WIDE-AREA AUGMENTATION SYSTEM PERFORMANCE ANALYSIS REPORT

Report #36

Reporting Period: January 1 to March 31, 2011

April 2011

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-sixth such WAAS quarterly report. This report covers WAAS performance during the period from January 1, 2011 to March 31, 2011.

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 1.779 meters	Denver 0.594 meters	Cold Bay 0.703 meters	Bethel 0.505 meters
95% Vertical Accuracy	Grand Forks 2.232 meters	Salt Lake City 0.84 meters	Barrow 1.328 meters	Fairbanks 0.952 meters
LPV Availability (HPL < 40 meters & VPL < 50 meters)	Salt Lake City 100%	Arcata 99.87%	Anchorage 99.97%	Barrow 99.15%
LPV 200 Availability (HPL < 40 meters & VPL < 35 meters)	Memphis 100%	Arcata 98.47%	Juneau 99.93%	Barrow 86.67%
95% HPL	Arcata 15.903 meters	Memphis 10.403 meters	Cold Bay 26.51 meters	Fairbanks 13.603 meters
95% VPL	Oakland 27.829 meters	Kansas City 17.757 meters	Barrow 40.08 meters	Juneau 21.86 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), PRN#138 (CRE) and PRN#133(AMR) are used in the evaluation. CRE and CRW GEO provide a ranging capability for enroute through NPA and PA service. CRW GEO returned to operational service on March 18, 2011. AMR GEO came into operational service on 11/11/2010 and is expected to provide NPA ranging service in a future upgrade to the WAAS.

Table 1-1 PA Sites

Location	Number of Days Evaluated	Number of Samples
NSTB:		
Arcata	82	7082533
Grand Forks	87	7552987
Oklahoma City	76	6523940
WAAS:		
Albuquerque	90	7774146
Anchorage	90	7773977
Atlanta	90	7774372
Barrow	90	7762218
Bethel	90	7766622
Billings	90	7766882
Boston	90	7774592
Chicago	90	7774374
Cleveland	90	7774491
Cold Bay	90	7737259
Dallas	90	7772184
Denver	90	7773569
Fairbanks	90	7767755
Gander	90	7765049
Goose Bay	90	7765071
Houston	90	7771940
Iqaluit	89	7699150
Jacksonville	90	7774343
Juneau	90	7753939
Kansas City	90	7774005
Kotzebue	90	7768126
Los Angeles	90	7774130
Memphis	90	7774550
Merida	90	7769795
Mexico City	90	7771590
Miami	90	7774291
Minneapolis	90	7774429
New York	90	7774316
Oakland	90	7773098
Puerto Vallarta	90	7753525
Salt Lake City	90	7774036
San Jose Del Cabo	90	7771102
Seattle	90	7773339
Tapachula	89	7692291
Washington DC	90	7774472
Winnipeg	90	7772520

Table 1-2 NPA Sites

Location	Number of Days Evaluated	Number of Samples
Albuquerque	90	7774030
Anchorage	88	7607834
Atlanta	88	7601403
Barrow	90	7764157
Bethel	90	7766390
Billings	89	7717216
Boston	90	7774083
Cleveland	90	7774076
Cold Bay	89	7731332
Fairbanks	90	7767349
Gander	90	7764897
Honolulu	90	7772343
Houston	88	7601304
Iqaluit	89	7693599
Juneau	90	7747997
Kansas City	90	7773693
Kotzebue	90	7768442
Los Angeles	90	7773909
Merida	90	7762075
Miami	90	7773993
Minneapolis	90	7773919
Oakland	90	7772908
Salt Lake City	90	7773926
San Jose Del Cabo	88	7588958
San Juan	90	7772309
Seattle	85	7344979
Tapachula	90	7772405
Washington DC	90	7773558

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 WAAS upgrades that happened this quarter. There are no upgrades this quarter. Table 1.6 lists events related to GUS switchovers.

Table 1-4 Test Events

Start Date	End Date	Location/ Satellite	Service Affected	Event Description
04/03/10	03/29/11	PRN135	LPV_Alaska, LPV200_Alaska	Loss control of CRW on 4/3/10 and GEO started to drift. CRW was voluntarily taken out of service on 12/16/2010 due to instability. On 12/23/2010, Intel Sat was able to communicate with CRW for possible restoration. On 1/5/2011, CRW was paced in test mode. From 1/20/2011 to 1/22/2011, CRW testing performed by IntelSat and Lockheed. On 3/18/2011, CRW returned to operational service. On 3/27/2011, CRW returns to PA ranging for 10% of the day.

Start Date	End Date	Location/ Satellite	Service Affected	Event Description
01/04/11	01/04/11	PRN4	LPV_CONUS, LPV200_CONUS, RNP1_All	NANU 2011001. Coarse slewing of the clock caused receiver tracking problems which caused multiple alerts from not monitored to do not use.
01/11/11	01/11/11	PRN6	LPV200_Alaska	NANU 2011006. Coarse slewing of the clock caused receiver tracking problems which caused multiple alerts from not monitored to do not use.
01/13/11	01/13/11	Washington D.C. (CnV), PRN138	LPV_Alaska	CCC trip caused a corresponding SV Alert which resulted in availability and coverage outages. GEO 138 had an SV Alert on PRN 138 that did not show up on the other GEOs.
01/18/11	01/18/11	GEO133, Pamalu (HDH)	None	Pamalu faulted causing a 3646 sec outage.
01/18/11	01/18/11	GEO133, Santa Paula (SZP)	None	Santa Paula faulted due to GUS receiver stopped out putting logs. Known problem to be fixed with future releases.
01/18/11	01/19/11	PRN30	LPV200_Alaska	NANU 2011007.
01/22/11	01/22/11	Miami (ZMA1), Miami (ZMA2), Miami (ZMA3)	LPV200_CONUS	1-sec unexpected LPV200 outage at Miami and Southern Florida due to DOP hole.
01/24/11	01/24/11	GEO138, Woodbine (QWE)	Alaska	FTI requested site access at the Woodbine GUS for troubleshooting and repair of communication circuits. FTI activity was not supposed to have any impact but the WAAS Operators manually switched from Woodbine to Brewster as a preventative measure.
01/26/11	01/26/11	PRN12	LPV_Alaska, LPV200_CONUS, LPV200_Alaska, RNP1_Alaska	NANU 2011011.
02/01/11	02/01/11	GEO138, Brewster (BRE-B)	Alaska	SIGGEN Comm Fault.
02/03/11	02/03/11	PRN4	LPV_CONUS, LPV200_CONUS	3 SV glitches on PRN 4 caused a loss of SQM data on all receivers which resulted in elevated UDREs.
02/04/11	02/05/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	Canada, LPV200_Alaska	Kp index reached 6. Northern latitude IGPs tripped end of 2/04/11 into 2/5/11.
02/10/11	02/10/11	GEO133, Pamalu (HDH)	None	Pamalu faulted, did not achieve loop lock. This was the cause of the AMR SIS outage of 733 sec. Operator returned Santa Paula to service.
02/14/11	02/14/11	GEO138, Woodbine (QWE)	All	GUS switchover, Woodbine faulted. TOW 127889-127902

Start Date	End Date	Location/ Satellite	Service Affected	Event Description
02/15/11	02/15/11	PRN21	All	NANU 2011015. There was a NANU 2011015 on PRN 21 from 11:15am to 20:05pm GMT and SV Alert on PRN 4 (11:32am-11:43am), which both affected LPV and LPV200 coverage. W1623D2 LPV Outages: 1. California outage due to SV alert on PRN 4 2. North-Central and Arizona outages due to NANU on PRN 21 LPV200 Outages: 1. California outage due to SV alert on PRN 4 2. North-Central, Arizona and Florida outages due to NANU on PRN 21.
02/17/11	02/17/11	Kansas City	Local	Kansas City experienced RFI 20 db Signal drop. See DR. 100 Kansas City Signal drop caused by RFI.
02/18/11	02/18/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	LPV_Alaska, LPV_Canada, LPV200_Alaska, LPV200_Canada	Up to 7 IGPs went to storm state over Alaska and Northwestern Canada. KP index reached 5.
02/18/11	02/18/11	PRN21	LPV_CONUS, LPV_Alaska, LPV_Canada, LPV200_CONUS, LPV200_Alaska, LPV200_Canada	SV glitch on PRN 21 caused a loss of SQM data at 17:11 which resulted in LPV and LPV200 outage over Canada, Alaska and northern CONUS
02/20/11	02/20/11	Boston (ZBW1), Boston (ZBW2), Boston (ZBW3)	Local	RFI caused a drop in Signal to noise ratio and LPV/LPV200 outage.
02/21/11	02/21/11	Washington DC (ZDC1), Washington DC (ZDC2), Washington DC (ZDC3)	Local	RFI caused a drop in Signal to noise ratio and LPV/LPV200 outage.
03/01/11	03/01/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	LPV_CONUS, LPV200_CONUS, LPV200_Alaska	KP Index reached 6 causing LPV and LPV200 outages on the West Coast.
03/03/11	03/03/11	PRN14, PRN18, PRN22, PRN138	LPV200_CONUS	Elevated UDREs on several satellites caused LPV200 drop. See DR 101 Elevated UDREs on serveral satellites caused LPV200 coverage drop.

Start Date	End Date	Location/ Satellite	Service Affected	Event Description
03/07/11	03/07/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	LPV_Canada, LPV200_Alaska, LPV200_Canada	684 GIVE trips at high latitudes caused decreased coverage.
03/10/11	03/11/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	LPV_Canada, LPV200_CONUS, LPV200_Alaska, LPV200_Canada	GIVE Monitor trips for 3/10/11 continuing into 3/11/11 impacting coverage in Canada and north central CONUS.
03/13/11	03/13/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV)	LPV200_Alaska, LPV200_Canada	GIVE monitor trips caused loss of service.
03/19/11	03/19/11	Los Angeles (ZLA1), Los Angeles (ZLA2), Los Angeles (ZLA3)	Local	LPV200 outage due to elevated UDREs on PRN 21.
03/21/11	03/21/11	PRN25	LPV_Alaska	NANU 2011024. PRN 25 outage caused LPV drop in Alaska.
03/22/11	03/22/11	PRN 25	LPV200_Alaska	Elevated UDREs on PRN 25 after maintenance affected coverage. LPV200 Alaska coverage down to 57%.
03/16/11	03/21/11	Washington D.C. (CnV), Los Angeles (CnV), Atlanta (CnV), PRN4	LPV200_Alaska, LPV200_Canada, LPV200_CONUS	Large number of alarms and glitches on PRN 4 from 3/16/11 to 3/21/11.

Table 1-5 WAAS Upgrades

There are no upgrades this quarter.

Table 1-6 GUS Switchovers

Start Date	End Date	GUS Switch	Location/Satellite	Service Affected	Event Description
01/14/11	01/14/11	Faulted	GEO135, Littleton (APA)	None	Littleton GUS faulted as an indirect result of Intelsat's G15 testing at 93W. PRN 135 was in test mode.
01/18/11	01/18/11	Faulted	GEO133, Santa Paula (SZP)	None	Santa Paula faulted due to GUS receiver stopped outputting logs. Known problem to be fixed with future releases.
01/19/11	01/19/11	Faulted	GEO135, NAPA (APC)	None	12 sec gap due to Napa faulting.
01/20/11	01/20/11	Faulted	GEO135, Littleton (APA)	None	13 sec gap due to Littleton faulting.
01/24/11	01/24/11	Manual	GEO138, Woodbine (QWE)	Alaska	FTI requested site access at the Woodbine GUS for troubleshooting and repair of communication circuits. FTI activity was not supposed to have any impact but the WAAS operators manually switched from Woodbine to Brewster as a preventative measure.
01/28/11	01/28/11	Manual	GEO135, NAPA (APC), Littleton (APA)	None	Total of 6 manual switchovers for testing. GEO still in test mode.
01/31/11	01/31/11	Manual	GEO135, NAPA (APC)	None	Intentional GUS switch for additional testing. GEO sat's L1 receiver failed.
02/01/11	02/01/11	Faulted	GEO138, Brewster (BRE-B)	Alaska	SIGGEN Comm Fault.
02/03/11	02/03/11	Manual	GEO135, Littleton (APA)	None	TLT verification.
02/07/11	02/07/11	Manual	GEO135, NAPA (APC)	None	GUS manual switchover, Napa to Littleton TOW 136606-136610
02/09/11	02/09/11	Manual	GEO135, Littleton (APA)	None	GUS manual switchover, LTN to Napa TOW 288015-288019
02/10/11	02/10/11	Faulted	GEO133, Santa Paula (SZP)	None	SZP faulted (SIGGEN Comm Fault), HDH to primary TOW 413066-413082
02/10/11	02/10/11	Faulted	GEO133, Pamalu (HDH)	None	Pamalu faulted, did not achieve loop lock. This was the cause of the AMR SIS outage 733 sec. Operator returned Santa Paula to service.
02/14/11	02/14/11	Faulted	GEO138, Woodbine (QWE)	All	GUS switchover, Woodbine faulted. TOW 127889-127902
02/20/11	02/20/11	Faulted	GEO133, Santa Paula (SZP)	None	Fault at Santa Paula TOW 46321-46332. Caused following SIS outage 80 min later from 51131 – 53873

Start Date	End Date	GUS Switch	Location/Satellite	Service Affected	Event Description
02/27/11	02/27/11	Manual	GEO135, NAPA (APC), Washington D.C. (CnV)	None	GUS switchover, Napa to Littleton. C&V commanded GUS switchover due to Doppler Spikes. Possibly due to SGS clock. TOW 34468-34472
03/03/11	03/03/11	Manual	GEO135, Littleton (APA)	None	GUS switchover, LTN faulted TOW 360269-360281
03/04/11	03/04/11	Manual	GEO133, Santa Paula (SZP)	None	Planned operational testing TOW 455547-455552
03/04/11	03/04/11	Manual	GEO133, Pamalu (HDH)	None	TOW 460894-460909. Planned operational testing
03/05/11	03/05/11	Faulted	GEO133, Pamalu (HDH), Santa Paula (SZP)	None	GUS switchover, HDH faulted TOW 578131-578147. Santa Paula faulted 80 minutes later causing a signal in space outage.
03/17/11	03/17/11	Manual	GEO135, NAPA (APC)	None	Manual GUS switchover, Napa to Littleton TOW 401530-401534. Re-sector the dish at Napa to be able to track PRN135.
03/24/11	03/24/11	Faulted	GEO135, Littleton (APA)	None	TOW 379939-379962, Napa and Littleton were unable to follow Galaxy 15 as it drifted past Galaxy 14. Littleton's antenna faulted.
03/24/11	03/24/11	Faulted	GEO135, NAPA (APC)	None	TOW 388627-388631. Napa and Littleton were unable to follow Galaxy 15 as it drifted past Galaxy 14.
03/24/11	03/24/11	Faulted	GEO135, Littleton (APA)	None	TOW 396093-396097. Napa and Littleton were unable to follow Galaxy 15 as it drifted past Galaxy 14.
03/25/11	03/25/11	Faulted	GEO135, NAPA (APC)	None	TOW 459207-459233. Napa and Littleton were unable to follow Galaxy 15 as it drifted past Galaxy 14. L5 GEO downlink message fault.

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, CRW, and AMR.

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

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

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

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

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

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

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

2.0 WAAS POSITION ACCURACY

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

Table 2-1 Operational Service Levels

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

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

During this reporting period, the maximum 95% CONUS horizontal and vertical LPV errors are 1.77 meters and 2.323 meters both at Grand Forks, respectively. The minimum 95% CONUS horizontal and vertical LPV errors are 0.594 meters at Denver and 0.84 meters at Salt Lake City, respectively. The maximum 95% and 99.999% NPA horizontal errors are 4.245 meters and 8.955 meters, both at Honolulu, respectively. The minimum 95% and 99.999% horizontal errors are 1.11 meters at Albuquerque and 2.42 meters at Atlanta, respectively. Low PA and NPA availability in Table 2.2 and Table 2.3 at Barrow and Kotzebue are due to CRW GEO not in service from for most of the quarter. CRW GEO returned to operational service on 3/18/2011.

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. High vertical error at Iqaluit was due to ionopheric activity.

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	0.784	0.784	1.109	100	*	*
Grand Forks	1.777	1.777	2.230	100	*	*
Oklahoma City	0.622	0.622	1.156	100	*	*
Albuquerque	0.621	0.621	0.963	100	1.941	3.837
Anchorage	0.589	0.589	1.020	100	*	*
Atlanta	0.725	0.725	1.126	100	2.249	4.031
Barrow	0.687	0.688	1.328	14.57354	*	*
Bethel	0.505	0.505	0.987	99.98855	1.894	4.510
Billings	0.645	0.645	0.861	100	2.151	3.780
Boston	0.779	0.779	0.836	100	2.430	3.711
Chicago	0.909	0.909	0.813	100	*	*
Cleveland	0.682	0.682	0.886	100	2.312	3.721
Cold Bay	0.701	0.701	1.024	99.99040	*	*
Dallas	0.668	0.668	1.372	100	*	*
Denver	0.596	0.596	0.772	100	*	*
Fairbanks	0.539	0.539	0.946	99.99143	1.786	4.552
Gander	0.849	0.849	1.122	99.99996	*	*
Goose Bay	0.721	0.722	1.054	100	*	*
Houston	0.648	0.648	1.683	100	1.953	4.115
Iqaluit	0.918	0.921	1.700	99.99830	*	*
Jacksonville	0.691	0.691	1.423	100	*	*
Juneau	0.650	0.650	0.950	100	*	*
Kansas City	0.664	0.664	0.775	100	2.170	3.929
Kotzebue	0.627	0.627	1.186	14.57760	1.793	4.546
Los Angeles	0.771	0.771	1.077	100	1.953	4.403
Memphis	0.699	0.699	1.007	100	*	*
Merida	0.673	0.673	1.882	100	*	*
Mexico City	0.749	0.749	2.205	100	*	*
Miami	0.877	0.877	1.864	100	2.287	4.192
Minneapolis	0.721	0.721	0.784	100	2.219	3.728
New York	0.848	0.848	0.875	100	*	*
Oakland	0.680	0.680	1.038	100	1.981	4.440
Puerto Vallarta	0.808	0.808	2.339	99.99986	*	*
Salt Lake City	0.604	0.604	0.771	100	2.078	3.924
San Jose Del Cabo	0.711	0.711	2.153	100	*	*
Seattle	0.744	0.744	0.867	100	2.230	4.149
Tapachula	0.968	0.969	2.216	100	*	*
Washington DC	0.843	0.843	0.871	100	2.410	3.852
Winnipeg	0.707	0.707	0.978	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	1.112	3.416	99.997	3.560
Anchorage	1.528	3.701	99.996	3.873
Atlanta	1.367	2.424	100	2.689
Barrow	2.001	3.211	14.587	3.259
Bethel	1.432	3.338	99.993	3.503
Billings	1.366	4.077	99.996	4.268
Boston	1.550	2.780	99.995	3.468
Cleveland	1.369	2.848	99.997	2.974
Cold Bay	1.476	4.848	99.992	5.036
Fairbanks	1.536	3.792	99.994	4.103
Gander	1.563	4.358	99.996	3.144
Honolulu	4.245	8.955	97.779	9.212
Houston	1.505	3.352	100	3.512
Iqaluit	1.431	3.232	99.995	3.401
Juneau	1.387	3.546	99.996	3.715
Kansas City	1.340	2.699	99.997	2.812
Kotzebue	1.921	3.108	14.592	8.008
Los Angeles	1.305	4.066	99.997	4.234
Merida	1.661	5.784	99.997	6.084
Miami	1.476	3.408	99.997	3.595
Minneapolis	1.530	3.112	99.997	3.233
Oakland	1.200	4.744	99.997	4.882
Salt Lake City	1.221	4.459	99.997	4.684
San Jose Del Cabo	1.656	5.731	100	6.917
San Juan	1.998	7.990	99.996	8.376
Seattle	1.355	3.860	100	4.584
Tapachula	2.382	7.564	99.997	7.780
Washington DC	1.626	2.844	99.997	3.050

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	3.089	0.169	0.175	7.055	0.289	0.289
Grand Forks	5.076	0.245	0.336	7.759	0.177	0.323
Oklahoma City	2.163	0.107	0.216	4.901	0.105	0.265
Albuquerque	1.525	0.136	0.166	2.428	0.180	0.180
Anchorage	1.982	0.186	0.186	2.847	0.113	0.130
Atlanta	1.645	0.139	0.170	2.479	0.156	0.166
Barrow	1.985	0.104	0.118	4.194	0.107	0.152
Bethel	1.849	0.116	0.122	3.653	0.075	0.107
Billings	1.962	0.196	0.196	2.924	0.143	0.145
Boston	1.662	0.131	0.147	2.726	0.146	0.151
Chicago	1.880	0.160	0.188	2.801	0.147	0.167
Cleveland	1.879	0.185	0.185	3.418	0.198	0.198
Cold Bay	2.616	0.109	0.138	3.551	0.081	0.108
Dallas	1.755	0.158	0.164	3.494	0.138	0.249
Denver	1.462	0.129	0.151	3.947	0.189	0.189
Fairbanks	2.841	0.214	0.243	5.339	0.231	0.231
Gander	3.083	0.120	0.120	3.880	0.113	0.115
Goose Bay	2.902	0.117	0.178	3.481	0.159	0.160
Houston	1.781	0.164	0.199	3.358	0.188	0.235
Iqaluit	2.735	0.107	0.172	10.691	0.366	0.366
Jacksonville	2.785	0.254	0.254	2.729	0.167	0.179
Juneau	2.111	0.134	0.182	3.248	0.206	0.206
Kansas City	1.557	0.153	0.153	2.828	0.060	0.174
Kotzebue	1.802	0.108	0.117	2.827	0.068	0.130
Los Angeles	1.719	0.153	0.153	2.871	0.130	0.167
Memphis	2.023	0.137	0.164	2.346	0.124	0.167
Merida	1.842	0.121	0.148	3.682	0.130	0.187
Mexico City	4.179	0.187	0.187	4.037	0.158	0.178
Miami	1.955	0.134	0.170	3.639	0.198	0.203
Minneapolis	1.658	0.116	0.176	3.661	0.115	0.180
New York	1.603	0.124	0.156	2.460	0.153	0.153
Oakland	2.222	0.196	0.197	2.865	0.123	0.123
Puerto Vallarta	2.805	0.145	0.145	5.360	0.236	0.236
Salt Lake City	1.844	0.176	0.193	2.956	0.182	0.199
San Jose Del Cabo	1.993	0.133	0.140	4.016	0.182	0.183
San Juan	2.567	0.145	0.145	5.937	0.155	0.166
Seattle	2.251	0.161	0.200	3.372	0.139	0.211
Tapachula	4.486	0.225	0.225	5.055	0.185	0.185
Washington DC	1.762	0.154	0.161	2.839	0.168	0.168
Winnipeg	2.968	0.145	0.215	5.313	0.209	0.209

