

**Dare County Beaches, Shore Protection Project
Physical Monitoring Program
Thanksgiving Nor'easter Profile Survey Report
April 2007**



Photo: South Nags Head, 22 November 2006
(photo courtesy of Charles Rocknak)

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Dare County Beaches, Shore Protection Project Physical Monitoring Program 2006 Thanksgiving Nor'easter Profile Survey Report

1. Purpose

This report presents the results from the profile survey conducted in November/December 2006. This was a supplemental survey to the bi-annual monitoring to capture the changes induced from the 2006 Thanksgiving Nor'easter. Since the monitoring plan began in 2004, this was the largest storm on record with wave heights of 17ft and storm surge of 3.5ft recorded at the USACE Field Research Facility in Duck North Carolina. The intent of this report is to provide a written reference for interpretation of the data. This report begins with a brief overview and list of previous surveys. Next, survey methods and datum's are discussed, followed by the last sections which present the data and dissemination.

2. Overview

The Dare County Beaches (Bodie Island) Shore Protection Project includes the towns of Kitty Hawk, Kill Devil Hills, and Nags Head along the Outer Banks of North Carolina. The design is to construct a 25-ft wide, 13-ft (ref. National Geodetic Vertical Datum of 1929-NGVD) high dune fronted by a 50-ft wide berm at an elevation of 7 ft (NGVD). In 2004, the South Atlantic Division, Wilmington District (SAW) initiated physical and biological monitoring to assess the performance of the project. SAW partnered with the USACE Engineer Research and Development Center, Coastal and Hydraulics Laboratory's Field Research Facility (FRF) located in Duck, NC for the physical monitoring. Data collected under the physical monitoring plan will be used to: (1) assess the beach response to the fill placement and will serve as the basis for maintaining the project; (2) quantify the movement of fill from the project limits to adjacent non-project areas, and (3) provide data in support of the biological monitoring effort. For this reason, the physical monitoring includes areas outside the project limits.

The physical monitoring will cover the pre, during, and post-construction phases of the project. The plan includes continuous operation of a single Acoustic Doppler Current Profiler (ADCP) to measure waves and currents. Summaries of these measurements can be found on the FRF's web site, <http://frf.usace.army.mil/>. This gauge will be used to provide a general wave climate and will be re-located approximately annually to address a number of specific issues. The initial location is in the lee of a northern borrow site, **Figure 1**. The next location will likely be close to where sand is initially placed on the beach. At some point in the future, the gauge will be returned to the initial location to determine if excavation has caused a change in the wave characteristics.

The monitoring plan calls for beach and nearshore profile surveys to be taken every 1000 ft starting in Southern Shores, 3-miles north of the Kitty Hawk town limit, and continuing south to Oregon Inlet, **Figures 1 and 2**. See **Appendix A** for a listing of the profile numbers, origin points, and line azimuths. Each of the 144 profile lines extends from a stable point landward of

