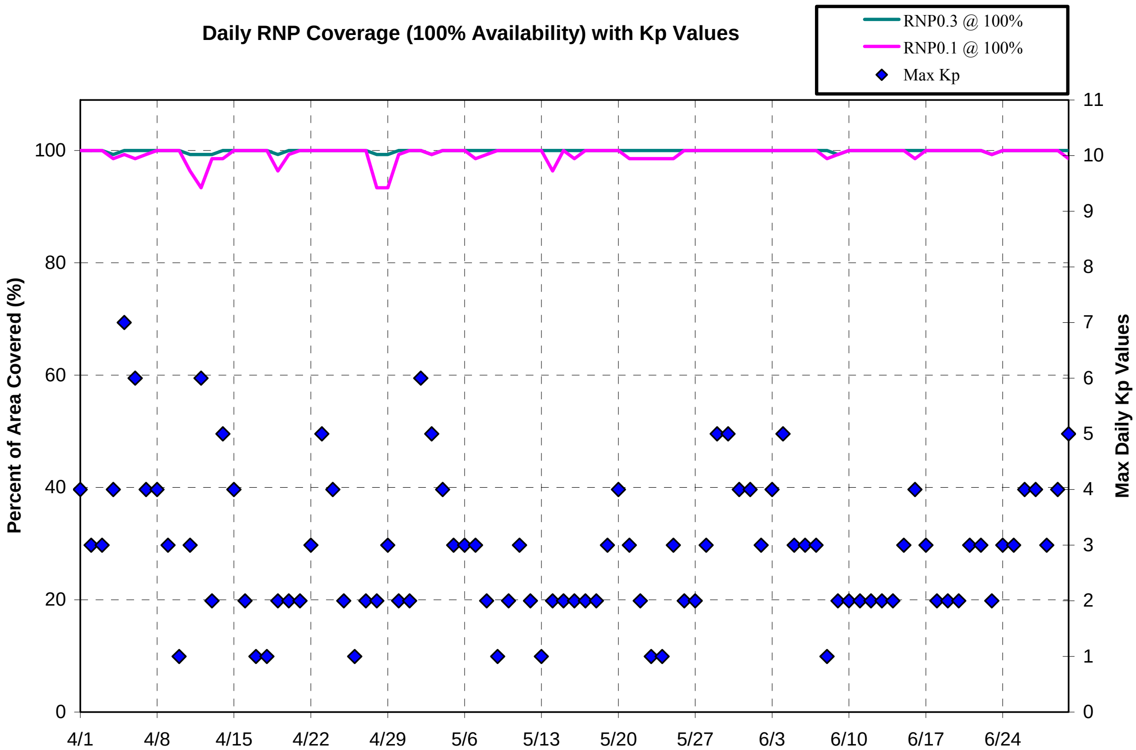


Figure 4-8 Daily RNP Coverage



5.0 <u>INTEGRITY</u>

5.1 HMI Analysis

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

Table 5.1 lists the safety index and the number of HMIs. For this evaluation period, the lowest safety margin index is 3.32 at Denver. There was no HMI event. Since WAAS was made available to the public in August 2000 there has not been an HMI event. WAAS was commissioned by the FAA for safety of life services in July 2003.

Table 5-1 Safety Margin Index and HMI Statistics

Location	Safety Index		Number of HMIs
	Horizontal	Vertical	
Arcata	5.68	6.10	0
Grand Forks	3.72	4.29	0
Oklahoma City	4.29	4.94	0
Albuquerque	3.36	7.23	0
Anchorage	7.88	6.91	0
Atlanta	4.21	6.45	0
Barrow	6.53	5.00	0
Bethel	5.51	9.33	0
Billings	3.67	7.26	0
Boston	7.02	5.02	0
Chicago	11.47	6.72	0
Cold Bay	13.74	9.98	0
Dallas	3.47	6.65	0
Denver	3.32	7.66	0
Fairbanks	6.41	10.66	0
Gander	10.53	12.40	0
Goose Bay	8.30	8.29	0
Houston	3.37	10.39	0
Iqaluit	10.44	6.26	0
Jacksonville	4.40	4.55	0
Juneau	4.15	7.61	0
Kansas City	3.43	7.54	0
Kotzebue	4.54	4.48	0
Los Angeles	3.68	8.91	0
Memphis	3.75	7.87	0
Merida	3.99	7.36	0
Mexico City	6.55	7.15	0
Miami	10.60	6.77	0
Minneapolis	4.06	8.73	0
New York	7.87	6.31	0
Oakland	3.38	7.41	0
Puerto Vallarta	4.58	7.94	0
Salt Lake City	3.40	7.91	0
San Jose Del Cabo	3.86	8.61	0
San Juan	10.52	8.74	0
Seattle	3.65	4.55	0
Tapachula	4.94	7.53	0
Washington DC	7.21	6.64	0
Winnipeg	9.71	6.25	0

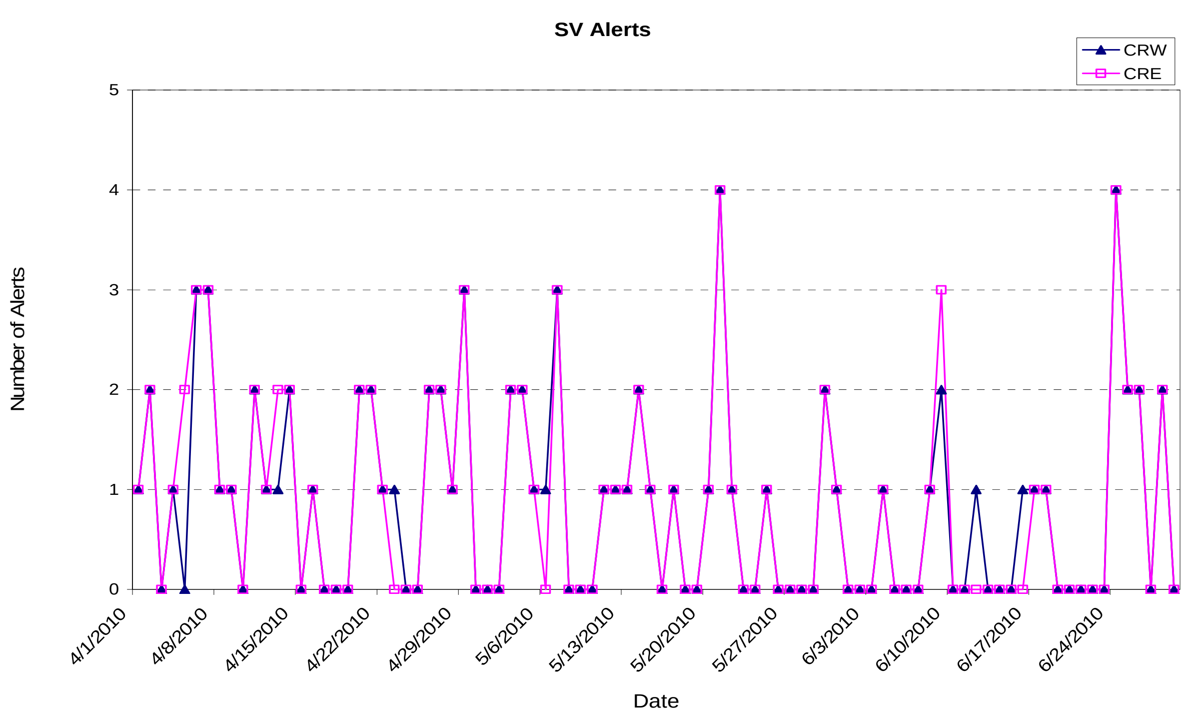
5.2 Broadcast Alerts

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	24	24	0.2667	0.2667
3	48	47	0.5333	0.5222
4	14	15	0.1556	0.1667
5	0	0	0	0
6	0	0	0	0
24	0	0	0	0
26	0	0	0	0
Total Alerts	86	86	0.9556	0.9556

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	105262	4	1936
2	1308982	50	6168
3	1310054	44	1929
4	1310001	49	1928
7	98182	11	1983
9	92107	2	2049
10	98093	4	2019
17	31241	2	2219

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

SV	On Time	Late	Max Late Length (seconds)
2	47376	0	0
3	50091	0	0
4	48402	0	0
5	48568	0	0
6	50541	0	0
7	47026	0	0
8	47411	2	344
9	42220	1	343
10	49326	0	0
11	50994	0	0
12	49096	1	168
13	47553	0	0
14	47838	0	0
15	50403	0	0
16	48288	0	0
17	47670	0	0
18	47436	0	0
19	50316	0	0
20	50535	0	0
21	46705	0	0
22	46447	0	0
23	47099	1	183
24	47400	0	0
26	48103	0	0
27	50658	1	168
28	47453	0	0
29	47704	0	0
30	50141	0	0
31	48876	0	0
32	46034	0	0

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

SV	On Time	Late	Max Late Length (seconds)
2	38915	1	190
3	41163	1	210
4	39746	0	0
5	39866	0	0
6	41524	0	0
7	38586	1	418
8	38974	3	420
9	34715	1	418
10	40462	1	122
11	41867	3	414
12	40330	1	165
13	39099	1	208
14	39307	0	0
15	41368	0	0
16	39673	2	208
17	39176	0	0
18	38949	2	128
19	41287	1	144
20	41520	2	152
21	38352	1	178
22	38133	3	2080
23	38663	2	2079
24	38886	1	178
26	39479	1	122
27	41612	1	128
28	38943	1	121
29	39223	1	136
30	41205	0	0
31	40098	2	165
32	37782	2	418
135	75078	3	210
138	74934	6	2080

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27279	8	2019
0	1	27291	11	2024
0	2	27286	8	2024
1	0	27290	8	2306
1	1	27282	5	2313
1	2	27288	7	2307
1	3	27277	10	2312
1	4	27300	5	2313
2	0	27284	5	2306
2	1	27283	7	2307
2	2	27284	10	2308
2	3	27277	9	2313
2	4	27281	9	2305
2	5	27297	9	2307
3	0	27274	11	2306
3	1	27281	12	2307
3	2	27282	11	2307
9	0	27297	7	2018
9	1	27283	8	2025
9	2	27276	10	2019
9	3	27276	11	2020
9	4	27282	13	2019
9	5	27302	5	2018
9	6	27279	12	2019

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

Band	On Time	Late	Max Late Length (seconds)
0	35586	5	2224
1	35612	5	2043
2	35565	5	2133
3	35543	3	2221
9	35614	3	2080

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

Message Type	On Time	Late	Max Late Length (seconds)
1	105047	2	3036
2	1309896	46	3022
3	1309931	44	3018
4	1309884	46	3012
7	97758	6	3141
9	92099	1	3088
10	97755	6	3106
17	31210	3	3239

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

SV	On Time	Late	Max Late Length (seconds)
2	47379	0	0
3	50077	0	0
4	48385	0	0
5	48575	0	0
6	50539	1	166
7	47006	0	0
8	47384	0	0
9	42187	0	0
10	49333	0	0
11	50987	1	170
12	49128	0	0
13	47548	0	0
14	47859	1	169
15	50385	0	0
16	48300	0	0
17	47664	0	0
18	47429	0	0
19	50289	0	0
20	50558	0	0
21	46710	1	166
22	46436	0	0
23	47126	0	0
24	47366	0	0
26	48082	1	170
27	50633	0	0
28	47413	0	0
29	47700	1	169
30	50170	0	0
31	48890	0	0
32	46062	0	0

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

SV	On Time	Late	Max Late Length (seconds)
2	38937	1	193
3	41143	1	147
4	39733	1	206
5	39873	1	123
6	41517	0	0
7	38575	0	0
8	38956	0	0
9	34688	1	208
10	40461	0	0
11	41866	0	0
12	40349	0	0
13	39073	1	205
14	39324	0	0
15	41345	1	208
16	39689	3	205
17	39172	2	208
18	38948	0	0
19	41285	3	3123
20	41529	1	153
21	38358	0	0
22	38133	1	144
23	38692	1	183
24	38862	1	170
26	39476	2	3123
27	41598	1	209
28	38908	0	0
29	39232	0	0
30	41228	2	183
31	40123	0	0
32	37796	1	121
135	45571	0	0
138	75308	2	160

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	27276	7	3478
0	1	27283	7	3482
0	2	27279	8	3468
1	0	27278	7	3470
1	1	27287	7	3456
1	2	27284	11	3465
1	3	27286	6	3182
1	4	27291	5	3184
2	0	27295	5	3178
2	1	27279	6	3184
2	2	27282	10	3183
2	3	27287	6	3183
2	4	27285	8	3172
2	5	27290	7	3182
3	0	27280	5	3168
3	1	27277	9	3182
3	2	27284	10	3172
9	0	27284	9	3177
9	1	27271	13	3178
9	2	27290	10	3168
9	3	27269	10	3476
9	4	27277	7	3471
9	5	27296	11	3461
9	6	27281	6	3471

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

Band	On Time	Late	Max Late Length (seconds)
0	35532	3	3358
1	35538	3	3327
2	35514	1	3216
3	35516	1	3202
9	35486	2	3188

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 Washington DC 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 Washington DC 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	3.29 Sigma Bounding(%)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1.663	100	1.407	100	1.758	100	1.391	100	2.300	100	1.171	100
3	0.715	100	1.233	100	1.216	100	1.269	100	1.236	100	1.46	100
4	1.401	100	1.783	100	1.517	100	1.557	100	1.299	100	1.803	100
5	1.842	100	1.429	100	1.323	100	1.474	100	1.794	100	1.234	100
6	1.624	100	1.201	100	1.273	100	1.664	100	2.312	100	1.498	100
7	1.146	100	1.239	100	1.294	100	1.059	100	1.087	100	1.34	100
8	0.988	100	1.149	100	1.144	100	1.016	100	0.958	100	1.228	100
9	0.945	100	1.603	100	1.016	100	1.157	100	1.595	100	1.313	100
10	1.119	100	0.946	100	0.980	100	1.067	100	1.815	100	1.523	100
11	1.009	100	0.821	100	1.132	100	1.297	100	1.328	100	0.896	100
12	1.164	100	1.359	100	1.158	100	1.212	100	2.468	100	1.706	100
13	1.256	100	1.236	100	1.197	100	0.995	100	1.736	100	1.356	100
14	1.866	100	0.888	100	1.074	100	1.042	100	1.467	100	0.939	100
15	1.121	100	1.241	100	1.363	100	1.856	100	1.766	100	1.61	100
16	1.133	100	1.179	100	1.275	100	1.459	100	1.399	100	1.07	100
17	2.426	100	1.300	100	1.750	100	1.161	100	1.263	100	1.189	100
18	1.580	100	0.921	100	1.373	100	1.502	100	1.520	100	1.109	100
19	2.781	100	2.166	100	2.407	100	2.441	100	2.259	100	2.543	100
20	1.254	100	1.508	100	1.655	100	1.284	100	1.869	100	1.251	100
21	1.311	100	1.223	100	1.751	100	1.396	100	1.278	100	1.098	100
22	1.450	100	0.910	100	1.615	100	1.593	100	1.775	100	1.075	100
23	1.764	100	1.822	100	2.260	100	2.229	100	1.982	100	1.61	100
24	1.540	100	1.703	100	1.699	100	1.698	100	1.986	100	1.963	100
25	-	-	-	-	-	-	-	-	-	-	-	-
26	1.401	100	1.447	100	1.451	100	1.889	100	1.843	100	1.732	100
27	1.207	100	1.147	100	1.195	100	1.540	100	1.337	100	1.307	100
28	1.226	100	0.879	100	1.354	100	1.381	100	1.765	100	0.847	100
29	1.754	100	1.777	100	1.189	100	1.466	100	1.121	100	1.719	100
30	1.667	100	1.349	100	1.482	100	1.692	100	1.678	100	1.802	100
31	1.085	100	1.576	100	0.919	100	1.018	100	1.519	100	1.532	100
32	0.966	100	1.003	100	0.942	100	1.178	100	1.209	100	1.578	100
135	1.977	99.9999	2.121	99.9999	2.839	99.9999	2.836	99.9999	1.937	99.9999	2.126	99.9999
138	1.865	100	1.696	100	1.943	100	1.676	100	2.201	100	1.922	100

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	-	-	-	-	-	-	-	-	-	-	-	-
2	2.165	100	1.772	100	1.679	100	1.599	100	0.922	100	1.451	100
3	0.923	100	1.079	100	1.337	100	1.536	100	1.694	100	1.414	100
4	1.527	100	1.111	100	2.027	100	1.479	100	2.034	100	1.356	100
5	0.869	100	1.331	100	1.385	100	1.697	100	1.996	100	1.145	100
6	1.153	100	1.012	100	1.193	100	1.673	100	1.822	100	1.748	100
7	0.985	100	0.998	100	1.425	100	1.000	100	1.828	100	1.077	100
8	0.802	100	0.739	100	1.129	100	1.209	100	1.593	100	1.031	100
9	0.982	100	1.185	100	1.426	100	1.208	100	1.816	100	1.280	100
10	1.387	100	1.086	100	1.118	100	1.032	100	1.331	100	0.743	100
11	1.207	100	1.107	100	1.038	100	1.444	100	1.001	100	1.470	100
12	1.061	100	0.974	100	1.197	100	1.263	100	1.686	100	1.158	100
13	0.813	100	1.309	100	1.825	100	1.136	100	1.611	100	1.087	100
14	0.986	100	1.169	100	1.407	100	0.848	100	1.346	100	0.913	100
15	1.264	100	1.038	100	1.693	100	1.403	100	1.992	100	1.495	100
16	1.554	100	1.121	100	1.594	100	1.176	100	0.994	100	1.018	100
17	0.947	100	1.112	100	1.408	100	0.936	100	1.517	100	1.001	100
18	1.453	100	1.436	100	1.643	100	1.430	100	0.930	100	1.214	100
19	2.325	100	2.400	100	2.453	100	2.559	100	2.060	100	2.622	100
20	1.567	100	1.660	100	1.258	100	1.249	100	1.055	100	1.202	100
21	1.565	100	1.328	100	1.324	100	1.531	100	0.838	100	1.229	100
22	1.842	100	1.779	100	2.224	100	1.137	100	0.988	100	1.422	100
23	2.066	100	2.053	100	2.341	100	1.872	100	1.436	100	1.695	100
24	1.078	100	1.664	100	2.414	100	1.668	100	2.229	100	1.651	100
25	-	-	-	-	-	-	-	-	-	-	-	-
26	1.047	100	1.224	100	1.779	100	1.535	100	2.032	100	1.422	100
27	1.147	100	1.040	100	1.468	100	1.566	100	1.783	100	1.345	100
28	1.202	100	0.901	100	2.160	100	0.913	100	0.870	100	0.710	100
29	1.006	100	1.638	100	1.794	100	1.267	100	1.878	100	1.474	100
30	1.543	100	1.072	100	1.734	100	1.326	100	2.375	100	1.622	100
31	1.081	100	0.906	100	1.479	100	0.987	100	1.587	100	1.160	100
32	0.973	100	1.270	100	1.238	100	1.123	100	1.526	100	0.914	100
135	1.858	99.9999	1.600	99.9999	2.186	99.9999	2.896	99.9999	2.079	99.9999	1.576	99.9999
138	2.153	100	1.909	100	1.783	100	1.800	100	2.122	100	1.470	100

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	-	-	-	-	-	-	-	-	-	-	-	-
2	1.263	100	0.907	100	1.244	100	0.937	100	1.156	100	0.785	100
3	0.278	100	0.558	100	0.416	100	0.463	100	0.546	100	0.656	100
4	0.772	100	1.314	100	0.998	100	1.134	100	1.240	100	1.387	100
5	0.962	100	0.845	100	0.629	100	0.659	100	0.924	100	0.573	100
6	0.583	100	0.683	100	0.568	100	0.804	100	1.135	100	0.673	100
7	0.647	100	0.643	100	0.463	100	0.567	100	0.676	100	0.573	100
8	0.394	100	0.522	100	0.534	100	0.482	100	0.584	100	0.558	100
9	0.424	100	0.733	100	0.374	100	0.378	100	0.677	100	0.469	100
10	0.628	100	0.474	100	0.352	100	0.352	100	1.130	100	0.715	100
11	0.609	100	0.457	100	0.446	100	0.450	100	0.551	100	0.367	100
12	0.470	100	0.727	100	0.475	100	0.499	100	0.948	100	0.773	100
13	0.469	100	0.653	100	0.485	100	0.467	100	0.874	100	0.618	100
14	1.211	100	0.365	100	0.682	100	0.294	100	0.676	100	0.327	100
15	0.590	100	0.706	100	0.499	100	0.900	100	0.967	100	0.863	100
16	0.831	100	0.518	100	0.567	100	0.489	100	0.850	100	0.451	100
17	1.556	100	0.769	100	1.003	100	0.624	100	0.919	100	0.615	100
18	1.209	100	0.715	100	0.734	100	0.781	100	0.758	100	0.568	100
19	1.750	100	1.455	100	1.521	100	1.369	100	1.337	100	1.437	100
20	0.775	100	0.728	100	0.868	100	0.526	100	0.887	100	0.581	100
21	1.096	100	0.678	100	1.152	100	0.938	100	0.834	100	0.623	100
22	1.111	100	0.610	100	0.958	100	0.840	100	1.042	100	0.666	100
23	1.378	100	1.310	100	1.525	100	1.376	100	1.348	100	1.105	100
24	0.830	100	1.039	100	0.804	100	0.932	100	1.126	100	1.172	100
25	-	-	-	-	-	-	-	-	-	-	-	-
26	0.764	100	0.925	100	0.685	100	0.947	100	1.170	100	1.043	100
27	0.491	100	0.646	100	0.431	100	0.548	100	0.689	100	0.611	100
28	0.866	100	0.412	100	0.839	100	0.576	100	0.994	100	0.369	100
29	0.699	100	1.014	100	0.614	100	0.659	100	0.758	100	0.915	100
30	0.703	100	0.837	100	0.642	100	0.707	100	0.692	100	0.811	100
31	0.418	100	0.752	100	0.218	100	0.514	100	0.894	100	0.987	100
32	0.498	100	0.492	100	0.379	100	0.343	100	0.500	100	0.732	100

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	-	-	-	-	-	-	-	-	-	-	-	-
2	1.161	100	1.216	100	0.810	100	1.009	100	0.455	100	1.068	100
3	0.385	100	0.429	100	0.648	100	0.777	100	0.875	100	0.578	100
4	1.016	100	0.749	100	1.234	100	0.891	100	1.293	100	0.774	100
5	0.539	100	0.676	100	0.865	100	0.698	100	1.067	100	0.632	100
6	0.575	100	0.499	100	0.610	100	0.679	100	1.000	100	0.672	100
7	0.515	100	0.493	100	0.780	100	0.471	100	1.050	100	0.618	100
8	0.477	100	0.351	100	0.648	100	0.538	100	0.912	100	0.511	100
9	0.494	100	0.492	100	0.565	100	0.529	100	0.890	100	0.580	100
10	0.699	100	0.497	100	0.401	100	0.398	100	0.545	100	0.377	100
11	0.604	100	0.528	100	0.515	100	0.593	100	0.391	100	0.854	100
12	0.526	100	0.486	100	0.670	100	0.581	100	0.930	100	0.514	100
13	0.476	100	0.519	100	0.972	100	0.426	100	0.876	100	0.486	100
14	0.434	100	0.647	100	0.554	100	0.395	100	0.598	100	0.548	100
15	0.644	100	0.547	100	0.831	100	0.623	100	1.010	100	0.710	100
16	0.793	100	0.690	100	0.442	100	0.635	100	0.369	100	0.691	100
17	0.695	100	0.609	100	0.839	100	0.448	100	0.948	100	0.432	100
18	0.803	100	0.978	100	0.735	100	0.908	100	0.394	100	1.051	100
19	1.504	100	1.643	100	1.251	100	1.647	100	1.094	100	1.838	100
20	0.666	100	0.909	100	0.647	100	0.706	100	0.390	100	0.635	100
21	0.784	100	0.974	100	0.909	100	1.300	100	0.378	100	0.951	100
22	0.949	100	1.029	100	1.061	100	0.761	100	0.433	100	0.912	100
23	1.389	100	1.510	100	1.565	100	1.261	100	0.956	100	1.193	100
24	0.915	100	1.021	100	1.368	100	0.897	100	1.412	100	0.928	100
25	-	-	-	-	-	-	-	-	-	-	-	-
26	0.728	100	0.691	100	1.004	100	0.813	100	1.227	100	0.782	100
27	0.643	100	0.460	100	0.679	100	0.747	100	0.880	100	0.623	100
28	0.572	100	0.539	100	1.263	100	0.486	100	0.377	100	0.534	100
29	0.753	100	0.821	100	1.044	100	0.593	100	1.186	100	0.725	100
30	0.886	100	0.646	100	0.955	100	0.657	100	1.205	100	0.735	100
31	0.565	100	0.436	100	0.680	100	0.374	100	0.820	100	0.490	100
32	0.426	100	0.480	100	0.641	100	0.416	100	0.758	100	0.431	100