Figure 2-1 95% Horizontal Accuracy at LPV

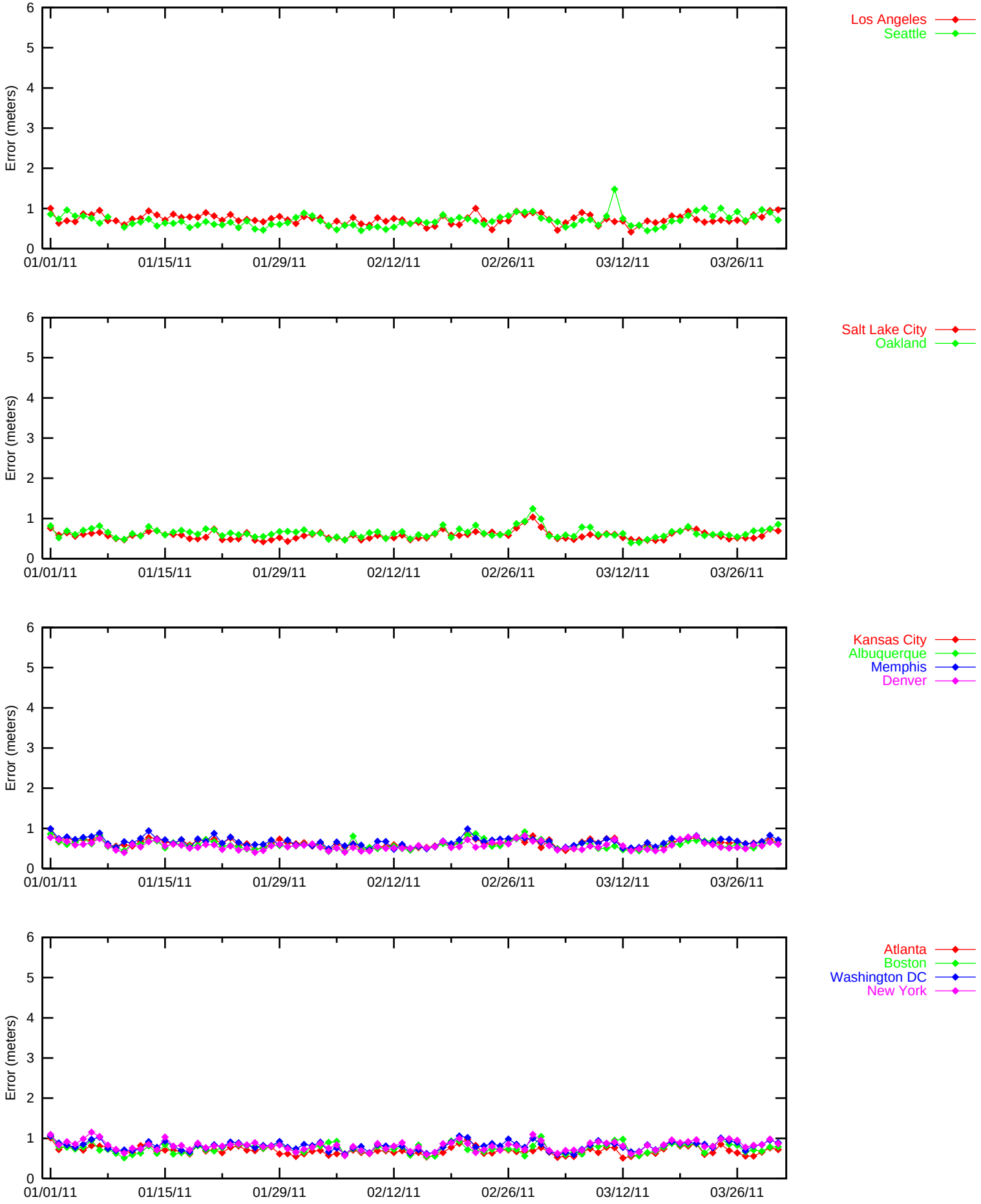


Figure 2-2 95% Horizontal Accuracy at LPV

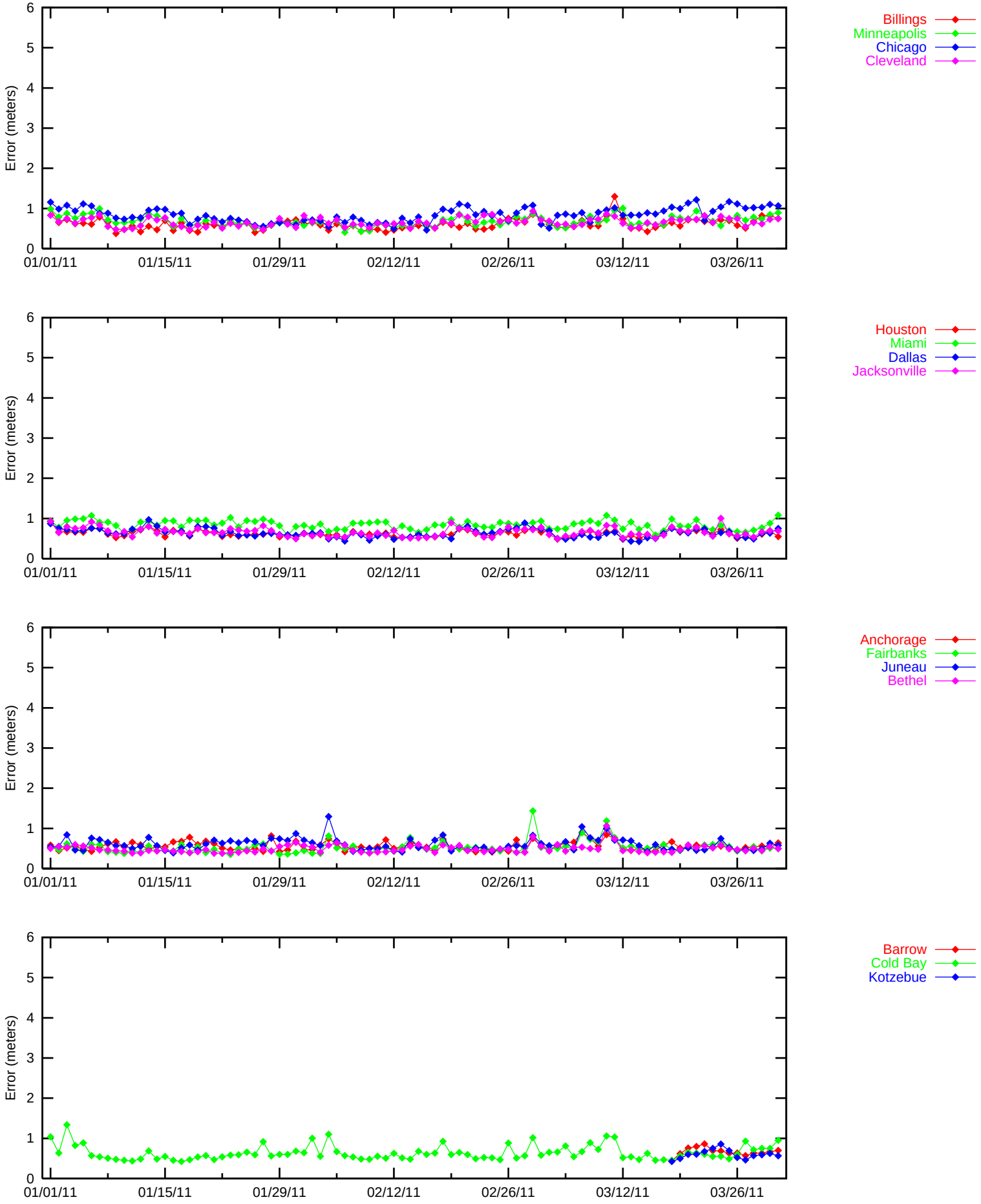


Figure 2-3 95% Horizontal Accuracy at LPV

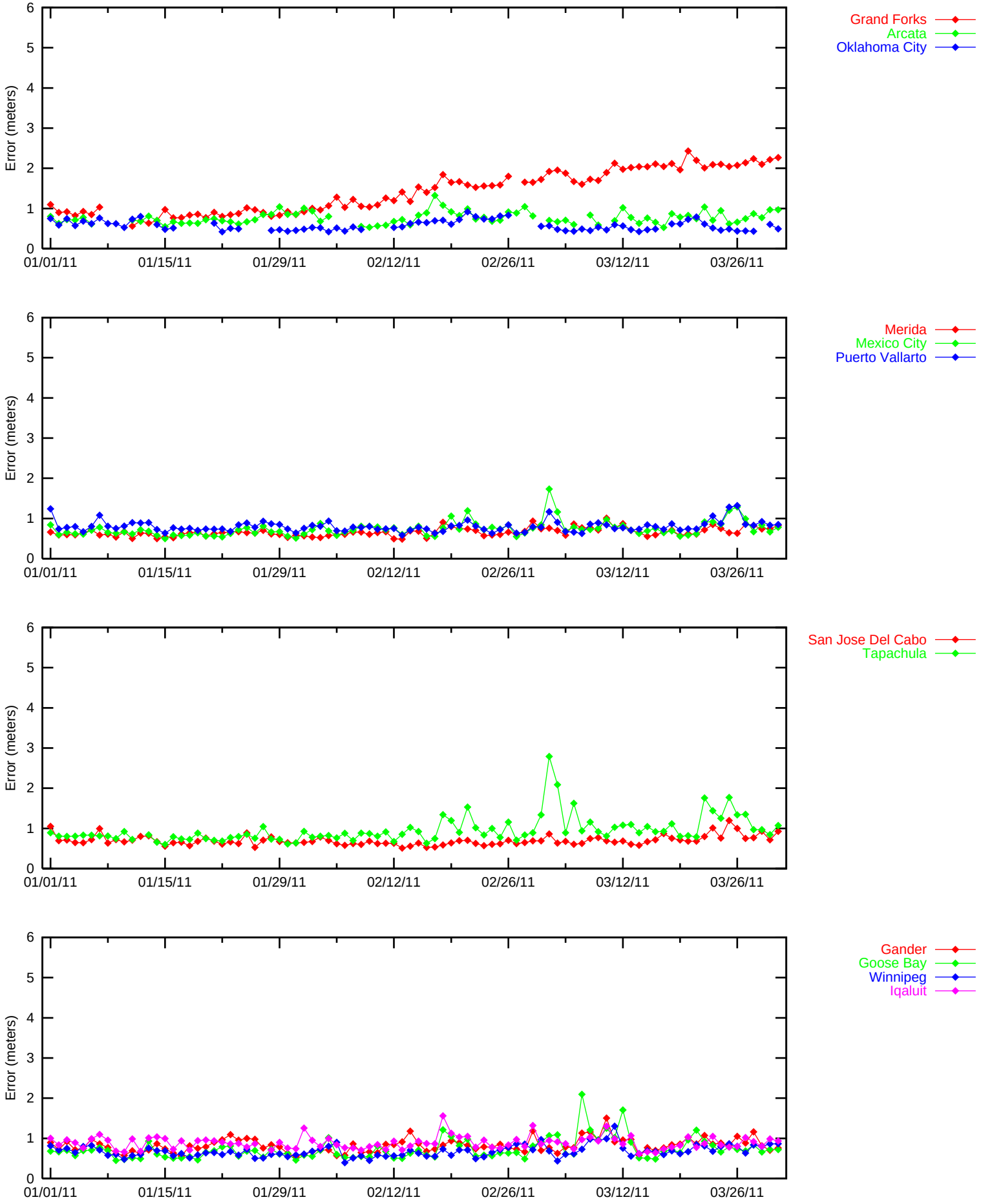


Figure 2-4 95% Vertical Accuracy at LPV

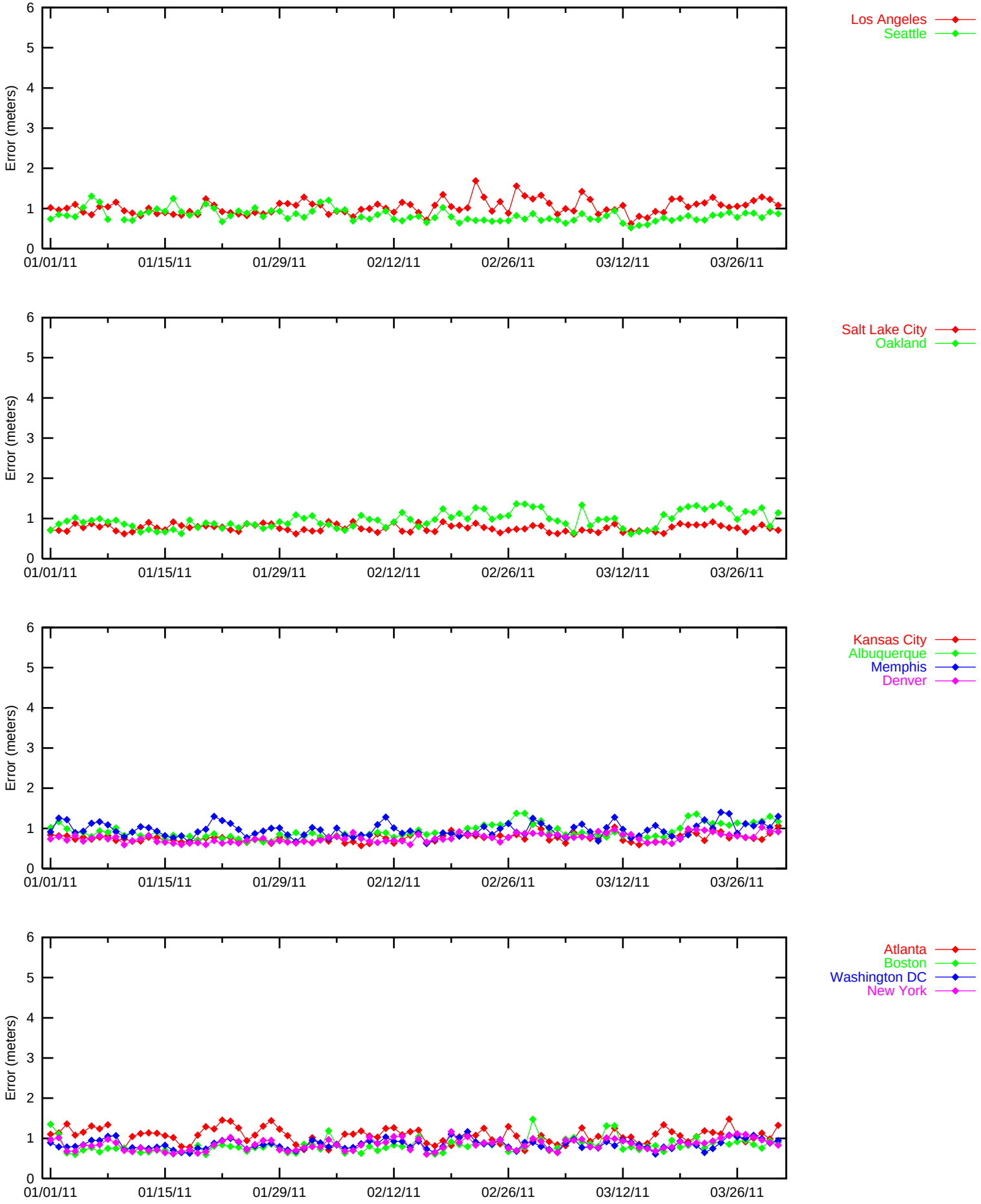


Figure 2-5 95% Vertical Accuracy at LPV

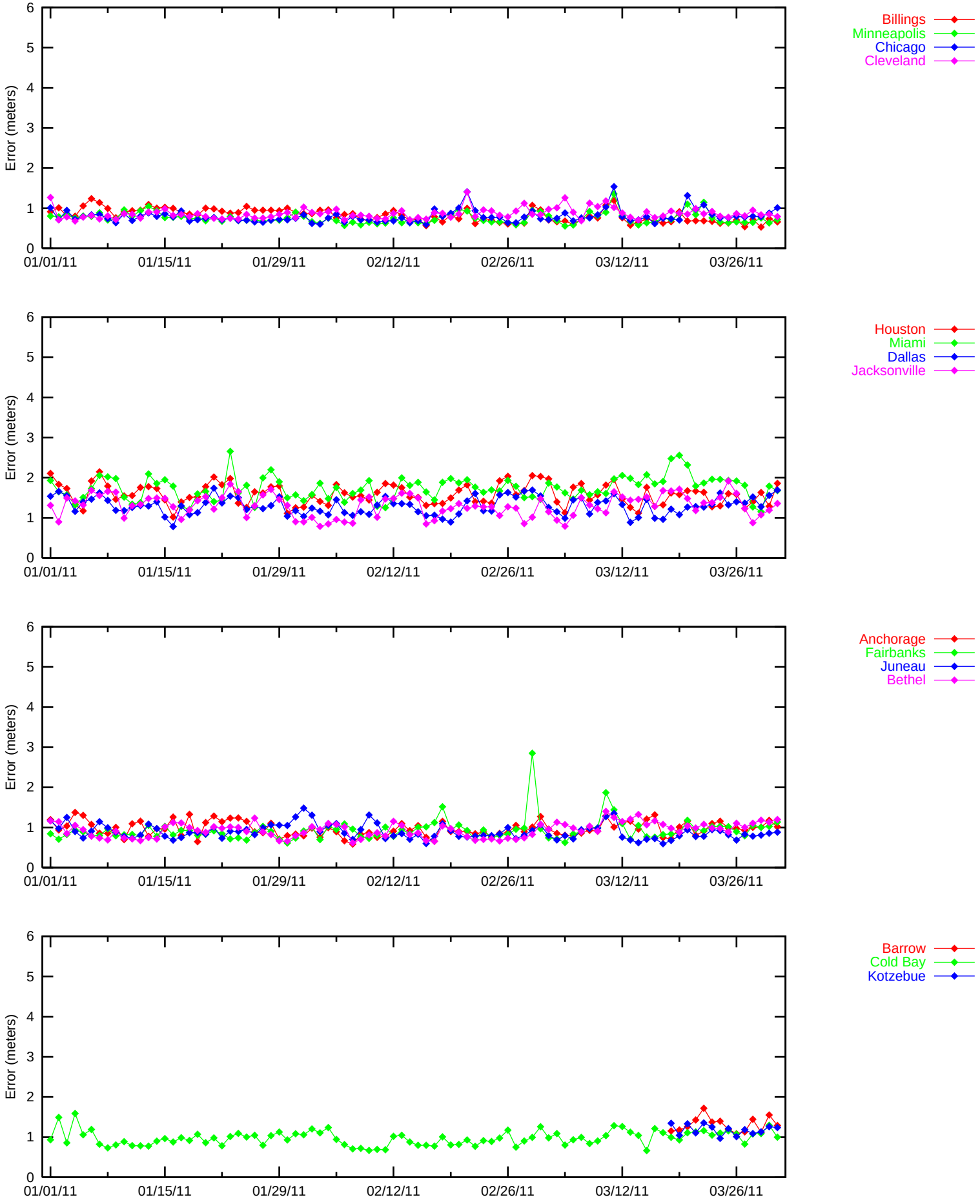


Figure 2-6 95% Vertical Accuracy at LPV

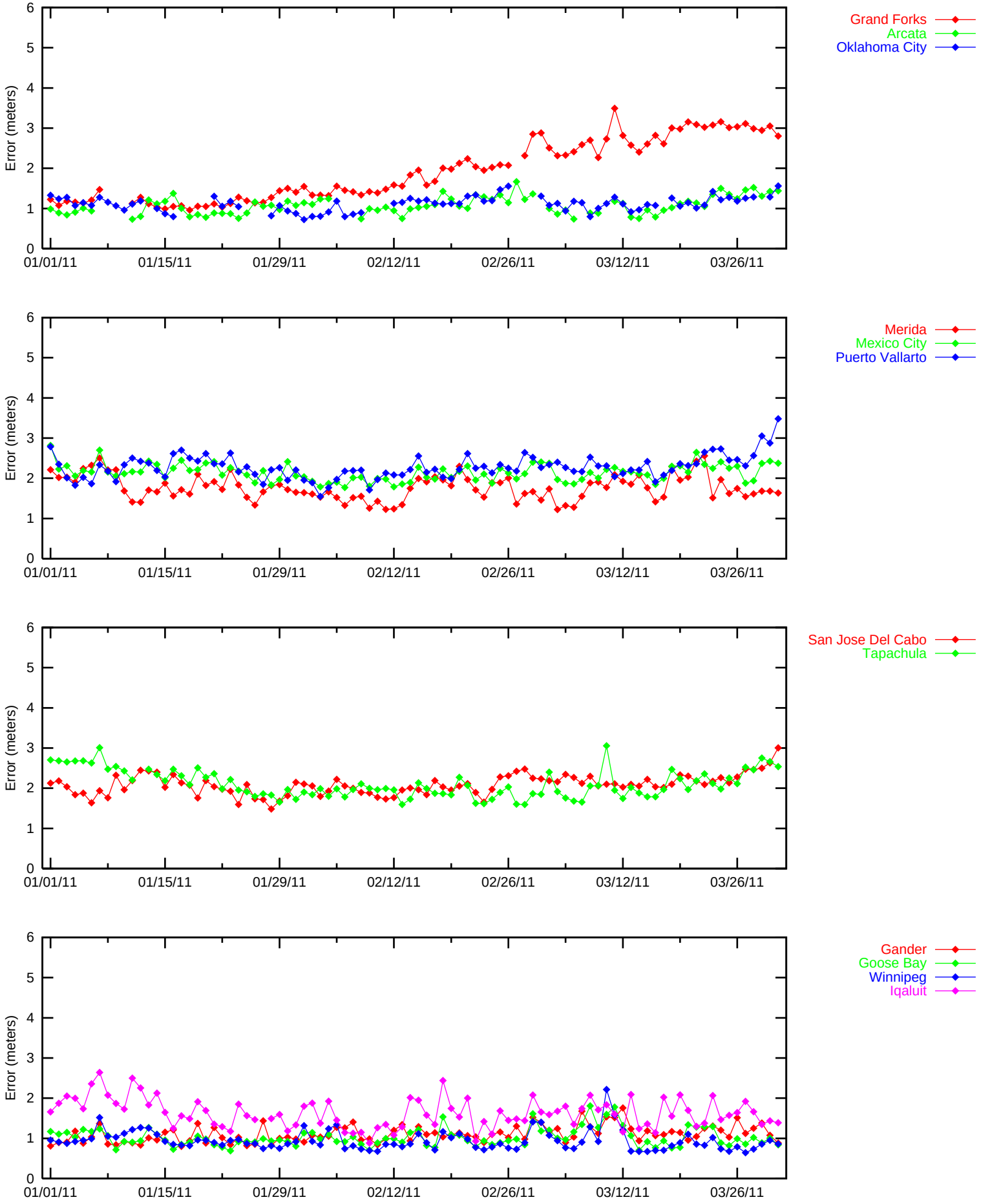


Figure 2-7 95% NPA Horizontal Accuracy

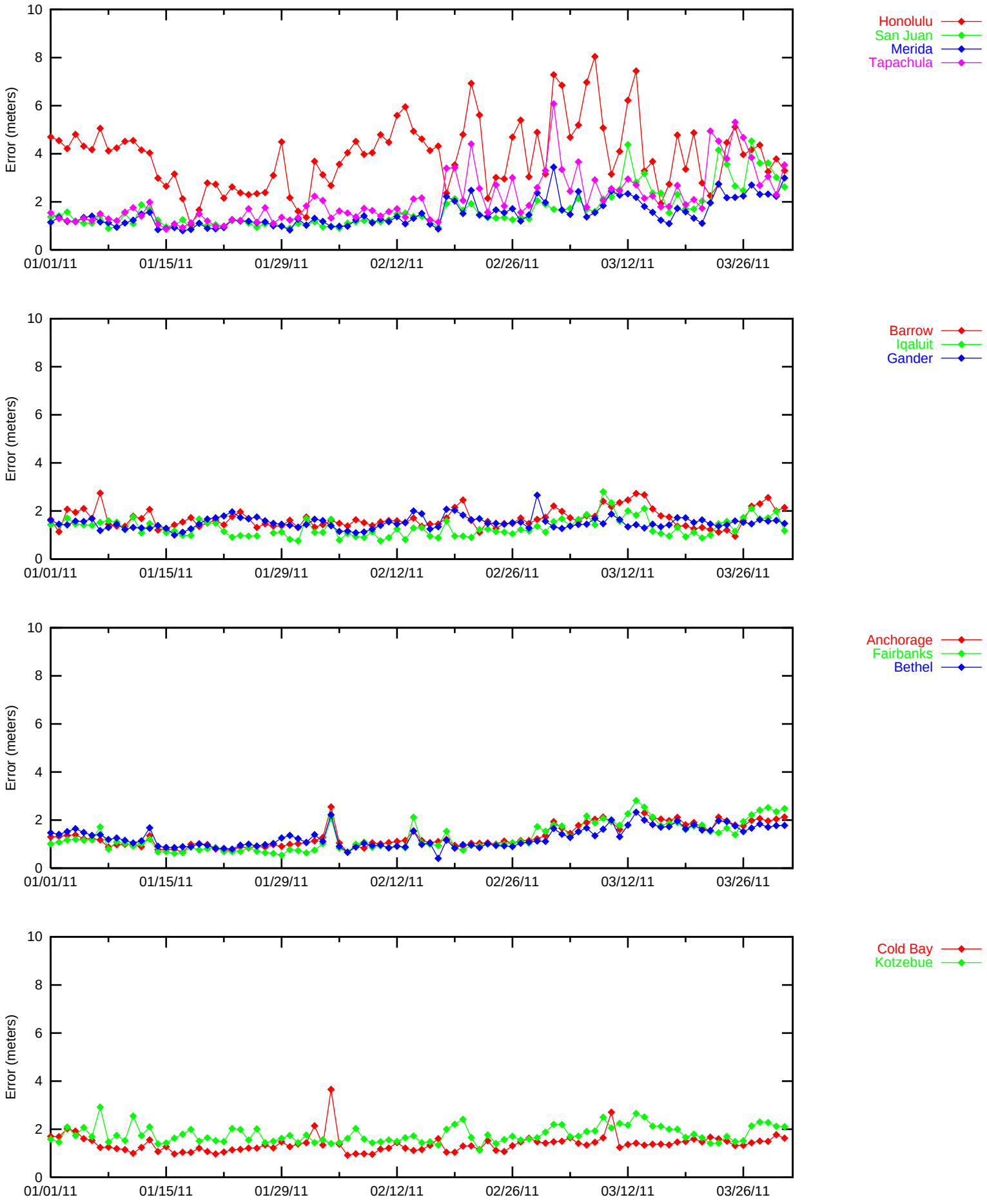


Figure 2-8 95% NPA Horizontal Accuracy

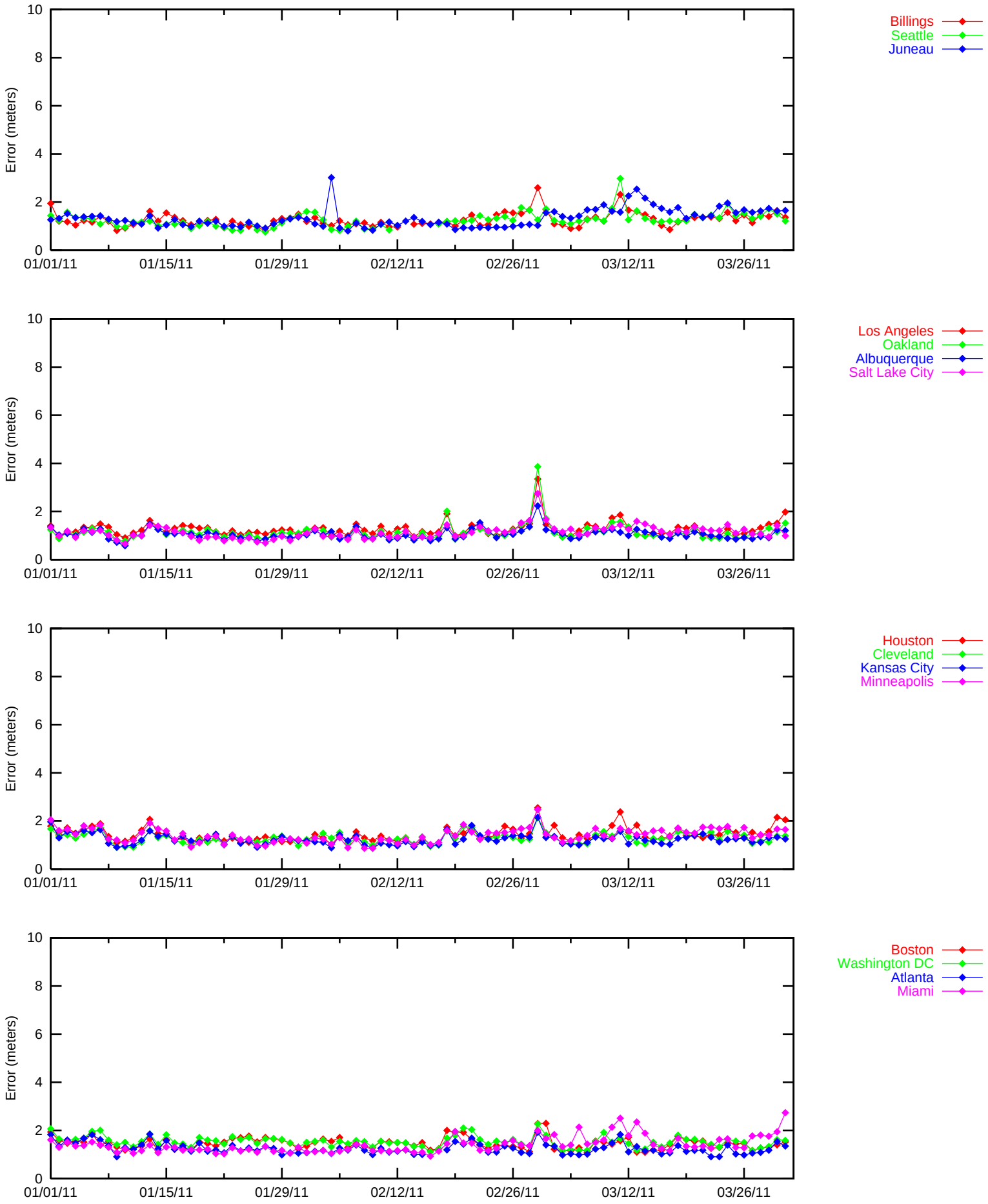


Figure 2-9 Horizontal Triangle Chart for the Quarter

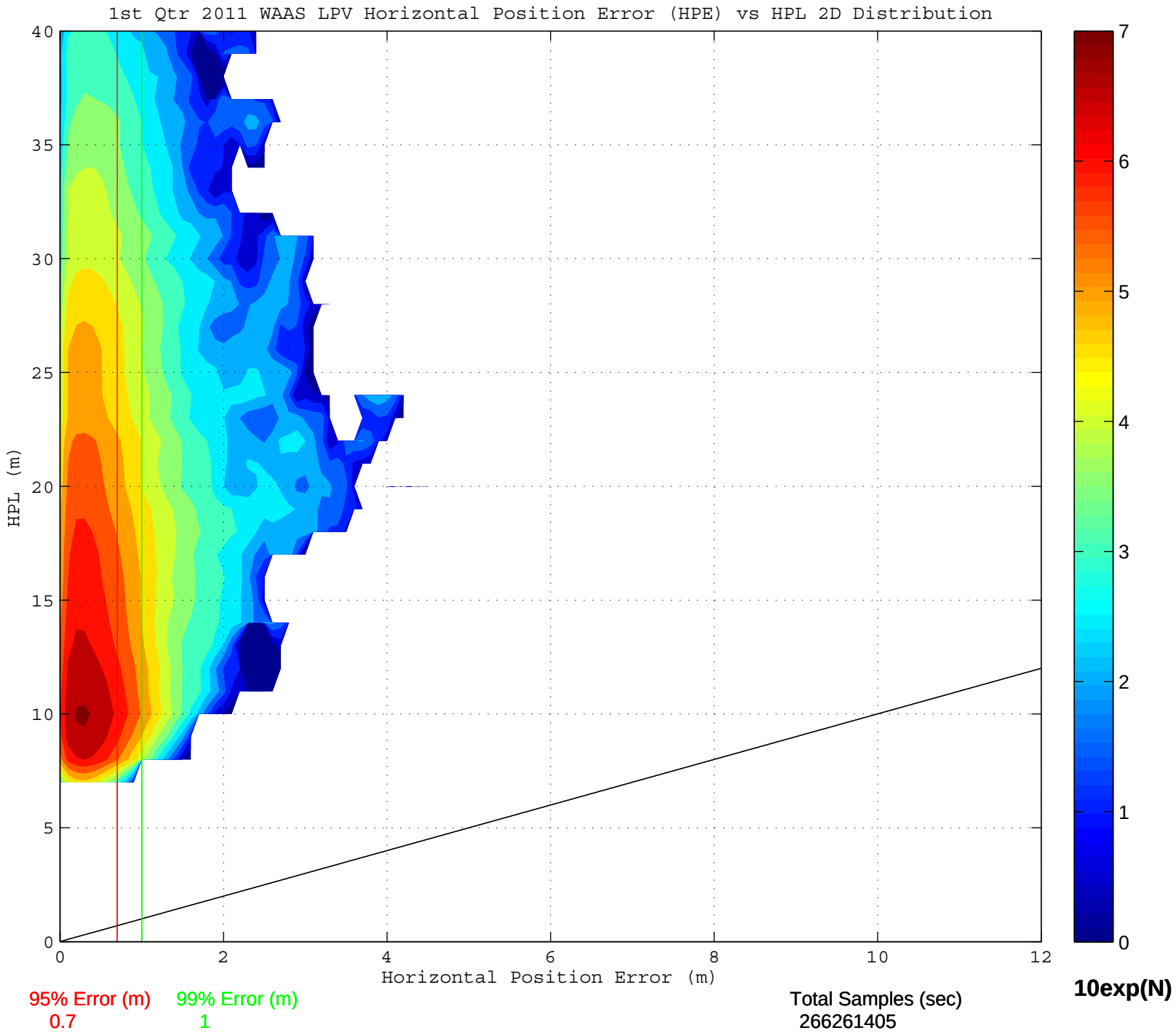


Figure 2-10 Vertical Triangle Chart for the Quarter

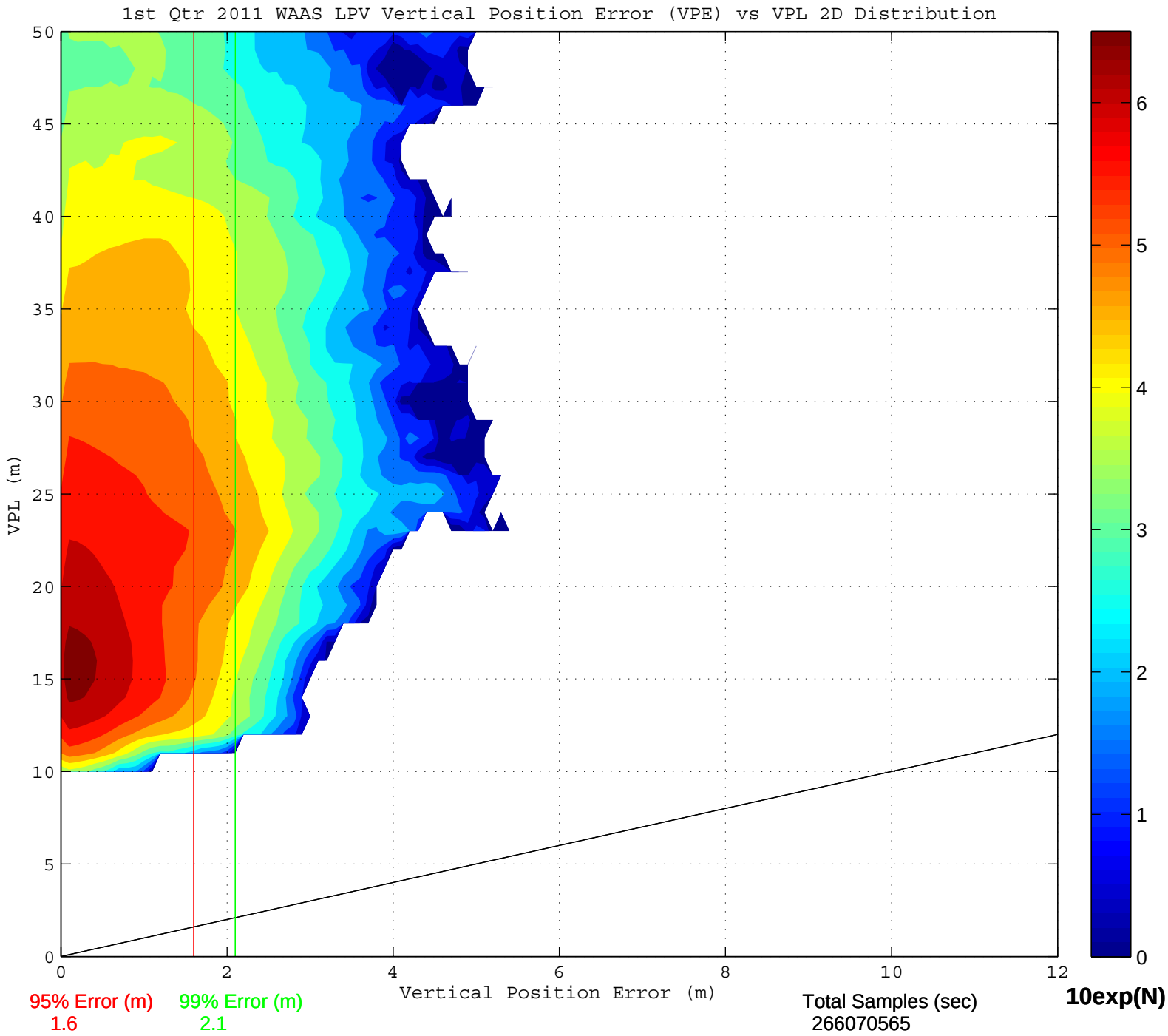


Figure 2-11 2-D Horizontal Histogram for the Quarter

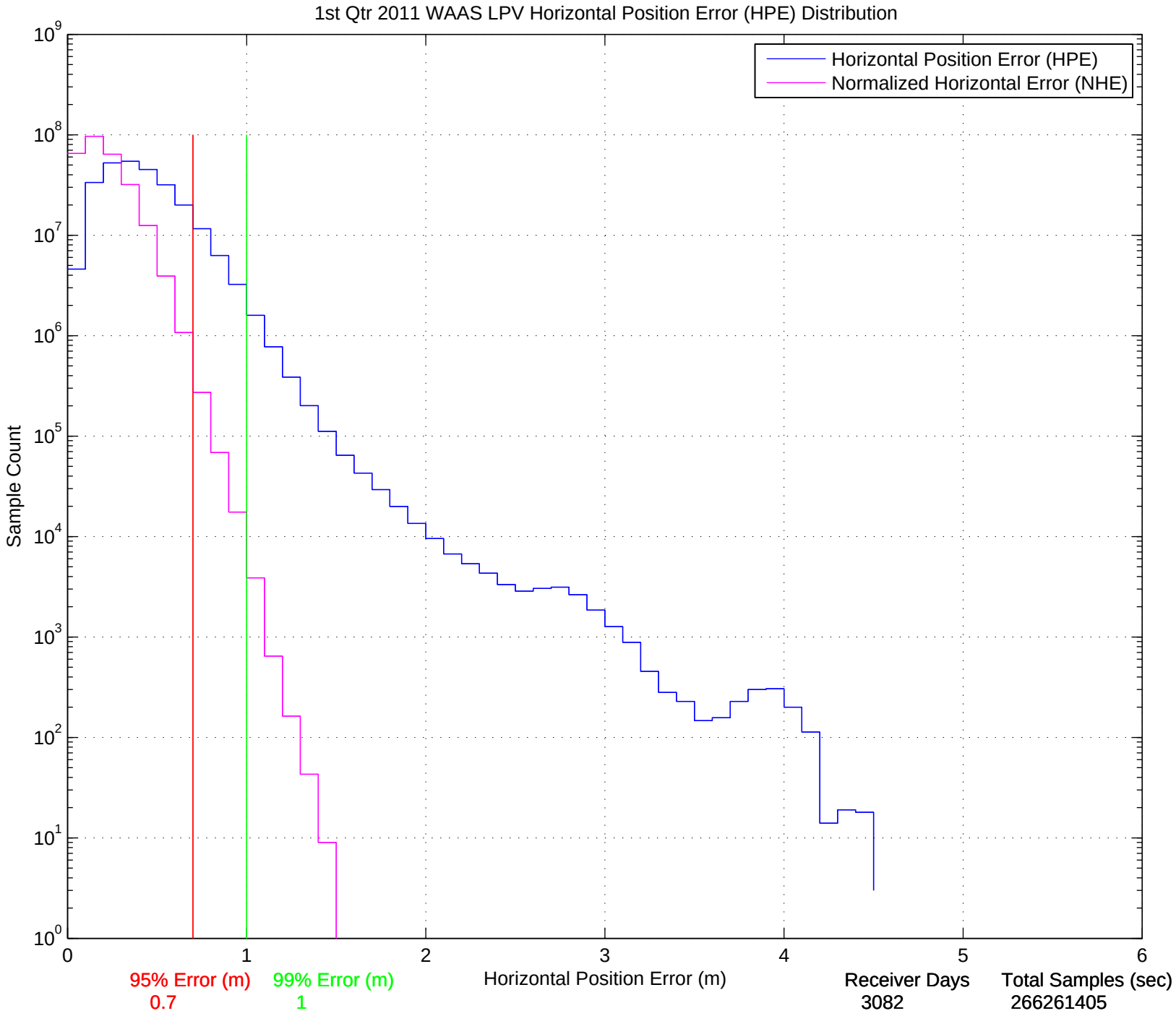
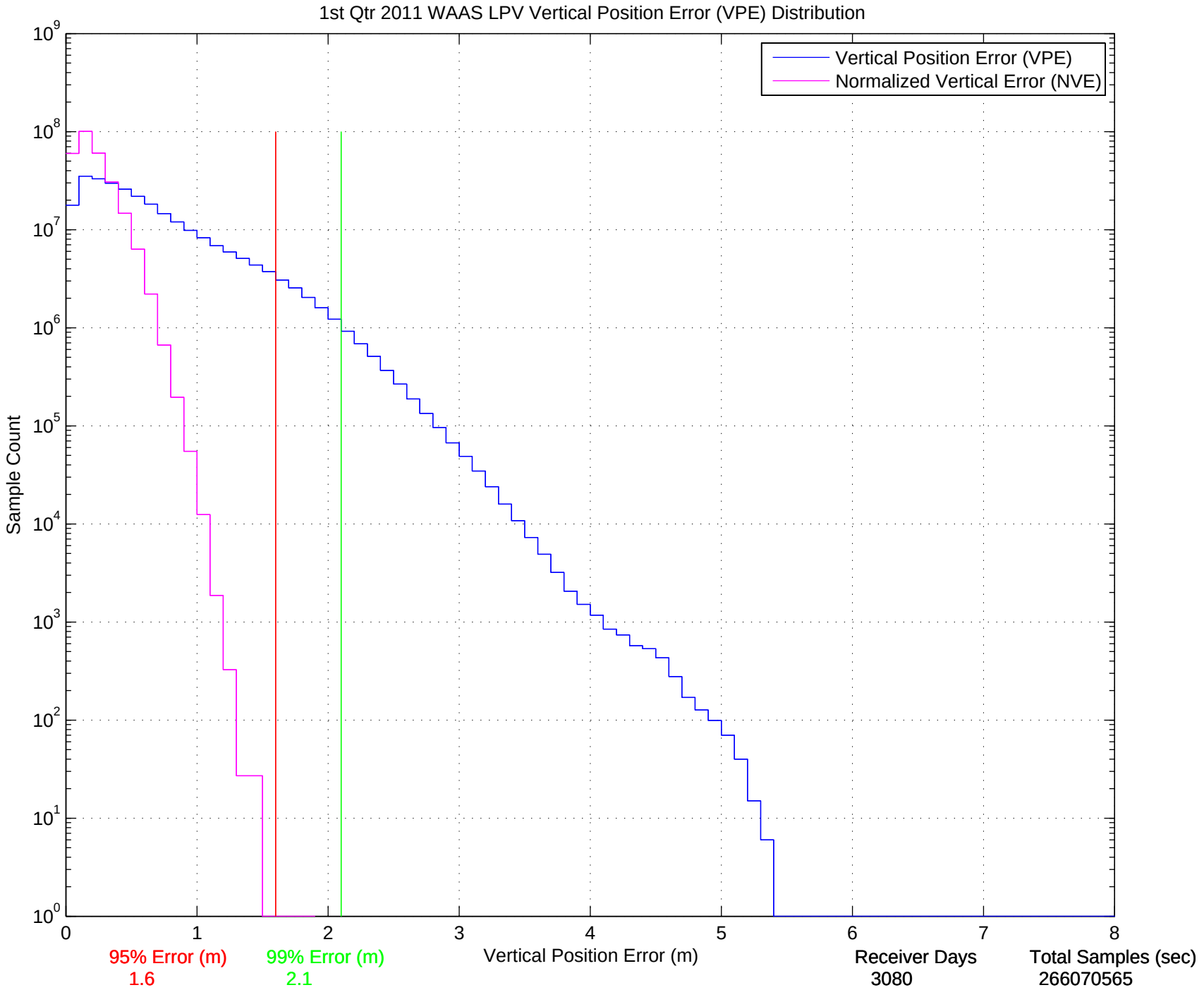


Figure 2-12 2-D Vertical Histogram for the Quarter



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 15.903 meters	Memphis 10.403 meters	Cold Bay 26.51 meters	Fairbanks 13.603 meters
95% VPL	Oakland 27.829 meters	Kansas City 17.757 meters	Barrow 40.08 meters	Juneau 21.86 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, low PA and NPA availability are mainly due to GPS satellite outages or GUS switchovers. Please refer to Table 1.4 for events that affected availability.

The CRW GEO satellite was taken out of service on 12/16/2010 due to instability and has returned to operational service on 3/18/2011. Low availability at Barrow and Kotzebue is due to CRW GEO out of service for most of the quarter.

The AMR GEO satellite (PRN 133) came into service on November 11, 2011. This GEO does not provide a ranging service yet, though it is expected to provide NPA ranging service (UDRE => 50 meters) in a future upgrade to the WAAS.

Radio frequency interference (RFI) caused localized loss of LPV availability at Kansas City on 2/17/11 (See DR. 100 Kansas City Sigal drop caused by RFI). Elevated UDREs on several satellites on 3/3/11 affected LPV 200 availability (See DR 101 Elevated UDREs on serveral satellites cause LPV200 coverage drop).

Table 3-1 95% Protection Level

Location	95% HPL (meters)	95% VPL (meters)	Percentage in PA mode
Arcata	15.897	27.754	100
Grand Forks	11.572	19.990	100
Oklahoma City	10.664	18.103	100
Albuquerque	11.238	19.120	100
Anchorage	14.268	21.851	100
Atlanta	11.044	18.938	100
Barrow	17.957	40.081	14.573540
Bethel	17.216	26.544	99.988550
Billings	11.359	20.630	100
Boston	13.365	20.483	100
Chicago	10.639	18.154	100
Cleveland	11.281	18.740	100
Cold Bay	26.514	34.955	99.990400
Dallas	10.680	18.722	100
Denver	10.884	20.402	100
Fairbanks	13.601	23.479	99.991430
Gander	21.792	32.746	99.999960
Goose Bay	17.103	25.987	100
Houston	11.007	19.548	100
Iqaluit	25.552	38.118	99.998300
Jacksonville	11.394	19.705	100
Juneau	13.815	21.861	100
Kansas City	10.626	17.754	100
Kotzebue	18.157	35.426	14.577600
Los Angeles	14.842	25.885	100
Memphis	10.402	18.151	100
Merida	15.267	26.867	100
Mexico City	19.786	32.511	100
Miami	13.345	23.093	100
Minneapolis	11.254	19.045	100
New York	12.997	20.367	100
Oakland	15.676	27.826	100
Puerto Vallarta	20.349	33.251	99.999860
Salt Lake City	11.295	20.950	100
San Jose Del Cabo	19.061	32.446	100
Seattle	13.233	22.386	100
Tapachula	29.237	44.666	100
Washington DC	11.670	19.507	100
Winnipeg	12.447	20.332	100

Table 3-2 Quarterly Availability Statistics

Location	LPV WAAS *With 15 minute window*	LPV 200 WAAS *With 15 minute window*
Arcata	0.9987355	0.9847653
Grand Forks	0.9999477	0.9995878
Oklahoma City	0.9999936	0.9998962
Albuquerque	0.9999696	0.9996967
Anchorage	0.9997780	0.9992611
Atlanta	1	1
Barrow	0.9915613	0.8667112
Bethel	0.9997556	0.9924537
Billings	1	0.9998933
Boston	0.9999910	0.9999910
Chicago	1	1
Cleveland	1	1
Cold Bay	0.9990498	0.9359471
Dallas	0.9999030	0.9996677
Denver	0.9999451	0.9998005
Fairbanks	0.9996080	0.9989432
Gander	0.9997906	0.9736209
Goose Bay	0.9995390	0.9977463
Houston	1	0.9998627
Iqaluit	0.9928899	0.8739022
Jacksonville	1	1
Juneau	0.9997771	0.9993299
Kansas City	1	0.9998352
Kotzebue	0.9942846	0.9326818
Los Angeles	1	0.9993638
Memphis	1	1
Merida	1	0.9982803
Mexico City	0.9998299	0.9745382
Miami	1	0.9992339
Minneapolis	1	0.9998583
New York	1	1
Oakland	0.9998741	0.9857358
Puerto Vallarta	0.9998129	0.9672407
Salt Lake City	1	0.9999484
San Jose Del Cabo	0.9999633	0.9687542
Seattle	0.9999641	0.9996321
Tapachula	0.9692231	0.5822741
Washington DC	0.9999880	0.9999070
Winnipeg	0.9999750	0.9992843

Table 3-3 NPA Availability

Location	NPA Availability (Excluding RAIM/FDE)
Albuquerque	1
Anchorage	1
Atlanta	1
Barrow	0.99507606
Bethel	0.99996745
Billings	1
Boston	0.99998881
Cleveland	1
Cold Bay	0.99996611
Fairbanks	0.99998056
Gander	1.00000000
Honolulu	1
Houston	1
Iqaluit	1
Juneau	1
Kansas City	1
Kotzebue	0.99507021
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	58	0.001230	172	0.003699
Grand Forks	1	0.000020	3	0.000060
Oklahoma City	1	0.000023	4	0.000092
Albuquerque	1	0.000019	2	0.000039
Anchorage	1	0.000019	4	0.000077
Atlanta	0	0	0	0
Barrow	10	0.001330	126	0.019175
Bethel	5	0.000097	91	0.001771
Billings	0	0	3	0.000058
Boston	1	0.000019	1	0.000019
Chicago	0	0	1	0.000019
Cleveland	0	0	0	0
Cold Bay	16	0.000310	564	0.011682
Dallas	2	0.000039	3	0.000058
Denver	1	0.000019	1	0.000019
Fairbanks	4	0.000077	13	0.000251
Gander	8	0.000155	292	0.005793
Goose Bay	2	0.000039	15	0.000290
Houston	0	0	2	0.000039
Iqaluit	120	0.002355	859	0.019151
Jacksonville	0	0	0	0
Juneau	1	0.000019	5	0.000097
Kansas City	0	0	2	0.000039
Kotzebue	5	0.000662	67	0.009462
Los Angeles	0	0	15	0.000290
Memphis	0	0	0	0
Merida	0	0	53	0.001025
Mexico City	1	0.000019	214	0.004238
Miami	0	0	29	0.000560
Minneapolis	0	0	3	0.000058
New York	0	0	0	0
Oakland	2	0.000039	145	0.002839
Puerto Vallarta	5	0.000097	290	0.005800
Salt Lake City	0	0	2	0.000039
San Jose Del Cabo	2	0.000039	281	0.005599
Seattle	1	0.000019	21	0.000405
Tapachula	413	0.008310	1248	0.041800
Washington DC	1	0.000019	11	0.000212
Winnipeg	1	0.000019	4	0.000077

Table 3-5 NPA Outage Rates

Location	NPA Outages	NPA Outage Rate
Albuquerque	0	0
Anchorage	0	0
Atlanta	0	0
Barrow	4	0.00052989
Bethel	3	0.00005860
Billings	0	0
Boston	1	0.00001930
Cleveland	0	0
Cold Bay	3	0.00005821
Fairbanks	2	0.00003863
Gander	0	0
Honolulu	0	0
Houston	0	0
Iqaluit	0	0
Juneau	0	0
Kansas City	0	0
Kotzebue	4	0.00052939
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)

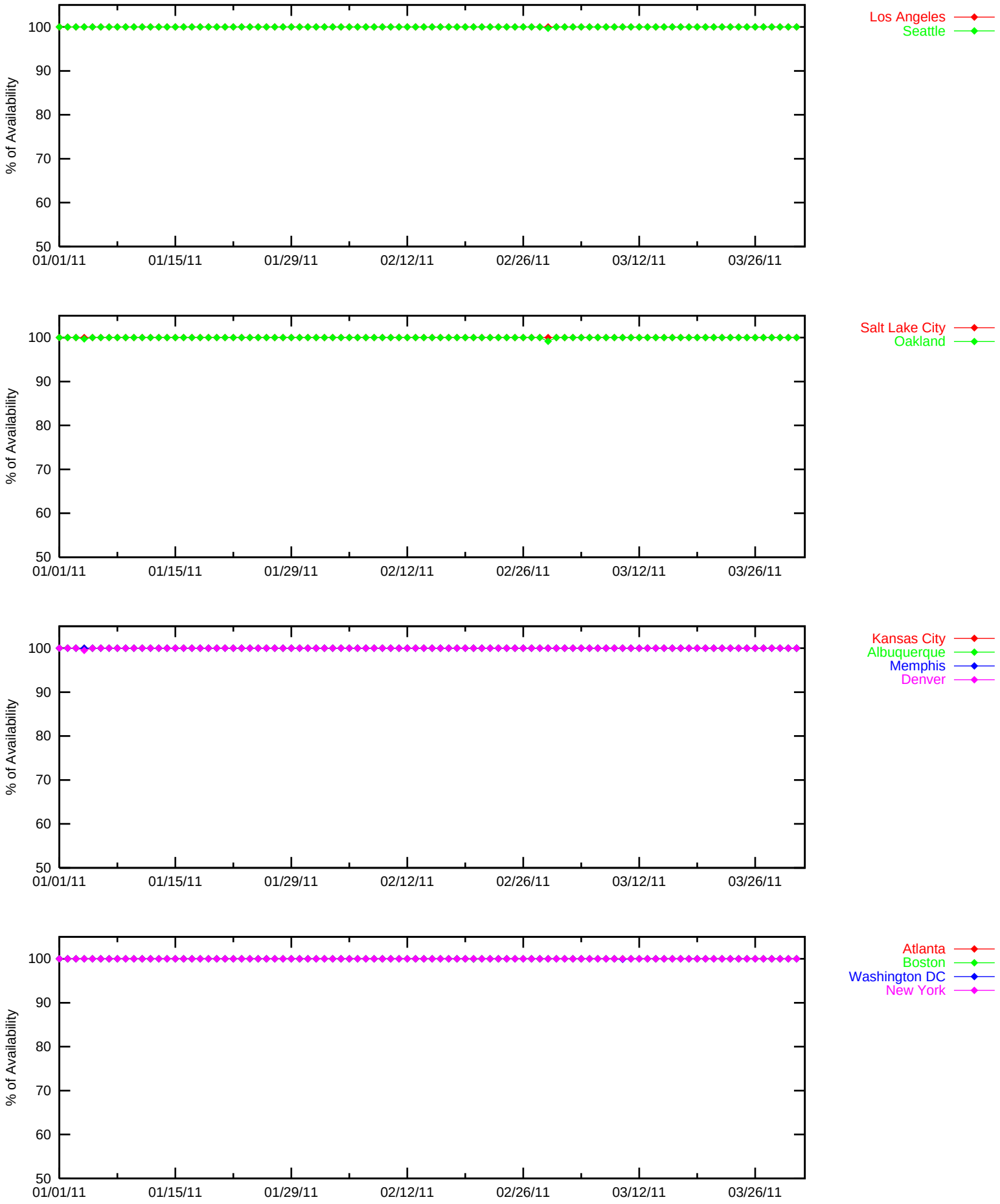


Figure 3-2 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

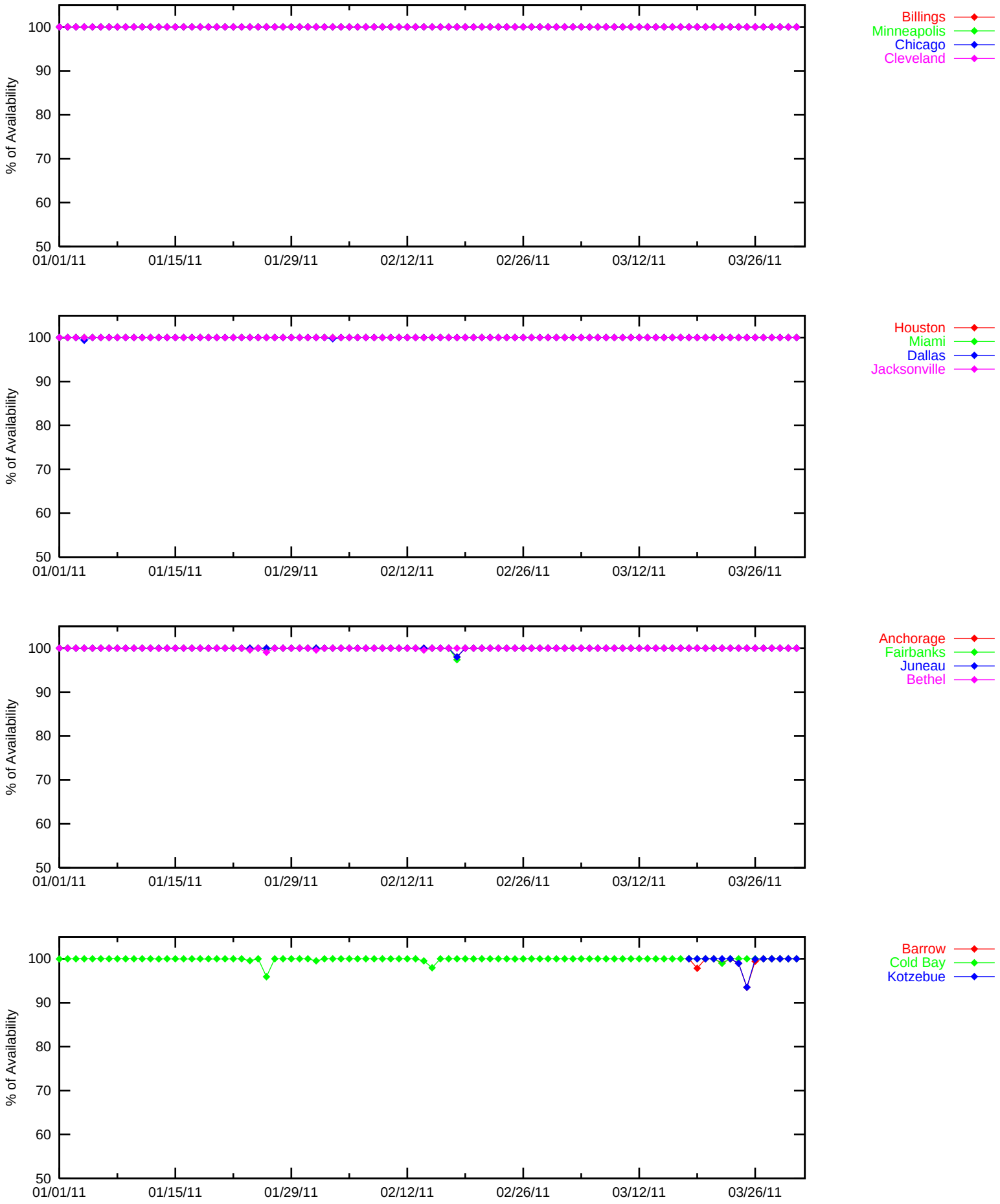


Figure 3-3 LPV Instantaneous Availability (HAL = 40m & VAL=50m)

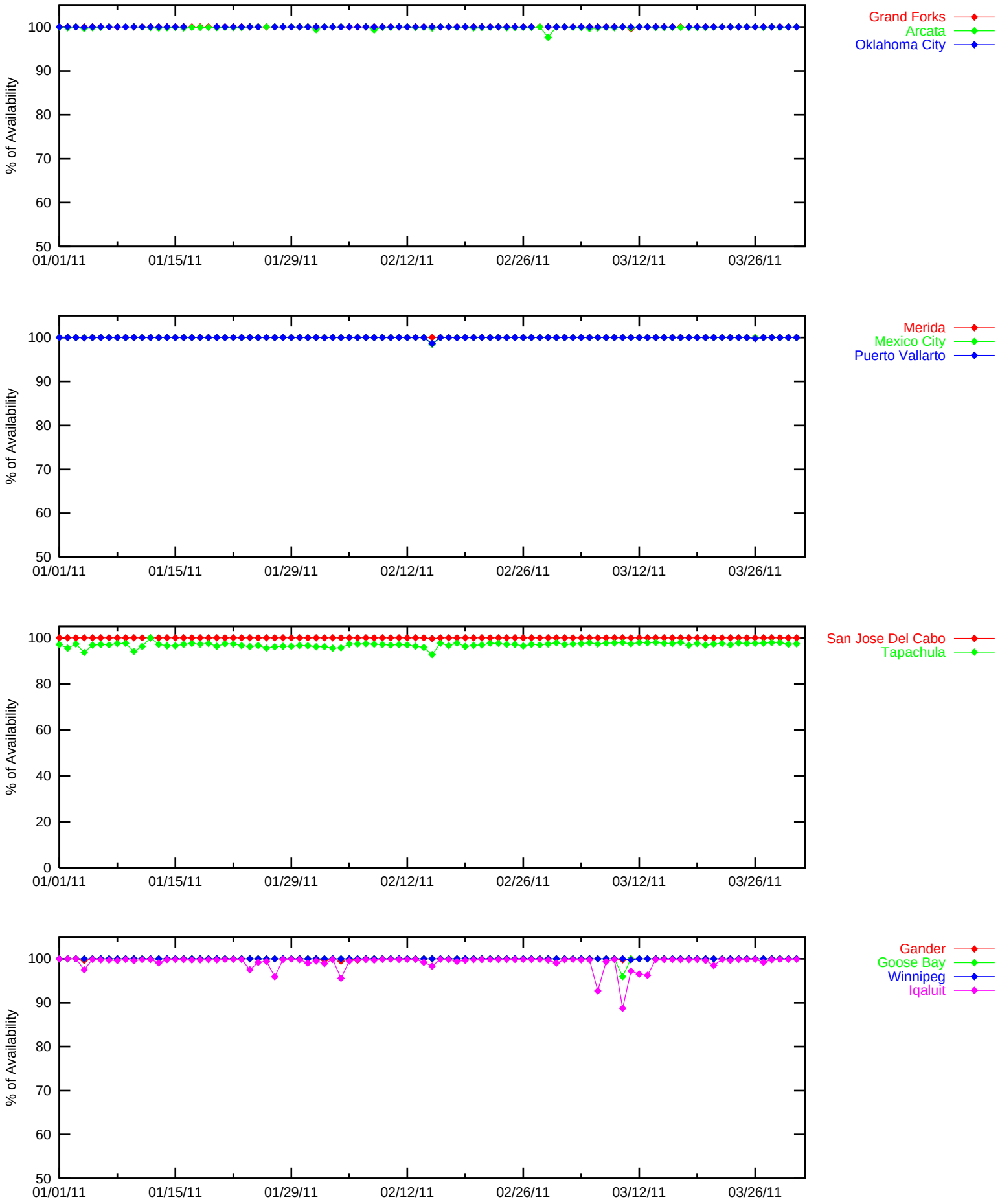


Figure 3-4 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

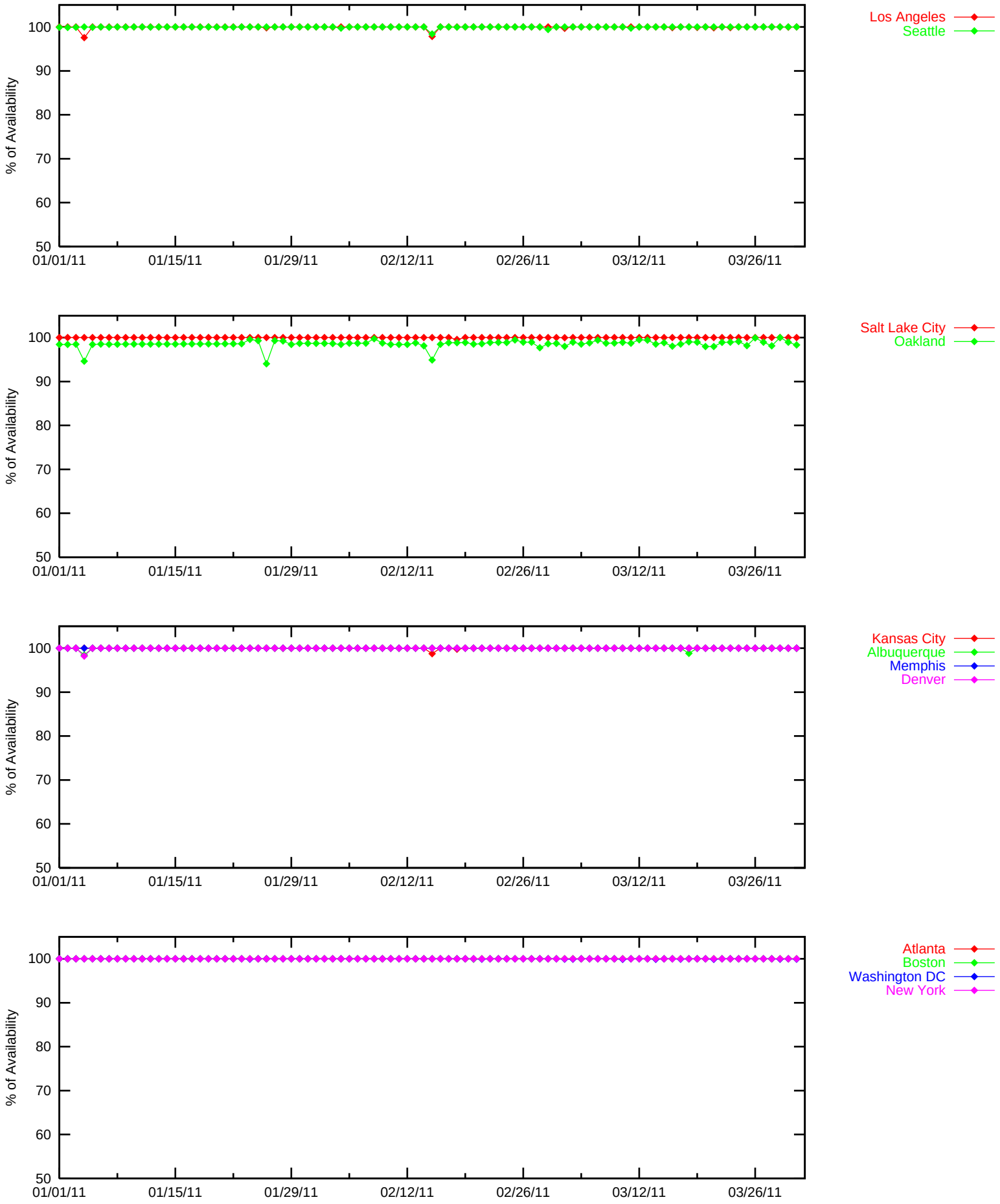


Figure 3-5 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)

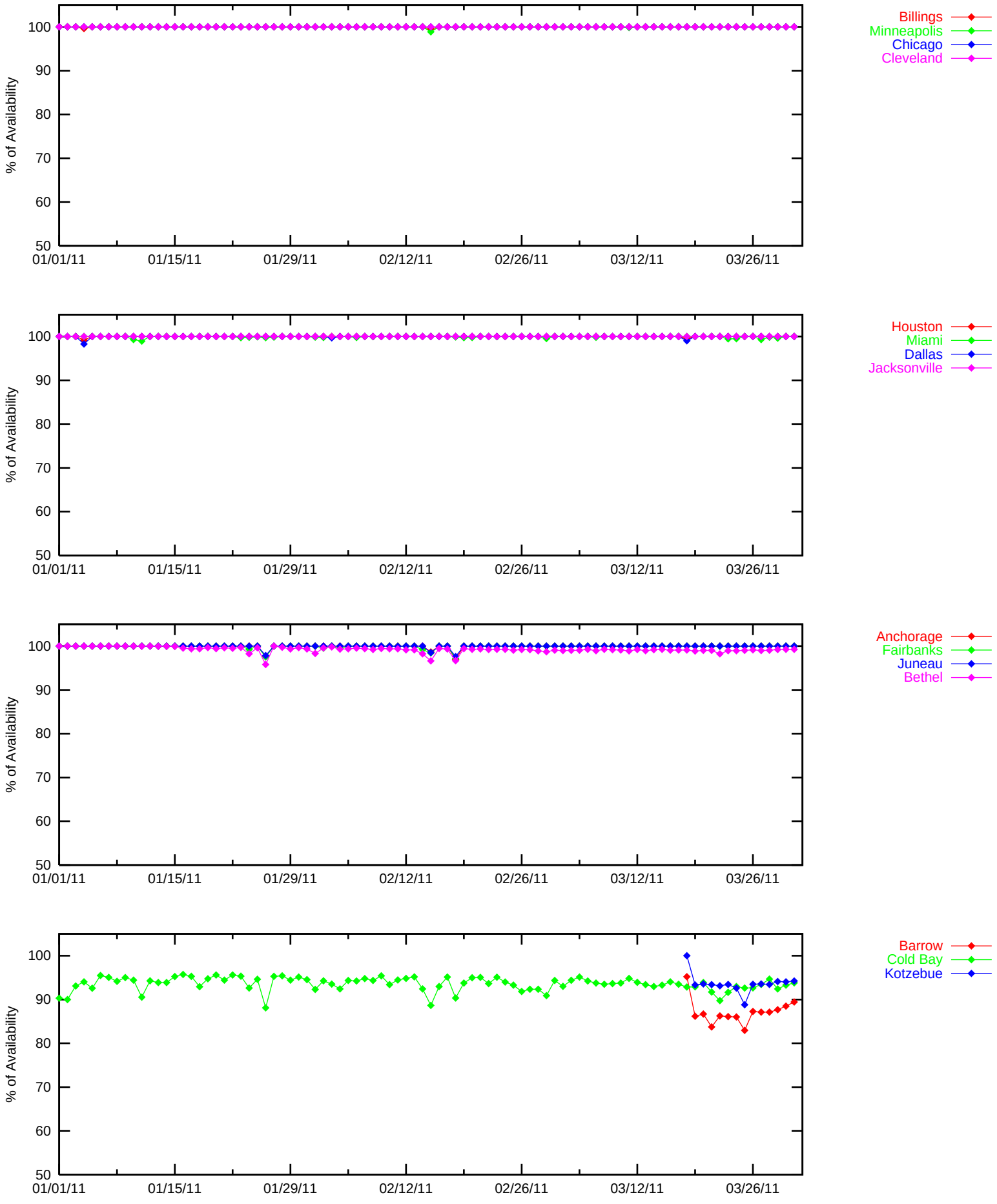
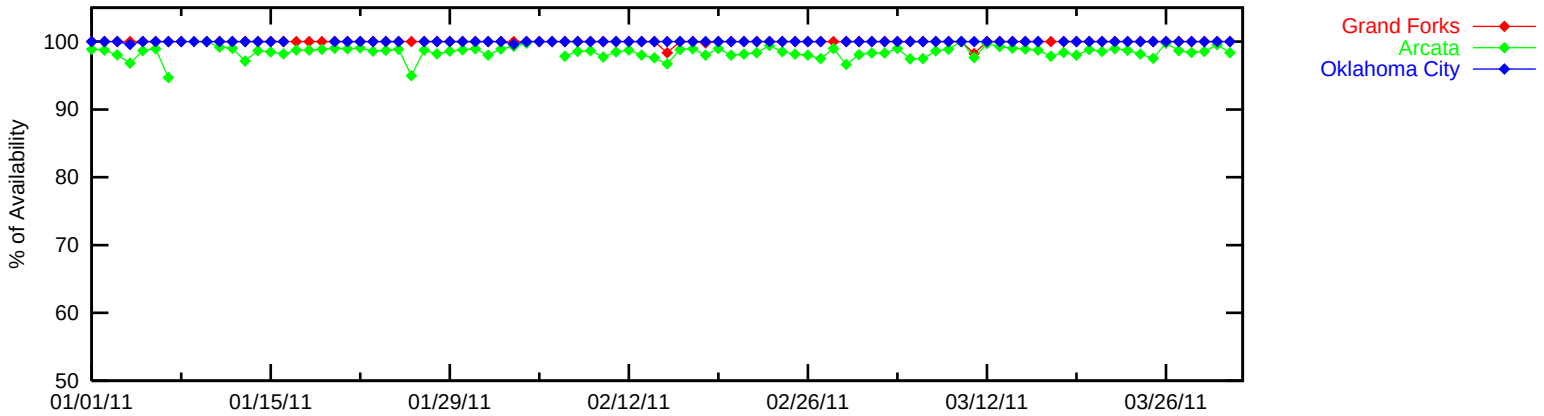
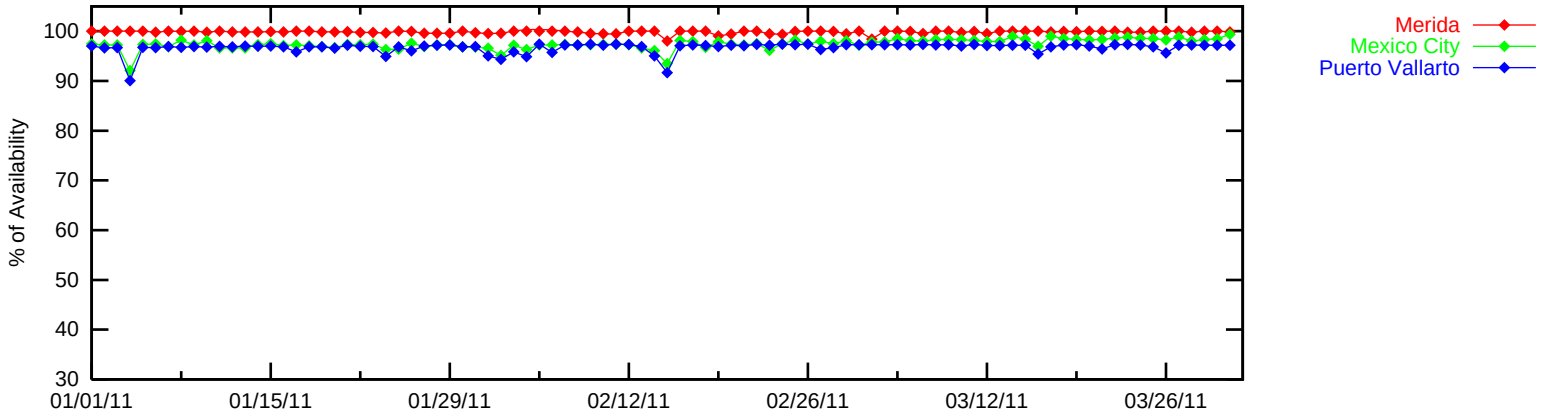
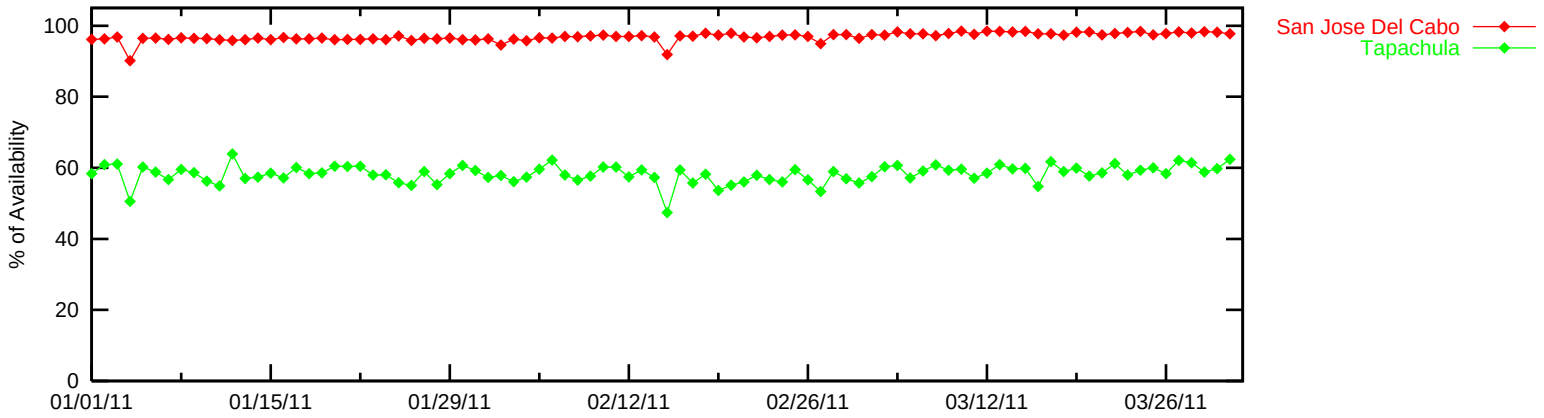