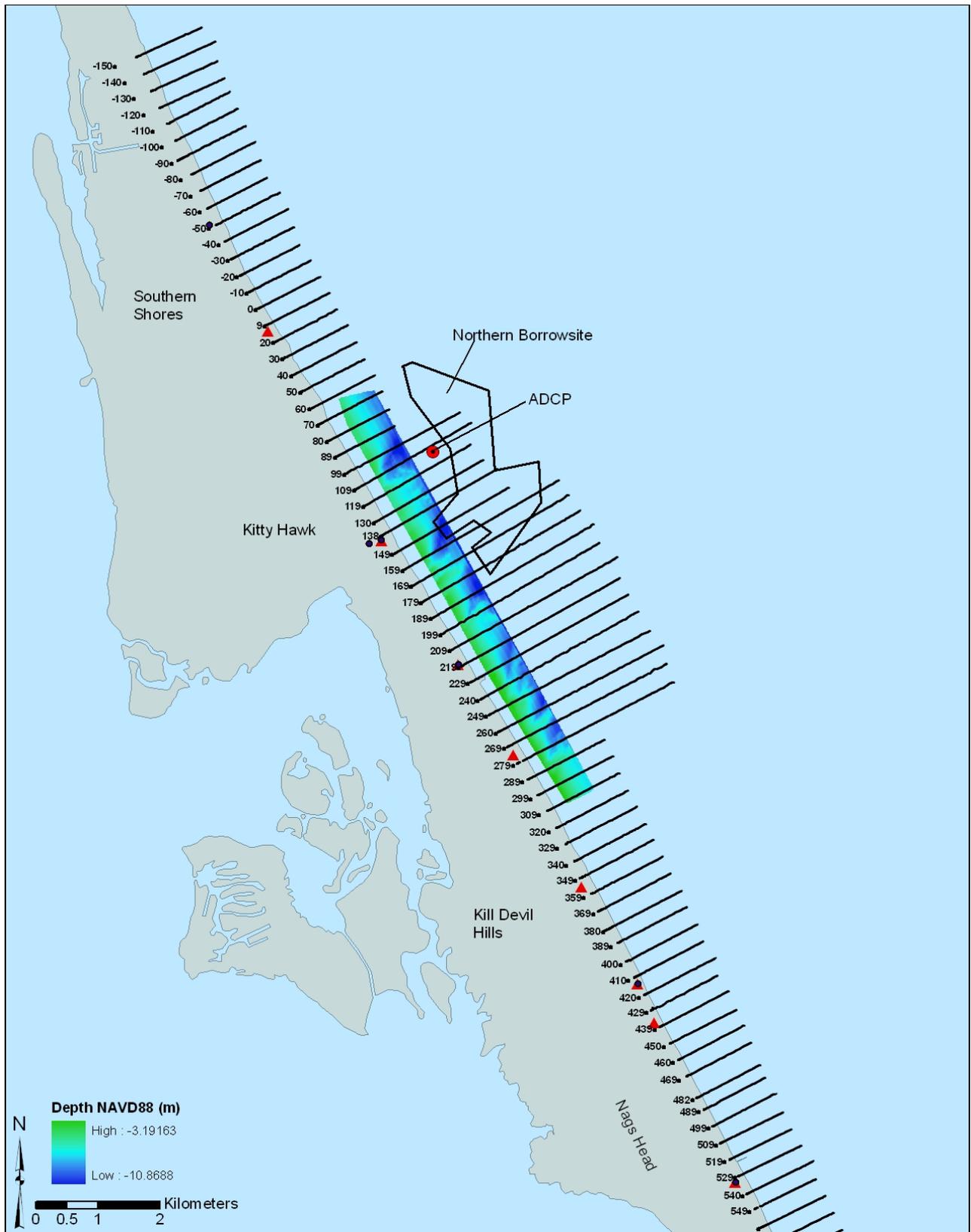


Figure 1. Profile lines and control locations (red triangles) in Southern Shores, Kitty Hawk, Kill Devil Hills, and Nags Head. Colored bathymetry is from swath data collected in the spring 2006