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

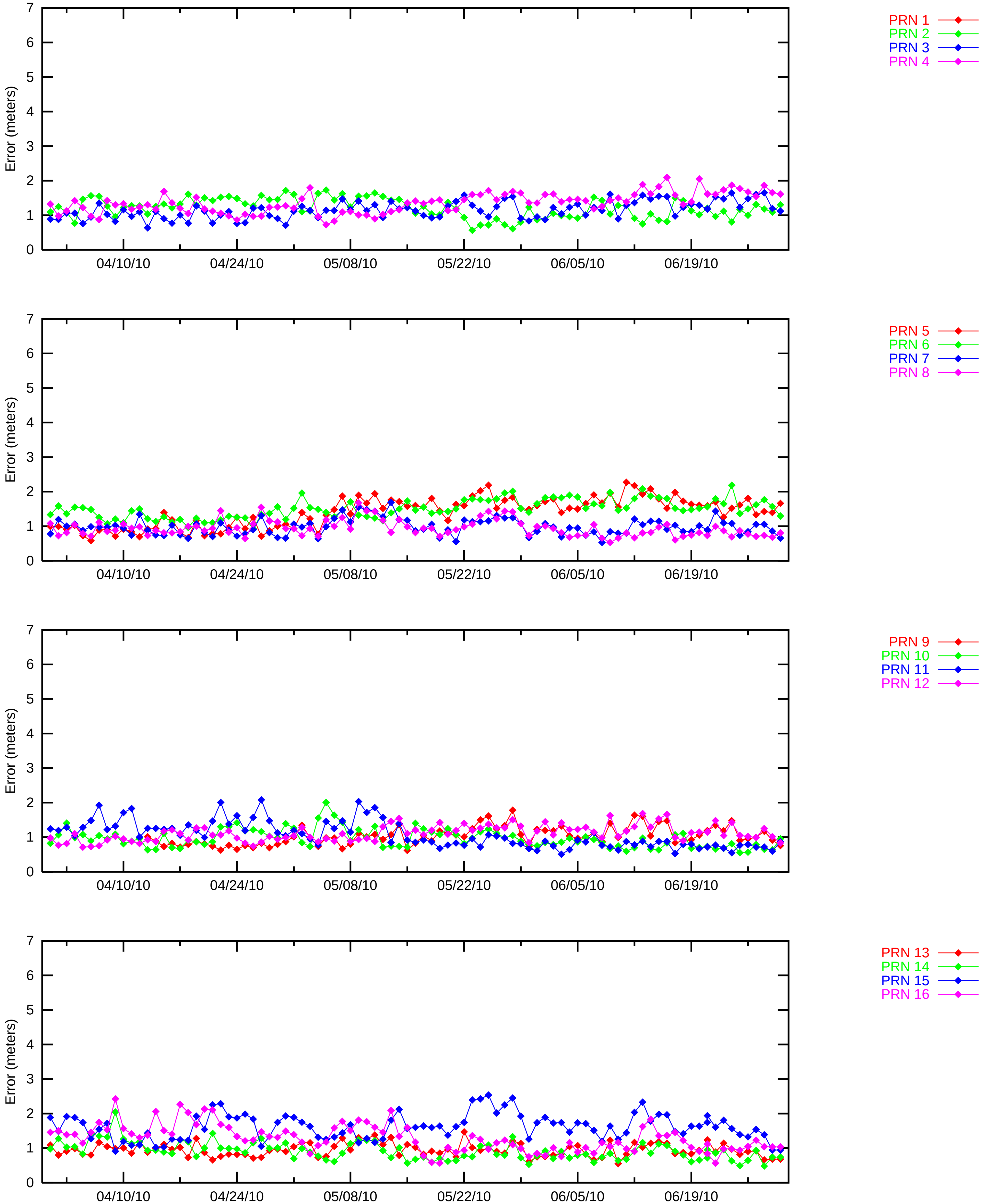


Figure 6-2 95% Range Error (PRN 17 - PRN 32) - Washington DC

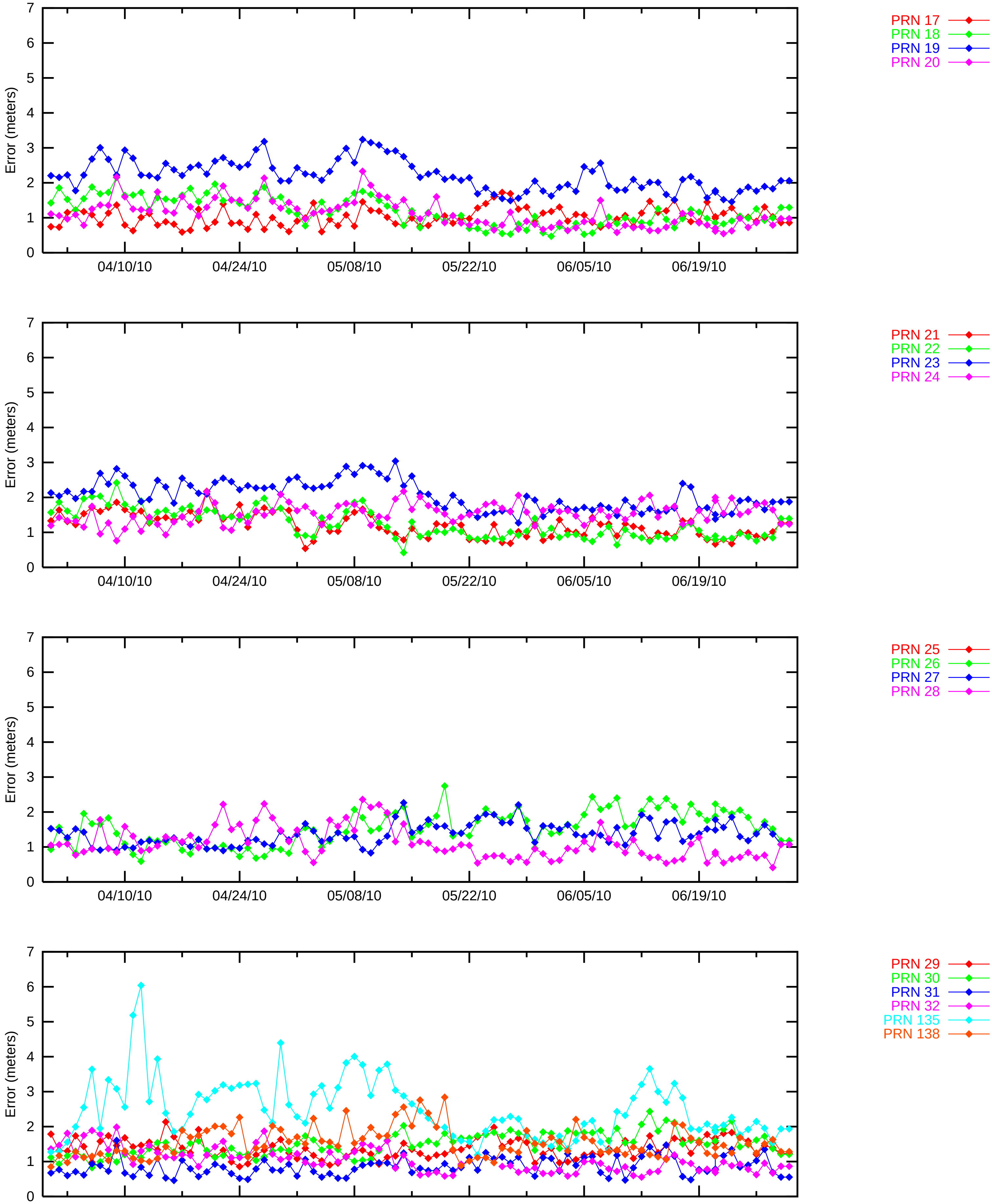


Figure 6-3 95% Ionospheric (PRN 1 - PRN 16) - Washington DC

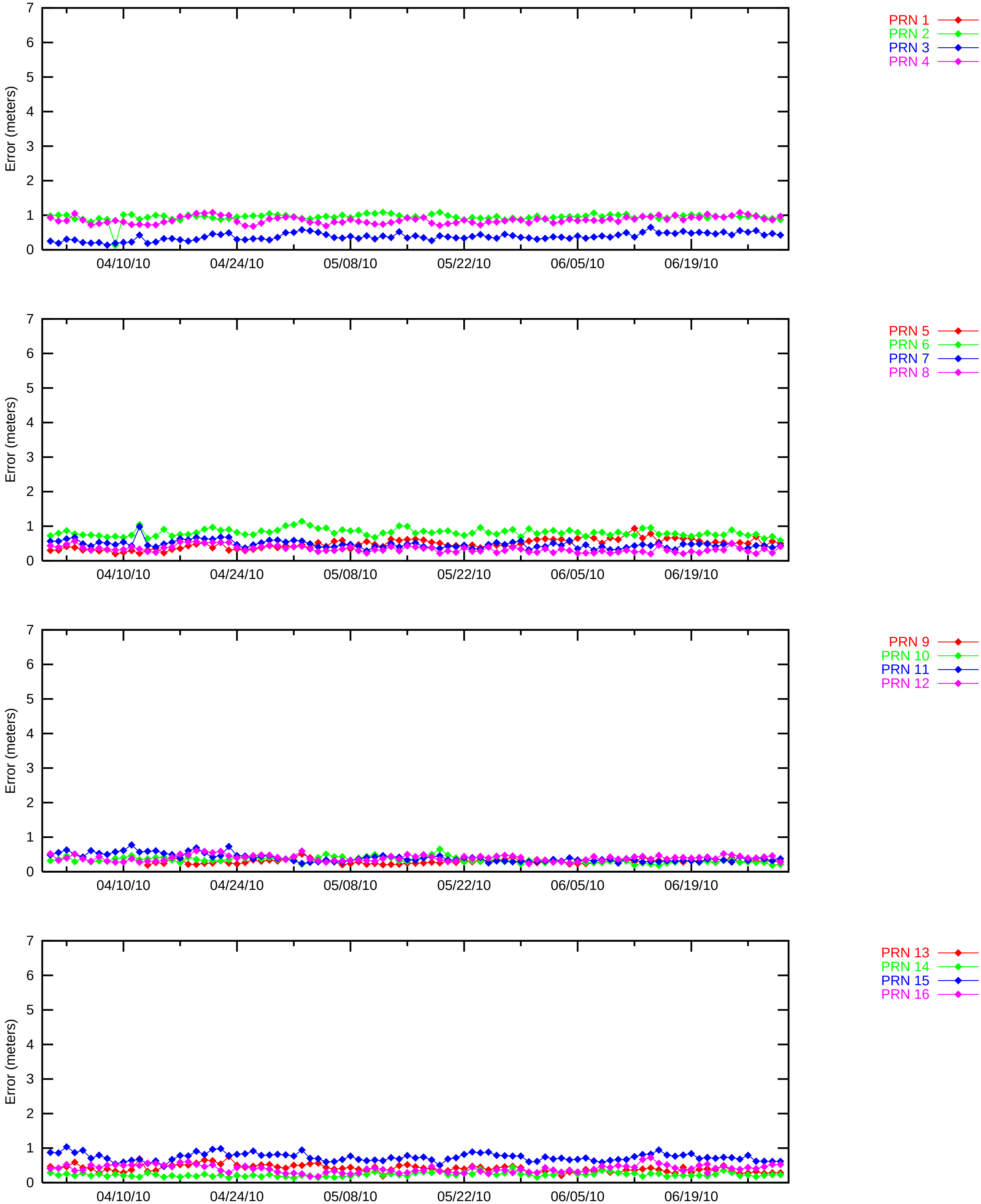
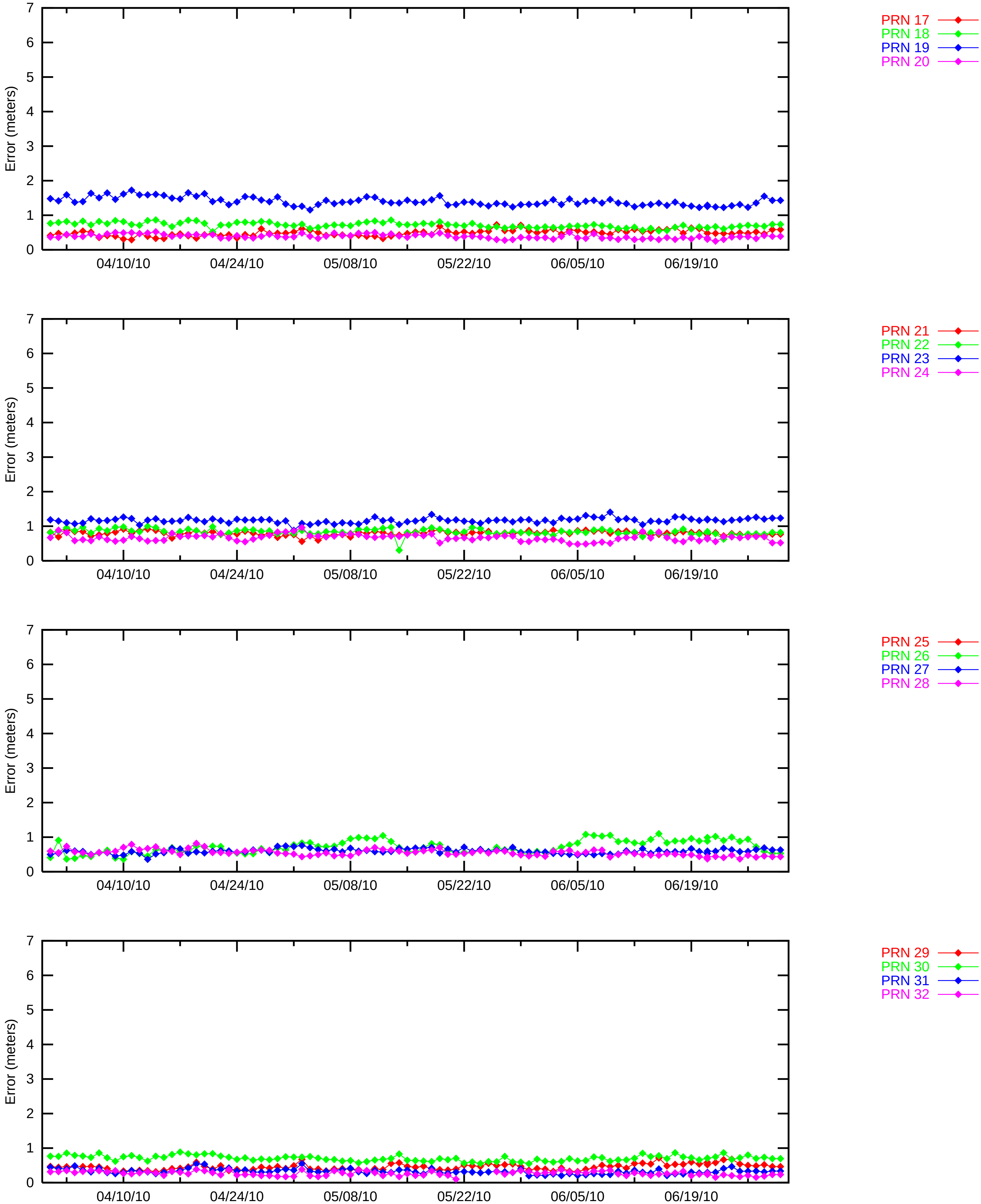


Figure 6-4 95% Ionospheric (PRN 17 - PRN 32) - Washington DC



7.0 GEO RANGING PERFORMANCE

WAAS GEO navigation messages provide corrections and UDRE values for each satellite. The GEO ranging availability from each GEO navigation message source was evaluated separately to determine the quality of service provided. For the evaluation period, both CRW (PRN 135) and CRE (PRN 138) GEO satellites provide ranging capability for enroute through NPA and PA service. Table 7.1 shows the GEO-Ranging performance for CRE and CRW GEO satellites throughout the evaluation period. Figure 7.1 shows the trend of CRW GEO PA Ranging Availability and Figure 7.2 shows the trend of CRE GEO PA Ranging Availability.

For this reporting period, from 4/5/10 to 5/19/10 when ZLA was the selected source for the CRE GEO, the CRW GEO UDRE reported by the CRE GEO was set to Not Monitored for most of the period causing low CRW GEO PA ranging availability. This problem was corrected on 5/20/10 when the selected source for the CRE GEO was changed from ZLA to ZTL. On 6/10/10, low CRW GEO PA ranging availability is due to lightning that caused a failure of the GUS at Napa which resulted in a 314 second CRW SIS outage. From 6/23/10 to 6/24/10, the Safety computer at Napa faulted resulting in a GUS switch over and low CRW GEO PA ranging availability.

Table 7-1 GEO Ranging Availability

GEO Source	GEO	PA (%)	NPA (%)	Not Monitored (%)	Do Not Use (%)
CRW 135	CRW	95.481	3.726	0.573	0.188
CRW 135	CRE	97.927	1.045	0.85	0.147
CRE 138	CRW	56.591	3.652	39.552	0.165
CRE 138	CRE	98.453	1.045	0.317	0.146

Figure 7-1 Daily PA CRW GEO Ranging Availability Trend

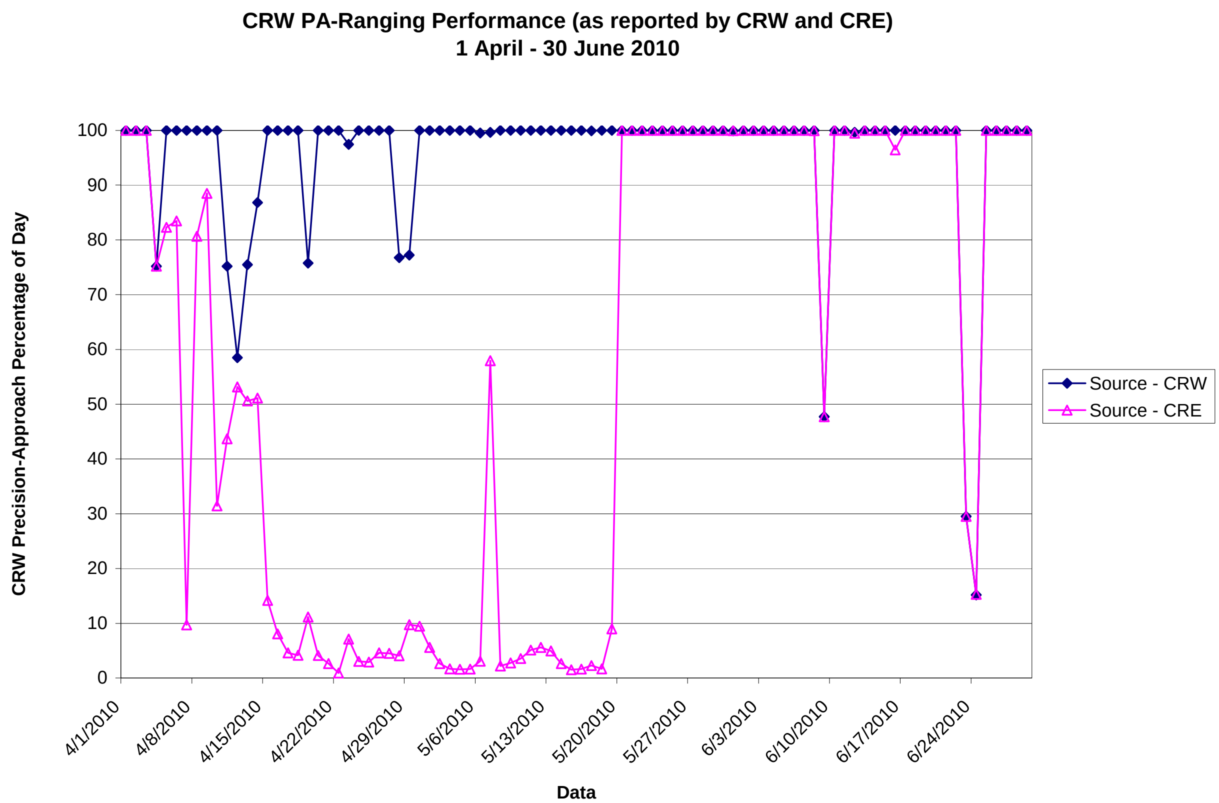
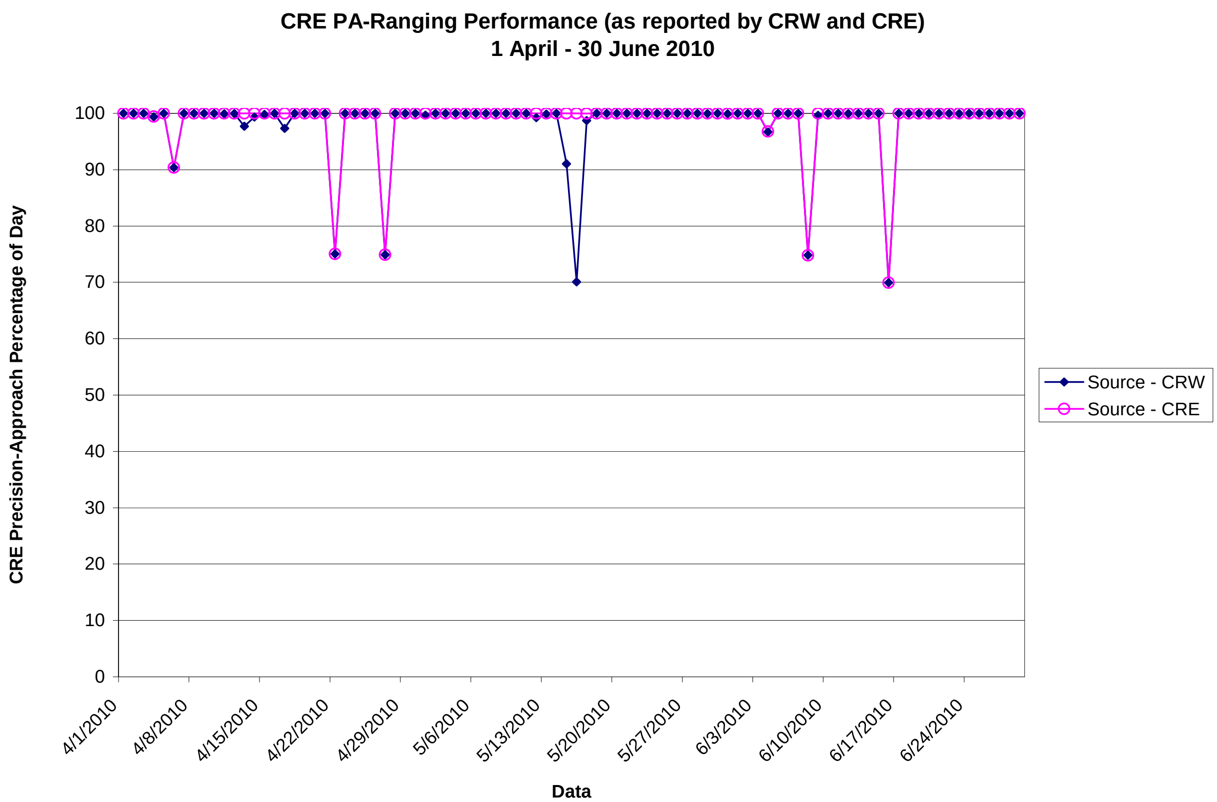


Figure 7-2 Daily PA CRE GEO Ranging Availability Trend



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	Event Description
04/03/10	C&V faulted due to broadcast message validation mis-compare. See DR # 91 CRE Reports High UDREs for CRW.
04/05/10	Large geomagnetic storm caused scintillation at multiple Alaska sites, WAAS service outages, and higher than normal VPE. See DR # 93 Ionospheric Storm Caused Alaska coverage Drop.
04/27/10	NANU 2010080 Planned Maintenance. Affected LPV and LPV200 coverage. See DR #94 PRN 17 NANU Affects WAAS Coverage
05/07/10	High range error on PRN135 as broadcast from PRN138 Geo stream caused high position errors and ratios. See DR #96 PRN 138 GEO Stream Caused Increased Position Errors and Ratios.
05/21/10	NANU 2010094 thru NANU 2010097. Both PRN 32 and PRN 16 experienced unplanned outages. Satellites were not tracked by any receivers with no unhealthy ephemeris. Events were not overlapped. Affected LPV coverge. See DR #95 PRN 16 and PRN 32 Unplanned Outage.

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, which provide a graphical representation of WAAS LPV service availability and outage counts, are omitted for this reporting period.

Table 9-1 WAAS LPV Outages and Availability

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PACD	COLD BAY	AK	45	0.995653	645	0.869218
PAEM	EMMONAK	AK	4	0.999496	182	0.975959
PAEN	KENAI MUNICIPAL	AK	3	0.999631	12	0.997949
PAFA	FAIRBANKS INTL	AK	2	0.999677	17	0.998293
PAGA	EDWARD G. PITKA SR	AK	3	0.999669	23	0.997190
PAGB	GALBRAITH LAKE	AK	2	0.999632	31	0.996621
PAGK	GULKANA	AK	2	0.999742	10	0.998508
PAHL	HUSLIA	AK	2	0.999671	25	0.996865
PAHO	HOMER	AK	2	0.999770	12	0.997820
PAKN	KING SALMON	AK	3	0.999675	48	0.994700
PAKT	KETCHIKAN INTL	AK	1	0.999967	3	0.999183
PAMK	ST MICHAEL	AK	2	0.999598	97	0.989990
PANC	TED STEVENS ANCHORAGE INTL	AK	3	0.999513	12	0.998109
PARY	RUBY	AK	2	0.999687	18	0.997540
PASK	SELAWIK	AK	3	0.999626	143	0.989349
PASM	ST MARY'S	AK	5	0.999474	162	0.983548
PAYA	YAKUTAT	AK	2	0.999742	4	0.999130
2R5	ST ELMO	AL	0	1	4	0.999757
79J	SOUTH ALABAMA RGNL AT BILL BEN	AL	0	1	4	0.999711
8A0	ALBERTVILLE RGNL-THOMAS J BRUM	AL	0	1	2	0.999816
ANB	ANNISTON METROPOLITAN	AL	0	1	4	0.999776
ASN	TALLADEGA MUNICIPAL	AL	0	1	5	0.999764
AUO	AUBURN-OPELIKA ROBERT G PITTS	AL	0	1	4	0.999736
BFM	MOBILE DOWNTOWN	AL	0	1	4	0.999747
BHM	BIRMINGHAM INTL	AL	0	1	4	0.999767
DCU	PRYOR FIELD RGNL	AL	0	1	2	0.999823
DHN	DOTHAN RGNL	AL	0	1	4	0.999765
EKY	BESSEMER	AL	0	1	4	0.999736
GAD	NORTHEAST ALABAMA RGNL	AL	0	1	4	0.999795
HSV	HUNTSVILLE INTL-CARL T JONES F	AL	0	1	2	0.999823

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
JKA	JACK EDWARDS	AL	0	1	5	0.999740
MDQ	MADISON COUNTY EXECUTIVE/TOM S	AL	0	1	2	0.999830
MGM	MONTGOMERY RGNL DANNELLY FIELD	AL	0	1	4	0.999694
MOB	MOBILE RGNL	AL	0	1	4	0.999749
MSL	NORTHWEST ALABAMA RGNL	AL	0	1	2	0.999818
PLR	ST CLAIR COUNTY	AL	0	1	4	0.999754
SEM	CRAIG FIELD	AL	0	1	4	0.999685
TCL	TUSCALOOSA RGNL	AL	0	1	3	0.999770
TOI	TROY MUNICIPAL	AL	0	1	4	0.999709
ARG	WALNUT RIDGE RGNL	AR	0	1	2	0.999799
ASG	SPRINGDALE MUNICIPAL	AR	0	1	1	0.999930
BPK	OZARK RGNL	AR	0	1	2	0.999899
BYH	ARKANSAS INTL	AR	0	1	2	0.999769
ELD	SOUTH ARKANSAS RGNL AT GOODWIN	AR	0	1	3	0.999764
FSM	FORT SMITH RGNL	AR	0	1	2	0.999866
HRO	BOONE COUNTY	AR	0	1	2	0.999927
JBR	JONESBORO MUNICIPAL	AR	0	1	2	0.999783
LIT	ADAMS FIELD	AR	0	1	2	0.999811
M19	NEWPORT MUNICIPAL	AR	0	1	2	0.999799
M73	ALMYRA MUNICIPAL	AR	0	1	2	0.999786
ORK	NORTH LITTLE ROCK MUNICIPAL	AR	0	1	2	0.999813
PBF	GRIDER FIELD	AR	0	1	2	0.999791
ROG	ROGERS MUNICIPAL-CARTER FIELD	AR	0	1	1	0.999932
RUE	RUSSELLVILLE RGNL	AR	0	1	2	0.999895
SGT	STUTTGART MUNICIPAL	AR	0	1	2	0.999790
SLG	SMITH FIELD	AR	0	1	1	0.999941
SRC	SEARCY MUNICIPAL	AR	0	1	2	0.999805
SUZ	SALINE COUNTY RGNL	AR	0	1	2	0.999817
VBT	BENTONVILLE MUNICIPAL LOUISE M THAD	AR	0	1	1	0.999933
XNA	NORTHWEST ARKANSAS RGNL	AR	0	1	1	0.999931
DVT	PHOENIX DEER VALLEY	AZ	0	1	55	0.997687
GCN	GRAND CANYON NATIONAL PARK	AZ	0	1	1	0.999998
GEU	GLENDALE MUNICIPAL	AZ	0	1	58	0.997061
IFP	LAUGHLIN/BULLHEAD INTL	AZ	0	1	31	0.999395
IWA	PHOENIX-MESA GATEWAY	AZ	17	0.999870	94	0.988781
PGA	PAGE MUNICIPAL	AZ	0	1	0	1
PHX	PHOENIX SKY HARBOR INTL	AZ	0	1	57	0.995913
PRC	ERNEST A. LOVE FIELD	AZ	0	1	11	0.999886
SJN	ST JOHNS INDUSTRIAL AIR PARK	AZ	1	0.999998	115	0.995405
TUS	TUCSON INTL	AZ	56	0.997859	94	0.985371
ACV	ARCATA	CA	4	0.999604	174	0.976015
APC	NAPA COUNTY	CA	3	0.999694	330	0.958649
APV	APPLE VALLEY	CA	0	1	66	0.995117
BFL	MEADOWS FIELD	CA	2	0.999941	159	0.983052
C83	BYRON	CA	3	0.999815	262	0.966914
CMA	CAMARILLO	CA	2	0.999915	212	0.964543
CNO	CHINO	CA	0	1	149	0.984064
CRQ	MC CLELLAN-PALOMAR	CA	0	1	151	0.979040
CVH	HOLLISTER MUNICIPAL	CA	3	0.999816	294	0.961415
DAG	BARSTOW-DAGGETT	CA	0	1	53	0.997010

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FAT	FRESNO YOSEMITE INTL	CA	2	0.999916	168	0.983533
HAF	HALF MOON BAY	CA	4	0.999707	349	0.952585
HWD	HAYWARD EXECUTIVE	CA	3	0.999799	324	0.957242
LAX	LOS ANGELES INTL	CA	2	0.999967	205	0.973286
LGB	LONG BEACH /DAUGHERTY FIELD	CA	1	0.999995	192	0.976700
MAE	MADERA MUNICIPAL	CA	3	0.999912	175	0.979469
MCE	MERCED MUNICIPAL MACREADY FIELD	CA	3	0.999876	198	0.976530
MHR	SACRAMENTO MATHER	CA	3	0.999750	255	0.978316
MOD	MODESTO CITY-CO-HARRY SHAM FLD	CA	3	0.999852	238	0.973921
MRY	MONTEREY PENINSULA	CA	4	0.999770	339	0.956670
O02	NERVINO	CA	2	0.999919	103	0.991710
OAK	METROPOLITAN OAKLAND INTL	CA	3	0.999781	334	0.956562
ONT	ONTARIO INTL	CA	0	1	149	0.984683
OXR	OXNARD	CA	2	0.999908	213	0.963154
PMD	PALMDALE RGNL/USAF PLANT 42	CA	1	0.999985	166	0.985914
RAL	RIVERSIDE MUNICIPAL	CA	0	1	124	0.984872
RBL	RED BLUFF MUNICIPAL	CA	3	0.999834	188	0.983563
RDD	REDDING MUNICIPAL	CA	2	0.999837	151	0.986289
SBA	SANTA BARBARA MUNICIPAL	CA	2	0.999885	226	0.957719
SFO	SAN FRANCISCO INTL	CA	4	0.999731	341	0.954436
SJC	NORMAN Y. MINETA SAN JOSE INTL	CA	3	0.999784	318	0.958123
SMF	SACRAMENTO INTL	CA	3	0.999731	265	0.975503
SNA	JOHN WAYNE AIRPORT-ORANGE COUN	CA	1	0.999999	183	0.979352
TCY	TRACY MUNICIPAL	CA	3	0.999825	255	0.968092
VCB	NUT TREE	CA	3	0.999720	281	0.967074
WJF	GENERAL WM J FOX AIRFIELD	CA	1	0.999971	166	0.985388
AKO	COLORADO PLAINS RGNL	CO	0	1	31	0.997445
ALS	SAN LUIS VALLEY RGNL BERGMAN FIELD	CO	0	1	32	0.997370
APA	CENTENNIAL	CO	0	1	27	0.998674
CEZ	CORTEZ MUNICIPAL	CO	0	1	7	0.999770
COS	CITY OF COLORADO SPRINGS MUNICIPAL	CO	0	1	31	0.997473
DEN	DENVER INTL	CO	0	1	21	0.999305
FTG	FRONT RANGE	CO	0	1	27	0.998321
GXY	GREELEY-WELD COUNTY	CO	0	1	2	0.999829
HDN	YAMPA VALLEY	CO	0	1	1	0.999931
ITR	KIT CARSON COUNTY	CO	0	1	32	0.997084
LAA	LAMAR MUNICIPAL	CO	0	1	32	0.997110
PUB	PUEBLO MEMORIAL	CO	0	1	31	0.997318
RIL	GARFIELD COUNTY RGNL	CO	0	1	1	0.999923
BDL	BRADLEY INTL	CT	0	1	4	0.999908
GON	GROTON-NEW LONDON	CT	0	1	4	0.999909
HVN	TWEED-NEW HAVEN	CT	0	1	3	0.999925
OXC	WATERBURY-OXFORD	CT	0	1	3	0.999921
DCA	RONALD REAGAN WASHINGTON NATIONAL	DC	0	1	3	0.999987
EVY	SUMMIT	DE	0	1	2	0.999999
GED	SUSSEX COUNTY	DE	0	1	0	1
AAF	APALACHICOLA MUNICIPAL	FL	0	1	4	0.999769
APF	NAPLES MUNICIPAL	FL	0	1	15	0.999162

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BCT	BOCA RATON	FL	0	1	27	0.999021
BKV	HERNANDO COUNTY	FL	0	1	2	0.999684
CEW	BOB SIKES	FL	0	1	4	0.999735
COI	MERRITT ISLAND	FL	0	1	6	0.999647
DAB	DAYTONA BEACH INTL	FL	0	1	2	0.999727
DED	DELAND MUNICIPAL-SIDNEY H TAYLOR FIELD	FL	0	1	2	0.999715
EVB	NEW SMYRNA BEACH MUNICIPAL	FL	0	1	2	0.999717
EYW	KEY WEST INTL	FL	1	0.999984	81	0.995755
FLL	FORT LAUDERDALE HOLLYWOOD INTL	FL	0	1	36	0.998816
FPR	ST LUCIE COUNTY INTL	FL	0	1	9	0.999482
FXE	FORT LAUDERDALE EXECUTIVE	FL	0	1	30	0.998932
GIF	WINTER HAVEN'S GILBERT	FL	0	1	3	0.999663
GNV	GAINESVILLE RGNL	FL	0	1	2	0.999807
ISM	KISSIMMEE GATEWAY	FL	0	1	2	0.999675
JAX	JACKSONVILLE INTL	FL	0	1	2	0.999830
LAL	LAKELAND LINDER RGNL	FL	0	1	3	0.999659
LCQ	LAKE CITY MUNICIPAL	FL	0	1	2	0.999817
LEE	LEESBURG INTL	FL	0	1	2	0.999706
MCO	ORLANDO INTL	FL	0	1	4	0.999671
MIA	MIAMI INTL	FL	0	1	42	0.998614
MLB	MELBOURNE INTL	FL	0	1	6	0.999642
MTH	THE FLORIDA KEYS MARATHON	FL	2	0.999964	84	0.995640
OCF	OCALA INTL-JIM TAYLOR FIELD	FL	0	1	2	0.999787
PBI	PALM BEACH INTL	FL	0	1	16	0.999211
PFN	PANAMA CITY-BAY CO INTL	FL	0	1	3	0.999810
PGD	CHARLOTTE COUNTY	FL	0	1	8	0.999489
PHK	PALM BEACH CO GLADES	FL	0	1	11	0.999368
PIE	ST PETERSBURG-CLEARWATER INTL	FL	0	1	2	0.999655
PMP	POMPANO BEACH AIRPARK	FL	0	1	29	0.998959
PNS	PENSACOLA RGNL	FL	0	1	4	0.999724
RSW	SOUTHWEST FLORIDA INTL	FL	0	1	11	0.999288
SFB	ORLANDO SANFORD INTL	FL	0	1	2	0.999702
SRQ	SARASOTA/BRADENTON INTL	FL	0	1	6	0.999603
TLH	TALLAHASSEE RGNL	FL	0	1	2	0.999819
TMB	KENDALL-TAMIAMI EXECUTIVE	FL	0	1	51	0.998316
TPA	TAMPA INTL	FL	0	1	3	0.999659
VDF	VANDENBERG	FL	0	1	3	0.999659
X14	LA BELLE MUNICIPAL	FL	0	1	9	0.999394
XFL	FLAGLER COUNTY	FL	0	1	2	0.999791
15J	COOK COUNTY	GA	0	1	3	0.999822
18A	FRANKLIN COUNTY	GA	0	1	3	0.999878
19A	JACKSON COUNTY	GA	0	1	3	0.999855
47A	CHEROKEE COUNTY	GA	0	1	3	0.999853
ABY	SOUTHWEST GEORGIA RGNL	GA	0	1	3	0.999803
ACJ	SOUTHER FIELD	GA	0	1	3	0.999785
AGS	AUGUSTA RGNL AT BUSH FIELD	GA	0	1	3	0.999882
ATL	HARTSFIELD - JACKSON ATLANTA	GA	0	1	3	0.999809
AYS	WAYCROSS-WARE COUNTY	GA	0	1	3	0.999826
BQK	BRUNSWICK GOLDEN ISLES	GA	0	1	3	0.999830
CCO	NEWNAN COWETA COUNTY	GA	0	1	3	0.999783

