LIDAR report for Florida Everglades Block 9

Prepared for:
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Project Name and location
Florida Areas 9 and 10

Date of Data Acquisition
(Area 9)

Dec 13, 07	10 lines
Dec 17, 07	24 lines
Dec 18, 07	5 lines
Dec 19, 07	24 lines
Dec 20, 07	9 lines
Dec 21, 07	12 lines

Map Coordinate System and Datum

NAD_1983_HARN_StatePlane_Florida_East_FIPS_0901_Feet
NAVD88 - Geoid03 (Feet)

Flight Parameters

Altitude: 1400m
Speed: 140 kts
System PRF: 100.0 kHz
Scan Freq: 38.0 Hz
Scan Angle: 20 degrees
Point/m2: 1.0

Deliverable Data Format
Unedited calibrated mass-point Data LAS format
Trajectory and SBET files

Date	12/21/2007								
Julian Day	355								
Temperature	64								
Visibility	10								
Clouds	2%								
Precipitation	0								
Wind Dir	30								
Wind Speed	3								
Pressure	30.01								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
1:03:59	1:05:14	1	784	0.19	2.1	8	100	38	20
1:09:45	1:11:00	1	826	180.19	1.6	9	100	38	20
1:29:46	1:40:50	67	731	360	2.1	9	100	38	20
1:45:34	1:48:13	205	725	89.98	2	9	100	38	20
1:52:36	1:54:48	205	745	269.98	1.9	9	100	38	20
1:59:06	2:12:26	68	723	180	1.9	9	100	38	20

Date	12/20/2007								
Julian Day	354								
Temperature	70F								
Visibility	10								
Clouds	2%								
Precipitation	0								
Wind Dir	360								
Wind Speed	5								
Pressure	30.13								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
15:00:00	15:01:20	1	829	0.19	1.8	8	100	38	20
15:05:26	15:06:37	1	849	180.19	1.8	8	100	38	20
15:24:19	15:36:02	55	709	360	2	8	100	38	20
15:39:41	15:44:26	205	749	89.98	2.3	8	100	38	20
15:47:44	15:51:34	205	743	269.98	2.5	8	100	38	20
15:56:22	16:08:42	56	718	180	2.8	8	100	38	20
16:19:03	16:19:47	52	720	180	3.2	8	100	38	20
16:27:14	16:39:13	57	723	360	3	8	100	38	20
16:43:19	16:56:02	58	738	180	2.1	8	100	38	20
17:00:09	17:12:03	59	727	360	2	8	100	38	20
17:16:25	17:28:49	60	741	180	2.1	7	100	38	20
17:32:54	17:44:33	65	697	360	1.8	7	100	38	20
17:49:14	18:01:16	66	696	180	1.7	7	100	38	20

Date	12/19/2007								
Julian Day	354								
Temperature	77f								
Visibility	10								
Clouds	40%								
Precipitation	0								
Wind Dir	90								
Wind Speed	8								
Pressure	30.13								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
22:09:56	22:11:23	1	844	0.19	2	10	100	38	20
22:15:34	22:16:43	1	826	180.19	2.1	10	100	38	20
22:45:23	22:53:40	61	755	360	3.3	9	100	38	20
23:10:54	23:20:53	63	741	360	1.9	11	100	38	20
23:24:29	23:35:04	84	716	180	1.6	11	100	38	20
23:40:21	23:52:11	83	740	360	1.6	9	100	38	20
23:56:07	0:06:38	82	748	180	1.9	8	100	38	20
0:12:04	0:24:47	81	734	360	1.6	9	100	38	20
0:28:52	0:33:13	205	673	269.98	1.7	9	100	38	20
0:38:09	0:42:23	205	739	89.98	1.9	8	100	38	20
0:47:31	0:59:28	64	736	180	2	8	100	38	20
1:05:32	1:10:23	63	737	360	2.1	8	100	38	20
1:14:32	1:18:54	62	740	180	1.6	9	100	38	20
1:23:42	1:28:55	61	729	360	1.6	9	100	38	20
1:31:34	1:36:09	52	744	180	2.2	9	100	38	20
1:40:39	1:53:37	53	742	360	2.1	9	100	38	20
1:58:15	2:10:18	54	735	180	1.9	9	100	38	20

Date	12/19/2007								
Julian Day	353								
Temperature	56								
Visibility	10								
Clouds	5%								
Precipitation	0								
Wind Dir	calm								
Wind Speed	0								
Pressure	30.24								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
2:01:24	2:01:34	1	800	0.19	1.9	9	100	38	20
2:05:52	2:07:11	1	869	0.19	1.9	9	100	38	20
2:10:27	2:11:46	1	860	180.19	1.8	9	100	38	20
2:29:47	2:33:17	41	727	360	1.6	9	100	38	20
2:36:41	2:47:10	41	734	360	1.6	9	100	38	20
2:51:21	3:03:26	40	756	180	1.7	8	100	38	20
3:07:26	3:19:46	43	747	360	1.4	10	100	38	20
3:24:56	3:36:54	42	751	180	1.5	11	100	38	20
3:41:16	3:53:25	45	730	360	2.2	10	100	38	20
3:57:22	4:09:13	44	734	180	2.3	11	100	38	20
4:12:46	4:24:59	47	734	360	2.4	10	100	38	20
4:29:08	4:41:03	46	737	180	2.3	10	100	38	20
4:45:08	4:57:13	49	734	360	2	10	100	38	20
5:00:53	5:12:46	48	733	180	1.7	10	100	38	20
5:16:04	5:28:09	51	736	360	2.1	9	100	38	20
5:31:56	5:33:30	205	736	269.98	3	8	100	38	20
5:38:10	5:40:16	205	734	89.98	3	8	100	38	20
5:43:36	5:55:51	50	737	180	2.9	8	100	38	20

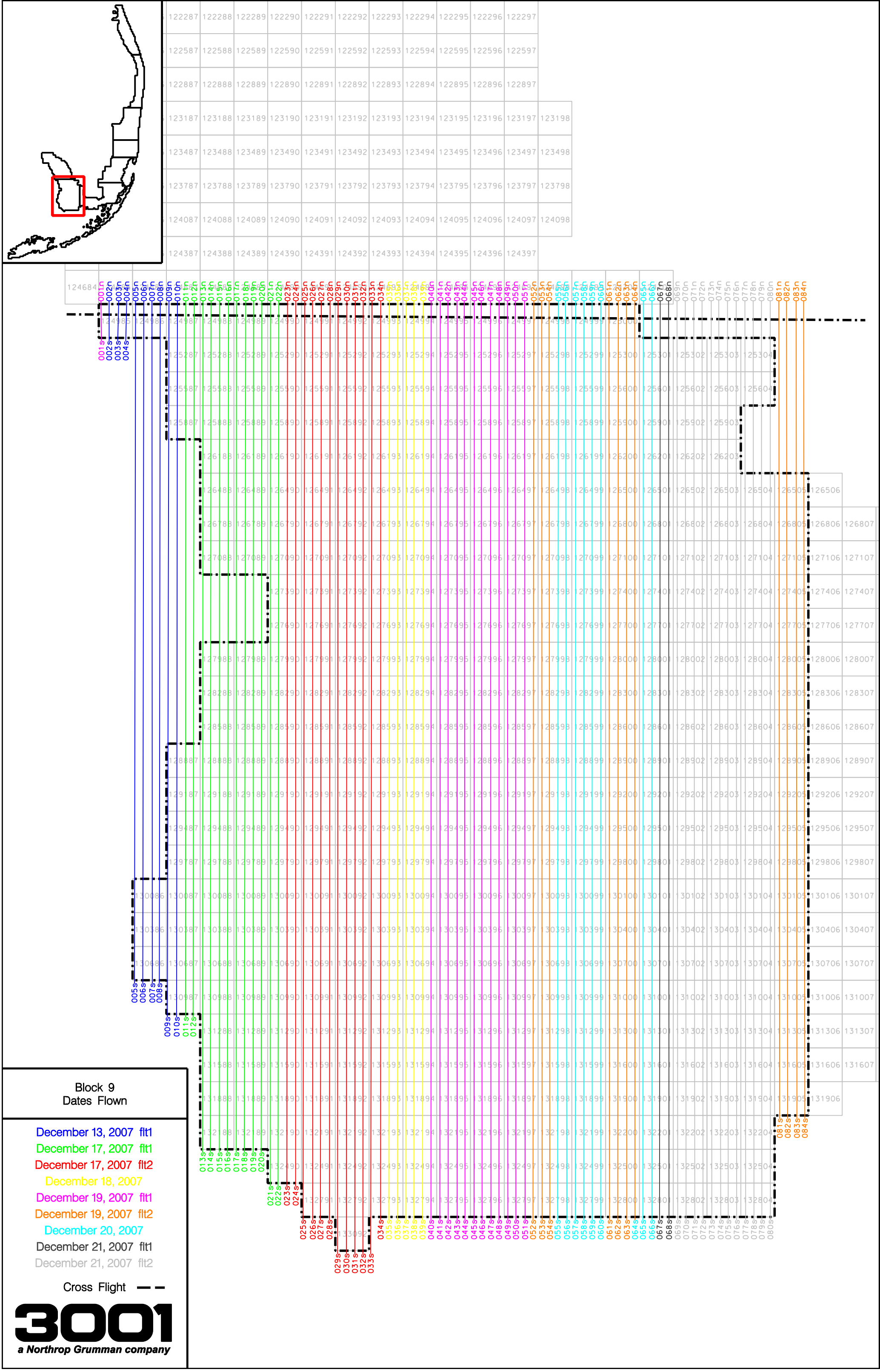
Date	12/18/2007								
Julian Day	352								
Temperature	66f								
Visibility	10								
Clouds	5%								
Precipitation	0								
Wind Dir	30								
Wind Speed	6								
Pressure	30.26								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
15:39:04	15:40:30	1	819	0.19	2.1	8	100	38	20
15:44:19	15:45:35	1	789	180.19	2.2	8	100	38	20
16:02:08	16:14:52	35	714	360	2.7	8	100	38	20
16:18:41	16:31:30	36	716	180	3.2	8	100	38	20
16:34:54	16:47:10	37	718	360	3	8	100	38	20
16:50:30	17:02:45	38	724	180	2.1	8	100	38	20
17:06:23	17:19:46	39	703	360	2	8	100	38	20
17:23:53	17:24:42	206	681	269.87	2.1	7	100	38	20
17:28:08	17:29:12	206	711	89.87	2	7	100	38	20
17:32:29	17:37:35	38	660	180	1.6	8	100	38	20

Date	12/17/2007								
Julian Day	351								
Temperature	66f								
Visibility	10								
Clouds	0								
Precipitation	0								
Wind Dir	360								
Wind Speed	15-Oct								
Pressure	30.19								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
18:11:16	18:11:53	1	814	0.19	1.7	7	100	38	20
18:15:02	18:16:43	1	784	180.19	2.5	6	100	38	20
18:34:32	18:46:33	23	748	360	2.3	6	100	38	20
18:50:12	19:01:54	24	725	180	2.1	6	100	38	20
19:06:00	19:18:31	25	728	360	2.1	7	100	38	20
19:22:23	19:34:37	26	706	180	2.4	7	100	38	20
19:38:55	19:51:38	27	716	360	1.6	9	100	38	20
19:55:52	20:08:07	28	723	180	1.7	9	100	38	20
20:12:11	20:25:01	29	728	360	2.4	7	100	38	20
20:28:36	20:41:06	30	740	180	2.1	8	100	38	20
20:45:31	20:58:28	31	742	360	2.2	8	100	38	20
21:01:57	21:14:30	32	757	180	1.7	9	100	38	20
21:18:27	21:31:30	33	736	360	1.7	9	100	38	20
21:35:29	21:37:34	206	718	269.87	1.8	9	100	38	20
21:41:41	21:43:21	206	729	89.87	1.6	10	100	38	20
21:46:37	21:58:50	34	718	180	1.6	10	100	38	20

Date	12/17/2007								
Julian Day	351								
Temperature	46								
Visibility	10								
Clouds	0								
Precipitation	0								
Wind Dir	360								
Wind Speed	20-Oct								
Pressure	30.14								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
11:36:47	11:37:12	1	820	0.19	1.8	8	100	38	20
11:40:13	11:41:37	1	828	0.19	1.8	8	100	38	20
11:45:13	11:46:15	1	796	180.19	1.7	8	100	38	20
12:07:04	12:17:34	11	658	360	1.7	8	100	38	20
12:21:38	12:31:43	12	708	180	1.8	8	100	38	20
12:36:51	12:49:02	13	719	360	1.5	9	100	38	20
12:53:16	13:04:38	14	705	180	1.9	9	100	38	20
13:16:01	13:21:17	15	712	360	1.9	9	100	38	20
13:26:01	13:37:17	16	715	180	1.8	9	100	38	20
13:40:59	13:52:43	17	702	360	1.6	10	100	38	20
13:56:28	14:07:56	18	741	180	1.4	10	100	38	20
14:12:03	14:24:19	19	742	360	2.1	8	100	38	20
14:27:59	14:39:22	20	746	180	1.9	8	100	38	20
14:43:04	14:55:43	21	734	360	1.7	8	100	38	20
15:00:36	15:02:34	206	725	269.87	1.6	8	100	38	20
15:06:21	15:08:14	206	746	89.87	2.4	7	100	38	20
15:15:28	15:16:19	15	719	360	1.8	8	100	38	20
15:22:48	15:34:13	22	726	180	1.9	8	100	38	20

Date	12/13/2007								
Julian Day	347								
Temperature	67F								
Visibility	10								
Clouds	2								
Precipitation	0								
Wind Dir	calm								
Wind Speed	0								
Pressure	30.14								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
0:58:34	0:59:47	1	832	180.19	1.7	9	100	38	20
1:28:40	1:32:01	1	763	360	2.1	8	100	38	20
1:35:44	1:36:57	2	680	180	1.6	9	100	38	20
1:41:02	1:42:25	3	648	360	1.6	9	100	38	20
1:45:50	1:46:49	4	677	180	1.6	9	100	38	20
1:58:04	2:08:10	5	680	360	2.4	8	100	38	20
2:11:34	2:20:46	6	658	180	2.1	9	100	38	20
2:24:48	2:34:31	7	657	360	2	9	100	38	20
2:37:54	2:47:28	8	641	180	1.8	9	100	38	20
2:51:36	3:02:11	9	705	360	1.6	9	100	38	20
3:05:40	3:15:26	10	656	180	1.5	9	100	38	20
3:37:28	3:40:38	206	679	89.87	1.5	10	100	38	20
3:44:25	3:47:00	206	654	269.87	1.5	10	100	38	20

Date	12/21/2007								
Julian Day	355								
Temperature	64F								
Visibility	10								
Clouds	30%								
Precipitation	0								
Wind Dir	270								
Wind Speed	10								
Pressure	29.9								
Start	Stop	Strip	Alt(m)	Hdg	PDOP	SVs	PRF	Freq	Angle
22:38:20	22:39:47	1	812	0.19	3.2	9	100	38	20
22:43:16	22:44:40	1	812	180.19	2.9	9	100	38	20
22:59:30	23:11:35	79	740	360	1.9	11	100	38	20
23:14:24	23:23:49	205	685	269.98	1.7	11	100	38	20
23:28:05	23:37:20	205	735	89.98	1.6	10	100	38	20
23:41:44	23:53:29	78	721	180	1.6	9	100	38	20
23:58:12	0:10:27	77	741	360	1.6	9	100	38	20
0:14:37	0:26:23	76	745	180	1.7	9	100	38	20
0:32:13	0:44:28	75	752	360	1.9	8	100	38	20
0:48:08	0:59:33	74	745	180	2.1	8	100	38	20
1:03:56	1:15:54	73	732	360	1.6	9	100	38	20
1:20:35	1:32:02	72	734	180	2.4	8	100	38	20
1:36:45	1:48:52	71	740	360	2.1	9	100	38	20
1:52:57	2:04:40	70	776	180	1.9	9	100	38	20
2:09:08	2:21:07	69	735	360	1.7	9	100	38	20
2:24:32	2:36:25	80	757	180	1.6	9	100	38	20


Block 9
Dates Flown
December 13, 2007 flt1
December 17, 2007 flt1
December 17, 2007 flt2
December 18, 2007
December 19, 2007 flt1
December 19, 2007 flt2
December 20, 2007
December 21, 2007 flt1
December 21, 2007 flt2
Cross Flight
3001
a Northrop Grumman company

General Workflow Description

DGPS Processing

The GPS trajectory of the survey aircraft was post processed differentially in the Applanix POSGPS software using the dual frequency data from the POS receiver on the plane and the available base station data. The coordinates (in NAD83 datum) and antenna types for the base stations were taken from the provided GPS control survey field data sheets and NGS OPUS solution reports delivered along with the RINEX data.