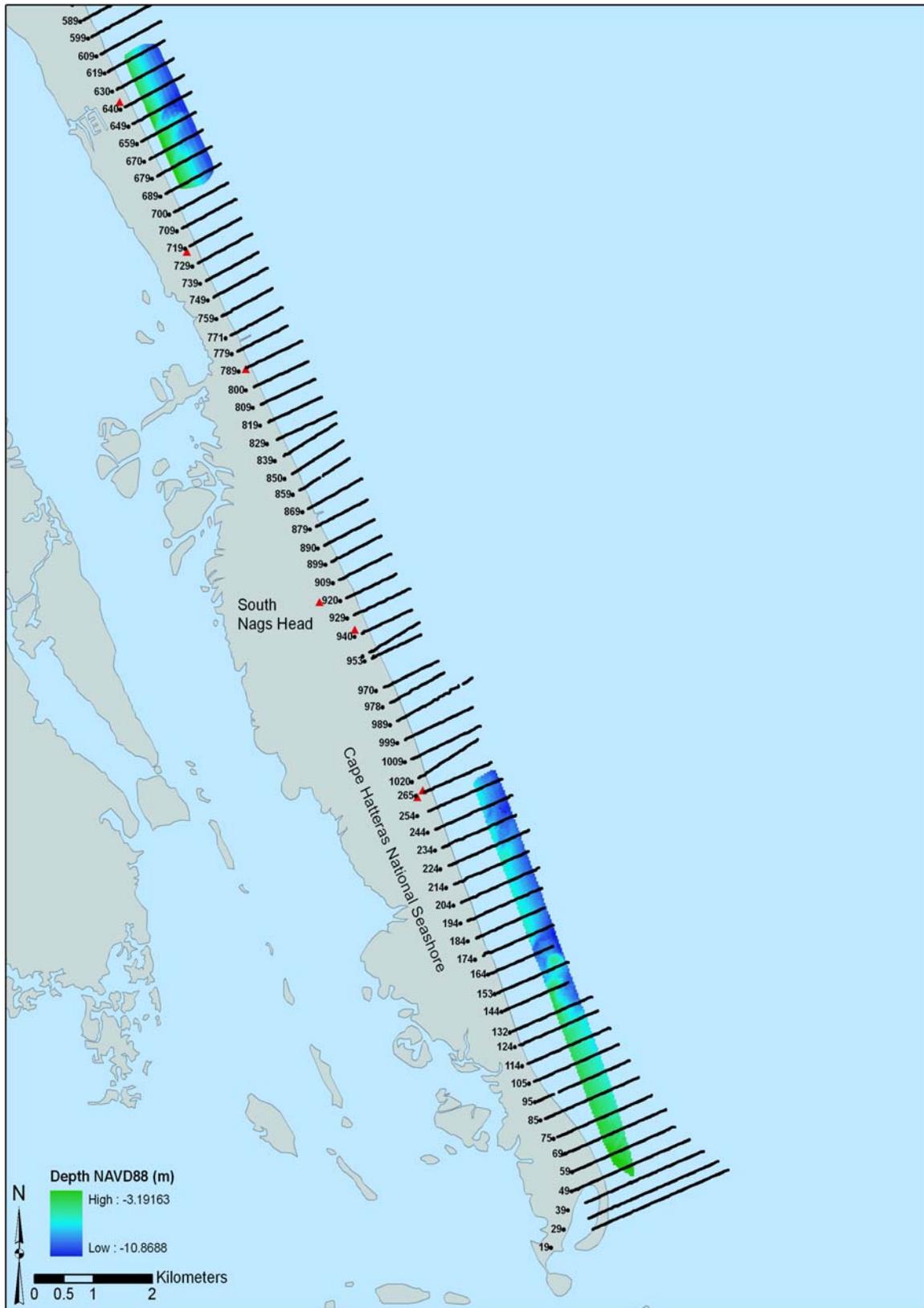


Figure 2. Profile lines and control locations (red triangles) in South Nags Head and Cape Hatteras National Seashore. Colored bathymetry is from swath data collected spring, 2006

the dune to the -30 ft depth contour. These profile lines will be surveyed twice per year, scheduled for the spring (Mar-Apr) and fall (Oct-Nov).

The monitoring plan also calls for swath bathymetry and sediment sampling. Swath bathymetry will be collected across shore and along shore where the isobaths are irregular and will supplement the profiling so that a complete model of the ocean bottom can be obtained. Sediment samples are to be taken from 67 selected lines, five samples along the onshore portion and five along the offshore portion. Sediment sample analysis, the responsibility of SAW, will be used to determine grain size and distribution before the project and any changes during the project.

3. Previous Surveys

The 2004 survey was the first of this monitoring program. The other surveys that exist are listed in **Table 1**. On sixty-two profile lines from Duck to Oregon Inlet, the beach was surveyed monthly from 1974-1977 as part of the USACE Beach Evaluation Program (BEP). In the mid 1990s, SAW established new lines in anticipation of the Dare Co. project. These lines will be referred to as the “DARE” profiles. In 1994, SAW surveyed both the beach and nearshore portion of the DARE profiles. The BEP lines within the project area were then resurveyed by SAW in 1995. In 2001, a subset of the DARE lines, where the anticipated first phase of the project would be located, was surveyed by SAW. The 2001 survey did not include the most northern lines, southern lines, and the middle lines in between the two fill areas. In 2003, the FRF in partnership with the U.S. Geological Society (USGS) surveyed the DARE lines from Southern Shores to Jeannette’s pier in Nags Head. In August 2004, all 144 DARE profiles were surveyed by the FRF. In 2005 92 lines were surveyed by the FRF and 52 lines were surveyed by Mckimm and Creed and in 2006 all 144 profiles were surveyed by the FRF in April, September, and November.