Figure 3-6 LPV 200 Instantaneous Availability (HAL = 40m & VAL=35m)







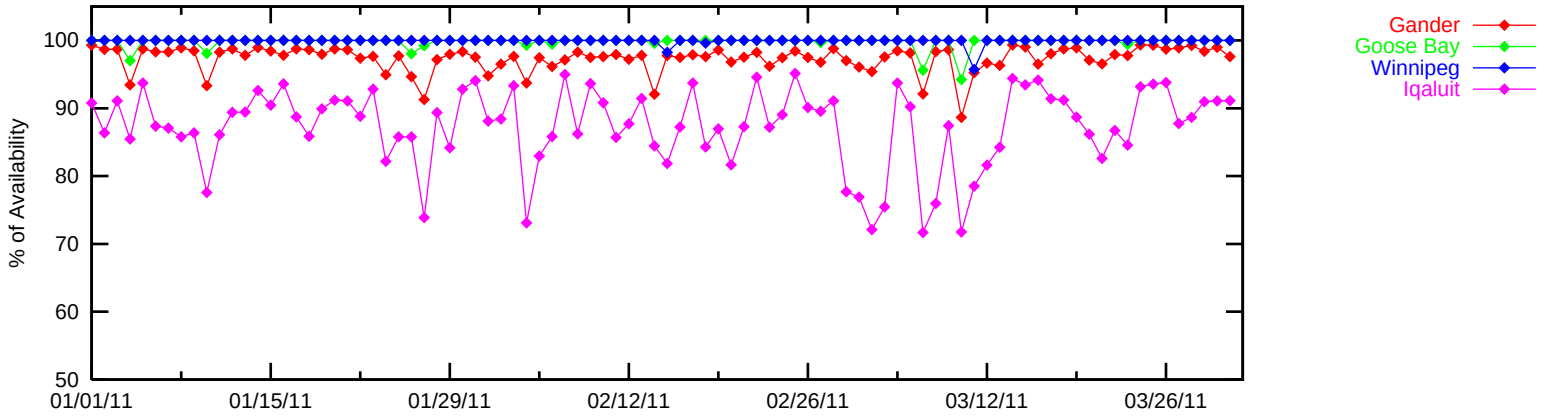


Figure 3-7 LPV Outages (HAL = 40m & VAL=50m)

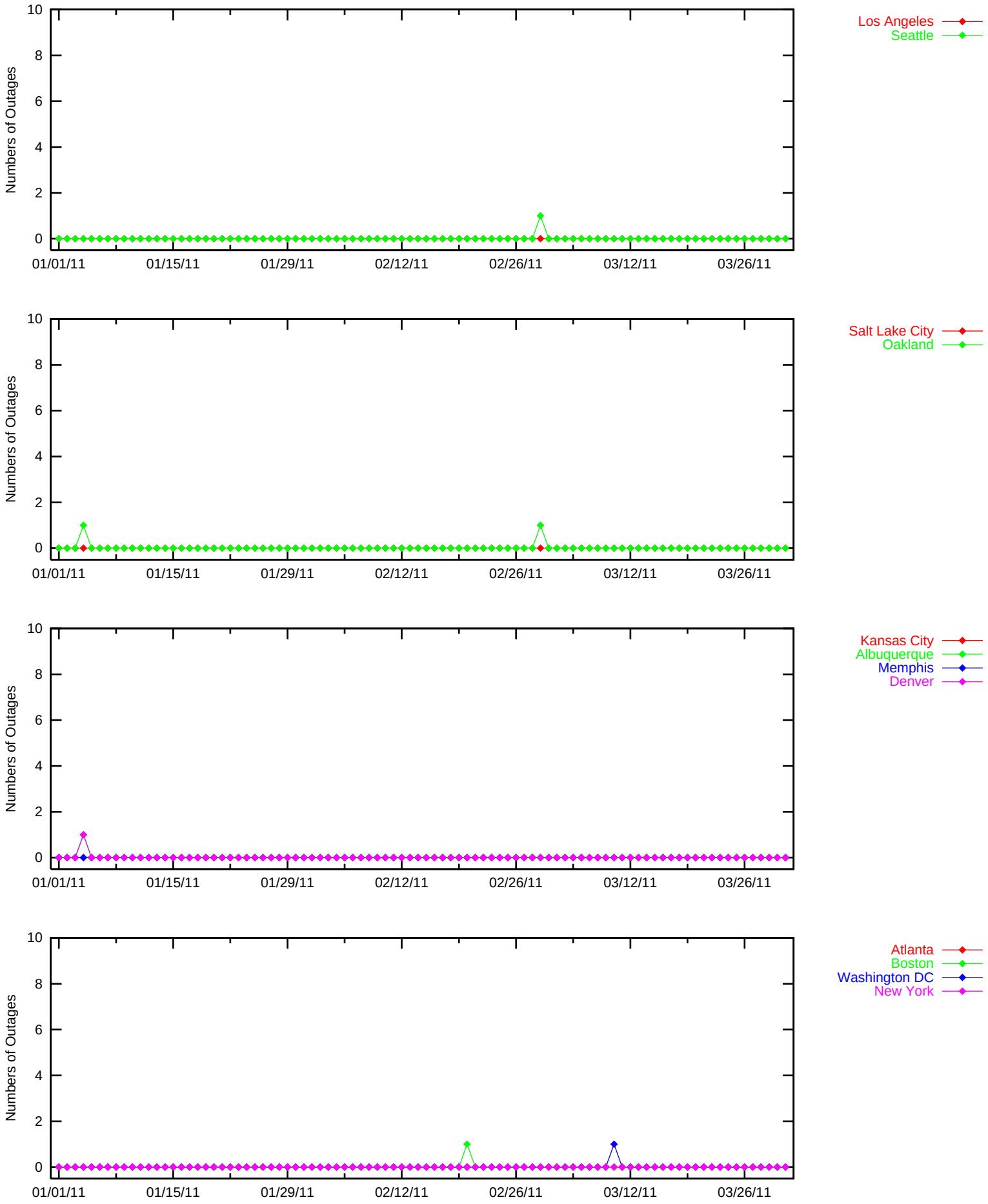


Figure 3-8 LPV Outages (HAL = 40m & VAL=50m)

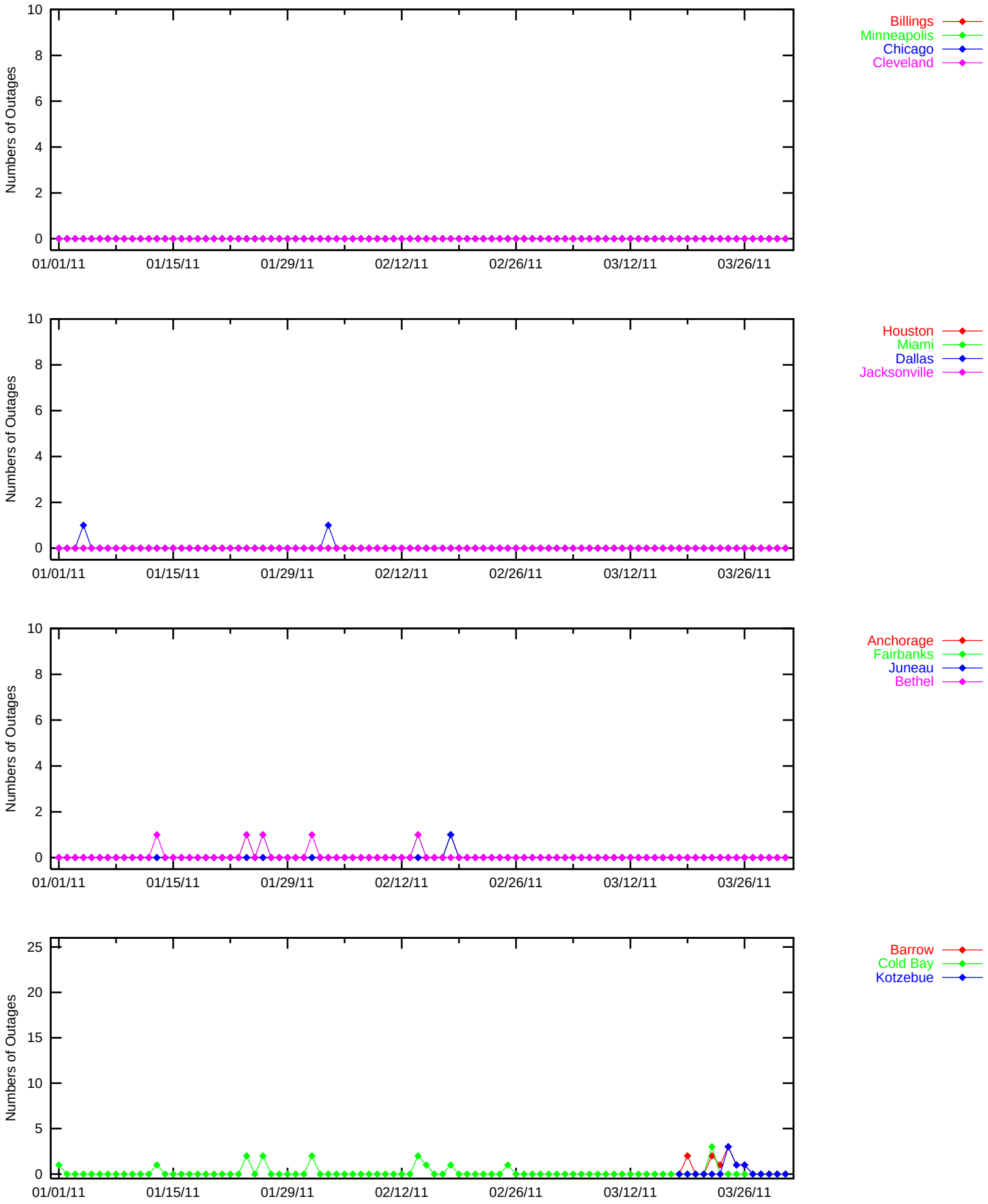


Figure 3-9 LPV Outages (HAL = 40m & VAL=50m)

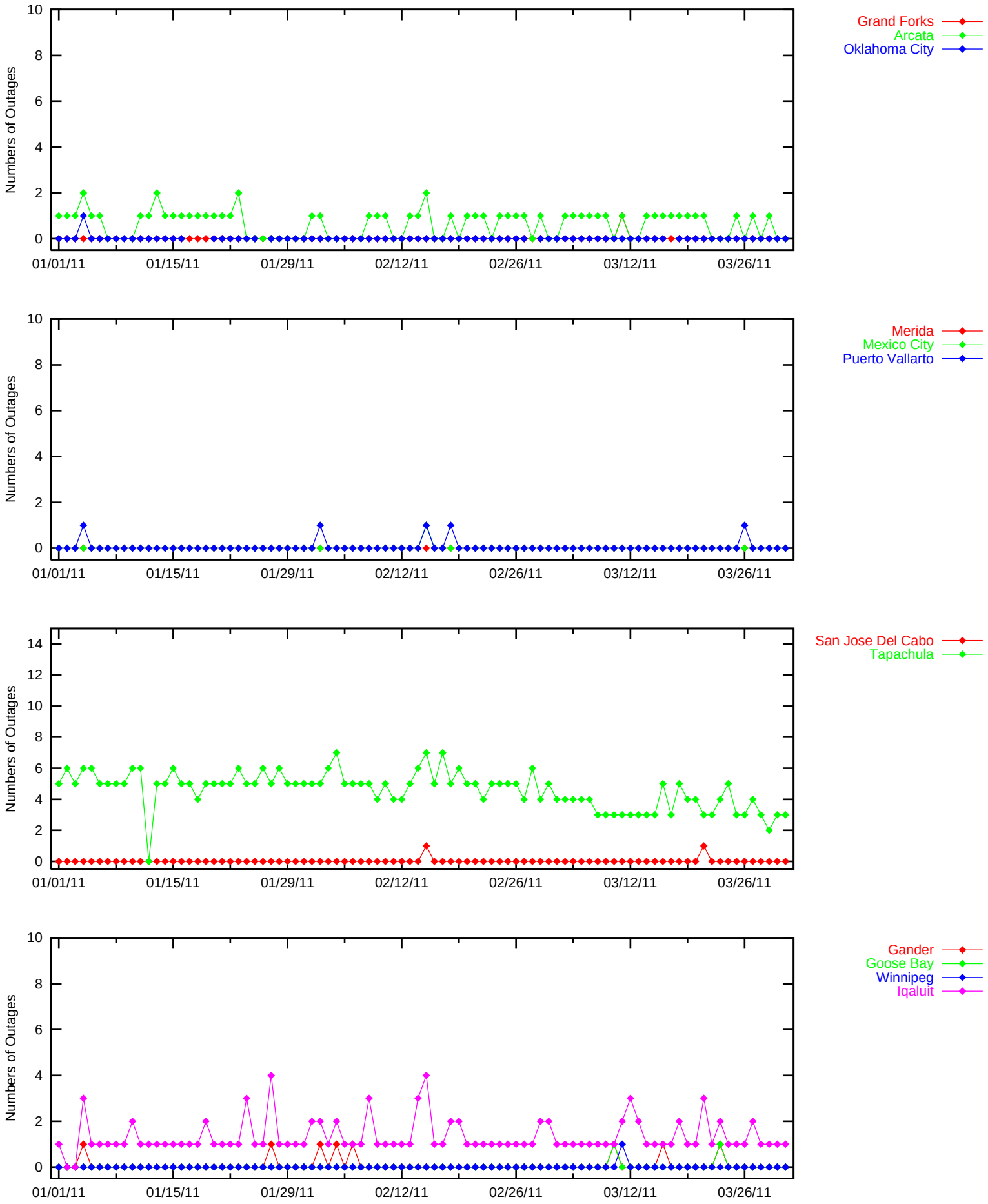


Figure 3-10 LPV 200 Outages (HAL = 40m & VAL=35m)

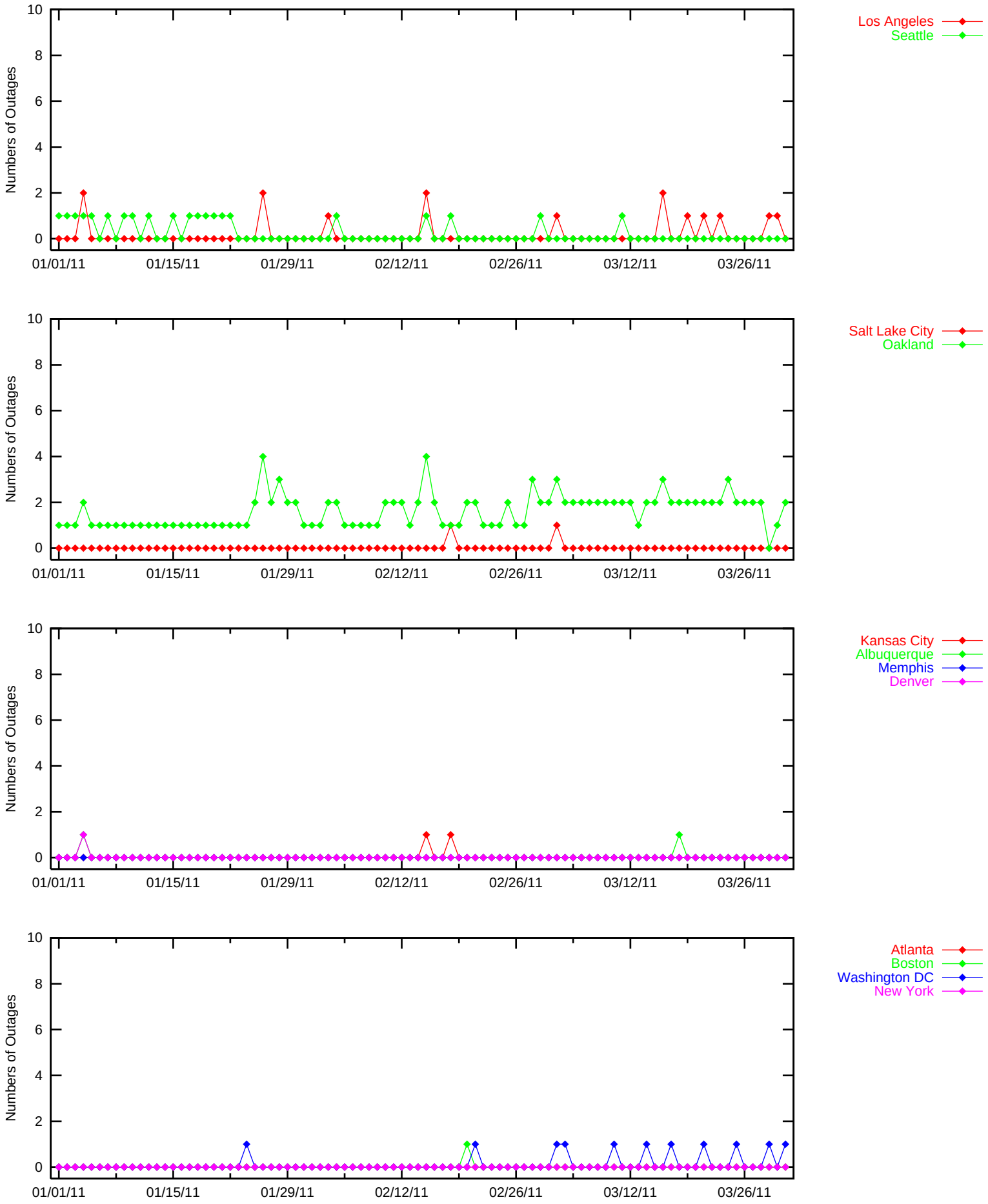


Figure 3-11 LPV 200 Outages (HAL = 40m & VAL=35m)

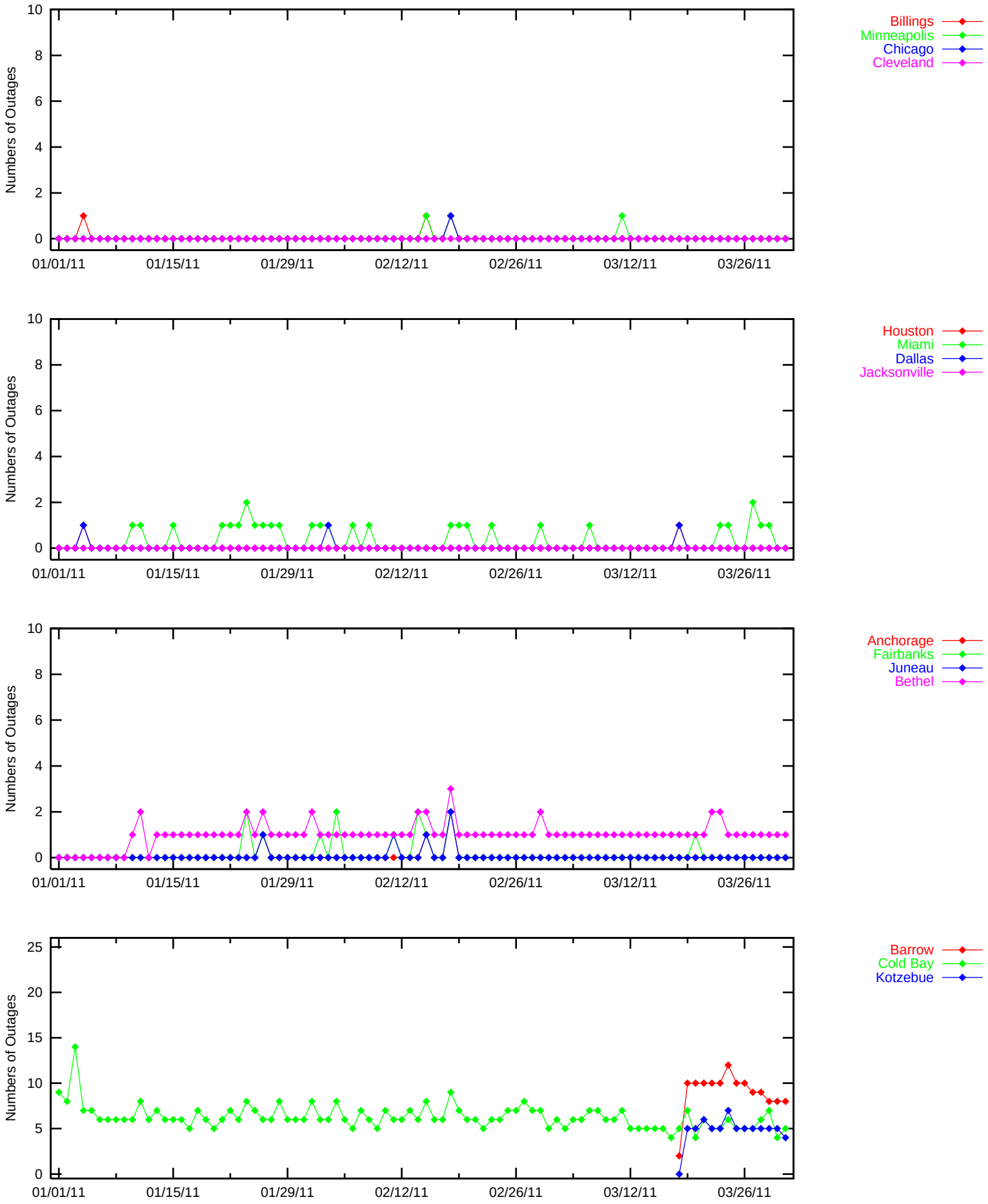
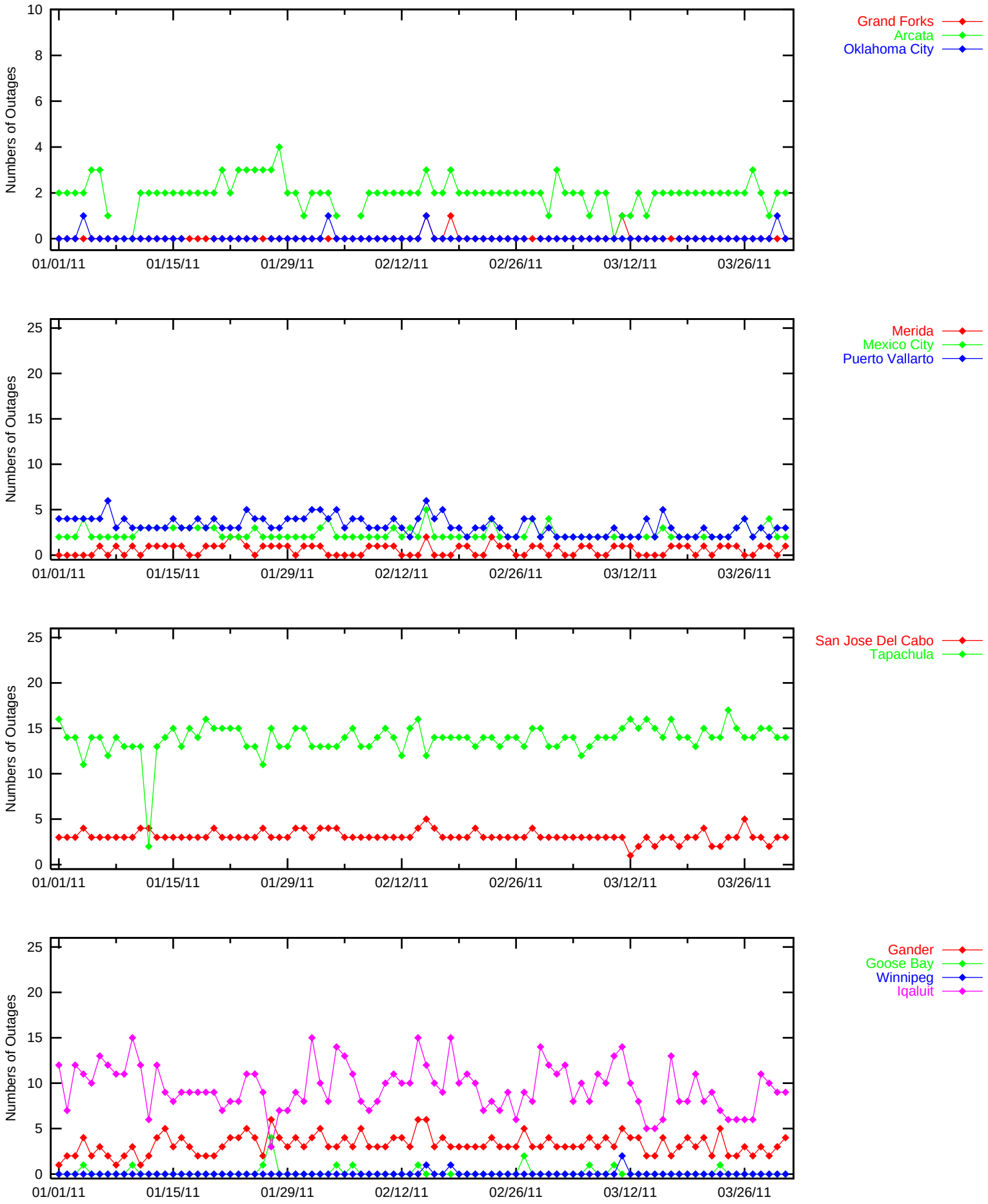


Figure 3-12 LPV 200 Outages (HAL = 40m & VAL=35m)



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 meters 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. Significant coverage drop on 2/15/11 is due to PRN 21 outage. Reduced Alaska coverage on 1/26/2011 is due to PRN 12 outage. Ionospheric activity on 2/18/2011 causing 7 IGPs over Alaska and Northwestern Canada to go to storm state affected Alaska coverage. Alaska LPV coverage is increased by 10% the last part of the quarter when CRW GEO came back to operational service.

The AMR GEO satellite (PRN 133) came into service on November 11, 2010. This GEO does not provide a ranging service yet, though it is expected to provide NPA ranging service (UDRE => 50 meters) in a future upgrade to the WAAS.

Radio frequency interference (RFI) caused localized loss of LPV availability at Kansas City on 2/17/11 (see DR. 100 Kansas City Sigal drop caused by RFI). Elevated UDREs on several satellites on 3/3/11 affected LPV 200 coverage (see DR 101 Elevated UDREs on serveral satellites cause LPV200 coverage drop).

Figure 4-1 LP North America Coverage for the Quarater

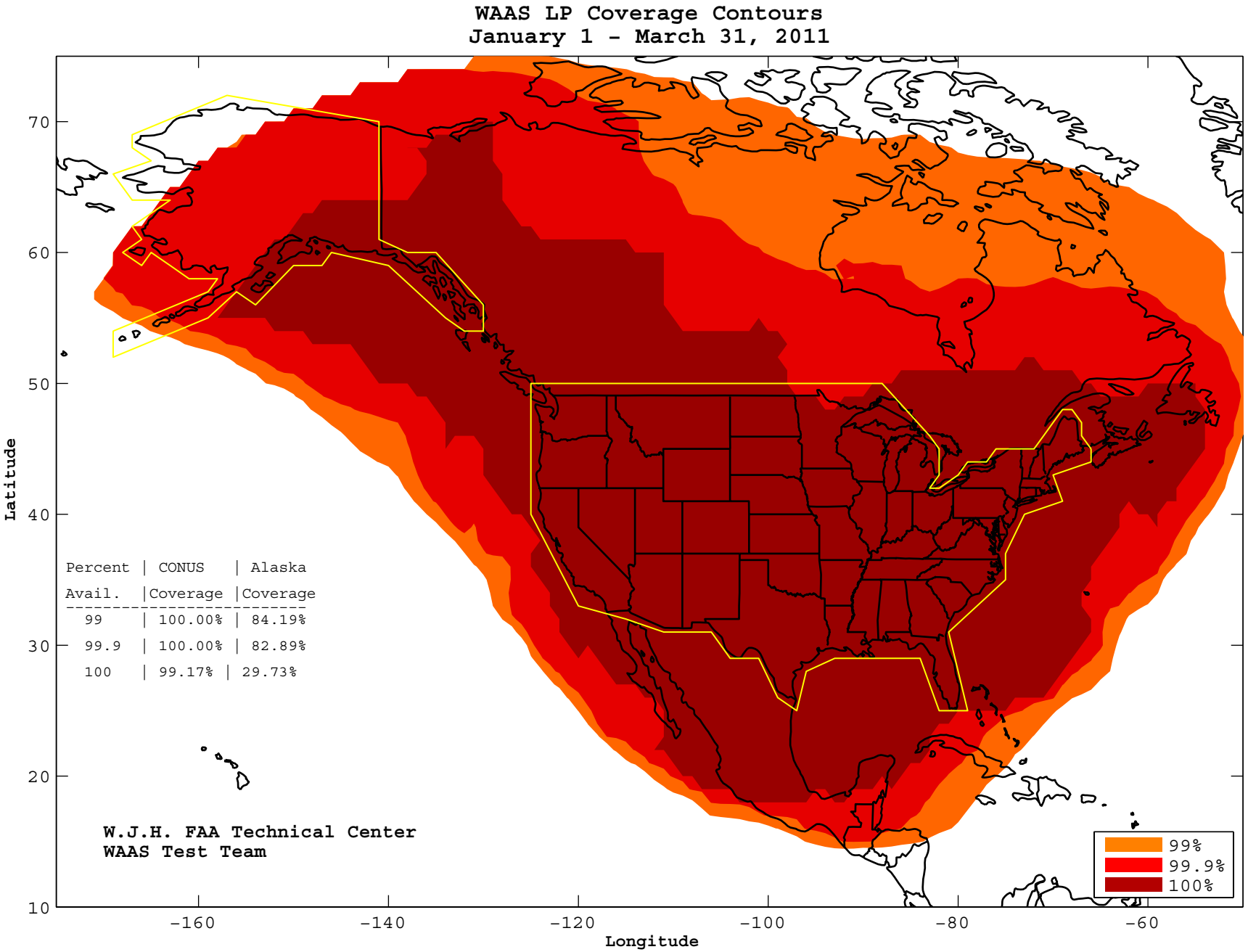


Figure 4-2 LPV North America Coverage for the Quarter

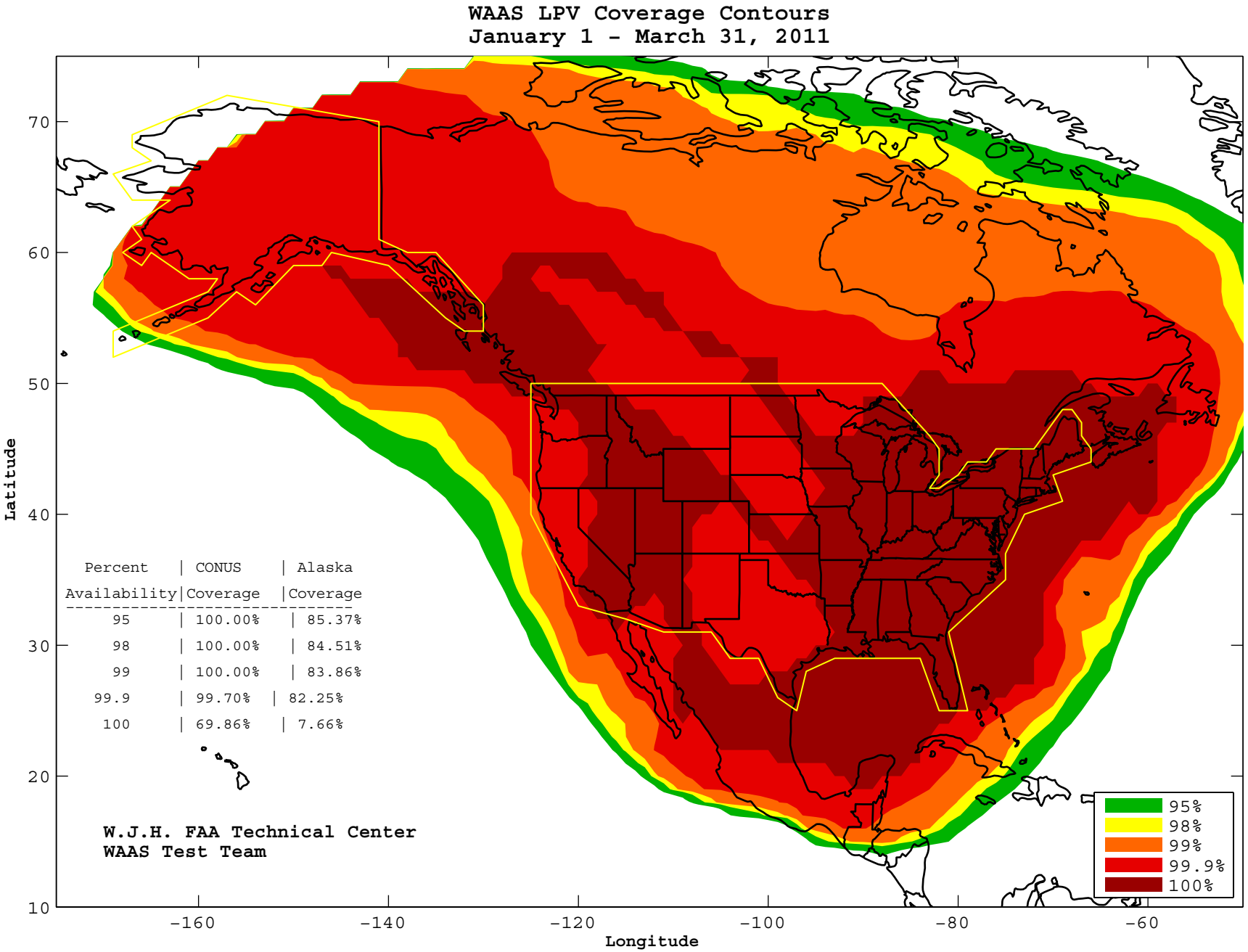


Figure 4-3 LPV 200 North America Coverage for the Quarter

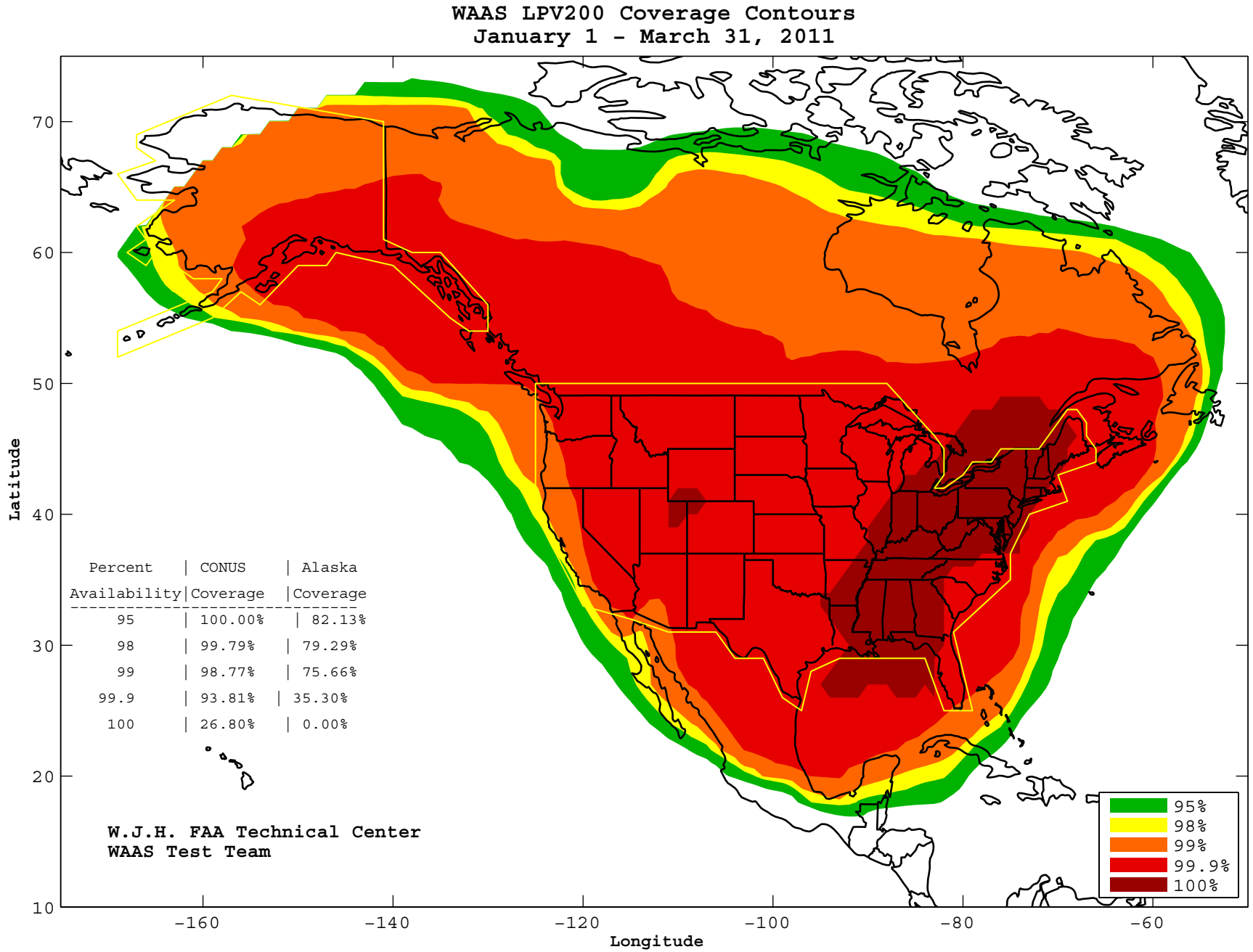


Figure 4-4 RNP 0.1 World Coverage for the Quarter

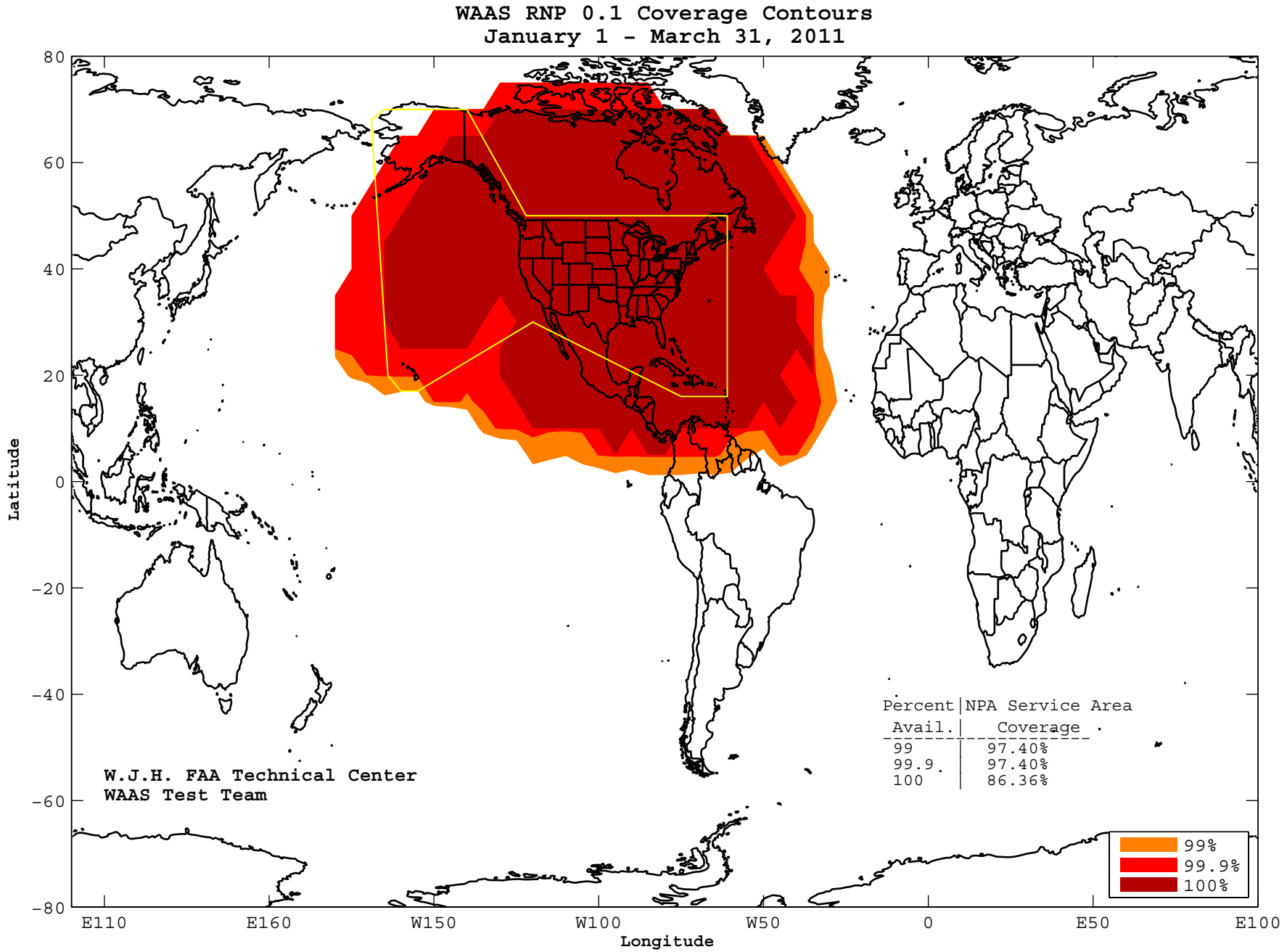


Figure 4-5 RNP 0.3 World Coverage for the Quarter

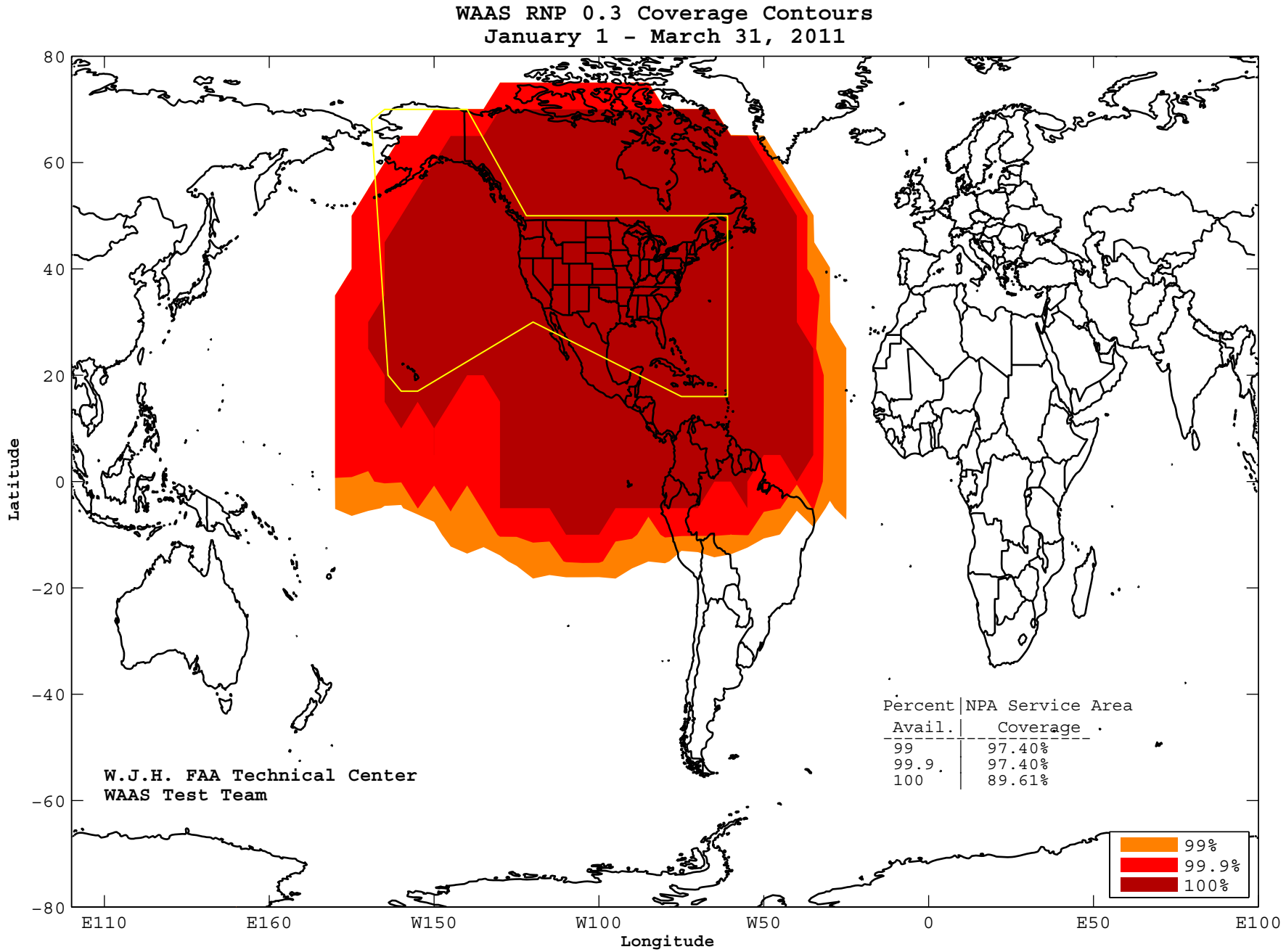


Figure 4-6 Daily LPV and LPV 200 CONUS Coverage

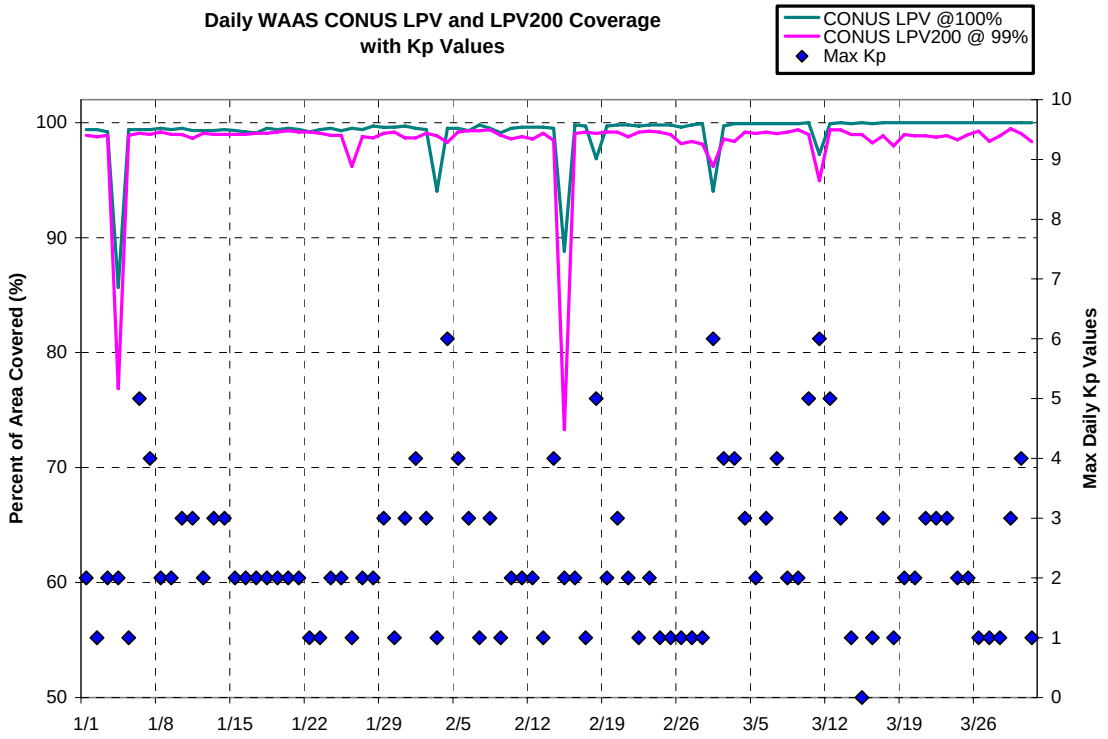


Figure 4-7 Daily LPV Alaska Coverage

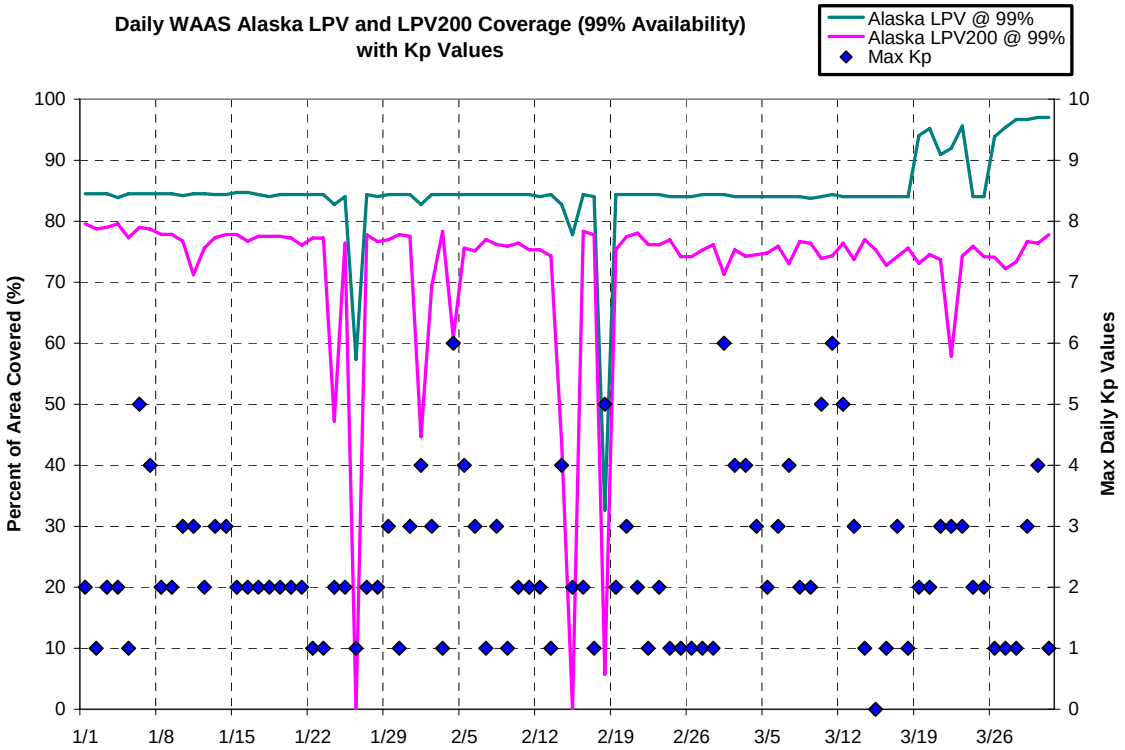
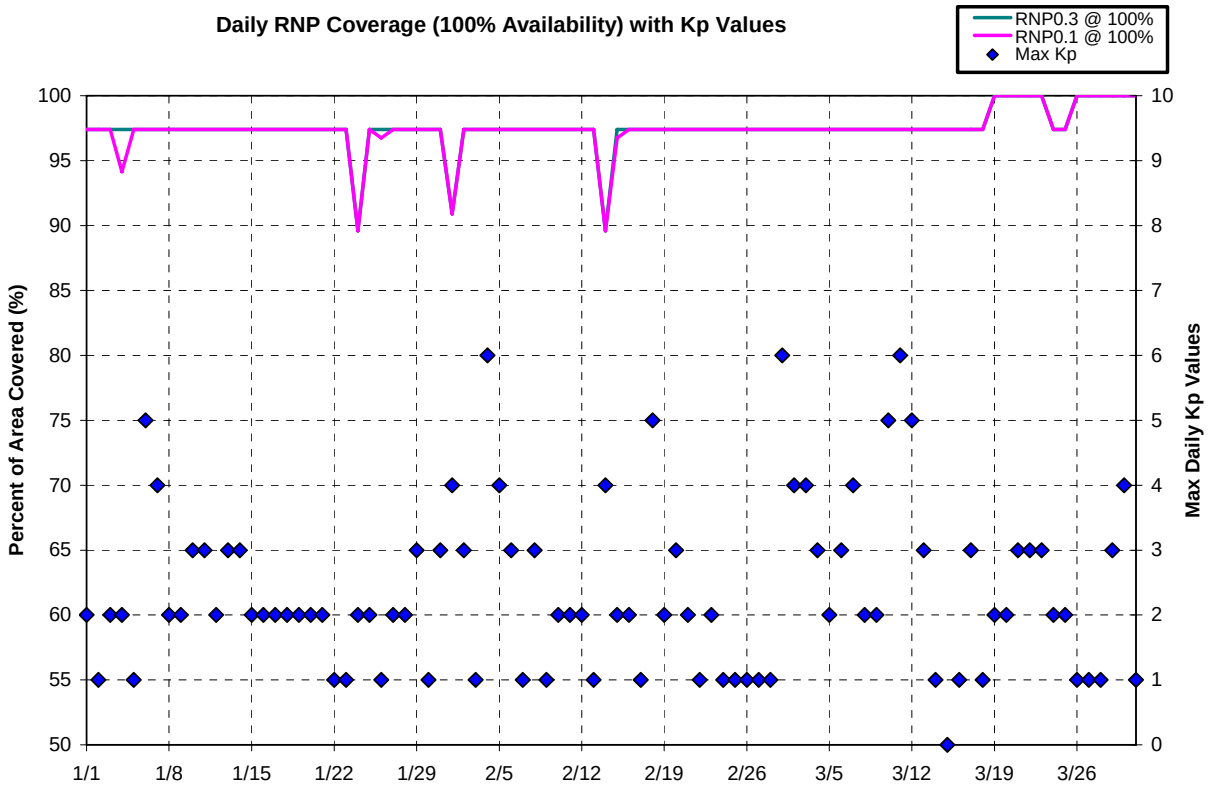


Figure 4-8 Daily RNP Coverage



5.0 INTEGRITY

5.1 HMI Analysis

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

Table 5.1 lists the safety index and the number of HMIs. For this evaluation period, the lowest safety margin index is 2.73 at Fairbanks. There was no HMI event. Since WAAS was made available to the public in August 2000 there has not been an HMI event. WAAS was commissioned by the FAA for safety of life services in July 2003.