The results were checked with a focus on:

- Reasonably small (< 4) OOP values
- Small Forward/Reverse solution separation values
- Good a posteriori estimated position accuracy

GPS/IMU Combination

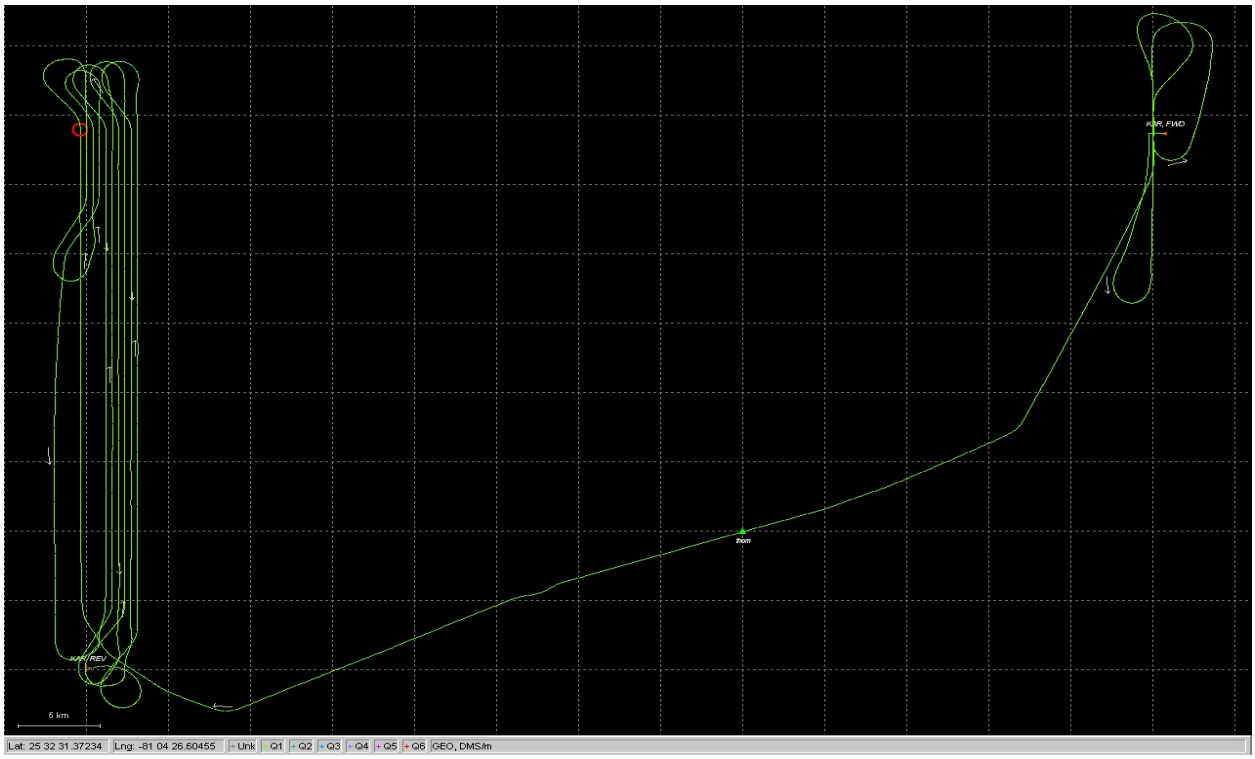
The smoothed best estimated trajectory (SBET) was calculated in Applanix POSPac, combining the post-processed GPS solution with the IMU and lever arm measurements.
The finished SBETs were checked for:

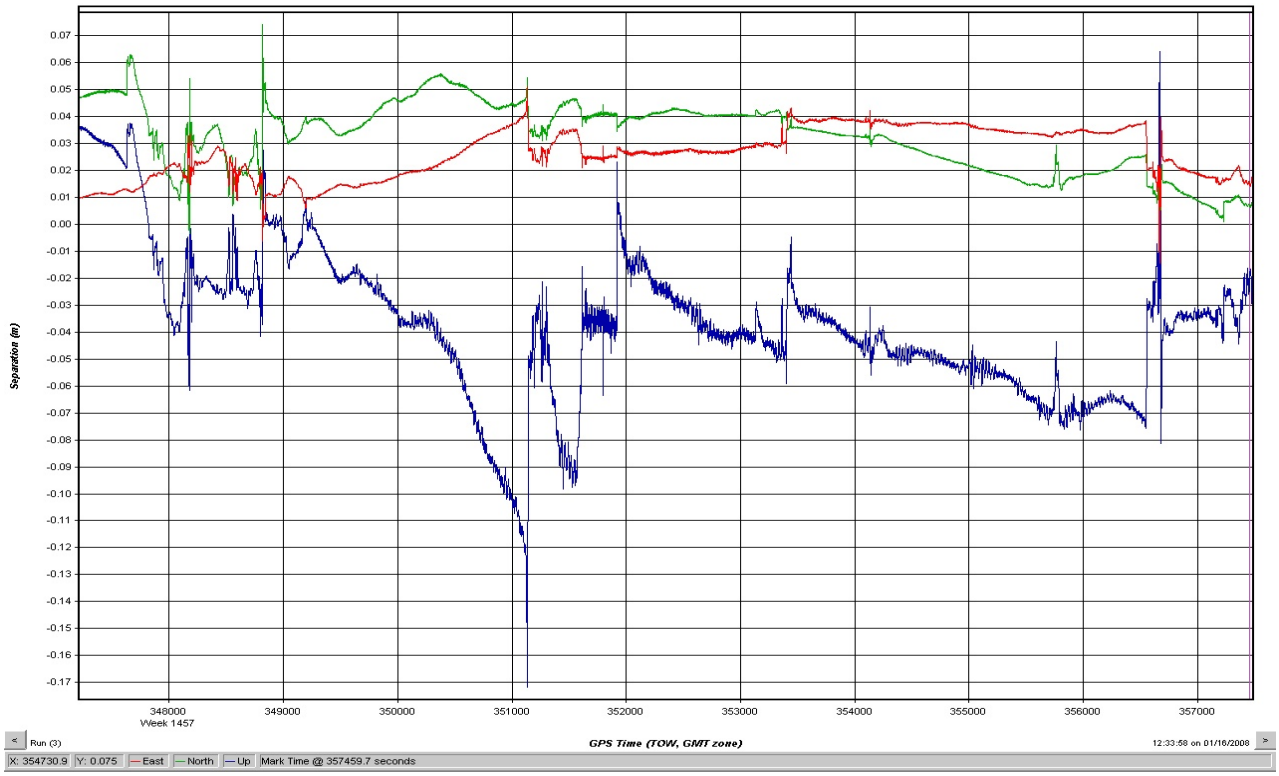
- Good a posteriori position and orientation accuracies
- No systematic error detected in the Kalman filter
- No systematic IMU problems or drifts

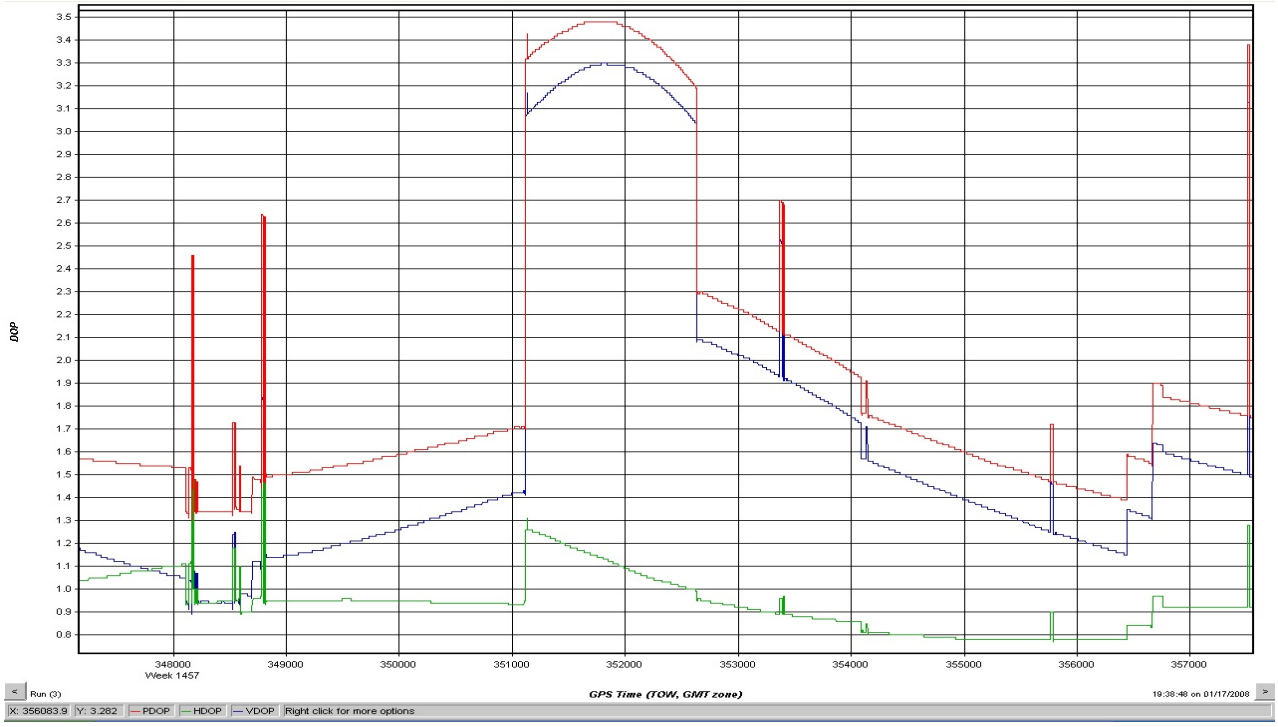
Laser data processing

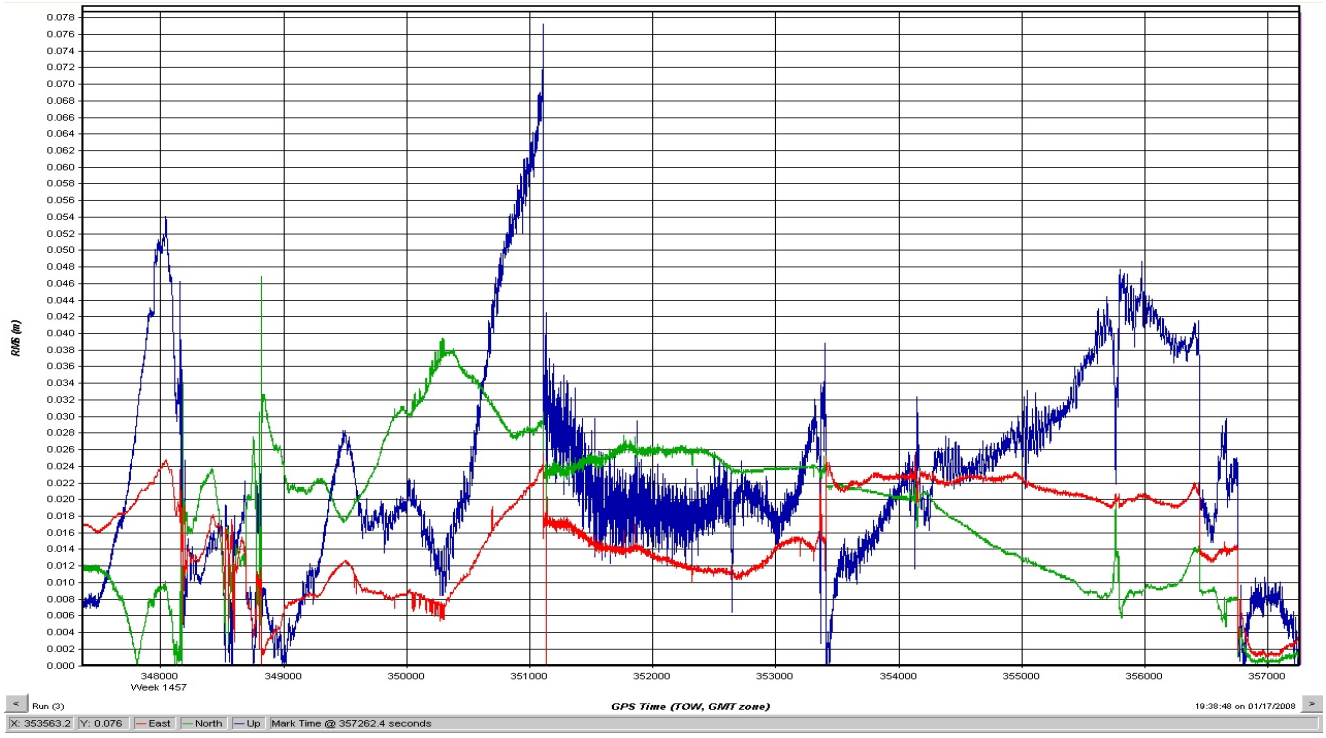
The 3D coordinates of the laser point measurements were computed in Optech's DASHMap software using standard filtering parameters to eliminate obvious outliers. Points were output in .las strip files in NAD83 UTM Zone 17N. Each project's data was then checked for complete area coverage and whether it had noticeable issues and errors.
The ALTM calibration parameters provided in the .res file were systematically checked and refined using TerraSolid's, TerraMatch program which estimates residual boresight angles (roll, pitch, heading) and scanner scale corrections from overlapping strip areas, minimizing the interstrip differences using a least squares approach. This calibration procedure was performed on each mission.
The strip .las data was imported into GeoCue and projected into the required State Plane Coordinate System.

GPS Processing for JD347FL01 (area 9)

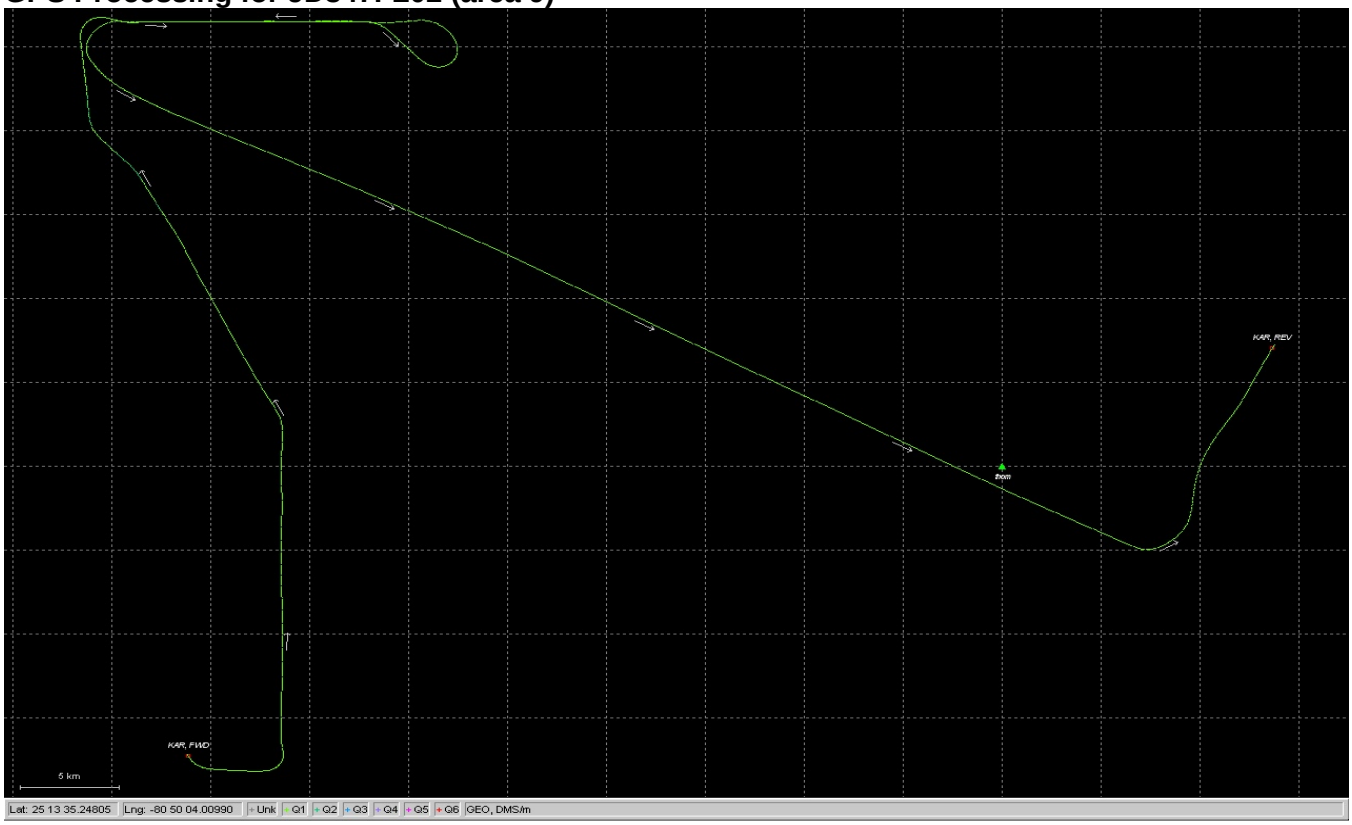


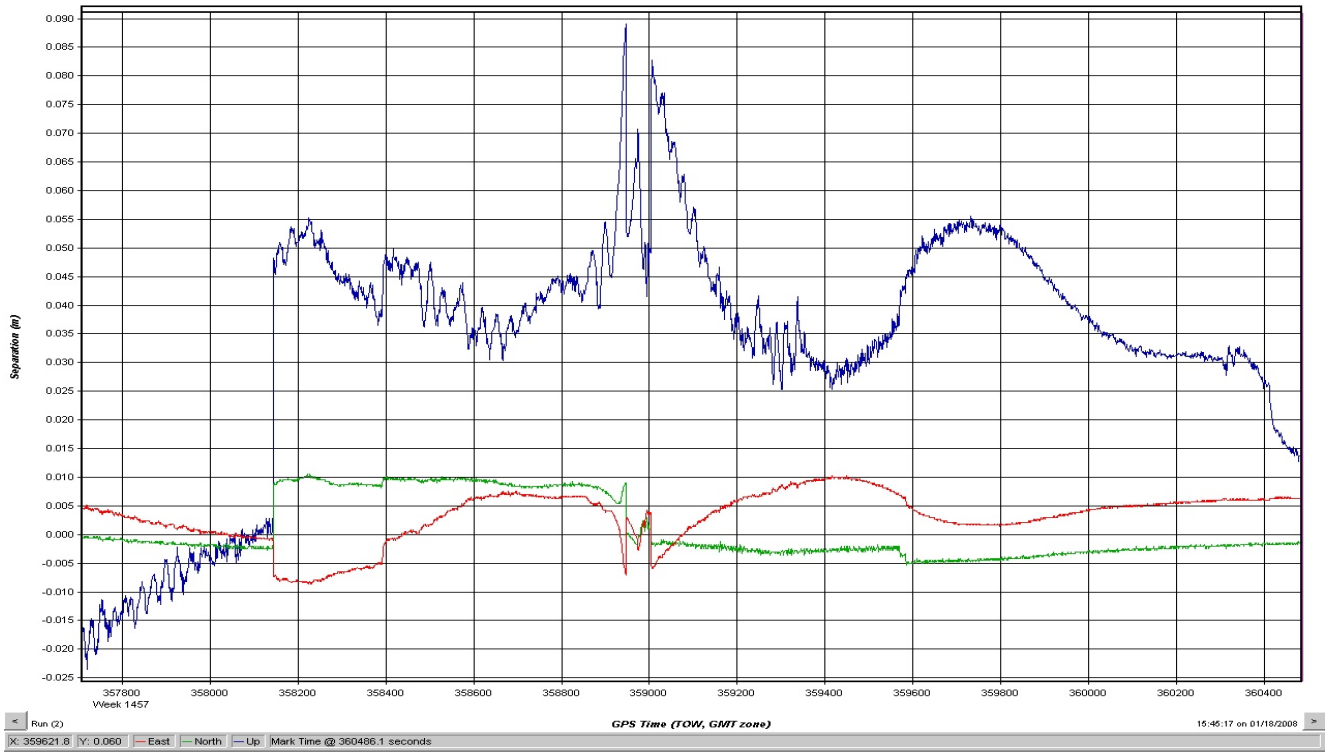


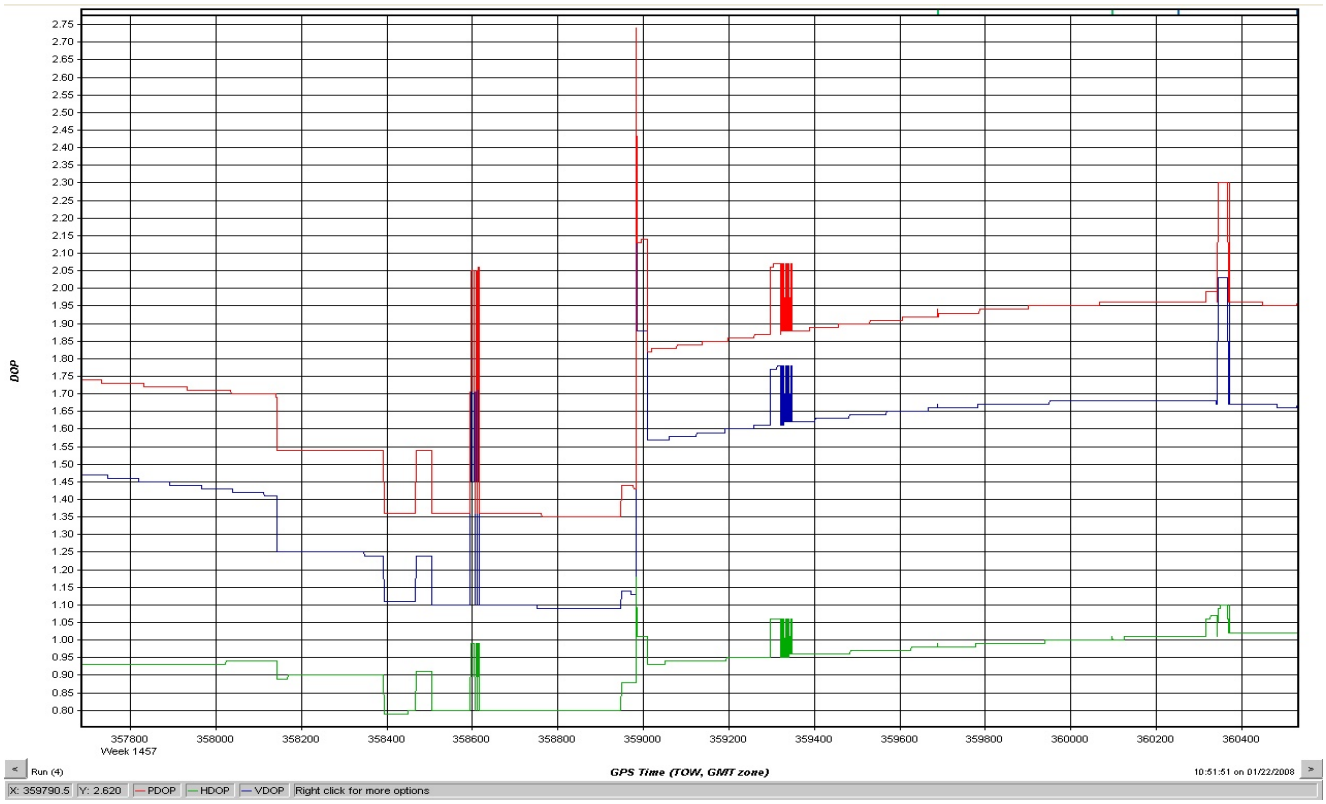

DOP
348000
Week 1457
349000
350000
351000
352000
353000
354000
355000
356000
357000
Run (3)
GPS Time (TOW, GMT zone)
19:38:48 on 01/17/2008
X: 356083.9
Y: 3.282
PDOP
HDOP
VDOP
Right click for more options