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CKF	CRISP COUNTY-CORDELE	GA	0	1	3	0.999797
CSG	COLUMBUS METROPOLITAN	GA	0	1	3	0.999757
CTJ	WEST GEORGIA RGNL – O V GRAY FIELD	GA	0	1	3	0.999801
DNN	DALTON MUNICIPAL	GA	0	1	2	0.999863
EZM	HEART OF GEORGIA RGNL	GA	0	1	3	0.999802
FFC	PEACHTREE CITY-FALCON FIELD	GA	0	1	3	0.999792
FTY	FULTON COUNTY AIRPORT-BROWN FIELD	GA	0	1	3	0.999817
GVL	LEE GILMER MEMORIAL	GA	0	1	3	0.999858
IIY	WASHINGTON-WILKES COUNTY	GA	0	1	3	0.999868
JYL	PLANTATION ARPK	GA	0	1	3	0.999864
JZP	PICKENS COUNTY	GA	0	1	3	0.999862
MCN	MIDDLE GEORGIA RGNL	GA	0	1	3	0.999799
MGR	MOULTRIE MUNICIPAL	GA	0	1	3	0.999821
MQW	TELFAIR-WHEELER	GA	0	1	3	0.999808
PXE	PERRY-HOUSTON COUNTY	GA	0	1	3	0.999786
RYY	COBB COUNTY-MC COLLUM FIELD	GA	0	1	3	0.999834
SAV	SAVANNAH/HILTON HEAD INTL	GA	0	1	3	0.999832
SBO	EMANUEL COUNTY	GA	0	1	3	0.999835
TBR	STATESBORO-BULLOCH COUNTY	GA	0	1	3	0.999849
TOC	TOCCOA RG LETOURNEAU FIELD	GA	0	1	3	0.999887
TVI	THOMASVILLE RGNL	GA	0	1	2	0.999818
VDI	VIDALIA RGNL	GA	0	1	3	0.999816
VLD	VALDOSTA RGNL	GA	0	1	2	0.999820
VPC	CARTERSVILLE	GA	0	1	3	0.999839
WDR	WINDER-BARROW	GA	0	1	3	0.999845
ALO	WATERLOO RGNL	IA	0	1	1	0.999964
CBF	COUNCIL BLUFFS MUNICIPAL	IA	0	1	0	1
CID	THE EASTERN IOWA	IA	0	1	1	0.999963
DBQ	DUBUQUE RGNL	IA	0	1	1	0.999971
DNS	DENISON MUNICIPAL	IA	0	1	1	0.999974
DSM	DES MOINES INTL	IA	0	1	1	0.999953
DVN	DAVENPORT MUNICIPAL	IA	0	1	1	0.999972
EOK	KEOKUK MUNICIPAL	IA	0	1	1	0.999965
EST	ESTHERVILLE MUNICIPAL	IA	0	1	1	0.999940
FFL	FAIRFIELD MUNICIPAL	IA	0	1	1	0.999965
GGI	GRINNELL RGNL	IA	0	1	1	0.999967
IKV	ANKENY RGNL	IA	0	1	1	0.999954
MCW	MASON CITY MUNICIPAL	IA	0	1	1	0.999960
MUT	MUSCATINE MUNICIPAL	IA	0	1	1	0.999966
MXO	MONTICELLO RGNL	IA	0	1	1	0.999962
OTM	OTTUMWA INDUSTRIAL	IA	0	1	1	0.999962
PRO	PERRY MUNICIPAL	IA	0	1	1	0.999955
SDA	SHENANDOAH MUNICIPAL	IA	0	1	1	0.999983
SLB	STORM LAKE MUNICIPAL	IA	0	1	1	0.999979
TNU	NEWTON MUNICIPAL	IA	0	1	1	0.999963
BOI	BOISE AIR TERMINAL/GOWEN FLD	ID	0	1	0	1
EUL	CALDWELL INDUSTRIAL	ID	1	0.999993	40	0.999727
GNG	GOODING MUNICIPAL	ID	0	1	0	1
IDA	IDAHO FALLS RGNL	ID	0	1	0	1
LWS	LEWISTON-NEZ PERCE COUNTY	ID	1	0.999999	43	0.999847

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PIH	POCATELLO RGNL	ID	0	1	0	1
S67	NAMPA MUNICIPAL	ID	1	0.999998	40	0.999922
3LF	LITCHFIELD MUNICIPAL	IL	0	1	2	0.999897
ALN	ST LOUIS RGNL	IL	0	1	2	0.999890
ARR	AURORA MUNICIPAL	IL	0	1	1	0.999909
BMI	CENTRAL IL REGL ARPT AT BLOOMI	IL	0	1	1	0.999907
C15	PEKIN MUNICIPAL	IL	0	1	1	0.999907
DEC	DECATUR	IL	0	1	1	0.999906
DKB	DE KALB TAYLOR MUNICIPAL	IL	0	1	1	0.999910
DNV	VERMILION COUNTY	IL	0	1	1	0.999970
ENL	CENTRALIA MUNICIPAL	IL	0	1	2	0.999883
FEP	ALBERTUS	IL	0	1	1	0.999916
FOA	FLORA MUNICIPAL	IL	0	1	2	0.999895
IGQ	LANSING MUNICIPAL	IL	0	1	1	0.999974
IKK	GREATER KANKAKEE	IL	0	1	1	0.999908
LOT	LEWIS UNIVERSITY	IL	0	1	1	0.999913
MDW	CHICAGO MIDWAY INTL	IL	0	1	1	0.999908
MLI	QUAD CITY INTL	IL	0	1	1	0.999974
MWA	WILLIAMSON COUNTY RGNL	IL	0	1	2	0.999854
ORD	CHICAGO O'HARE INTL	IL	0	1	1	0.999909
PIA	GREATER PEORIA RGNL	IL	0	1	1	0.999908
PNT	PONTIAC MUNICIPAL	IL	0	1	1	0.999907
PPQ	PITTSFIELD PENSTONE MUNICIPAL	IL	0	1	1	0.999967
RFD	CHICAGO/ROCKFORD INTL	IL	0	1	1	0.999912
RSV	ROBINSON MUNICIPAL	IL	0	1	1	0.999906
SLO	SALEM-LECKRONE	IL	0	1	2	0.999890
SPI	ABRAHAM LINCOLN CAPITAL	IL	0	1	1	0.999903
TIP	RANTOUL NATL AVN CNTR-FRANK EL	IL	0	1	1	0.999903
UGN	WAUKEGAN RGNL	IL	0	1	1	0.999981
UIN	QUINCY RGNL-BALDWIN FIELD	IL	0	1	1	0.999966
4I7	PUTNAM COUNTY	IN	0	1	1	0.999962
ANQ	TRI-STATE STEUBEN COUNTY	IN	0	1	1	0.999953
BAK	COLUMBUS MUNICIPAL	IN	0	1	1	0.999947
BMG	MONROE COUNTY	IN	0	1	1	0.999956
CEV	METTEL FIELD	IN	0	1	1	0.999943
EKM	ELKHART MUNICIPAL	IN	0	1	1	0.999959
EYE	EAGLE CREEK AIRPARK	IN	0	1	1	0.999954
FWA	FORT WAYNE INTL	IN	0	1	1	0.999952
GEZ	SHELBYVILLE MUNICIPAL	IN	0	1	1	0.999947
GGP	LOGANSPORT/CASS COUNTY	IN	0	1	1	0.999959
GSH	GOSHEN MUNICIPAL	IN	0	1	1	0.999955
GWB	DE KALB COUNTY	IN	0	1	1	0.999953
HFY	GREENWOOD MUNICIPAL	IN	0	1	1	0.999951
IMS	MADISON MUNICIPAL	IN	0	1	1	0.999943
IND	INDIANAPOLIS INTL	IN	0	1	1	0.999954
LAF	PURDUE UNIVERSITY	IN	0	1	1	0.999961
MIE	DELAWARE COUNTY - JOHNSON FIELD	IN	0	1	1	0.999949
MZZ	MARION MUNICIPAL	IN	0	1	1	0.999949
OXI	STARKE COUNTY	IN	0	1	1	0.999966
RCR	FULTON COUNTY	IN	0	1	1	0.999958
SBN	SOUTH BEND RGNL	IN	0	1	1	0.999963
SER	FREEMAN MUNICIPAL	IN	0	1	1	0.999945

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TYQ	INDIANAPOLIS EXECUTIVE	IN	0	1	1	0.999955
VPZ	PORTER COUNTY MUNICIPAL	IN	0	1	1	0.999967
AAO	COLONEL JAMES JABARA	KS	0	1	1	1
CBK	SHALZ FIELD	KS	0	1	34	0.996913
DDC	DODGE CITY RGNL	KS	0	1	32	0.998965
EGT	WELLINGTON MUNICIPAL	KS	0	1	0	1
EMP	EMPORIA MUNICIPAL	KS	0	1	0	1
EWK	NEWTON-CITY-COUNTY	KS	0	1	0	1
FOE	FORBES FIELD	KS	0	1	0	1
FSK	FORT SCOTT MUNICIPAL	KS	0	1	1	0.999969
GCK	GARDEN CITY RGNL	KS	0	1	34	0.998188
GLD	RENNER FLD /GOODLAND MUNICIPAL	KS	0	1	33	0.996712
HQG	HUGOTON MUNICIPAL	KS	0	1	33	0.998244
HYS	HAYS RGNL	KS	0	1	25	0.998994
ICT	WICHITA MID-CONTINENT	KS	0	1	3	0.999992
IXD	NEW CENTURY AIRCENTER	KS	0	1	1	0.999972
LBL	LIBERAL MID-AMERICA RGNL	KS	0	1	33	0.998714
LWC	LAWRENCE MUNICIPAL	KS	0	1	1	0.999974
MHK	MANHATTAN RGNL	KS	0	1	0	1
MPR	MC PHERSON	KS	0	1	0	1
OEL	OAKLEY MUNICIPAL	KS	0	1	34	0.997228
OJC	JOHNSON COUNTY EXECUTIVE	KS	0	1	1	0.999974
PPF	TRI-CITY	KS	0	1	2	0.999996
PTS	ATKINSON MUNICIPAL	KS	0	1	1	0.999968
PTT	PRATT INDUSTRIAL	KS	0	1	8	0.999719
RSL	RUSSELL MUNICIPAL	KS	0	1	9	0.999497
SLN	SALINA MUNICIPAL	KS	0	1	0	1
TOP	PHILIP BILLARD MUNICIPAL	KS	0	1	0	1
TQK	SCOTT CITY MUNICIPAL	KS	0	1	34	0.997616
ULS	ULYSSES	KS	0	1	34	0.997911
WLD	STROTHER FIELD	KS	0	1	0	1
27K	GEORGETOWN SCOTT COUNTY - MARS	KY	0	1	1	0.999946
CVG	CINCINNATI/NORTHERN KENTUCKY	KY	0	1	1	0.999937
DVK	STUART POWELL FIELD	KY	0	1	2	0.999925
EHR	HENDERSON CITY-COUNTY	KY	0	1	2	0.999870
EKX	ADDINGTON FIELD	KY	0	1	2	0.999918
GLW	GLASGOW MUNICIPAL	KY	0	1	2	0.999894
K22	BIG SANDY RGNL	KY	0	1	0	1
LEX	BLUE GRASS	KY	0	1	1	0.999943
LOU	BOWMAN FIELD	KY	0	1	2	0.999944
LOZ	LONDON-CORBIN ARPT-MAGEE FLD	KY	0	1	2	0.999924
OWB	OWENSBORO-DAVIESS COUNTY	KY	0	1	2	0.999919
PAH	BARKLEY RGNL	KY	0	1	0	1
SDF	LOUISVILLE INTL-STANDIFORD FIELD	KY	0	1	2	0.999936
SME	LAKE CUMBERLAND RGNL	KY	0	1	2	0.999909
W38	WILLIAMSBURG-WHITLEY COUNTY	KY	0	1	2	0.999917
AEX	ALEXANDRIA INTL	LA	0	1	2	0.999787
ARA	ACADIANA RGNL	LA	0	1	2	0.999768
BQP	MOREHOUSE MEMORIAL	LA	0	1	3	0.999766
BTR	BATON ROUGE METROPOLITAN RYAN	LA	0	1	4	0.999702
CWF	CHENNAULT INTL	LA	0	1	2	0.999821
DRI	BEAUREGARD RGNL	LA	0	1	2	0.999820

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
DTN	SHREVEPORT DOWNTOWN	LA	0	1	3	0.999845
ESF	ESLER RGNL	LA	0	1	3	0.999770
GAO	SOUTH LAFOURCHE LEONARD MILLER	LA	1	0.999997	3	0.999661
HZR	FALSE RIVER RGNL	LA	0	1	3	0.999724
LCH	LAKE CHARLES RGNL	LA	0	1	2	0.999824
LFT	LAFAYETTE RGNL	LA	0	1	3	0.999762
MSY	LOUIS ARMSTRONG NEW ORLEANS	LA	0	1	3	0.999699
NEW	LAKEFRONT	LA	0	1	3	0.999670
PTN	HARRY P WILLIAMS MEMORIAL	LA	0	1	3	0.999721
SHV	SHREVEPORT RGNL	LA	0	1	3	0.999847
TVR	VICKSBURG TALLULAH RGNL	LA	0	1	3	0.999729
BAF	BARNES MUNICIPAL	MA	0	1	3	0.999905
BED	LAURENCE G HANSCOM FLD	MA	3	0.999959	3	0.999896
BOS	GENERAL EDWARD LAWRENCE LOGAN	MA	3	0.999958	3	0.999897
HYA	BARNSTABLE MUNICIPAL-BOARDMAN/POLAN	MA	3	0.999958	4	0.999908
MVY	MARTHAS VINEYARD	MA	3	0.999959	4	0.999915
ORH	WORCESTER RGNL	MA	3	0.999980	3	0.999902
OWD	NORWOOD MEMORIAL	MA	3	0.999960	3	0.999901
PVC	PROVINCETOWN MUNICIPAL	MA	3	0.999948	3	0.999900
2W6	ST. MARY'S COUNTY RGNL	MD	0	1	3	0.999981
BWI	BALTIMORE/WASHINGTON INTL	MD	0	1	3	0.999998
DMW	CARROLL COUNTY RGNL/JACK B POA	MD	0	1	1	1
ESN	EASTON/NEWNAM FIELD	MD	0	1	3	0.999996
FDK	FREDERICK MUNICIPAL	MD	0	1	1	0.999997
GAI	MONTGOMERY COUNTY AIRPARK	MD	0	1	3	0.999993
AUG	AUGUSTA STATE	ME	2	0.999909	4	0.999854
BGR	BANGOR INTL	ME	3	0.999898	6	0.999835
BHB	HANCOCK COUNTY-BAR HARBOR	ME	3	0.999898	17	0.999774
LEW	AUBURN/LEWISTON MUNICIPAL	ME	2	0.999920	4	0.999861
PQI	NORTHERN MAINE RGNL ARPT	ME	1	0.999880	5	0.999719
PWM	PORTLAND INTL JETPORT	ME	3	0.999925	3	0.999869
WVL	WATERVILLE ROBERT LAFLEUR	ME	2	0.999906	4	0.999849
ACB	ANTRIM COUNTY	MI	0	1	3	0.999894
ADG	LENAWEE COUNTY	MI	0	1	1	0.999965
ARB	ANN ARBOR MUNICIPAL	MI	0	1	1	0.999968
AZO	KALAMAZOO/BATTLE CREEK INTL	MI	0	1	1	0.999957
BAX	HURON COUNTY MEMORIAL	MI	0	1	2	0.999936
BIV	TULIP CITY	MI	0	1	1	0.999965
CIU	CHIPPEWA COUNTY INTL	MI	0	1	3	0.999856
CMX	HOUGHTON COUNTY MEMORIAL	MI	0	1	4	0.999758
CVX	CHARLEVOIX MUNICIPAL	MI	0	1	3	0.999872
DTW	DETROIT METROPOLITAN WAYNE COU	MI	0	1	1	0.999973
FFX	FREMONT MUNICIPAL	MI	0	1	1	0.999968
FNT	BISHOP INTL	MI	0	1	2	0.999967
GRR	GERALD R. FORD INTL	MI	0	1	1	0.999965
HYX	SAGINAW COUNTY H.W. BROWNE	MI	0	1	2	0.999951
LDM	MASON COUNTY	MI	0	1	2	0.999964
MBS	MBS INTL	MI	0	1	2	0.999948
MKG	MUSKEGON COUNTY	MI	0	1	1	0.999970
OEB	BRANCH COUNTY MEMORIAL	MI	0	1	1	0.999954
OZW	LIVINGSTON COUNTY SPENCER J. H	MI	0	1	1	0.999967

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
RNP	OWOSSO COMMUNITY	MI	0	1	1	0.999965
TTF	CUSTER	MI	0	1	1	0.999971
YIP	WILLOW RUN	MI	0	1	1	0.999970
AEL	ALBERT LEA MUNICIPAL	MN	0	1	1	0.999960
ANE	ANOKA COUNTY-BLAINE ARPT(JANES	MN	0	1	3	0.999908
AUM	AUSTIN MUNICIPAL	MN	0	1	1	0.999968
AXN	CHANDLER FIELD	MN	0	1	2	0.999876
BDE	BAUDETTE INTL	MN	0	1	3	0.999840
BDH	WILLMAR MUNICIPAL-JOHN L RICE FIELD	MN	0	1	2	0.999911
BRD	BRAINERD LAKES RGNL	MN	0	1	4	0.999826
CKN	CROOKSTON MUNICIPAL KIRKWOOD FLD	MN	0	1	2	0.999919
DLH	DULUTH INTL	MN	0	1	3	0.999779
DTL	DETROIT LAKES-WETHING FIELD	MN	0	1	1	0.999948
HIB	CHISHOLM-HIBBING	MN	0	1	5	0.999735
INL	FALLS INTL	MN	0	1	4	0.999770
JYG	ST JAMES MUNICIPAL	MN	0	1	1	0.999940
MML	SOUTHWEST MINNESOTA RGNL MARSH	MN	0	1	1	0.999945
MSP	MINNEAPOLIS-ST PAUL INTL	MN	0	1	2	0.999914
RGK	RED WING RGNL	MN	0	1	2	0.999922
ROX	ROSEAU MUNICIPAL RUDY BILLBERG FIELD	MN	0	1	2	0.999877
RRT	WARROAD INTL MEMORIAL	MN	0	1	3	0.999862
RST	ROCHESTER INTL	MN	0	1	2	0.999946
STC	ST CLOUD RGNL	MN	0	1	3	0.999887
STP	ST PAUL DOWNTOWN HOLMAN FLD	MN	0	1	2	0.999914
1H0	CREVE COEUR	MO	0	1	2	0.999889
6M6	LEWIS COUNTY RGNL	MO	0	1	1	0.999962
AIZ	LEE C FINE MEMORIAL	MO	0	1	1	0.999951
CGI	CAPE GIRARDEAU RGNL	MO	0	1	2	0.999821
COU	COLUMBIA RGNL	MO	0	1	1	0.999958
DMO	SEDALIA MEMORIAL	MO	0	1	1	0.999954
DXE	DEXTER MUNICIPAL	MO	0	1	2	0.999802
EOS	NEOSHO HUGH ROBINSON	MO	0	1	1	0.999948
GPH	MIDWEST NATIONAL AIR CENTER	MO	0	1	1	0.999985
HIG	HIGGINSVILLE INDUSTRIAL MUNICIPAL	MO	0	1	1	0.999958
IRK	KIRKSVILLE RGNL	MO	0	1	1	0.999965
JEF	JEFFERSON CITY MEMORIAL	MO	0	1	1	0.999957
JLN	JOPLIN RGNL	MO	0	1	1	0.999972
K57	GOULD PETERSON MUNICIPAL	MO	0	1	1	0.999983
LBO	FLOYD W. JONES LEBANON	MO	0	1	2	0.999945
LRY	LAWRENCE SMITH MEMORIAL	MO	0	1	1	0.999982
LXT	LEE'S SUMMIT MUNICIPAL	MO	0	1	1	0.999982
M05	CARUTHERSVILLE MEMORIAL	MO	0	1	2	0.999773
M17	BOLIVAR MUNICIPAL	MO	0	1	1	0.999945
M58	MONETT MUNICIPAL	MO	0	1	1	0.999939
MCI	KANSAS CITY INTL	MO	0	1	1	0.999977
MHL	MARSHALL MEMORIAL MUNICIPAL	MO	0	1	1	0.999961
MKC	CHARLES B. WHEELER DOWNTOWN	MO	0	1	1	0.999979
MYJ	MEXICO MEMORIAL	MO	0	1	1	0.999963

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POF	POPLAR BLUFF MUNICIPAL	MO	0	1	2	0.999799
RCM	SKYHAVEN	MO	0	1	1	0.999965
SGF	SPRINGFIELD-BRANSON NATIONAL	MO	0	1	1	0.999942
SIK	SIKESTON MEMORIAL MUNICIPAL	MO	0	1	2	0.999807
STJ	ROSECRANS MEMORIAL	MO	0	1	1	0.999975
STL	LAMBERT-ST LOUIS INTL	MO	0	1	2	0.999894
TBN	WAYNESVILLE RGNL ARPT AT FORNE	MO	0	1	2	0.999926
TKX	KENNETT MEMORIAL	MO	0	1	2	0.999778
UNO	WEST PLAINS MUNICIPAL	MO	0	1	2	0.999893
VER	JESSE VIERTEL MEMORIAL	MO	0	1	1	0.999958
CRX	ROSCOE TURNER	MS	0	1	2	0.999749
GNF	GRENADA MUNICIPAL	MS	0	1	2	0.999746
GPT	GULFPORT-BILOXI INTL	MS	0	1	3	0.999661
GTR	GOLDEN TRIANGLE RGNL	MS	0	1	3	0.999758
GWO	GREENWOOD-LEFLORE	MS	0	1	2	0.999748
HBG	HATTIESBURG BOBBY L CHAIN MUNICIPAL	MS	0	1	3	0.999768
HEZ	HARDY-ANDERS FIELD NATCHEZ-ADA	MS	0	1	4	0.999715
HSA	STENNIS INTL	MS	0	1	3	0.999666
JAN	JACKSON-EVERS INTL	MS	0	1	2	0.999763
LUL	HESLER-NOBLE FIELD	MS	0	1	3	0.999765
M16	JOHN BELL WILLIAMS	MS	0	1	3	0.999734
M40	MONROE COUNTY	MS	0	1	2	0.999758
M43	PRENTISS-JEFFERSON DAVIS COUNTY	MS	0	1	3	0.999755
MCB	MC COMB/PIKE COUNTY/JOHN E LEW	MS	0	1	3	0.999703
MEI	KEY FIELD	MS	0	1	3	0.999759
MJD	PICAYUNE MUNICIPAL	MS	0	1	3	0.999671
OLV	OLIVE BRANCH	MS	0	1	2	0.999746
PIB	HATTIESBURG-LAUREL RGNL	MS	0	1	3	0.999768
PQL	TRENT LOTT INTL	MS	0	1	4	0.999765
STF	GEORGE M BRYAN	MS	0	1	2	0.999757
UOX	UNIVERSITY-OXFORD	MS	0	1	2	0.999741
UTA	TUNICA MUNICIPAL	MS	0	1	2	0.999757
BIL	BILLINGS LOGAN INTL	MT	0	1	1	0.999995
BTM	BERT MOONEY	MT	0	1	1	0.999988
GPI	GLACIER PARK INTL	MT	0	1	3	0.999875
GTF	GREAT FALLS INTL	MT	0	1	2	0.999870
HLN	HELENA RGNL	MT	0	1	1	0.999991
LWT	LEWISTOWN MUNICIPAL	MT	0	1	1	1
MLS	FRANK WILEY FIELD	MT	0	1	2	0.999880
AFP	ANSON COUNTY	NC	0	1	2	0.999999
AKH	GASTONIA MUNICIPAL	NC	0	1	1	0.999993
AVL	ASHEVILLE RGNL	NC	0	1	2	0.999945
CLT	CHARLOTTE/DOUGLAS INTL	NC	0	1	1	0.999997
ECG	ELIZABETH CITY CG AIR STATION	NC	0	1	1	0.999934
EDE	NORTHEASTERN RGNL	NC	0	1	2	0.999894
EQY	MONROE RGNL	NC	0	1	1	0.999997
EWN	CRAVEN COUNTY RGNL	NC	0	1	2	0.999887
FAY	FAYETTEVILLE RGNL/GRANNIS FIELD	NC	0	1	3	0.999973
GSO	PIEDMONT TRIAD INTL	NC	0	1	1	1
GWW	GOLDSBORO-WAYNE MUNICIPAL	NC	0	1	3	0.999952
HBI	ASHEBORO RGNL	NC	0	1	2	0.999999

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
HNZ	HENDERSON-OXFORD	NC	0	1	3	0.999968
HRJ	HARNETT RGNL JETPORT	NC	0	1	3	0.999970
ILM	WILMINGTON INTL	NC	0	1	5	0.999900
ISO	KINSTON RGNL JETPORT AT STALLI	NC	0	1	3	0.999941
JQF	CONCORD RGNL	NC	0	1	0	1
LHZ	FRANKLIN COUNTY	NC	0	1	3	0.999962
OAJ	ALBERT J ELLIS	NC	0	1	5	0.999898
PGV	PITT-GREENVILLE	NC	0	1	3	0.999938
RDU	RALEIGH-DURHAM INTL	NC	0	1	3	0.999971
RUQ	ROWAN COUNTY	NC	0	1	0	1
RWI	ROCKY MOUNT-WILSON RGNL	NC	0	1	3	0.999952
SVH	STATESVILLE RGNL	NC	0	1	0	1
TTA	SANFORD-LEE COUNTY RGNL	NC	0	1	3	0.999980
5N8	CASSELTON ROBERT MILLER RGNL	ND	0	1	1	0.999948
BIS	BISMARCK MUNICIPAL	ND	0	1	1	0.999946
DIK	DICKINSON - THEODORE ROOSEVELT	ND	0	1	1	0.999919
DVL	DEVILS LAKE RGNL	ND	0	1	2	0.999929
FAR	HECTOR INTL	ND	0	1	1	0.999945
GFK	GRAND FORKS INTL	ND	0	1	2	0.999922
JMS	JAMESTOWN RGNL	ND	0	1	1	0.999963
MOT	MINOT INTL	ND	0	1	2	0.999957
AFK	NEBRASKA CITY MUNICIPAL	NE	0	1	0	1
AHQ	WAHOO MUNICIPAL	NE	0	1	0	1
AIA	ALLIANCE MUNICIPAL	NE	0	1	2	0.999900
ANW	AINSWORTH MUNICIPAL	NE	0	1	1	0.999970
AUH	AURORA MUNICIPAL – AL POTTER FIELD	NE	0	1	0	1
BBW	BROKEN BOW MUNICIPAL	NE	0	1	1	0.999995
BFF	WESTERN NEB. RGNL/WILLIAM B. H	NE	0	1	2	0.999894
BIE	BEATRICE MUNICIPAL	NE	0	1	0	1
BVN	ALBION MUNICIPAL	NE	0	1	0	1
CDR	CHADRON MUNICIPAL	NE	0	1	1	0.999894
CEK	CRETE MUNICIPAL	NE	0	1	0	1
CZD	COZAD MUNICIPAL	NE	0	1	3	0.999991
EAR	KEARNEY RGNL	NE	0	1	0	1
FBY	FAIRBURY MUNICIPAL	NE	0	1	0	1
FET	FREMONT MUNICIPAL	NE	0	1	0	1
FNB	BRENNER FIELD	NE	0	1	1	1
GGF	GRANT MUNICIPAL	NE	0	1	33	0.997412
GRI	CENTRAL NEBRASKA RGNL	NE	0	1	0	1
GRN	GORDON MUNICIPAL	NE	0	1	1	0.999916
HDE	BREWSTER FIELD	NE	0	1	0	1
HSI	HASTINGS MUNICIPAL	NE	0	1	0	1
IBM	KIMBALL MUNICIPAL ROBERT E ARRAJ FI	NE	0	1	2	0.999852
IML	IMPERIAL MUNICIPAL	NE	0	1	33	0.996799
JYR	YORK MUNICIPAL	NE	0	1	0	1
LBF	NORTH PLATTE RGNL AIRPORT LEE	NE	0	1	5	0.999844
LCG	WAYNE MUNICIPAL	NE	0	1	0	1
LNK	LINCOLN	NE	0	1	0	1
LXN	JIM KELLY FIELD	NE	0	1	0	1
MCK	MC COOK RGNL	NE	0	1	35	0.998772

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MLE	MILLARD	NE	0	1	0	1
OFK	KARL STEFAN MEMORIAL	NE	0	1	0	1
OGA	SEARLE FIELD	NE	0	1	32	0.998279
OKS	GARDEN COUNTY	NE	0	1	31	0.997812
OLU	COLUMBUS MUNICIPAL	NE	0	1	0	1
OMA	EPPLEY AIRFIELD	NE	0	1	0	1
ONL	THE O'NEILL MUNICIPAL-JOHN L BAKER	NE	0	1	0	1
PMV	PLATTSMOUTH MUNICIPAL	NE	0	1	0	1
SCB	SCRIBNER STATE	NE	0	1	0	1
SNY	SIDNEY MUNICIPAL LLOYD W. CARR FIELD	NE	0	1	28	0.998378
SWT	SEWARD MUNICIPAL	NE	0	1	0	1
VTN	MILLER FIELD	NE	0	1	1	0.999953
ASH	BOIRE FIELD	NH	3	0.999953	3	0.999890
CON	CONCORD MUNICIPAL	NH	2	0.999944	2	0.999883
EEN	DILLANT-HOPKINS	NH	2	0.999961	2	0.999891
LCI	LACONIA MUNICIPAL	NH	2	0.999935	3	0.999875
MHT	MANCHESTER	NH	3	0.999947	3	0.999887
PSM	PORTSMOUTH INTL AT PEASE	NH	3	0.999937	3	0.999882
ACY	ATLANTIC CITY INTL	NJ	0	1	4	0.999999
EWR	NEWARK LIBERTY INTL	NJ	0	1	3	0.999952
MIV	MILLVILLE MUNICIPAL	NJ	0	1	2	0.999999
TEB	TETERBORO	NJ	0	1	3	0.999938
WWD	CAPE MAY COUNTY	NJ	0	1	0	1
ABQ	ALBUQUERQUE INTL SUNPORT	NM	0	1	77	0.996064
AEG	DOUBLE EAGLE II	NM	0	1	77	0.996028
CVN	CLOVIS MUNICIPAL	NM	0	1	34	0.998924
FMN	FOUR CORNERS RGNL	NM	0	1	64	0.998143
LRU	LAS CRUCES INTL	NM	0	1	100	0.995789
ROW	ROSWELL INTL AIR CENTER	NM	0	1	85	0.998171
SVC	GRANT COUNTY	NM	6	0.999967	95	0.992896
4SD	RENO/STEAD	NV	2	0.999930	89	0.993173
LAS	MC CARRAN INTL	NV	0	1	14	0.999645
RNO	RENO/TAHOE INTL	NV	2	0.999933	92	0.993370
WMC	WINNEMUCCA MUNICIPAL	NV	1	0.999980	46	0.998464
44N	SKY ACRES	NY	0	1	2	0.999919
9G3	AKRON	NY	0	1	1	0.999935
ALB	ALBANY INTL	NY	0	1	1	0.999899
BGM	GREATER BINGHAMTON/EDWIN A LIN	NY	0	1	2	0.999929
BUF	BUFFALO NIAGARA INTL	NY	0	1	1	0.999941
ELM	ELMIRA/CORNING RGNL	NY	0	1	1	0.999944
ELZ	WELLSVILLE MUNICIPAL ARPT`TARANTINE	NY	0	1	1	0.999960
FOK	FRANCIS S GABRESKI	NY	0	1	4	0.999931
HPN	WESTCHESTER COUNTY	NY	0	1	3	0.999932
HWV	BROOKHAVEN	NY	0	1	3	0.999934
JFK	JOHN F KENNEDY INTL	NY	0	1	3	0.999948
JHW	CHAUTAUQUA COUNTY/JAMESTOWN	NY	0	1	1	0.999975
LGA	LA GUARDIA	NY	0	1	3	0.999945
MSS	MASSENA INTL-RICHARDS FIELD	NY	1	0.999945	4	0.999859
N66	ONEONTA MUNICIPAL	NY	0	1	2	0.999906