Table 5-1 Safety Margin Index and HMI Statistics

Location	Safety Index		
	Horizontal	Vertical	Number of HMIs
Arcata	5.92	3.46	0
Grand Forks	4.08	5.65	0
Oklahoma City	9.32	9.54	0
Albuquerque	7.34	5.57	0
Anchorage	5.37	8.82	0
Atlanta	7.21	6.43	0
Barrow	9.63	9.34	0
Bethel	8.62	13.30	0
Billings	5.11	7.01	0
Boston	7.65	6.85	0
Chicago	6.27	6.80	0
Cleveland	5.40	5.05	0
Cold Bay	9.14	12.31	0
Dallas	6.34	7.26	0
Denver	7.78	5.30	0
Fairbanks	4.68	4.33	0
Gander	8.34	8.83	0
Goose Bay	8.54	6.29	0
Houston	6.10	5.33	0
Iqaluit	9.38	2.73	0
Jacksonville	3.94	5.98	0
Juneau	7.49	4.85	0
Kansas City	6.54	16.57	0
Kotzebue	9.27	14.80	0
Los Angeles	6.54	7.71	0
Memphis	7.31	8.04	0
Merida	8.25	7.69	0
Mexico City	5.36	6.33	0
Miami	7.46	5.04	0
Minneapolis	8.60	8.71	0
New York	8.09	6.52	0
Oakland	5.09	8.10	0
Puerto Vallarta	6.88	4.24	0
Salt Lake City	5.68	5.50	0
San Jose Del Cabo	7.52	5.49	0
Seattle	6.21	7.18	0
Tapachula	4.44	4.27	0
Washington DC	6.50	5.95	0
Winnipeg	6.88	4.78	0

5.2 Broadcast Alerts

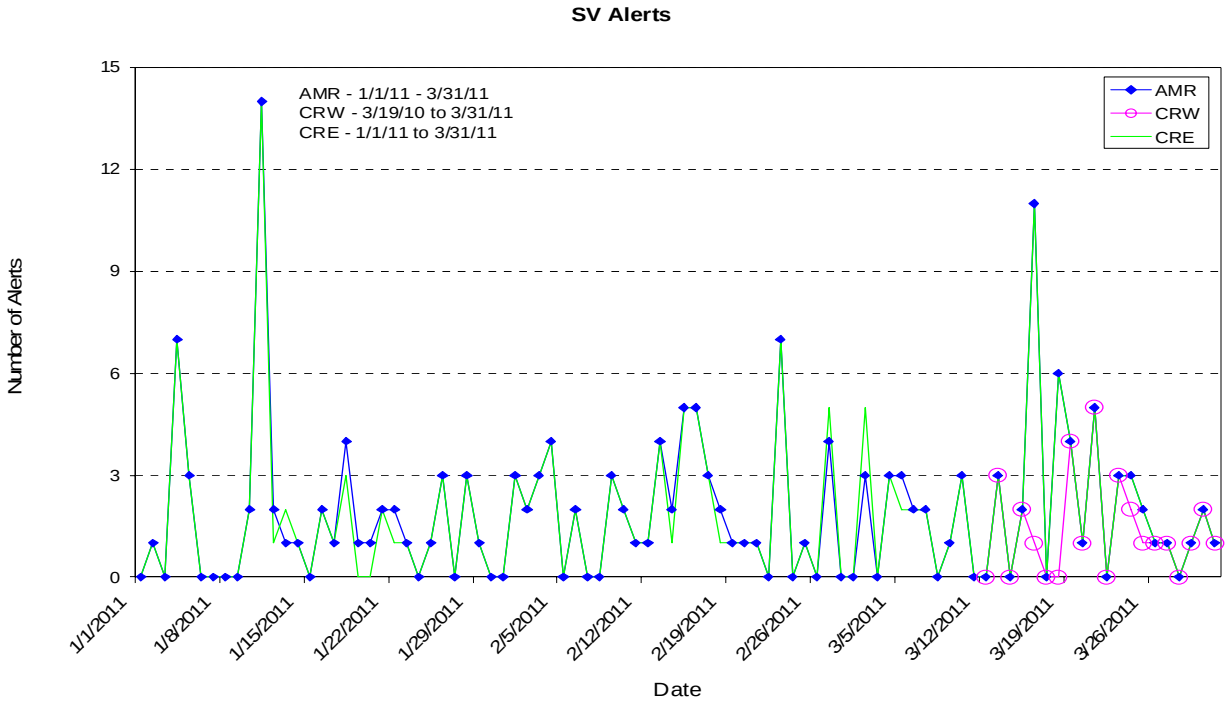
The WAAS transmits alert messages to protect the users from satellite degradation or severe ionospheric activity, both of which can cause unsafe conditions for a user. Space Vehicle (SV) alerts increase the User Differential Range Error (UDRE) of satellites, which can reduce the weighting of the satellite 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.

CRW was voluntarily taken out of service on 12/16/10 due to instability of orbit drift and came back to operational service on 3/18/2011. AMR GEO came into operational service on 11/11/2010.

Table 5-2 WAAS SV Alert

	Number of Alerts			Average Alerts Per Day		
Message Type	**AMR**	**CRW**	**CRE**	**AMR**	**CRW**	**CRE**
2	78	13	78	0.8667	1.0000	0.8667
3	51	6	47	0.5667	0.4615	0.5222
4	44	3	44	0.4889	0.2308	0.4889
5	0	0	0	0.0000	0.0000	0.0000
6	0	0	0	0.0000	0.0000	0.0000
24	0	0	0	0.0000	0.0000	0.0000
26	0	0	0	0.0000	0.0000	0.0000
Total Alerts	173	22	169	1.9222	1.6923	1.8778
Days in Service	90	13	90			

Figure 5-1 SV Daily Alert Trend



5.3 Availability of WAAS Messages (CRE , CRW, and AMR)

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 AMR. Table 5.9 to 5.13 show message rates statistics broadcasted on CRW. Table 5.14 to 5.18 show message rates statistics 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 – AMR

Message Type	On Time	Late	Max Late Length (seconds)
0	49	6	409208
1	101739	9	3740
2	1294181	90	3654
3	1294103	96	3654
4	1294097	91	3648
7	94228	22	3690
9	90985	5	3752
10	94220	18	3683
17	30633	8	4020

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

SV	On Time	Late	Max Late Length (seconds)
2	47141	2	170
3	50183	0	0
4	47540	0	0
5	48021	0	0
6	50477	1	164
7	47141	0	0
8	46809	0	0
9	49120	0	0
10	50117	0	0
11	51584	0	0
12	48085	1	151
13	47279	1	181
14	47654	0	0
15	48319	0	0
16	48441	0	0
17	47446	1	125
18	47235	0	0
19	50381	0	0
20	50254	2	176
21	46870	1	164
22	48255	0	0
23	46856	0	0
24	51288	0	0
25	50663	0	0
26	48828	1	166
27	51602	1	151
28	48271	0	0
29	47295	0	0
30	48111	0	0
31	48443	0	0
32	47938	0	0

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

SV	On Time	Late	Max Late Length (seconds)
2	38682	1	2903
3	41274	2	834
4	39034	2	210
5	39416	2	2919
6	41476	2	1454
7	38695	1	1480
8	38466	1	3110
9	40339	11	208
10	41175	3	3744
11	42400	2	832
12	39499	1	122
13	38790	1	145
14	39150	0	0
15	39677	0	0
16	39807	2	3853
17	38977	0	0
18	38772	2	832
19	41345	1	3744
20	41286	3	3744
21	38453	0	0
22	39610	1	161
23	38483	2	155
24	42139	4	3110
25	41552	3	2920
26	40107	4	1417
27	42373	3	1450
28	39652	3	829
29	38909	2	1481
30	39455	3	3809
31	39705	2	2908
32	39353	1	145
135	24556	2	3008
138	47913	2	3744

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	26946	14	3746
0	1	26949	15	3748
0	2	26933	13	4032
1	0	26948	17	4032
1	1	26958	16	4032
1	2	26952	10	4032
1	3	26934	13	4032
1	4	26957	14	4032
2	0	26954	10	4038
2	1	26950	14	4037
2	2	26946	16	4032
2	3	26942	12	4033
2	4	26935	17	4033
2	5	26937	16	4037
3	0	26960	13	4040
3	1	26944	13	4033
3	2	26947	15	4038
9	0	26941	18	3744
9	1	26954	15	3744
9	2	26954	11	3744
9	3	26942	13	3744
9	4	26941	16	3744
9	5	26948	15	3744
9	6	26961	15	3749

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

Band	On Time	Late	Max Late Length (seconds)
0	34802	7	4028
1	34763	7	3935
2	34770	7	3839
3	34784	8	3810
9	34782	7	3821

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

Message Type	On Time	Late	Max Late Length (seconds)
0	26	4	482853
1	14573	7	4982
2	186368	14	4956
3	186348	17	4956
4	186337	19	4956
7	13513	6	5016
9	13100	3	5027
10	13487	9	5063
17	4401	1	5262

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

SV	On Time	Late	Max Late Length (seconds)
2	6795	1	5022
3	7281	0	0
4	6870	2	180
5	6954	1	186
6	7388	0	0
7	6853	0	0
8	6733	0	0
9	7014	0	0
10	7227	1	159
11	7378	0	0
12	6922	1	168
13	6857	0	0
14	6816	1	170
15	6996	0	0
16	7026	0	0
17	6771	1	5022
18	6812	0	0
19	7292	0	0
20	7222	2	186
21	6813	0	0
22	6935	1	194
23	6791	1	180
24	7331	0	0
25	7182	1	159
26	7037	0	0
27	7394	1	168
28	6908	0	0
29	6855	1	170
30	6990	0	0
31	7006	0	0
32	6877	0	0

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

SV	On Time	Late	Max Late Length (seconds)
2	5573	2	205
3	5993	0	0
4	5640	1	207
5	5705	1	204
6	6076	0	0
7	5627	0	0
8	5533	0	0
9	5761	2	150
10	5927	1	207
11	6068	1	133
12	5683	2	212
13	5627	0	0
14	5595	2	205
15	5744	1	210
16	5775	0	0
17	5558	2	5081
18	5594	0	0
19	5991	0	0
20	5934	3	5095
21	5583	0	0
22	5693	1	136
23	5564	1	204
24	6019	1	210
25	5906	1	121
26	5782	1	144
27	6070	2	5093
28	5670	2	212
29	5640	1	210
30	5731	0	0
31	5738	1	210
32	5646	2	205
135	10548	0	0
138	1231	1	146

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

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	3879	5	5191
0	1	3881	3	5190
0	2	3878	2	5200
1	0	3877	2	5472
1	1	3878	2	5478
1	2	3879	2	5194
1	3	3888	1	5190
1	4	3880	1	5190
2	0	3878	2	5188
2	1	3882	2	5190
2	2	3884	4	5195
2	3	3877	3	5184
2	4	3876	4	5191
2	5	3877	4	5197
3	0	3885	3	5489
3	1	3881	3	5485
3	2	3878	2	5500
9	0	3878	2	5498
9	1	3876	4	5500
9	2	3874	6	5484
9	3	3883	2	5203
9	4	3880	1	5200
9	5	3883	2	5204
9	6	3877	3	5206

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

Band	On Time	Late	Max Late Length (seconds)
0	4989	1	4992
1	4987	1	5088
2	4992	3	5298
3	5000	3	5009
9	4985	2	5006

Table 5-14 WAAS Fast Correction and Degradation Message Rates – CRE

Message Type	On Time	Late	Max Late Length (seconds)
0	25	3	572576
1	108244	2	127
2	1296114	73	32
3	1296011	85	26
4	1296021	74	29
7	99756	15	144
9	91125	0	0
10	99661	12	144
17	31221	2	369

Table 5-15 WAAS Long Correction Message Rates (Type 24 and 25) – CRE

SV	On Time	Late	Max Late Length (seconds)
2	47259	1	173
3	50254	1	165
4	47652	0	0
5	48112	0	0
6	50542	0	0
7	47238	0	0
8	46903	0	0
9	49188	0	0
10	50186	0	0
11	51633	0	0
12	48160	0	0
13	47359	0	0
14	47700	0	0
15	48416	0	0
16	48532	0	0
17	47477	1	173
18	47286	1	165
19	50467	0	0
20	50351	0	0
21	46956	0	0
22	48333	0	0
23	46941	0	0
24	51344	0	0
25	50716	0	0
26	48921	0	0
27	51668	0	0
28	48309	0	0
29	47401	0	0
30	48204	0	0
31	48516	0	0
32	48014	0	0

Table 5-16 WAAS Ephemeris Covariance Message Rates (Type 28) – CRE

SV	On Time	Late	Max Late Length (seconds)
2	38775	0	0
3	41306	0	0
4	39127	0	0
5	39497	0	0
6	41532	0	0
7	38775	1	139
8	38549	0	0
9	40399	2	167
10	41223	0	0
11	42441	1	207
12	39555	1	129
13	38847	0	0
14	39182	0	0
15	39751	0	0
16	39873	0	0
17	39007	1	207
18	38812	1	126
19	41424	1	139
20	41362	0	0
21	38532	0	0
22	39660	2	184
23	38528	0	0
24	42157	3	150
25	41610	0	0
26	40170	1	136
27	42428	1	126
28	39692	1	129
29	38996	0	0
30	39526	0	0
31	39791	0	0
32	39451	0	0
135	24567	0	0
138	73871	1	169

Table 5-17 WAAS Ionospheric Correction Message Rates (Type 26) – CRE

Band	Block	On Time	Late	Max Late Length (seconds)
0	0	26984	10	470
0	1	26990	8	486
0	2	26983	7	482
1	0	26989	9	462
1	1	26995	7	462
1	2	26988	11	307
1	3	26986	13	304
1	4	26978	9	306
2	0	26985	10	305
2	1	26995	8	305
2	2	26993	14	306
2	3	26990	9	306
2	4	26966	16	320
2	5	26995	11	308
3	0	26986	8	305
3	1	26996	10	305
3	2	26980	13	579
9	0	26982	12	311
9	1	26987	7	304
9	2	27001	9	307
9	3	26978	15	455
9	4	26976	17	451
9	5	26989	13	452
9	6	26979	11	456

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

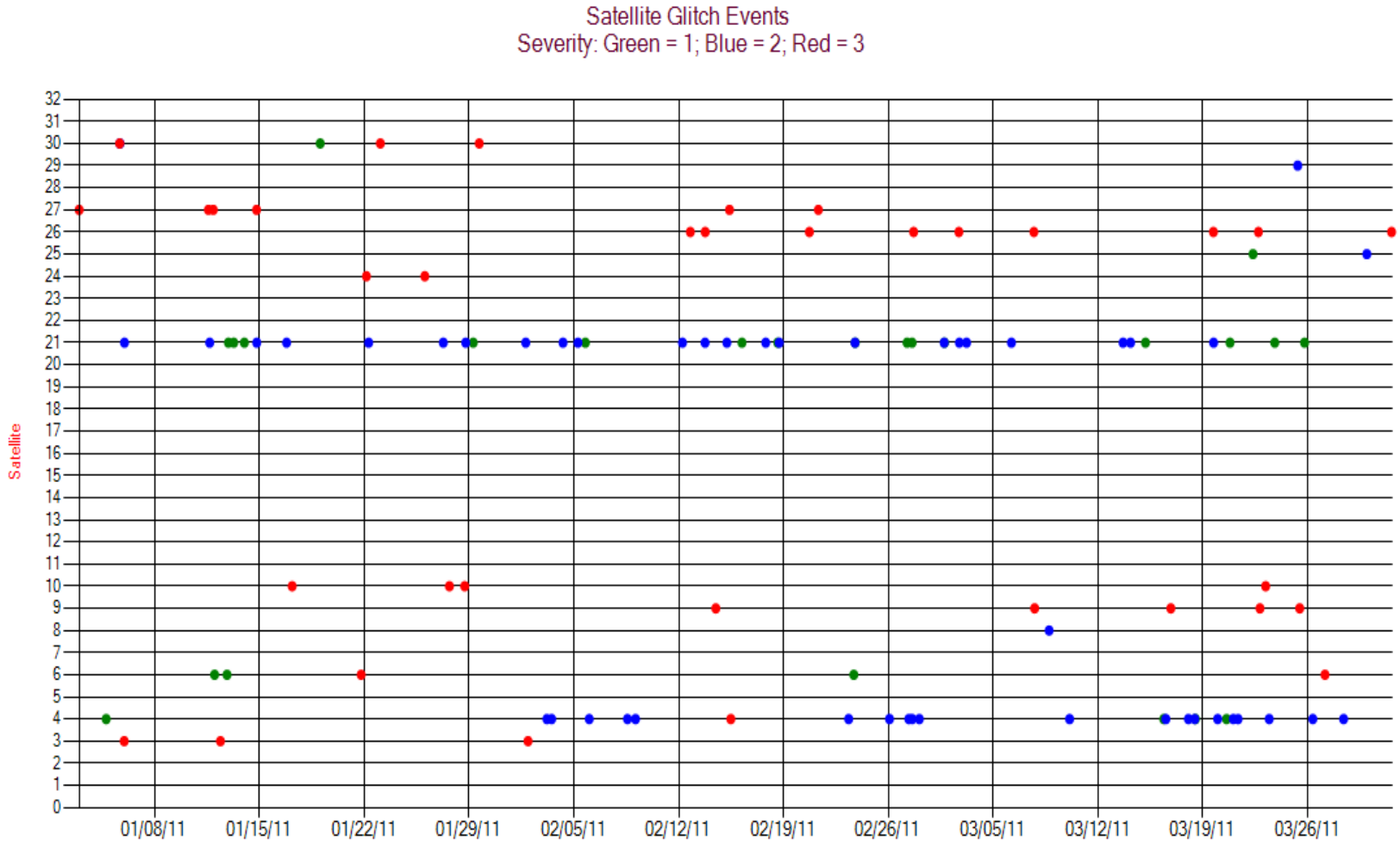
Band	On Time	Late	Max Late Length (seconds)
0	35586	0	0
1	35558	0	0
2	35553	0	0
3	35596	0	0
9	35630	0	0

5.4 Satellite Glitches

The GPS satellites occasionally have periods of signal carrier stability 'glitches' of varying magnitude. These are short degradations in the signal that in severe cases cause WAAS to lose track or cycle slip at some or all of the reference stations. The more severe glitches will cause the WAAS reported UDRE spike to 'Not Monitor' and result in an alert.

Figure 5.2 shows the satellite glitches visible to WAAS for the quarter. Glitches are categorized into three severity levels. Severity one glitches cause a significant number of the receivers to simultaneously have bad subframe parity, but not all. Severity two glitches cause all of the receivers to report bad subframe parity data and some receivers to also have cycle slips and or lose tracking of L2 and or L1. Severity three glitches cause all of the receivers to lose track of both L1, and L2 data.

Figure 5-2 SV Glitch Trend



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	1.275	100	1.259	100	1.597	100	1.522	100	2.133	100	1.693	100
3	0.819	100	1.343	100	1.195	100	0.953	100	1.235	100	1.161	100
4	1.487	100	1.590	100	1.282	100	1.301	100	1.202	100	1.524	100
5	1.622	100	1.420	100	1.124	100	1.274	100	1.188	100	1.282	100
6	1.353	100	1.235	100	1.146	100	0.963	100	0.928	100	0.999	100
7	1.117	100	1.175	100	1.196	100	1.215	100	0.919	100	0.997	100
8	1.093	100	0.953	100	0.866	100	1.175	100	1.264	100	1.085	100
9	0.984	100	1.264	100	0.834	100	1.109	100	1.152	100	1.166	100
10	0.865	100	0.991	100	0.864	100	1.041	100	1.470	100	1.108	100
11	0.618	100	0.781	100	1.060	100	1.142	100	1.471	100	1.019	100
12	1.179	100	1.268	100	1.561	100	1.743	100	1.328	100	1.154	100
13	1.427	100	0.931	100	1.231	100	1.344	100	1.024	100	1.195	100
14	1.262	100	0.760	100	1.084	100	1.024	100	1.525	100	0.950	100
15	1.255	100	1.643	100	1.123	100	1.166	100	1.188	100	1.173	100
16	0.888	100	1.115	100	1.155	100	1.020	100	1.888	100	1.363	100
17	1.905	100	1.165	100	1.366	100	0.863	100	1.356	100	0.727	100
18	1.156	100	1.043	100	1.375	100	1.367	100	1.617	100	1.203	100
19	2.342	100	2.100	100	2.453	100	2.318	100	2.840	100	2.537	100
20	0.898	100	1.520	100	1.114	100	1.172	100	1.926	100	1.422	100
21	1.232	100	1.133	100	1.296	100	1.120	100	1.591	100	1.102	100
22	1.598	100	2.025	100	2.499	100	2.417	100	2.735	100	2.244	100
23	1.321	100	1.690	100	1.889	100	1.736	100	2.566	100	1.481	100
24	1.634	100	1.769	100	1.296	100	1.460	100	1.756	100	1.644	100
25	2.704	100	2.294	100	2.147	100	2.165	100	3.276	100	2.240	100
26	1.512	100	1.488	100	1.325	100	1.638	100	1.558	100	1.176	100
27	1.143	100	1.244	100	1.376	100	1.150	100	1.731	100	1.000	100
28	0.707	100	1.022	100	1.118	100	0.941	100	1.695	100	0.998	100
29	1.456	100	1.511	100	1.234	100	1.521	100	1.027	100	1.282	100
30	1.455	100	1.407	100	0.987	100	1.127	100	1.101	100	1.231	100
31	1.674	100	1.081	100	0.876	100	0.787	100	1.123	100	1.077	100
32	1.026	100	1.020	100	0.867	100	0.920	100	1.322	100	0.941	100
135	1.790	100	1.701	100	2.951	100	1.868	100	1.815	100	1.678	100
138	1.469	100	1.609	100	1.619	100	1.859	100	2.029	100	1.540	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	1.927	100	1.588	100	2.027	100	1.409	100	1.237	100	1.473	100
3	1.278	100	0.972	100	0.857	100	1.863	100	1.285	100	1.200	100
4	1.380	100	1.360	100	2.097	100	1.370	100	1.809	100	1.474	100
5	1.242	100	1.515	100	1.423	100	1.636	100	1.651	100	1.379	100
6	0.984	100	1.492	100	0.851	100	1.147	100	1.526	100	1.288	100
7	1.100	100	1.074	100	1.460	100	1.378	100	1.327	100	1.268	100
8	0.765	100	0.742	100	1.077	100	1.509	100	1.001	100	1.206	100
9	0.962	100	0.939	100	0.935	100	1.449	100	1.449	100	1.035	100
10	0.994	100	1.018	100	0.988	100	0.698	100	0.966	100	0.841	100
11	1.145	100	1.254	100	1.485	100	1.005	100	1.083	100	1.078	100
12	0.999	100	0.979	100	1.264	100	1.301	100	1.555	100	1.214	100
13	0.766	100	2.321	100	1.085	100	1.143	100	1.315	100	1.171	100
14	0.986	100	1.069	100	1.658	100	0.804	100	0.866	100	0.795	100
15	1.168	100	1.254	100	1.290	100	1.606	100	1.563	100	1.441	100
16	1.472	100	1.308	100	1.839	100	1.109	100	1.086	100	0.859	100
17	0.872	100	1.066	100	1.124	100	0.778	100	1.176	100	1.042	100
18	1.271	100	1.566	100	1.665	100	1.051	100	1.349	100	1.154	100
19	2.219	100	2.495	100	2.574	100	2.279	100	2.286	100	2.268	100
20	1.335	100	1.532	100	1.341	100	1.202	100	1.281	100	1.037	100
21	1.220	100	1.111	100	2.173	100	1.189	100	1.061	100	1.144	100
22	2.134	100	2.225	100	2.721	100	2.189	100	2.356	100	2.169	100
23	1.746	100	1.888	100	2.110	100	1.397	100	1.716	100	1.583	100
24	1.190	100	2.149	100	1.145	100	1.345	100	1.925	100	1.595	100
25	2.014	100	1.910	100	2.790	100	2.182	100	2.452	100	2.226	100
26	1.270	100	1.314	100	1.167	100	1.880	100	1.807	100	1.472	100
27	1.122	100	1.306	100	1.369	100	1.649	100	1.585	100	1.241	100
28	0.926	100	1.001	100	1.940	100	0.837	100	1.199	100	0.757	100
29	0.775	100	2.200	100	1.674	99.9998	1.453	100	1.463	100	1.350	100
30	1.231	100	1.475	100	0.942	100	1.764	100	1.427	100	1.566	100
31	0.961	100	1.101	100	1.153	100	0.922	100	0.959	100	1.040	100
32	0.734	100	1.095	100	1.075	100	0.887	100	1.016	100	0.996	100
135	1.502	100	1.471	100	2.543	100	2.818	100	1.453	100	1.507	100
138	2.197	100	1.903	100	2.801	100	1.760	100	1.733	100	2.065	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	1.056	100	0.746	100	1.152	100	1.032	100	0.987	100	1.071	100
3	0.324	100	0.663	100	0.661	100	0.453	100	0.777	100	0.645	100
4	1.101	100	1.258	100	0.992	100	1.183	100	1.223	100	1.330	100
5	0.991	100	1.061	100	0.553	100	0.870	100	1.019	100	0.892	100
6	0.622	100	0.632	100	0.703	100	0.438	100	0.668	100	0.448	100
7	0.739	100	0.865	100	0.757	100	0.850	100	0.732	100	0.767	100
8	0.521	100	0.696	100	0.576	100	0.655	100	0.619	100	0.597	100
9	0.592	100	0.716	100	0.507	100	0.578	100	0.589	100	0.594	100
10	0.389	100	0.478	100	0.472	100	0.392	100	0.684	100	0.490	100
11	0.455	100	0.413	100	0.509	100	0.434	100	0.704	100	0.497	100
12	0.674	100	0.847	100	0.763	100	0.836	100	0.677	100	0.577	100
13	0.706	100	0.798	100	0.712	100	0.749	100	0.766	100	0.728	100
14	0.609	100	0.417	100	0.632	100	0.467	100	0.762	100	0.432	100
15	0.717	100	1.015	100	0.621	100	0.850	100	0.943	100	0.738	100
16	0.688	100	0.514	100	0.546	100	0.490	100	0.775	100	0.506	100
17	1.199	100	0.800	100	0.954	100	0.632	100	0.563	100	0.591	100
18	1.034	100	0.530	100	0.902	100	0.839	100	0.882	100	0.697	100
19	1.644	100	1.391	100	1.616	100	1.564	100	2.107	100	1.704	100
20	0.667	100	0.740	100	0.673	100	0.515	100	0.863	100	0.714	100
21	1.051	100	0.667	100	1.121	100	0.783	100	1.029	100	0.817	100
22	1.480	100	1.430	100	1.742	100	1.638	100	1.721	100	1.646	100
23	1.169	100	1.136	100	1.547	100	1.393	100	1.761	100	1.064	100
24	0.836	100	1.037	100	0.782	100	0.763	100	1.051	100	0.769	100
25	1.548	100	1.534	100	1.320	100	1.308	100	1.909	100	1.246	100
26	0.910	100	0.988	100	0.774	100	0.951	100	0.978	100	0.694	100
27	0.693	100	0.800	100	0.700	100	0.589	100	0.725	100	0.553	100
28	0.602	100	0.346	100	0.680	100	0.451	100	0.633	100	0.605	100
29	0.654	100	0.987	100	0.651	100	0.724	100	0.831	100	0.721	100
30	0.786	100	0.988	100	0.626	100	0.814	100	1.035	100	0.857	100
31	1.090	100	0.725	100	0.357	100	0.518	100	0.757	100	0.664	100
32	0.549	100	0.657	100	0.494	100	0.441	100	0.490	100	0.473	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	1.091	100	1.086	100	0.962	100	1.022	100	0.745	100	1.193	100
3	0.520	100	0.445	100	0.705	100	0.740	100	0.840	100	0.411	100
4	0.975	100	0.962	100	1.672	100	1.048	100	1.363	100	0.821	100
5	0.859	100	0.831	100	1.255	100	0.846	100	1.135	100	0.793	100
6	0.494	100	0.593	100	0.693	100	0.506	100	0.957	100	0.508	100
7	0.864	100	0.607	100	1.079	100	0.846	100	1.210	100	0.665	100
8	0.566	100	0.456	100	0.918	100	0.844	100	0.902	100	0.565	100
9	0.543	100	0.543	100	0.630	100	0.718	100	0.901	100	0.541	100
10	0.428	100	0.450	100	0.444	100	0.377	100	0.411	100	0.471	100
11	0.534	100	0.650	100	0.591	100	0.524	100	0.496	100	0.668	100
12	0.788	100	0.586	100	0.850	100	0.709	100	0.937	100	0.608	100
13	0.627	100	1.048	100	0.933	100	0.688	100	1.013	100	0.518	100
14	0.472	100	0.594	100	0.682	100	0.398	100	0.508	100	0.630	100
15	0.791	100	0.692	100	0.906	100	0.877	100	1.105	100	0.716	100
16	0.779	100	0.644	100	0.430	100	0.541	100	0.434	100	0.702	100
17	0.730	100	0.614	100	0.900	100	0.541	100	0.926	100	0.484	100
18	0.801	100	1.102	100	0.831	100	0.767	100	0.760	100	0.940	100
19	1.511	100	1.683	100	1.314	100	1.662	100	1.425	100	1.720	100
20	0.600	100	0.782	100	0.731	100	0.680	100	0.544	100	0.640	100
21	0.746	100	0.861	100	1.347	100	0.940	100	0.705	100	0.926	100
22	1.584	100	1.761	100	1.565	100	1.702	100	1.598	100	1.755	100
23	1.103	100	1.356	100	1.337	100	1.068	100	1.100	100	1.271	100
24	0.742	100	0.915	100	0.949	100	0.832	100	1.170	100	0.704	100
25	1.470	100	1.290	100	1.745	100	1.370	100	1.691	100	1.384	100
26	0.827	100	0.774	100	0.843	100	1.064	100	1.174	100	0.804	100
27	0.709	100	0.694	100	0.824	100	0.879	100	0.981	100	0.610	100
28	0.345	100	0.529	100	1.047	100	0.517	100	0.556	100	0.643	100
29	0.694	100	1.150	100	1.106	100	0.791	100	1.010	100	0.661	100
30	0.917	100	0.731	100	0.976	100	0.993	100	1.148	100	0.775	100
31	0.579	100	0.548	100	0.925	100	0.555	100	0.759	100	0.389	100
32	0.549	100	0.581	100	0.809	100	0.489	100	0.780	100	0.455	100

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

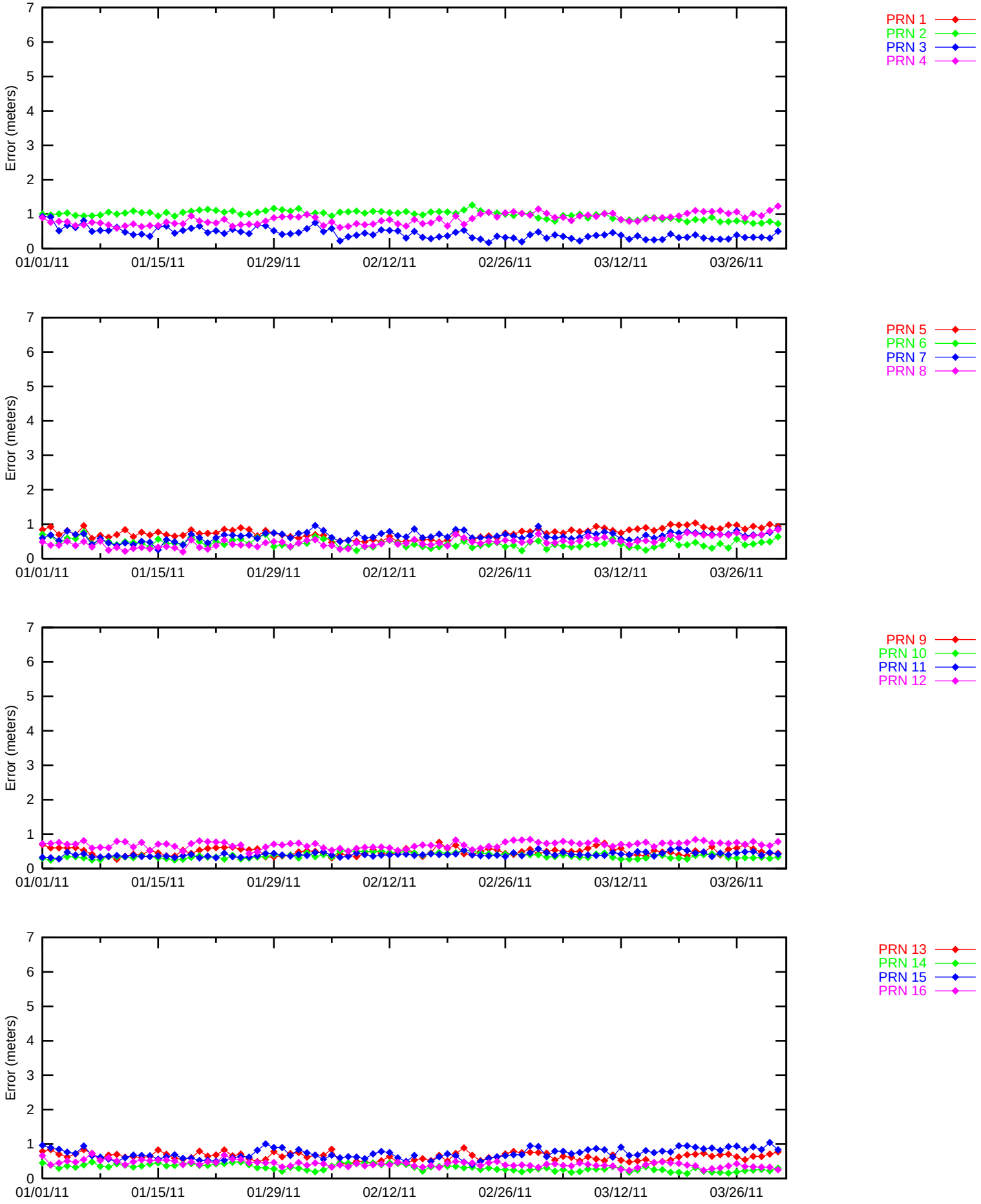


Figure 6-2 95% Range Error (PRN 17 - PRN 32) - Washington DC

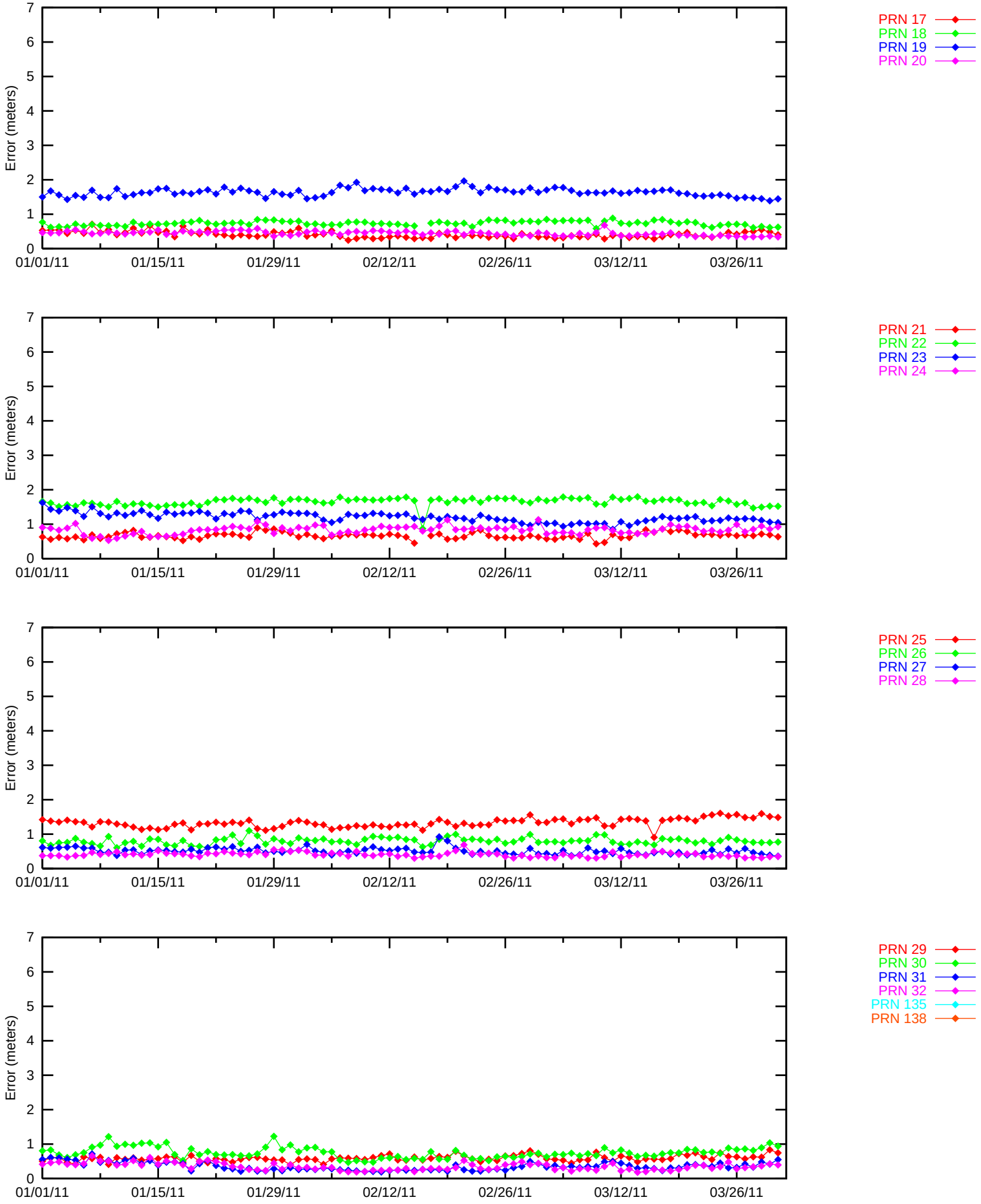


Figure 6-3 95% Ionospheric (PRN 1 - PRN 16) - Washington DC

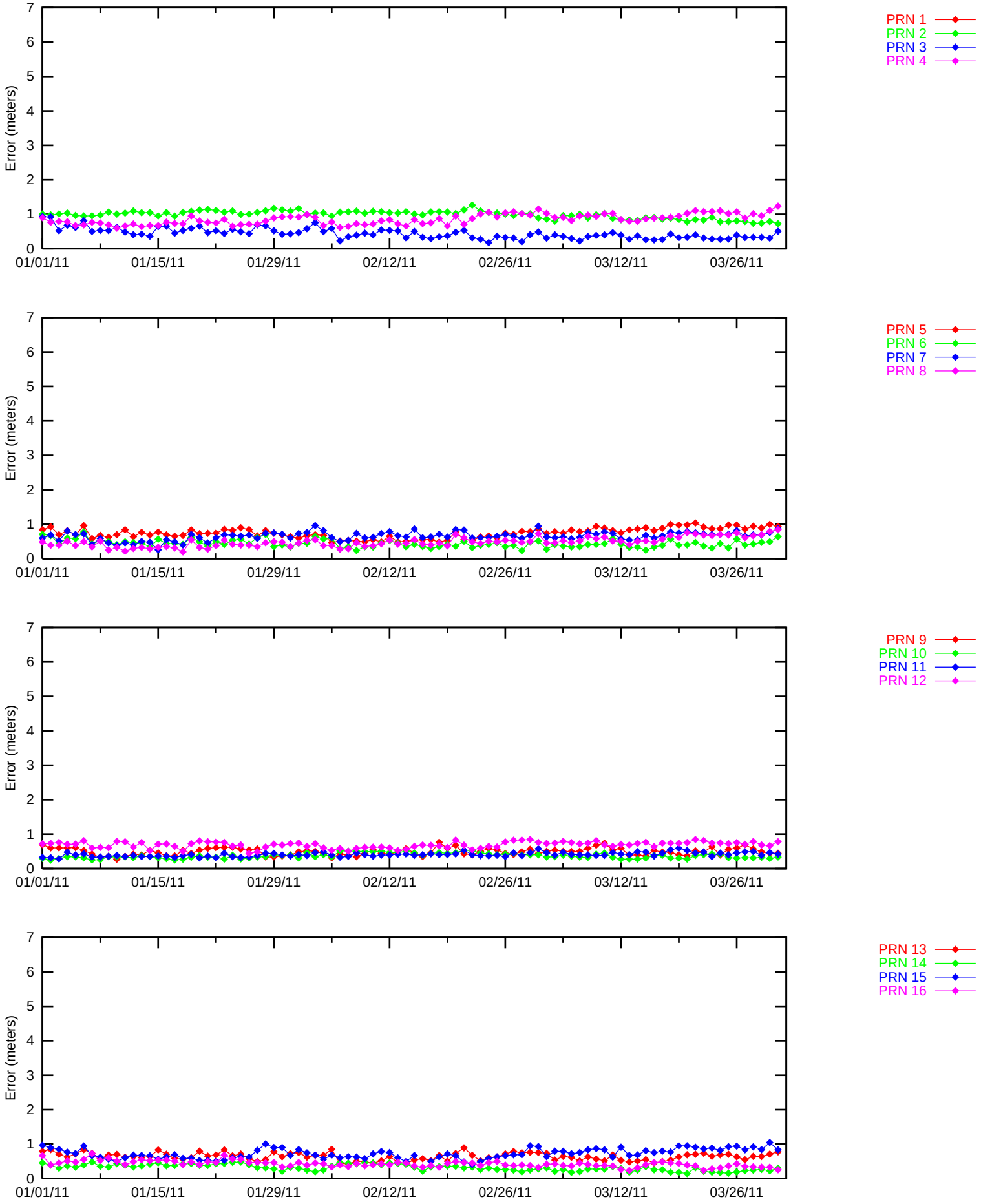
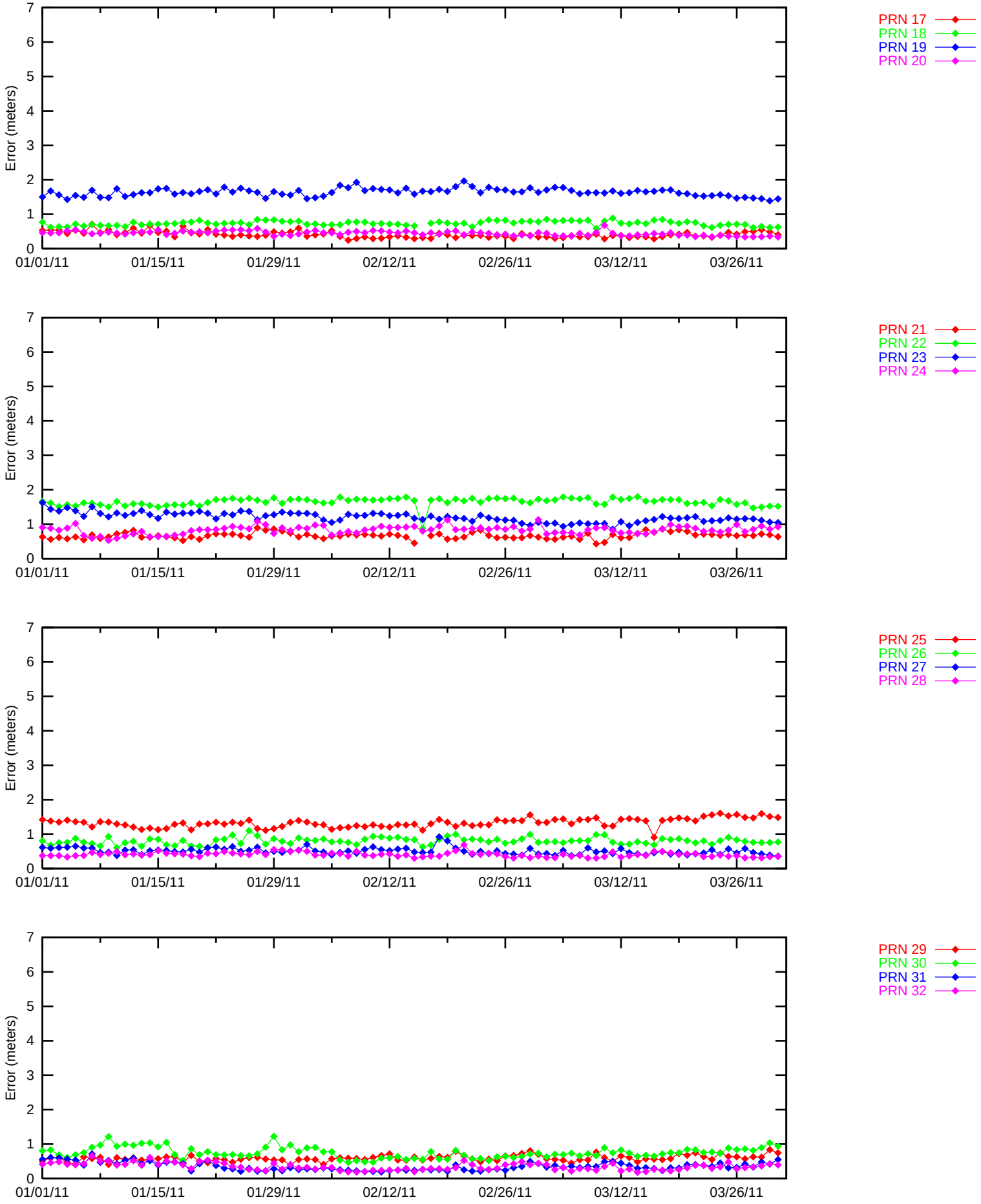


Figure 6-4 95% Ionospheric (PRN 17 - PRN 32) - Washington DC



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.