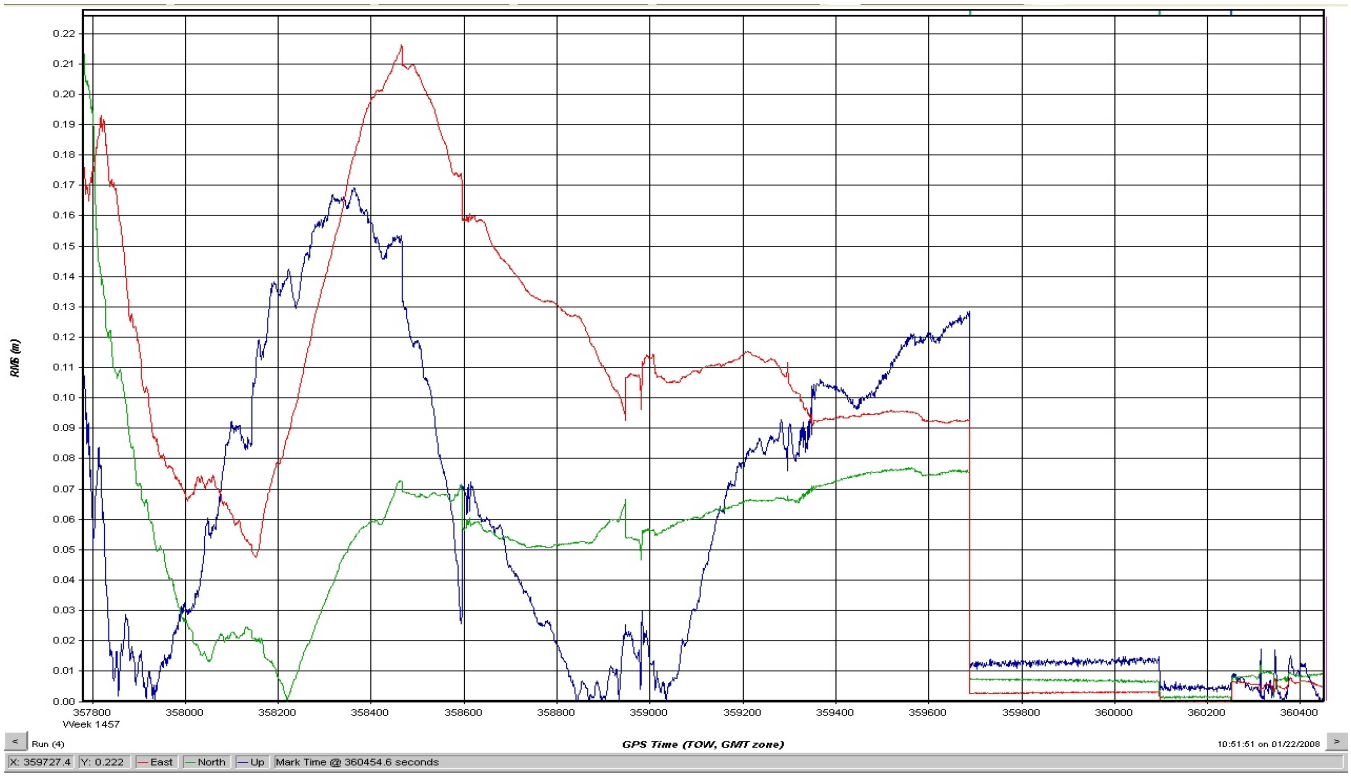

RMS (m)
348000
Week 1457
349000
350000
351000
352000
353000
354000
355000
356000
357000
Run (3)
GPS Time (TOW, GMT zone)
19:38:48 on 01/17/2008
X: 353563.2
Y: 0.076
East
North
Up
Mark Time @ 357262.4 seconds

GPS Processing for JD347FL02 (area 9)

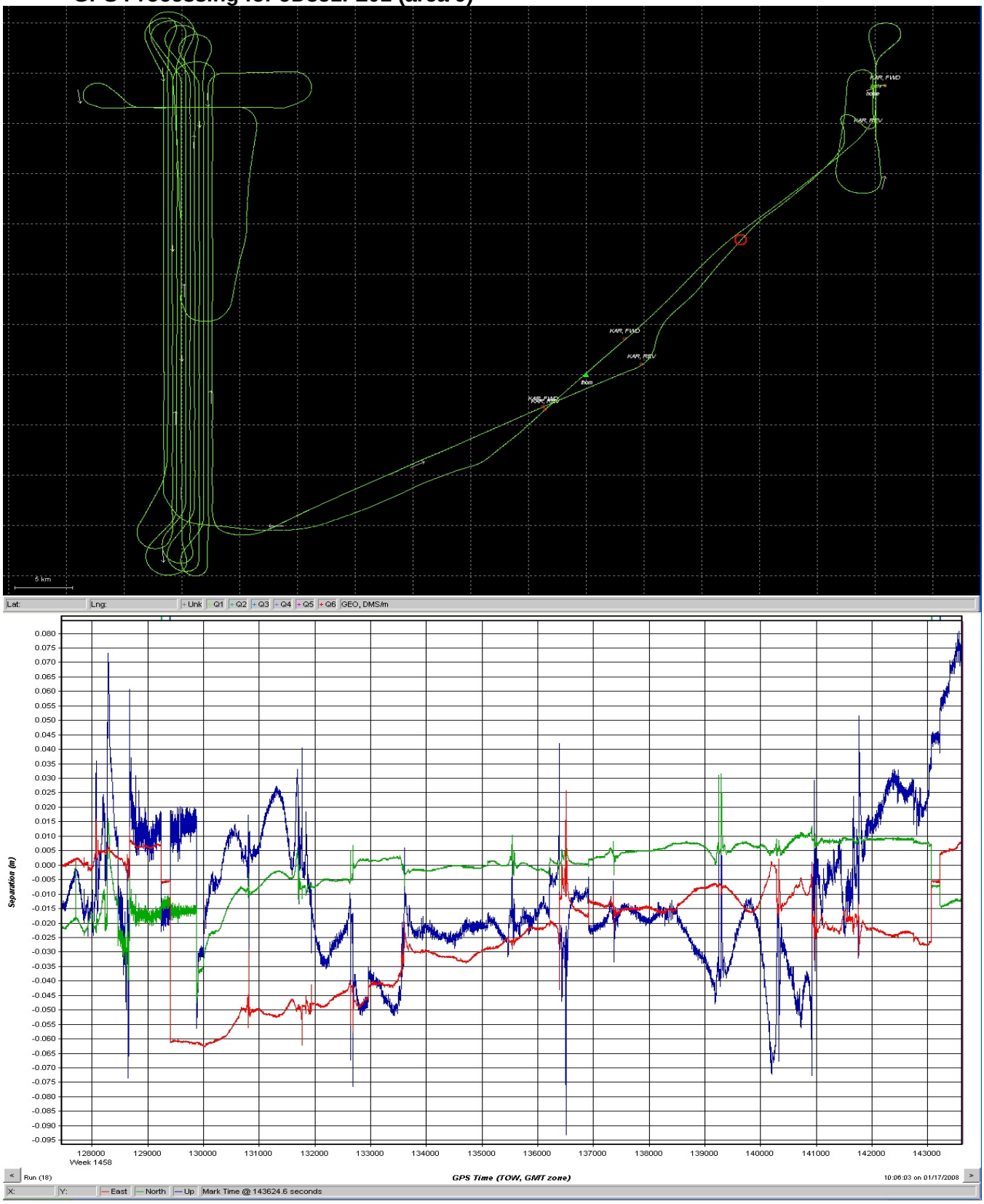


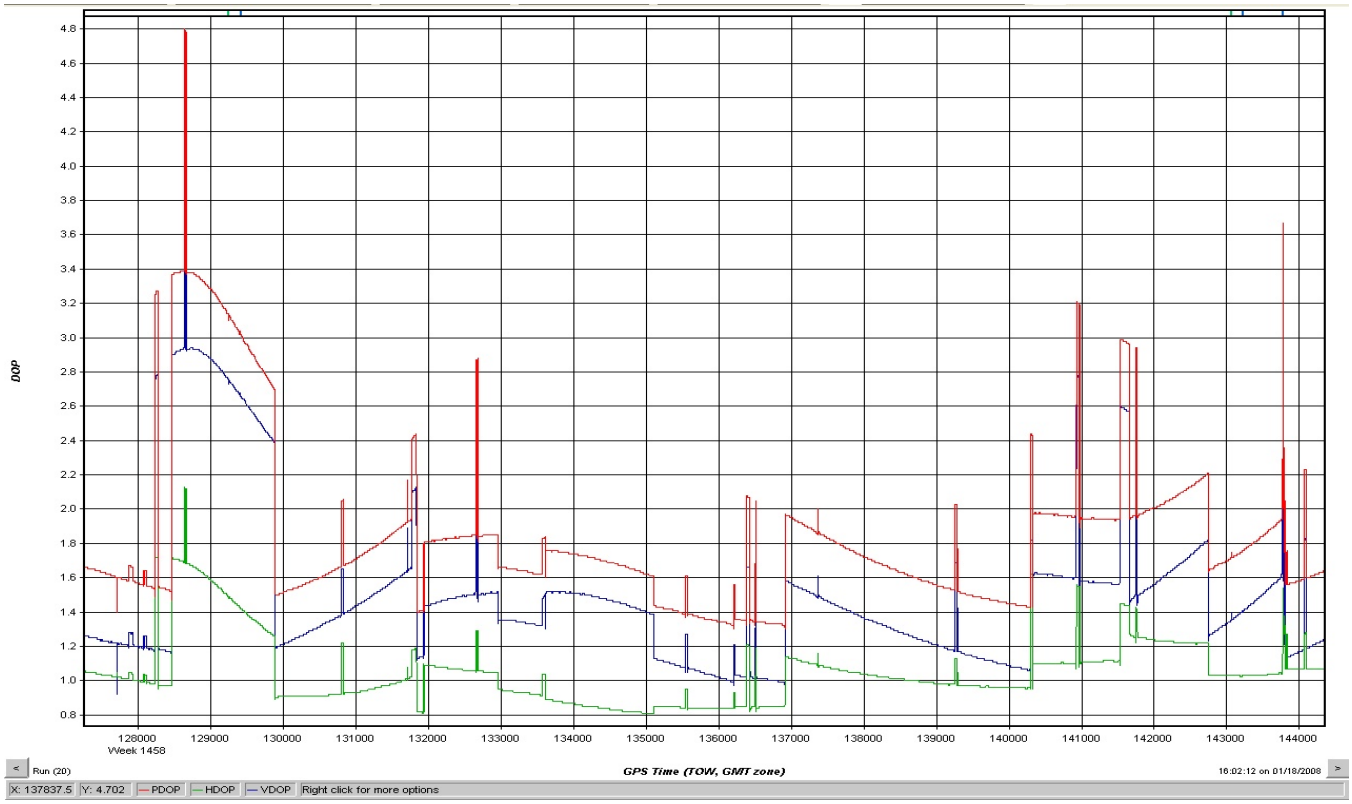


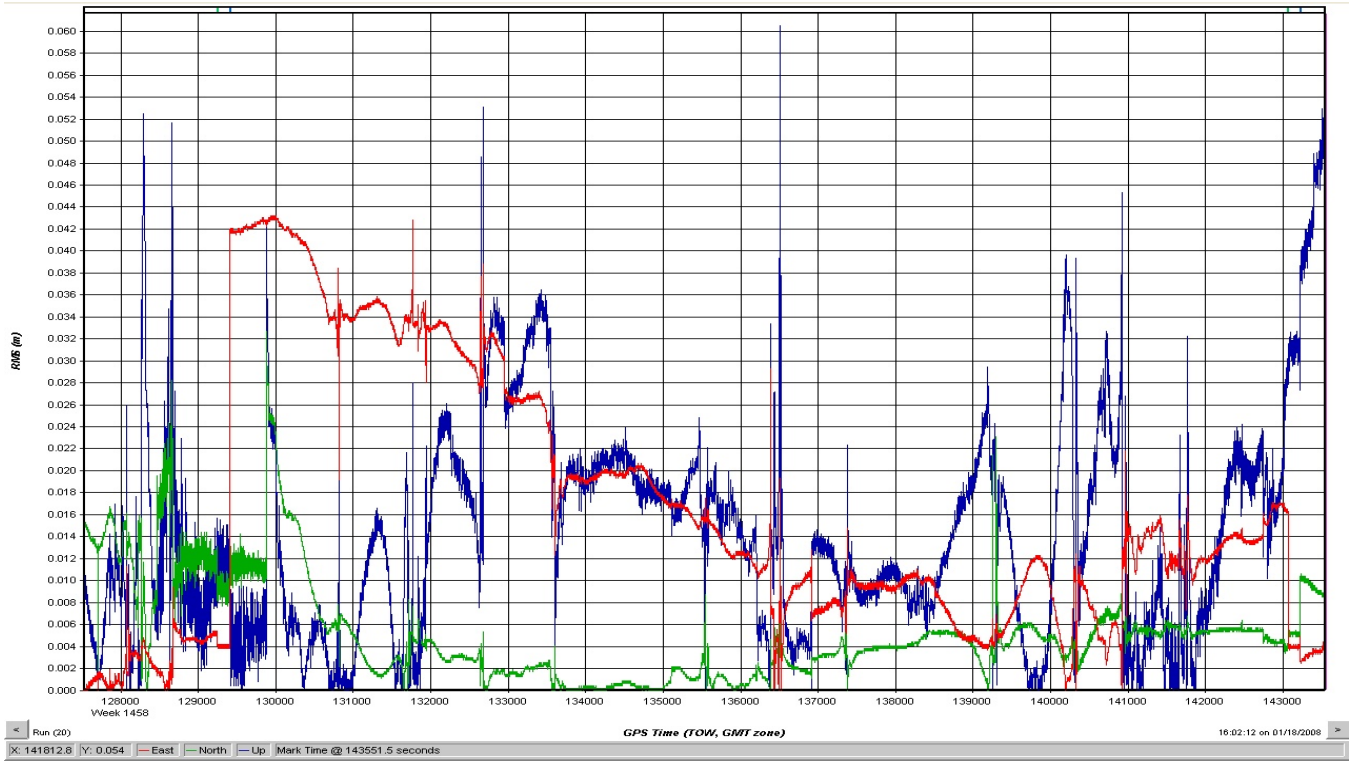

DOP
GPS Time (TOW, GMT zone)
Week 1457
Run (4)
10:51:51 on 01/22/2008
X: 359790.5
Y: 2.620
PDOP
HDOP
VDOP
Right click for more options


RMS (m)
GPS Time (TOW, GMT zone)
Week 1457
Run (4)
10:51:51 on 01/22/2008
X: 359727.4
Y: 0.222
East
North
Up
Mark Time @ 360454.6 seconds

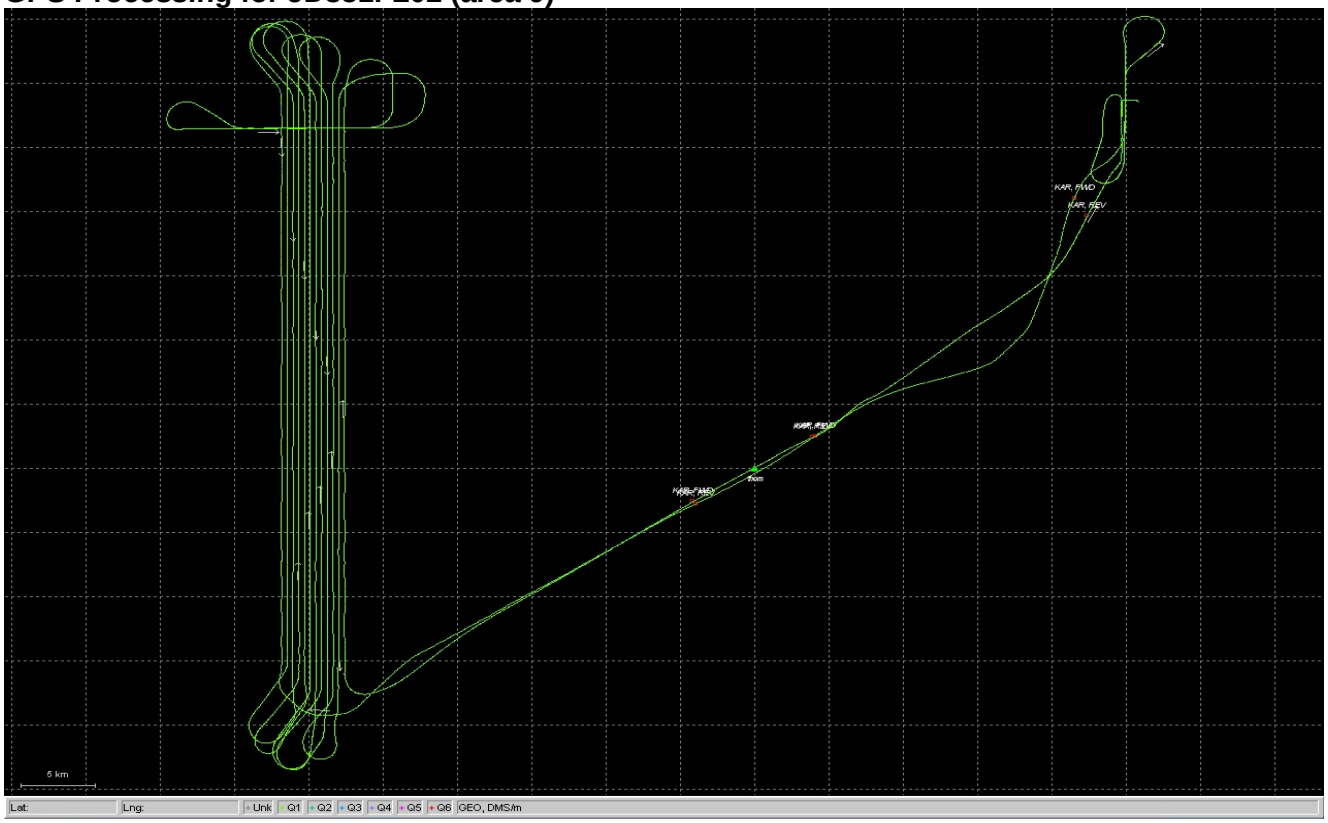
GPS Processing for JD351FL01 (area 9)