Table 1. Previous Dare County Surveys

Data Set	Lines (# surveyed)	By
1974-1977	BEP	USACE BEP
1994	DARE	SAW
1995	BEP	SAW
2001	DARE	SAW
2003	DARE	FRF/USGS
2004	DARE (144)	FRF
2005	DARE (144)	FRF & McKim & Creed
2006 April	DARE (144)	FRF
2006 Sept.	DARE (144)	FRF
2006 Nov.	DARE (144)	FRF

4. Bathymetric and Topographic Surveys

Bathymetric and topographic surveys began on 25 November and were completed by 11 December 2006. The survey schedule **Appendix B**, shows that 6 of the 17 days were lost to inclement weather (wind and waves).

4.1. LARC Profiles.

The bathymetric data were collected with the FRF's LARC 191, a Korean War era Army *Lighter Amphibious Resupply Cargo* amphibious vessel. The survey system consisted of a Real Time Kinematic (RTK) Global Positioning Satellite (GPS) system, single beam echo sounder, and a motion sensor measuring heave, pitch and roll, **Figure 3**. Using input from a base station at a known location, published accuracies for RTK GPS systems are between 1 to 3 inches depending on satellite configurations and distance from the base station. Trimble 4000 dual frequency receivers were used both on the LARC and at the base station. Equipment specifications are given in **Table 2**. Control, datums, and other considerations are provided below.

The echo sounder was a Knudsen 320BP dual frequency fathometer. This unit has been widely used by the USACE. Although equipped with 50 and 200 kHz frequency transducers, in this application, only the 200 kHz was used to provide better resolution at shallow depths, (0-66 ft.) The Knudsen was also equipped with a close proximity option allowing accurate depths as shallow as 0.5 ft. to be obtained. This was valuable since when the LARC wheels stop touching the sand, in depths over 1.5 ft below the transducer, the fathometer signal was required. The VT TSS Ltd DMS Series 3-25 heave, roll, and pitch sensor was used to track the vessel's motion.

Coastal Oceanographic's Hypack Max v.4.3 was used to guide the vessel along the profiles and to collect the position, depth, and motion information. The RTK-GPS signal was sampled at 1 Hz, the sounder at 9 Hz, and the motion sensor at 20 Hz. Custom software developed at the FRF used the RTK GPS information to remove the wave and water level variation. This was accomplished by careful adjustment of the timing between sounder and GPS data streams such that a precise measure of the depth was obtained at the exact moment that the GPS position was acquired. With this sampling rate, data points were acquired, on average, every 10 ft. The sounder depth value was also adjusted for the roll and pitch of the boat and for the variation in the speed of sound through the water column. The speed of sound was determined by measuring the



Figure 3. Equipment on LARC

Table 2. Survey Equipment List		
Model	LARC-V	US Army
Length	10.7 meters / 35 feet	
Drive System	Four Wheel plus marine drive	see Figure 1
Echosounder		
Model/Manufacturer	320B/P Portable	Knudsen Engineering
Frequency	50/200 kHz	
Resolution	1cm	0-99.99 meters range
Sound Velocity	1300-1700 m/s	Resolution 1 m/s
Transmit Blanking	0-5 meters	User Selectable
Motion Reference Unit		
Model/Manufacturer	DMS Series 3-25	VT TSS Limited
Heave Accuracy	The greater of 5cm or 5%	Resolution 1 cm
Pitch/Roll Accuracy	+/-0.25 degree	
GPS Receivers		
Model/Manufacturer	4000 SSE, 4700, & 5700	Trimble
Frequency	Dual high precision L1 and L2	
RTK-GPS Accuracy	Dependant on conditions such as multipath, obstructions, satellite geometry, atmospheric parameters and base station control quality.	
Published Horizontal Accuracy	1Hz = 1cm +/-2ppm	
Published Vertical Accuracy	1Hz = 2cm +/-2ppm	
Solution Precision	2 to 5 cm	
Speed of Sound Instrument (CTD)		
Model/Manufacturer	OS-200	Ocean Sensors
Maximum Scan Rate	145 per second	
Pressure Accuracy	dBar = 0.50%	
Temperature	deg C = 0.01	
Conductivity	mS/cm = 0.02	
Salinity	PSU = 0.03	
Computers & Software		
Model/Manufacturer	Inspiron Laptop 730 Mhz	Dell
Collection Software	Hypack Max version 4.3	Coastal Oceanographics
Echosounder	Sounder Suite	Knudsen Engineering
Tablet PC	Stylus Itp-600	Fujitsu
Processing Software	Fathomax	Custom FORTRAN routine
CTD Processing	CTD2SSP	Custom PERL routine