Table 7.1 shows the GEO-Ranging performance. 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.

CRW GEO was voluntarily taken out of service on 12/16/2010 due to drifting and has returned to operational service on March 18, 2011.

From 2/18/11 to 3/31/11, there was an orbit mismatch between C&V ZLA and ZTL that caused AMR GEO and CRE GEO to broadcast different UDREs for CRE. C&V ZLA was the selected source for AMR and C&V ZTL was the selected source for CRE. The CRE UDRE reported by the AMR was set to Not Monitored for most of the period causing 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	31.22	66.32	2.00	0.00
CRW 135	CRE	11.33	0.00	87.99	0.22
CRE 138	CRW	4.46	28.02	58.24	9.29
CRE 138	CRE	98.19	0.55	0.18	1.08
AMR 133	CRW	4.46	27.99	58.09	9.32
AMR 133	CRE	63.89	0.56	34.45	0.96

Figure 7-1 Daily PA CRW GEO Ranging Availability Trend

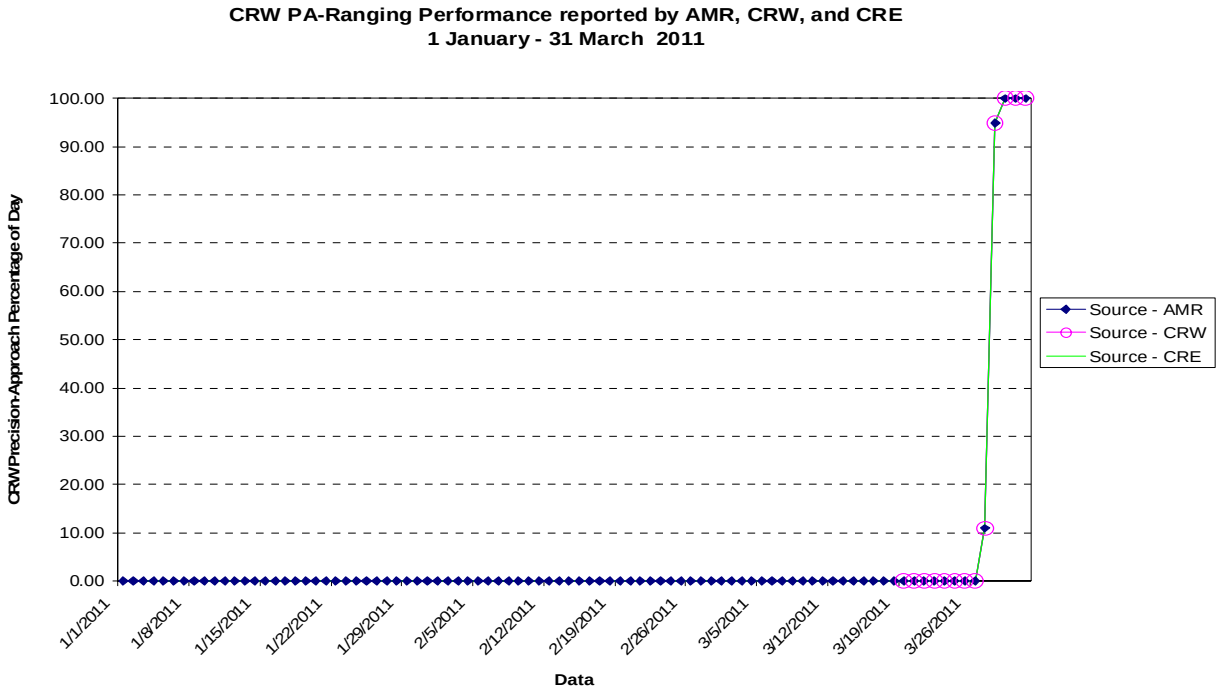
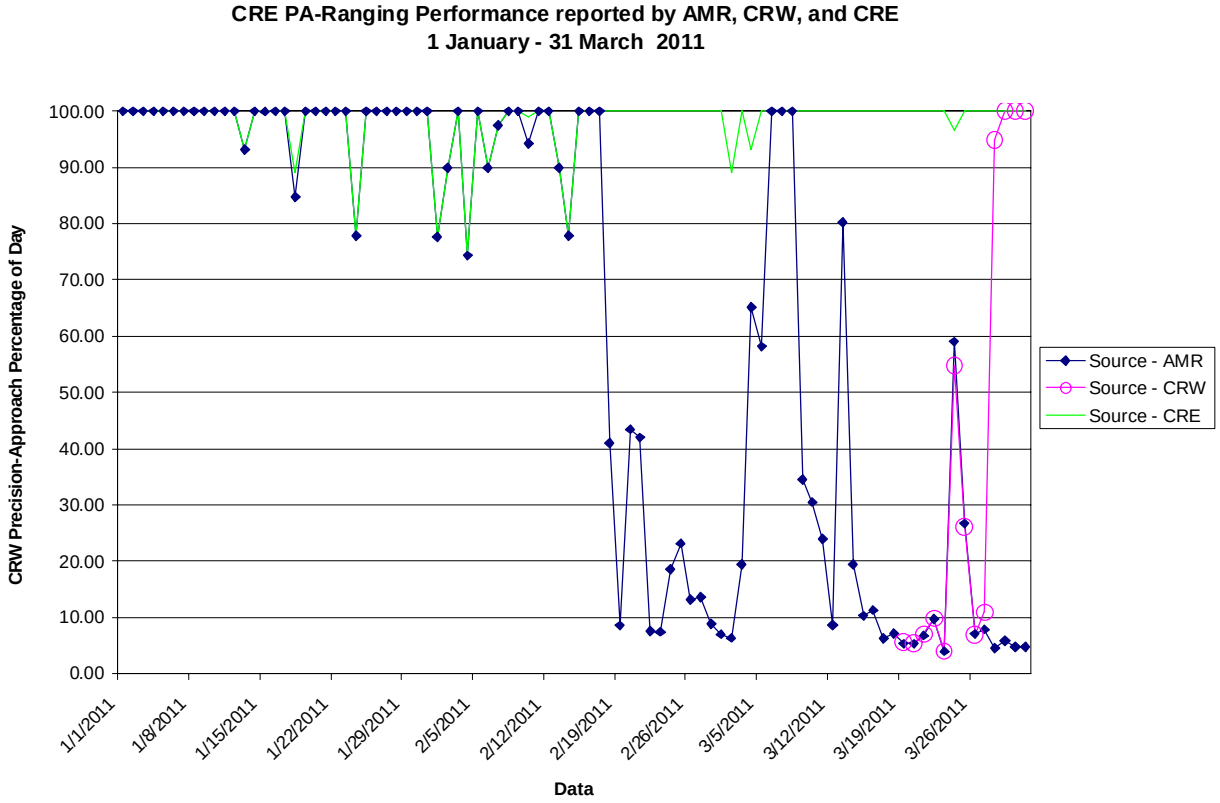


Figure 7-2 Daily PA CRE GEO Ranging Availability Trend



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
2/17/2011	Local RFI in the vicinity of Kansas City caused 18 db Hz drop in signal (C/No) that affected the receiver ability to maintain track of the GEO and GPS satellites for 136 seconds. See DR. 100 Kansas City Signal drop caused by RFI.
3/3/2011	Elevated UDREs on several satellites caused LPV200 drop. See DR 101 Elevated UDREs on several satellites cause LPV200 coverage drop.

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.

Table 9-1 WAAS LPV Outages and Availability

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
CDB	COLD BAY	AK	LPV	19	0.999111	572	0.933292
GAL	EDWARD G. PITKA SR	AK	LPV	5	0.999566	21	0.998439
ENM	EMMONAK	AK	LPV	6	0.999491	194	0.985641
FAI	FAIRBANKS INTL	AK	LPV200	4	0.999596	15	0.998860
GBH	Galbraith Lake	AK		5	0.999463	36	0.997414
GKN	GULKANA	AK	LPV	1	0.999763	6	0.999266
HOM	HOMER	AK	LPV	2	0.999958	6	0.999317
HLA	HUSLIA	AK	LPV	5	0.999564	25	0.998205
ENA	KENAI MUNICIPAL	AK	LPV	3	0.999889	6	0.999232
KTN	KETCHIKAN INTL	AK	LPV	1	0.999581	5	0.998838
AKN	KING SALMON	AK	LPV	4	0.999830	23	0.998710
RBY	RUBY	AK	LPV	5	0.999499	20	0.998577
WLK	SELAWIK	AK	LPV	6	0.999483	49	0.996653
KSM	ST MARY'S	AK	LPV	6	0.999565	123	0.989561
SMK	ST MICHAEL	AK	LPV	6	0.999536	65	0.996228
ANC	TED STEVENS ANCHORAGE INTL	AK	LPV	2	0.999790	6	0.999254
YAK	YAKUTAT	AK	LPV200	1	0.999873	8	0.999257
8A0	ALBERTVILLE RGNL-THOMAS J BRUM	AL	LPV	0	1	0	1
ANB	ANNISTON METROPOLITAN	AL	LPV	0	1	0	1
AUO	AUBURN UNIVERSITY RGNL	AL	LPV	0	1	0	1
EKY	BESSEMER	AL	LPV200	0	1	0	1
BHM	BIRMINGHAM-SHUTTLESWORTH INTL	AL	LPV200	0	1	0	1
SEM	CRAIG FIELD	AL	LPV	0	1	0	1
DHN	DOTHAN RGNL	AL	LPV	0	1	0	1
HSV	HUNTSVILLE INTL-CARL T JONES	AL	LPV200	0	1	0	1
JKA	JACK EDWARDS	AL	LPV	0	1	0	1
MDQ	MADISON COUNTY EXECUTIVE	AL	LPV	0	1	0	1
BFM	MOBILE DOWNTOWN	AL	LPV200	0	1	0	1
MOB	MOBILE RGNL	AL	LPV	0	1	0	1
MGM	MONTGOMERY RGNL DANNELLY FIELD	AL	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GAD	NORTHEAST ALABAMA RGNL	AL	LPV	0	1	0	1
MSL	NORTHWEST ALABAMA RGNL	AL	LPV200	0	1	0	1
DCU	PRYOR FIELD RGNL	AL	LPV200	0	1	0	1
79J	SOUTH ALABAMA RGNL	AL	LPV	0	1	0	1
PLR	ST CLAIR COUNTY	AL	LPV	0	1	0	1
2R5	ST ELMO	AL	LPV	0	1	0	1
ASN	TALLADEGA MUNICIPAL	AL	LPV	0	1	0	1
TOI	TROY MUNICIPAL	AL	LPV200	0	1	0	1
TCL	TUSCALOOSA RGNL	AL	LPV	0	1	0	1
LIT	ADAMS FIELD	AR	LPV200	0	1	0	1
M73	ALMYRA MUNICIPAL	AR	LNAV	0	1	0	1
BYH	ARKANSAS INTL	AR	LPV200	0	1	0	1
VBT	BENTONVILLE MUNICIPAL/ LOUISE M THAD	AR	VNAV	0	1	1	0.999926
HRO	BOONE COUNTY	AR	LPV	0	1	1	0.999965
FSM	FORT SMITH RGNL	AR	LPV200	0	1	1	0.999950
PBF	GRIDER FIELD	AR	VNAV	0	1	0	1
JBR	JONESBORO MUNICIPAL	AR	LPV	0	1	0	1
M19	NEWPORT MUNICIPAL	AR	LPV	0	1	0	1
ORK	NORTH LITTLE ROCK MUNICIPAL	AR	LPV	0	1	0	1
XNA	NORTHWEST ARKANSAS RGNL	AR	LPV	0	1	1	0.999925
BPK	OZARK RGNL	AR	LPV	0	1	1	0.999984
ROG	ROGERS MUNICIPAL-CARTER FIELD	AR	LPV	0	1	1	0.999930
RUE	RUSSELLVILLE RGNL	AR	LPV	0	1	1	0.999994
SUZ	SALINE COUNTY RGNL	AR	LPV	0	1	0	1
SRC	SEARCY MUNICIPAL	AR	LPV	0	1	0	1
SLG	SMITH FIELD	AR	LPV	0	1	2	0.999920
ELD	SOUTH ARKANSAS RGNL AT GOODWIN	AR	LPV	0	1	0	1
ASG	SPRINGDALE MUNICIPAL	AR	LPV	0	1	1	0.999934
SGT	STUTTGART MUNICIPAL	AR	LPV	0	1	0	1
ARG	WALNUT RIDGE RGNL	AR	VNAV	0	1	0	1
PRC	ERNEST A. LOVE FIELD	AZ	LPV	0	1	5	0.999776
GEU	GLENDALE MUNICIPAL	AZ	LPV	1	0.999990	46	0.998788
GCN	GRAND CANYON NATIONAL PARK	AZ	VNAV	0	1	2	0.999917
IFP	LAUGHLIN/BULLHEAD INTL	AZ	LPV	0	1	4	0.999980
PGA	PAGE MUNICIPAL	AZ	LPV	0	1	2	0.999927
DVT	PHOENIX DEER VALLEY	AZ	LPV	1	0.999999	26	0.999164
PHX	PHOENIX SKY HARBOR INTL	AZ	LPV	1	0.999994	51	0.998533
IWA	PHOENIX-MESA GATEWAY	AZ	LPV	1	1	44	0.998496
SJN	ST JOHNS INDUSTRIAL AIR PARK	AZ	VNAV	0	1	6	0.999723
TUS	TUCSON INTL	AZ	LPV	1	0.999996	30	0.998932
APV	APPLE VALLEY	CA	LPV	1	0.999899	12	0.999375
ACV	ARCATA	CA	LPV	33	0.999451	175	0.987266
DAG	BARSTOW-DAGGETT	CA	LPV	1	0.999949	9	0.999427
C83	BYRON	CA	LPV	3	0.999644	133	0.989356
CMA	CAMARILLO	CA	LPV	1	0.999782	78	0.994515
CNO	CHINO	CA	LPV	1	0.999905	17	0.999236
FAT	FRESNO YOSEMITE INTL	CA	LPV	1	0.999807	44	0.998506
WJF	GENERAL WM J FOX AIRFIELD	CA	LPV	1	0.999877	18	0.998943
HAF	HALF MOON BAY	CA	LPV	40	0.999380	178	0.978793
HWD	HAYWARD EXECUTIVE	CA	LPV	4	0.999617	154	0.982706

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
CVH	HOLLISTER MUNICIPAL	CA	LPV	4	0.999682	158	0.985680
SNA	JOHN WAYNE AIRPORT-ORANGE COUNTY	CA	LPV	1	0.999908	26	0.999012
LGB	LONG BEACH /DAUGHERTY FIELD	CA	LPV	1	0.999899	28	0.998871
LAX	LOS ANGELES INTL	CA	LPV	1	0.999891	32	0.998489
MAE	MADERA MUNICIPAL	CA	LPV	2	0.999779	63	0.998036
CRQ	MC CLELLAN-PALOMAR	CA	LPV	1	0.999931	32	0.997626
BFL	MEADOWS FIELD	CA	LPV200	1	0.999800	28	0.998750
MCE	MERCED RGNL//MACREADY FIELD	CA	LPV	4	0.999757	85	0.996898
OAK	METROPOLITAN OAKLAND INTL	CA	LPV	7	0.999602	156	0.982274
MOD	MODESTO CITY-CO-HARRY SHAM FLD	CA	LPV	4	0.999702	99	0.995320
MRY	MONTEREY PENINSULA	CA	LPV	9	0.999648	198	0.978665
APC	NAPA COUNTY	CA	LPV	4	0.999587	149	0.983865
O02	NERVINO	CA	LPV	3	0.999924	50	0.998975
SJC	NORMAN Y. MINETA SAN JOSE INTL	CA	LPV	4	0.999630	158	0.983011
VCB	NUT TREE	CA	LPV	4	0.999732	129	0.987848
ONT	ONTARIO INTL	CA	LPV	1	0.999904	17	0.999256
OXR	OXNARD	CA	LPV	1	0.999782	98	0.993828
PMD	PALMDALE RGNL/USAF PLANT 42	CA	VNAV	1	0.999882	19	0.999079
RBL	RED BLUFF MUNICIPAL	CA	LPV	3	0.999809	89	0.994952
RDD	REDDING MUNICIPAL	CA	LPV	2	0.999817	92	0.995622
RAL	RIVERSIDE MUNICIPAL	CA	LPV	1	0.999909	16	0.999269
SMF	SACRAMENTO INTL	CA	LPV	4	0.999745	101	0.993227
MHR	SACRAMENTO MATHER	CA	LPV	3	0.999770	96	0.994971
SFO	SAN FRANCISCO INTL	CA	LPV	19	0.999540	163	0.980706
SBA	SANTA BARBARA MUNICIPAL	CA	LPV	1	0.999795	163	0.988207
TCY	TRACY MUNICIPAL	CA	LPV	4	0.999665	131	0.990992
APA	CENTENNIAL	CO	LPV	2	0.999915	4	0.999631
COS	CITY OF COLORADO SPRINGS MUNICIPAL	CO	LPV200	2	0.999900	4	0.999633
AKO	COLORADO PLAINS RGNL	CO	VNAV	0	1	4	0.999909
CEZ	CORTEZ MUNICIPAL	CO	LPV	0	1	3	0.999742
DEN	DENVER INTL	CO	LPV200	2	0.999910	4	0.999688
FTG	FRONT RANGE	CO	LPV	2	0.999910	4	0.999685
RIL	GARFIELD COUNTY RGNL	CO	LPV	0	1	2	0.999969
GXY	GREELEY-WELD COUNTY	CO	LPV	2	0.999911	4	0.999732
ITR	KIT CARSON COUNTY	CO	LPV	0	1	5	0.999888
LAA	LAMAR MUNICIPAL	CO	LPV	2	0.999886	4	0.999580
PUB	PUEBLO MEMORIAL	CO	LPV200	2	0.999897	4	0.999631
ALS	SAN LUIS VALLEY RGNL	CO	LPV200	2	0.999948	4	0.999696
HDN	YAMPA VALLEY	CO	LPV	0	1	0	1
BDL	BRADLEY INTL	CT	LPV200	0	1	0	1
GON	GROTON-NEW LONDON	CT	LPV	0	1	0	1
HVN	TWEED-NEW HAVEN	CT	LPV	0	1	0	1
OXC	WATERBURY-OXFORD	CT	LPV	0	1	0	1
DCA	RONALD REAGAN WASHINGTON NATIONAL	DC	LPV	0	1	0	1
EVY	SUMMIT	DE	LPV	0	1	0	1
GED	SUSSEX COUNTY	DE	LPV	0	1	0	1
AAF	APALACHICOLA REGIONAL	FL	LPV	0	1	0	1
CEW	BOB SIKES	FL	LPV	0	1	0	1
BCT	BOCA RATON	FL	LPV	0	1	33	0.999218

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PGD	CHARLOTTE COUNTY	FL	LPV	0	1	1	0.999984
DAB	DAYTONA BEACH INTL	FL	LPV	0	1	3	0.999929
DED	DELAND MUNICIPAL- SIDNEY H TAYLOR FIELD	FL	LPV	0	1	3	0.999946
XFL	FLAGLER COUNTY	FL	LPV	0	1	5	0.999930
FXE	FORT LAUDERDALE EXECUTIVE	FL	LPV200	0	1	41	0.998991
FLL	FORT LAUDERDALE/ HOLLYWOOD INTL	FL	LPV	0	1	48	0.998726
GNV	GAINESVILLE RGNL	FL	LPV	0	1	2	0.999992
BKV	HERNANDO COUNTY	FL	LPV	0	1	0	1
JAX	JACKSONVILLE INTL	FL	LPV	0	1	1	0.999985
TMB	KENDALL-TAMIAMI EXECUTIVE	FL	LPV200	0	1	62	0.998058
EYW	KEY WEST INTL	FL	LPV	0	1	78	0.996874
ISM	KISSIMMEE GATEWAY	FL	LPV200	0	1	1	0.999971
X14	LA BELLE MUNICIPAL	FL	LPV	0	1	3	0.999954
LCQ	LAKE CITY MUNICIPAL	FL	LPV	0	1	0	1
LAL	LAKELAND LINDER RGNL	FL	LPV200	0	1	1	0.999989
LEE	LEESBURG INTL	FL	LPV	0	1	1	0.999982
MLB	MELBOURNE INTL	FL	LPV	0	1	2	0.999934
COI	MERRITT ISLAND	FL	LPV	0	1	1	0.999942
MIA	MIAMI INTL	FL	LPV	0	1	60	0.998200
APF	NAPLES MUNICIPAL	FL	LPV	0	1	9	0.999879
EVB	NEW SMYRNA BEACH MUNICIPAL	FL	LPV	0	1	3	0.999932
OCF	OCALA INTL-JIM TAYLOR FIELD	FL	LPV200	0	1	3	0.999985
MCO	ORLANDO INTL	FL	LPV200	0	1	1	0.999968
SFB	ORLANDO SANFORD INTL	FL	LPV200	0	1	3	0.999961
PHK	PALM BEACH CO GLADES	FL	LPV	0	1	7	0.999766
PBI	PALM BEACH INTL	FL	LPV	0	1	21	0.999550
PNS	PENSACOLA GULF COAST RGNL	FL	LPV	0	1	0	1
PMP	POMPANO BEACH AIRPARK	FL	LPV	0	1	40	0.999037
SRQ	SARASOTA/BRADENTON INTL	FL	LPV200	0	1	0	1
RSW	SOUTHWEST FLORIDA INTL	FL	LPV	0	1	3	0.999960
FPR	ST LUCIE COUNTY INTL	FL	LPV	0	1	3	0.999817
PIE	ST PETERSBURG-CLEARWATER INTL	FL	LPV200	0	1	0	1
TLH	TALLAHASSEE RGNL	FL	LPV	0	1	0	1
VDF	TAMPA EXECUTIVE	FL	LPV	0	1	1	0.999999
TPA	TAMPA INTL	FL	LPV200	0	1	0	1
MTH	THE FLORIDA KEYS MARATHON	FL	LPV	0	1	79	0.996257
GIF	WINTER HAVEN'S GILBERT	FL	LPV	0	1	1	0.999981
FFC	ATLANTA RGNL FALCON FIELD	GA	LPV200	0	1	0	1
AGS	AUGUSTA RGNL AT BUSH FIELD	GA	LPV	0	1	0	1
WDR	BARROW COUNTY	GA	LPV	0	1	0	1
BQK	BRUNSWICK GOLDEN ISLES	GA	LPV200	0	1	1	0.999983
VPC	CARTERSVILLE	GA	LPV	0	1	0	1
47A	CHEROKEE COUNTY	GA	LPV	0	1	0	1
RYY	COBB COUNTY-MC COLLUM FIELD	GA	LPV200	0	1	0	1
CSG	COLUMBUS METROPOLITAN	GA	LPV	0	1	0	1
15J	COOK COUNTY	GA	LPV	0	1	0	1
CKF	CRISP COUNTY-CORDELE	GA	LPV	0	1	0	1
DNN	DALTON MUNICIPAL	GA	LPV	0	1	0	1
SBO	EMANUEL COUNTY	GA	LPV	0	1	0	1
18A	FRANKLIN COUNTY	GA	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
FTY	FULTON COUNTY AIRPORT-BROWN FIELD	GA	LPV	0	1	0	1
ATL	HARTSFIELD - JACKSON ATLANTA	GA	LPV200	0	1	0	1
EZM	HEART OF GEORGIA RGNL	GA	LPV	0	1	0	1
19A	JACKSON COUNTY	GA	LPV	0	1	0	1
ACJ	JIMMY CARTER RGNL	GA	VNAV	0	1	0	1
GVL	LEE GILMER MEMORIAL	GA	LPV	0	1	0	1
MCN	MIDDLE GEORGIA RGNL	GA	LPV	0	1	0	1
MGR	MOULTRIE MUNICIPAL	GA	LPV	0	1	0	1
CCO	NEWNAN COWETA COUNTY	GA	LPV	0	1	0	1
PXE	PERRY-HOUSTON COUNTY	GA	LPV	0	1	0	1
JZP	PICKENS COUNTY	GA	LPV	0	1	0	1
JYL	PLANTATION ARPK	GA	LPV	0	1	1	0.999994
SAV	SAVANNAH/HILTON HEAD INTL	GA	LPV200	0	1	1	0.999978
ABY	SOUTHWEST GEORGIA RGNL	GA	LPV200	0	1	0	1
TBR	STATESBORO-BULLOCH COUNTY	GA	LPV	0	1	1	0.999998
MQW	TELFAIR-WHEELER	GA	LPV	0	1	0	1
TVI	THOMASVILLE RGNL	GA	LPV	0	1	0	1
TOC	TOCCOA RG LETOURNEAU FIELD	GA	LPV	0	1	0	1
VLD	VALDOSTA RGNL	GA	LPV	0	1	0	1
VDI	VIDALIA RGNL	GA	LPV	0	1	0	1
IIY	WASHINGTON-WILKES COUNTY	GA	LPV	0	1	0	1
AYS	WAYCROSS-WARE COUNTY	GA	LPV	0	1	0	1
CTJ	WEST GEORGIA RGNL	GA	LPV	0	1	0	1
IKV	ANKENY RGNL	IA	LPV	0	1	2	0.999831
CBF	COUNCIL BLUFFS MUNICIPAL	IA	LPV200	2	0.999971	2	0.999797
DVN	DAVENPORT MUNICIPAL	IA	LPV200	0	1	2	0.999917
DNS	DENISON MUNICIPAL	IA	LPV	2	0.999970	2	0.999783
DSM	DES MOINES INTL	IA	LPV	1	1	2	0.999809
DBQ	DUBUQUE RGNL	IA	LPV200	0	1	2	0.999901
EST	ESTHERVILLE MUNICIPAL	IA	LPV	0	1	2	0.999808
FFL	FAIRFIELD MUNICIPAL	IA	LPV	0	1	2	0.999872
GGI	GRINNELL RGNL	IA	LPV	0	1	2	0.999849
EOK	KEOKUK MUNICIPAL	IA	LPV	0	1	2	0.999903
MCW	MASON CITY MUNICIPAL	IA	VNAV	0	1	2	0.999822
MXO	MONTICELLO RGNL	IA	VNAV	0	1	2	0.999899
MUT	MUSCATINE MUNICIPAL	IA	LPV	0	1	2	0.999912
TNU	NEWTON MUNICIPAL	IA	LPV	0	1	2	0.999843
OTM	OTTUMWA RGNL	IA	LPV	0	1	2	0.999860
PRO	PERRY MUNICIPAL	IA	LPV	1	1	2	0.999792
SDA	SHENANDOAH MUNICIPAL	IA	LPV	2	0.999989	2	0.999802
SLB	STORM LAKE MUNICIPAL	IA	LPV	2	0.999962	2	0.999780
CID	THE EASTERN IOWA	IA	LPV200	0	1	2	0.999897
ALO	WATERLOO RGNL	IA	LPV	0	1	2	0.999889
BOI	BOISE AIR TERMINAL/GOWEN FLD	ID	LPV	0	1	5	0.999858
EUL	CALDWELL INDUSTRIAL	ID	LPV	0	1	5	0.999852
GNG	GOODING MUNICIPAL	ID	LPV	0	1	3	0.999901
IDA	IDAHO FALLS RGNL	ID	LPV200	0	1	3	0.999927
LWS	LEWISTON-NEZ PERCE COUNTY	ID	LPV200	0	1	2	0.999816
MAN	NAMPA MUNICIPAL	ID	LPV	0	1	5	0.999852
PIH	POCATELLO RGNL	ID	LPV200	0	1	3	0.999935
SPI	ABRAHAM LINCOLN CAPITAL	IL	LPV	0	1	2	0.999988

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
FEP	ALBERTUS	IL	LPV	0	1	2	0.999921
ARR	AURORA MUNICIPAL	IL	LPV	0	1	2	0.999958
BMI	CENTRAL IL RGNL ARPT	IL	LPV	0	1	2	0.999996
ENL	CENTRALIA MUNICIPAL	IL	VNAV	0	1	0	1
MDW	CHICAGO MIDWAY INTL	IL	LPV	0	1	2	0.999989
ORD	CHICAGO O'HARE INTL	IL	LPV200	0	1	2	0.999970
RFD	CHICAGO/ROCKFORD INTL	IL	LPV200	0	1	2	0.999930
RSV	CRAWFORD CO	IL	LPV	0	1	0	1
DKB	DE KALB TAYLOR MUNICIPAL	IL	LPV	0	1	2	0.999947
DEC	DECATUR	IL	LPV	0	1	0	1
FOA	FLORA MUNICIPAL	IL	VNAV	0	1	0	1
PIA	GENERAL DOWNING - PEORIA INTL	IL	LPV	0	1	2	0.999961
IKK	GREATER KANKAKEE	IL	LPV	0	1	1	1
IGQ	LANSING MUNICIPAL	IL	LPV	0	1	1	1
LOT	LEWIS UNIVERSITY	IL	LPV200	0	1	2	0.999977
3LF	LITCHFIELD MUNICIPAL	IL	LPV	0	1	0	1
C15	PEKIN MUNICIPAL	IL	LPV	0	1	2	0.999967
PPQ	PITTSFIELD PENSTONE MUNICIPAL	IL	VNAV	0	1	2	0.999944
PNT	PONTIAC MUNICIPAL	IL	LPV	0	1	2	0.999989
MLI	QUAD CITY INTL	IL	LPV	0	1	2	0.999923
UIN	QUINCY RGNL-BALDWIN FIELD	IL	LPV200	0	1	2	0.999924
TIP	RANTOUL NATL AVN CNTR	IL	VNAV	0	1	0	1
SLO	SALEM-LECKRONE	IL	VNAV	0	1	0	1
ALN	ST LOUIS RGNL	IL	LPV	0	1	1	0.999990
DNV	VERMILION REGIONAL	IL	LPV	0	1	0	1
UGN	WAUKEGAN RGNL	IL	LPV	0	1	2	0.999952
MWA	WILLIAMSON COUNTY RGNL	IL	LPV	0	1	0	1
BAK	COLUMBUS MUNICIPAL	IN	LPV	0	1	0	1
GWB	DE KALB COUNTY	IN	LPV	0	1	0	1
MIE	DELAWARE COUNTY RGNL	IN	LPV	0	1	0	1
EYE	EAGLE CREEK AIRPARK	IN	LPV	0	1	0	1
EKM	ELKHART MUNICIPAL	IN	LPV	0	1	0	1
FWA	FORT WAYNE INTL	IN	LPV200	0	1	0	1
SER	FREEMAN MUNICIPAL	IN	LPV	0	1	0	1
RCR	FULTON COUNTY	IN	LPV	0	1	0	1
GSH	GOSHEN MUNICIPAL	IN	LPV	0	1	0	1
HFY	GREENWOOD MUNICIPAL	IN	LPV	0	1	0	1
TYQ	INDIANAPOLIS EXECUTIVE	IN	LPV	0	1	0	1
IND	INDIANAPOLIS INTL	IN	LPV	0	1	0	1
GGP	LOGANSPORT/CASS COUNTY	IN	LPV	0	1	0	1
IMS	MADISON MUNICIPAL	IN	LPV	0	1	0	1
MZZ	MARION MUNICIPAL	IN	LPV	0	1	0	1
CEV	METTEL FIELD	IN	LPV	0	1	0	1
BMG	MONROE COUNTY	IN	LPV200	0	1	0	1
VPZ	PORTER COUNTY MUNICIPAL	IN	LPV	0	1	0	1
LAF	PURDUE UNIVERSITY	IN	LPV	0	1	0	1
4I7	PUTNAM COUNTY	IN	LPV	0	1	0	1
GEZ	SHELBYVILLE MUNICIPAL	IN	LPV	0	1	0	1
SBN	SOUTH BEND RGNL	IN	LPV	0	1	0	1
OXI	STARKE COUNTY	IN	LPV	0	1	0	1
ANQ	TRI-STATE STEUBEN COUNTY	IN	VNAV	0	1	0	1
PTS	ATKINSON MUNICIPAL	KS	LPV	0	1	2	0.999857

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
AAO	COLONEL JAMES JABARA	KS	LPV	0	1	1	0.999911
DDC	DODGE CITY RGNL	KS	LPV	0	1	5	0.999929
EMP	EMPORIA MUNICIPAL	KS	LPV	1	1	2	0.999864
FOE	FORBES FIELD	KS	LPV	1	1	2	0.999831
FSK	FORT SCOTT MUNICIPAL	KS	LPV	0	1	2	0.999843
GCK	GARDEN CITY RGNL	KS	LPV	0	1	7	0.999789
HYS	HAYS RGNL	KS	LPV200	0	1	1	0.999929
HQG	HUGOTON MUNICIPAL	KS	LPV	2	0.999886	4	0.999543
OJC	JOHNSON COUNTY EXECUTIVE	KS	LPV	0	1	2	0.999818
LWC	LAWRENCE MUNICIPAL	KS	LPV200	0	1	2	0.999823
LBL	LIBERAL MID-AMERICA RGNL	KS	LPV	2	0.999887	4	0.999535
MHK	MANHATTAN RGNL	KS	LPV200	2	0.999991	2	0.999860
MPR	MC PHERSON	KS	LPV	1	0.999997	1	0.999911
IXD	NEW CENTURY AIRCENTER	KS	LPV	0	1	2	0.999820
EWK	NEWTON-CITY-COUNTY	KS	LPV	0	1	2	0.999907
OEL	OAKLEY MUNICIPAL	KS	LPV	0	1	1	0.999958
TOP	PHILIP BILLARD MUNICIPAL	KS	VNAV	1	1	2	0.999828
PTT	PRATT RGNL	KS	LPV	0	1	1	0.999953
GLD	RENNER FLD /GOODLAND MUNICIPAL	KS	LPV200	0	1	1	0.999970
RSL	RUSSELL MUNICIPAL	KS	LPV	0	1	1	0.999919
SLN	SALINA MUNICIPAL	KS	LPV	2	0.999988	2	0.999901
TQK	SCOTT CITY MUNICIPAL	KS	LPV	0	1	5	0.999968
CBK	SHALZ FIELD	KS	LPV	0	1	1	0.999953
WLD	STROTHER FIELD	KS	VNAV	0	1	1	0.999925
PPF	TRI-CITY	KS	LPV	0	1	2	0.999863
ULS	ULYSSES	KS	LPV	2	0.999887	4	0.999542
EGT	WELLINGTON MUNICIPAL	KS	LPV	0	1	1	0.999929
ICT	WICHITA MID-CONTINENT	KS	LPV200	0	1	1	0.999920
EKX	ADDINGTON FIELD	KY	LPV	0	1	0	1
PAH	BARKLEY RGNL	KY	LPV	0	1	0	1
K22	BIG SANDY RGNL	KY	LPV	0	1	0	1
LEX	BLUE GRASS	KY	LPV	0	1	0	1
LOU	BOWMAN FIELD	KY	LPV	0	1	0	1
CVG	CINCINNATI/NORTHERN KENTUCKY	KY	LPV200	0	1	0	1
27K	GEORGETOWN SCOTT COUNTY	KY	LPV200	0	1	0	1
GLW	GLASGOW MUNICIPAL	KY	LPV	0	1	0	1
EHR	HENDERSON CITY-COUNTY	KY	LPV	0	1	0	1
SME	LAKE CUMBERLAND RGNL	KY	LPV	0	1	0	1
LOZ	LONDON-CORBIN ARPT-MAGEE FLD	KY	LPV	0	1	0	1
SDF	LOUISVILLE INTL-STANDIFORD FIELD	KY	LPV200	0	1	0	1
OWB	OWENSBORO-DAVIESS COUNTY	KY	LPV200	0	1	0	1
DVK	STUART POWELL FIELD	KY	LPV	0	1	0	1
W38	WILLIAMSBURG-WHITLEY COUNTY	KY	LPV	0	1	0	1
ARA	ACADIANA RGNL	LA	LPV	0	1	0	1
AEX	ALEXANDRIA INTL	LA	LPV200	0	1	0	1
BTR	BATON ROUGE METROPOLITAN	LA	LPV200	0	1	0	1
DRI	BEAUREGARD RGNL	LA	VNAV	0	1	1	0.999978
CWF	CHENNAULT INTL	LA	LPV200	0	1	1	0.999997
ESF	ESLER RGNL	LA	LPV200	0	1	0	1
HZR	FALSE RIVER RGNL	LA	LPV	0	1	0	1
PTN	HARRY P WILLIAMS MEMORIAL	LA	VNAV	0	1	0	1
LFT	LAFAYETTE RGNL	LA	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
LCH	LAKE CHARLES RGNL	LA	LPV	0	1	1	0.999978
NEW	LAKEFRONT	LA	LPV	0	1	0	1
MSY	LOUIS ARMSTRONG NEW ORLEANS	LA	LPV200	0	1	0	1
BQP	MOREHOUSE MEMORIAL	LA	LPV	0	1	0	1
DTN	SHREVEPORT DOWNTOWN	LA	LPV	0	1	0	1
SHV	SHREVEPORT RGNL	LA	LPV200	0	1	0	1
GAO	SOUTH LAFOURCHE LEONARD MILLER	LA	LPV	0	1	0	1
TVR	VICKSBURG TALLULAH RGNL	LA	LPV	0	1	0	1
BAF	BARNES MUNICIPAL	MA	LPV	0	1	0	1
HYA	BARNSTABLE MUNICIPAL - BOARDMAN/POLAN	MA	LPV200	0	1	1	0.999935
BOS	GENERAL EDWARD LAWRENCE lOGAN	MA	VNAV	0	1	0	1
BED	LAURENCE G HANSCOM FLD	MA	LPV200	0	1	0	1
MVY	MARTHAS VINEYARD	MA	LPV200	0	1	1	0.999930
OWD	NORWOOD MEMORIAL	MA	LPV	0	1	0	1
PVC	PROVINCETOWN MUNICIPAL	MA	VNAV	0	1	1	0.999941
ORH	WORCESTER RGNL	MA	LPV	0	1	0	1
BWI	BALTIMORE/WASHINGTON INTL	MD	LPV200	0	1	0	1
DMW	CARROLL COUNTY RGNL	MD	LPV200	0	1	0	1
ESN	EASTON/NEWNAM FIELD	MD	LPV200	0	1	0	1
FDK	FREDERICK MUNICIPAL	MD	LPV	0	1	0	1
GAI	MONTGOMERY COUNTY AIRPARK	MD	LPV	0	1	0	1
2W6	ST. MARY'S COUNTY RGNL	MD	LPV	0	1	0	1
LEW	AUBURN/LEWISTON MUNICIPAL	ME	LPV200	0	1	0	1
AUG	AUGUSTA STATE	ME	LPV	0	1	0	1
BGR	BANGOR INTL	ME	LPV	0	1	1	0.999992
BHB	HANCOCK COUNTY-BAR HARBOR	ME	LPV200	0	1	2	0.999992
PQI	NORTHERN MAINE RGNL ARPT	ME	LPV200	0	1	2	0.999987
PWM	PORTLAND INTL JETPORT	ME	LPV	0	1	0	1
WVL	WATERVILLE ROBERT LAFLEUR	ME	LPV200	0	1	0	1
ARB	ANN ARBOR MUNICIPAL	MI	LPV	0	1	0	1
ACB	ANTRIM COUNTY	MI	LPV	0	1	2	0.999947
FNT	BISHOP INTL	MI	LPV200	0	1	0	1
OEB	BRANCH COUNTY MEMORIAL	MI	LPV	0	1	0	1
CVX	CHARLEVOIX MUNICIPAL	MI	LPV	0	1	2	0.999936
CIU	CHIPPEWA COUNTY INTL	MI	LPV	0	1	2	0.999933
TTF	CUSTER	MI	LPV	0	1	0	1
DTW	DETROIT METROPOLITAN WAYNE COUNTY	MI	LPV	0	1	0	1
FFX	FREMONT MUNICIPAL	MI	LPV	0	1	2	0.999969
GRR	GERALD R. FORD INTL	MI	LPV200	0	1	0	1
CMX	HOUGHTON COUNTY MEMORIAL	MI	LPV	0	1	4	0.999759
BAX	HURON COUNTY MEMORIAL	MI	LPV	0	1	0	1
AZO	KALAMAZOO/BATTLE CREEK INTL	MI	LPV	0	1	0	1
ADG	LENAWEE COUNTY	MI	LPV	0	1	0	1
OZW	LIVINGSTON COUNTY SPENCER J. H	MI	LPV	0	1	0	1
LDM	MASON COUNTY	MI	LPV	0	1	2	0.999943
MBS	MBS INTL	MI	LPV200	0	1	0	1
MKG	MUSKEGON COUNTY	MI	LPV200	0	1	2	0.999970
RNP	OWOSSO COMMUNITY	MI	LPV	0	1	0	1
HYX	SAGINAW COUNTY H.W. BROWNE	MI	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
BIV	TULIP CITY	MI	LPV	0	1	1	0.999998
YIP	WILLOW RUN	MI	LPV	0	1	0	1
AEL	ALBERT LEA MUNICIPAL	MN	LPV	0	1	2	0.999868
ANE	ANOKA COUNTY-BLAINE ARPT	MN	LPV	0	1	3	0.999805
AUM	AUSTIN MUNICIPAL	MN	LPV	0	1	2	0.999870
BDE	BAUDETTE INTL	MN	LPV	1	0.999940	4	0.999342
BRD	BRAINERD LAKES RGNL	MN	LPV200	1	0.999983	4	0.999490
AXN	CHANDLER FIELD	MN	LPV	0	1	3	0.999755
CKN	CROOKSTON MUNICIPAL KIRKWOOD FLD	MN	LPV	0	1	3	0.999476
DTL	DETROIT LAKES-WETHING FIELD	MN	LPV	0	1	5	0.999600
DLH	DULUTH INTL	MN	LPV200	1	0.999951	4	0.999501
INL	FALLS INTL	MN	LPV	1	0.999922	4	0.999380
MSP	MINNEAPOLIS-ST PAUL INTL	MN	LPV	0	1	3	0.999817
HIB	RANGE REGIONAL	MN	VNAV	1	0.999960	4	0.999475
RGK	RED WING RGNL	MN	LPV	0	1	2	0.999867
RST	ROCHESTER INTL	MN	LPV	0	1	2	0.999872
ROX	ROSEAU MUNICIPAL/ RUDY BILLBERG FIELD	MN	LPV	1	0.999956	4	0.999393
MML	SOUTHWEST MINNESOTA RGNL	MN	LPV	0	1	3	0.999734
STC	ST CLOUD RGNL	MN	LPV200	0	1	4	0.999773
JYG	ST JAMES MUNICIPAL	MN	VNAV	0	1	3	0.999785
STP	ST PAUL DOWNTOWN HOLMAN FLD	MN	LPV	0	1	3	0.999817
RRT	WARROAD INTL MEMORIAL	MN	LPV	1	0.999951	4	0.999322
BDH	WILLMAR MUNICIPAL- JOHN L RICE FIELD	MN	LPV	0	1	3	0.999724
M17	BOLIVAR MUNICIPAL	MO	LPV	0	1	2	0.999912
CGI	CAPE GIRARDEAU RGNL	MO	LPV	0	1	0	1
M05	CARUTHERSVILLE MEMORIAL	MO	LPV	0	1	0	1
MKC	CHARLES B. WHEELER DOWNTOWN	MO	LPV	0	1	2	0.999814
COU	COLUMBIA RGNL	MO	LPV	0	1	2	0.999908
1H0	CREVE COEUR	MO	LPV	0	1	1	0.999980
DXE	DEXTER MUNICIPAL	MO	LPV	0	1	0	1
LBO	FLOYD W. JONES LEBANON	MO	VNAV	0	1	2	0.999941
K57	GOULD PETERSON MUNICIPAL	MO	LPV	2	0.999991	2	0.999805
HIG	HIGGINSVILLE INDUSTRIAL MUNICIPAL	MO	LPV	0	1	2	0.999837
JEF	JEFFERSON CITY MEMORIAL	MO	LPV	0	1	2	0.999921
VER	JESSE VIERTEL MEMORIAL	MO	LPV	0	1	2	0.999882
JLN	JOPLIN RGNL	MO	LPV	0	1	2	0.999878
MCI	KANSAS CITY INTL	MO	LPV	0	1	2	0.999811
TKX	KENNETT MEMORIAL	MO	LNAV	0	1	0	1
IRK	KIRKSVILLE RGNL	MO	LPV200	0	1	2	0.999856
STL	LAMBERT-ST LOUIS INTL	MO	LPV	0	1	1	0.999983
LRY	LAWRENCE SMITH MEMORIAL	MO	LPV	0	1	2	0.999829
AIZ	LEE C FINE MEMORIAL	MO	LPV	0	1	2	0.999925
LXT	LEE'S SUMMIT MUNICIPAL	MO	LPV	0	1	2	0.999820
6M6	LEWIS COUNTY RGNL	MO	LPV	0	1	2	0.999900
MHL	MARSHALL MEMORIAL MUNICIPAL	MO	LPV	0	1	2	0.999853
MYJ	MEXICO MEMORIAL	MO	LPV	0	1	2	0.999910
GPH	MIDWEST NATIONAL AIR CENTER	MO	LPV	0	1	2	0.999813
HFJ	MONETT MUNICIPAL	MO	LPV	0	1	2	0.999911

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
EOS	NEOSHO HUGH ROBINSON	MO	LPV	0	1	2	0.999898
POF	POPLAR BLUFF MUNICIPAL	MO	LPV	0	1	0	1
STJ	ROSECRANS MEMORIAL	MO	LPV200	0	1	2	0.999807
DMO	SEDALIA MEMORIAL	MO	LPV	0	1	2	0.999871
SIK	SIKESTON MEMORIAL MUNICIPAL	MO	LPV	0	1	0	1
RCM	SKYHAVEN	MO	LPV	0	1	2	0.999840
SGF	SPRINGFIELD-BRANSON NATIONAL	MO	LPV	0	1	2	0.999925
TBN	WAYNESVILLE-ST. ROBERT RGNL	MO	LPV	0	1	1	0.999957
UNO	WEST PLAINS RGNL	MO	LPV	0	1	1	0.999988
STF	GEORGE M BRYAN	MS	LPV200	0	1	0	1
GTR	GOLDEN TRIANGLE RGNL	MS	LPV	0	1	0	1
GWO	GREENWOOD-LEFLORE	MS	LPV	0	1	0	1
GNF	GRENADA MUNICIPAL	MS	LPV	0	1	0	1
GPT	GULFPORT-BILOXI INTL	MS	LPV200	0	1	0	1
HEZ	HARDY-ANDERS FIELD NATCHEZ-ADA	MS	LPV	0	1	0	1
HBG	HATTIESBURG BOBBY L CHAIN MUNICIPAL	MS	LPV200	0	1	0	1
PIB	HATTIESBURG-LAUREL RGNL	MS	LPV200	0	1	0	1
LUL	HESLER-NOBLE FIELD	MS	LPV	0	1	0	1
JAN	JACKSON-EVERS INTL	MS	LPV200	0	1	0	1
M16	JOHN BELL WILLIAMS	MS	LPV	0	1	0	1
MEI	KEY FIELD	MS	LPV200	0	1	0	1
MCB	MC COMB/PIKE COUNTY	MS	LPV	0	1	0	1
M40	MONROE COUNTY	MS	LPV	0	1	0	1
OLV	OLIVE BRANCH	MS	LPV	0	1	0	1
MJD	PICAYUNE MUNICIPAL	MS	LPV	0	1	0	1
M43	PRENTISS- JEFFERSON DAVIS COUNTY	MS	LPV	0	1	0	1
CRX	ROSCOE TURNER	MS	LPV200	0	1	0	1
HSA	STENNIS INTL	MS	LPV	0	1	0	1
PQL	TRENT LOTT INTL	MS	LPV200	0	1	0	1
UTA	TUNICA MUNICIPAL	MS	LPV200	0	1	0	1
UOX	UNIVERSITY-OXFORD	MS	LPV	0	1	0	1
BTM	BERT MOONEY	MT	LPV	0	1	4	0.999692
BIL	BILLINGS LOGAN INTL	MT	LPV	0	1	4	0.999770
MLS	FRANK WILEY FIELD	MT	LPV	1	0.999966	4	0.999816
GPI	GLACIER PARK INTL	MT	LPV	0	1	2	0.999808
GTF	GREAT FALLS INTL	MT	LPV	0	1	2	0.999821
HLN	HELENA RGNL	MT	LPV	0	1	5	0.999802
LWT	LEWISTOWN MUNICIPAL	MT	LPV	1	0.999991	4	0.999738
OAJ	ALBERT J ELLIS	NC	LPV	0	1	1	0.999953
AFP	ANSON COUNTY -JEFF CLOUD FIELD	NC	LPV	0	1	1	0.999968
HBI	ASHEBORO RGNL	NC	VNAV	0	1	1	0.999991
AVL	ASHEVILLE RGNL	NC	LPV	0	1	0	1
CLT	CHARLOTTE/DOUGLAS INTL	NC	LPV200	0	1	1	0.999981
EQY	CHARLOTTE-MONROE EXECUTIVE	NC	LPV	0	1	1	0.999971
EWN	COASTAL CAROLINA REGIONAL	NC	LPV	0	1	1	0.999959
JQF	CONCORD RGNL	NC	LPV	0	1	1	0.999982
ECG	ELIZABETH CITY CG AIR STATION	NC	LPV	0	1	0	1
FAY	FAYETTEVILLE RGNL/GRANNIS FIELD	NC	LPV	0	1	1	0.999964
AKH	GASTONIA MUNICIPAL	NC	LPV	0	1	1	0.999988
GWW	GOLDSBORO-WAYNE MUNICIPAL	NC	LPV	0	1	1	0.999976