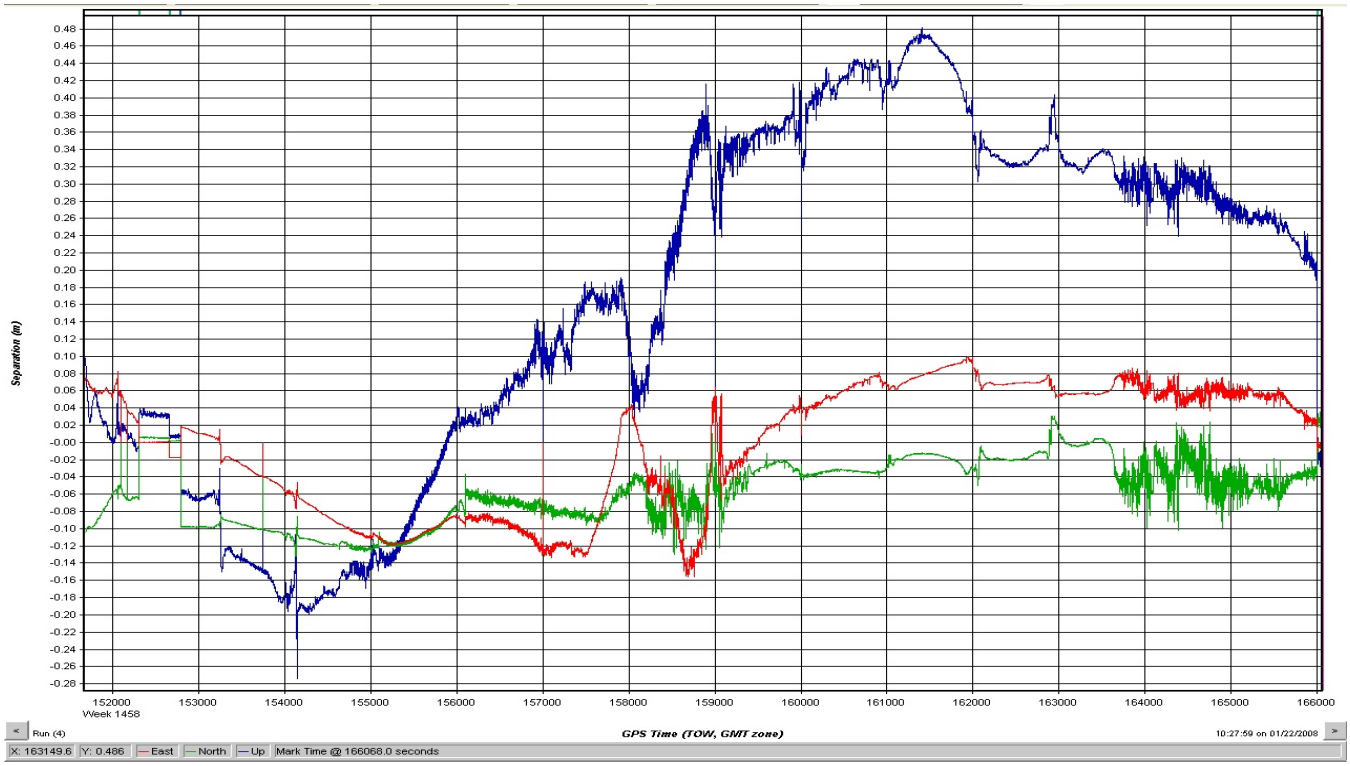


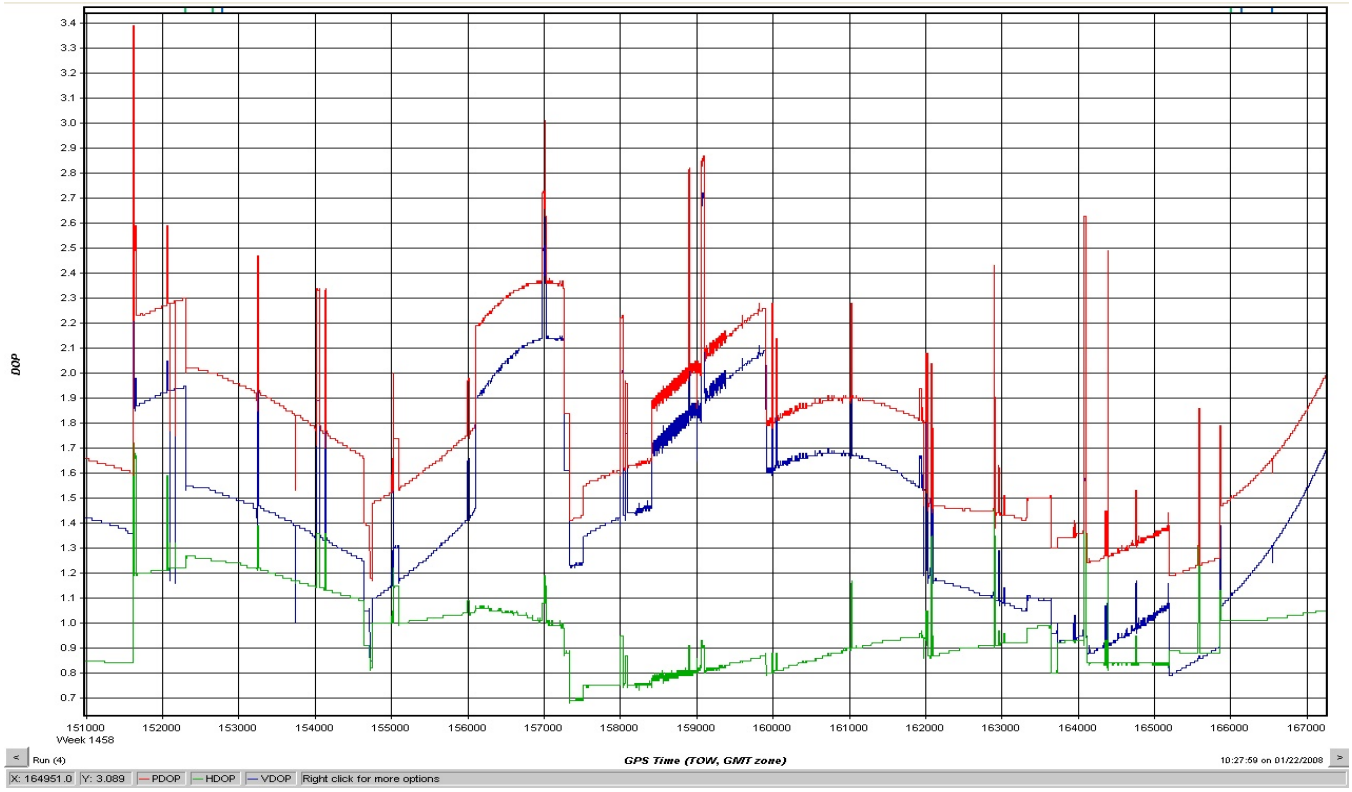

DOP
GPS Time (TOW, GMT zone)
Week 1458
Run (20)
16:02:12 on 01/18/2008
X: 137837.5
Y: 4.702
PDOP
HDOP
VDOP
Right click for more options

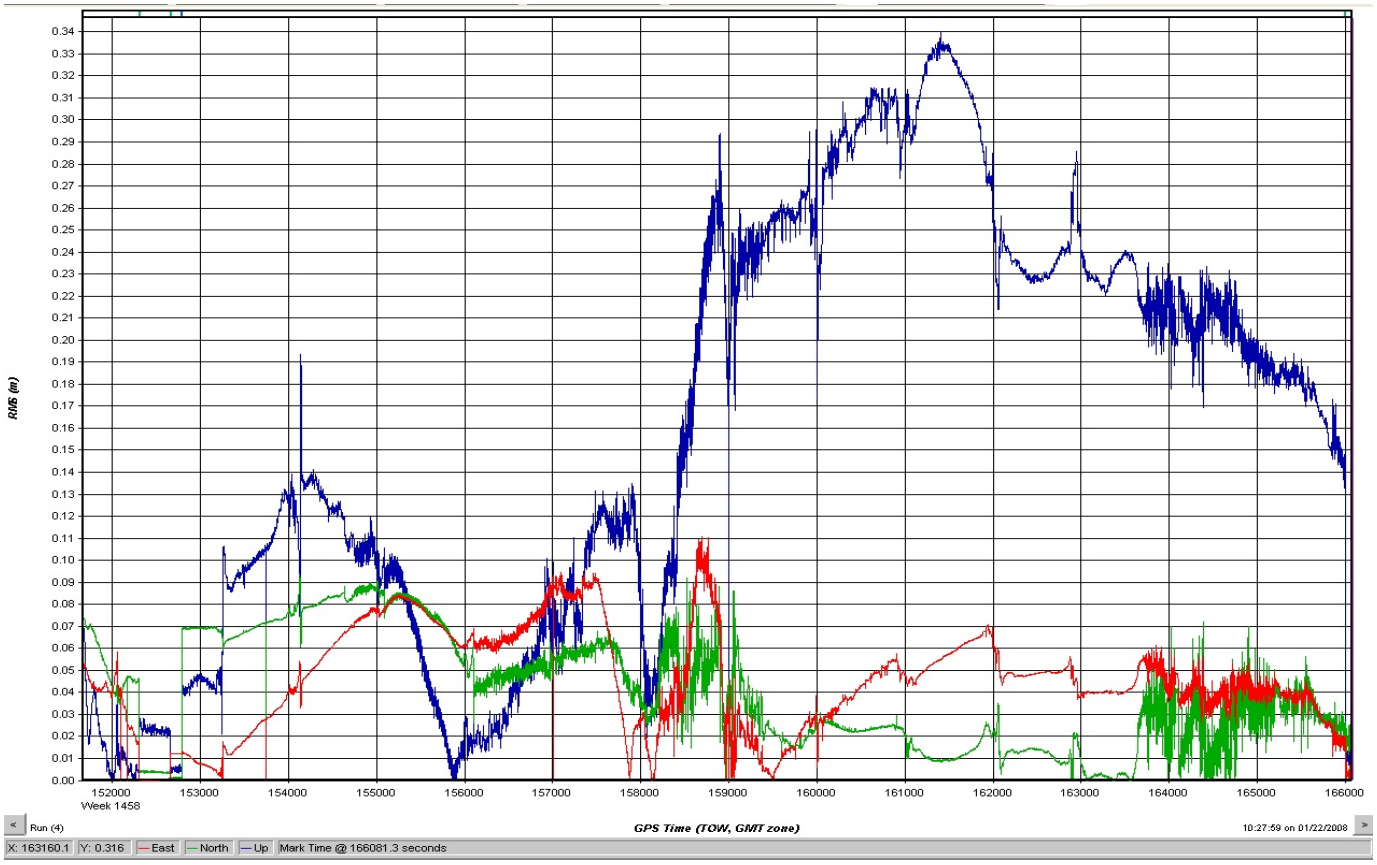

RMS (m)
GPS Time (TOW, GMT zone)
Week 1458
Run (20)
16:02:12 on 01/18/2008
X: 141812.8
Y: 0.054
East
North
Up
Mark Time @ 143551.5 seconds

GPS Processing for JD351FL02 (area 9)

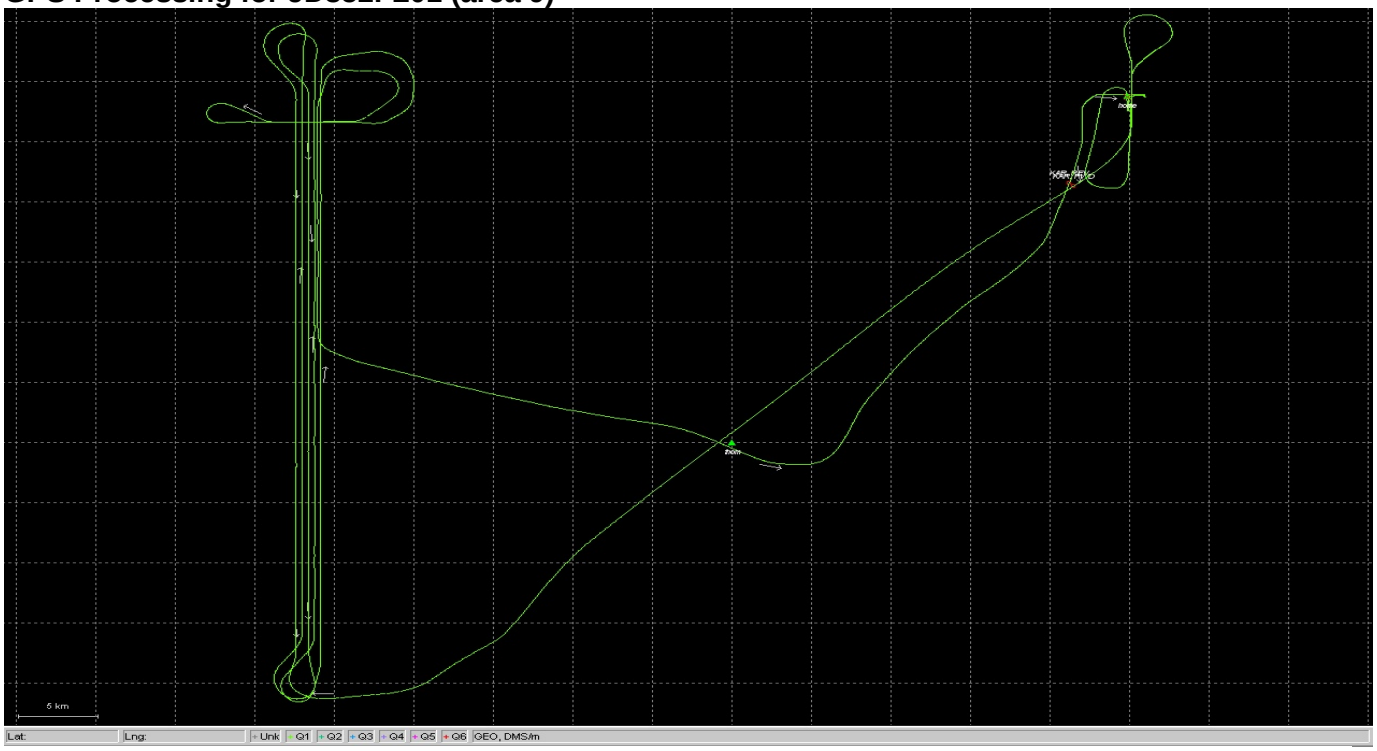


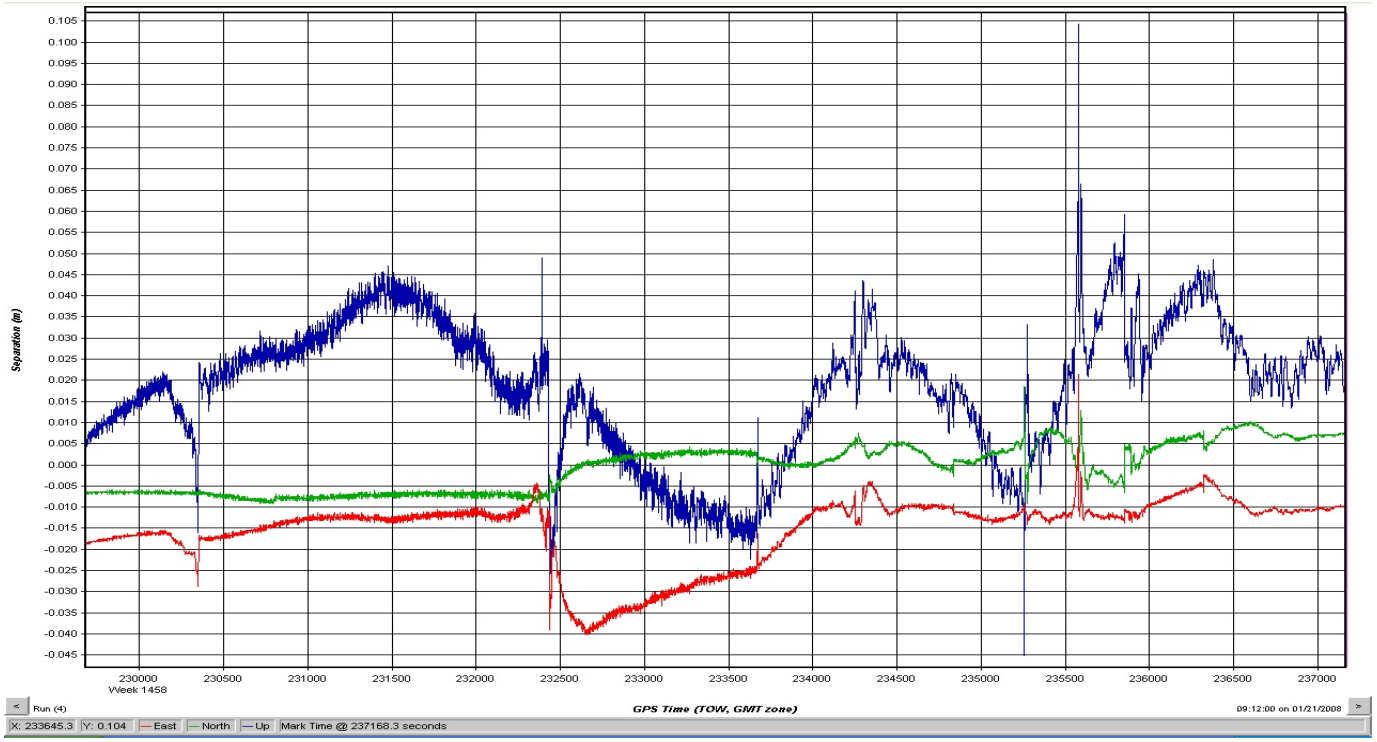


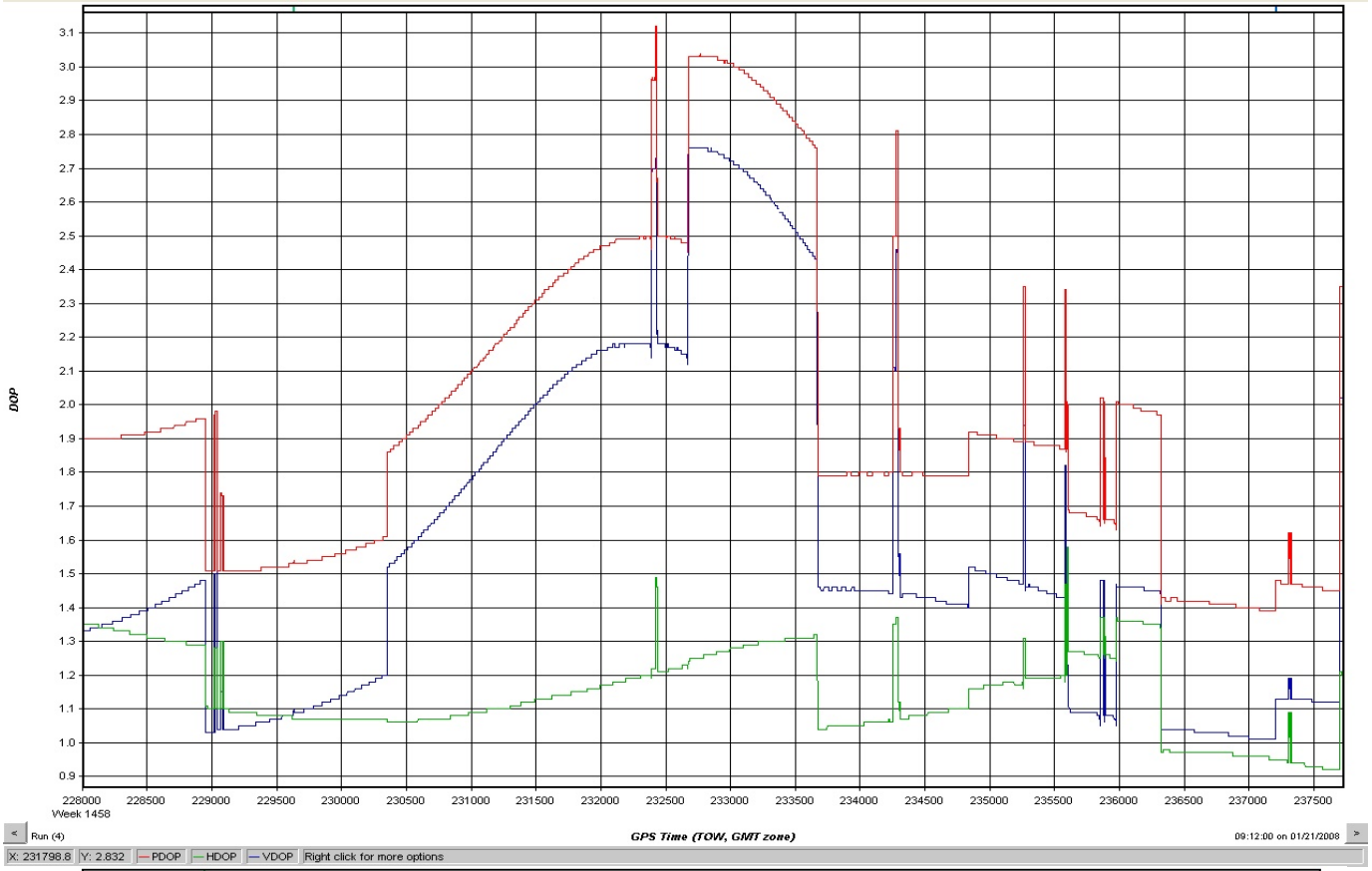

DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (4)
10:27:59 on 01/22/2008
X: 164951.0
Y: 3.089
PDOP
HDOP
VDOP
Right click for more options