conductivity, temperature, and depth (CTD), with an Ocean Sensors CTD OS200. These CTD casts were performed approximately every 2 hours at the offshore ends of the survey line in approximately 30-ft depth. From the CTD information, the speed of sound was computed. Speed of sound can be important, for example an 80 ft/s error in the speed of sound (nominally 4,950 ft/s) will result in a 5 inch depth error in 30 ft of water.

4.2. Topographic Profiles.

Topographic (Topo), or beach, profiles were obtained with backpack mounted Trimble 5700 RTK GPS systems **Figure 4.** The GPS antennas were mounted on the backpacks at a fixed height, and data points were collected every second (approx. every 2ft) as the surveyor continuously walked along the profile. The beach profiles began at a baseline (such as a road) or a stable point behind the primary dune and continued to the waters edge. The surveyor used a Fujitsu Tablet PC with Hypack v. 4.3 for data logging and navigation along the pre-programmed line. All terrain vehicles (ATV) were used to transport the surveyors to each profile location.



Figure 4. Backpack survey

The same control was used for both the beach and offshore surveys. For each profile the Topo overlapped the LARC data to ensure homogeneity. The LARC was used to cover the wet portion of the Topo lines extending up onto the beach to the toe of the dune providing much more than required overlap with the walking backpack data collection.

4.3 Control, Datums, and QA/QC.

Horizontal/vertical control and datums are basic ingredients for accurate surveys. Geodesy controls for this survey were the North American Datum of 1983 (NAD83), as adjusted in 2001, North Carolina State Plane for horizontal and the North American Vertical Datum of 1988 (NAVD88), using the 2003 Geoid for the vertical. The survey data were collected using metric units and post processed to English (feet) units.

The 30 miles of coast was broken up into 5 approximately 5-mile-long sections. In each section a base station and separate calibration station locations were established. First order control for the base and calibration stations was provided by SAW.

Both Topo and LARC survey teams occupied calibration stations at least daily to document horizontal and vertical accuracies **Figure 5.** **Appendix C** contains tables for the 3 calibration stations that summarize the daily evaluations. For all of the calibration



Figure 5. Topographic Calibration check on Juncos MP 19.7

stations, both the Topo and LARC systems operated well within the expected vertical RTK-GPS accuracy of 1 to 3 inches.

4.4 Field Notes

The LARC digital survey notes are included as **Appendix D**. These field notes describe the status of the GPS equipment as each line is surveyed and any notes the survey technician added to better define the field conditions. LARC line notes include the locations of where CTD measurements were collected, and any notes to provide insight when post processing the data. Federal Geographic Data Committee approved metadata files have been created for each survey day and are included in **Appendix E**. These metadata files are named with year, month, and day in the following format 20060413.met.

5. Data

The Thanksgiving Nor'easter began on Tuesday 21 November and peaked early Wednesday morning 22 November. Winds of 55 mph and waves of 17.6 ft were measured at the FRF during the morning of 22 November. The detailed monthly summary of FRF observations for November is included as **Appendix F**.

One measure of data consistency and, to some extent, quality is to examine changes at the seaward end of the profile; particularly for parallel offsets between successive surveys and between adjacent lines. For the most part, the offshore ends of all the surveys are tight and consistent alongshore, however the beach and nearshore bar show the effects of a storm. This can be seen in the example "stacked" cross-section plot shown in **Figure 6**, and in the complete set of plots comparing the 2006 October and December profiles in **Appendix G**.