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
HRJ	HARNETT RGNL JETPORT	NC	LPV	0	1	1	0.999977
HNZ	HENDERSON-OXFORD	NC	LPV	0	1	0	1
ISO	KINSTON RGNL JETPORT	NC	LPV	0	1	1	0.999970
EDE	NORTHEASTERN RGNL	NC	LPV	0	1	1	0.999988
GSO	PIEDMONT TRIAD INTL	NC	LPV200	0	1	0	1
PGV	PITT-GREENVILLE	NC	LPV	0	1	1	0.999979
TTA	RALEIGH EXEC JETPORT	NC	VNAV	0	1	1	0.999986
RDU	RALEIGH-DURHAM INTL	NC	LPV200	0	1	1	0.999995
RWI	ROCKY MOUNT-WILSON RGNL	NC	LPV200	0	1	1	0.999989
RUQ	ROWAN COUNTY	NC	VNAV	0	1	1	0.999992
SVH	STATESVILLE RGNL	NC	LPV	0	1	1	0.999996
LHZ	TRIANGLE NORTH EXECUTIVE	NC	LPV	0	1	1	0.999997
ILM	WILMINGTON INTL	NC	LPV	0	1	1	0.999935
BIS	BISMARCK MUNICIPAL	ND	LPV	1	0.999943	2	0.999784
5N8	CASSELTON ROBERT MILLER RGNL	ND	LPV	0	1	4	0.999736
DVL	DEVILS LAKE RGNL	ND	LPV	0	1	2	0.999727
DIK	DICKINSON - THEODORE ROOSEVELT	ND	LPV200	2	0.999921	3	0.999794
GFK	GRAND FORKS INTL	ND	LPV	0	1	3	0.999580
FAR	HECTOR INTL	ND	LPV200	0	1	4	0.999708
JMS	JAMESTOWN RGNL	ND	LPV200	0	1	2	0.999765
MOT	MINOT INTL	ND	LPV	1	0.999985	2	0.999750
ANW	AINSWORTH RGNL	NE	LPV200	2	0.999955	2	0.999874
BVN	ALBION MUNICIPAL	NE	LPV	2	0.999945	2	0.999839
AIA	ALLIANCE MUNICIPAL	NE	LPV200	0	1	1	0.999927
AUH	AURORA MUNICIPAL – AL POTTER FIELD	NE	LPV	2	0.999957	2	0.999860
BIE	BEATRICE MUNICIPAL	NE	LPV	2	0.999977	2	0.999835
FNB	BRENNER FIELD	NE	LPV	2	0.999999	2	0.999811
HDE	BREWSTER FIELD	NE	LPV	1	0.999984	1	0.999906
BBW	BROKEN BOW MUNICIPAL	NE	LPV	1	0.999970	1	0.999894
GRI	CENTRAL NEBRASKA RGNL	NE	LPV	2	0.999960	2	0.999866
CDR	CHADRON MUNICIPAL	NE	LPV	1	0.999992	1	0.999920
OLU	COLUMBUS MUNICIPAL	NE	LPV	2	0.999952	2	0.999824
CZD	COZAD MUNICIPAL	NE	LPV	1	0.999985	1	0.999908
CEK	CRETE MUNICIPAL	NE	LPV	2	0.999969	2	0.999834
OMA	EPPLEY AIRFIELD	NE	LPV	2	0.999971	2	0.999801
FBY	FAIRBURY MUNICIPAL	NE	LPV	2	0.999971	2	0.999851
FET	FREMONT MUNICIPAL	NE	LPV	2	0.999963	2	0.999805
OKS	GARDEN COUNTY	NE	LPV	0	1	1	0.999931
GRN	GORDON MUNICIPAL	NE	LPV	1	0.999982	1	0.999909
GGF	GRANT MUNICIPAL	NE	LPV	0	1	1	0.999931
HSI	HASTINGS MUNICIPAL	NE	LPV	2	0.999967	2	0.999880
IML	IMPERIAL MUNICIPAL	NE	LPV	0	1	1	0.999934
LXN	JIM KELLY FIELD	NE	LPV	1	0.999984	1	0.999905
EAR	KEARNEY RGNL	NE	LPV	2	0.999974	2	0.999895
IBM	KIMBALL MUNICIPAL/ ROBERT E ARRAJ FIELD	NE	LPV	0	1	1	0.999954
LNK	LINCOLN	NE	LPV	2	0.999968	2	0.999823
MCK	MC COOK BEN NELSON RGNL	NE	LPV	0	1	1	0.999926
MLE	MILLARD	NE	LPV	2	0.999971	2	0.999805
VTN	MILLER FIELD	NE	LPV	2	0.999956	2	0.999883
AFK	NEBRASKA CITY MUNICIPAL	NE	LPV	2	0.999987	2	0.999803

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
OFK	NORFOLK RGNL/ KARL STEFAN MEMORIAL	NE	LPV	2	0.999946	2	0.999813
LBF	NORTH PLATTE RGNL AIRPORT LEE	NE	LPV	1	0.999988	1	0.999913
PMV	PLATTSMOUTH MUNICIPAL	NE	LPV	2	0.999977	2	0.999805
SCB	SCRIBNER STATE	NE	VNAV	2	0.999955	2	0.999799
OGA	SEARLE FIELD	NE	LPV	0	1	1	0.999928
SWT	SEWARD MUNICIPAL	NE	LPV	2	0.999955	2	0.999833
SNY	SIDNEY MUNICIPAL/ LLOYD W. CARR FIELD	NE	LPV	0	1	1	0.999943
ONL	THE O'NEILL MUNICIPAL- JOHN L BAKER	NE	LPV	2	0.999939	2	0.999838
AHQ	WAHOO MUNICIPAL	NE	LPV	2	0.999965	2	0.999809
LCG	WAYNE MUNICIPAL	NE	LPV	2	0.999944	2	0.999793
BFF	WESTERN NEB. RGNL/WILLIAM B. H	NE	LPV	0	1	1	0.999940
JYR	YORK MUNICIPAL	NE	LPV	2	0.999954	2	0.999848
ASH	BOIRE FIELD	NH	LPV	0	1	0	1
CON	CONCORD MUNICIPAL	NH	LPV	0	1	0	1
EEN	DILLANT-HOPKINS	NH	LPV	0	1	0	1
LCI	LACONIA MUNICIPAL	NH	LPV	0	1	0	1
MHT	MANCHESTER	NH	LPV200	0	1	0	1
PSM	PORTSMOUTH INTL AT PEASE	NH	LPV200	0	1	0	1
ACY	ATLANTIC CITY INTL	NJ	LPV200	0	1	0	1
WWD	CAPE MAY COUNTY	NJ	LPV	0	1	0	1
MIV	MILLVILLE MUNICIPAL	NJ	LPV	0	1	0	1
EWR	NEWARK LIBERTY INTL	NJ	LPV	0	1	0	1
TEB	TETERBORO	NJ	LPV	0	1	0	1
ABQ	ALBUQUERQUE INTL SUNPORT	NM	LPV	1	0.999965	5	0.999659
CVN	CLOVIS MUNICIPAL	NM	LPV	2	0.999866	4	0.999612
AEG	DOUBLE EAGLE II	NM	VNAV	1	0.999968	5	0.999672
FMN	FOUR CORNERS RGNL	NM	LPV200	1	0.999994	3	0.999703
SVC	GRANT COUNTY	NM	LPV	0	1	6	0.999705
LRU	LAS CRUCES INTL	NM	VNAV	1	0.999985	7	0.999745
ROW	ROSWELL INTL AIR CENTER	NM	LPV	1	0.999926	6	0.999627
LAS	MC CARRAN INTL	NV	LPV	0	1	3	0.999968
RTS	RENO/STEAD	NV	LPV	2	0.999957	33	0.999320
RNO	RENO/TAHOE INTL	NV	LPV	2	0.999967	35	0.999353
WMC	WINNEMUCCA MUNICIPAL	NV	LPV	0	1	4	0.999771
9G3	AKRON	NY	LPV	0	1	0	1
ALB	ALBANY INTL	NY	LPV	0	1	0	1
HWV	BROOKHAVEN	NY	LPV	0	1	0	1
BUF	BUFFALO NIAGARA INTL	NY	LPV	0	1	0	1
OLE	CATTARAUGUS COUNTY-OLEAN	NY	LPV	0	1	0	1
JHW	CHAUTAUQUA COUNTY/JAMESTOWN	NY	LPV200	0	1	0	1
ELM	ELMIRA/CORNING RGNL	NY	VNAV	0	1	0	1
FOK	FRANCIS S GABRESKI	NY	LPV	0	1	0	1
BGM	GREATER BINGHAMTON	NY	LPV200	0	1	0	1
ROC	GREATER ROCHESTER INTL	NY	LPV200	0	1	0	1
JFK	JOHN F KENNEDY INTL	NY	LPV	0	1	0	1
LGA	LA GUARDIA	NY	LPV	0	1	0	1
MSS	MASSENA INTL-RICHARDS FIELD	NY	LPV	0	1	0	1
N66	ONEONTA MUNICIPAL	NY	LPV	0	1	0	1
PEO	PENN YAN	NY	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
PBG	PLATTSBURGH INTL	NY	LPV	0	1	0	1
44N	SKY ACRES	NY	LPV	0	1	0	1
SWF	STEWART INTL	NY	LPV200	0	1	0	1
SYR	SYRACUSE HANCOCK INTL	NY	LPV200	0	1	0	1
ELZ	WELLSVILLE MUNICIPAL ARPT`TARANTINE	NY	LPV	0	1	0	1
HPN	WESTCHESTER COUNTY	NY	LPV	0	1	0	1
SDC	WILLIAMSON-SODUS	NY	LPV	0	1	0	1
HAO	BUTLER CO RGNL	OH	LPV	0	1	0	1
CXY	CAPITAL CITY	OH	LPV	0	1	0	1
LUK	CINCINNATI MUNICIPAL AIRPORT LUNKEN	OH	LPV	0	1	0	1
CLE	CLEVELAND-HOPKINS INTL	OH	LPV	0	1	0	1
MGY	DAYTON-WRIGHT BROTHERS	OH	LPV	0	1	0	1
DLZ	DELAWARE MUNICIPAL	OH	LPV	0	1	0	1
LHQ	FAIRFIELD COUNTY	OH	LPV	0	1	0	1
FDY	FINDLAY	OH	LPV	0	1	0	1
PMH	GREATER PORTSMOUTH RGNL	OH	LPV	0	1	0	1
I19	GREENE COUNTY-LEWIS A. JACKSON	OH	LPV	0	1	0	1
DAY	JAMES M COX DAYTON INTL	OH	LPV200	0	1	0	1
1G3	KENT STATE UNIV	OH	LPV	0	1	0	1
I68	LEBANON-WARREN COUNTY	OH	LNAV	0	1	0	1
UYF	MADISON COUNTY	OH	LPV	0	1	0	1
MNN	MARION MUNICIPAL	OH	LPV	0	1	0	1
AXV	NEIL ARMSTRONG	OH	LPV	0	1	0	1
OSU	OHIO STATE UNIVERSITY	OH	LPV200	0	1	0	1
UNI	OHIO UNIVERSITY SNYDER FIELD	OH	LPV200	0	1	0	1
CMH	PORT COLUMBUS INTL	OH	LPV200	0	1	0	1
RZT	ROSS COUNTY	OH	VNAV	0	1	0	1
TOL	TOLEDO EXPRESS	OH	LPV200	0	1	0	1
1G0	WOOD COUNTY	OH	LPV	0	1	0	1
YNG	YOUNGSTOWN-WARREN RGNL	OH	LPV	0	1	0	1
AVK	ALVA RGNL	OK	VNAV	0	1	3	0.999945
BVO	BARTLESVILLE MUNICIPAL	OK	LPV	0	1	2	0.999899
CQB	CHANDLER RGNL	OK	VNAV	0	1	1	0.999966
CHK	CHICKASHA MUNICIPAL	OK	VNAV	2	0.999877	3	0.999562
GCM	CLAREMORE RGNL	OK	LPV	0	1	2	0.999893
RCE	CLARENCE E PAGE MUNICIPAL	OK	LPV	1	0.999979	3	0.999893
1K4	DAVID JAY PERRY	OK	VNAV	1	0.999973	3	0.999892
MKO	DAVIS FIELD	OK	LPV	0	1	2	0.999929
DUA	DURANT RGNL - EAKER FIELD	OK	LPV	2	0.999922	3	0.999791
ELK	ELK CITY RGNL BUSINESS	OK	LPV	2	0.999875	3	0.999544
GMJ	GROVE MUNICIPAL	OK	LPV	0	1	2	0.999890
GOK	GUTHRIE-EDMOND RGNL	OK	LPV	0	1	2	0.999975
2O8	HINTON MUNICIPAL	OK	VNAV	2	0.999889	3	0.999553
HBR	HOBART RGNL	OK	LPV	2	0.999873	3	0.999553
MLC	MC ALESTER RGNL	OK	LPV	0	1	1	0.999964
MIO	MIAMI MUNICIPAL	OK	VNAV	0	1	2	0.999872
MDF	MOORELAND MUNICIPAL	OK	VNAV	2	0.999968	5	0.999707
OKM	OKMULGEE RGNL	OK	LPV	0	1	2	0.999942
PVJ	PAULS VALLEY MUNICIPAL	OK	LPV200	2	0.999928	3	0.999760
PNC	PONCA CITY RGNL	OK	LPV	0	1	1	0.999941

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
RVS	RICHARD LLOYD JONES JR	OK	LPV	0	1	2	0.999928
2K4	SCOTT FIELD	OK	LNAV	2	0.999867	3	0.999550
SNL	SHAWNEE RGNL	OK	LPV200	0	1	2	0.999982
SWO	STILLWATER RGNL	OK	LPV	0	1	1	0.999959
TQH	TAHLEQUAH MUNICIPAL	OK	LPV	0	1	2	0.999919
TUL	TULSA INTL	OK	LPV200	0	1	2	0.999917
OUN	UNIVERSITY OF OKLAHOMA	OK	LPV	1	0.999982	2	0.999910
OKC	WILL ROGERS WORLD	OK	LPV200	1	0.999986	3	0.999914
UAO	AURORA STATE	OR	LPV	1	0.999881	61	0.998307
BDN	BEND MUNICIPAL	OR	LPV	1	0.999947	30	0.999360
LMT	KLAMATH FALLS	OR	LPV	1	0.999958	51	0.998558
LGD	LA GRANDE/UNION COUNTY	OR	LPV	0	1	2	0.999936
EUG	MAHLON SWEET FIELD	OR	LPV200	2	0.999865	70	0.997220
MMV	MC MINNVILLE MUNICIPAL	OR	LPV	2	0.999872	71	0.997901
SLE	MCNARY FLD	OR	LPV200	2	0.999874	65	0.997942
ONP	NEWPORT MUNICIPAL	OR	VNAV	1	0.999808	82	0.996179
ONO	ONTARIO MUNICIPAL	OR	LPV	0	1	4	0.999841
PDX	PORTLAND INTL	OR	LPV200	1	0.999887	56	0.998602
AGC	ALLEGHENY COUNTY	PA	LPV	0	1	0	1
AOO	ALTOONA-BLAIR COUNTY	PA	LPV	0	1	0	1
LBE	ARNOLD PALMER RGNL	PA	LPV	0	1	0	1
BFD	BRADFORD RGNL	PA	LPV200	0	1	0	1
BTP	BUTLER COUNTY/ K W SCHOLTER FIELD	PA	LPV	0	1	0	1
MQS	CHESTER COUNTY G O CARLSON	PA	LPV	0	1	0	1
AXQ	CLARION COUNTY	PA	LPV	0	1	0	1
9D4	DECK	PA	LPV	0	1	0	1
DUJ	DUBOIS RGNL	PA	LPV200	0	1	0	1
WAY	GREENE COUNTY	PA	LPV	0	1	0	1
HZL	HAZLETON MUNICIPAL	PA	LPV	0	1	0	1
JST	JOHN MURTHA JOHNSTOWN-CAMBRIA	PA	LPV200	0	1	0	1
LNS	LANCASTER	PA	LPV	0	1	0	1
ABE	LEHIGH VALLEY INTL	PA	LPV	0	1	0	1
RVL	MIFFLIN COUNTY	PA	LPV	0	1	0	1
UCP	NEW CASTLE MUNICIPAL	PA	LPV	0	1	0	1
PNE	NORTHEAST PHILADELPHIA	PA	LPV	0	1	0	1
PHL	PHILADELPHIA INTL	PA	LPV	0	1	0	1
PIT	PITTSBURGH INTL	PA	LPV200	0	1	0	1
FWQ	ROSTRAVER	PA	LPV	0	1	0	1
2G9	SOMERSET COUNTY	PA	LPV	0	1	0	1
OYM	ST MARYS MUNICIPAL	PA	LPV	0	1	0	1
UNV	UNIVERSITY PARK	PA	LPV200	0	1	0	1
FKL	VENANGO RGNL	PA	LPV	0	1	0	1
BID	BLOCK ISLAND STATE	RI	LPV	0	1	1	0.999967
OQU	QUONSET STATE	RI	LPV	0	1	0	1
PVD	THEODORE FRANCIS GREEN STATE	RI	LPV	0	1	0	1
AIK	AIKEN MUNICIPAL	SC	LPV	0	1	0	1
AND	ANDERSON RGNL	SC	LPV200	0	1	0	1
CHS	CHARLESTON AFB/INTL	SC	LPV200	0	1	1	0.999945
JZI	CHARLESTON EXECUTIVE	SC	LPV200	0	1	1	0.999940
CAE	COLUMBIA METROPOLITAN	SC	LPV200	0	1	1	0.999984
UDG	DARLINGTON COUNTY JETPORT	SC	LPV	0	1	1	0.999946

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
GYH	DONALDSON CENTER	SC	LPV	0	1	0	1
GGE	GEORGETOWN COUNTY	SC	LPV200	0	1	1	0.999920
GSP	GREENVILLE SPARTANBURG INTL	SC	LPV200	0	1	0	1
MYR	MYRTLE BEACH INTL	SC	LPV200	0	1	1	0.999917
CEU	OCONEE COUNTY RGNL	SC	LPV	0	1	0	1
CDN	WOODWARD FIELD	SC	LPV	0	1	1	0.999966
ABR	ABERDEEN RGNL	SD	LPV200	1	0.999969	3	0.999796
BKX	BROOKINGS RGNL	SD	LPV	1	0.999973	3	0.999755
YKN	CHAN GURNEY MUNICIPAL	SD	LPV	2	0.999935	2	0.999790
HON	HURON RGNL	SD	LPV200	2	0.999910	3	0.999737
FSD	JOE FOSS FIELD	SD	VNAV	2	0.999933	2	0.999785
MHE	MITCHELL MUNICIPAL	SD	LPV	2	0.999919	2	0.999785
PIR	PIERRE RGNL	SD	LPV	2	0.999929	2	0.999832
RAP	RAPID CITY RGNL	SD	LPV200	1	0.999972	2	0.999839
ATY	WATERTOWN RGNL	SD	LPV200	1	0.999991	3	0.999737
PVE	BEECH RIVER RGNL	TN	LPV	0	1	0	1
SYI	BOMAR FIELD-SHELBYVILLE MUNICIPAL	TN	LPV	0	1	0	1
UCY	EVERETT-STEWART RGNL	TN	LPV	0	1	0	1
CHA	LOVELL FIELD	TN	LPV200	0	1	0	1
TYS	MC GHEE TYSON	TN	LPV	0	1	0	1
MEM	MEMPHIS INTL	TN	LPV200	0	1	0	1
NQA	MILLINGTON RGNL JETPORT	TN	LPV	0	1	0	1
BNA	NASHVILLE INTL	TN	LPV200	0	1	0	1
SZY	ROBERT SIBLEY	TN	LPV	0	1	0	1
TRI	TRI-CITIES RGNL TN/VA	TN	VNAV	0	1	0	1
BGF	WINCHESTER MUNICIPAL	TN	LPV	0	1	0	1
ABI	ABILENE RGNL	TX	LPV200	2	0.999872	3	0.999609
ADS	ADDISON	TX	LPV	2	0.999896	3	0.999660
ALI	ALICE INTL	TX	LPV	0	1	2	0.999938
LFK	ANGELINA COUNTY	TX	LPV	1	0.999979	2	0.999820
GKY	ARLINGTON MUNICIPAL	TX	LPV200	2	0.999896	3	0.999667
AUS	AUSTIN-BERGSTROM INTL	TX	VNAV	1	0.999966	2	0.999729
BWD	BROWNWOOD RGNL	TX	LPV	2	0.999893	3	0.999650
E30	BRUCE FIELD	TX	LPV	2	0.999883	3	0.999629
TKI	COLLIN COUNTY RGNL AT MC KINNEY	TX	LPV200	2	0.999895	3	0.999655
CRP	CORPUS CHRISTI INTL	TX	LPV200	0	1	2	0.999933
CFD	COULTER FIELD	TX	LPV	1	0.999973	2	0.999774
PRX	COX FIELD	TX	LPV	0	1	0	1
BBD	CURTIS FIELD	TX	LPV	2	0.999916	3	0.999651
RBD	DALLAS EXECUTIVE	TX	LPV	2	0.999900	3	0.999671
DAL	DALLAS LOVE FIELD	TX	LPV	2	0.999899	3	0.999664
DFW	DALLAS/FORT WORTH INTL	TX	LPV200	2	0.999896	3	0.999659
DWH	DAVID WAYNE HOOKS MEMORIAL	TX	LPV	1	0.999997	2	0.999843
LUD	DECATUR MUNICIPAL	TX	LPV	2	0.999883	3	0.999634
DRT	DEL RIO INTL	TX	LPV	1	0.999953	4	0.999812
TPL	DRAUGHON-MILLER CENTRAL TEXAS	TX	LPV200	1	0.999952	2	0.999721
GGG	EAST TEXAS RGNL	TX	LPV	2	0.999994	3	0.999986
CLL	EASTERWOOD FIELD	TX	VNAV	1	0.999976	2	0.999776
ELP	EL PASO INTL	TX	VNAV	1	0.999975	10	0.999721
AFW	FORT WORTH ALLIANCE	TX	VNAV	2	0.999891	3	0.999650
FWS	FORT WORTH SPINKS	TX	LPV	2	0.999895	3	0.999667

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
IAH	GEORGE BUSH INTERCONTINENTAL	TX	LPV	0	1	2	0.999862
PVW	HALE COUNTY	TX	LPV	2	0.999855	3	0.999555
INJ	HILLSBORO MUNICIPAL	TX	LPV	2	0.999921	3	0.999690
TME	HOUSTON EXECUTIVE	TX	LPV	1	0.999995	2	0.999841
AXH	HOUSTON-SOUTHWEST	TX	LPV	0	1	2	0.999889
ERV	KERRVILLE MUNICIPAL/ LOUIS SCHREINER	TX	LPV	1	0.999957	2	0.999765
LNC	LANCASTER RGNL	TX	LPV200	2	0.999916	3	0.999677
LRD	LAREDO INTL	TX	LPV	0	1	2	0.999942
CXO	LONE STAR EXECUTIVE	TX	LPV200	1	0.999991	2	0.999831
LBB	LUBBOCK PRESTON SMITH INTL	TX	LPV200	2	0.999851	3	0.999565
GVT	MAJORS	TX	LPV	2	0.999902	3	0.999670
5T9	MAVERICK COUNTY MEMORIAL INTL	TX	LPV	1	0.999970	3	0.999847
MFE	MC ALLEN MILLER INTL	TX	LPV	0	1	2	0.999926
HQZ	MESQUITE METRO	TX	LPV	2	0.999918	3	0.999674
MAF	MIDLAND INTL	TX	LPV	2	0.999852	3	0.999644
OSA	MOUNT PLEASANT RGNL	TX	VNAV	0	1	0	1
RAS	MUSTANG BEACH	TX	LPV	0	1	2	0.999926
BAZ	NEW BRAUNFELS MUNICIPAL	TX	LPV	1	0.999975	2	0.999765
PIL	PORT ISABEL-CAMERON COUNTY	TX	LPV	0	1	2	0.999937
AMA	RICK HUSBAND AMARILLO INTL	TX	LPV200	2	0.999862	4	0.999551
SJT	SAN ANGELO RGNL/MATHIS FIELD	TX	LPV	2	0.999884	3	0.999644
SAT	SAN ANTONIO INTL	TX	LPV200	1	0.999974	2	0.999799
HYI	SAN MARCOS MUNICIPAL	TX	VNAV	1	0.999972	2	0.999751
GLS	SCHOLES INTL AT GALVESTON	TX	LPV	0	1	2	0.999945
SPS	SHEPPARD AFB/ WICHITA FALLS MUNICIPAL	TX	VNAV	2	0.999862	3	0.999586
EBG	SOUTH TEXAS INTL AT EDINBURG	TX	LPV	0	1	2	0.999939
SGR	SUGAR LAND RGNL	TX	LPV	0	1	2	0.999870
TFP	T P MC CAMPBELL	TX	LPV	0	1	2	0.999922
TRL	TERRELL MUNICIPAL	TX	LPV	2	0.999921	3	0.999680
LBX	TEXAS GULF COAST RGNL	TX	LPV	0	1	2	0.999920
TYR	TYLER POUNDS RGNL	TX	LPV	2	0.999949	3	0.999758
HRL	VALLEY INTL	TX	VNAV	0	1	2	0.999932
IWS	WEST HOUSTON	TX	VNAV	1	0.999998	2	0.999854
HOU	WILLIAM P HOBBY	TX	LPV	0	1	2	0.999891
CDC	CEDAR CITY RGNL	UT	VNAV	0	1	1	0.999989
KNB	KANAB MUNICIPAL	UT	LNAV	0	1	3	0.999972
LGU	LOGAN-CACHE	UT	LPV	0	1	2	0.999969
OGD	OGDEN-HINCKLEY	UT	LPV	0	1	3	0.999979
PVU	PROVO MUNICIPAL	UT	LPV	0	1	1	0.999990
SLC	SALT LAKE CITY INTL	UT	VNAV	0	1	3	0.999981
DXZ	ST GEORGE MUNICIPAL	UT	LPV	0	1	0	1
MFV	ACCOMACK COUNTY	VA	LPV	0	1	0	1
MTV	BLUE RIDGE	VA	LPV	0	1	0	1
CHO	CHARLOTTESVILLE-ALBEMARLE	VA	LPV	0	1	0	1
FCI	CHESTERFIELD COUNTY	VA	LPV	0	1	0	1
CJR	CULPEPER RGNL	VA	LPV	0	1	0	1
PTB	DINWIDDIE COUNTY	VA	LPV	0	1	0	1
OFP	HANOVER COUNTY MUNICIPAL	VA	LPV	0	1	0	1
JYO	LEESBURG EXECUTIVE	VA	LPV	0	1	0	1
LNP	LONESOME PINE	VA	LPV	0	1	0	1

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
LYH	LYNCHBURG RGNL/ PRESTON GLENN FIELD	VA	LPV	0	1	0	1
HEF	MANASSAS RGNL/HARRY P. DAVIS F	VA	LPV	0	1	0	1
MKJ	MOUNTAIN EMPIRE	VA	LPV	0	1	0	1
PSK	NEW RIVER VALLEY	VA	LPV	0	1	0	1
PHF	NEWPORT NEWS/ WILLIAMSBURG INTL	VA	LPV200	0	1	0	1
ORF	NORFOLK INTL	VA	VNAV	0	1	0	1
RIC	RICHMOND INTL	VA	LPV200	0	1	0	1
RMN	STAFFORD RGNL	VA	LPV	0	1	0	1
XSA	TAPPAHANNOCK-ESSEX COUNTY	VA	LPV	0	1	0	1
BCB	VIRGINIA TECH/ MONTGOMERY EXECUTIVE	VA	LPV	0	1	0	1
IAD	WASHINGTON DULLES INTL	VA	LPV200	0	1	0	1
BTV	BURLINGTON INTL	VT	VNAV	0	1	0	1
FSO	FRANKLIN COUNTY STATE	VT	LPV	0	1	0	1
BLI	BELLINGHAM INTL	WA	LPV	1	1	13	0.999621
HQM	BOWERMAN	WA	LPV200	2	0.999904	66	0.998113
PWT	BREMERTON NATIONAL	WA	LPV	1	0.999957	36	0.999282
DEW	DEER PARK	WA	LPV	0	1	2	0.999806
FHR	FRIDAY HARBOR	WA	LPV	1	1	20	0.999541
MWH	GRANT CO INTL	WA	LPV200	0	1	2	0.999807
OLM	OLYMPIA RGNL	WA	LPV	1	0.999938	51	0.999040
PUW	PULLMAN/MOSCOW RGNL	WA	LPV	0	1	2	0.999809
RLD	RICHLAND	WA	LPV	0	1	2	0.999901
SEA	SEATTLE-TACOMA INTL	WA	LPV200	1	0.999967	34	0.999500
BVS	SKAGIT RGNL	WA	LPV	1	1	11	0.999631
PAE	SNOHOMISH COUNTY (PAINE FLD)	WA	LPV	0	1	13	0.999660
GEG	SPOKANE INTL	WA	LPV200	0	1	2	0.999808
TIW	TACOMA NARROWS	WA	LPV	1	0.999951	38	0.999327
PSC	TRI-CITIES	WA	LPV200	0	1	2	0.999901
ALW	WALLA WALLA RGNL	WA	LPV	0	1	2	0.999911
CLM	WILLIAM R FAIRCHILD INTL	WA	LPV	1	1	40	0.999184
GRB	AUSTIN STRAUBEL INTL	WI	LPV200	0	1	2	0.999905
DLL	BARABOO WISCONSIN DELLS	WI	LPV	0	1	2	0.999898
OVS	BOSCOBEL	WI	LPV	0	1	2	0.999894
CWA	CENTRAL WISCONSIN	WI	VNAV	0	1	2	0.999884
EAU	CHIPPEWA VALLEY RGNL	WI	LPV200	0	1	2	0.999869
MSN	DANE COUNTY RGNL-TRUAX FIELD	WI	VNAV	0	1	2	0.999911
UNU	DODGE COUNTY	WI	LPV	0	1	2	0.999916
SUE	DOOR COUNTY CHERRYLAND	WI	LPV	0	1	2	0.999909
EGV	EAGLE RIVER UNION	WI	LPV	0	1	2	0.999872
FLD	FOND DU LAC COUNTY	WI	LPV	0	1	2	0.999916
MKE	GENERAL MITCHELL INTL	WI	LPV200	0	1	2	0.999934
ASX	JOHN F KENNEDY MEMORIAL	WI	LPV	0	1	4	0.999611
LSE	LA CROSSE MUNICIPAL	WI	LPV	0	1	2	0.999882
MTW	MANITOWOC COUNTY	WI	LPV200	0	1	2	0.999917
MFI	MARSHFIELD MUNICIPAL	WI	LPV	0	1	2	0.999882
LUM	MENOMONIE MUNICIPAL-SCORE FIELD	WI	LPV	0	1	2	0.999868
RRL	MERRILL MUNICIPAL	WI	LPV	0	1	2	0.999877

Airport Id	Airport Name	State	Service	LPV Outages	LPV Availability	LPV 200 Outages	LPV 200 Availability
C29	MIDDLETON MUNICIPAL – MOREY FIELD	WI	LPV	0	1	2	0.999904
ATW	OUTAGAMIE COUNTY RGNL	WI	LPV200	0	1	2	0.999903
PBH	PRICE COUNTY	WI	LPV	0	1	2	0.999868
RHI	RHINELANDER-ONEIDA COUNTY	WI	LPV200	0	1	2	0.999874
RPD	RICE LAKE RGNL - CARL'S FIELD	WI	LPV	0	1	3	0.999856
HYR	SAWYER COUNTY	WI	LPV	0	1	4	0.999781
SBM	SHEBOYGAN COUNTY MEMORIAL	WI	LPV	0	1	2	0.999917
JVL	SOUTHERN WISCONSIN RGNL	WI	LPV200	0	1	2	0.999924
TKV	TOMAHAWK RGNL	WI	LPV	0	1	2	0.999874
LNR	TRI-COUNTY RGNL	WI	LPV	0	1	2	0.999897
OSH	WITTMAN RGNL	WI	LPV	0	1	2	0.999904
MRB	EASTERN WV RGNL/SHEPHERD FLD	WV	LPV	0	1	0	1
PKB	MID-OHIO VALLEY RGNL	WV	LPV	0	1	0	1
HTS	TRI-STATE/MILTON J. FERGUSON F	WV	LPV	0	1	0	1
CPR	CASPER/NATRONA COUNTY INTL	WY	LPV	0	1	2	0.999954
CYS	CHEYENNE RGNL/ JERRY OLSON FIELD	WY	LPV	0	1	3	0.999939
EVW	EVANSTON- UINTA COUNTY BURNS FIELD	WY	LPV	0	1	2	0.999992
GCC	GILLETTE-CAMPBELL COUNTY	WY	LPV	1	0.999995	2	0.999835
JAC	JACKSON HOLE	WY	LPV	0	1	3	0.999952
LAR	LARAMIE RGNL	WY	LPV	0	1	1	0.999990
RIW	RIVERTON RGNL	WY	LPV200	0	1	2	0.999983
RKS	ROCK SPRINGS- SWEETWATER COUNTY	WY	LPV200	0	1	0	1
SHR	SHERIDAN COUNTY	WY	LPV	0	1	4	0.999818
COD	YELLOWSTONE RGNL	WY	LPV	0	1	5	0.999918

10.0 WAAS DETERMINISTIC CODE NOISE AND MULTIPATH BOUNDING ANALYSIS

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

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

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

Table 10-1 CNMP Bounding Statistics

WAAS Site	WRE	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10	Jan 11	Feb 11	Mar 11
Albuquerque	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Anchorage	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Atlanta	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Barrow	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Bethel	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Billings	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Boston	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Chicago	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Cleveland	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Cold Bay	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Dallas	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Denver	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Fairbanks	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Gander	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Goose Bay	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Honolulu	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Houston	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Iqaluit	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Jacksonville	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●

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

WAAS Site	WRE	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10	Jan 11	Feb 11	Mar 11
Juneau	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Kansas City	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Kotzebue	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Los Angeles	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Memphis	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Merida	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Mexico City	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Miami	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Minneapolis	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
New York	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Oakland	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Puerto Vallarta	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Salt Lake City	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
San Jose Del Cabo	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
San Juan	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Seattle	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Tapachula	A	●	●	●	–	–	–	–	–	●	●	●	●
	B	●	●	●	–	–	–	–	–	●	●	●	●
	C	●	●	●	–	–	–	–	–	–	–	–	●
Washington, DC	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●
Winnipeg	A	●	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●	●
	C	●	●	●	●	●	●	●	●	●	●	●	●

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

11.0 WAAS REFERENCE STATION SURVEY VALIDATION

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

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

Antenna L1 phase center position surveys were preformed for the WAAS antennas using a 25 hour set of data from 23:00 on 4/1/1 to 23:59:30 on 4/2/11 for all of the WAAS receivers except Tapachula Mexico thread C (MTP-C). Tapachula C is still off line pending delivery of replacements for the lightning arrestors.

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. OPUS was exhibiting problems and manual selection of the reference sites was required for the Canadian, Mexican, Juneau, Los Angeles, and Honolulu sites. The overall RMS qualities reported by OPUS were all still less than or equal to 2.3 cm. The CSRS survey's RSSs of the reported ECEF sigma's were all less than equal to 1.6 cm. The OPUS and CSRS surveys agreed to 5 cm or better except for Houston, Iqaluit, and Goose Bay. Iqaluit was in the 5 cm to 6.8 cm range. Houston and Goose Bay were in the 5 cm to 6 cm range.

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 6.075, which will be fielded this fall 2011. The build 6.012 positions have been interpolated to 8/1/10. The build 6.075 positions have been interpolated forward to 4/1/2011.

The CSRS surveys agree with the build 6.012 positions to better than or equal to 8.6 cm (CDB1), with the expected exception of Mexico City which was 16 cm. The CSRS surveys agree with the build 6.075 positions to better or equal 8.6 cm (YYR3).

Table 11.1 lists the WAAS antenna L1 phase center positions as of 4/2/11. The positions are in IRTF05(2011) and are the CSRS estimated positions. CSRS positions are being used this quarter because of the OPUS issue mentioned above.

Figure 11.1 to 11.3 show the RSS of the ECEF difference between the 4/2/11 CSRS survey antenna phase center locations and the locations in the build 6.012 software which was fielded 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(A). The next two bars in the chart are Bethel string 2(B) and Bethel string 3(C). 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 4/2/11 CSRS survey antenna phase center locations and the locations in the build 6.075 software which will be fielded later this year.

Table 11-1 WAAS Antenna Positions (CSRS IRTF05-2011), MTP3 is Build 6.075

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
BET1	-2965385.003	-972576.619	5543892.938	60.7879159722222	-161.8417247777780	52.198
BET2	-2965385.775	-972580.343	5543891.887	60.7878965277778	-161.8416642222220	52.205
BET3	-2965388.340	-972577.473	5543891.019	60.7878806388889	-161.8417289722220	52.200
BIL1	-1416445.840	-4223577.035	4550862.186	45.8037070277778	-108.5397225000000	1112.271
BIL2	-1416449.902	-4223574.892	4550862.904	45.8037163055556	-108.5397808055560	1112.270
BIL3	-1416441.531	-4223574.295	4550866.034	45.8037567500000	-108.5396811666670	1112.264
BRW1	-1886758.871	-809058.654	6018494.487	71.2827653888889	-156.7899244166670	15.565
BRW2	-1886756.282	-809055.914	6018495.665	71.2827981388889	-156.7899662500000	15.571
BRW3	-1886755.192	-809059.694	6018495.491	71.2827935000000	-156.7898572777780	15.563
CDB1	-3484099.021	-1084748.807	5213678.678	55.1923745555556	-162.7064041666670	49.724
CDB2	-3484105.664	-1084741.596	5213675.730	55.1923284722222	-162.7065432777780	49.700
CDB3	-3484111.927	-1084734.830	5213672.987	55.1922851388889	-162.7066739444440	49.714
FAI1	-2304741.749	-1448715.275	5748843.705	64.8096305277778	-147.8473402500000	149.930
FAI2	-2304741.277	-1448706.465	5748846.100	64.8096809722222	-147.8474919444440	149.932
FAI3	-2304732.746	-1448707.401	5748849.245	64.8097475555555	-147.8473797222220	149.915
HNL1	-5508637.098	-2234493.410	2303722.161	21.3129898888889	-157.9208266111110	24.691
HNL2	-5508656.260	-2234483.726	2303686.916	21.3126470000000	-157.9209825277780	25.032
HNL3	-5508647.672	-2234497.662	2303694.009	21.3127156111111	-157.9208269444440	25.076
JNU1	-2354254.838	-2388549.648	5407043.108	58.3625748888889	-134.5857063888890	16.075
JNU2	-2354252.754	-2388565.762	5407036.941	58.3624693055556	-134.5854877777780	16.077
JNU3	-2354239.535	-2388568.613	5407041.402	58.3625457222222	-134.5852927500000	16.072
MMD1	35070.443	-5959686.694	2264365.779	20.9319092777778	-89.6628404722222	29.149
MMD2	35065.521	-5959687.060	2264364.996	20.9319015833333	-89.6628878055556	29.184
MMD3	35065.178	-5959685.267	2264369.653	20.9319466666667	-89.6628910000000	29.171
MMX1	-948701.134	-5943935.908	2109212.809	19.4316535000000	-99.0683895277778	2235.916
MMX2	-948696.703	-5943935.735	2109215.233	19.4316767500000	-99.0683481388889	2235.903
MMX3	-948705.564	-5943936.094	2109210.384	19.4316301944444	-99.0684308888889	2235.941
MPR1	-1570142.203	-5759530.632	2238184.775	20.6790034166667	-105.2492029722220	11.006
MPR2	-1570139.379	-5759530.145	2238188.824	20.6790415000000	-105.2491780555560	11.301
MPR3	-1570143.483	-5759528.023	2238190.589	20.6790595000000	-105.2492214166670	11.019
MSD1	-1979519.679	-5523223.098	2493106.778	23.1604466944444	-109.7176475277780	104.306
MSD2	-1979521.237	-5523225.438	2493100.373	23.1603838333333	-109.7176541388890	104.296
MSD3	-1979525.692	-5523222.170	2493104.043	23.1604198888889	-109.7177058611110	104.292
MTP1	-254854.343	-6162909.183	1617805.099	14.7913662500000	-92.3679990833333	54.966
MTP2	-254850.723	-6162910.217	1617801.670	14.7913342500000	-92.3679650833333	54.945
MTP3*	-254855.485	-6162910.315	1617800.118	14.7913200000	-92.3680092500	54.833
OTZ1	-2396055.977	-750356.169	5843502.549	66.8873326111111	-162.6113724444440	10.901
OTZ2	-2396052.807	-750354.341	5843504.069	66.8873674166667	-162.6113906388890	10.897
OTZ3	-2396052.786	-750358.276	5843503.582	66.8873561666667	-162.6113048055560	10.903
YFB1	1035381.502	-2634289.650	5696539.551	63.7314903333333	-68.5431824722222	10.049
YFB2	1035372.290	-2634296.056	5696538.191	63.7314640833333	-68.5434034444444	9.978
YFB3	1035366.220	-2634306.805	5696534.414	63.7313864722222	-68.5435973888889	10.035

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
YQX1	2430424.685	-3419640.395	4788223.830	48.9664897777778	-54.5976316111111	146.898
YQX2	2430432.639	-3419639.048	4788220.772	48.9664479166667	-54.5975324166667	146.895
YQX3	2430440.550	-3419637.679	4788217.772	48.9664066944444	-54.5974335277778	146.909
YWG1	-520164.318	-4083475.905	4855843.017	49.9005745000000	-97.2593968888889	222.056
YWG2	-520150.453	-4083468.845	4855850.392	49.9006774166667	-97.2592178611111	222.057
YWG3	-520152.317	-4083477.964	4855842.572	49.9005683055556	-97.2592275555556	222.055
YYR1	1885341.471	-3321428.365	5091171.657	53.3086469166667	-60.4194677222222	37.863
YYR2	1885344.430	-3321419.887	5091176.073	53.3087132222222	-60.4193663333333	37.873
YYR3	1885340.148	-3321413.071	5091182.076	53.3088033888889	-60.4193717222222	37.881
ZAB1	-1488636.802	-5003946.561	3654557.725	35.1735754722222	-106.5673492777780	1620.143
ZAB2	-1488631.470	-5003948.237	3654557.703	35.1735748611111	-106.5672879444440	1620.200
ZAB3	-1488632.244	-5003950.829	3654553.847	35.1735324166667	-106.5672879722220	1620.190
ZAN1	-2659536.593	-1549114.797	5567750.777	61.2292021388889	-149.7802499722220	80.696
ZAN2	-2659548.351	-1549110.842	5567746.290	61.2291185000000	-149.7804237500000	80.695
ZAN3	-2659541.300	-1549106.716	5567750.764	61.2292020833333	-149.7804240555560	80.685
ZAU1	138704.169	-4761244.152	4227763.943	41.7826580555556	-88.3313360555556	195.905
ZAU2	138704.421	-4761248.775	4227758.790	41.7825956944444	-88.3313346388889	195.922
ZAU3	138711.132	-4761248.513	4227758.871	41.7825966388889	-88.3312538611111	195.927
ZBW1	1490299.281	-4448983.187	4306010.502	42.7357203333333	-71.4804252222222	39.144
ZBW2	1490304.384	-4448981.170	4306010.847	42.7357243888889	-71.4803583055556	39.164
ZBW3	1490306.096	-4448984.798	4306006.532	42.7356715277778	-71.4803525555556	39.162
ZDC1	1069125.816	-4839599.003	4001126.516	39.1015958055556	-77.5427459722222	80.090
ZDC2	1069128.210	-4839603.634	4001120.311	39.1015238055556	-77.5427305000000	80.087
ZDC3	1069124.105	-4839602.730	4001122.505	39.1015491944444	-77.5427745833333	80.098
ZDV1	-1273628.572	-4711375.598	4094890.143	40.1873034166667	-105.1272238333330	1541.386
ZDV2	-1273622.873	-4711377.109	4094890.159	40.1873036944444	-105.1271546111110	1541.374
ZDV3	-1273624.883	-4711380.311	4094885.867	40.1872531666667	-105.1271675833330	1541.366
ZFW1	-659983.158	-5324060.814	3438276.502	32.8306498055556	-97.0664713055556	155.662
ZFW2	-659988.422	-5324063.365	3438271.500	32.8305963611111	-97.0665237500000	155.622
ZFW3	-659983.456	-5324063.893	3438271.711	32.8305983888889	-97.0664704166667	155.663
ZHU1	-513864.435	-5506451.746	3166720.503	29.9618964166667	-95.3314258611111	10.897
ZHU2	-513867.078	-5506455.136	3166714.337	29.9618319166667	-95.3314498611111	10.954
ZHU3	-513873.360	-5506457.779	3166708.737	29.9617736666667	-95.3315121111111	10.943
ZJX1	772646.489	-5434462.204	3237231.753	30.6988596388889	-81.9081846666667	2.160
ZJX2	772649.824	-5434463.766	3237228.359	30.6988240277778	-81.9081525000000	2.160
ZJX3	772645.756	-5434466.201	3237225.252	30.6987914722222	-81.9081981111111	2.155
ZKC1	-415247.465	-4954556.409	3982161.138	38.8801594722222	-94.7908332222222	305.924
ZKC2	-415231.074	-4954557.727	3982161.192	38.8801601666667	-94.7906437222222	305.914
ZKC3	-415237.199	-4954561.078	3982155.997	38.8801019722222	-94.7907108333333	305.651
ZLA1	-2474409.887	-4637294.701	3602183.527	34.6035181388889	-118.0838946388890	763.526
ZLA2	-2474404.606	-4637297.503	3602183.532	34.6035182500000	-118.0838294722220	763.518
ZLA3	-2474411.214	-4637297.182	3602179.549	34.6034742222222	-118.0838946666670	763.584
ZLC1	-1808273.177	-4486410.850	4145303.059	40.7860435000000	-111.9521770277780	1287.467
ZLC2	-1808274.577	-4486414.461	4145298.564	40.7859900833333	-111.9521764166670	1287.463