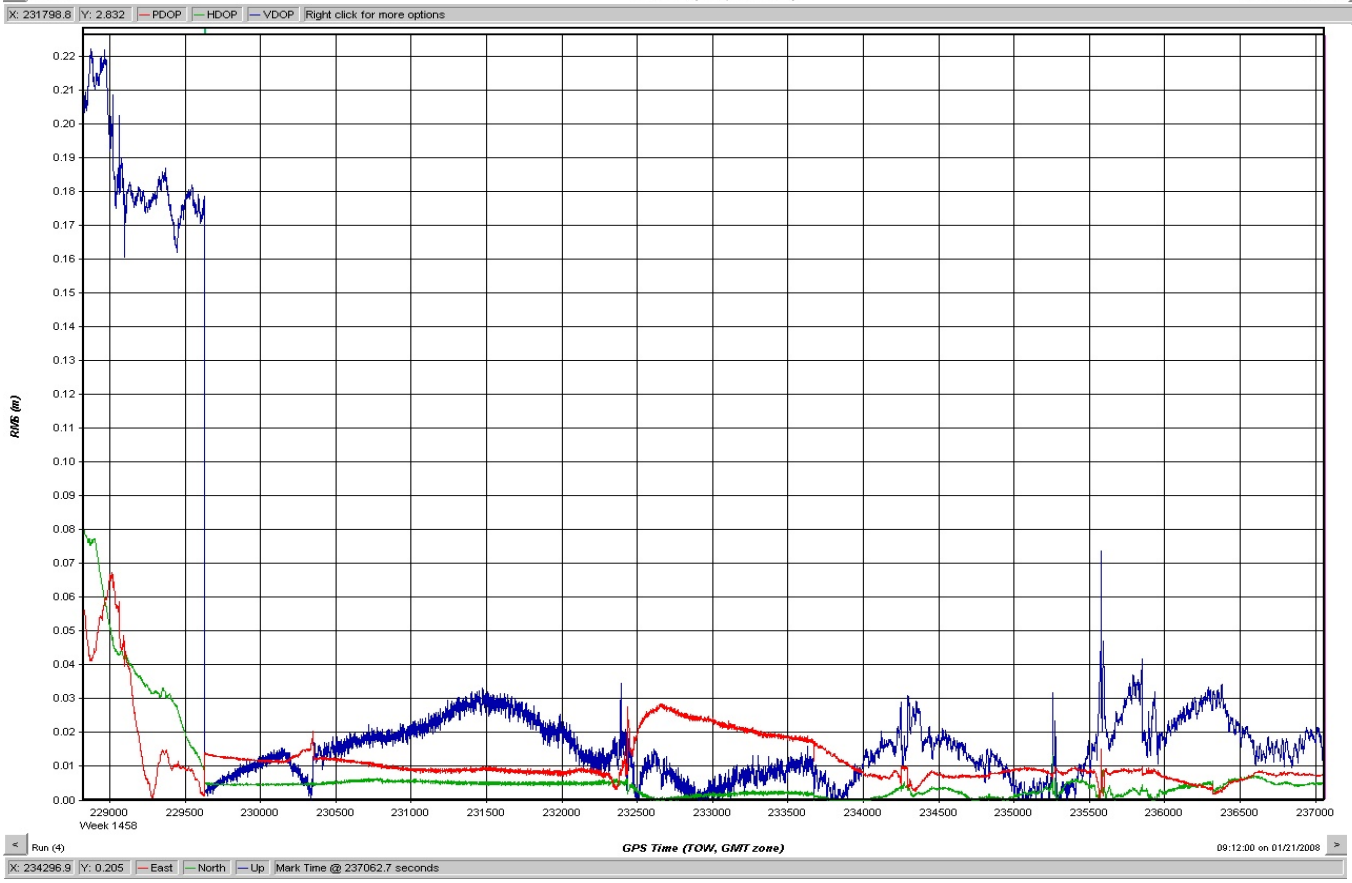

RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (4)
10:27:59 on 01/22/2008
X: 163160.1
Y: 0.316
East
North
Up
Mark Time @ 166081.3 seconds

GPS Processing for JD352FL01 (area 9)

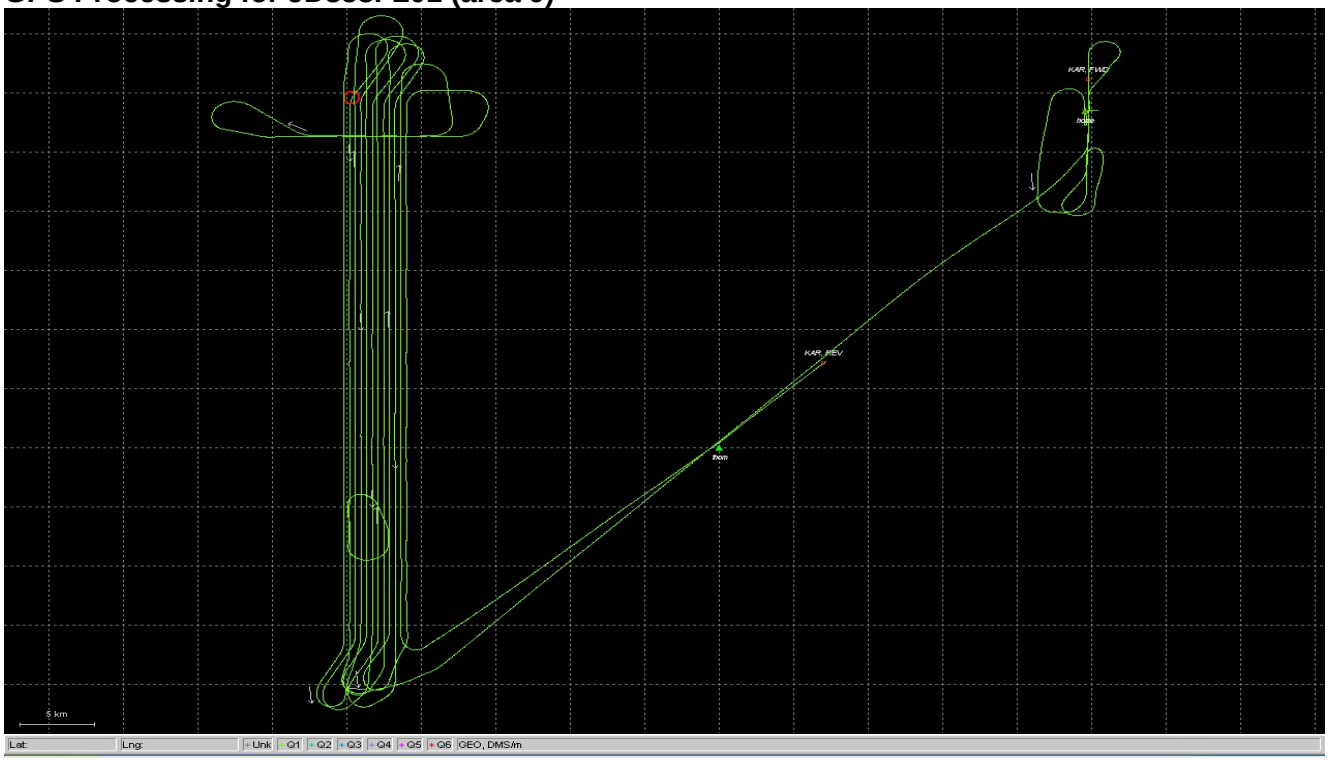


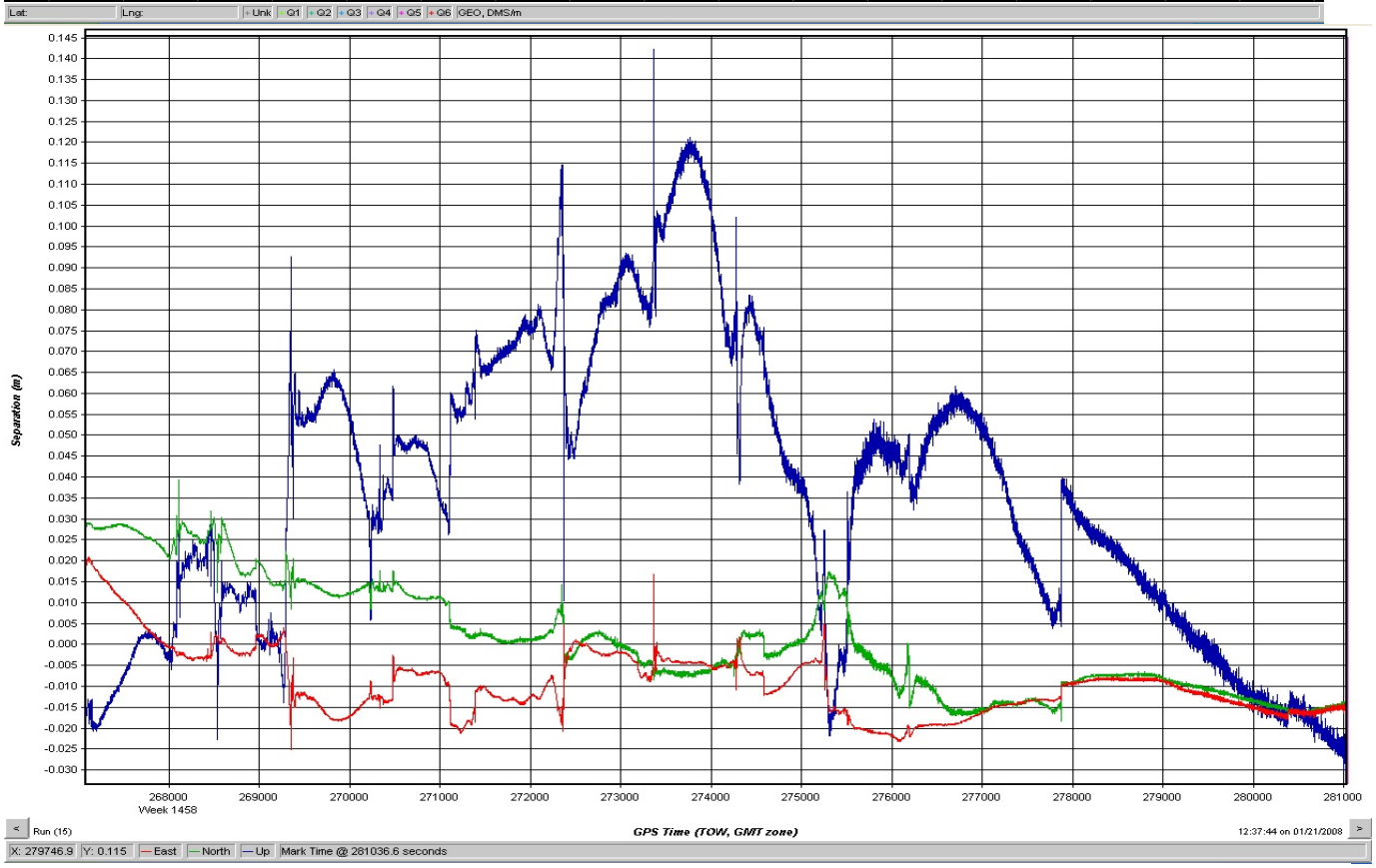


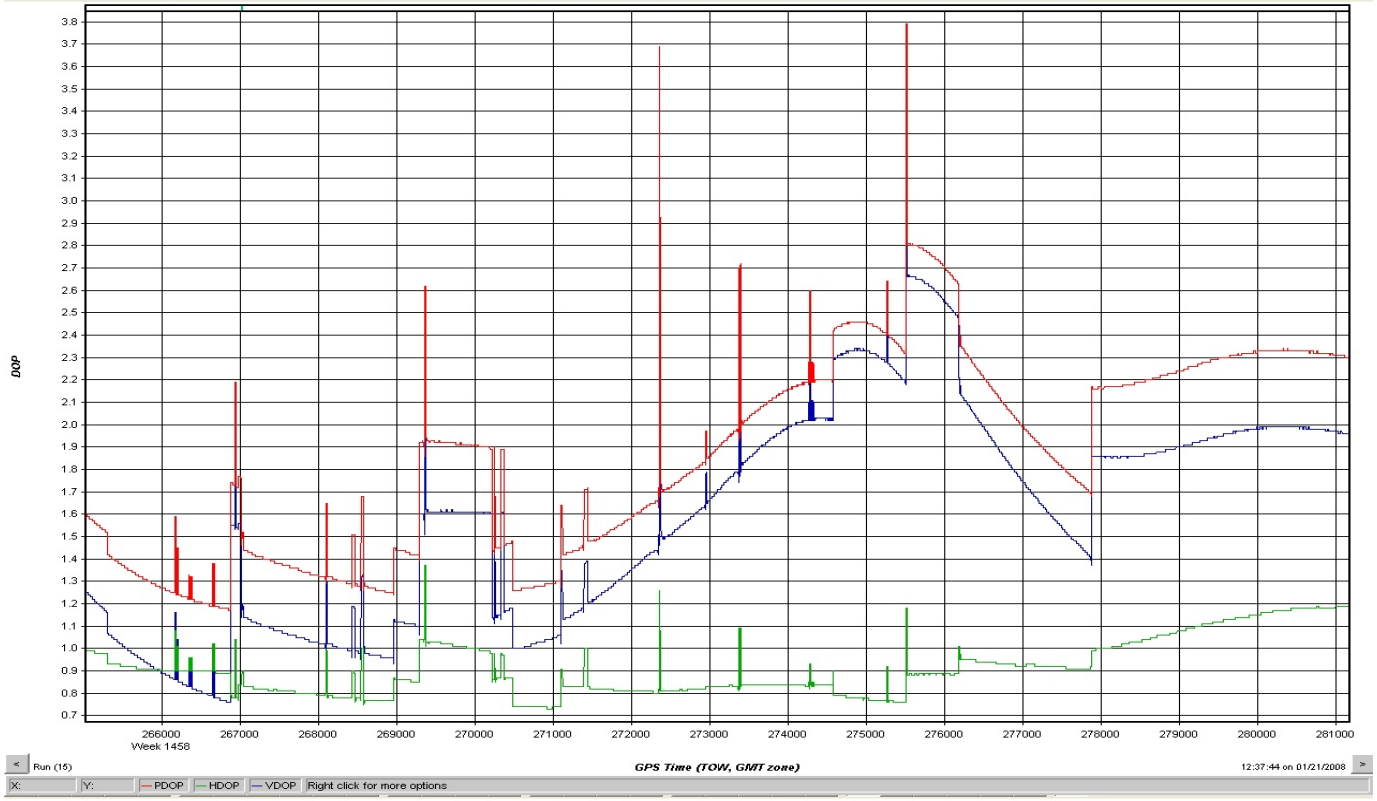

DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (4)
09:12:00 on 01/21/2008
X: 231798.8
Y: 2.832
PDOP
HDOP
VDOP
Right click for more options

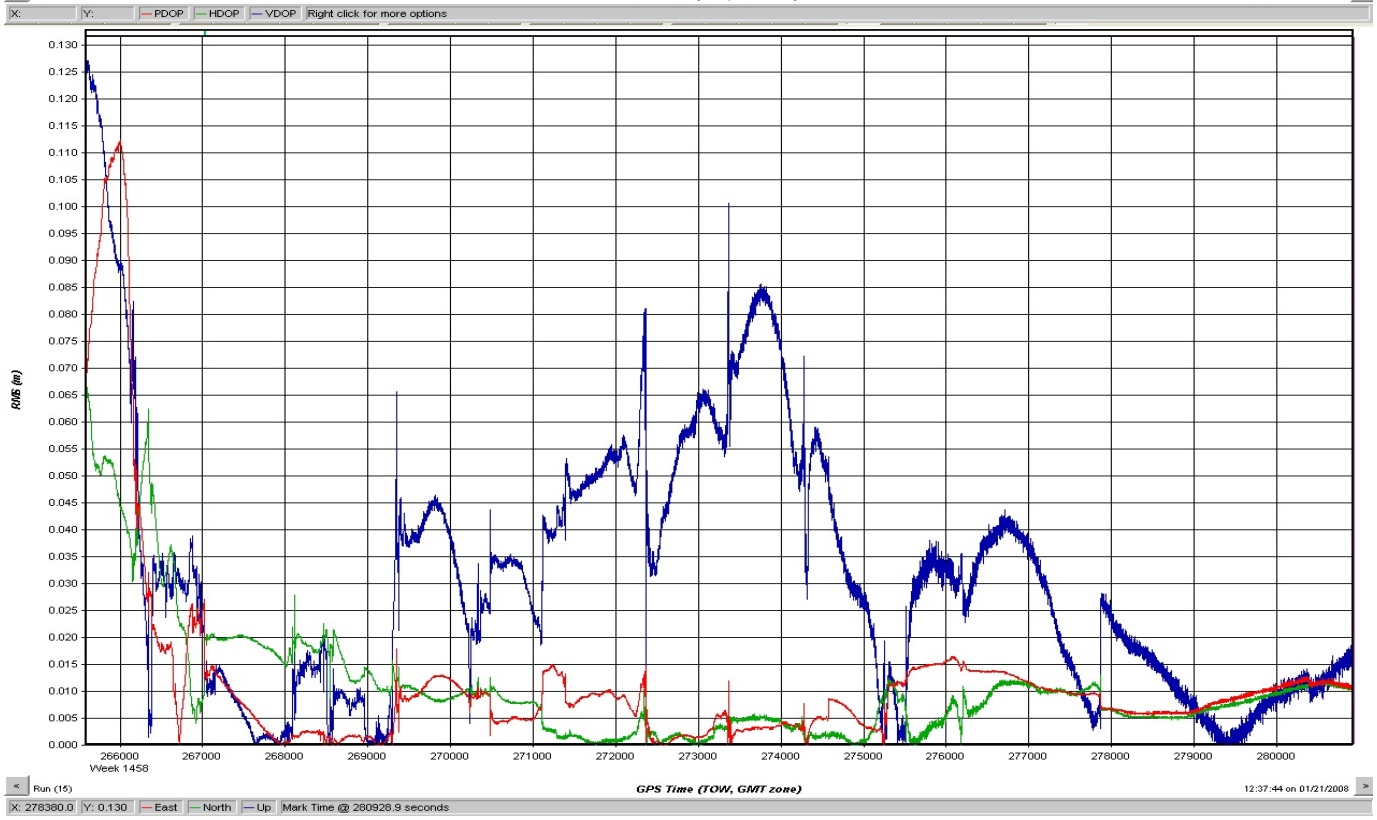

RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (4)
09:12:00 on 01/21/2008
X: 234296.9
Y: 0.205
East
North
Up
Mark Time @ 237062.7 seconds