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OLE	CATTARAUGUS COUNTY-OLEAN	NY	0	1	1	0.999961
PBG	PLATTSBURGH INTL	NY	1	0.999936	3	0.999861
PEO	PENN YAN	NY	0	1	1	0.999930
ROC	GREATER ROCHESTER INTL	NY	0	1	1	0.999922
SDC	WILLIAMSON-SODUS	NY	0	1	1	0.999910
SWF	STEWART INTL	NY	0	1	2	0.999924
SYR	SYRACUSE HANCOCK INTL	NY	0	1	2	0.999900
1G0	WOOD COUNTY	OH	0	1	1	0.999969
1G3	KENT STATE UNIV	OH	0	1	0	1
AXV	NEIL ARMSTRONG	OH	0	1	1	0.999959
CLE	CLEVELAND-HOPKINS INTL	OH	0	1	0	1
CMH	PORT COLUMBUS INTL	OH	0	1	1	0.999998
CXY	CAPITAL CITY	OH	0	1	1	1
DAY	JAMES M COX DAYTON INTL	OH	0	1	1	0.999967
DLZ	DELAWARE MUNICIPAL	OH	0	1	1	0.999984
FDY	FINDLAY	OH	0	1	1	0.999969
HAO	BUTLER CO RGNL	OH	0	1	1	0.999944
I19	GREENE COUNTY-LEWIS A. JACKSON	OH	0	1	1	0.999971
I68	LEBANON-WARREN COUNTY	OH	0	1	1	0.999969
LHQ	FAIRFIELD COUNTY	OH	0	1	0	1
LUK	CINCINNATI MUNICIPAL AIRPORT LUNKEN	OH	0	1	1	0.999946
MGY	DAYTON-WRIGHT BROTHERS	OH	0	1	1	0.999968
MNN	MARION MUNICIPAL	OH	0	1	1	0.999985
OSU	OHIO STATE UNIVERSITY	OH	0	1	1	0.999994
PMH	GREATER PORTSMOUTH RGNL	OH	0	1	0	1
RZT	ROSS COUNTY	OH	0	1	1	0.999998
TOL	TOLEDO EXPRESS	OH	0	1	1	0.999967
UNI	OHIO UNIVERSITY SNYDER FIELD	OH	0	1	0	1
UYF	MADISON COUNTY	OH	0	1	1	0.999982
YNG	YOUNGSTOWN-WARREN RGNL	OH	0	1	0	1
1K4	DAVID JAY PERRY	OK	0	1	0	1
2K4	SCOTT FIELD	OK	0	1	0	1
2O8	HINTON MUNICIPAL	OK	0	1	0	1
AVK	ALVA RGNL	OK	0	1	4	0.999958
BVO	BARTLESVILLE MUNICIPAL	OK	0	1	1	0.999999
CHK	CHICKASHA MUNICIPAL	OK	0	1	0	1
CQB	CHANDLER RGNL	OK	0	1	0	1
DUA	EAKER FIELD	OK	0	1	1	0.999996
ELK	ELK CITY RGNL BUSINESS	OK	0	1	0	1
F29	CLARENCE E PAGE MUNICIPAL	OK	0	1	0	1
GCM	CLAREMORE RGNL	OK	0	1	2	0.999977
GMJ	GROVE MUNICIPAL	OK	0	1	1	0.999965
GOK	GUTHRIE-EDMOND RGNL	OK	0	1	0	1
HBR	HOBART RGNL	OK	0	1	0	1
MDF	MOORELAND MUNICIPAL	OK	0	1	6	0.999917
MIO	MIAMI MUNICIPAL	OK	0	1	1	0.999962
MKO	DAVIS FIELD	OK	0	1	2	0.999969
MLC	MC ALESTER RGNL	OK	0	1	1	0.999996
OKC	WILL ROGERS WORLD	OK	0	1	0	1
OKM	OKMULGEE RGNL	OK	0	1	1	0.999996
OUN	UNIVERSITY OF OKLAHOMA WESTHEI	OK	0	1	0	1

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PNC	PONCA CITY RGNL	OK	0	1	0	1
PVJ	PAULS VALLEY MUNICIPAL	OK	0	1	1	0.999999
RVS	RICHARD LLOYD JONES JR	OK	0	1	1	0.999996
SNL	SHAWNEE RGNL	OK	0	1	1	1
SWO	STILLWATER RGNL	OK	0	1	0	1
TQH	TAHLEQUAH MUNICIPAL	OK	0	1	2	0.999956
TUL	TULSA INTL	OK	0	1	1	0.999996
BDN	BEND MUNICIPAL	OR	1	0.999902	50	0.996852
EUG	MAHLON SWEET FIELD	OR	1	0.999886	67	0.993360
LGD	LA GRANDE/UNION COUNTY	OR	2	0.999928	41	0.998722
LMT	KLAMATH FALLS	OR	2	0.999883	76	0.993576
MMV	MC MINNVILLE MUNICIPAL	OR	1	0.999882	55	0.994931
ONO	ONTARIO MUNICIPAL	OR	2	0.999973	41	0.999031
ONP	NEWPORT MUNICIPAL	OR	2	0.999874	74	0.992024
PDX	PORTLAND INTL	OR	1	0.999882	48	0.995808
SLE	MCNARY FLD	OR	1	0.999885	55	0.994965
UAO	AURORA STATE	OR	1	0.999884	51	0.995509
2G9	SOMERSET COUNTY	PA	0	1	0	1
9D4	DECK	PA	0	1	2	0.999997
ABE	LEHIGH VALLEY INTL	PA	0	1	2	0.999974
AGC	ALLEGHENY COUNTY	PA	0	1	0	1
AOO	ALTOONA-BLAIR COUNTY	PA	0	1	0	1
AXQ	CLARION COUNTY	PA	0	1	0	1
BFD	BRADFORD RGNL	PA	0	1	1	0.999979
BTP	BUTLER COUNTY K W SCHOLTER FIELD	PA	0	1	0	1
DUJ	DUBOIS RGNL	PA	0	1	0	1
FKL	VENANGO RGNL	PA	0	1	0	1
FWQ	ROSTRAVER	PA	0	1	0	1
HZL	HAZLETON MUNICIPAL	PA	0	1	2	0.999971
JST	JOHN MURTHA JOHNSTOWN-CAMBRIA	PA	0	1	0	1
LBE	ARNOLD PALMER RGNL	PA	0	1	0	1
LNS	LANCASTER	PA	0	1	2	0.999999
MQS	CHESTER COUNTY G O CARLSON	PA	0	1	1	1
OYM	ST MARYS MUNICIPAL	PA	0	1	1	0.999991
PHL	PHILADELPHIA INTL	PA	0	1	1	0.999998
PIT	PITTSBURGH INTL	PA	0	1	0	1
PNE	NORTHEAST PHILADELPHIA	PA	0	1	1	0.999987
RVL	MIFFLIN COUNTY	PA	0	1	0	1
UCP	NEW CASTLE MUNICIPAL	PA	0	1	0	1
UNV	UNIVERSITY PARK	PA	0	1	0	1
WAY	GREENE COUNTY	PA	0	1	0	1
BID	BLOCK ISLAND STATE	RI	0	1	4	0.999916
OQU	QUONSET STATE	RI	3	0.999987	3	0.999913
PVD	THEODORE FRANCIS GREEN STATE	RI	3	0.999983	3	0.999911
AIK	AIKEN MUNICIPAL	SC	0	1	3	0.999904
AND	ANDERSON RGNL	SC	0	1	3	0.999899
CAE	COLUMBIA METROPOLITAN	SC	0	1	2	0.999959
CDN	WOODWARD FIELD	SC	0	1	2	0.999977
CEU	OCONEE COUNTY RGNL	SC	0	1	3	0.999898
CHS	CHARLESTON AFB/INTL	SC	0	1	4	0.999835
GGE	GEORGETOWN COUNTY	SC	0	1	5	0.999779

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GSP	GREENVILLE SPARTANBURG INTL	SC	0	1	3	0.999940
GYH	DONALDSON CENTER	SC	0	1	3	0.999923
JZI	CHARLESTON EXECUTIVE	SC	0	1	4	0.999802
MYR	MYRTLE BEACH INTL	SC	0	1	6	0.999817
UDG	DARLINGTON COUNTY JETPORT	SC	0	1	3	0.999992
ABR	ABERDEEN RGNL	SD	0	1	1	0.999944
ATY	WATERTOWN RGNL	SD	0	1	1	0.999954
BKX	BROOKINGS RGNL	SD	0	1	1	0.999965
FSD	JOE FOSS FIELD	SD	0	1	1	0.999969
HON	HURON RGNL	SD	0	1	1	0.999970
MHE	MITCHELL MUNICIPAL	SD	0	1	1	0.999985
PIR	PIERRE RGNL	SD	0	1	1	0.999936
RAP	RAPID CITY RGNL	SD	0	1	1	0.999879
YKN	CHAN GURNEY MUNICIPAL	SD	0	1	0	1
BGF	WINCHESTER MUNICIPAL	TN	0	1	2	0.999843
BNA	NASHVILLE INTL	TN	0	1	2	0.999855
CHA	LOVELL FIELD	TN	0	1	2	0.999859
MEM	MEMPHIS INTL	TN	0	1	2	0.999751
NQA	MILLINGTON RGNL JETPORT	TN	0	1	2	0.999755
PVE	BEECH RIVER RGNL	TN	0	1	2	0.999776
SYI	BOMAR FIELD-SHELBYVILLE MUNICIPAL	TN	0	1	2	0.999845
SZY	ROBERT SIBLEY	TN	0	1	2	0.999760
TRI	TRI-CITIES RGNL TN/VA	TN	0	1	2	0.999981
TYS	MC GHEE TYSON	TN	0	1	2	0.999912
UCY	EVERETT-STEWART RGNL	TN	0	1	2	0.999793
5T9	MAVERICK COUNTY MEMORIAL INTL	TX	0	1	0	1
ABI	ABILENE RGNL	TX	0	1	0	1
ADS	ADDISON	TX	0	1	1	0.999996
AFW	FORT WORTH ALLIANCE	TX	0	1	1	0.999996
ALI	ALICE INTL	TX	0	1	2	0.999902
AMA	RICK HUSBAND AMARILLO INTL	TX	0	1	25	0.999515
AUS	AUSTIN-BERGSTROM INTL	TX	0	1	1	0.999983
AXH	HOUSTON-SOUTHWEST	TX	0	1	1	0.999908
BAZ	NEW BRAUNFELS MUNICIPAL	TX	0	1	1	0.999981
BBD	CURTIS FIELD	TX	0	1	0	1
BWD	BROWNWOOD RGNL	TX	0	1	0	1
CFD	COULTER FIELD	TX	0	1	2	0.999927
CLL	EASTERWOOD FIELD	TX	0	1	2	0.999932
CRP	CORPUS CHRISTI INTL	TX	0	1	1	0.999777
CXO	LONE STAR EXECUTIVE	TX	0	1	1	0.999906
DAL	DALLAS LOVE FIELD	TX	0	1	1	0.999996
DFW	DALLAS/FORT WORTH INTL	TX	0	1	1	0.999996
DRT	DEL RIO INTL	TX	0	1	0	1
DWH	DAVID WAYNE HOOKS MEMORIAL	TX	0	1	1	0.999913
E30	BRUCE FIELD	TX	0	1	0	1
EBG	SOUTH TEXAS INTL AT EDINBURG	TX	0	1	2	0.999822
ELP	EL PASO INTL	TX	2	0.999989	101	0.995548
ERV	KERRVILLE MUNICIPAL LOUIS SCHREINER	TX	0	1	0	1
FWS	FORT WORTH SPINKS	TX	0	1	1	0.999996
GGG	EAST TEXAS RGNL	TX	0	1	2	0.999856

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GKY	ARLINGTON MUNICIPAL	TX	0	1	1	0.999996
GLS	SCHOLES INTL AT GALVESTON	TX	0	1	1	0.999858
GVT	MAJORS	TX	0	1	2	0.999940
HOU	WILLIAM P HOBBY	TX	0	1	1	0.999902
HQZ	MESQUITE METRO	TX	0	1	1	0.999996
HRL	VALLEY INTL	TX	0	1	1	0.999706
HYI	SAN MARCOS MUNICIPAL	TX	0	1	1	0.999982
IAH	GEORGE BUSH INTERCONTINENTAL	TX	0	1	1	0.999903
INJ	HILLSBORO MUNICIPAL	TX	0	1	1	0.999996
IWS	WEST HOUSTON	TX	0	1	1	0.999916
LBB	LUBBOCK PRESTON SMITH INTL	TX	0	1	7	0.999919
LBX	BRAZORIA COUNTY	TX	0	1	1	0.999891
LFK	ANGELINA COUNTY	TX	0	1	2	0.999869
LNC	LANCASTER	TX	0	1	1	0.999996
LRD	LAREDO INTL	TX	0	1	1	0.999946
LUD	DECATUR MUNICIPAL	TX	0	1	1	0.999996
MAF	MIDLAND INTL	TX	0	1	0	1
MFE	MC ALLEN MILLER INTL	TX	0	1	2	0.999817
OSA	MOUNT PLEASANT RGNL	TX	0	1	2	0.999823
PIL	PORT ISABEL-CAMERON COUNTY	TX	0	1	1	0.999710
PRX	COX FIELD	TX	0	1	2	0.999881
PVW	HALE COUNTY	TX	0	1	8	0.999843
RAS	MUSTANG BEACH	TX	0	1	1	0.999775
RBD	DALLAS EXECUTIVE	TX	0	1	1	0.999996
SAT	SAN ANTONIO INTL	TX	0	1	1	0.999987
SGR	SUGAR LAND RGNL	TX	0	1	1	0.999913
SJT	SAN ANGELO RGNL/MATHIS FIELD	TX	0	1	0	1
SPS	SHEPPARD AFB/WICHITA FALLS MUN	TX	0	1	0	1
TFP	T P MC CAMPBELL	TX	0	1	1	0.999786
TKI	COLLIN COUNTY RGNL AT MC KINNE	TX	0	1	1	0.999996
TME	HOUSTON EXECUTIVE	TX	0	1	1	0.999913
TPL	DRAUGHON-MILLER CENTRAL TEXAS	TX	0	1	1	0.999996
TRL	TERRELL MUNICIPAL	TX	0	1	2	0.999942
TYR	TYLER POUNDS RGNL	TX	0	1	2	0.999849
CDC	CEDAR CITY RGNL	UT	0	1	0	1
KNB	KANAB MUNICIPAL	UT	0	1	1	0.999999
LGU	LOGAN-CACHE	UT	0	1	0	1
OGD	OGDEN-HINCKLEY	UT	0	1	0	1
PVU	PROVO MUNICIPAL	UT	0	1	0	1
SGU	ST GEORGE MUNICIPAL	UT	0	1	1	0.999999
SLC	SALT LAKE CITY INTL	UT	0	1	0	1
BCB	VIRGINIA TECH MONTGOMERY EXECUTIVE	VA	0	1	0	1
CHO	CHARLOTTESVILLE-ALBEMARLE	VA	0	1	2	0.999978
CJR	CULPEPER RGNL	VA	0	1	2	0.999972
FCI	CHESTERFIELD COUNTY	VA	0	1	3	0.999955
HEF	MANASSAS RGNL HARRY P. DAVIS FIELD	VA	0	1	2	0.999980
IAD	WASHINGTON DULLES INTL	VA	0	1	2	0.999986
JYO	LEESBURG EXECUTIVE	VA	0	1	3	0.999987
LNP	LONESOME PINE	VA	0	1	1	0.999994

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
LYH	LYNCHBURG RGNL PRESTON GLENN FIELD	VA	0	1	2	0.999986
MFV	ACCOMACK COUNTY	VA	0	1	1	0.999975
MKJ	MOUNTAIN EMPIRE	VA	0	1	0	1
MTV	BLUE RIDGE	VA	0	1	1	1
OFP	HANOVER COUNTY MUNICIPAL	VA	0	1	3	0.999958
ORF	NORFOLK INTL	VA	0	1	1	0.999954
PHF	NEWPORT NEWS/WILLIAMSBURG INTL	VA	0	1	2	0.999956
PSK	NEW RIVER VALLEY	VA	0	1	0	1
PTB	DINWIDDIE COUNTY	VA	0	1	3	0.999953
RIC	RICHMOND INTL	VA	0	1	3	0.999955
RMN	STAFFORD RGNL	VA	0	1	2	0.999974
XSA	TAPPAHANNOCK-ESSEX COUNTY	VA	0	1	3	0.999967
BTV	BURLINGTON INTL	VT	1	0.999937	1	0.999863
FSO	FRANKLIN COUNTY STATE	VT	1	0.999931	4	0.999854
ALW	WALLA WALLA RGNL	WA	2	0.999929	43	0.998786
BLI	BELLINGHAM INTL	WA	1	0.999864	46	0.997422
BVS	SKAGIT RGNL	WA	1	0.999862	46	0.997192
CLM	WILLIAM R FAIRCHILD INTL	WA	2	0.999862	47	0.995610
DEW	DEER PARK	WA	0	1	2	0.999961
FHR	FRIDAY HARBOR	WA	2	0.999859	47	0.996919
GEG	SPOKANE INTL	WA	1	0.999995	45	0.999671
HQM	BOWERMAN	WA	2	0.999860	50	0.994427
MWH	GRANT CO INTL	WA	1	0.999915	45	0.998581
OLM	OLYMPIA	WA	2	0.999878	47	0.995470
PAE	SNOHOMISH COUNTY (PAINE FLD)	WA	1	0.999872	0	1
PSC	TRI-CITIES	WA	2	0.999911	43	0.998603
PUW	PULLMAN/MOSCOW RGNL	WA	0	1	40	0.999897
PWT	BREMERTON NATIONAL	WA	2	0.999873	45	0.995771
RLD	RICHLAND	WA	2	0.999908	43	0.998523
SEA	SEATTLE-TACOMA INTL	WA	1	0.999877	45	0.996262
TIW	TACOMA NARROWS	WA	1	0.999877	45	0.995917
ASX	JOHN F KENNEDY MEMORIAL	WI	0	1	3	0.999812
ATW	OUTAGAMIE COUNTY RGNL	WI	0	1	2	0.999915
C29	MIDDLETON MUNICIPAL – MOREY FIELD	WI	0	1	1	0.999989
CWA	CENTRAL WISCONSIN	WI	0	1	3	0.999968
DLL	BARABOO WISCONSIN DELLS	WI	0	1	1	0.999987
EAU	CHIPPEWA VALLEY RGNL	WI	0	1	5	0.999923
EGV	EAGLE RIVER UNION	WI	0	1	3	0.999879
FLD	FOND DU LAC COUNTY	WI	0	1	1	0.999913
GRB	AUSTIN STRAUBEL INTL	WI	0	1	2	0.999901
HYR	SAWYER COUNTY	WI	0	1	3	0.999852
JVL	SOUTHERN WISCONSIN RGNL	WI	0	1	1	0.999913
LNR	TRI-COUNTY RGNL	WI	0	1	1	0.999981
LSE	LA CROSSE MUNICIPAL	WI	0	1	2	0.999957
LUM	MENOMONIE MUNICIPAL-SCORE FIELD	WI	0	1	3	0.999919
MFI	MARSHFIELD MUNICIPAL	WI	0	1	4	0.999964
MKE	GENERAL MITCHELL INTL	WI	0	1	1	0.999983
MSN	DANE COUNTY RGNL-TRUAX FIELD	WI	0	1	1	0.999917
MTW	MANITOWOC COUNTY	WI	0	1	2	0.999905
OSH	WITTMAN RGNL	WI	0	1	1	0.999913

Airport Id	Airport Name	State	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
OVS	BOSCOBEL	WI	0	1	1	0.999972
PBH	PRICE COUNTY	WI	0	1	3	0.999892
RHI	RHINELANDER-ONEIDA COUNTY	WI	0	1	3	0.999910
RPD	RICE LAKE RGNL - CARL'S FIELD	WI	0	1	3	0.999891
RRL	MERRILL MUNICIPAL	WI	0	1	3	0.999937
SBM	SHEBOYGAN COUNTY MEMORIAL	WI	0	1	1	0.999985
SUE	DOOR COUNTY CHERRYLAND	WI	0	1	2	0.999875
TKV	TOMAHAWK RGNL	WI	0	1	3	0.999917
UNU	DODGE COUNTY	WI	0	1	1	0.999913
HTS	TRI-STATE/MILTON J. FERGUSON F	WV	0	1	0	1
MRB	EASTERN WV RGNL/SHEPHERD FLD	WV	0	1	1	0.999991
PKB	MID-OHIO VALLEY RGNL	WV	0	1	0	1
COD	YELLOWSTONE RGNL	WY	0	1	1	0.999991
CPR	NATRONA COUNTY INTL	WY	0	1	1	0.999980
CYS	CHEYENNE RGNL/JERRY OLSON FIELD	WY	0	1	2	0.999876
EVW	EVANSTON-UINTA COUNTY BURNS FIELD	WY	0	1	0	1
GCC	GILLETTE-CAMPBELL COUNTY	WY	0	1	1	0.999871
JAC	JACKSON HOLE	WY	0	1	0	1
LAR	LARAMIE RGNL	WY	0	1	1	0.999877
RIW	RIVERTON RGNL	WY	0	1	0	1
RKS	ROCK SPRINGS-SWEETWATER COUNTY	WY	0	1	1	0.999999
SHR	SHERIDAN COUNTY	WY	0	1	1	1

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	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10
Albuquerque	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	yellow	blue	green	blue	blue	blue	blue
	C	red	yellow	green	blue	blue	blue	blue	blue	blue	green	blue	blue
Anchorage	A	blue	blue	blue	green	green	blue	blue	blue	blue	blue	green	blue
	B	green	blue	yellow	blue	blue	green	blue	blue	blue	green	green	blue
	C	green	blue	blue	blue	blue	yellow	blue	blue	green	blue	blue	blue
Atlanta	A	blue	blue	blue	blue	–	blue	blue	blue	green	blue	blue	blue
	B	blue	yellow	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	green	blue
Barrow	A	green	yellow	green	blue	yellow	green	blue	blue	yellow	blue	blue	blue
	B	blue	blue	blue	blue	green	blue	blue	blue	blue	blue	blue	yellow
	C	blue	green	yellow	blue	yellow	blue	blue	blue	blue	yellow	yellow	yellow
Bethel	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	green	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	yellow	blue	blue
Billings	A	green	blue	green	blue	green	blue	blue	green	blue	blue	blue	blue
	B	blue	blue	green	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	green	green	blue	green	yellow	blue
Boston	A	blue	blue	blue	blue	blue	blue	blue	yellow	yellow	yellow	blue	blue
	B	blue	blue	green	blue	blue	yellow	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Chicago	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	blue	blue	green	blue	green	blue	blue	blue	blue	green	yellow
Cleveland	A	green	red	blue	yellow	blue	blue	green	blue	blue	red	yellow	yellow
	B	blue	blue	blue	blue	blue	blue	blue	blue	yellow	blue	blue	blue
	C	blue	blue	green	green	blue	green	blue	yellow	green	green	blue	blue
Cold Bay	A	blue	green	–	–	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	–	–	yellow	red	blue	green	blue	blue	blue	blue
	C	blue	blue	–	–	yellow	blue	blue	blue	blue	blue	blue	green
Dallas	A	blue	blue	red	blue	blue	blue	blue	red	blue	yellow	blue	blue
	B	yellow	yellow	yellow	blue	yellow	red	green	red	blue	green	yellow	green
	C	blue	blue	blue	green	blue	blue	blue	blue	green	yellow	blue	blue
Denver	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	yellow
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	green	blue	blue	yellow	green	blue	blue	green	green	blue	blue	green
Fairbanks	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	yellow	blue	yellow	yellow	yellow	blue	blue	blue	blue
	C	blue	yellow	blue	blue	red	red	blue	blue	yellow	yellow	blue	blue
Gander	A	blue	yellow	blue	blue	blue	green	blue	blue	blue	blue	blue	yellow
	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
Goose Bay	A	blue	yellow	blue	yellow	blue	yellow	blue	blue	green	blue	blue	yellow
	B	yellow	yellow	blue	blue	green	blue	blue	blue	blue	yellow	blue	blue
	C	yellow	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
Honolulu	A	blue	blue	yellow	blue	blue	yellow	green	green	blue	yellow	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	C	blue	yellow	blue	blue	yellow	blue	blue	yellow	yellow	blue	blue	blue
Houston	A	green	green	green	yellow	red	green	blue	green	yellow	yellow	yellow	yellow
	B	yellow	yellow	red	red	red	yellow	blue	yellow	yellow	yellow	green	yellow
	C	red	red	red	yellow	yellow	yellow	blue	yellow	yellow	yellow	yellow	blue
Iqaluit	A	green	green	yellow	red	yellow	yellow	blue	yellow	blue	blue	blue	green
	B	blue	blue	blue	blue	green	green	blue	blue	blue	blue	blue	red
	C	blue	yellow	blue	yellow	blue	blue	blue	blue	blue	blue	blue	red
Jacksonville	A	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue
	B	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	yellow
	C	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue	blue

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

WAAS Site	WRE	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10
Juneau	A	Excellent	Excellent	Good	Fair	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Fair	Excellent
	B	Fair	Good	Excellent	Good	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good
	C	Fair	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent
Kansas City	A	Fair	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Excellent	Good	Fair
	B	Good	Good	Fair	Excellent	Excellent	Fair	Excellent	Fair	Fair	Good	Fair	Excellent
	C	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent
Kotzebue	A	Poor	Excellent	Fair	Excellent	–	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Fair	–	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent
	C	Fair	Fair	Fair	Excellent	–	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent
Los Angeles	A	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Fair	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Excellent
	C	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Memphis	A	Good	Excellent	Fair	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
Merida	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	Good	Excellent	Excellent	Excellent	Fair	Excellent	Excellent	Fair	Excellent	Fair	Fair	Fair
Mexico City	A	Excellent	Poor	Excellent	Fair	Excellent	Fair	Excellent	Excellent	Fair	Good	Excellent	Excellent
	B	Good	Excellent	Good	Good	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Good
	C	Fair	Good	Fair	Excellent	Excellent	Excellent	Poor	Excellent	Excellent	Fair	Excellent	Excellent
Miami	A	Fair	Fair	Fair	Good	Good	Excellent	Excellent	Excellent	Fair	Fair	Fair	Good
	B	Excellent	Good	Fair	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Good	Excellent
	C	Fair	Poor	Excellent	Excellent	Poor	Fair	Good	Good	Good	Good	Good	Excellent
Minneapolis	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Poor	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Good
	C	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Fair	Good	Fair	Excellent
New York	A	Good	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	C	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Good	Fair	Excellent	Fair	Excellent	Good
Oakland	A	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Fair	Fair	Excellent	Excellent	Fair	Excellent	Excellent	Excellent	Fair	Excellent	Fair	Excellent
	C	Fair	Fair	Good	Good	Fair	Good	Fair	Excellent	Excellent	Excellent	Excellent	Excellent
Puerto Vallarta	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Poor	Excellent	Excellent
	B	Fair	Fair	Good	Excellent	Excellent	Excellent	Good	Excellent	Fair	Excellent	Fair	Excellent
	C	Fair	Excellent	Fair	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Fair	Excellent
Salt Lake City	A	Excellent	Excellent	Excellent	Excellent	Fair	Fair	Good	Fair	Poor	Fair	Excellent	Fair
	B	Poor	Excellent	Excellent	Fair	Poor	Fair	Excellent	Fair	Excellent	Good	Fair	Fair
	C	Poor	Good	Poor	Excellent	Fair	Fair	Excellent	Good	Good	Good	Fair	Excellent
San Jose Del Cabo	A	Poor	Poor	Poor	Fair	Excellent	Good	Poor	Poor	Poor	Poor	Poor	Excellent
	B	Fair	Fair	Good	Poor	Excellent	Fair	Excellent	Fair	Good	Good	Fair	Poor
	C	Poor	Poor	Fair	Good	Excellent	Fair	Fair	Poor	Poor	Good	Poor	Poor
San Juan	A	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Fair	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent
	C	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Seattle	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair
	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
Tapachula	A	Good	Fair	Excellent	Poor	Poor	Good	Excellent	Poor	Poor	Good	Poor	Excellent
	B	Good	Good	Poor	Fair	Fair	Good	Excellent	Fair	Fair	Fair	Poor	Good
	C	Poor	Fair	Good	Good	Poor	Poor	Excellent	Poor	Poor	Poor	Poor	Fair
Washington, DC	A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
	B	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent
	C	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Winnipeg	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

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

11.0 WAAS REFERENCE STATION SURVEY VALIDATION

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

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

Antenna L1 phase center position surveys were preformed for the WAAS antennas using a 25 hour set of data from 23:00 on 6/29/10 to 23:59:30 on 6/30/10 for all of the WAAS receivers except Tapachula Mexico (MTP). Tapachula was off line on 6/30/10 due to failed communications circuits. A 24 hour data set from 4/26/10 was used for Tapachula.

Surveys were performed using the National Geodetic Survey (NGS) Online Positioning User Service (OPUS) and the Canadian Spatial Reference System (CSRS) Precise Point Positioning (PPP) service. The overall RMS qualities reported by OPUS were all less than or equal to 2.4 cm. The CSRS survey's RSSs of the reported ECEF sigma's were all less than equal to 1.5 cm. The OPUS and CSRS surveys agreed to 6.5 cm or better.

The positions were compared to the positions in the current WAAS software build 6.012 that was fielded during November 2009 and the next release, build 6.071, which will be fielded this fall. The build 6.012 positions have been interpolated forward to 8/1/10. The build6.071 positions have been interpolated forward to 4/1/2011.

The OPUS surveys agree with the build 6.012 positions to better than or equal to 6 cm with the exceptions of Miami which agrees to 9 cm to 10 cm. The CSRS Miami surveys agree with build 6.012 to within 4.6 cm. Miami is also a slight outlier in the OPUS to CSRS comparison.

Table 11.1 lists the WAAS antenna L1 phase center positions as of 6/30/10. The positions are in IRTF-2000 and are the OPUS estimated positions. OPUS is now using GEOID 09.

Figure 11.1 to 11.3 show the RSS of the ECEF difference between the 6/30/10 OPUS survey antenna phase center locations and the locations in the build 6.012 software which was fielded this November 2009. Each reference station has three independent strings of WAAS receiving equipment (WRE). A surveyed antenna phase center location is required for each WRE. All three strings of a reference station are shown in the three figures. For example, BET1 identifies the RSS delta for the Bethel WRS string 1. The next two bars in the chart are Bethel string 2 and Bethel string 3. Figure 11.4 to 11.6 show the OPUS overall RMS quality indications.

Figure 11.7 to 11.9 show the RSS of the ECEF difference between the positions obtained from OPUS and the positions obtained from the Canadian Spatial Reference System (CSRS). Note that that OPUS positions are in ITRF-2000 and the CSRS positions are in ITRF-2005. Figures 11.10 to 11.12 show the RSS of ECEF sigma's reported by CSRS.

Figure 11.13 to 11.15 show the RSS of the ECEF difference between the 6/30/10 OPUS survey antenna phase center locations and the locations in the build 6.071 software which will be fielded about November 2010. The antenna phase center information in WFO release 2 has been interpolated forward in time to 4/1/11. Mexico City is an outlier because it has a significant subsidence rate.