WRE	X(m)	Y(m)	Z(m)	Latitude	Longitude	H(m)
ZLC3	-1808270.358	-4486416.158	4145298.554	40.7859900277778	-111.9521225555560	1287.454
ZMA1	966042.335	-5662999.834	2761581.514	25.8246122500000	-80.3191894722222	-7.567
ZMA2	966029.360	-5662999.136	2761585.998	25.8246599722222	-80.3193158611111	-8.196
ZMA3	966037.441	-5662997.975	2761586.352	25.8246620000000	-80.3192344722222	-7.849
ZME1	4070.939	-5226189.308	3644028.438	35.0673941666667	-89.9553694722222	68.621
ZME2	4070.965	-5226186.756	3644032.547	35.0674376944445	-89.9553691666667	68.892
ZME3	4064.775	-5226186.631	3644032.708	35.0674395555556	-89.9554370277778	68.879
ZMP1	-249978.331	-4539297.521	4458955.081	44.6374633333333	-93.1520848333333	262.688
ZMP2	-249972.533	-4539297.861	4458955.079	44.6374631944444	-93.1520116388889	262.701
ZMP3	-249973.632	-4539302.138	4458950.602	44.6374071388889	-93.1520225000000	262.638
ZNY1	1406144.690	-4627343.999	4144322.063	40.7843284444444	-73.0971651111111	6.477
ZNY2	1406146.484	-4627347.030	4144317.282	40.7842757222222	-73.0971552222222	5.945
ZNY3	1406140.928	-4627348.690	4144317.325	40.7842761666667	-73.0972239166667	5.952
ZOA1	-2684436.814	-4293337.477	3865351.845	37.5430535833333	-122.0159468055560	-3.488
ZOA2	-2684433.808	-4293341.569	3865349.418	37.5430259444444	-122.0158934166670	-3.480
ZOA3	-2684438.181	-4293342.437	3865345.564	37.5429816388889	-122.0159301666670	-3.406
ZOB1	650770.233	-4754715.683	4187420.765	41.2971544444444	-82.2064441666667	223.704
ZOB2	650777.909	-4754714.857	4187422.779	41.2971667500000	-82.2063520277778	225.201
ZOB3	650776.241	-4754719.686	4187414.994	41.2970870000000	-82.2063795833333	223.488
ZSE1	-2308930.239	-3668169.689	4663526.501	47.2869934444444	-122.1883723888890	82.113
ZSE2	-2308934.633	-3668175.233	4663520.096	47.2869078888889	-122.1883825000000	82.177
ZSE3	-2308935.692	-3668179.507	4663516.153	47.2868561944444	-122.1883642500000	82.116
ZSU1	2462589.391	-5529371.555	2003724.634	18.4313386666667	-65.9934750000000	-28.556
ZSU2	2462587.308	-5529377.310	2003711.636	18.4312146666667	-65.9935151666667	-28.482
ZSU3	2462593.952	-5529375.096	2003709.578	18.4311950833333	-65.9934491944445	-28.487
ZTL1	529840.447	-5305248.822	3489342.863	33.3796886111111	-84.2967255555556	261.156
ZTL2	529846.827	-5305247.989	3489343.152	33.3796917500000	-84.2966564444444	261.152
ZTL3	529847.513	-5305251.425	3489337.919	33.3796350555556	-84.2966527777778	261.185

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

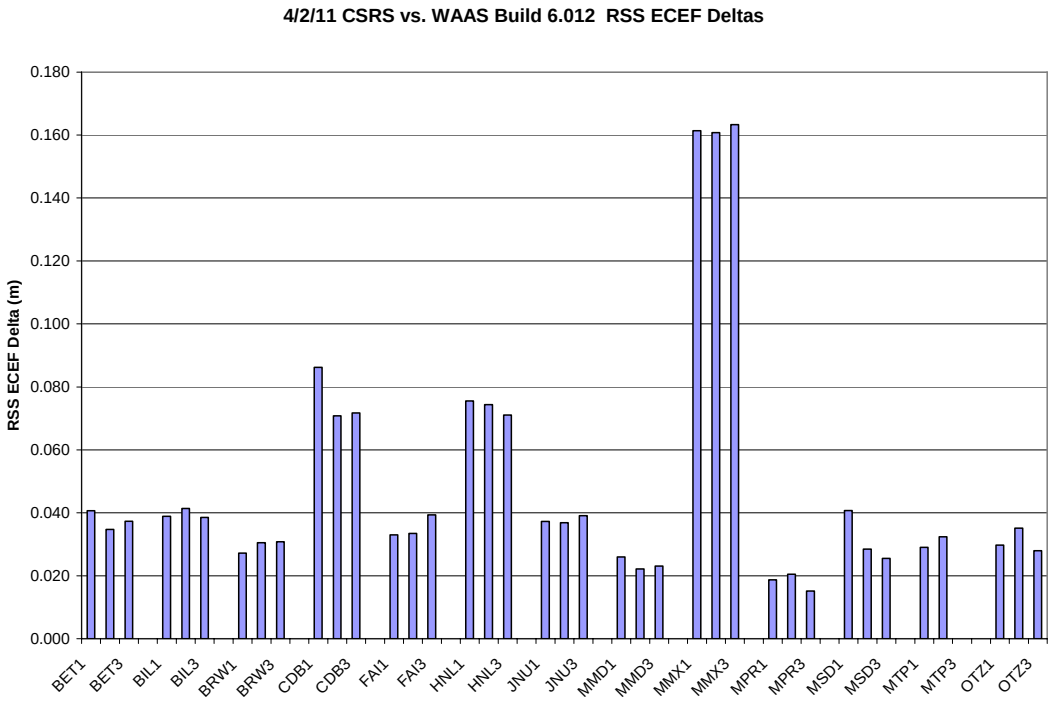


Figure 11-2 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

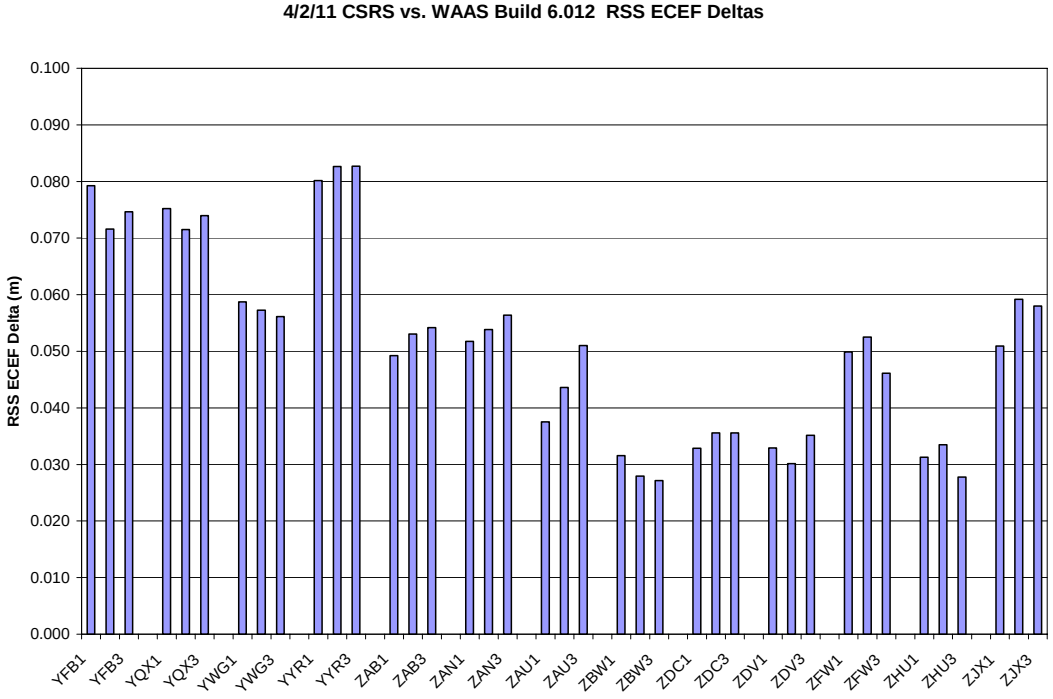


Figure 11-3 WAAS Build 6.012 Antenna Positions Deltas from OPUS Survey

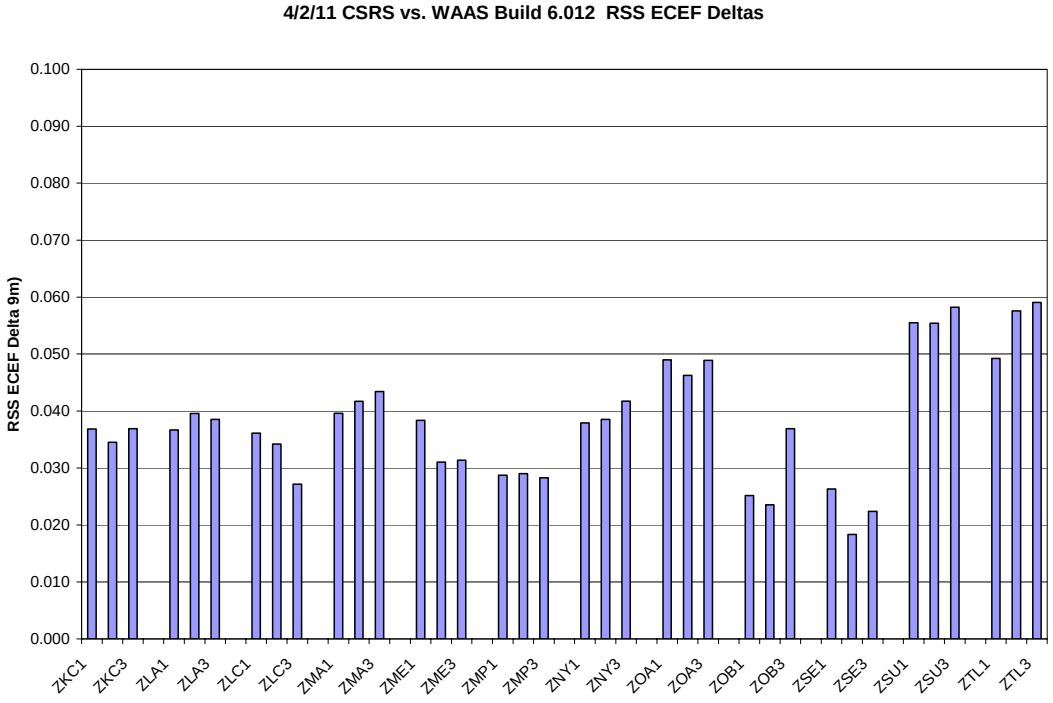


Figure 11-4 OPUS Overall RMS Qualitites

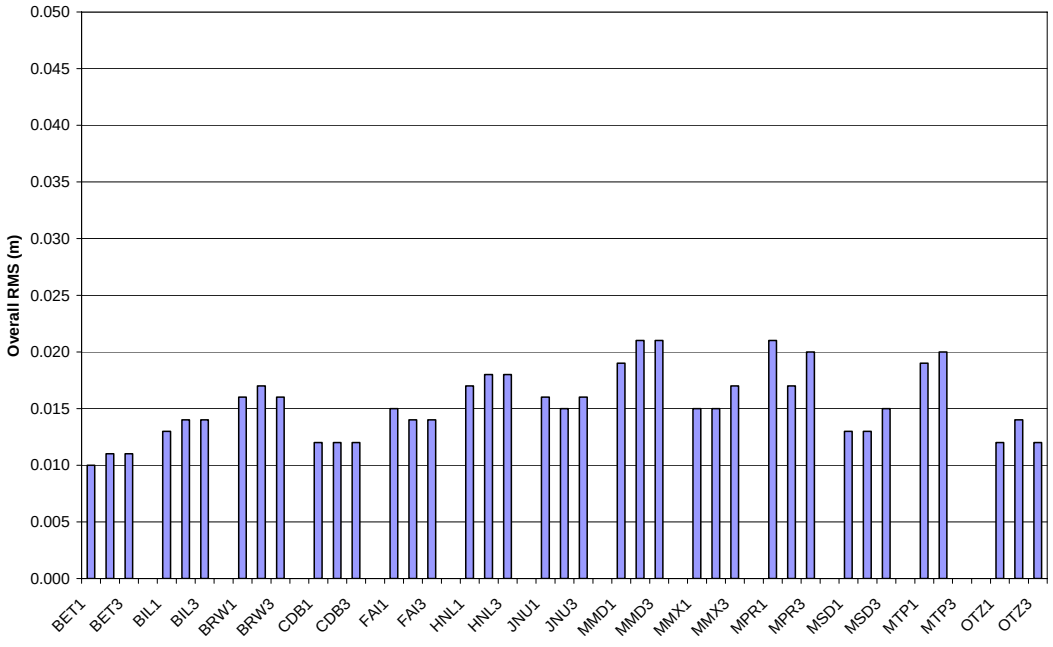


Figure 11-5 OPUS Survey Overall RMS Qualities

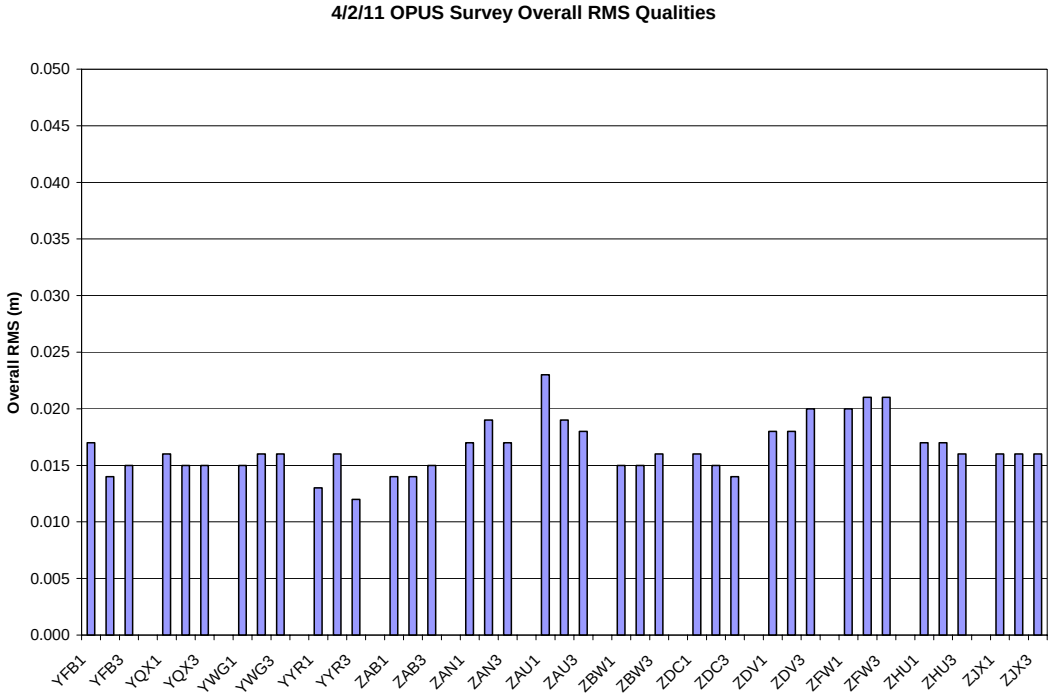


Figure 11-6 OPUS Survey Overall RMS Qualities

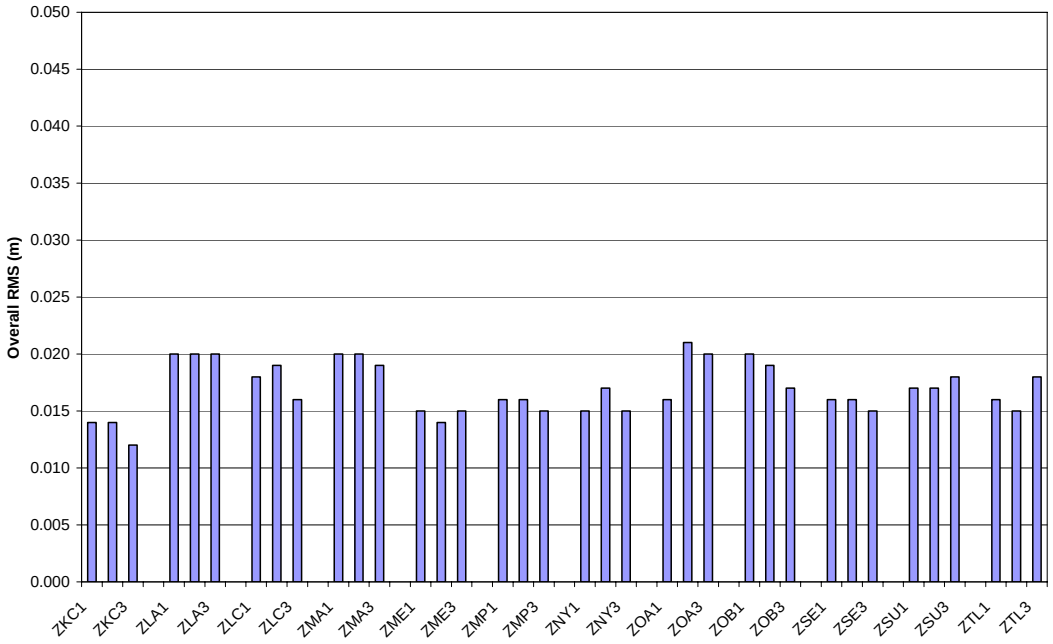


Figure 11-7 OPUS vs. CSRS RSS ECEF Deltas

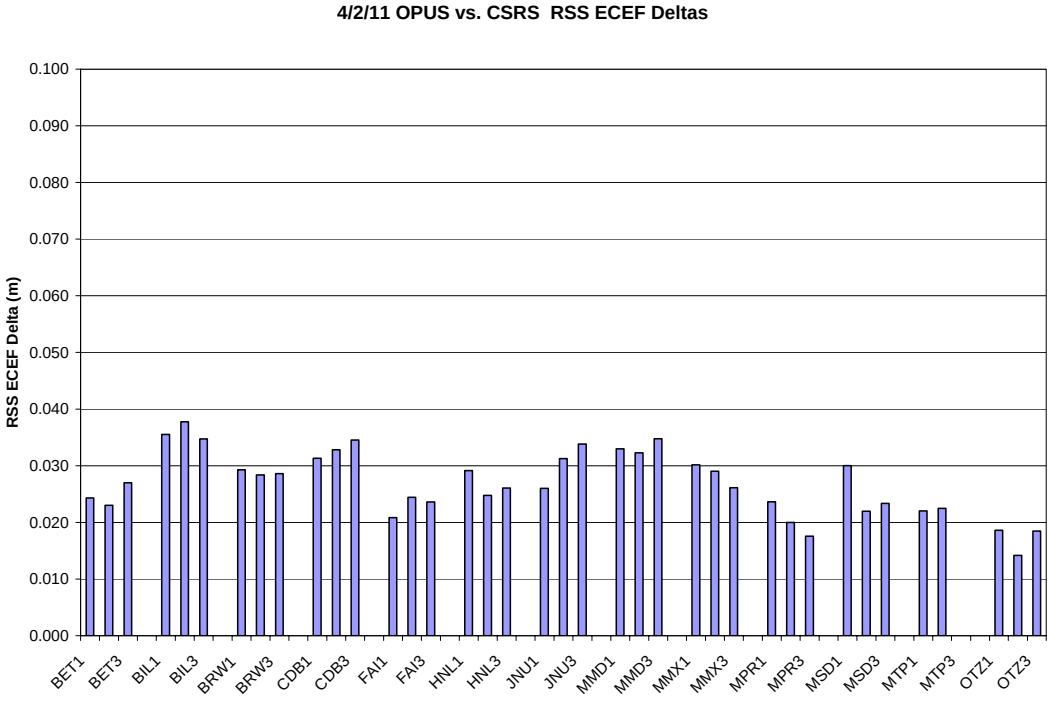


Figure 11-8 OPUS vs. CSRS RSS ECEF Deltas

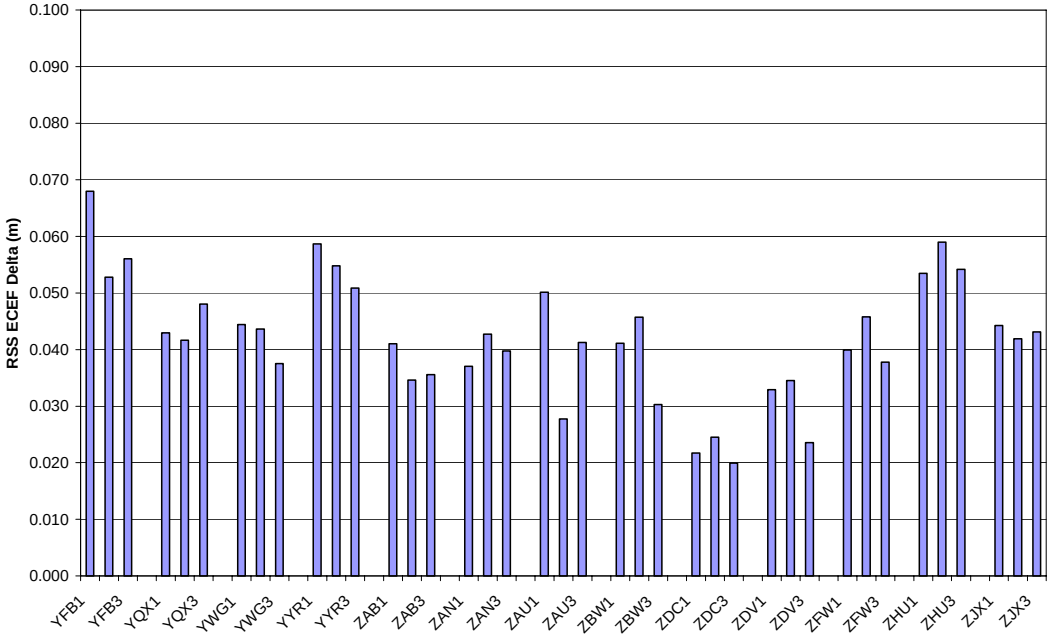


Figure 11-9 OPUS vs. CSRS RSS ECEF Deltas

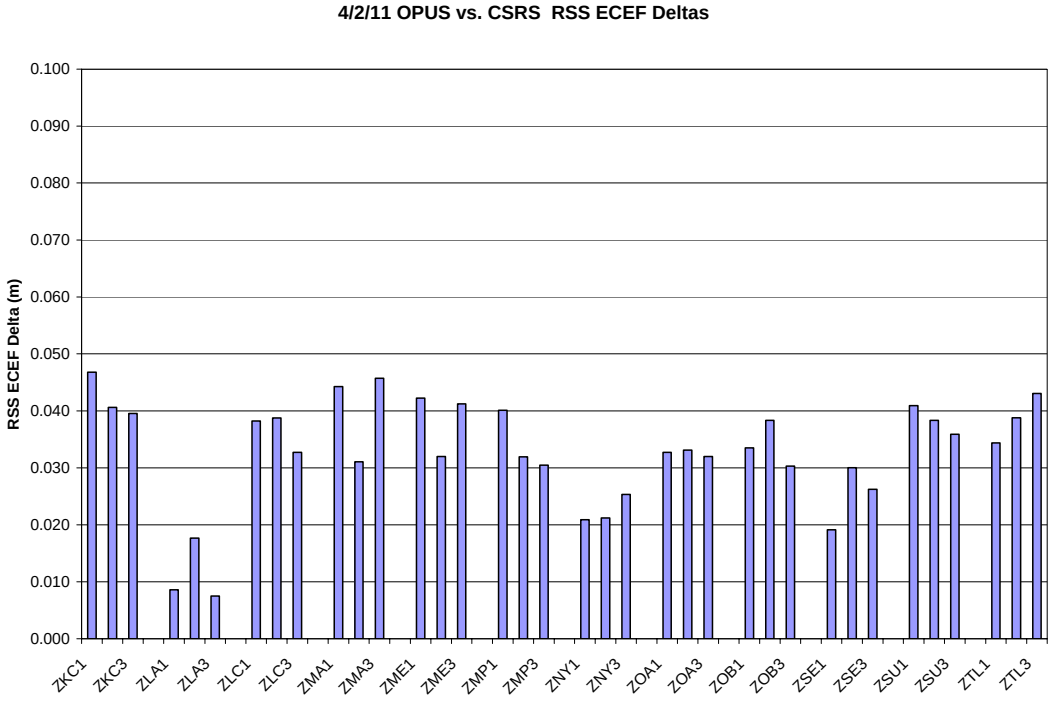


Figure 11-10 CSRS Survey Qualities

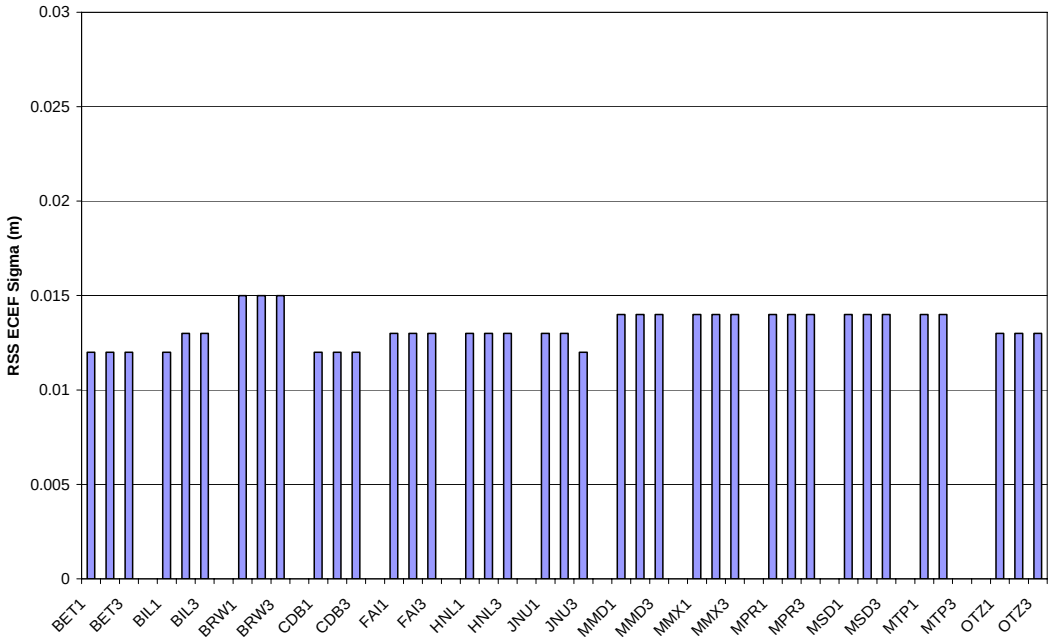


Figure 11-11 CSRS Survey Qualities

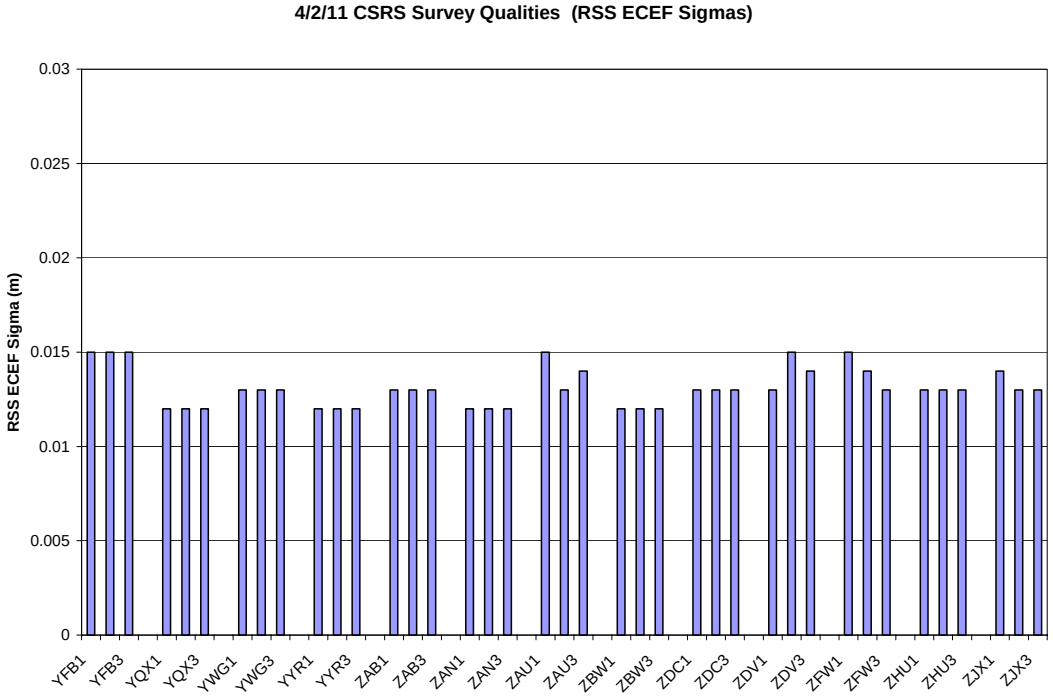


Figure 11-12 CSRS Survey Qualities

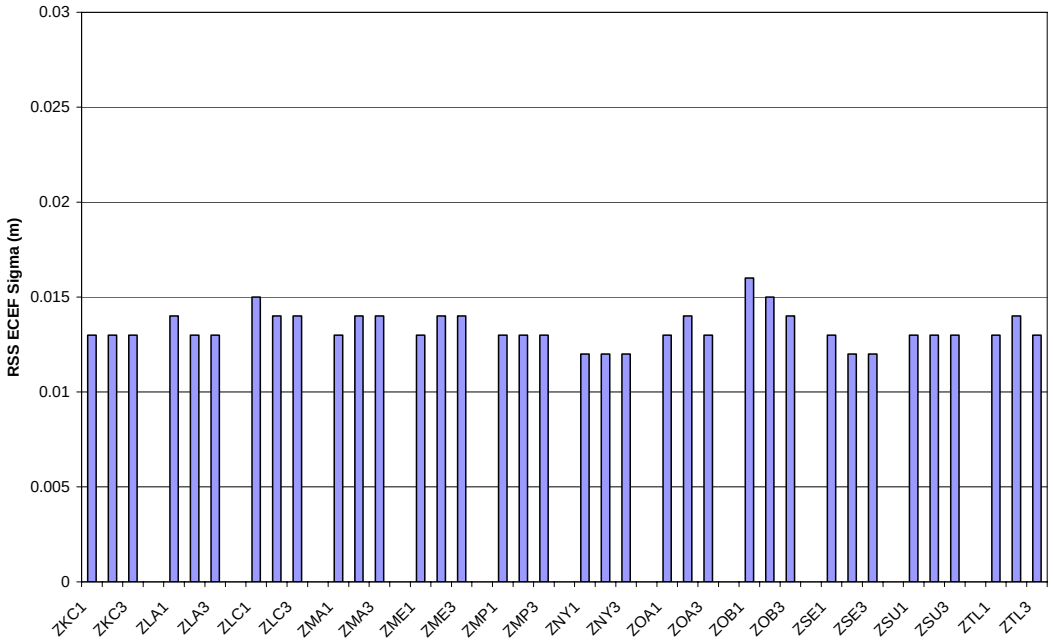


Figure 11-13 WAAS Build 6.071Antenna Positions Deltas from OPUS Survey

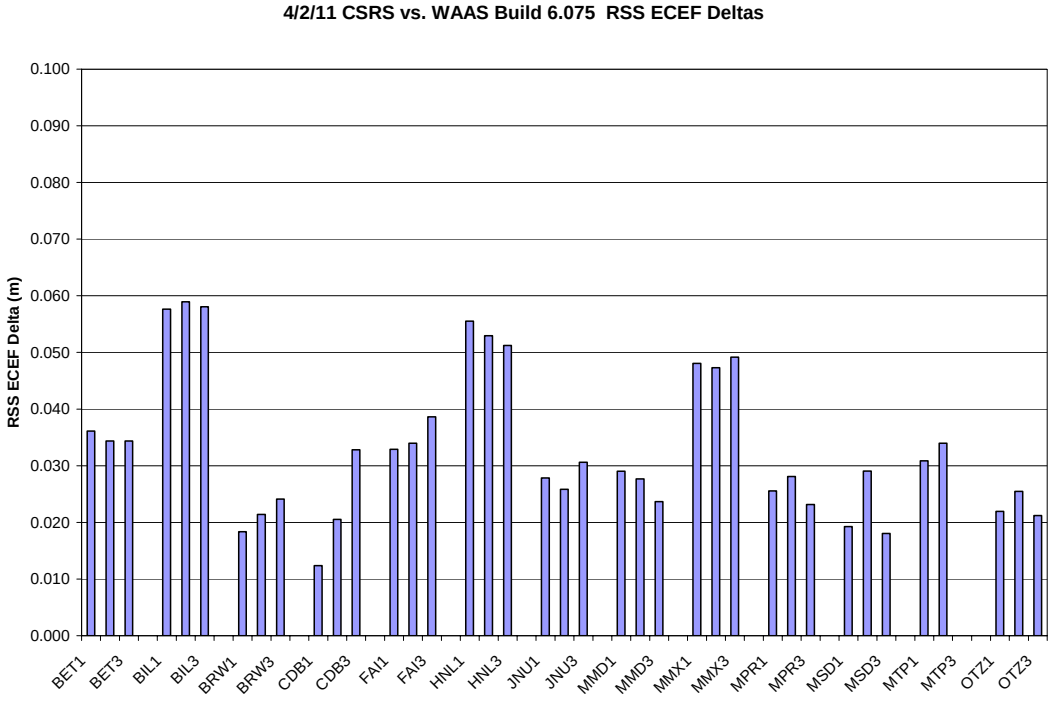


Figure 11-14 WAAS Build 6.071Antenna Positions Deltas from OPUS Survey

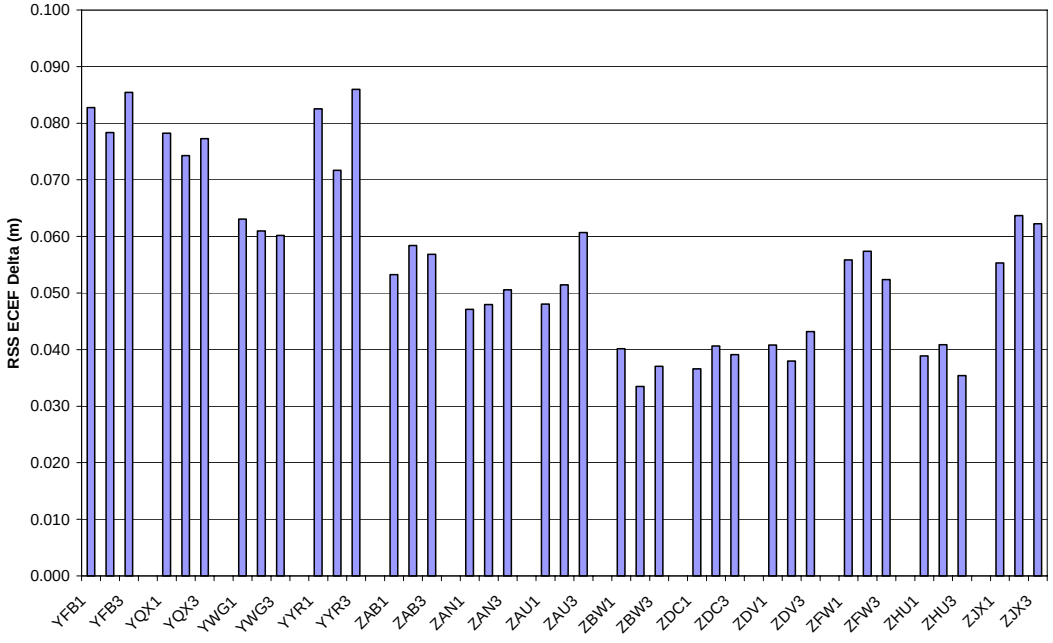
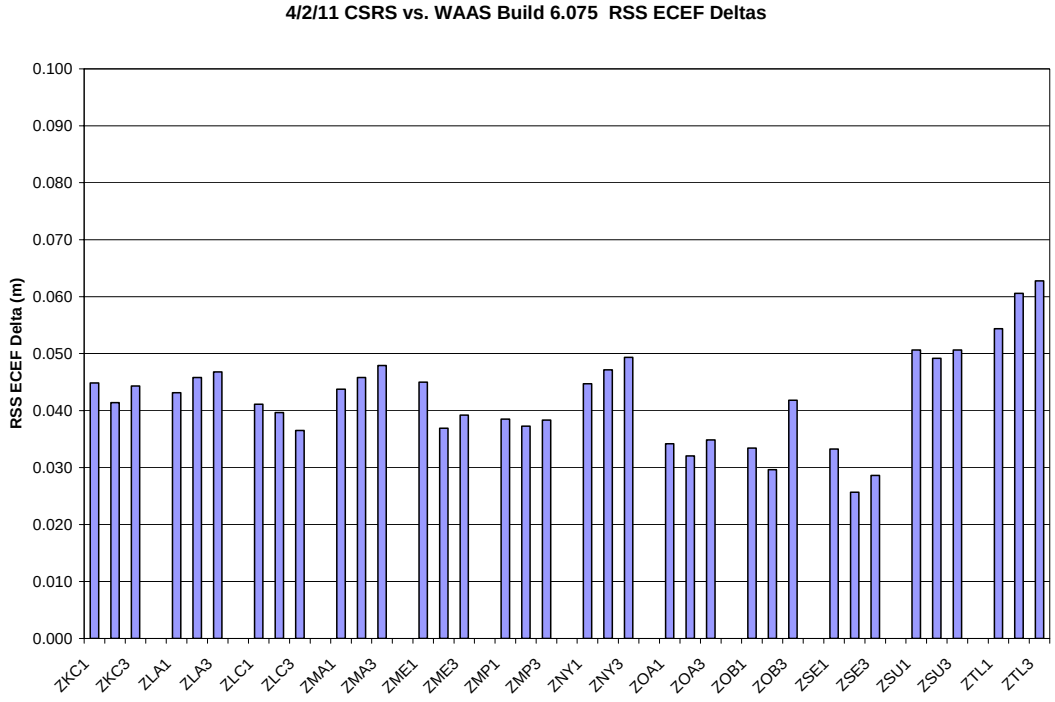


Figure 11-15 WAAS Build 6.071Antenna Positions Deltas from OPUS Survey



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.

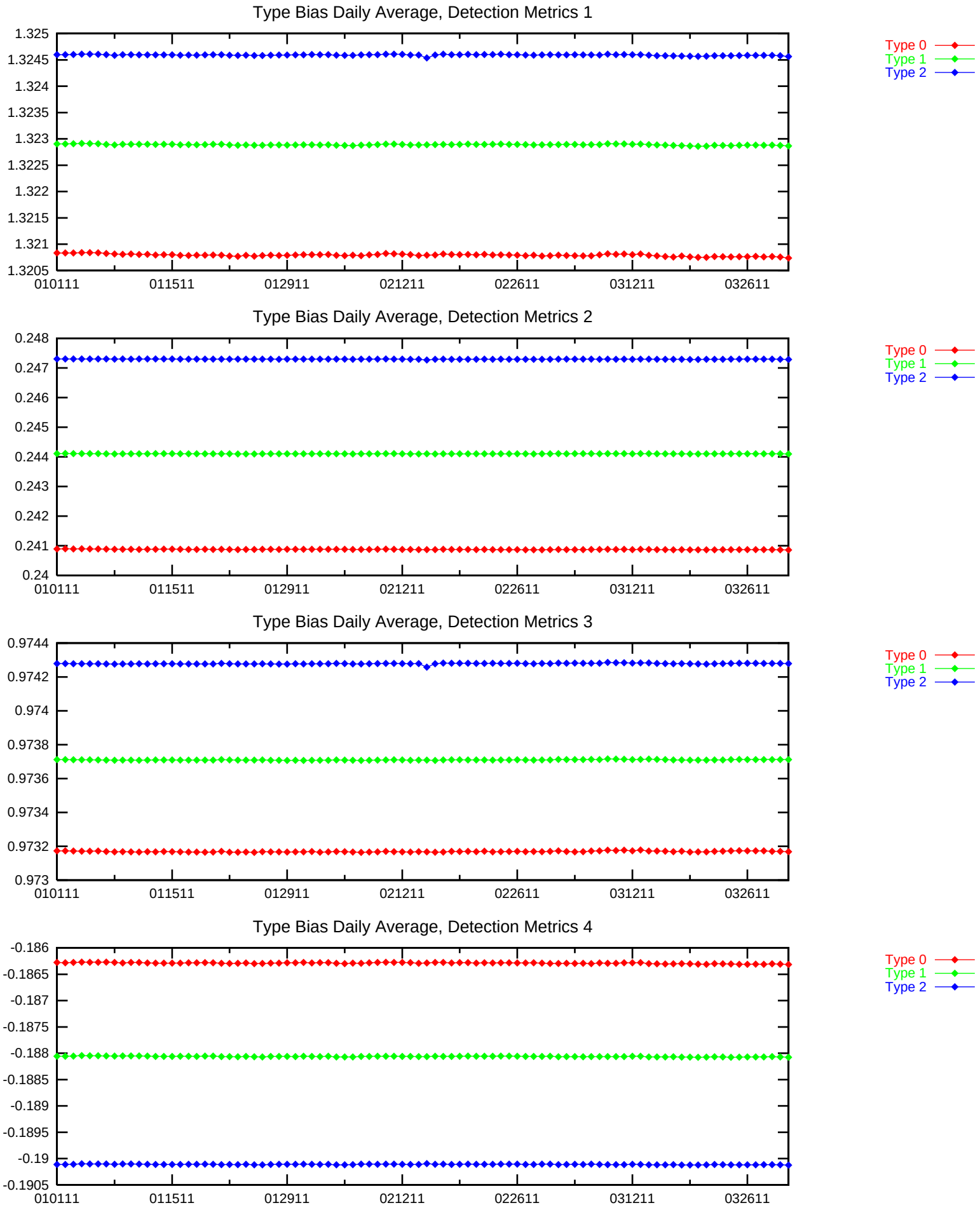
Table 12-2 Type Bias Average for the Quarter

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.32079	1.32289	1.32459
DM 2	0.240875	0.244104	0.247295
DM 3	0.973169	0.97371	0.974279
DM 4	-0.186289	-0.188062	-0.19011

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

Detection Metric	Type 0	Type 1	Type 2
DM 1	1.3210300	1.3229200	1.3246200
DM 2	0.2408400	0.2441090	0.2472840
DM 3	0.9731770	0.9737140	0.9742770
DM 4	-0.1861400	-0.1880540	-0.1900850

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 0.00098895. The maximum average for DM2 is PRN 25 at 0.00018649. The maximum average for DM3 is PRN 10 at 0.00027044 and the maximum average for DM4 is PRN 23 at 0.00042049.

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. PRN 10 bias shifted slightly since coming back from maintenance on 1/28/11.

Table 12-4 PRN Bias Average for the Quarter

PRN	DM1	DM2	DM3	DM4
2	0.00022451	0.00005699	0.00002988	0.00010113
3	0.00021605	0.00006110	0.00010217	0.00035635
4	0.00020174	0.00004604	0.00006550	0.00012794
5	0.00014928	0.00012947	0.00006028	0.00010437
6	0.00019234	0.00006617	0.00005606	0.00011667
7	0.00015658	0.00009321	0.00003408	0.00013146
8	0.00018657	0.00013544	0.00004270	0.00011523
9	0.00017659	0.00005300	0.00006313	0.00010408
10	0.00071290	0.00005655	0.00027014	0.00010947
11	0.00091674	0.00018551	0.00005798	0.00026225
12	0.00017734	0.00008354	0.00009908	0.00007894
13	0.00053115	0.00005677	0.00006930	0.00015308
14	0.00065742	0.00011166	0.00011359	0.00012847
15	0.00014012	0.00006548	0.00002762	0.00014366
16	0.00017055	0.00007702	0.00011831	0.00034677
17	0.00018530	0.00007144	0.00004490	0.00014114
18	0.00064726	0.00010532	0.00004635	0.00023903
19	0.00041018	0.00014563	0.00004413	0.00010056
20	0.00015540	0.00005337	0.00003747	0.00016401
21	0.00057175	0.00016925	0.00019992	0.00010929
22	0.00044422	0.00006382	0.00008845	0.00036957
23	0.00098895	0.00015727	0.00003972	0.00042049
24	0.00027083	0.00005791	0.00003520	0.00011530
25	0.00034713	0.00018649	0.00009156	0.00012526
26	0.00027531	0.00008474	0.00014564	0.00010030
27	0.00045707	0.00009001	0.00005821	0.00033668
28	0.00027767	0.00006154	0.00003609	0.00010744
29	0.00024642	0.00006978	0.00010055	0.00029102
30	0.00032985	0.00008893	0.00002673	0.00012238
31	0.00042273	0.00015344	0.00003731	0.00025789
32	0.00021215	0.00005768	0.00009972	0.00009161

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	0.00018525	0.00005703	0.00002342	0.00009293
3	0.00021844	0.00005614	0.00008997	0.00035407
4	0.00023732	0.00004479	0.00007318	0.00013265
5	0.00025952	0.00010696	0.00008547	0.00012101
6	0.00015951	0.00005660	0.00004642	0.00012564
7	0.00013365	0.00009020	0.00003539	0.00012216
8	0.00016229	0.00012600	0.00004420	0.00010151
9	0.00021866	0.00005375	0.00006764	0.00011132
10	0.00066398	0.00006702	0.00026701	0.00009500
11	0.00090100	0.00018317	0.00005717	0.00023610
12	0.00023054	0.00008706	0.00010479	0.00008093
13	0.00051161	0.00005522	0.00006079	0.00015636
14	0.00064634	0.00012020	0.00011249	0.00012244
15	0.00012210	0.00006821	0.00002757	0.00013280
16	0.00016494	0.00007388	0.00011048	0.00034258
17	0.00013055	0.00007651	0.00003493	0.00012163
18	0.00061205	0.00010341	0.00004106	0.00021389
19	0.00038017	0.00013570	0.00003576	0.00008378
20	0.00015974	0.00004804	0.00003948	0.00013463
21	0.00061502	0.00018588	0.00020201	0.00008983
22	0.00018007	0.00008920	0.00010013	0.00013536
23	0.00095471	0.00014450	0.00003518	0.00042054
24	0.00030331	0.00004865	0.00003565	0.00010709
25	0.00020670	0.00013111	0.00008323	0.00025814
26	0.00027164	0.00008929	0.00015184	0.00008906
27	0.00047921	0.00008201	0.00006446	0.00032996
28	0.00024426	0.00005401	0.00003323	0.00009074
29	0.00022390	0.00006621	0.00010551	0.00028806
30	0.00029947	0.00009466	0.00002785	0.00011623
31	0.00046769	0.00015691	0.00003833	0.00025624
32	0.00029253	0.00004898	0.00011014	0.00009942

Figure 12-2 PRN Bias Average for the Quarter

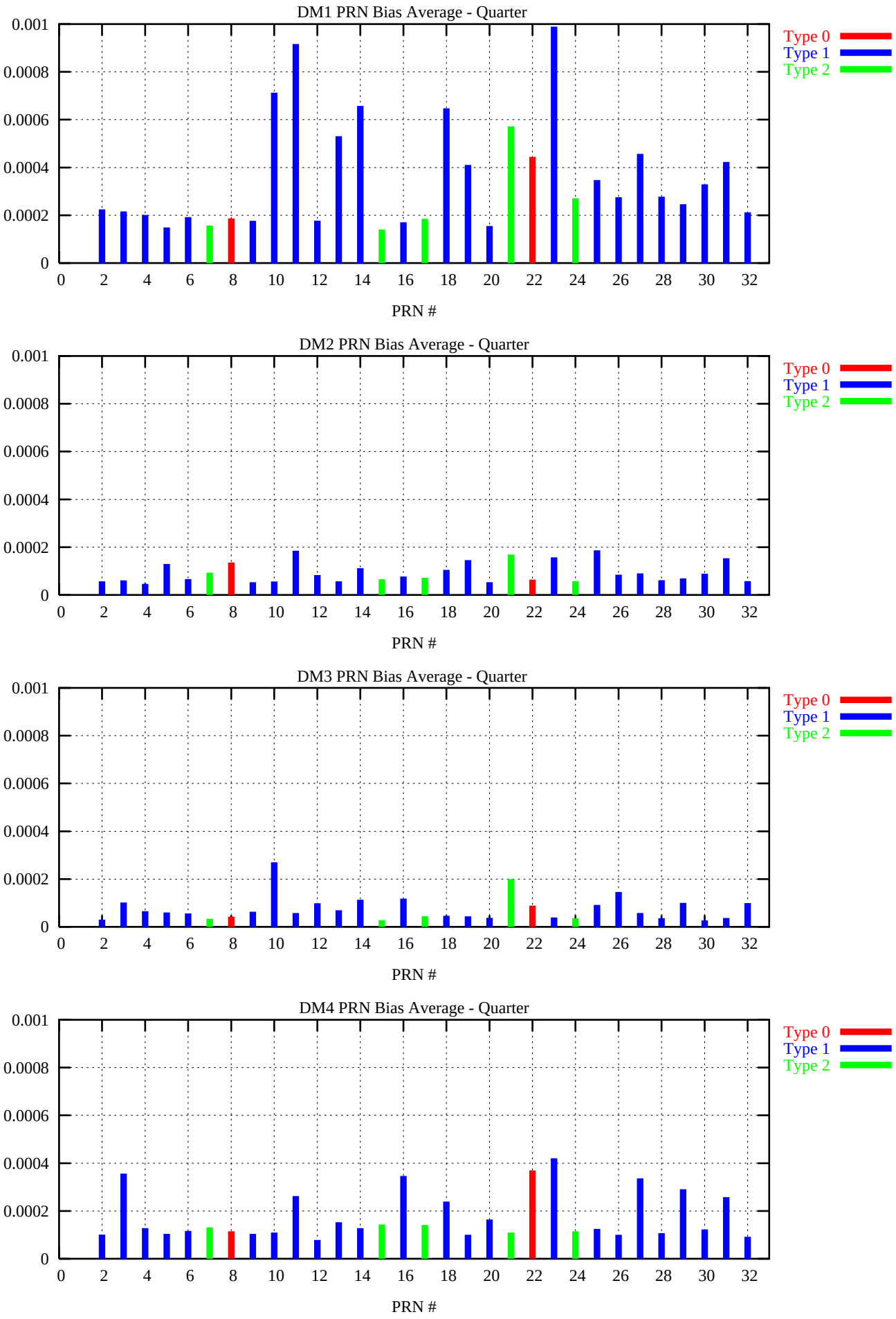


Figure 12-3 PRN Bias Average Trend (PRN 1 - PRN 4)