GPS Processing for JD353FL01 (area 9)

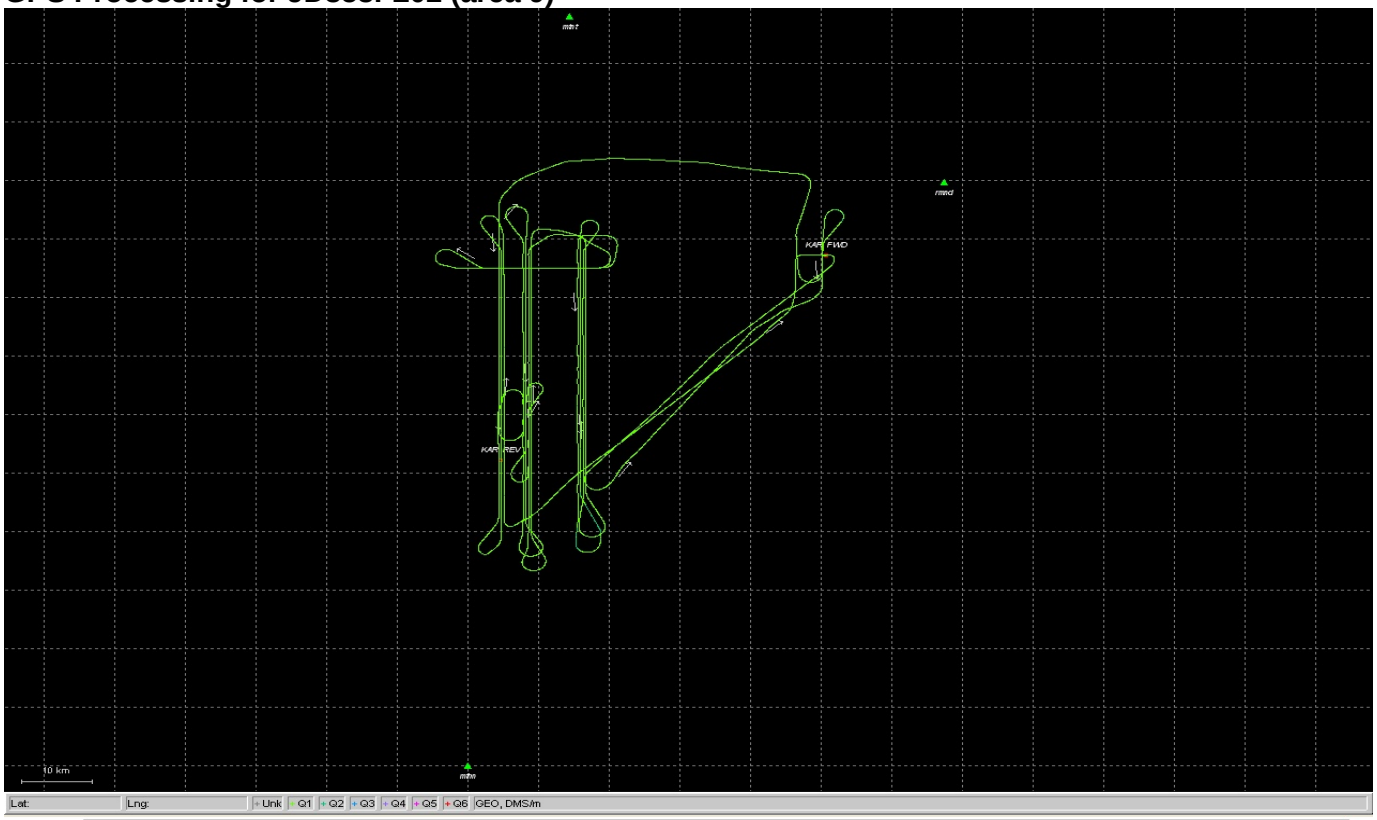


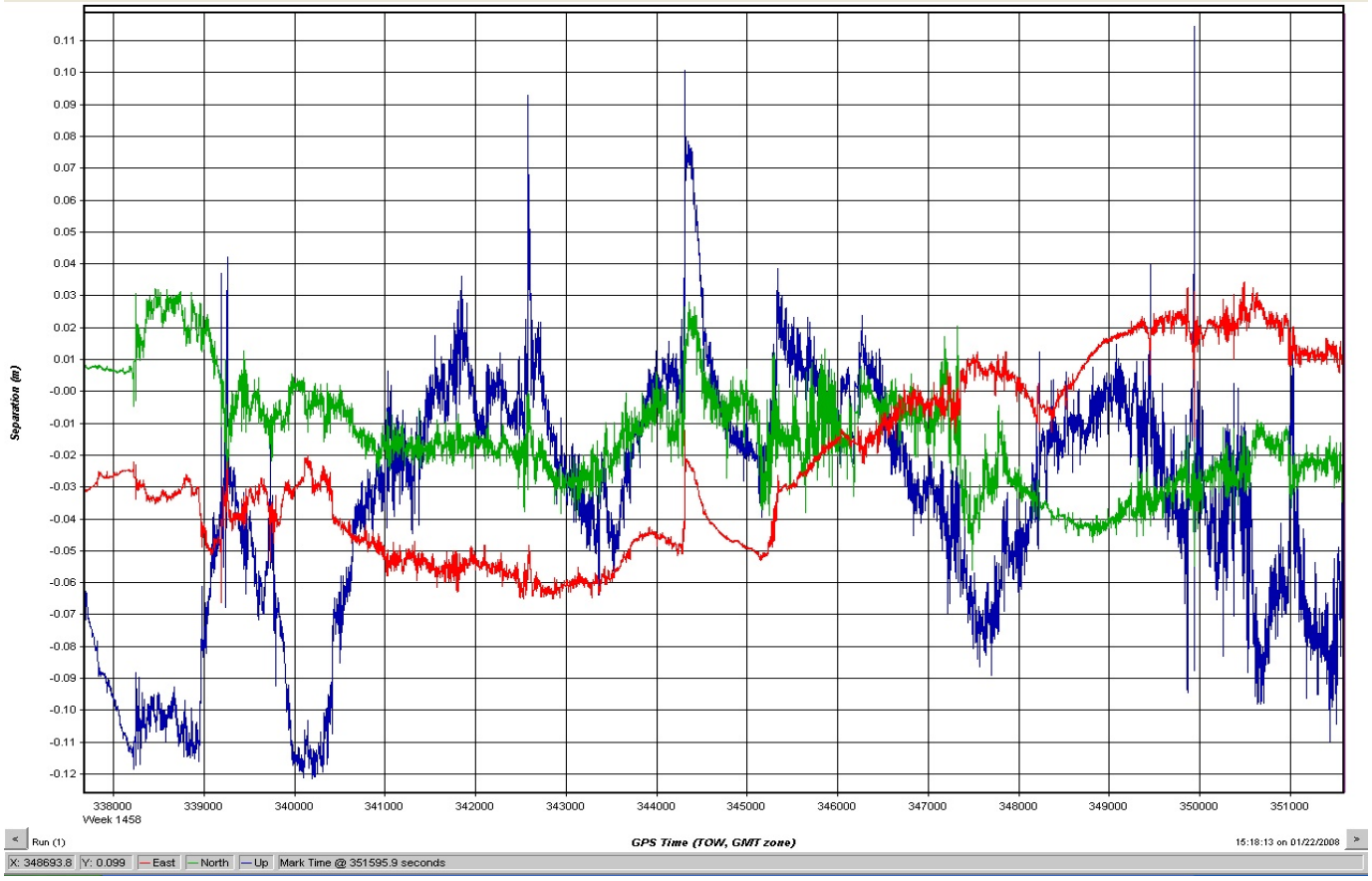


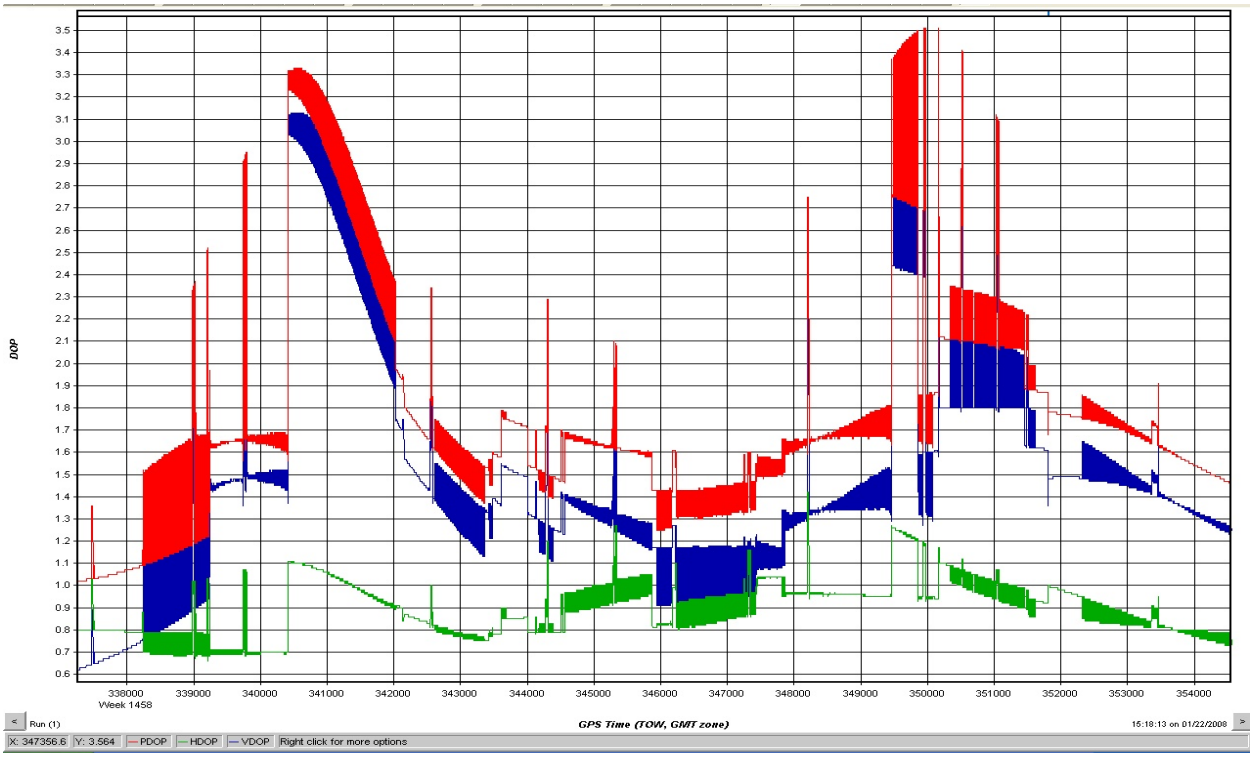

DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (15)
12:37:44 on 01/21/2008
X:
Y:
PDOP
HDOP
VDOP
Right click for more options

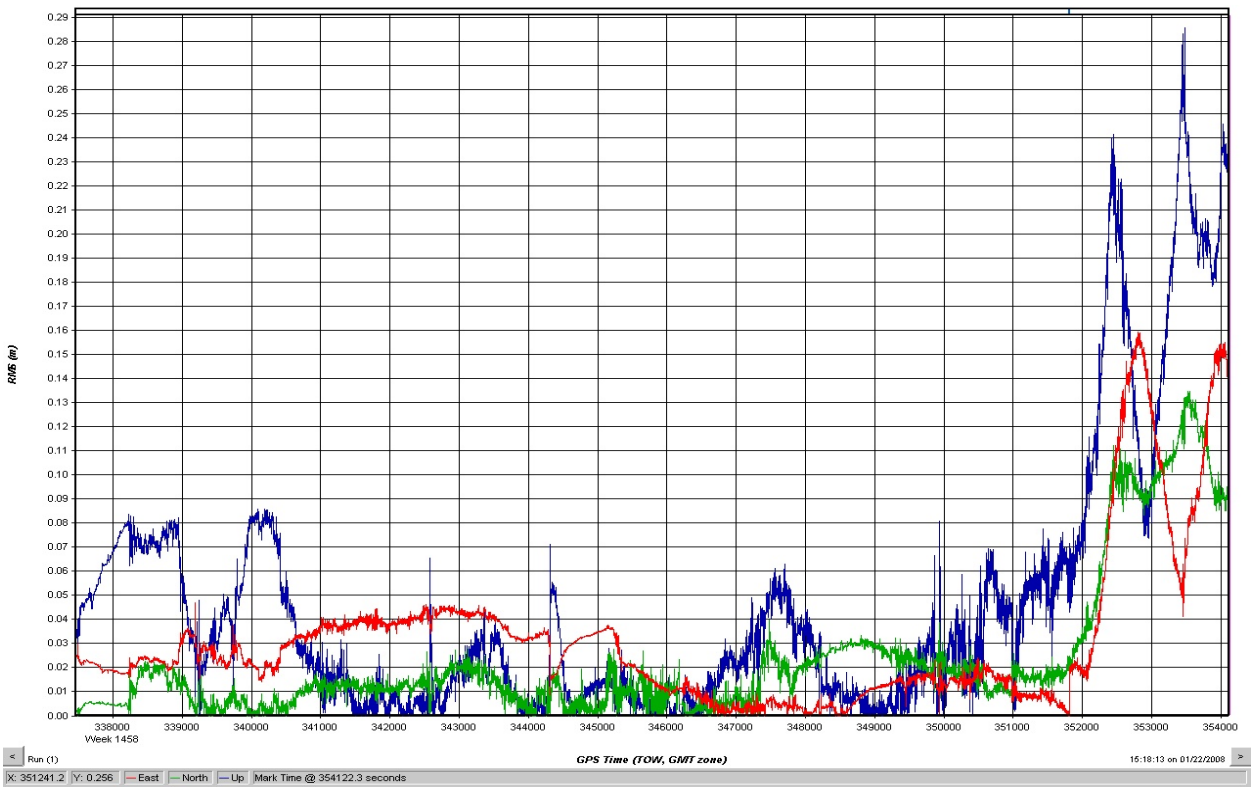

RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (15)
12:37:44 on 01/21/2008
X: 278380.0
Y: 0.130
East
North
Up
Mark Time @ 280928.9 seconds

GPS Processing for JD353FL02 (area 9)