Table 11-1 WAAS Survey Positions (OPUS ITRF-2000) as of 1/3/10

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
BET1	-2965384.993	-972576.631	5543892.947	60.787916056	-161.841724511	52.203
BET2	-2965385.765	-972580.352	5543891.893	60.787896611	-161.841664017	52.207
BET3	-2965388.331	-972577.484	5543891.024	60.787880706	-161.841728731	52.202
BIL1	-1416445.846	-4223577.035	4550862.165	45.803706889	-108.539722581	1112.257
BIL2	-1416449.915	-4223574.894	4550862.889	45.803716175	-108.539780953	1112.263
BIL3	-1416441.538	-4223574.297	4550866.015	45.803756608	-108.539681244	1112.253
BRW1	-1886758.858	-809058.680	6018494.509	71.282765467	-156.789923619	15.586
BRW2	-1886756.273	-809055.938	6018495.691	71.282798206	-156.789965522	15.596
BRW3	-1886755.181	-809059.722	6018495.503	71.282793525	-156.789856447	15.574
CDB1	-3484098.994	-1084748.816	5213678.682	55.192374750	-162.706403911	49.714
CDB2	-3484105.642	-1084741.613	5213675.727	55.192328575	-162.706542925	49.689
CDB3	-3484111.908	-1084734.853	5213672.979	55.192285181	-162.706673517	49.701
FAI1	-2304741.736	-1448715.280	5748843.688	64.809630531	-147.847340017	149.911
FAI2	-2304741.264	-1448706.471	5748846.086	64.809680978	-147.847491700	149.916
FAI3	-2304732.736	-1448707.406	5748849.237	64.809747569	-147.847379517	149.906
HNL1	-5508637.075	-2234493.458	2303722.116	21.312989522	-157.920826100	24.672
HNL2	-5508656.240	-2234483.774	2303686.867	21.312646589	-157.920982025	25.014
HNL3	-5508647.646	-2234497.713	2303693.959	21.312715206	-157.920826394	25.054
JNU1	-2354254.832	-2388549.651	5407043.074	58.362574744	-134.585706275	16.044
JNU2	-2354252.751	-2388565.765	5407036.912	58.362469169	-134.585487706	16.052
JNU3	-2354239.530	-2388568.611	5407041.362	58.362545572	-134.585292711	16.035
MMD1	35070.447	-5959686.706	2264365.759	20.931909069	-89.662840431	29.153
MMD2	35065.522	-5959687.077	2264364.974	20.931901344	-89.662887797	29.192
MMD3	35065.184	-5959685.297	2264369.633	20.931946397	-89.662890947	29.192
MMX1	-948701.161	-5943936.064	2109212.845	19.431653328	-99.068389547	2236.077
MMX2	-948696.734	-5943935.897	2109215.272	19.431676589	-99.068348186	2236.071
MMX3	-948705.598	-5943936.253	2109210.415	19.431629972	-99.068430972	2236.104
MPR1	-1570142.210	-5759530.636	2238184.756	20.679003236	-105.249203033	11.004
MPR2	-1570139.389	-5759530.147	2238188.808	20.679041347	-105.249178144	11.300
MPR3	-1570143.494	-5759528.016	2238190.571	20.679059361	-105.249221536	11.009
MSD1	-1979519.641	-5523223.121	2493106.740	23.160446350	-109.717647100	104.299
MSD2	-1979521.211	-5523225.455	2493100.345	23.160383578	-109.717653844	104.291
MSD3	-1979525.661	-5523222.175	2493104.012	23.160419653	-109.717705558	104.275
MTP1	-254854.337	-6162909.198	1617805.081	14.791366058	-92.367999019	54.976
MTP2	-254850.737	-6162910.232	1617801.654	14.791334072	-92.367965211	54.956
MTP3	-254855.506	-6162910.340	1617800.127	14.791320025	-92.368009431	54.861
OTZ1	-2396055.955	-750356.177	5843502.532	66.887332700	-162.611372125	10.878
OTZ2	-2396052.786	-750354.349	5843504.062	66.887367533	-162.611390322	10.884
OTZ3	-2396052.764	-750358.286	5843503.571	66.887356275	-162.611304436	10.886
YFB1	1035381.506	-2634289.645	5696539.502	63.731490164	-68.543182353	10.004
YFB2	1035372.289	-2634296.051	5696538.150	63.731463958	-68.543403433	9.938
YFB3	1035366.218	-2634306.804	5696534.370	63.731386308	-68.543597431	9.995

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
YQX1	2430424.667	-3419640.397	4788223.792	48.966489614	-54.597631831	146.863
YQX2	2430432.631	-3419639.056	4788220.741	48.966447725	-54.597532567	146.873
YQX3	2430440.530	-3419637.683	4788217.726	48.966406478	-54.597433775	146.868
YWG1	-520164.311	-4083475.879	4855842.964	49.900574375	-97.259396831	221.998
YWG2	-520150.431	-4083468.821	4855850.337	49.900677281	-97.259217603	221.999
YWG3	-520152.301	-4083477.934	4855842.518	49.900568208	-97.259227394	221.993
YYR1	1885341.457	-3321428.357	5091171.597	53.308646692	-60.419467847	37.808
YYR2	1885344.418	-3321419.879	5091176.014	53.308712997	-60.419366431	37.817
YYR3	1885340.129	-3321413.060	5091182.020	53.308803225	-60.419371889	37.825
ZAB1	-1488636.805	-5003946.546	3654557.698	35.173575342	-106.567349358	1620.116
ZAB2	-1488631.470	-5003948.229	3654557.678	35.173574719	-106.567287972	1620.180
ZAB3	-1488632.247	-5003950.813	3654553.821	35.173532303	-106.567288058	1620.163
ZAN1	-2659536.564	-1549114.822	5567750.767	61.229202194	-149.780249294	80.682
ZAN2	-2659548.328	-1549110.867	5567746.281	61.229118517	-149.780423139	80.684
ZAN3	-2659541.277	-1549106.742	5567750.756	61.229202103	-149.780423428	80.675
ZAU1	138704.150	-4761244.166	4227763.940	41.782657956	-88.331336286	195.913
ZAU2	138704.414	-4761248.775	4227758.776	41.782595606	-88.331334728	195.913
ZAU3	138711.119	-4761248.511	4227758.862	41.782596594	-88.331254017	195.919
ZBW1	1490299.258	-4448983.175	4306010.473	42.735720250	-71.480425439	39.110
ZBW2	1490304.371	-4448981.159	4306010.818	42.735724286	-71.480358417	39.133
ZBW3	1490306.084	-4448984.794	4306006.511	42.735671431	-71.480352681	39.142
ZDC1	1069125.808	-4839599.011	4001126.499	39.101595653	-77.542746083	80.084
ZDC2	1069128.205	-4839603.647	4001120.293	39.101523617	-77.542730586	80.084
ZDC3	1069124.097	-4839602.730	4001122.487	39.101549075	-77.542774669	80.085
ZDV1	-1273628.580	-4711375.606	4094890.128	40.187303258	-105.127223897	1541.384
ZDV2	-1273622.874	-4711377.117	4094890.143	40.187303539	-105.127154600	1541.370
ZDV3	-1273624.885	-4711380.310	4094885.853	40.187253072	-105.127167608	1541.357
ZFW1	-659983.177	-5324060.794	3438276.471	32.830649653	-97.066471536	155.630
ZFW2	-659988.445	-5324063.341	3438271.474	32.830596269	-97.066524025	155.590
ZFW3	-659983.473	-5324063.888	3438271.695	32.830598278	-97.066470608	155.652
ZHU1	-513864.449	-5506451.786	3166720.496	29.961896181	-95.331425964	10.929
ZHU2	-513867.097	-5506455.178	3166714.331	29.961831675	-95.331450014	10.989
ZHU3	-513873.381	-5506457.813	3166708.727	29.961773425	-95.331512300	10.969
ZJX1	772646.474	-5434462.241	3237231.739	30.698859369	-81.908184875	2.182
ZJX2	772649.809	-5434463.787	3237228.327	30.698823694	-81.908152683	2.160
ZJX3	772645.741	-5434466.198	3237225.217	30.698791219	-81.908198264	2.132
ZKC1	-415247.483	-4954556.405	3982161.115	38.880159328	-94.790833428	305.907
ZKC2	-415231.091	-4954557.723	3982161.171	38.880160036	-94.790643919	305.899
ZKC3	-415237.208	-4954561.076	3982155.974	38.880101814	-94.790710939	305.636
ZLA1	-2474409.882	-4637294.740	3602183.521	34.603517928	-118.083894389	763.550
ZLA2	-2474404.607	-4637297.535	3602183.533	34.603518106	-118.083829317	763.542
ZLA3	-2474411.213	-4637297.228	3602179.547	34.603474003	-118.083894422	763.615

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
ZLC1	-1808273.165	-4486410.842	4145303.028	40.786043356	-111.952176931	1287.438
ZLC2	-1808274.563	-4486414.445	4145298.532	40.785989981	-111.952176336	1287.427
ZLC3	-1808270.358	-4486416.154	4145298.523	40.785989842	-111.952122569	1287.431
ZMA1	966042.374	-5662999.881	2761581.500	25.824611931	-80.319189167	-7.525
ZMA2	966029.416	-5662999.162	2761585.979	25.824659678	-80.319315358	-8.173
ZMA3	966037.506	-5662997.988	2761586.336	25.824661778	-80.319233853	-7.834
ZME1	4070.926	-5226189.315	3644028.415	35.067393961	-89.955369617	68.613
ZME2	4070.959	-5226186.770	3644032.534	35.067437528	-89.955369233	68.897
ZME3	4064.762	-5226186.632	3644032.687	35.067439394	-89.955437172	68.868
ZMP1	-249978.345	-4539297.526	4458955.051	44.637463106	-93.152085006	262.671
ZMP2	-249972.538	-4539297.865	4458955.047	44.637462961	-93.152011697	262.682
ZMP3	-249973.637	-4539302.140	4458950.573	44.637406942	-93.152022564	262.619
ZNY1	1406144.686	-4627343.997	4144322.048	40.784328361	-73.097165156	6.464
ZNY2	1406146.488	-4627347.039	4144317.276	40.784275622	-73.097155206	5.948
ZNY3	1406140.924	-4627348.700	4144317.308	40.784276006	-73.097223997	5.947
ZOA1	-2684436.813	-4293337.501	3865351.815	37.543053261	-122.015946650	-3.491
ZOA2	-2684433.811	-4293341.577	3865349.391	37.543025708	-122.015893397	-3.490
ZOA3	-2684438.175	-4293342.462	3865345.529	37.542981294	-122.015929958	-3.414
ZOB1	650770.215	-4754715.709	4187420.759	41.297154267	-82.206444422	223.718
ZOB2	650777.896	-4754714.888	4187422.781	41.297166589	-82.206352236	225.224
ZOB3	650776.223	-4754719.705	4187414.984	41.297086836	-82.206379825	223.493
ZSE1	-2308930.231	-3668169.698	4663526.491	47.286993361	-122.188372233	82.108
ZSE2	-2308934.627	-3668175.247	4663520.082	47.286907744	-122.188382336	82.173
ZSE3	-2308935.689	-3668179.524	4663516.142	47.286856044	-122.188364100	82.117
ZSU1	2462589.363	-5529371.558	2003724.606	18.431338453	-65.993475253	-28.573
ZSU2	2462587.285	-5529377.318	2003711.619	18.431214525	-65.993515403	-28.489
ZSU3	2462593.922	-5529375.111	2003709.551	18.431194844	-65.993449514	-28.494
ZTL1	529840.437	-5305248.823	3489342.837	33.379688414	-84.296725661	261.141
ZTL2	529846.818	-5305247.986	3489343.125	33.379691567	-84.296656533	261.134
ZTL3	529847.500	-5305251.423	3489337.887	33.379634831	-84.296652911	261.164