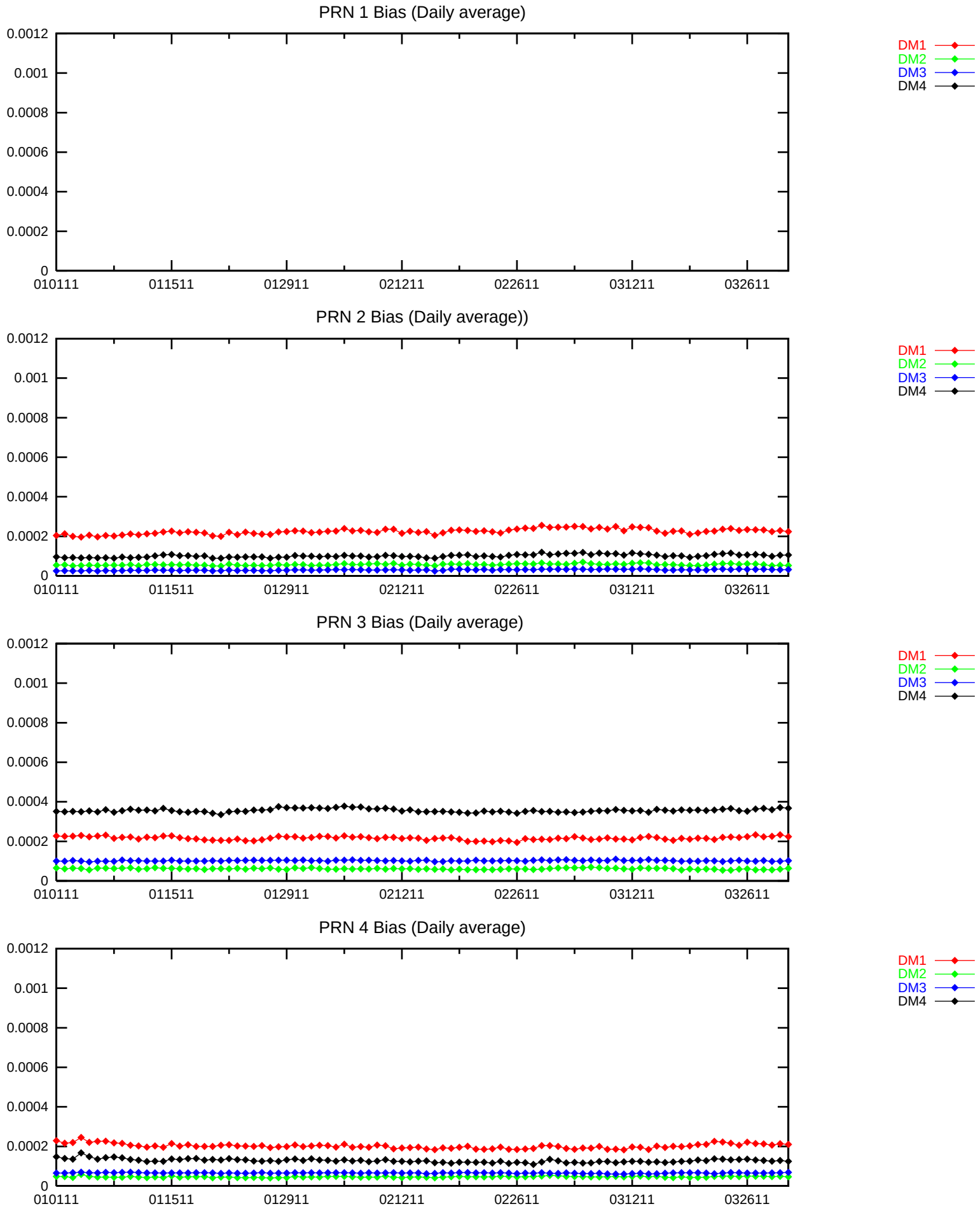


Figure 12-4 PRN Bias Average Trend (PRN 5 - PRN 8)

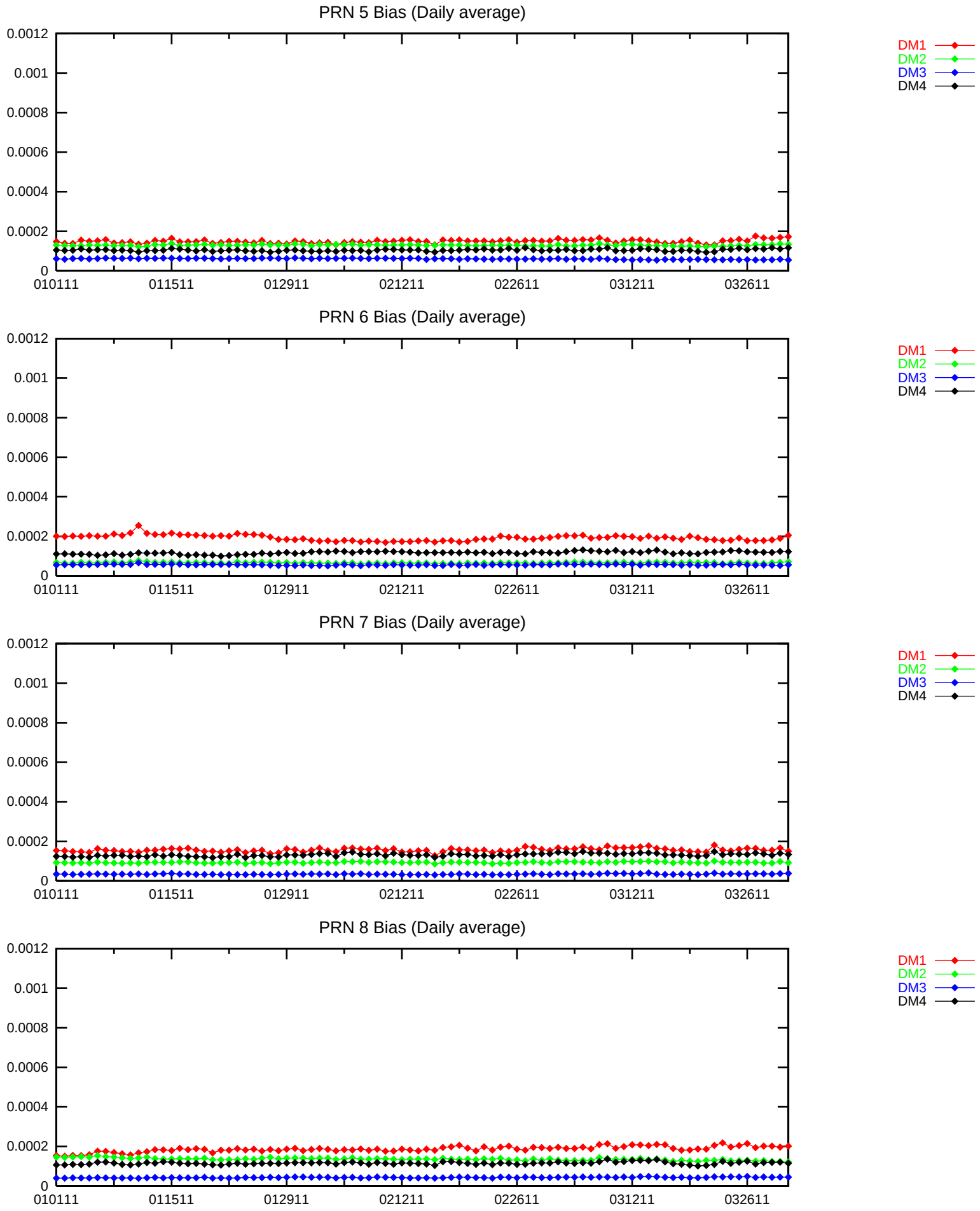


Figure 12-5 PRN Bias Average Trend (PRN 9 - PRN 12)

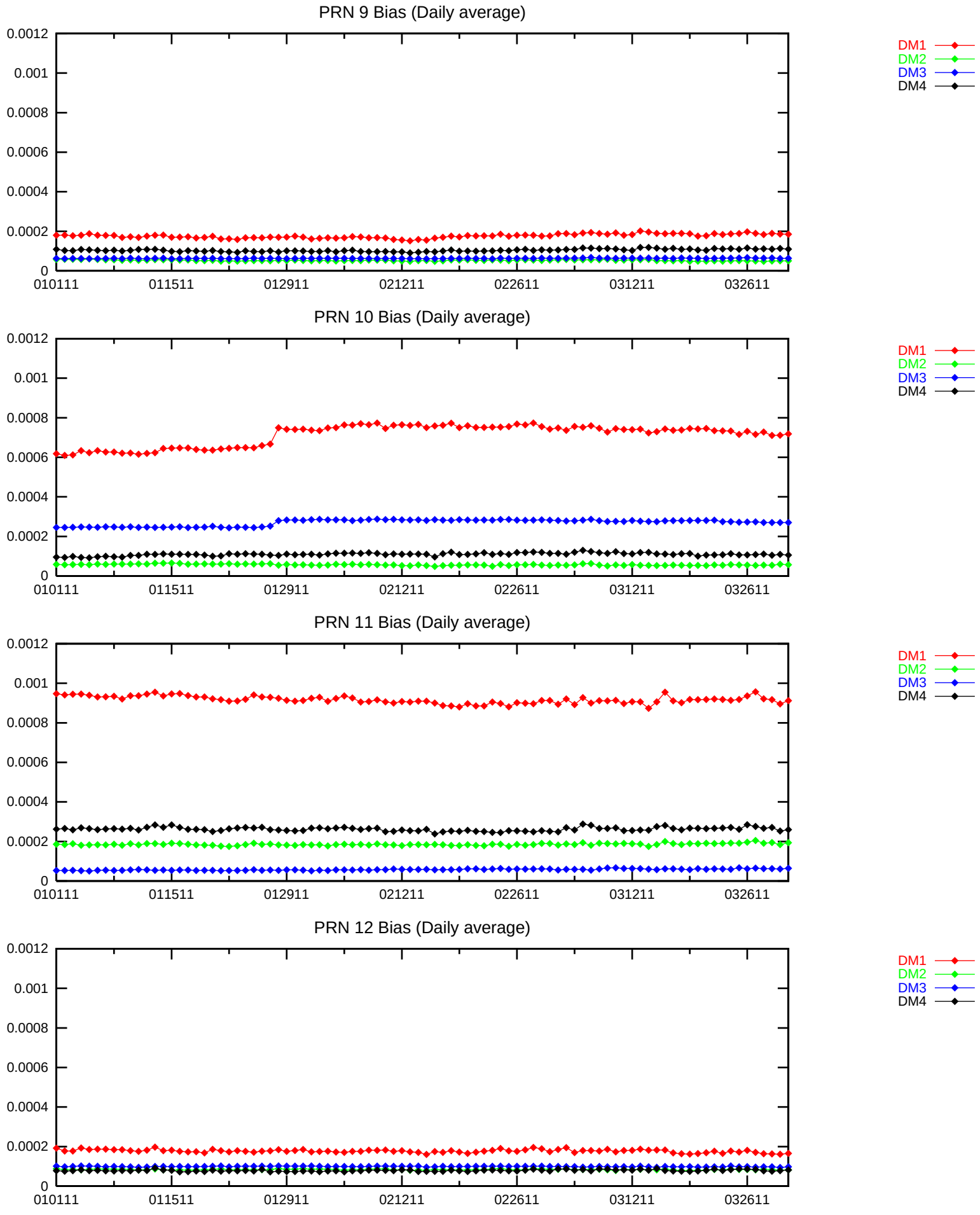


Figure 12-6 PRN Bias Average Trend (PRN 13 - PRN 16)

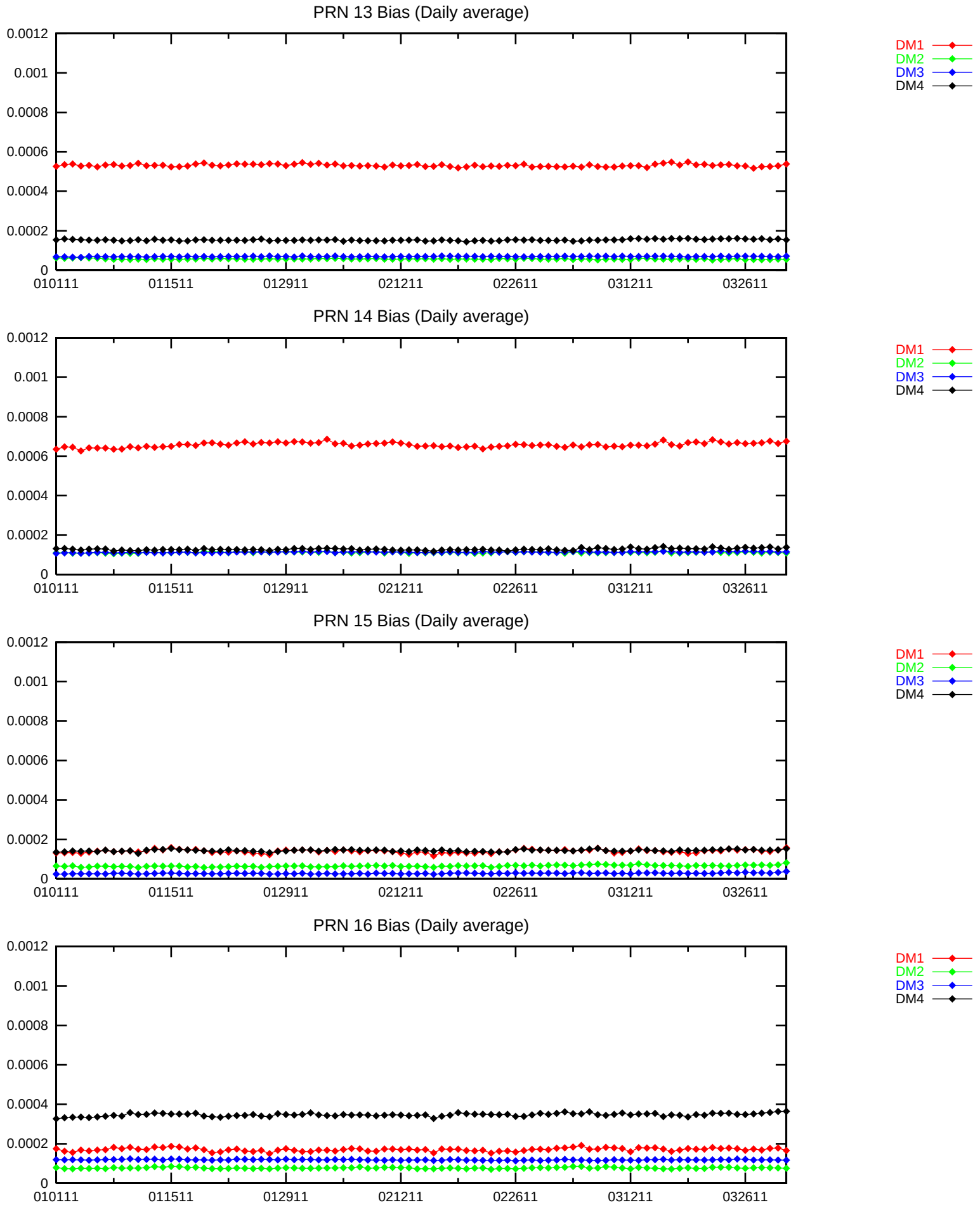


Figure 12-7 PRN Bias Average Trend (PRN 17 - PRN 20)

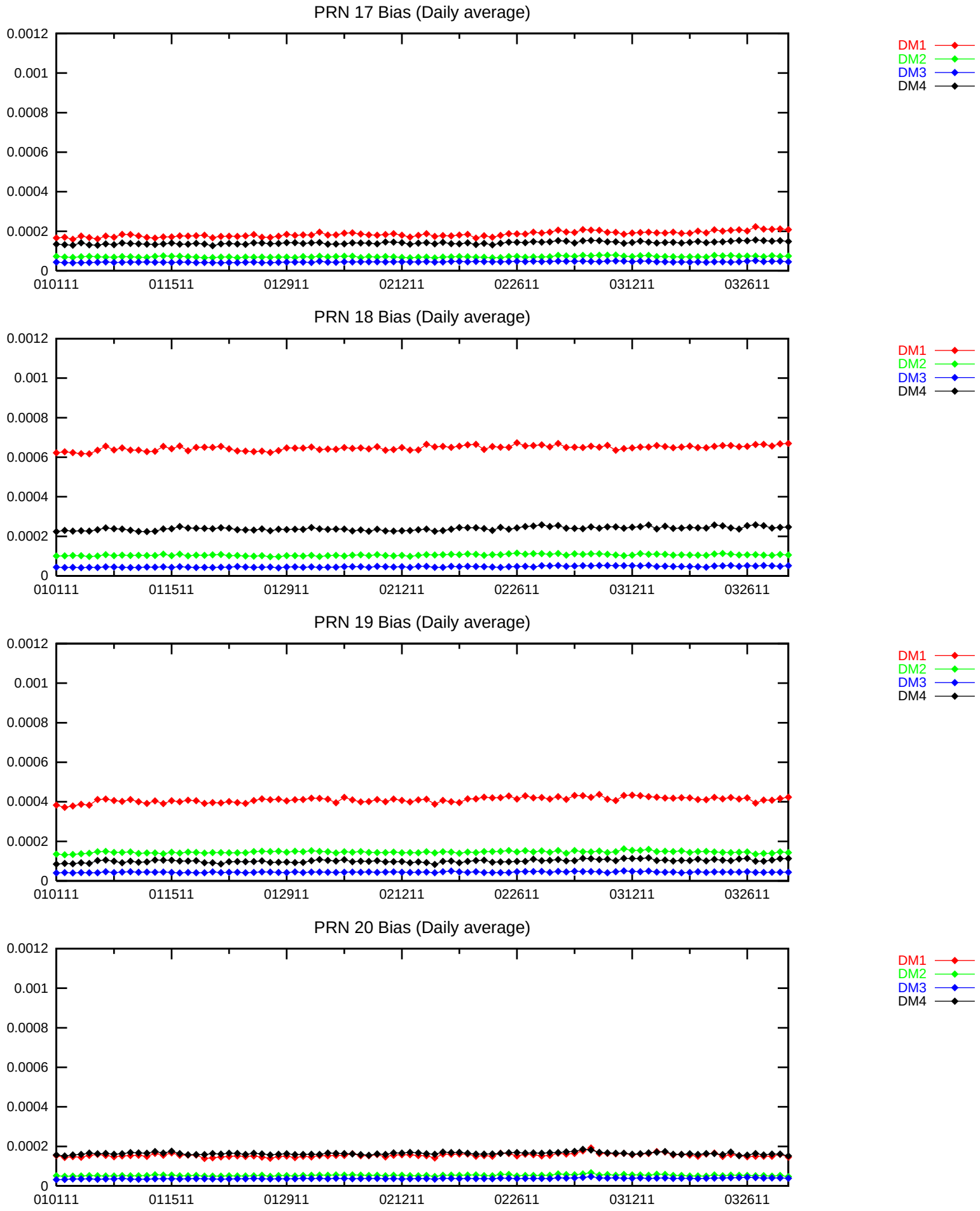


Figure 12-8 PRN Bias Average Trend (PRN 21 - PRN 24)

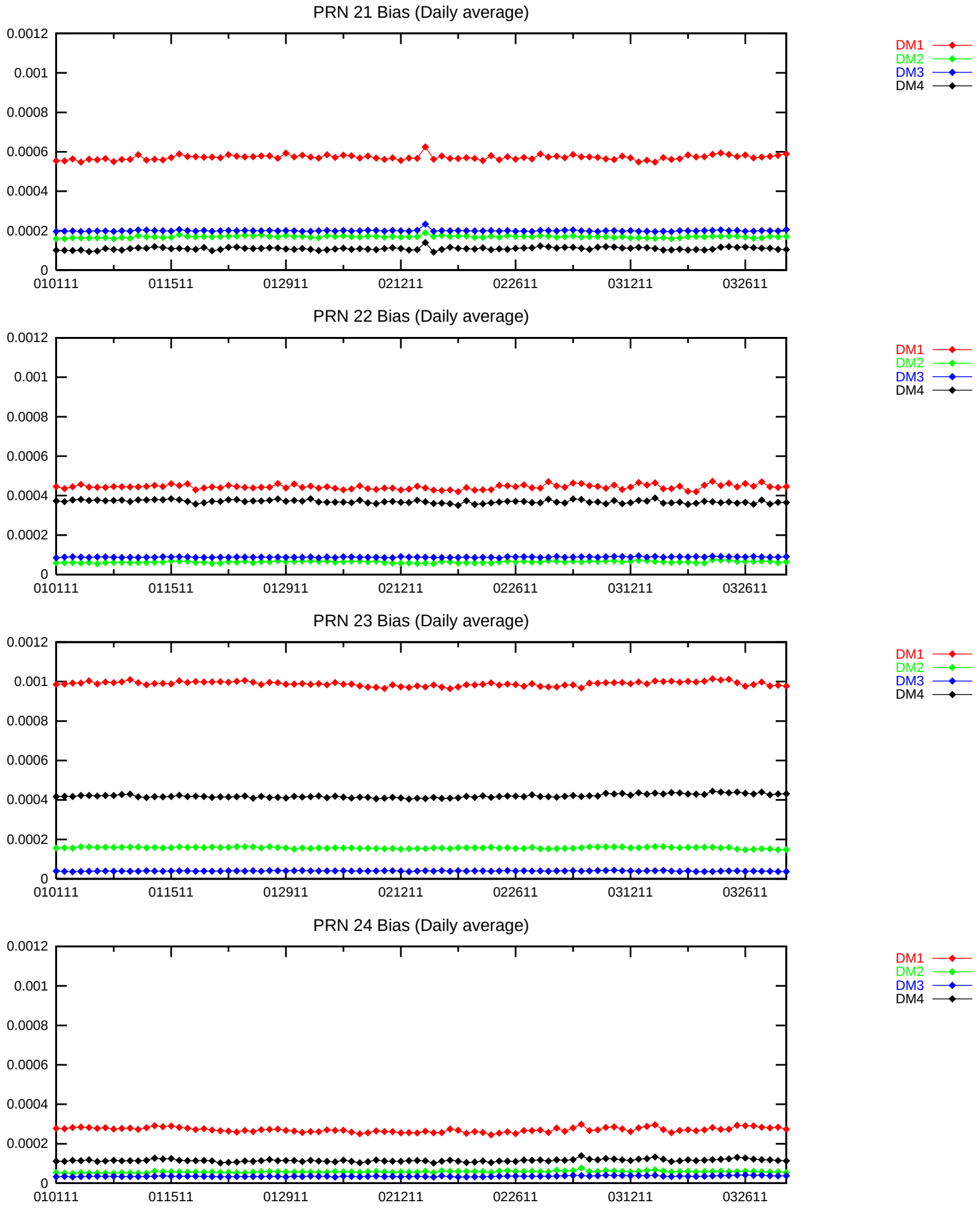


Figure 12-9 PRN Bias Average Trend (PRN 25 - PRN 28)

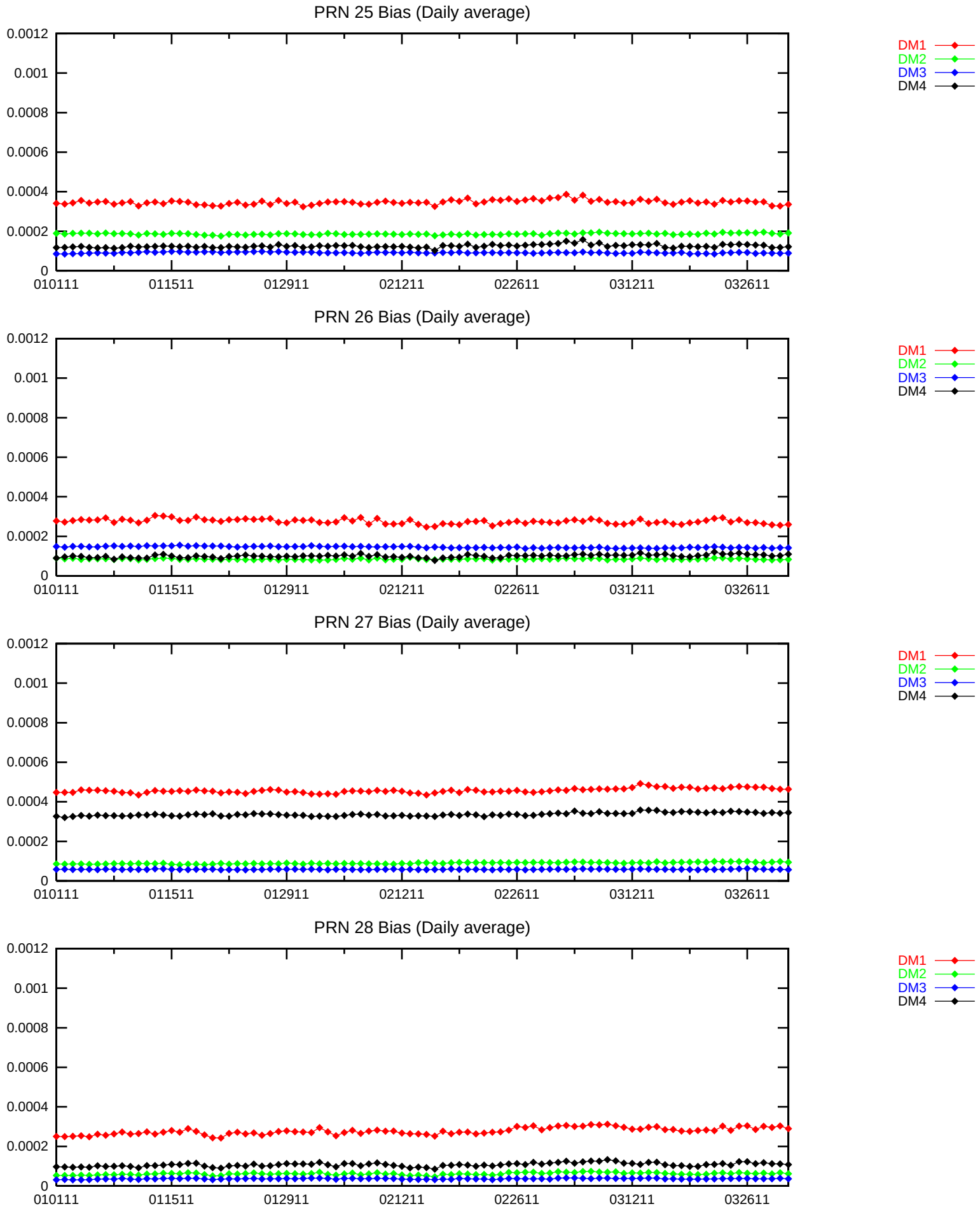
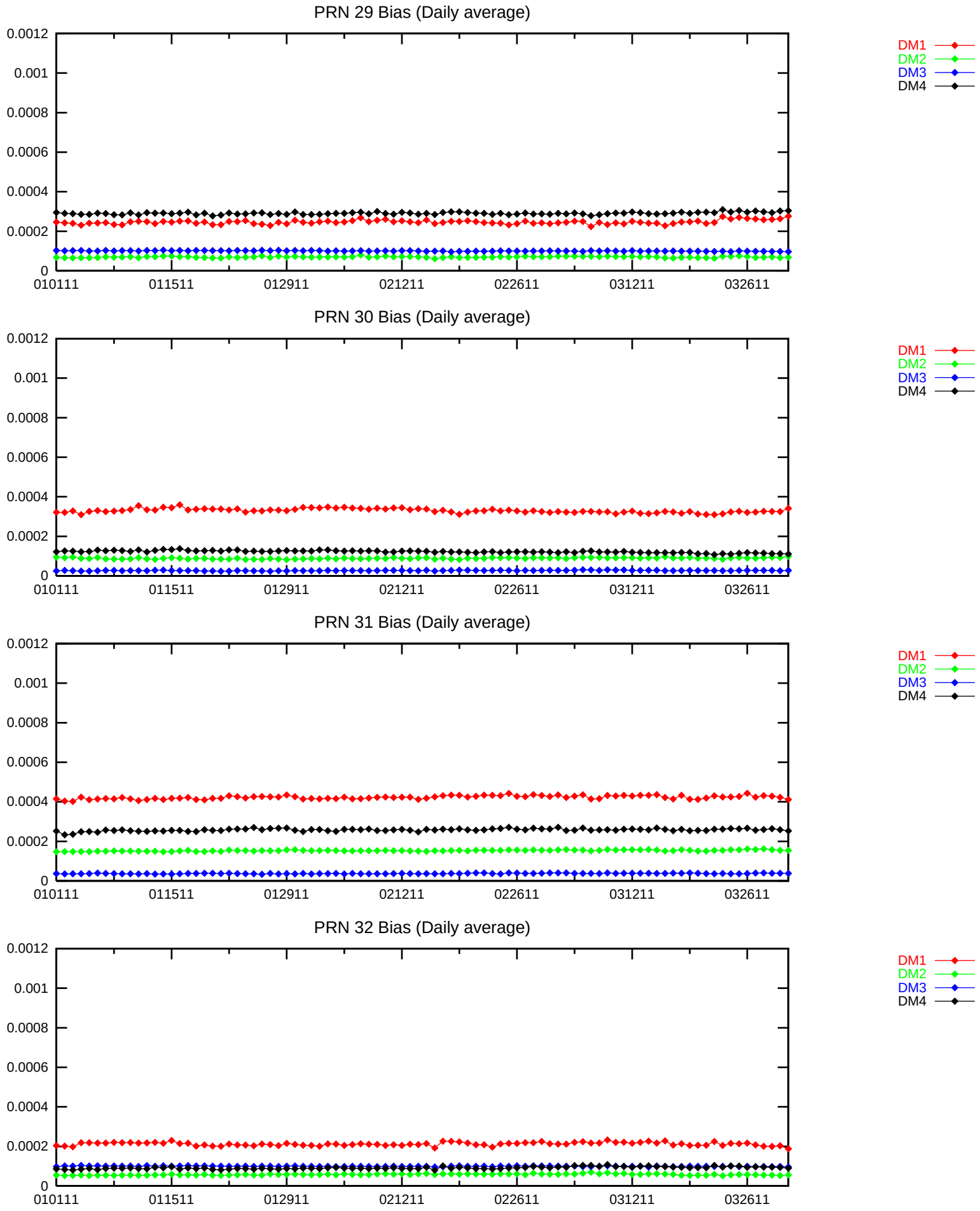


Figure 12-10 PRN Bias Average Trend (PRN 29 - PRN 32)



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.

S**ignal 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, 98% LPV availability contours, and 98% LP availability contours for the quarter. Figure B-1 shows CONUS coverage with 98% LP availability contour. Figure B-2 shows Alaska coverage with 98% LP availability contour. .Figure B-3 shows CONUS coverage with 98% LPV availability contour. Figure B-4 shows Alaska coverage with 98% LPV availability contour. Figure B-5 shows CONUS coverage with 99% LPV 200 availability contour. Figure B-6 shows Alaska coverage with 99% LPV 200 availability contour.

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

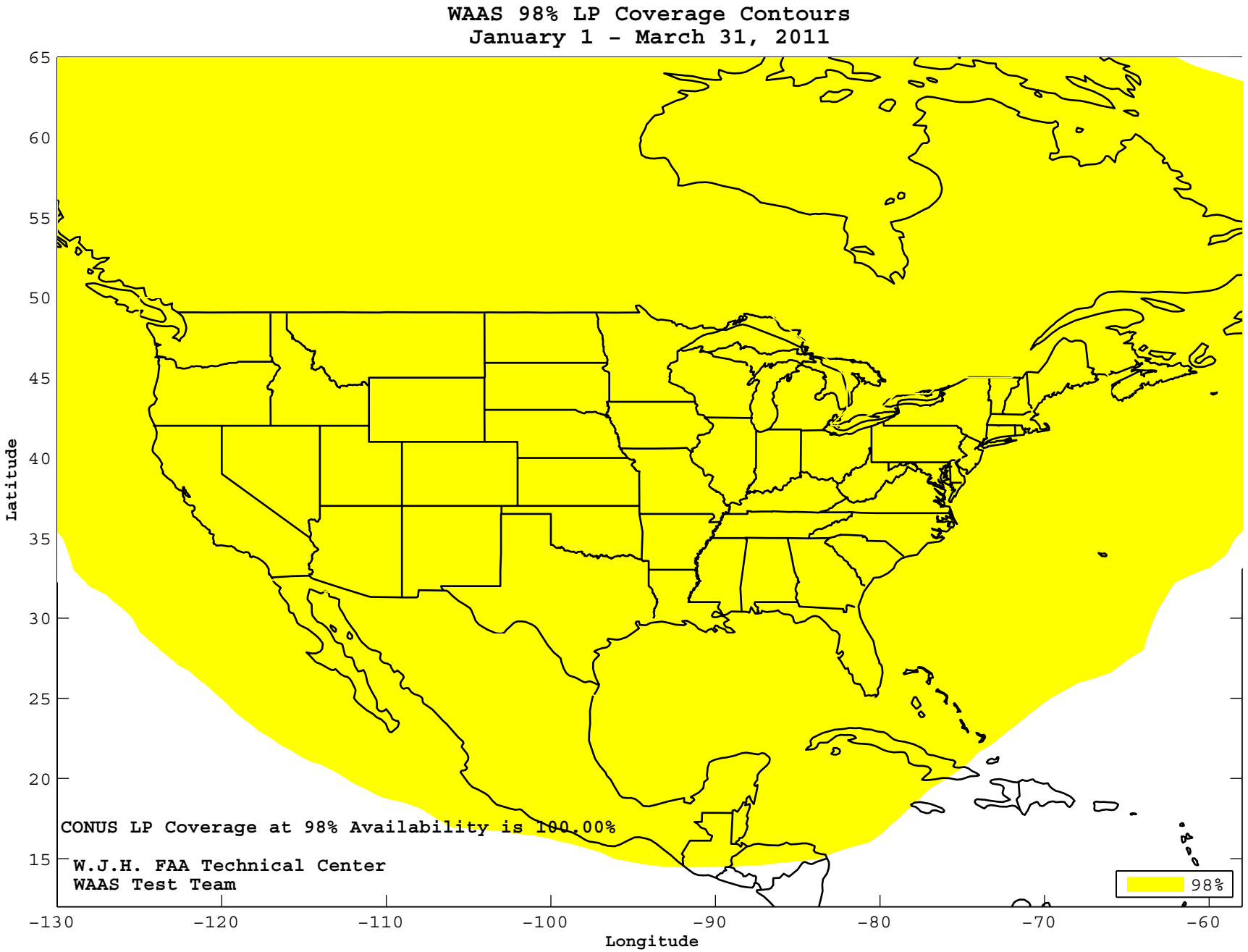


Figure B-2 98% Alaska LP Availability Contour for the Quarter

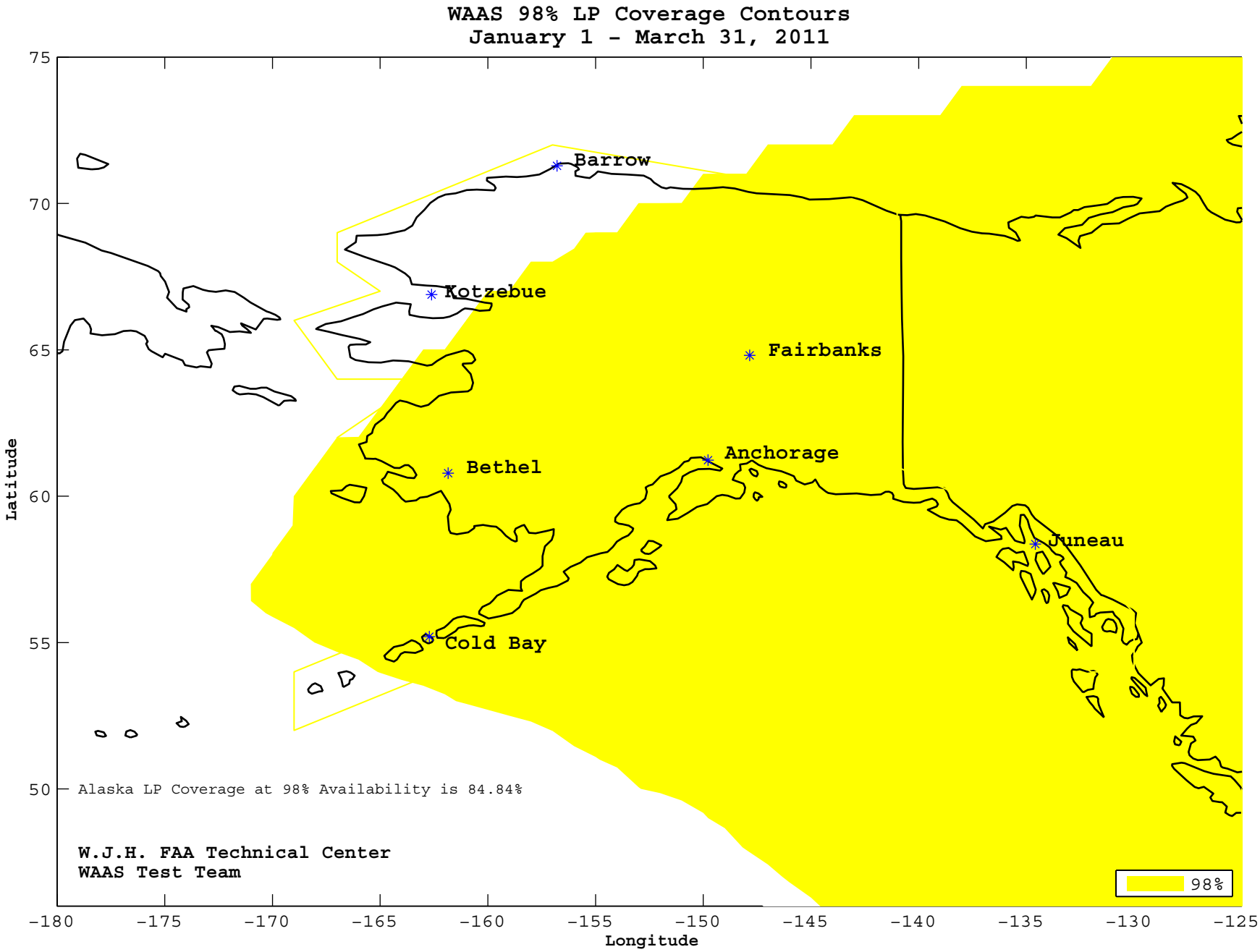


Figure B-3 98% CONUS LPV Availability Contour for the Quarter

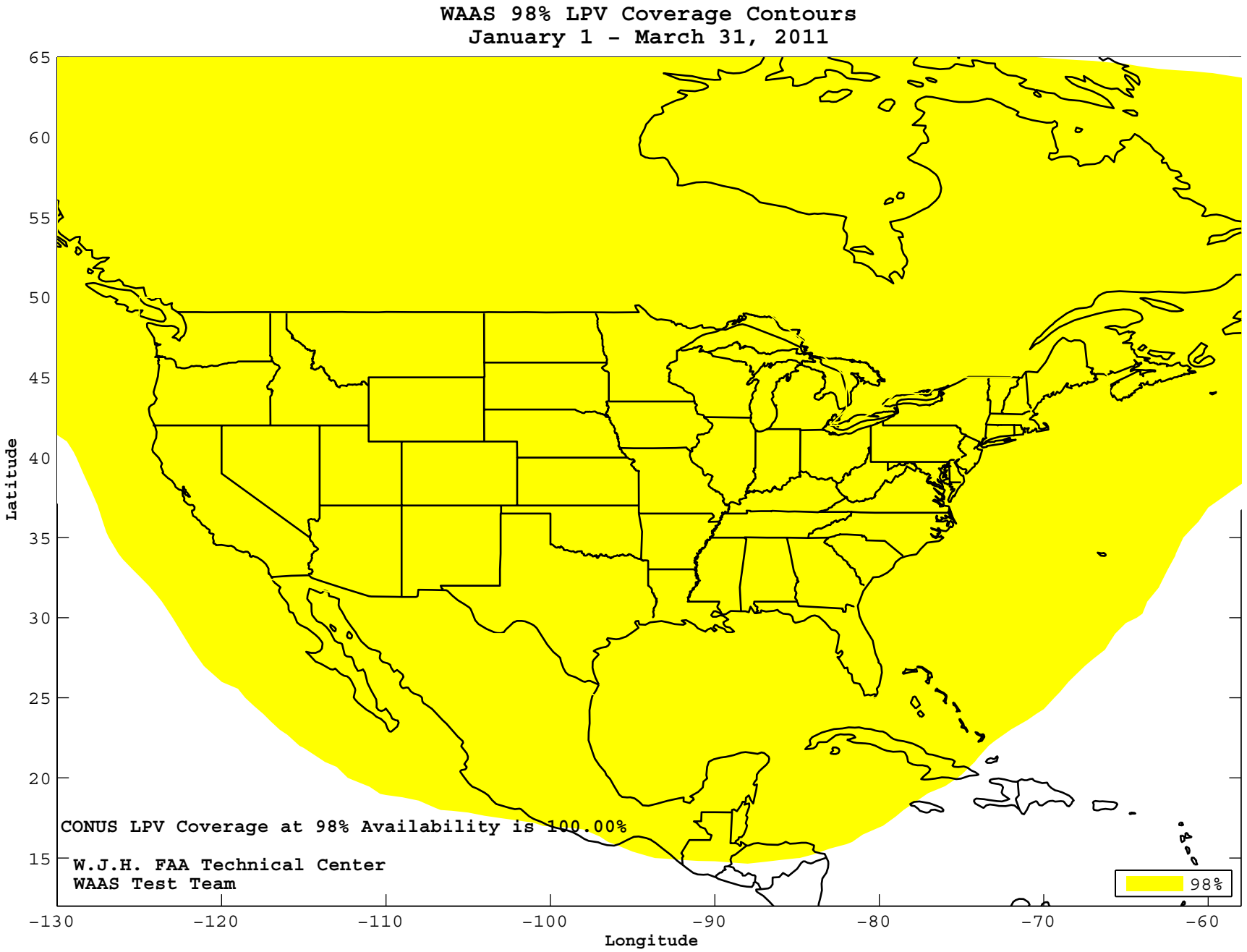


Figure B-4 98% Alaska LPV Availability Contour for the Quarter

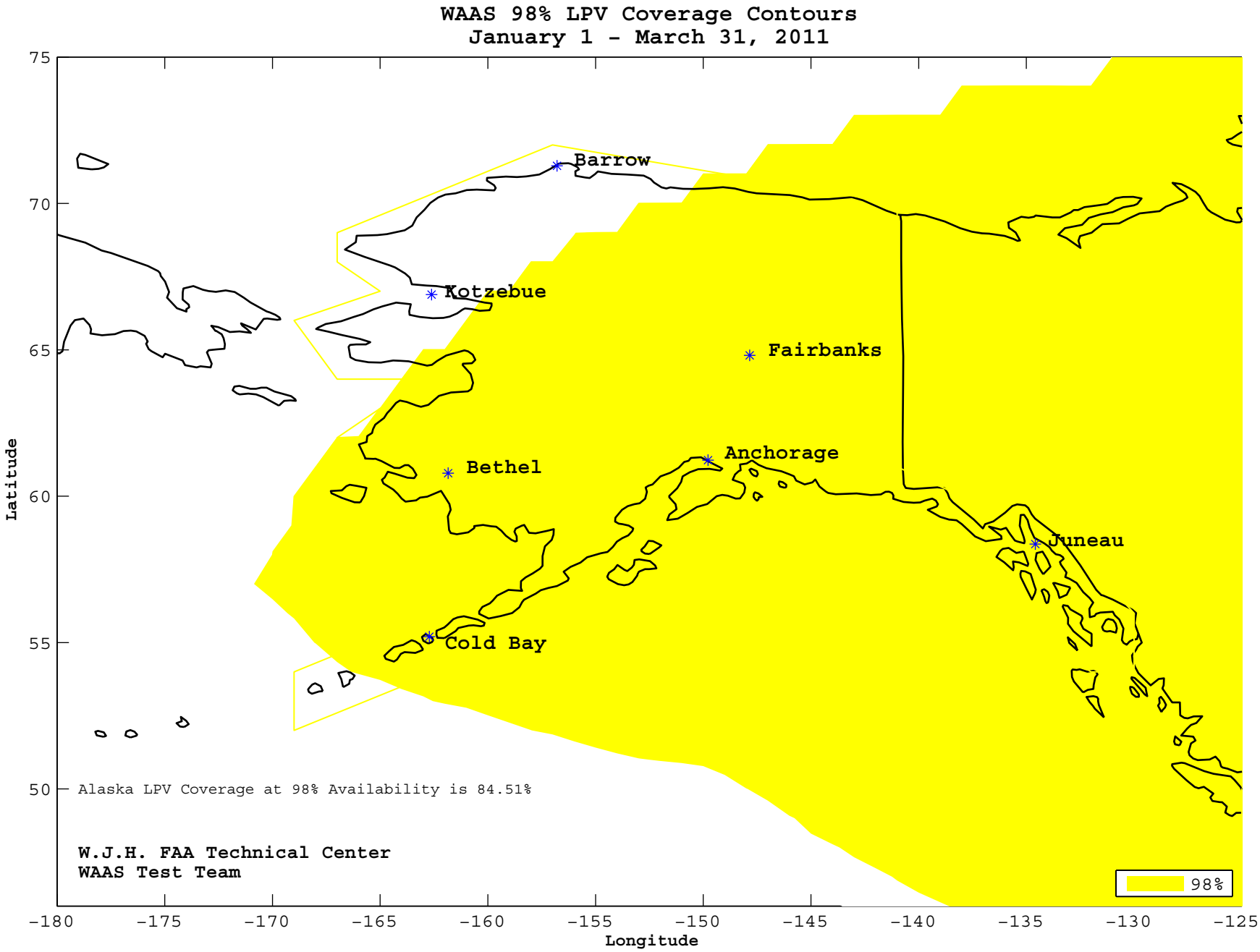


Figure B-5 99% CONUS LPV 200 Availability Contour for the Quarter

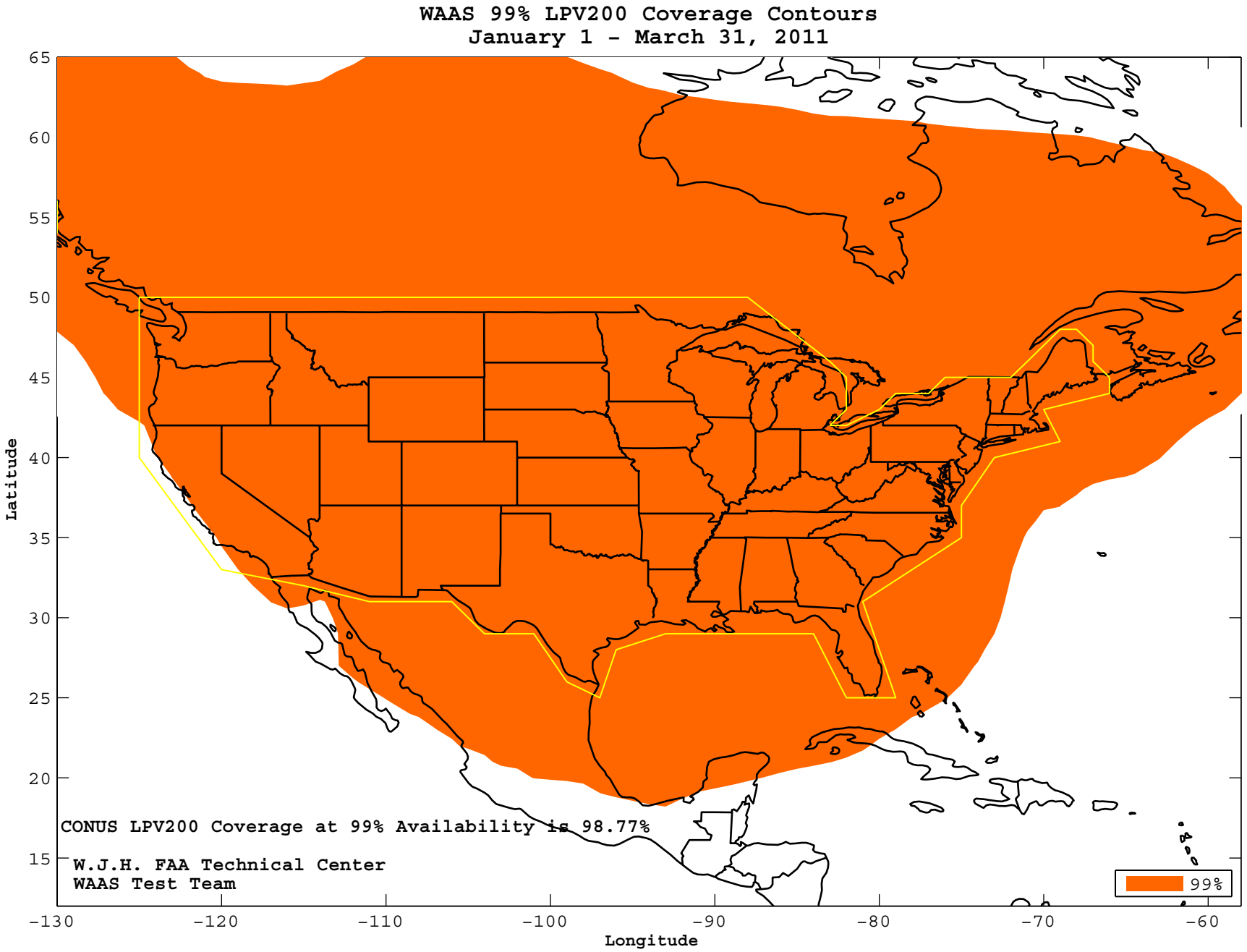


Figure B-6 99% Alaska LPV 200 Availability Contour for the Quarter