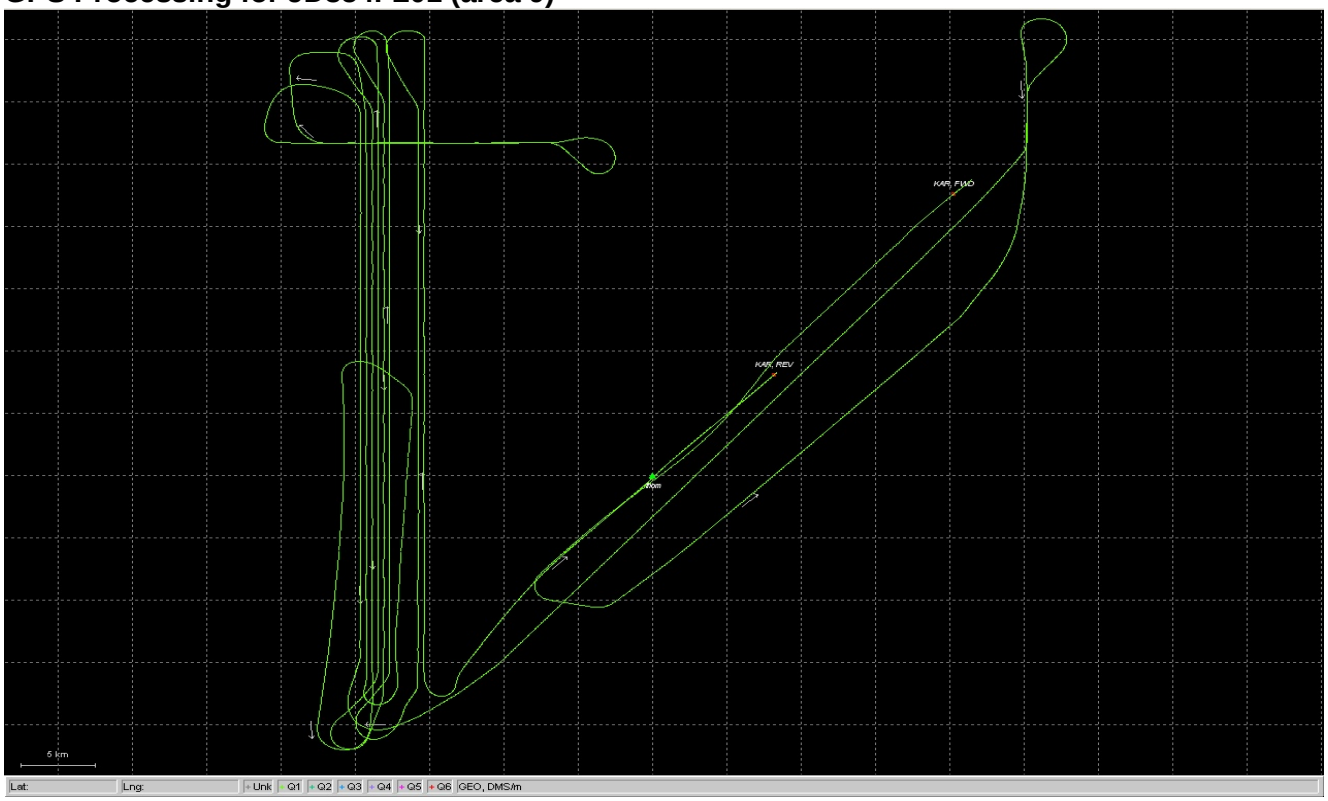


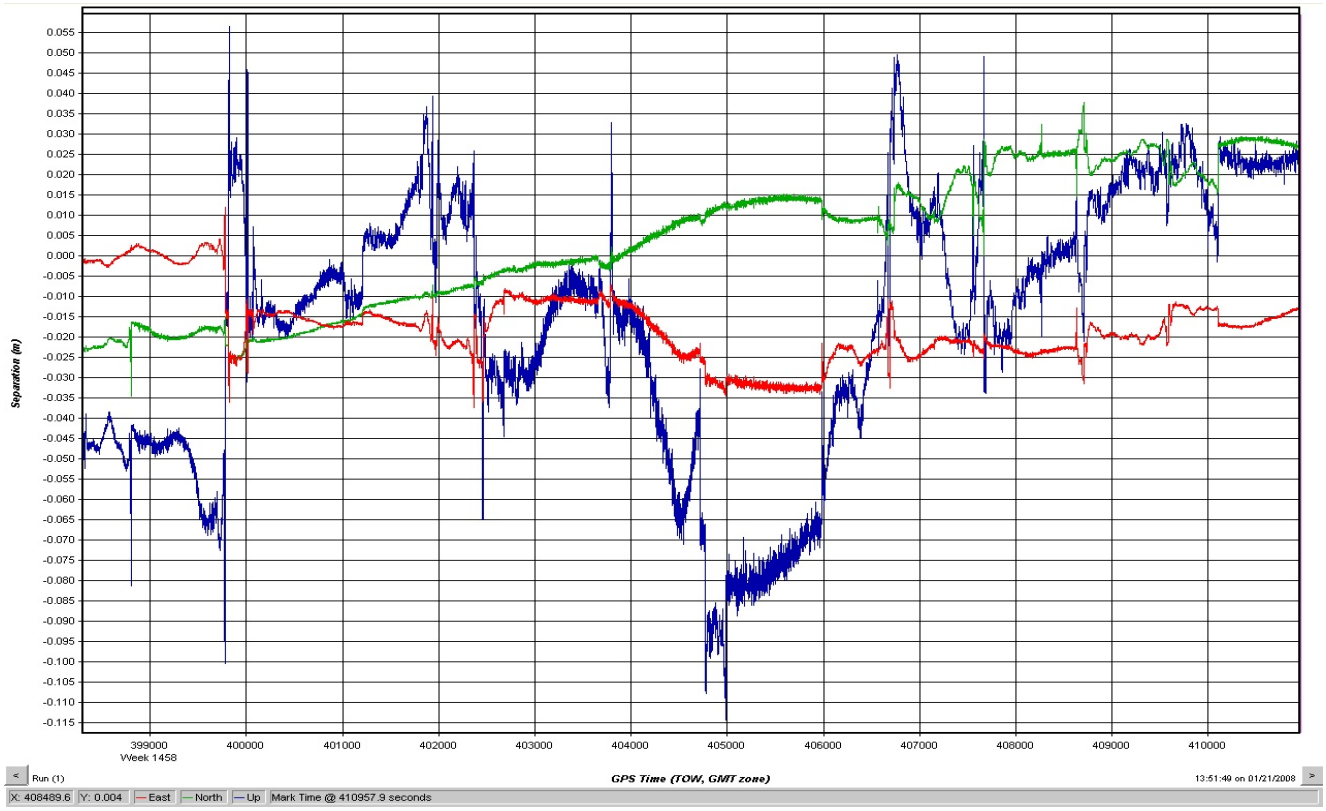


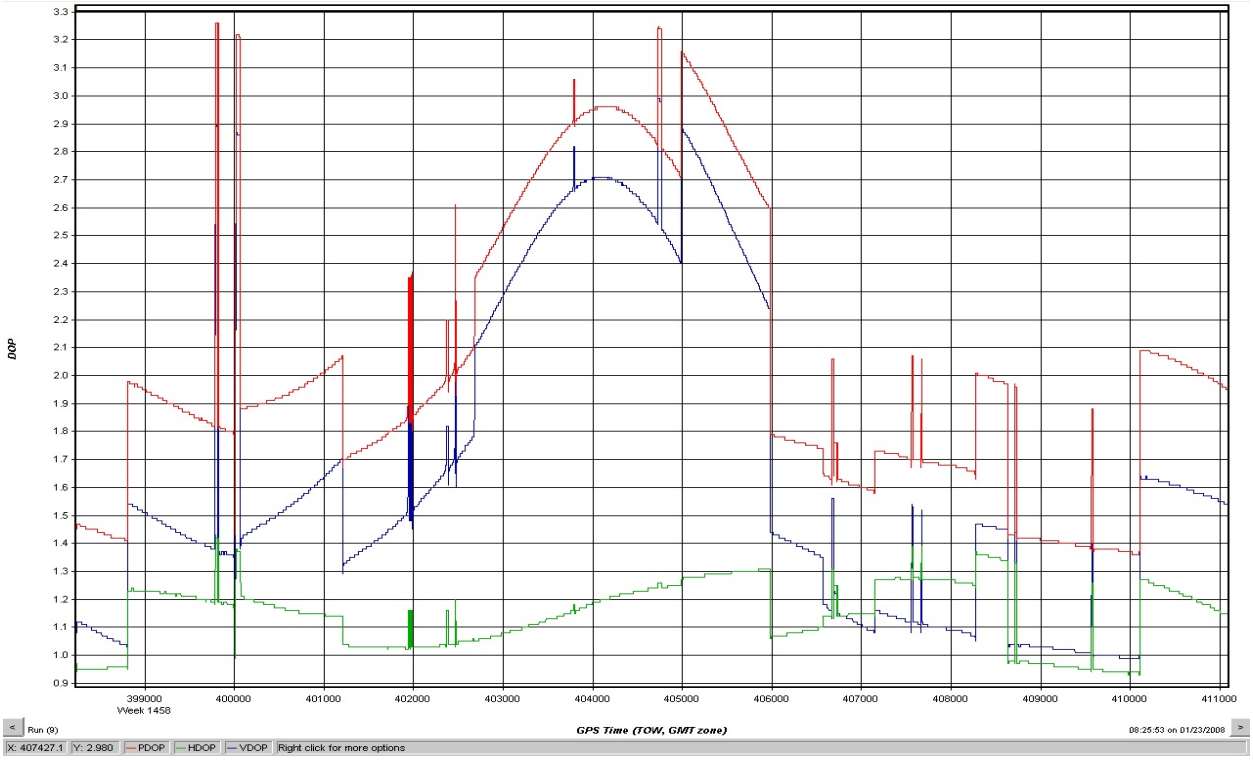

DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (1)
15:18:13 on 01/22/2008
X: 347356.6
Y: 3.564
PDOP
HDOP
VDOP
Right click for more options

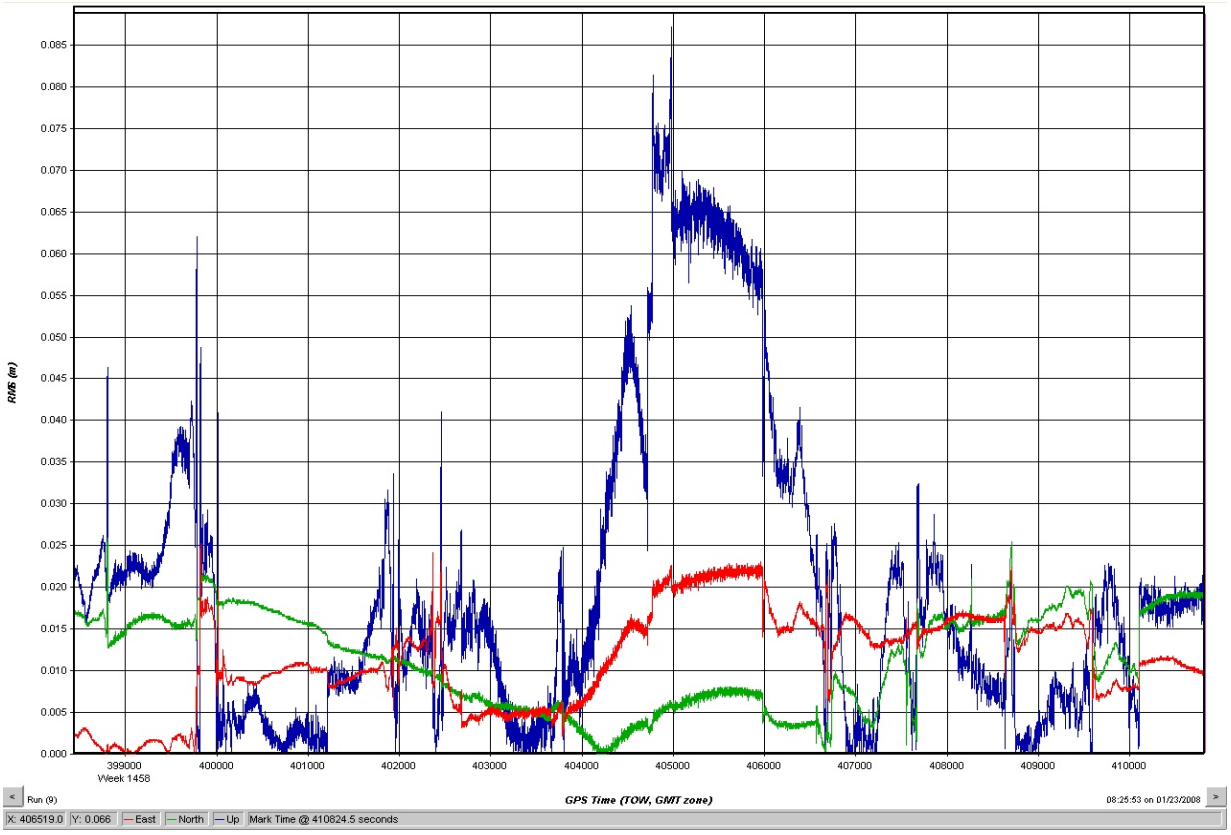

RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (1)
15:18:13 on 01/22/2008
X: 351241.2
Y: 0.256
East
North
Up
Mark Time @ 354122.3 seconds

GPS Processing for JD354FL01 (area 9)

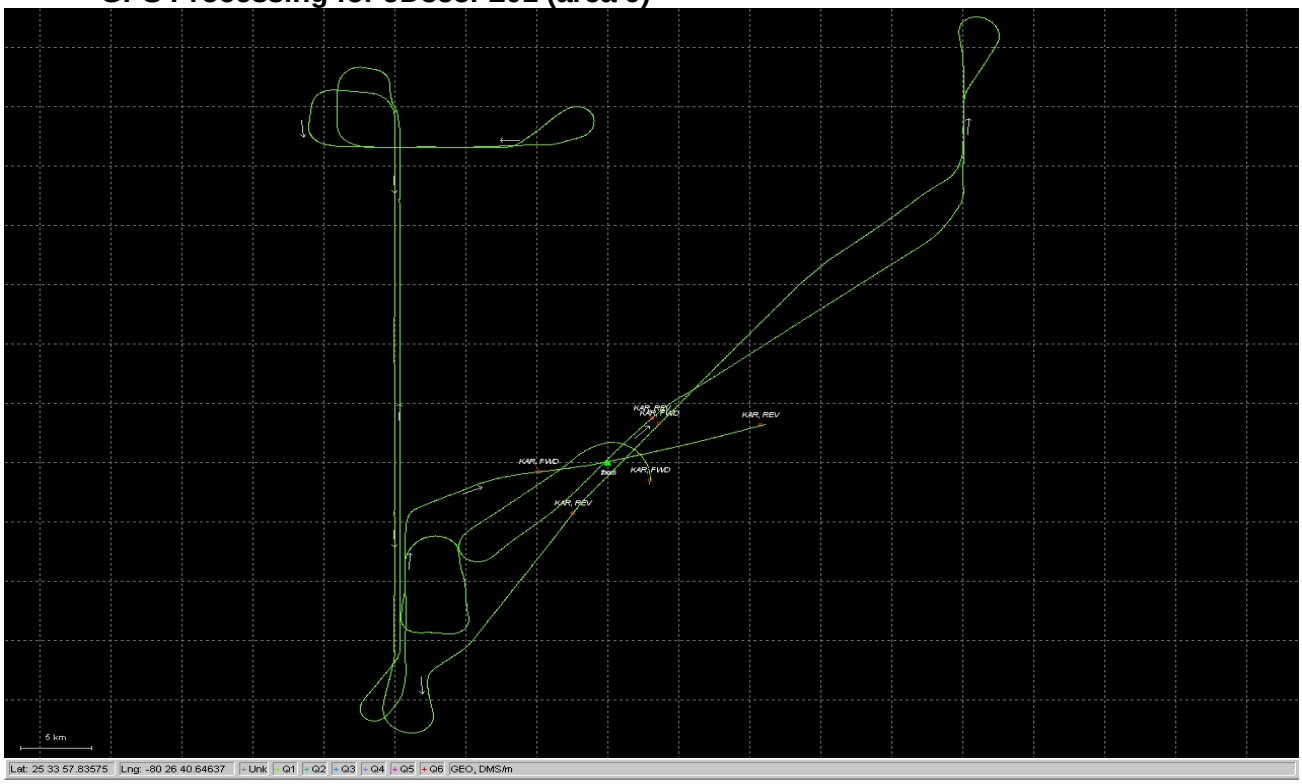


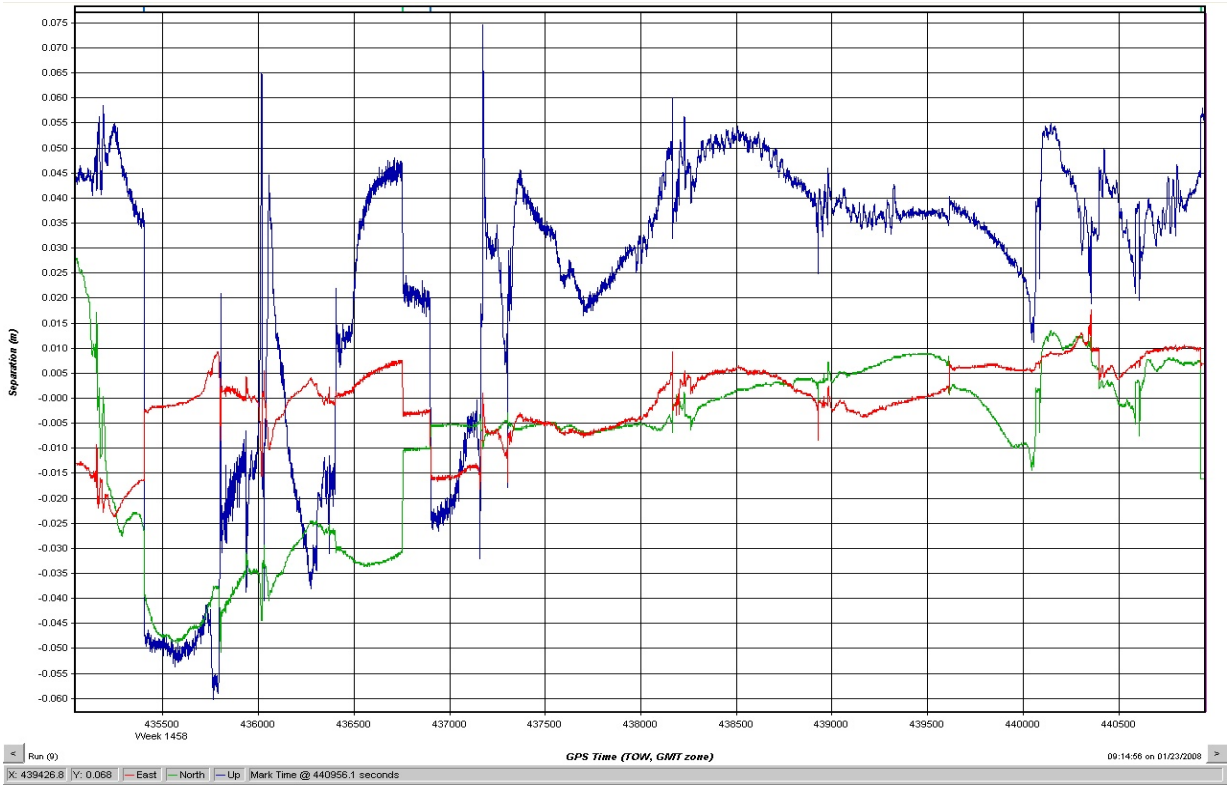


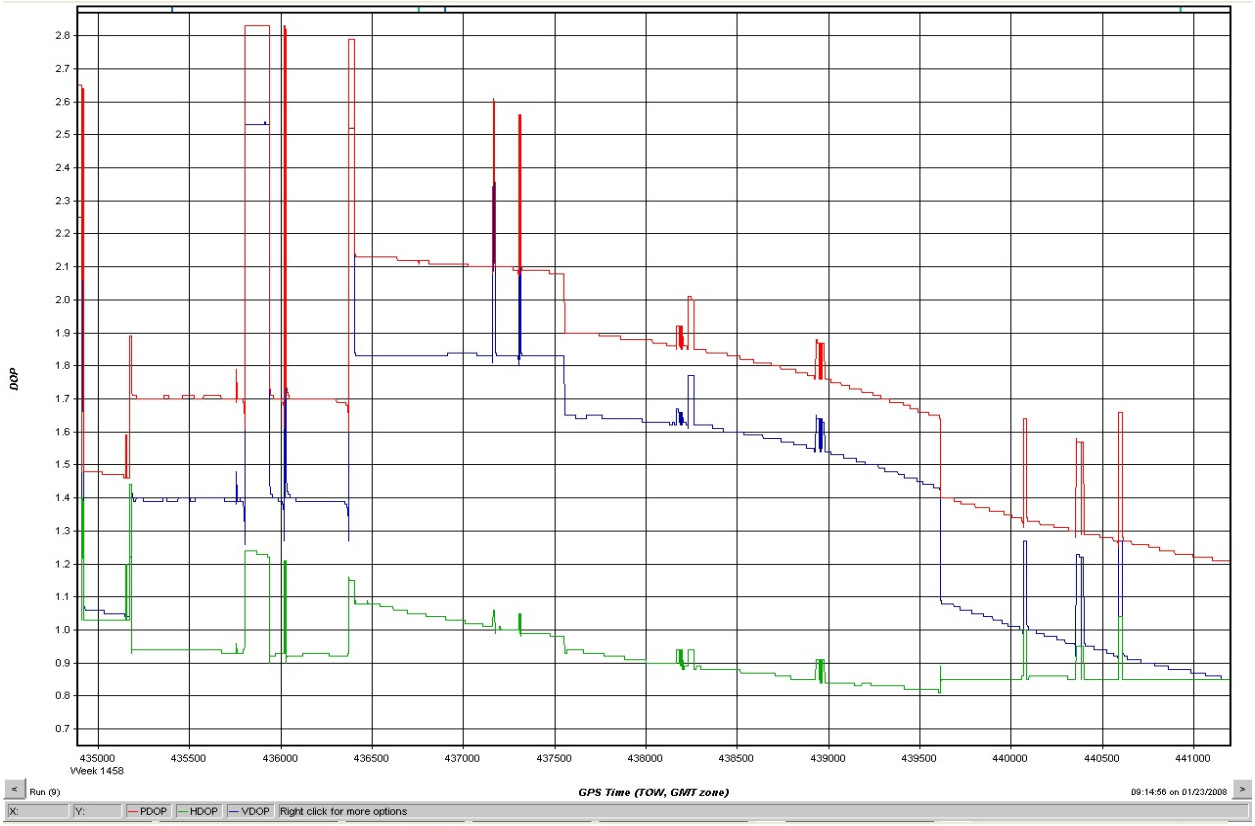

DOP
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
399000
Week 1458
400000
401000
402000
403000
404000
405000
406000
407000
408000
409000
410000
411000
Run (9)
GPS Time (TOW, GMT zone)
08:25:53 on 01/23/2008
X: 407427.1
Y: 2.980
PDOP
HDOP
VDOP
Right click for more options