Figure 11-1 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

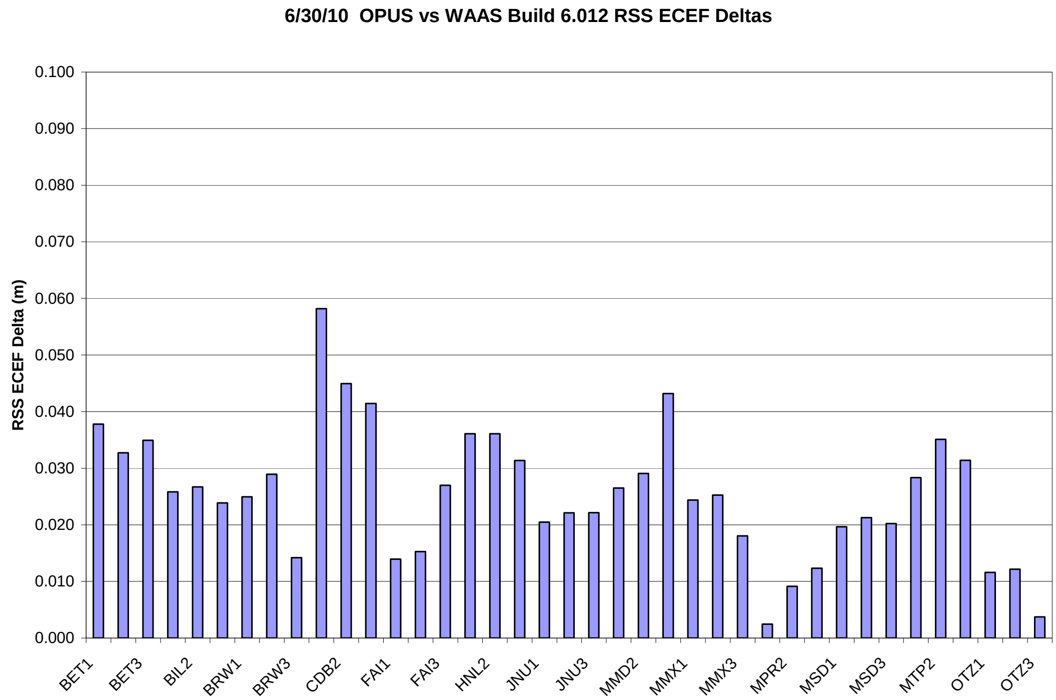


Figure 11-2 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

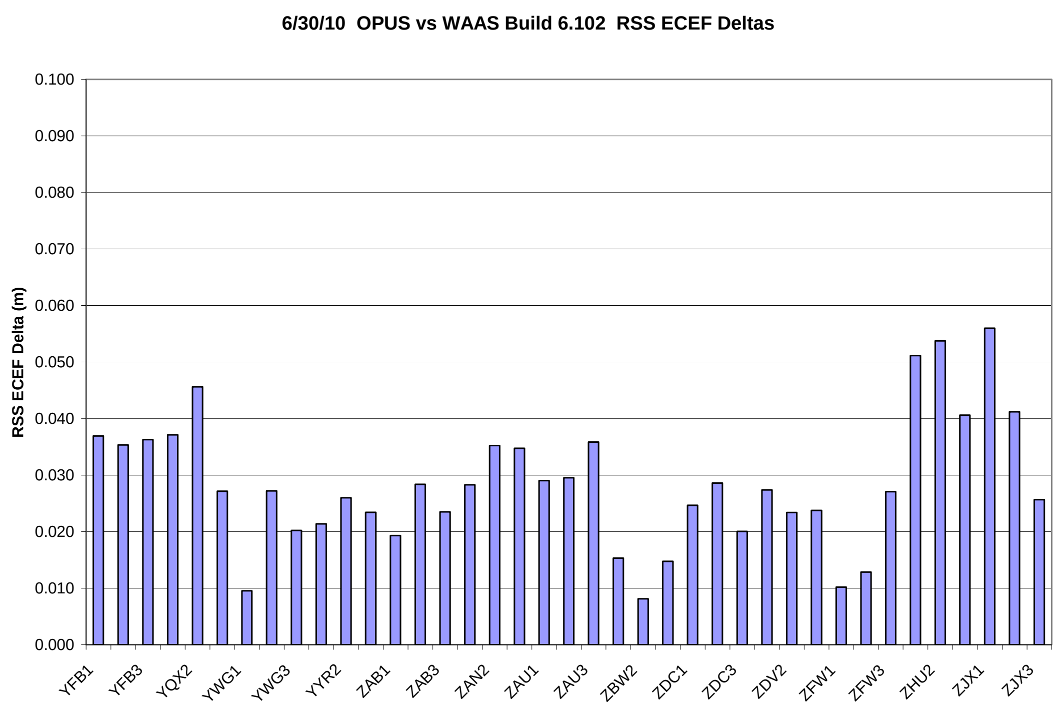


Figure 11-3 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

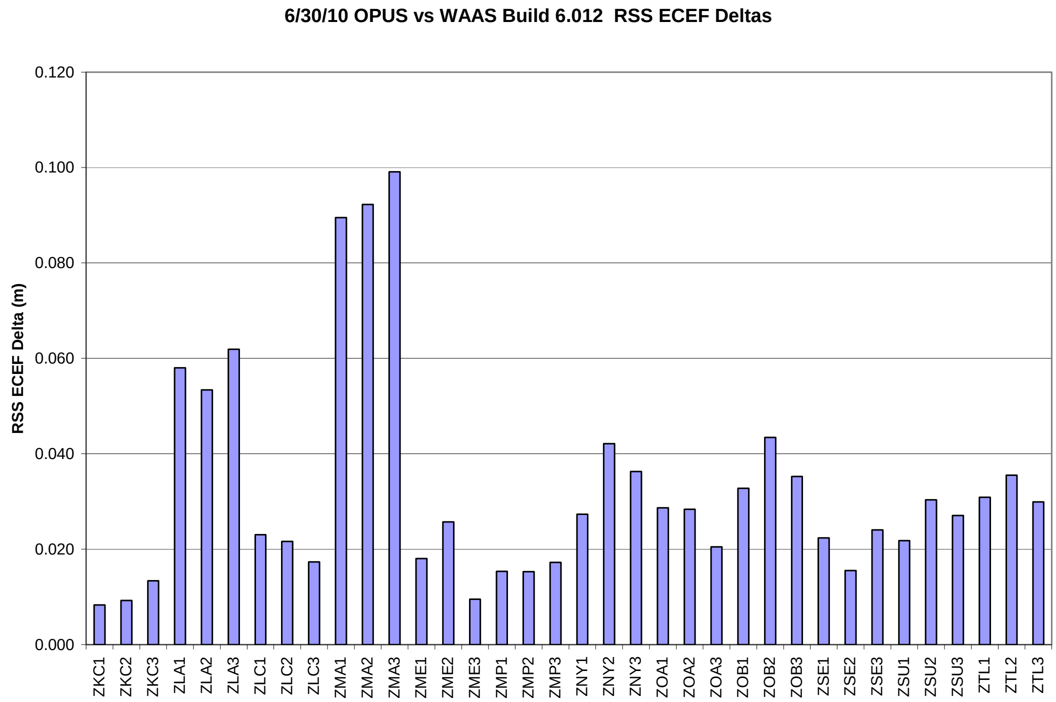


Figure 11-4 OPUS Overall RMS Qualitites

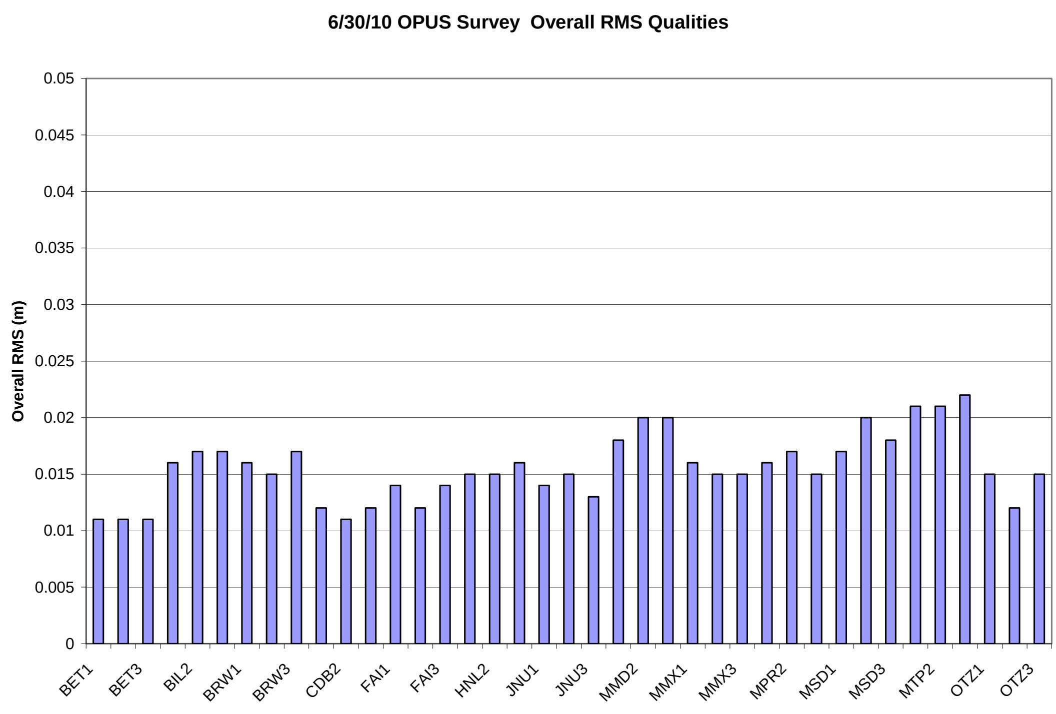


Figure 11-5 OPUS Survey Overall RMS Qualities

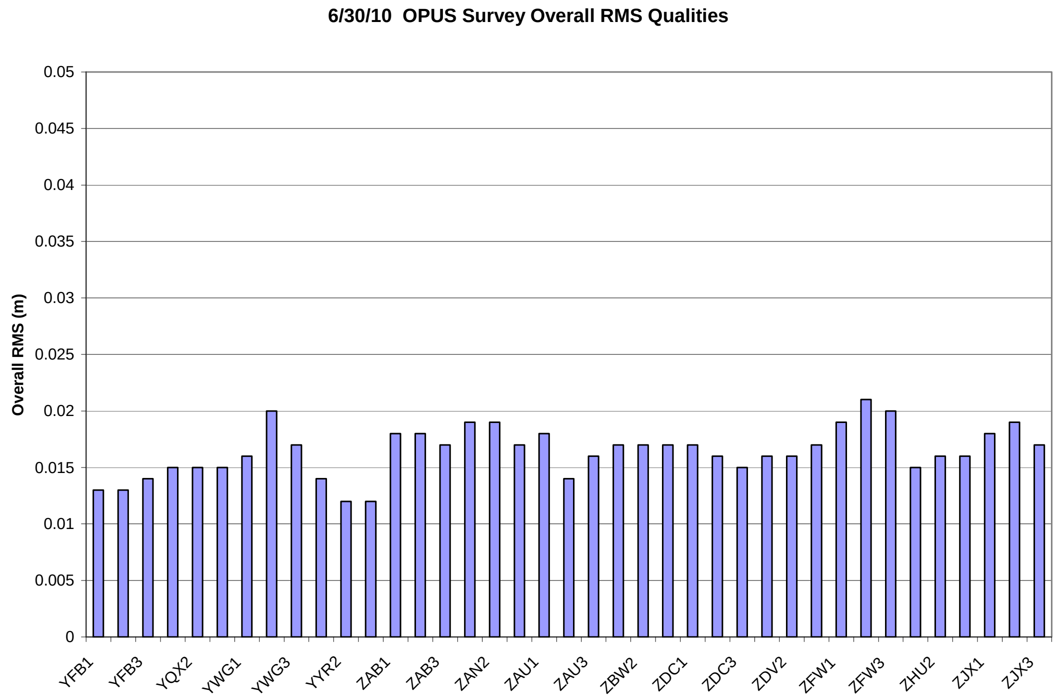


Figure 11-6 OPUS Survey Overall RMS Qualities

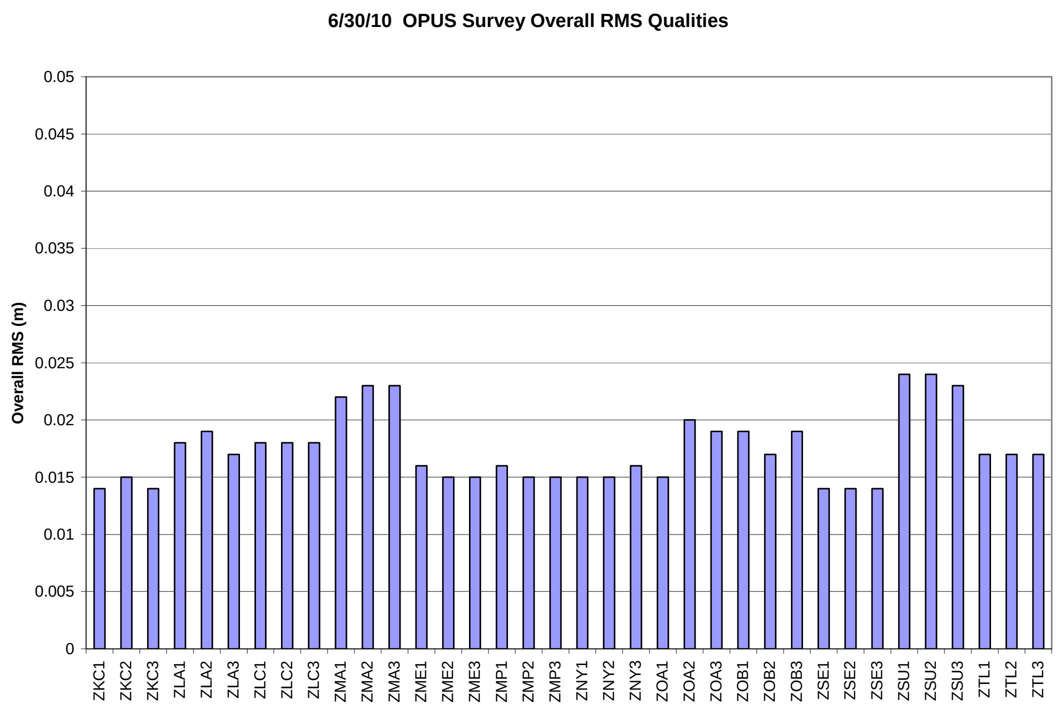


Figure 11-7 OPUS vs. CSRS RSS ECEF Deltas

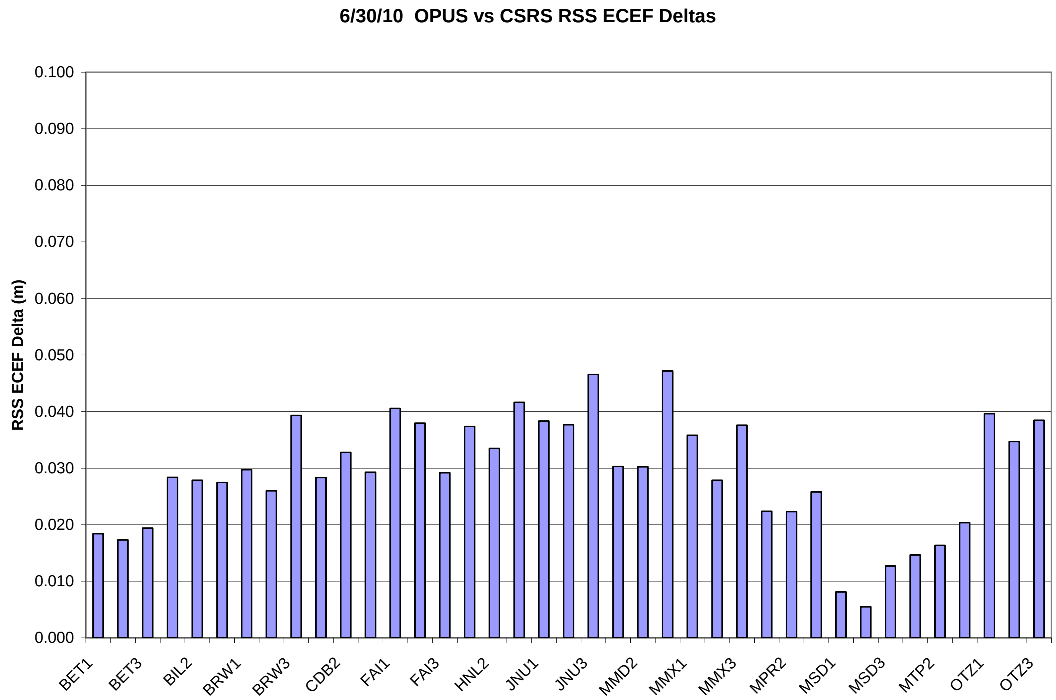


Figure 11-8 OPUS vs. CSRS RSS ECEF Deltas

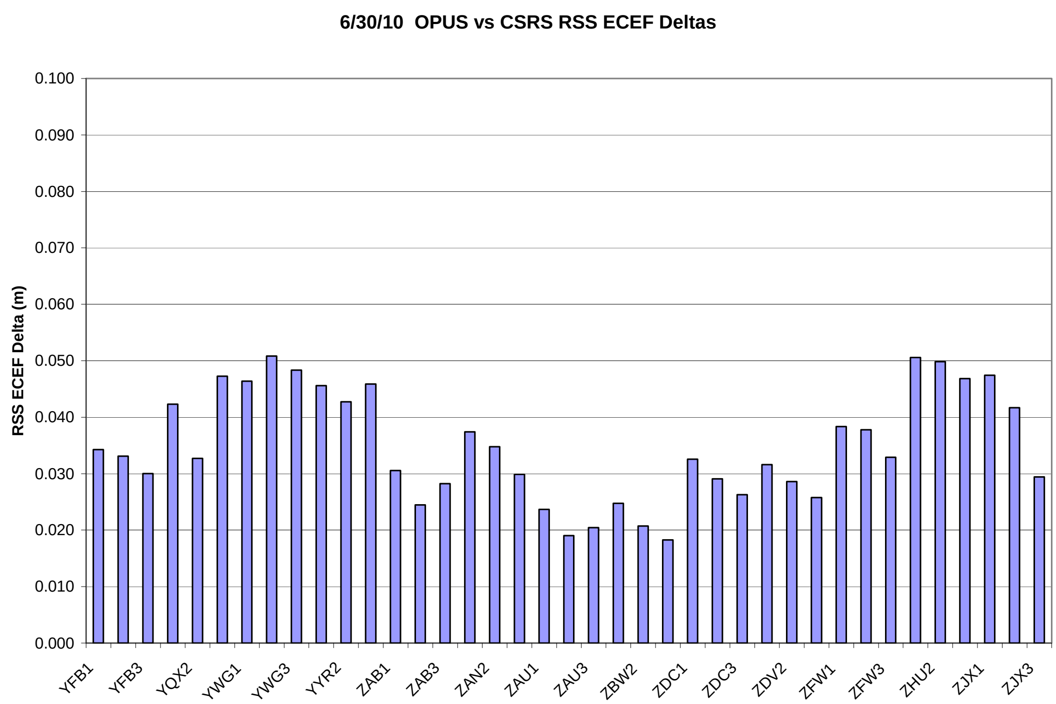


Figure 11-9 OPUS vs. CSRS RSS ECEF Deltas

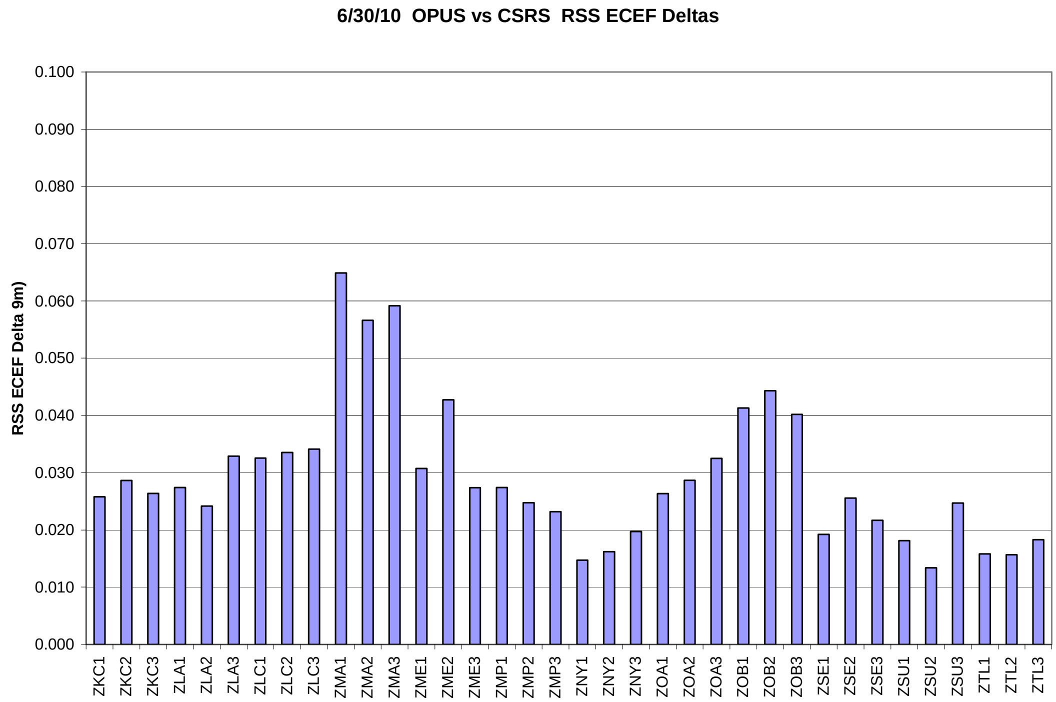


Figure 11-10 CSRS Survey Qualities

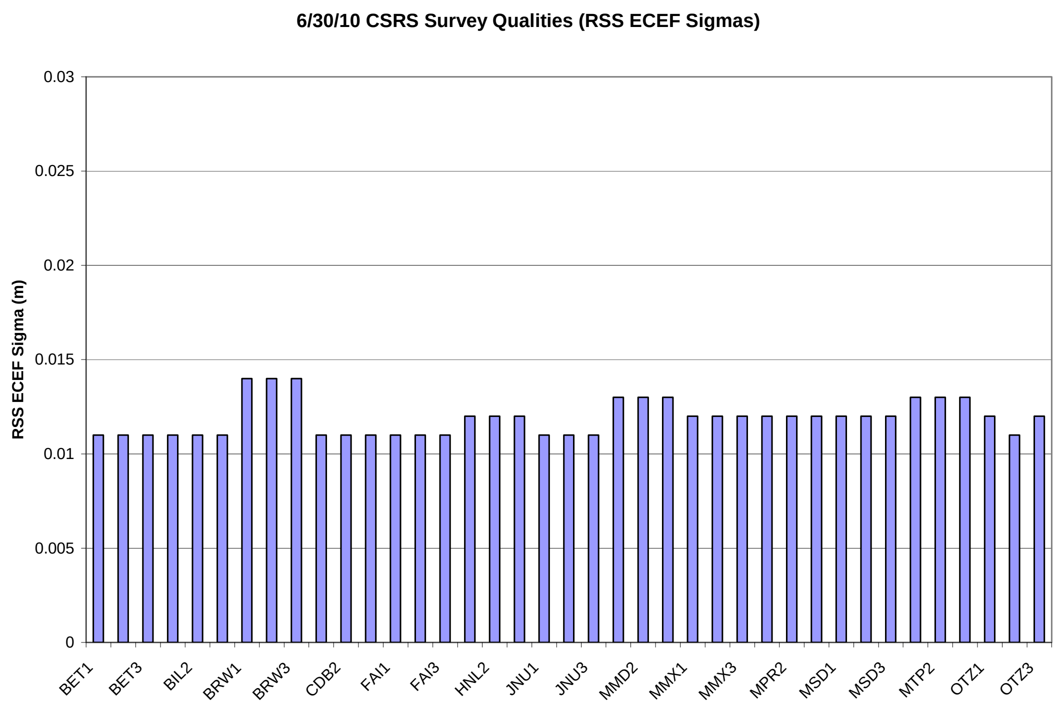


Figure 11-11 CSRS Survey Qualities

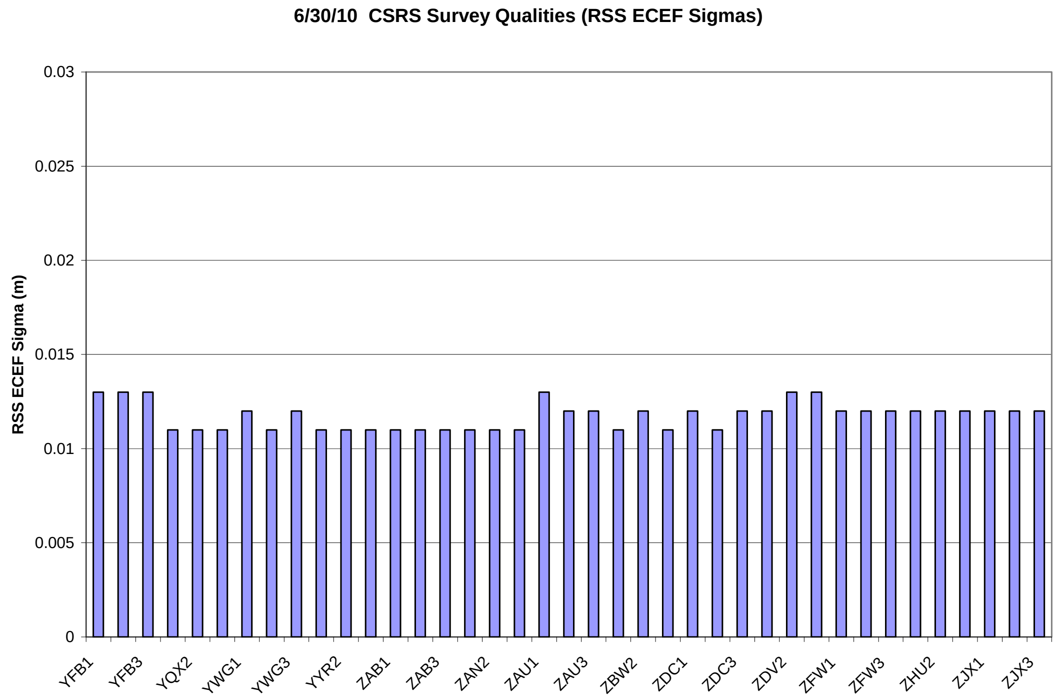


Figure 11-12 CSRS Survey Qualities

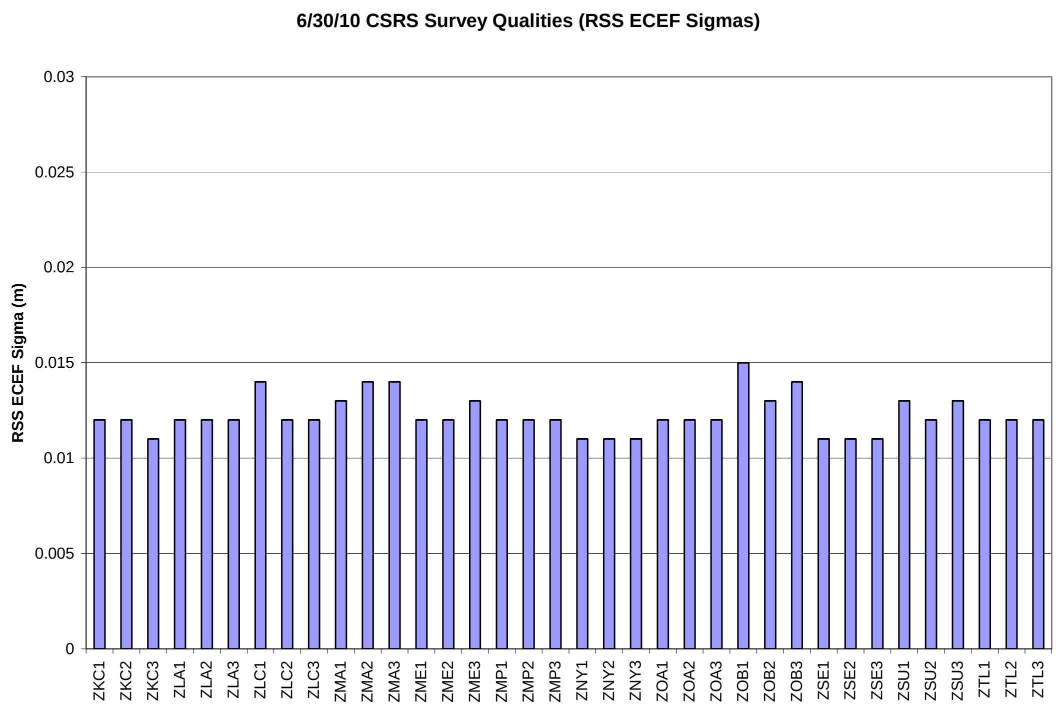


Figure 11-13 WAAS Build 6.071Antenna Positions Deltas from 6/30/10 OPUS Survey

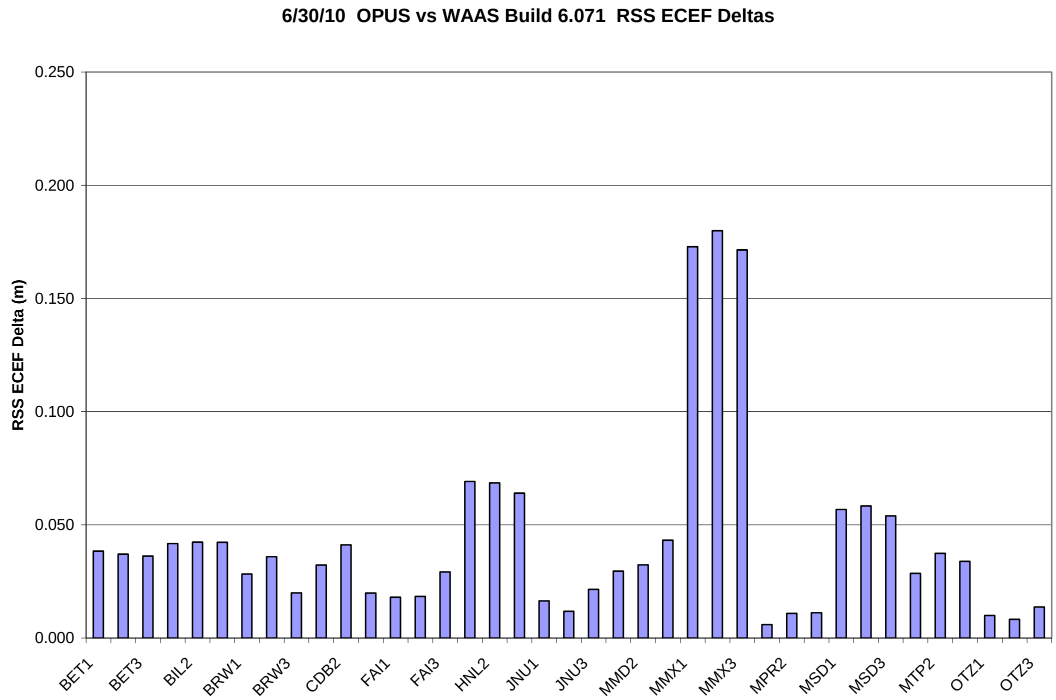


Figure 11-14 WAAS Build 6.071Antenna Positions Deltas from 6/30/10 OPUS Survey

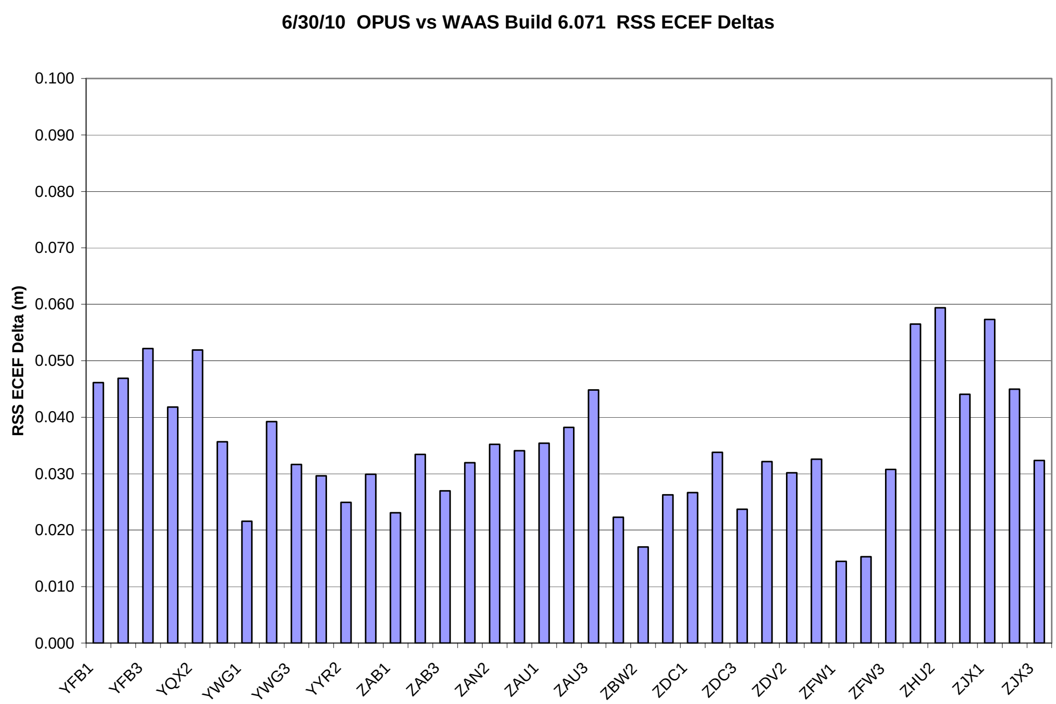
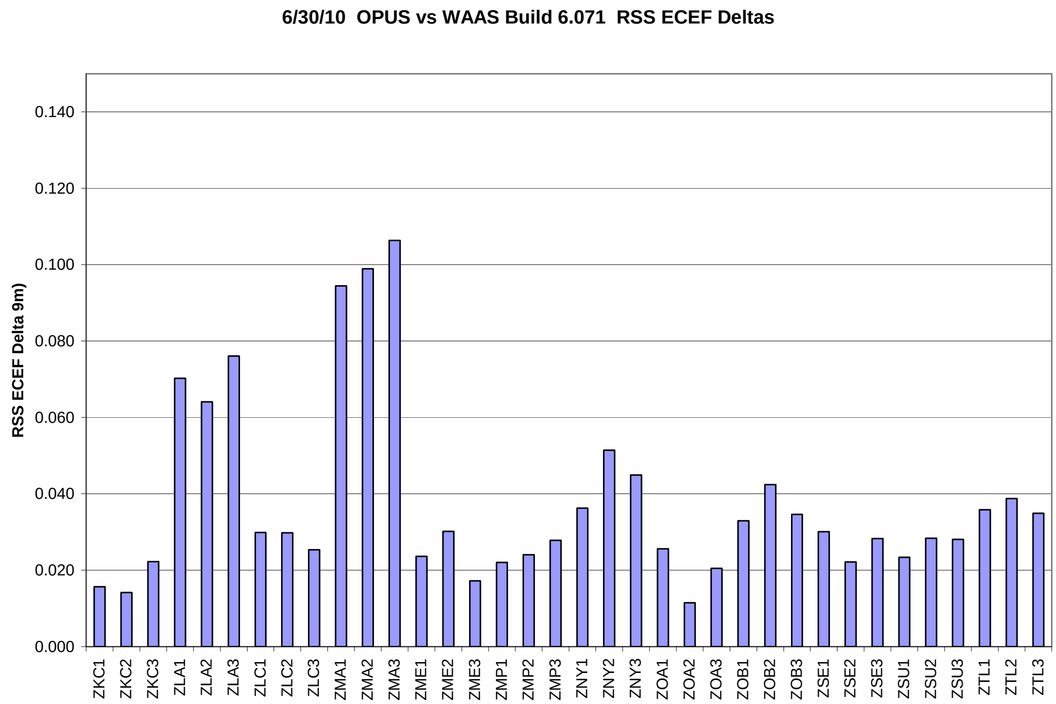


Figure 11-15 WAAS Build 6.071Antenna Positions Deltas from 6/30/10 OPUS Survey



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 Type Bias

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

For this reporting period, geostationary satellites type biases are not evaluated. Table12.3 shows the rollup average for the quarter. Table 12.4 shows the rollup average since January 1, 2008. Figure 12.1 shows the daily average for the four detection metrics for the quarter.

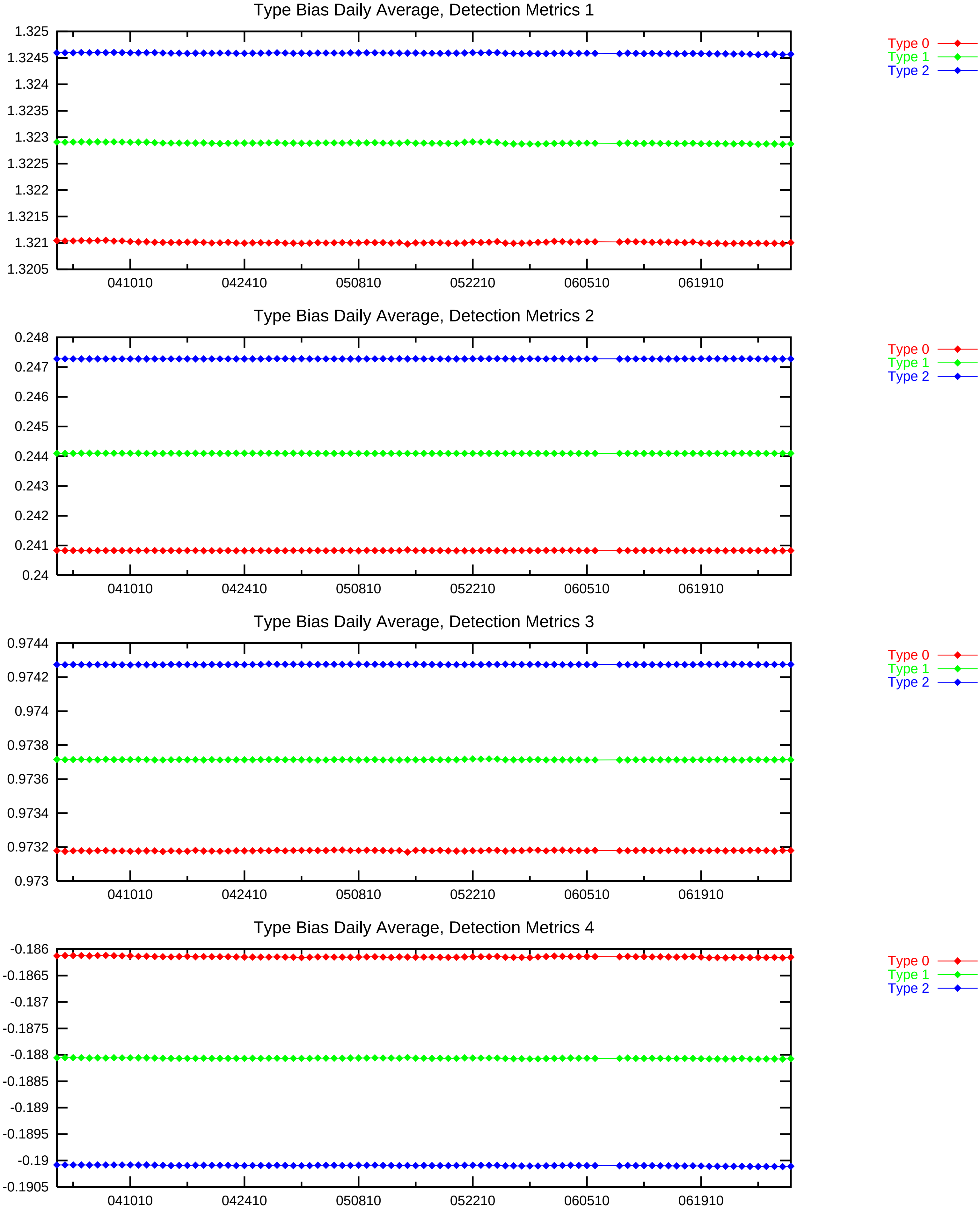
Table 12-2 Type Bias Average for the Quarter

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.3210100	1.3228900	1.3245900
DM 2	0.2408280	0.2440990	0.2472760
DM 3	0.9731790	0.9737140	0.9742750
DM 4	-0.1861460	-0.1880650	-0.1900940

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

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.3210700	1.3229200	1.3246300
DM 2	0.2408350	0.2441110	0.2472830
DM 3	0.9731790	0.9737140	0.9742770
DM 4	-0.1861180	-0.1880520	-0.1900800

Figure 12-1 PRN Type Bias Average Trend



12.3 PRN Bias

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

Table 12.4 and Figure 12.2 show the rollup PRN bias average for the quarter. Table 12.5 shows the rollup PRN bias average since January 1, 2008. Figure 12.3 to 12.10 show the PRN bias average trend for each SV. The maximum average for DM1 for this quarter is PRN 23 at 0.0009313. The maximum average for DM2 is PRN 21 at 0.00019978. The maximum average for DM3 is PRN 10 at 0.00025745 and the maximum average for DM4 is PRN 23 at 0.00041366.

For this reporting period, geostationary satellite biases are not evaluated. Please refer to Table 1.4 for events that may have an impact on PRN bias statistics. Small spikes in PRN bias daily average are due to satellite outages. June 7, 2010 and June 8, 2010 data are not evaluated for this report due to a communication line problem that caused large data gaps on those 2 days.

Table 12-4 PRN Bias Average for the Quarter

PRN	DM1	DM2	DM3	DM4
2	0.00017597	0.00005277	0.00002145	0.00008783
3	0.00022203	0.00006250	0.00009387	0.00036937
4	0.00026254	0.00004243	0.00007555	0.00014481
5	0.00015415	0.00013459	0.00006386	0.00009450
6	0.00013910	0.00005613	0.00004491	0.00014263
7	0.00013032	0.00008586	0.00003381	0.00012314
8	0.00018349	0.00013531	0.00004342	0.00010067
9	0.00021831	0.00005002	0.00006694	0.00011726
10	0.00066232	0.00005927	0.00025745	0.00009301
11	0.00086206	0.00017864	0.00004479	0.00023819
12	0.00024398	0.00009005	0.00010615	0.00008879
13	0.00049849	0.00004908	0.00006121	0.00015237
14	0.00059457	0.00010786	0.00010821	0.00011099
15	0.00012209	0.00006584	0.00002892	0.00012789
16	0.00017385	0.00006857	0.00011064	0.00035869
17	0.00013016	0.00007342	0.00003394	0.00012398
18	0.00060082	0.00010235	0.00004095	0.00020713
19	0.00037795	0.00013858	0.00003701	0.00008145
20	0.00017652	0.00004771	0.00003523	0.00016619
21	0.00064264	0.00019978	0.00020694	0.00008824
22	0.00013480	0.00009702	0.00010488	0.00010372
23	0.00093131	0.00014690	0.00003383	0.00041366
24	0.00032664	0.00005247	0.00003850	0.00011432
26	0.00027533	0.00008563	0.00015115	0.00008864
27	0.00052843	0.00008863	0.00005987	0.00036568
28	0.00023548	0.00005696	0.00003255	0.00009472
29	0.00021980	0.00006333	0.00010476	0.00028305
30	0.00028977	0.00010204	0.00002952	0.00010887
31	0.00049714	0.00016249	0.00004031	0.00027423
32	0.00028913	0.00004989	0.00010797	0.00010387

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

PRN	DM1	DM2	DM3	DM4
1	0.00013788	0.00004337	0.00007352	0.00007985
2	0.00017978	0.00005733	0.00002256	0.00009214
3	0.00021762	0.00005376	0.00008696	0.00035054
4	0.00024039	0.00004431	0.00007426	0.00013193
5	0.00030348	0.00009579	0.00009471	0.00012825
6	0.00015645	0.00005447	0.00004385	0.00012371
7	0.00013157	0.00009097	0.00003584	0.00012082
8	0.00015861	0.00012286	0.00004431	0.00010036
9	0.00022599	0.00005372	0.00006868	0.00011213
10	0.00065795	0.00006986	0.00026824	0.00009279
11	0.00090257	0.00018340	0.00005893	0.00023177
12	0.00023916	0.00008822	0.00010600	0.00008132
13	0.00050780	0.00005589	0.00005863	0.00015704
14	0.00065092	0.00012294	0.00011249	0.00012306
15	0.00011963	0.00006902	0.00002789	0.00013229
16	0.00016433	0.00007371	0.00010804	0.00034207
17	0.00011958	0.00007791	0.00003254	0.00011694
18	0.00060816	0.00010277	0.00004036	0.00021192
19	0.00037462	0.00013335	0.00003382	0.00008264
20	0.00015884	0.00004747	0.00004091	0.00012516
21	0.00062582	0.00018926	0.00020260	0.00008662
22	0.00014194	0.00009347	0.00010190	0.00010111
23	0.00094996	0.00014191	0.00003517	0.00041989
24	0.00030537	0.00004628	0.00003550	0.00010460
25	0.00015833	0.00011328	0.00008136	0.00030547
26	0.00027096	0.00009087	0.00015320	0.00008699
27	0.00048107	0.00008014	0.00006594	0.00032801
28	0.00024284	0.00005365	0.00003309	0.00008892
29	0.00022053	0.00006670	0.00010704	0.00028997
30	0.00029412	0.00009460	0.00002837	0.00011581
31	0.00047442	0.00015827	0.00003904	0.00025519
32	0.00031199	0.00004741	0.00011237	0.00010343

Figure 12-2 PRN Bias Average for the Quarter

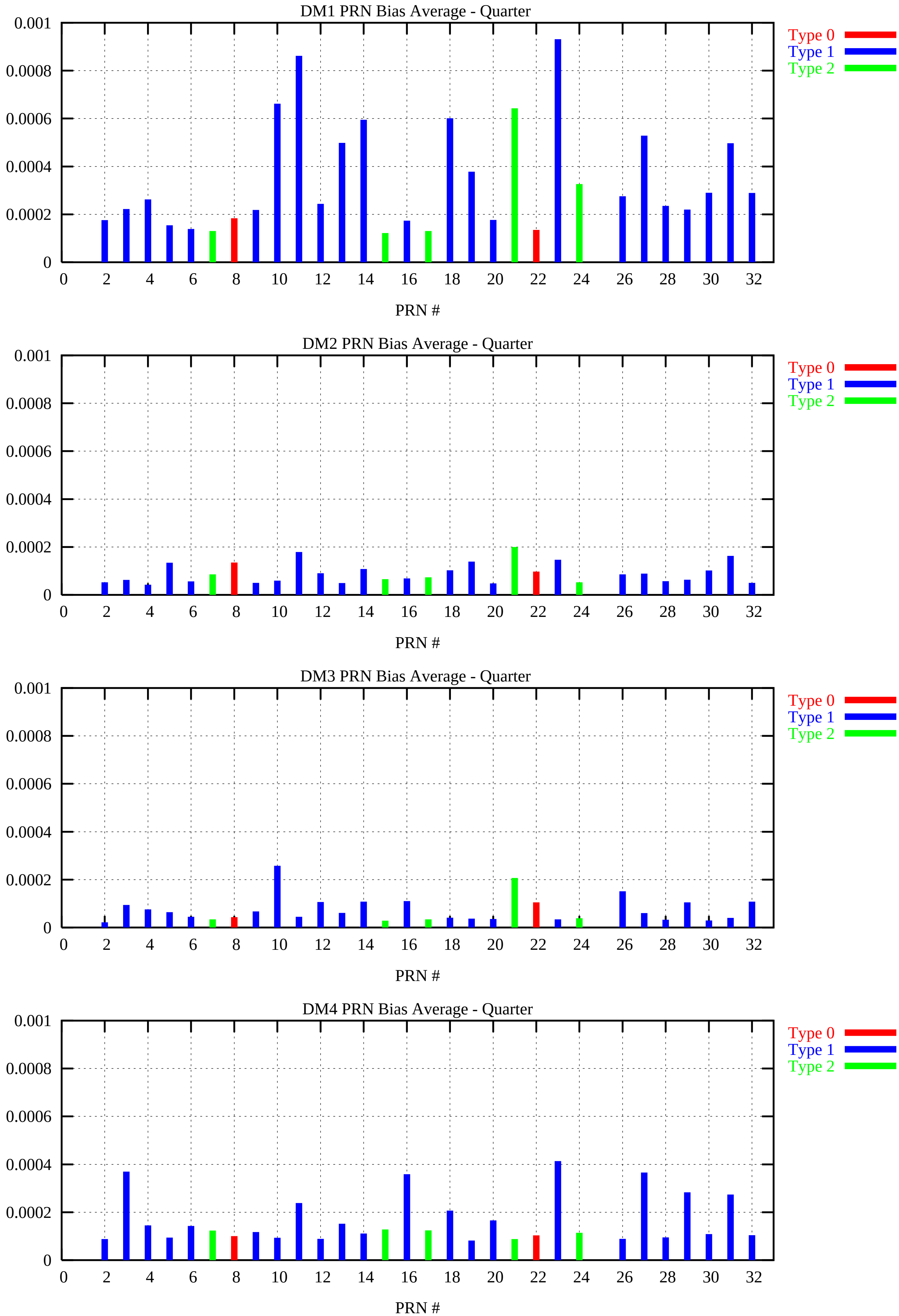
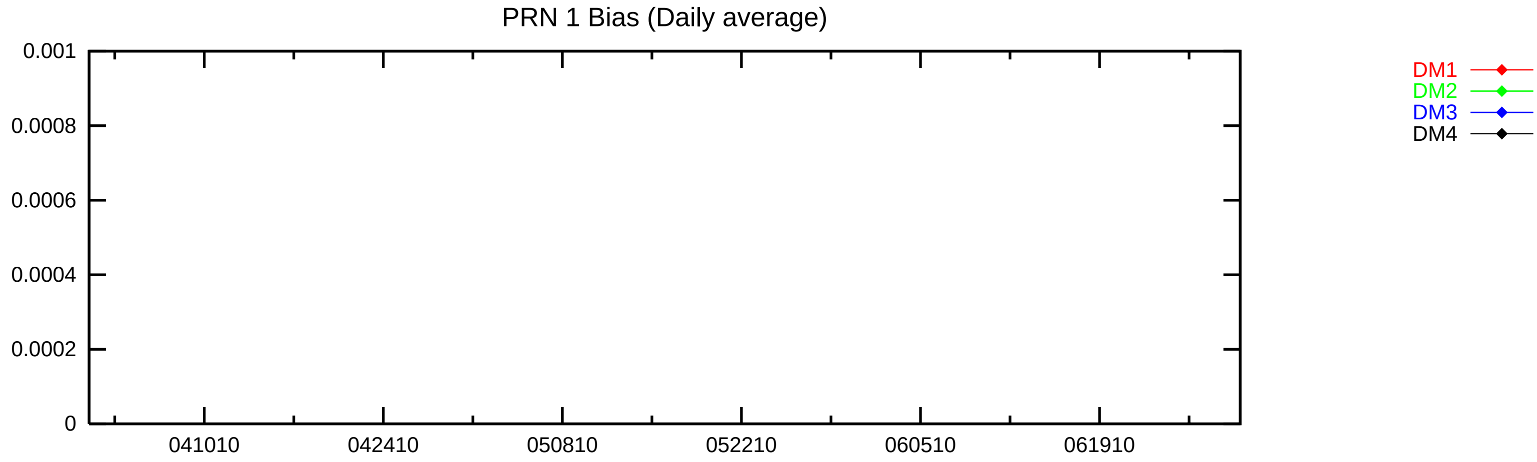
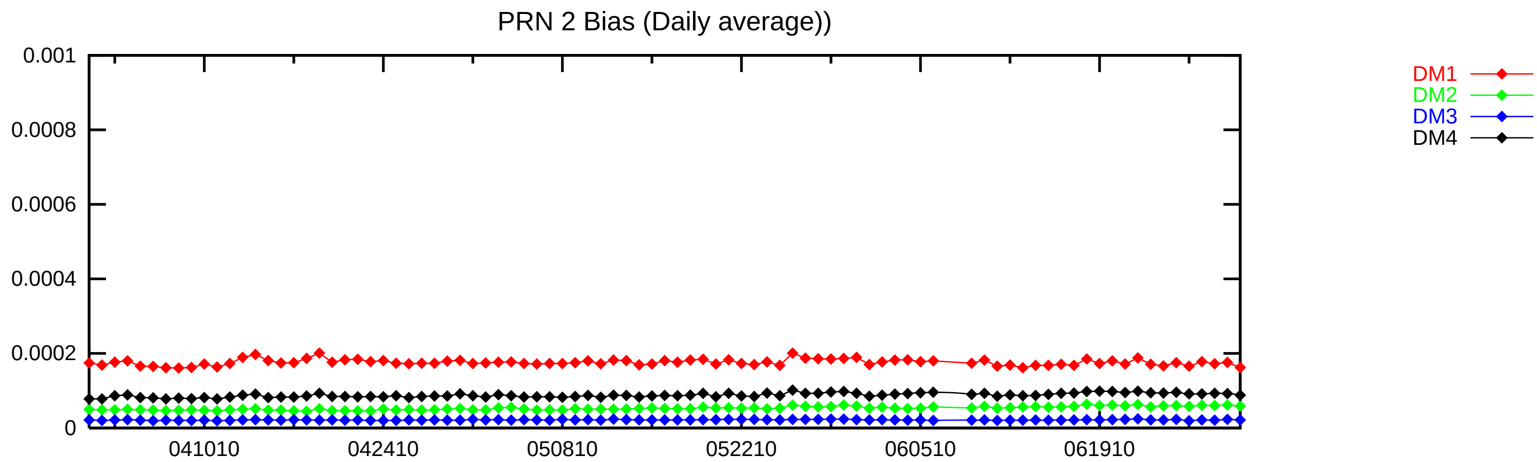
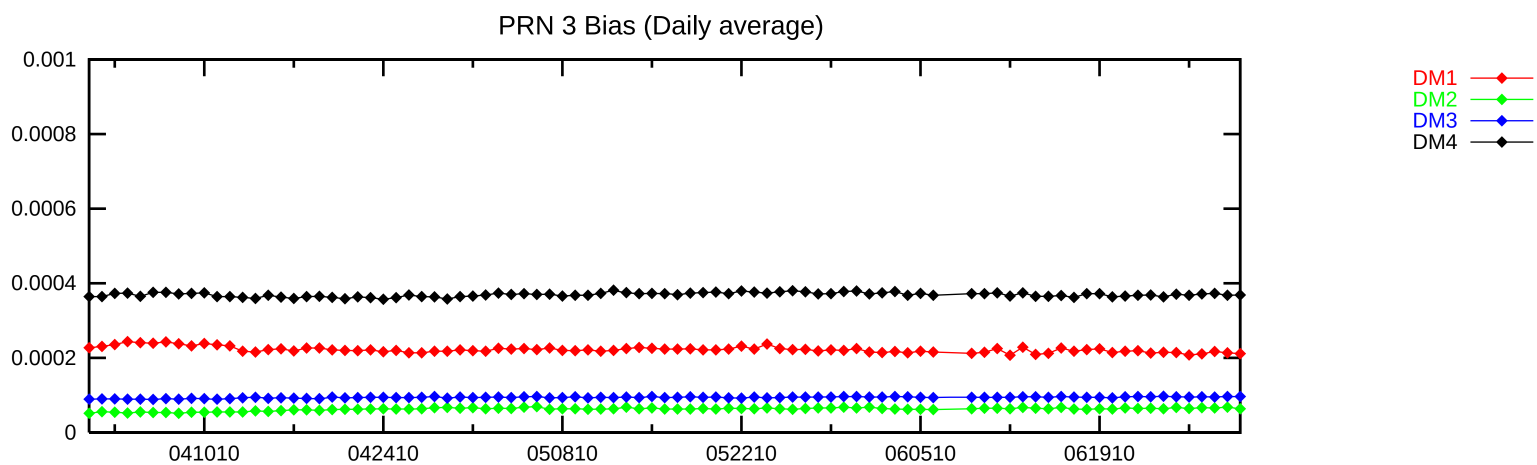