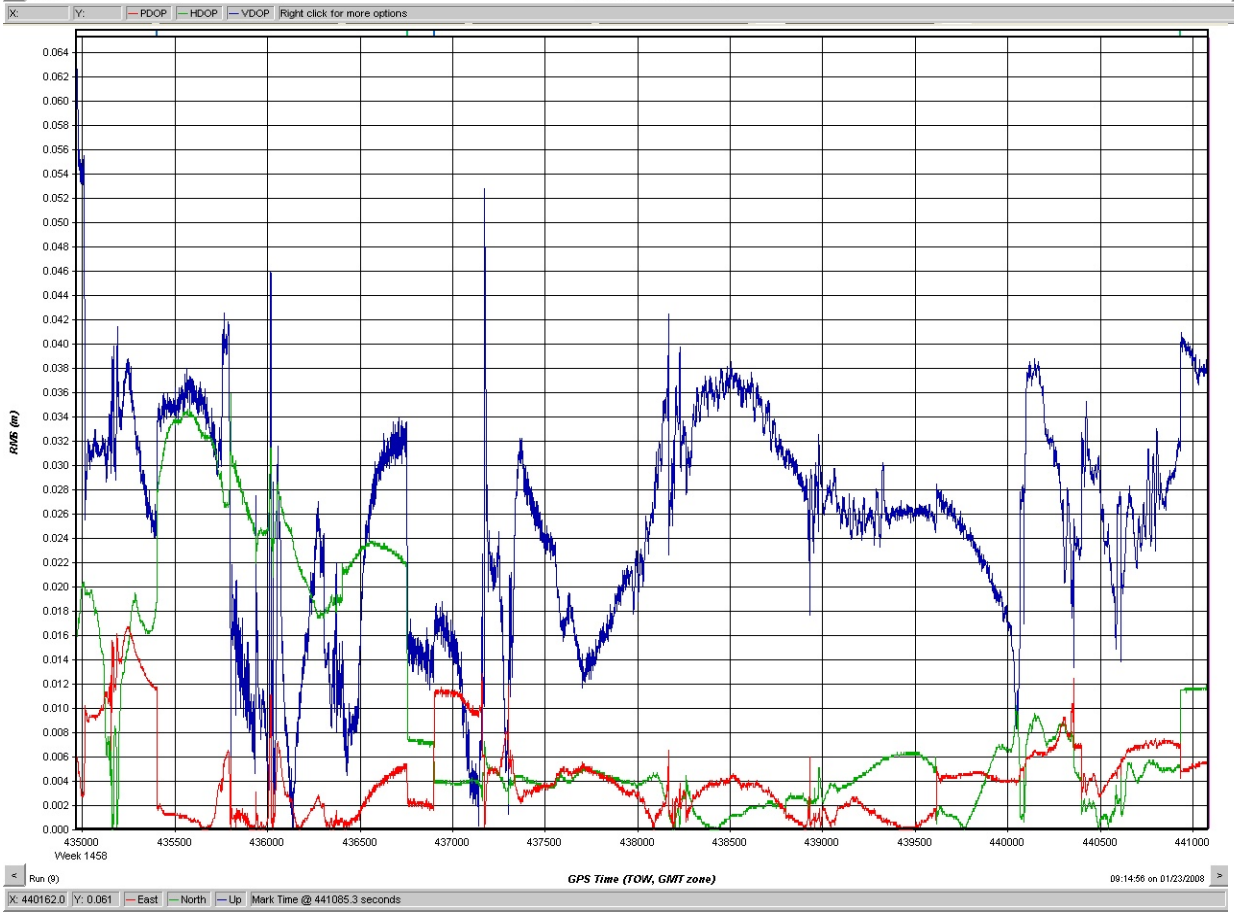

RMS (m)
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
399000
Week 1458
400000
401000
402000
403000
404000
405000
406000
407000
408000
409000
410000
Run (9)
GPS Time (TOW, GMT zone)
08:25:53 on 01/23/2008
X: 406519.0
Y: 0.066
East
North
Up
Mark Time @ 410824.5 seconds

GPS Processing for JD355FL01 (area 9)

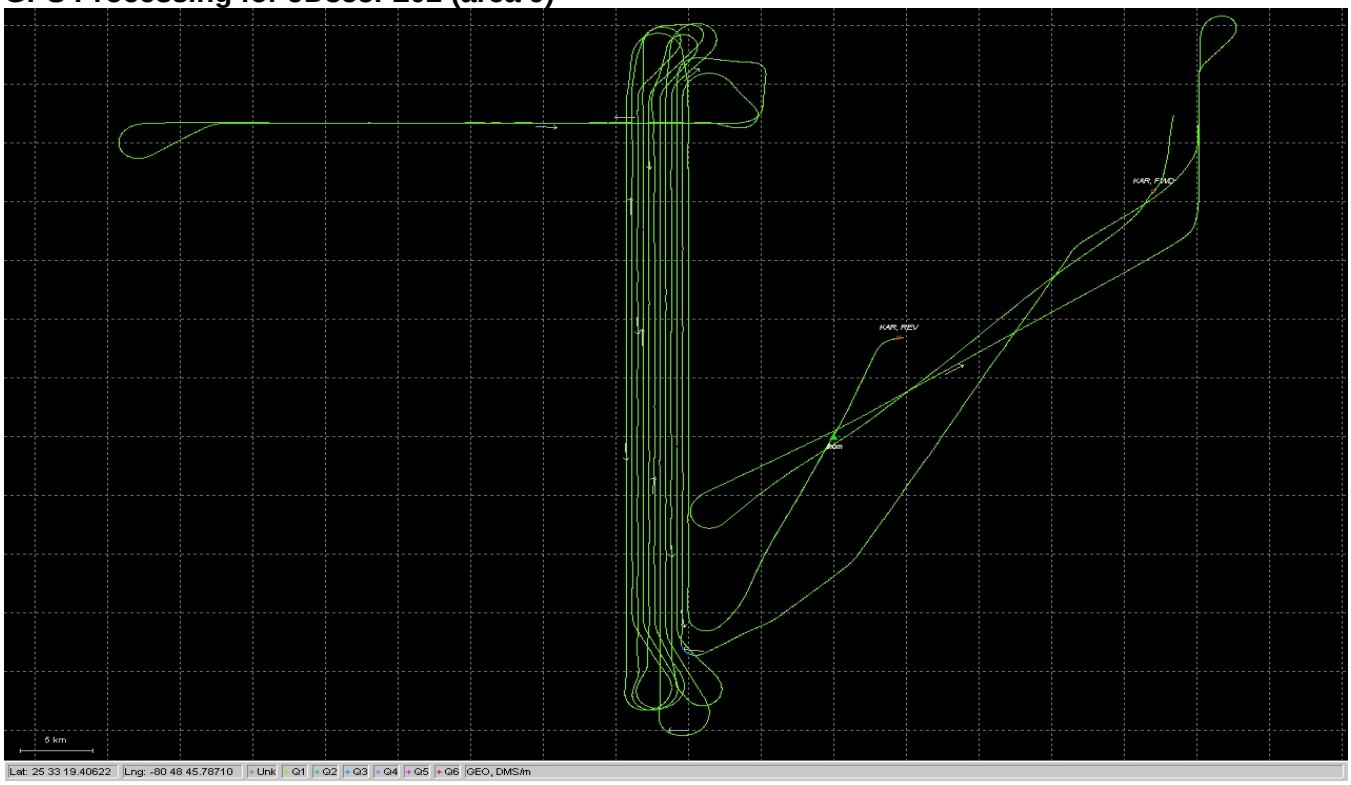


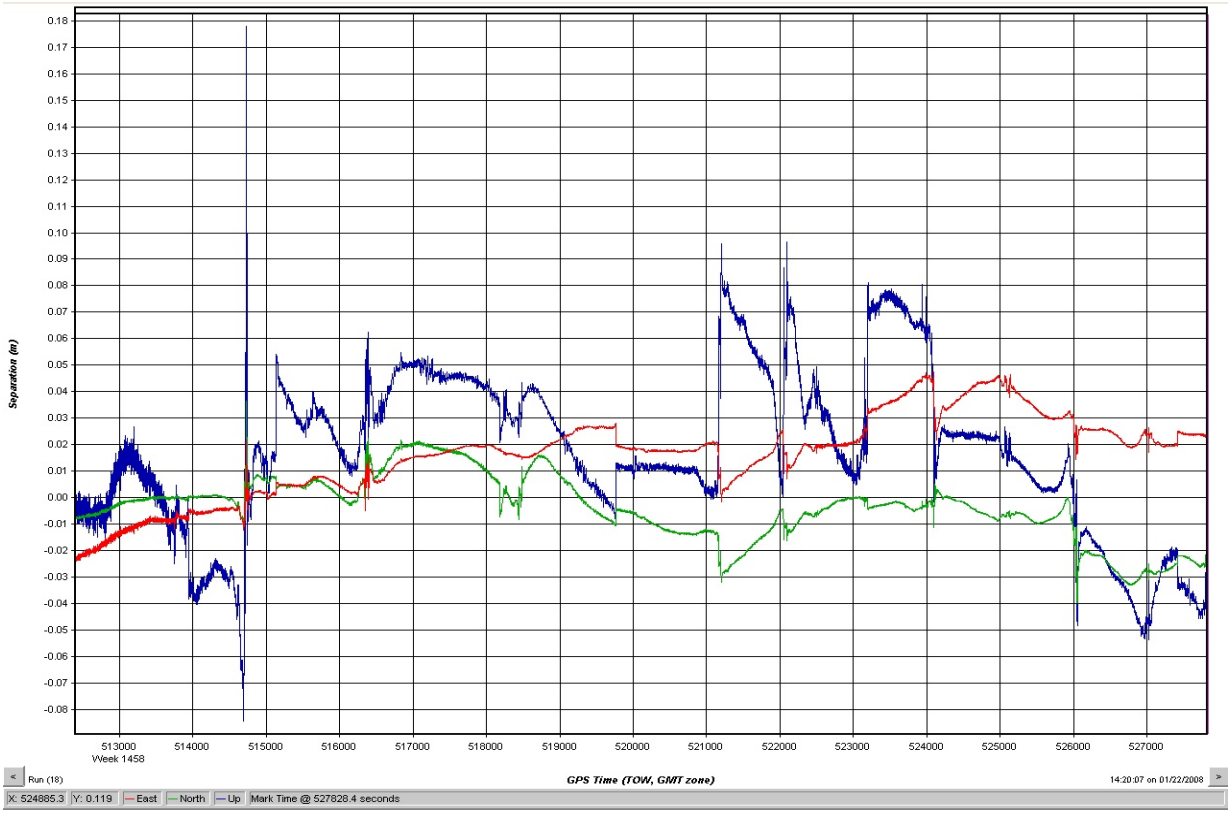


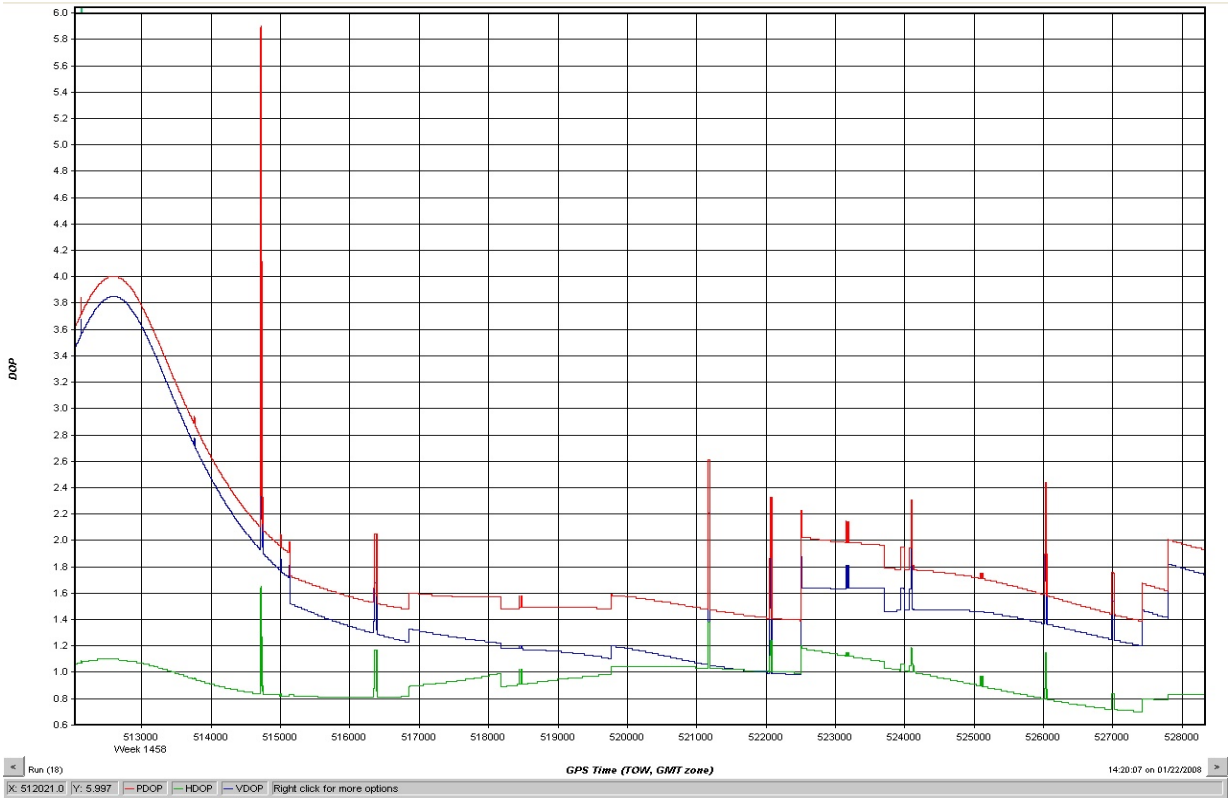

DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (9)
09:14:56 on 01/23/2008
X:
Y:
PDOP
HDOP
VDOP
Right click for more options

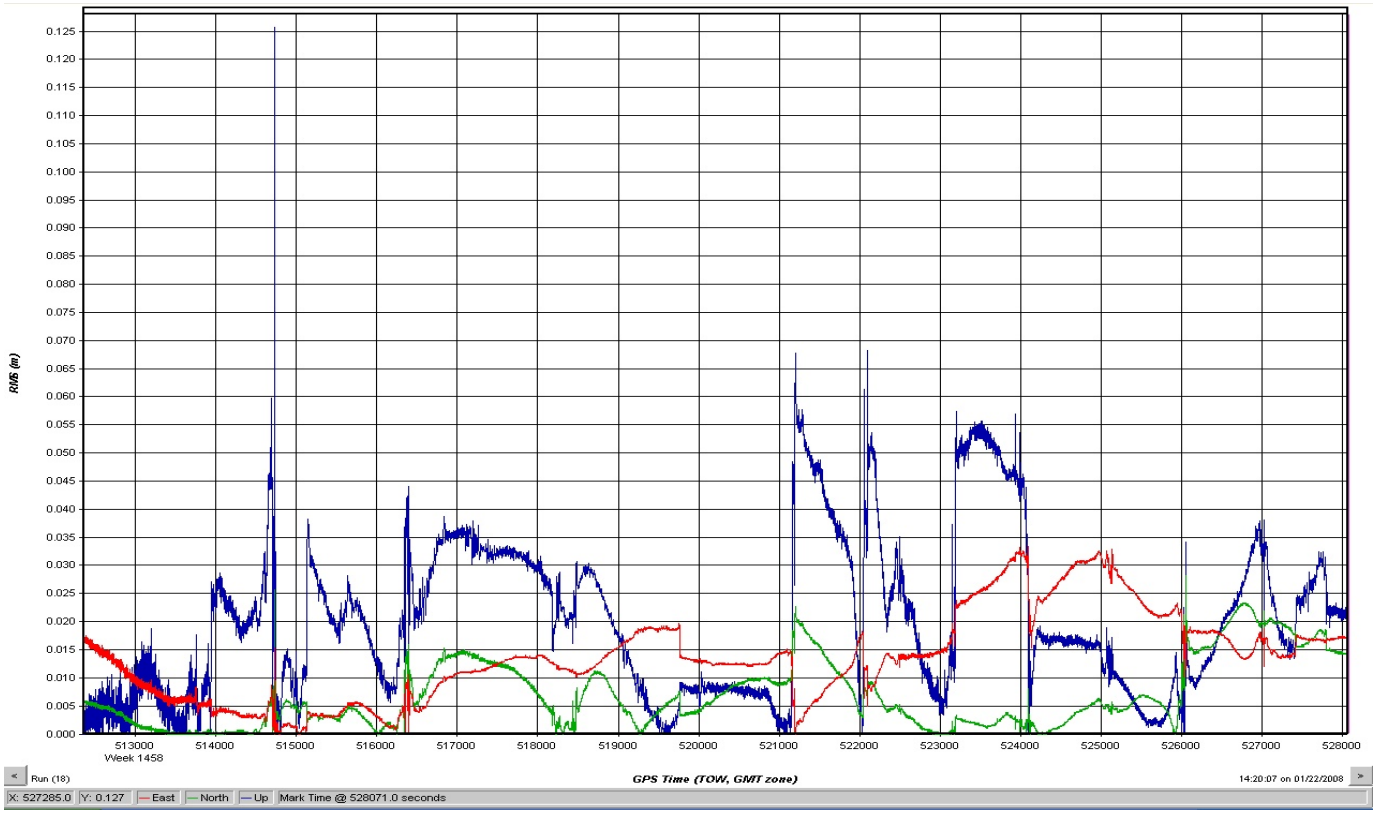

RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (9)
09:14:56 on 01/23/2008
X: 440162.0
Y: 0.061
East
North
Up
Mark Time @ 441085.3 seconds

GPS Processing for JD355FL02 (area 9)






DOP
Week 1458
GPS Time (TOW, GMT zone)
Run (18)
14:20:07 on 01/22/2008
X: 512021.0
Y: 5.997
PDOP
HDOP
VDOP
Right click for more options


RMS (m)
Week 1458
GPS Time (TOW, GMT zone)
Run (18)
14:20:07 on 01/22/2008
X: 527285.0
Y: 0.127
East
North
Up
Mark Time @ 528071.0 seconds

Quality Assurance

A rigorous quality assurance program insures that the final data products meet all requirements prior to delivery. Quality Assurance / Quality Control is embedded into the processing steps we use. Quality assurance is inherent in developing the project plan, verifying data and processing, and assuring that the final products meet all contract requirements.

Glossary

3D	Three Dimensional
Alt	Altitude
ALTM	Airborne Laser Terrain Mapping
DGPS	Differential Global Positioning System
GPS	Global Positioning System
GRS80	Geodetic Reference System 1980
HARN	High Accuracy Reference Network
Hdg	Heading
IMU	Inertial Measurement Unit
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGS OPUS	The National Geodetic Survey's On-line Positioning User Service
PDOP	Positional Dilution of Precision
POS	Position and Orientation System
PRF	Pulse Rate Frequency
RINEX	Receiver Independent Exchange Format
SBET	Smoothed Best Estimation of Trajectory
SVs	Space Vehicles
UTC	Coordinated Universal Time
UTM	Universal Transverse Mercator