Figure 12-3 PRN Bias Average Trend (PRN 1 - PRN 4)







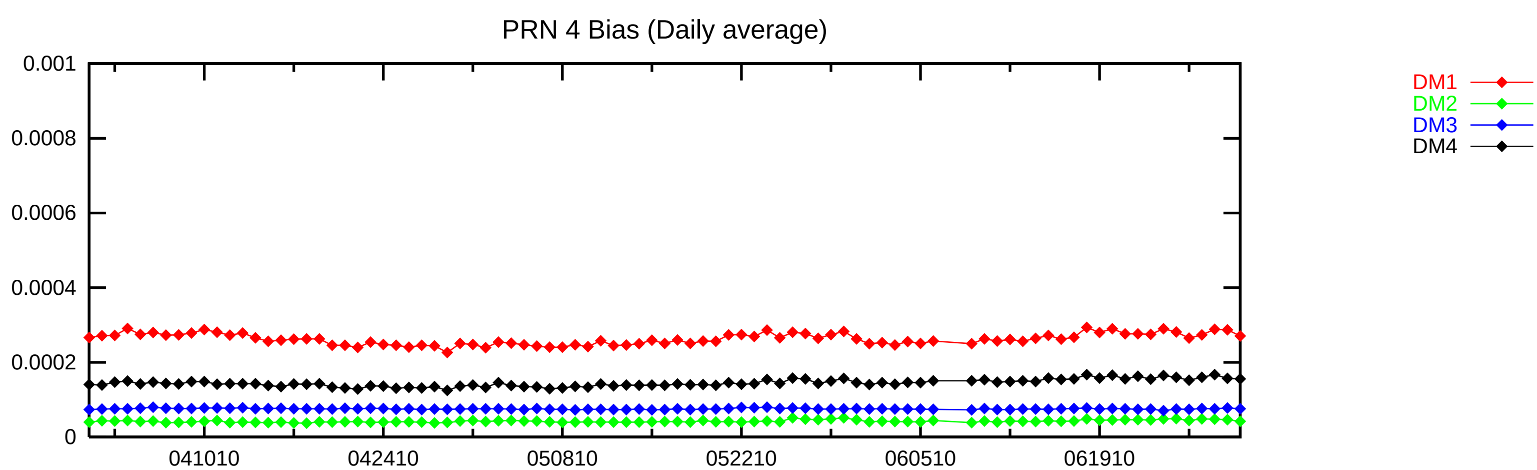
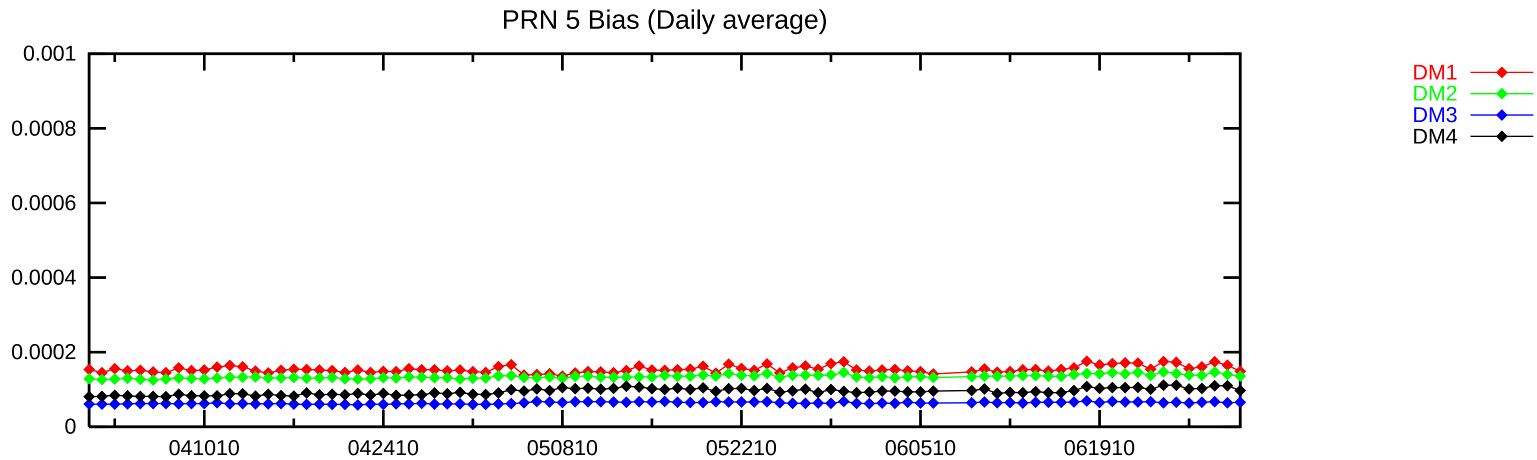
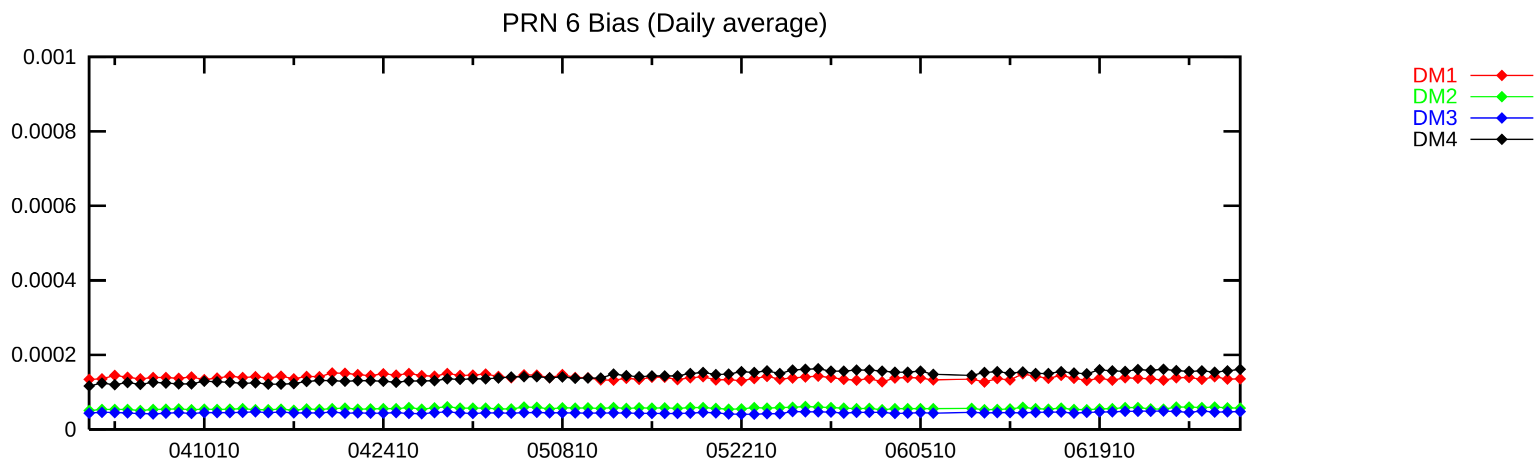
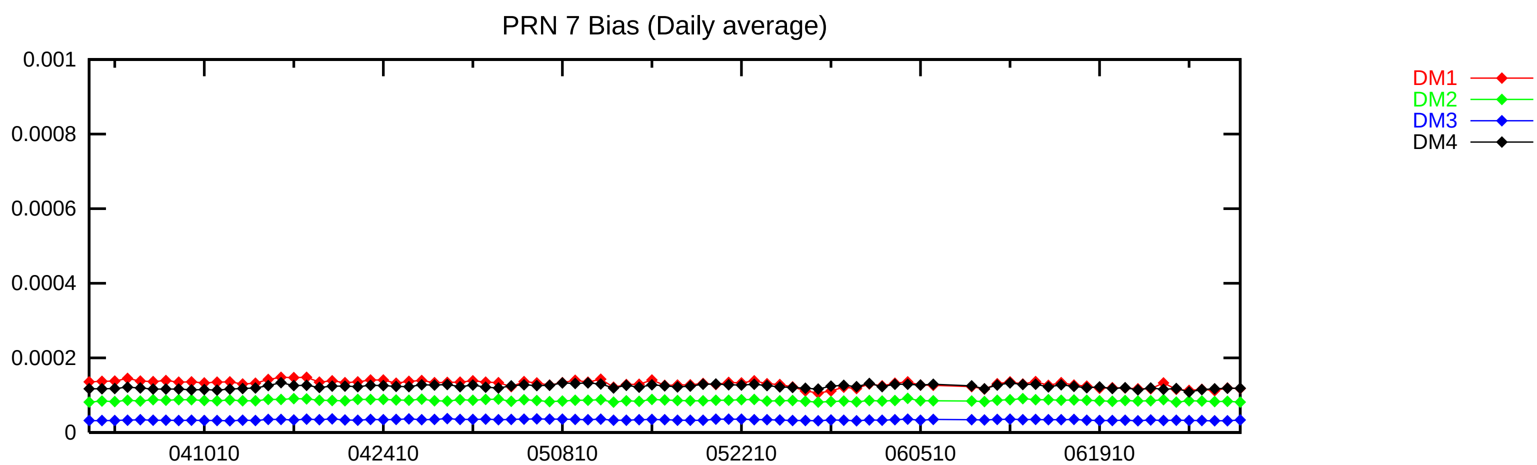


Figure 12-4 PRN Bias Average Trend (PRN 5 - PRN 8)







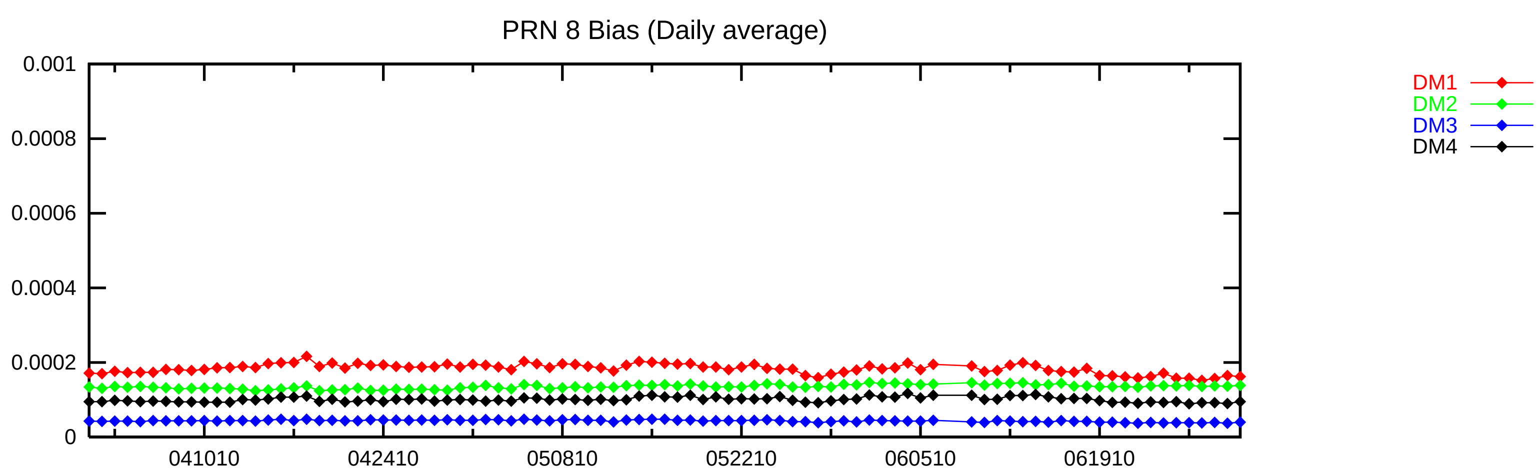


Figure 12-5 PRN Bias Average Trend (PRN 9 - PRN 12)

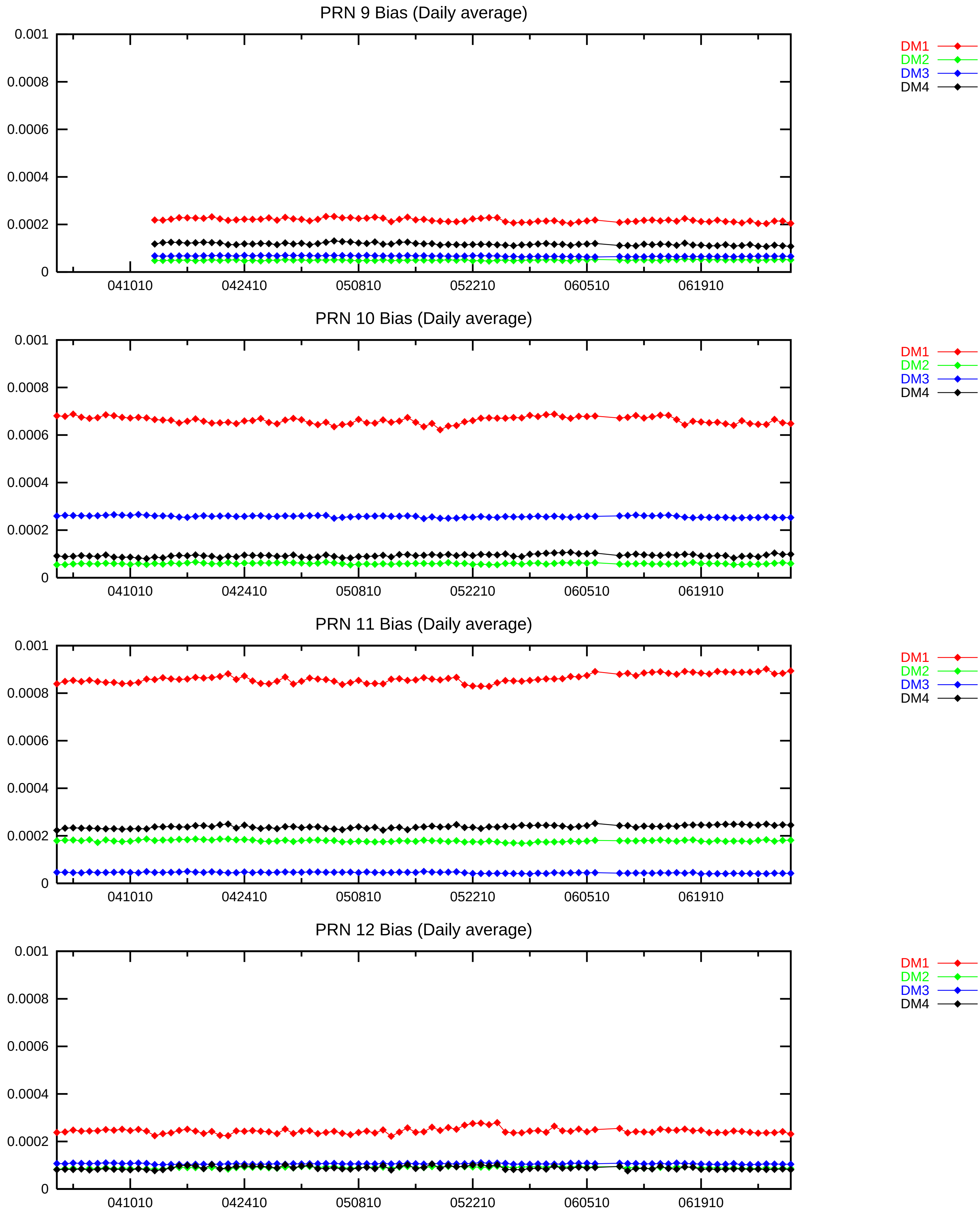


Figure 12-6 PRN Bias Average Trend (PRN 13 - PRN 16)

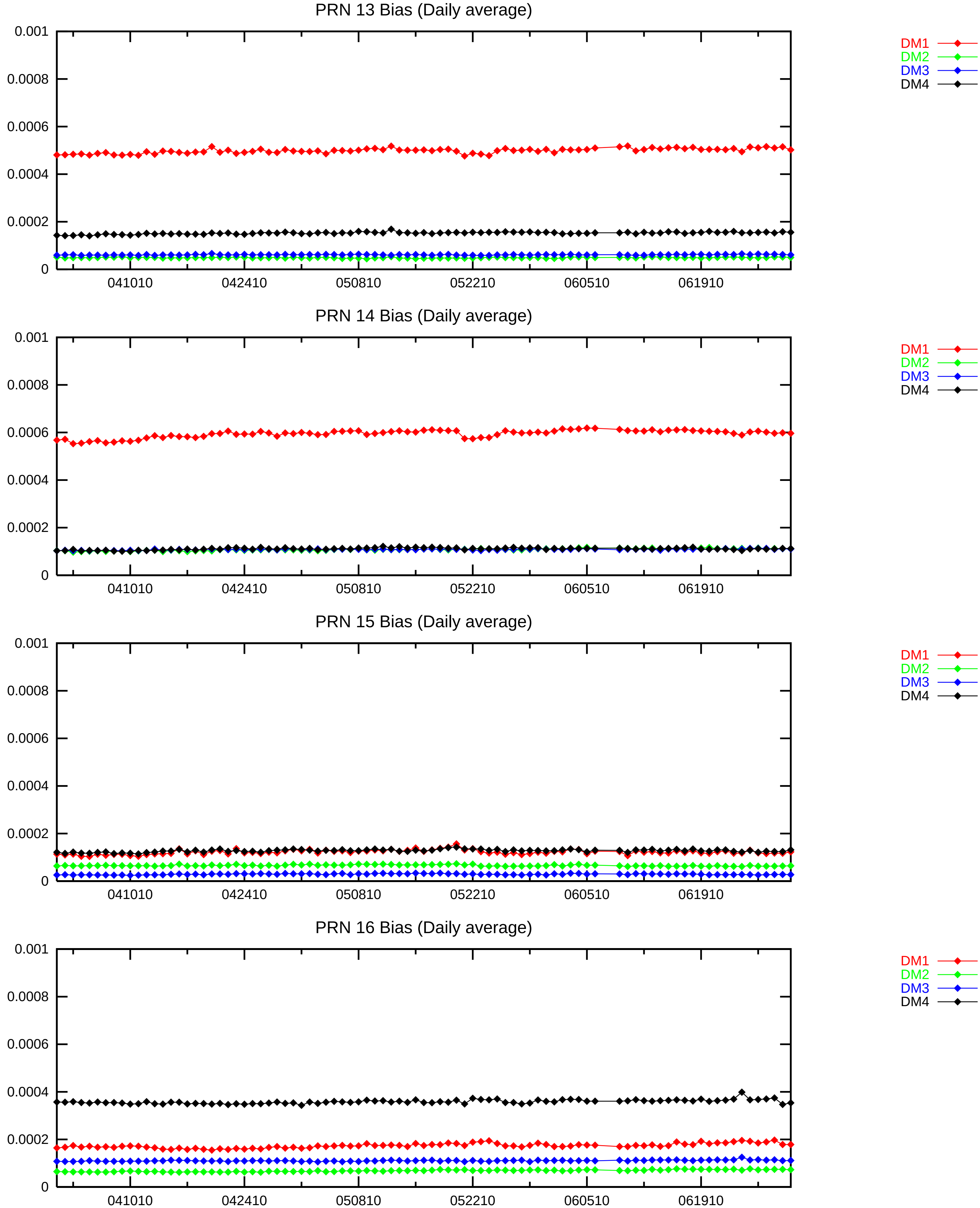
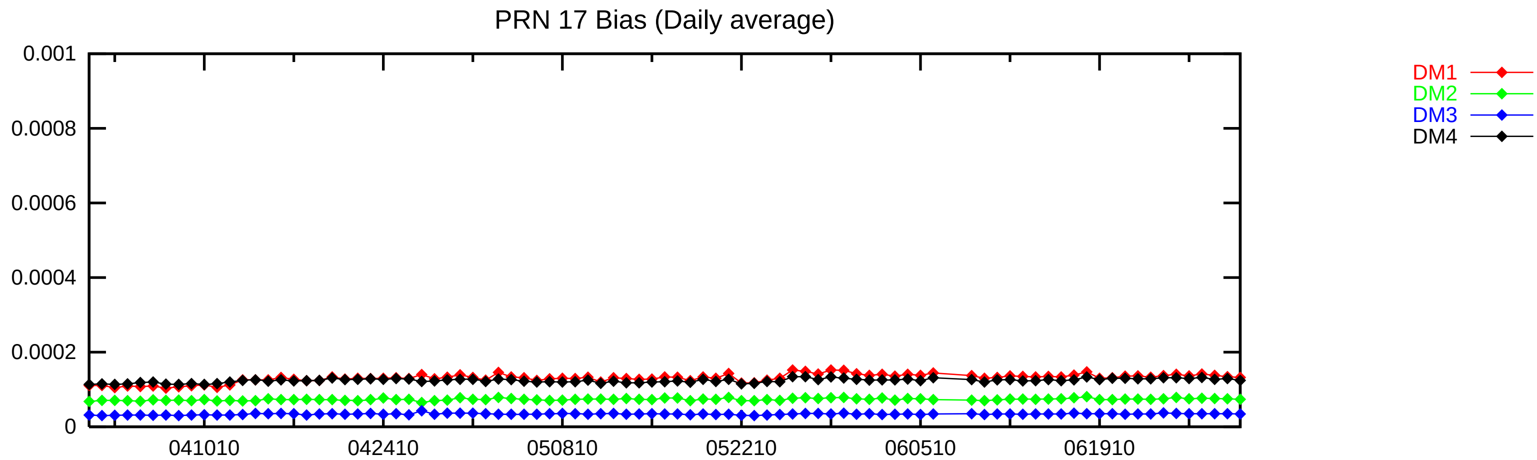
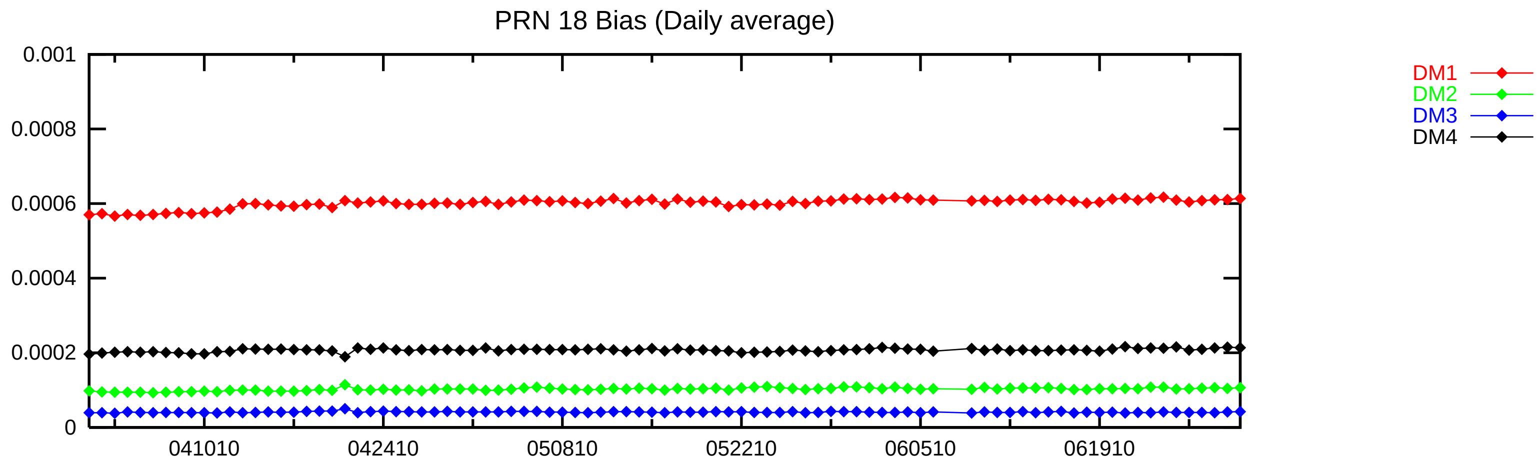
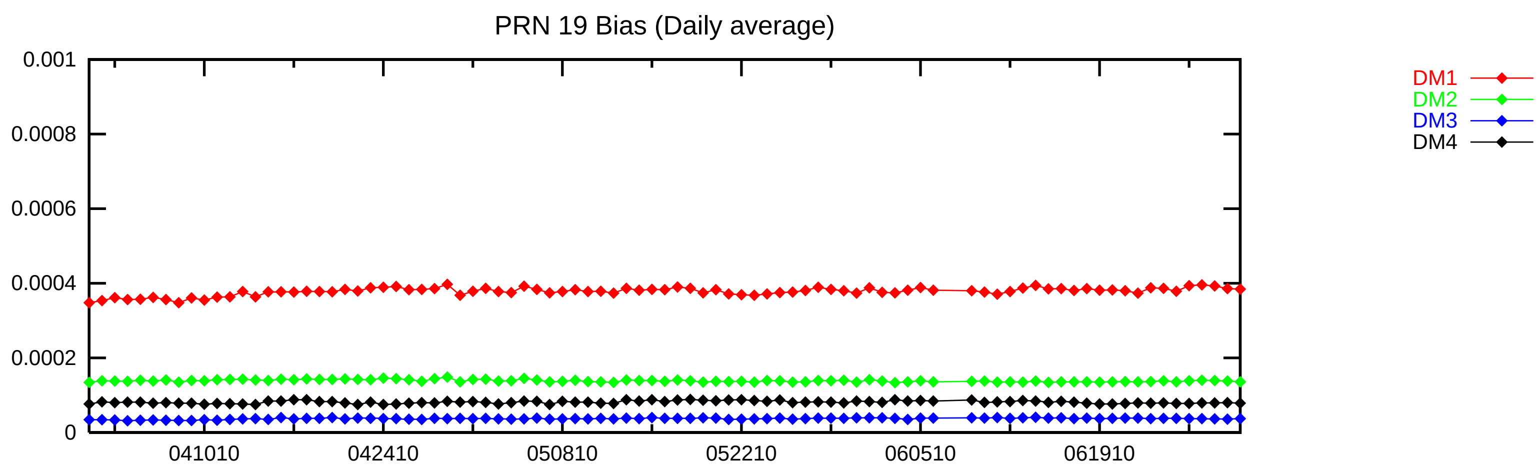


Figure 12-7 PRN Bias Average Trend (PRN 17 - PRN 20)







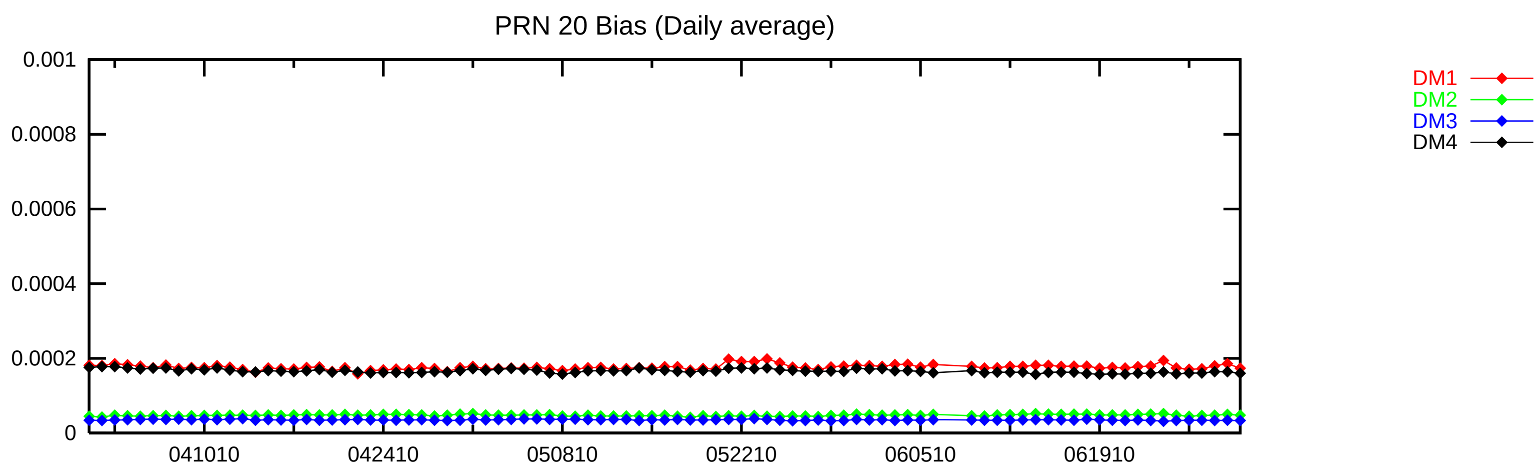


Figure 12-8 PRN Bias Average Trend (PRN 21 - PRN 24)

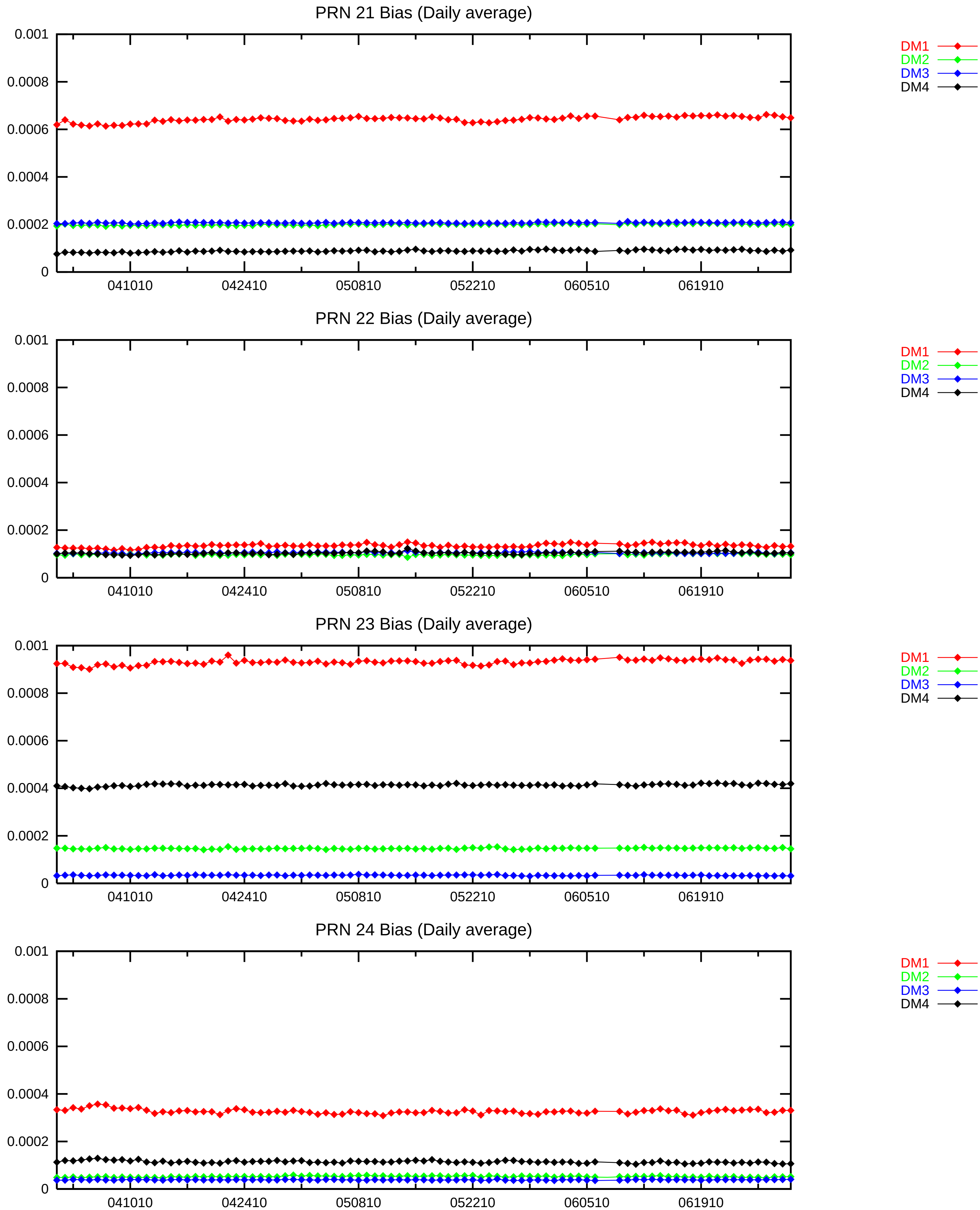
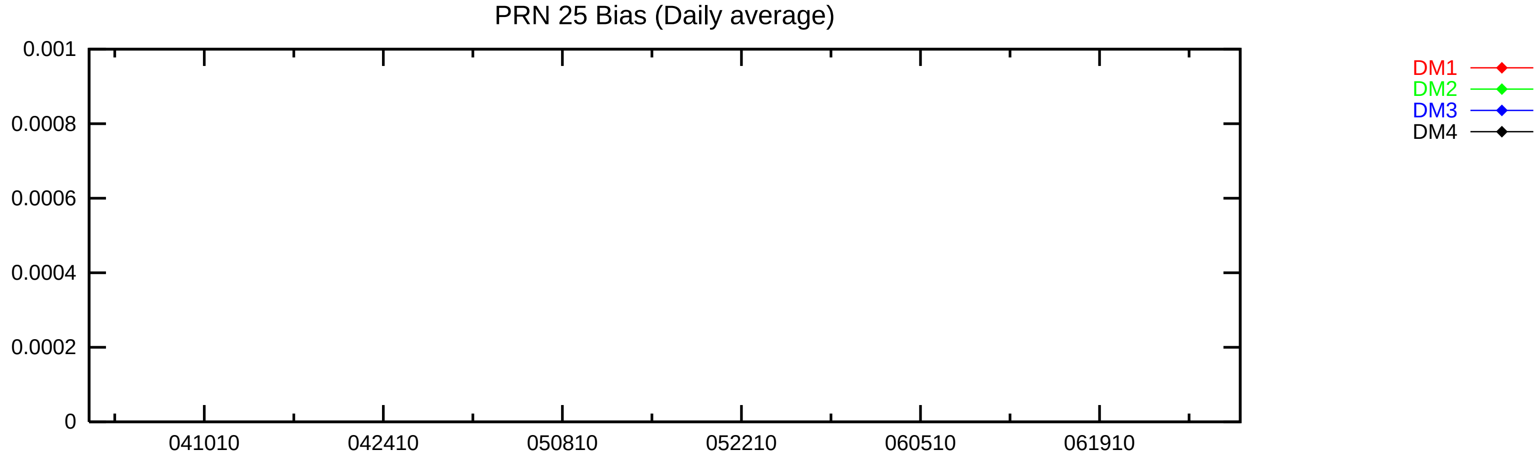
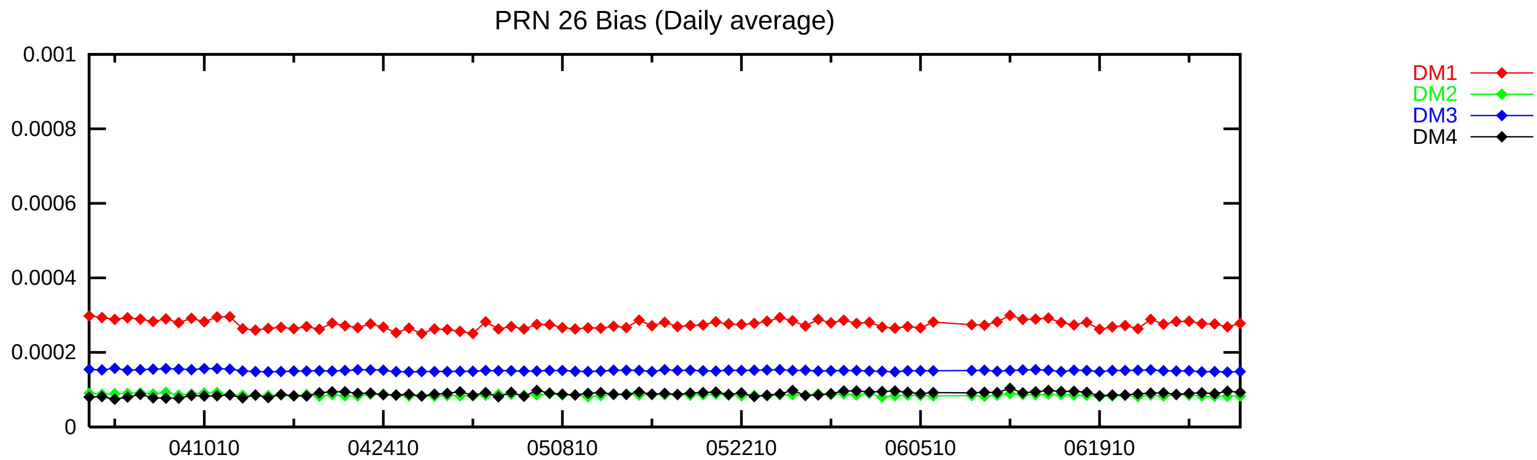
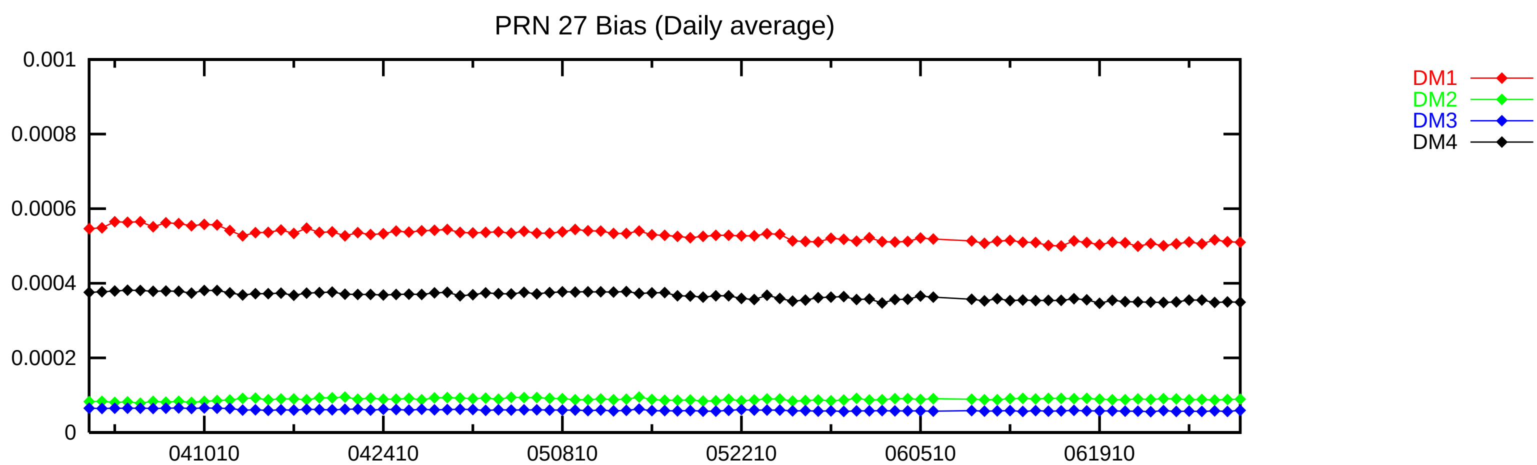


Figure 12-9 PRN Bias Average Trend (PRN 25 - PRN 28)







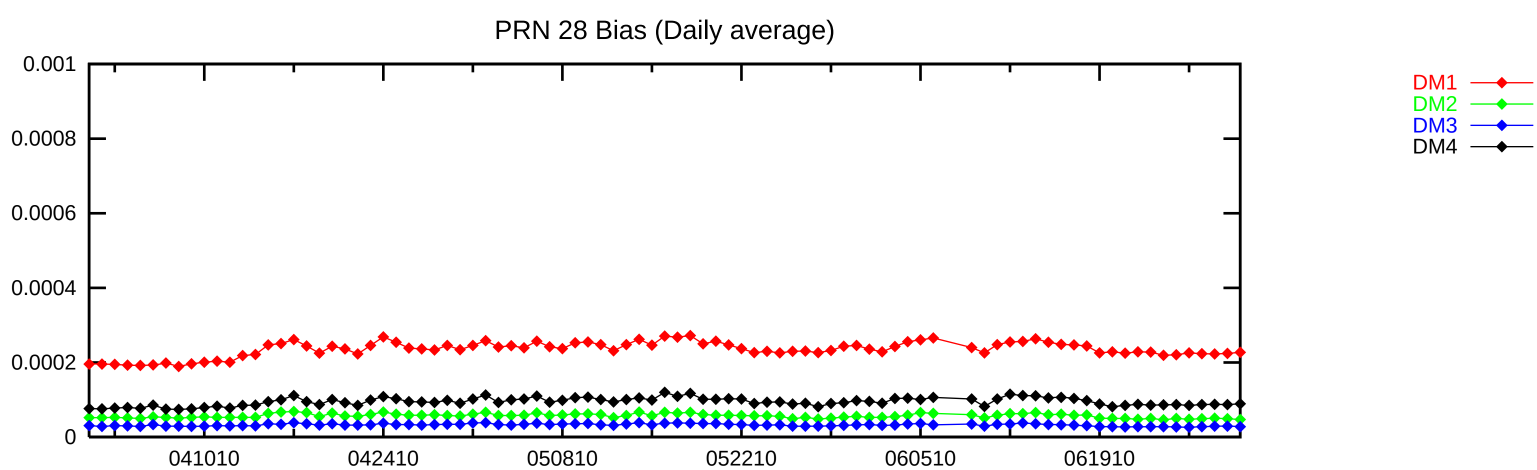
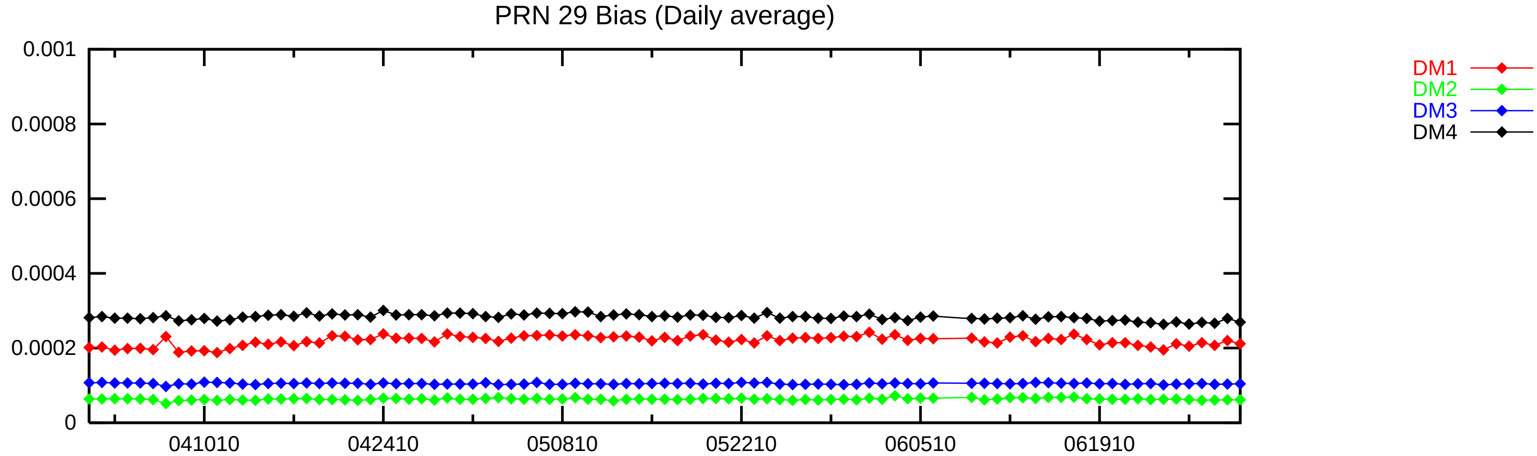
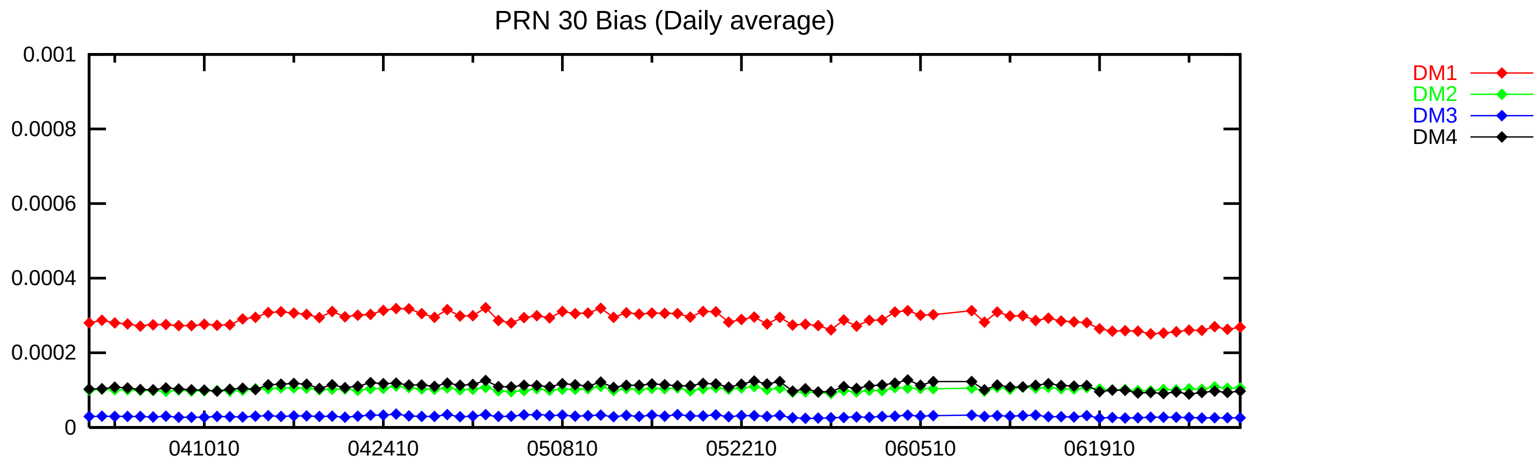
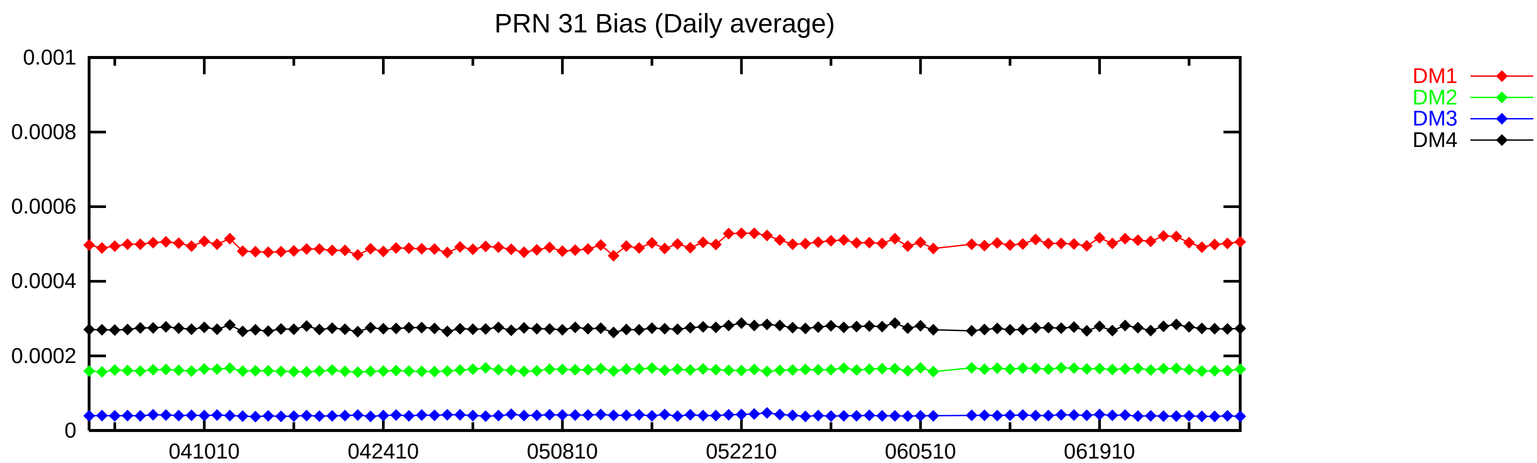
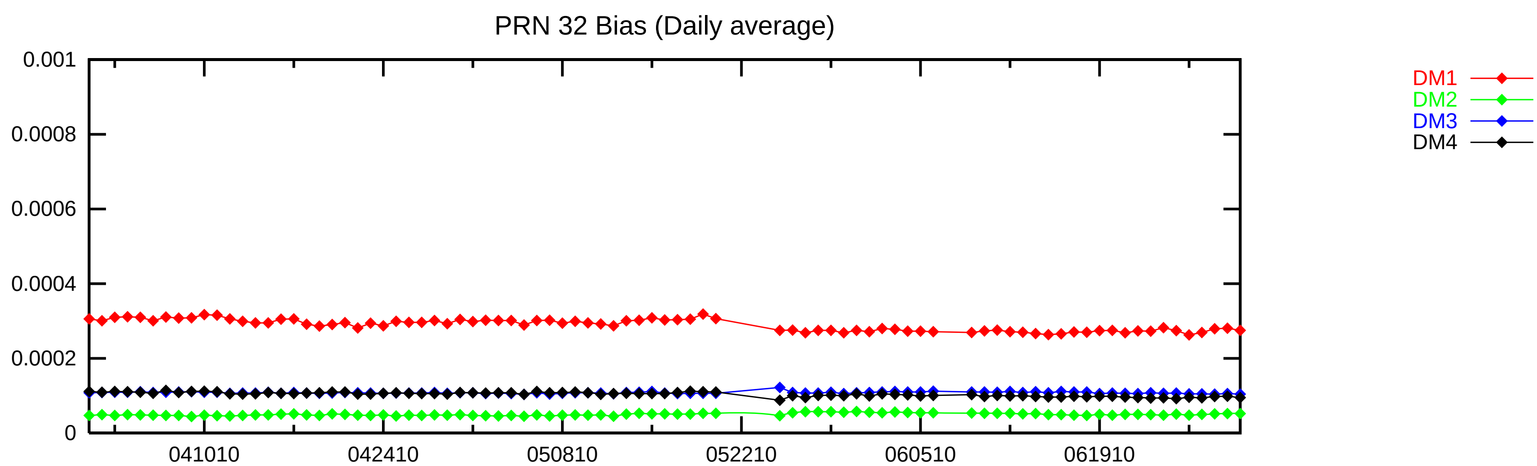


Figure 12-10 PRN Bias Average Trend (PRN 29 - PRN 32)









12.4 SQM Trips

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

Appendix A: Glossary

General Terms and Definitions

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

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

C&V. The Correction and Verification Subsystem.

CONUS. Continental United States.

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

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

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

DR. Discrepancy Report

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

GEO. Geostationary Satellite.

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

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

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

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

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

IGS. International GPS Service.

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

LNAV. Lateral Navigation.

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

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

MOPS. Minimum Operational Performance Standards.

Navigation Message. Message structure designed to carry navigation data.

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

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

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

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

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

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

SV. Space Vehicle.

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

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

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

VNAV. Vertical Navigation.

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

Appendix B: Additional Coverage Plots

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

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

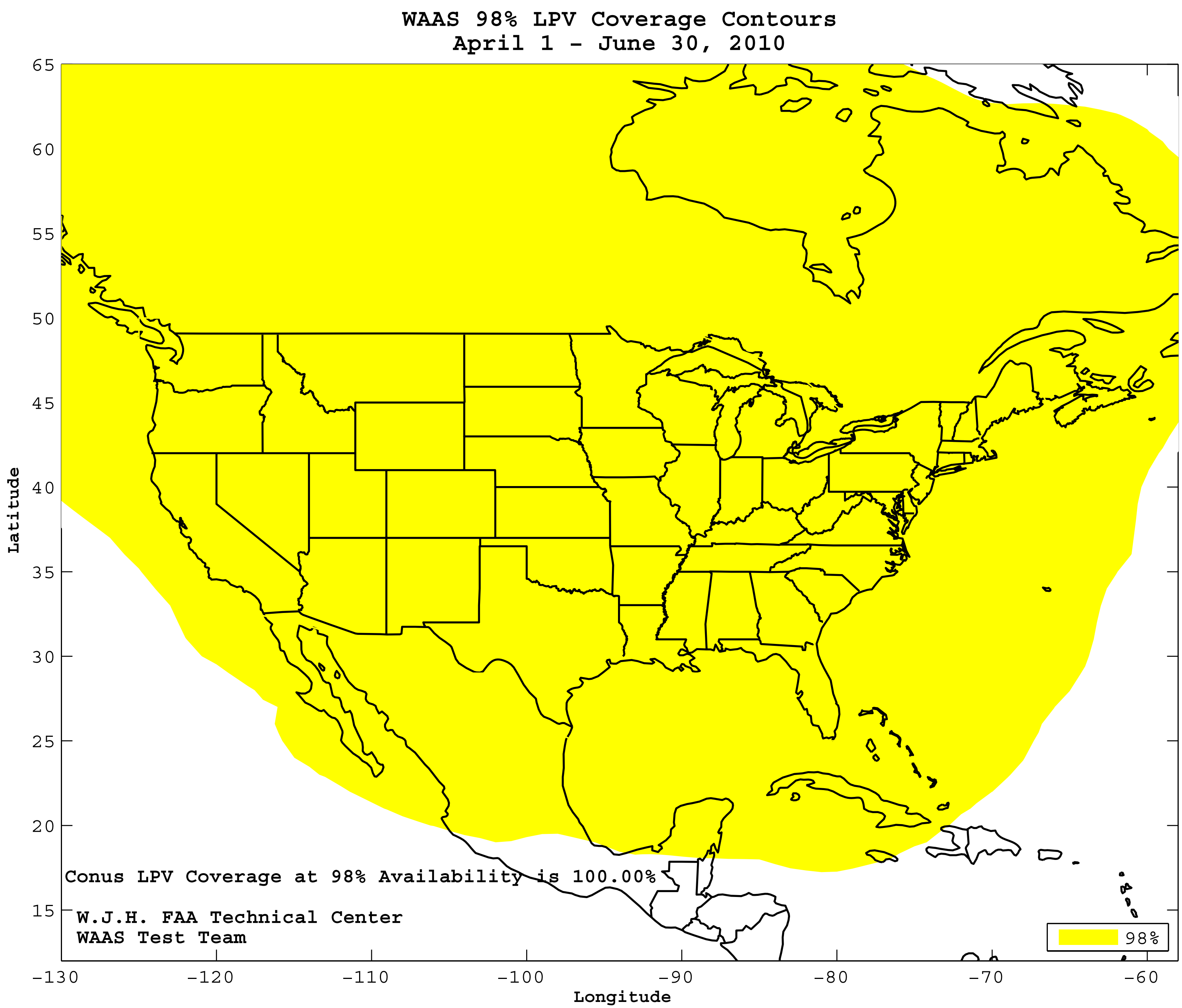


Figure B-2 98% Alaska LPV Availability Contour for the Quarter

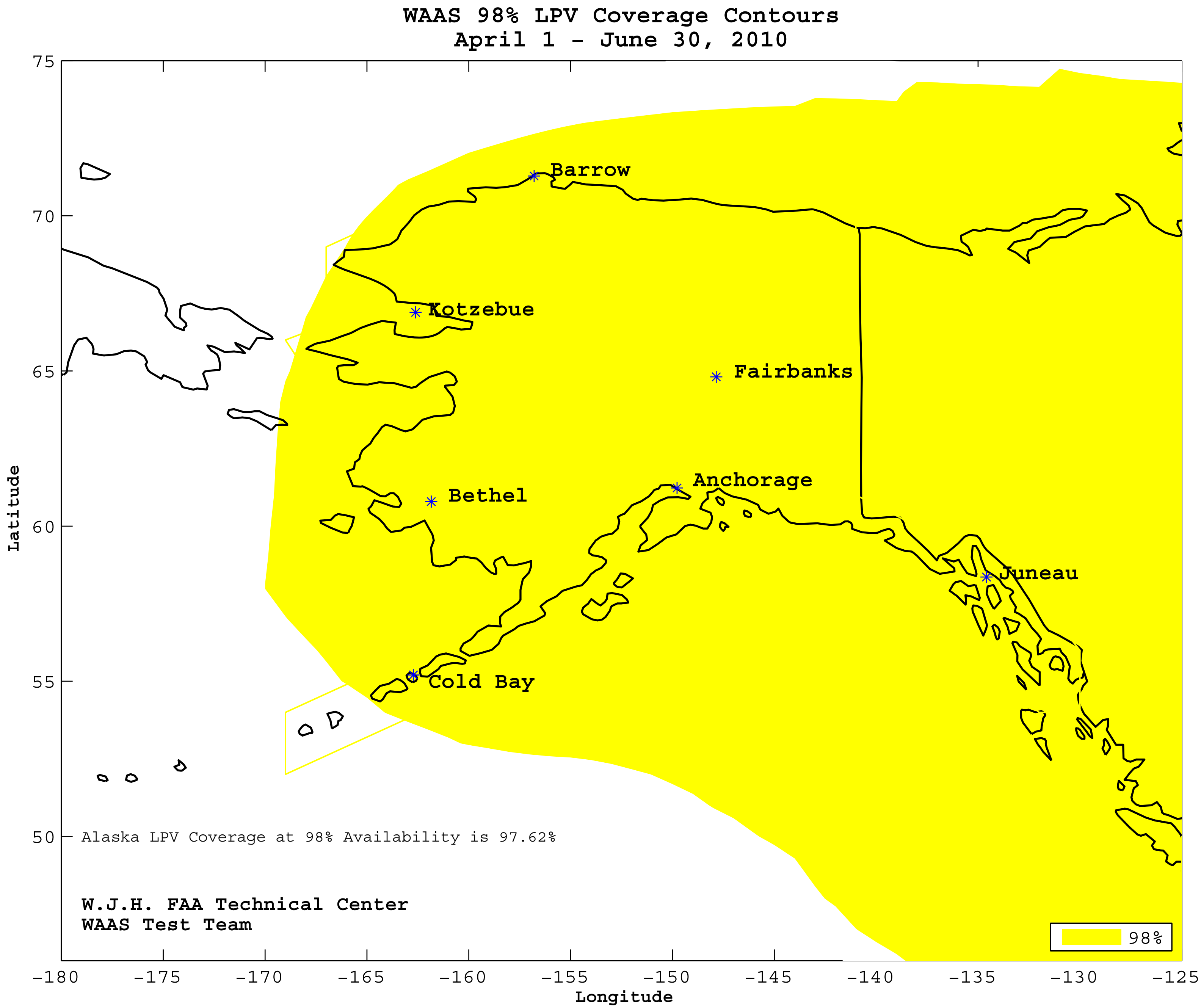


Figure B-3 99% CONUS LPV 200 Availability Contour for the Quarter

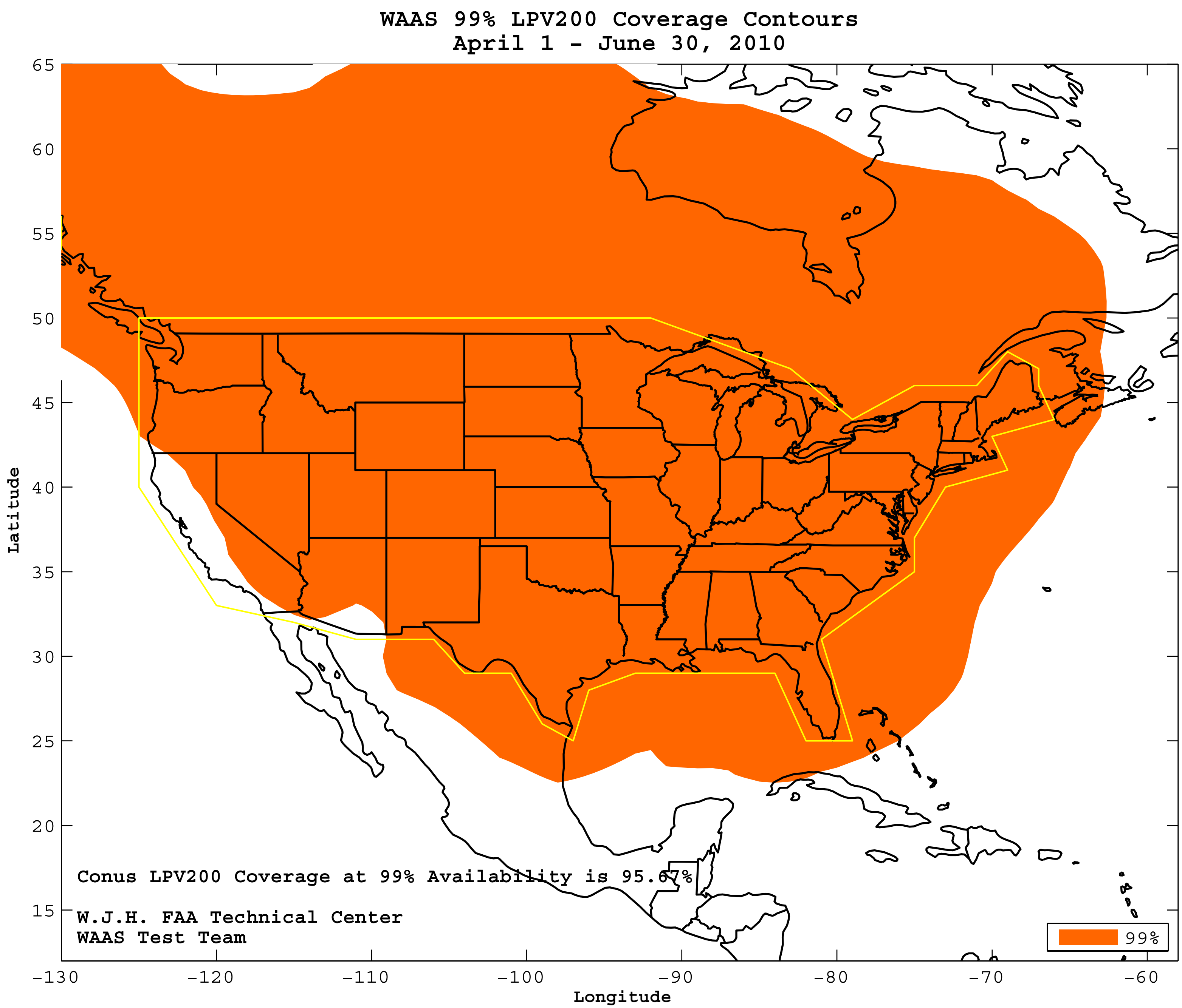


Figure B-4 99% Alaska LPV 200 Availability Contour for the Quarter