The 1.18ft NAVD88 or Mean High Water (MHW) contour change was calculated between the Sept/October and November/December profiles to get a general idea of the beach response to the storm conditions **Figures 7a & 7b**. Areas in Northern Kitty Hawk, Nags Head, South Nags Head, and the Cape Hatteras National Seashore exhibited the highest erosion at this contour. Certain profiles exceeded 100 feet of retreat. Kill Devil Hills, southern Kitty Hawk, and other localized areas remained relatively stable during the storm.

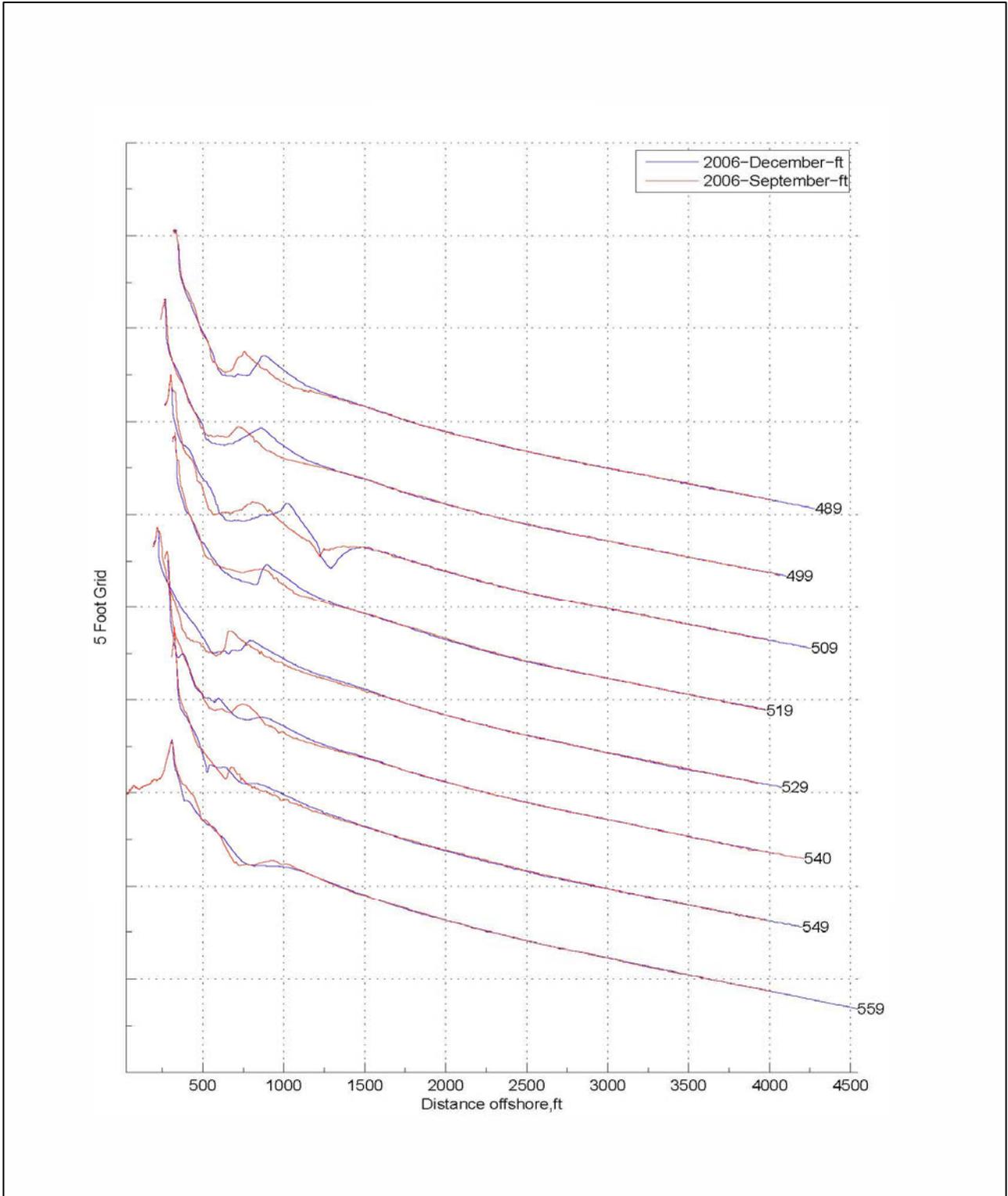


Figure 6. Example stackplot from select profiles in Nags Head

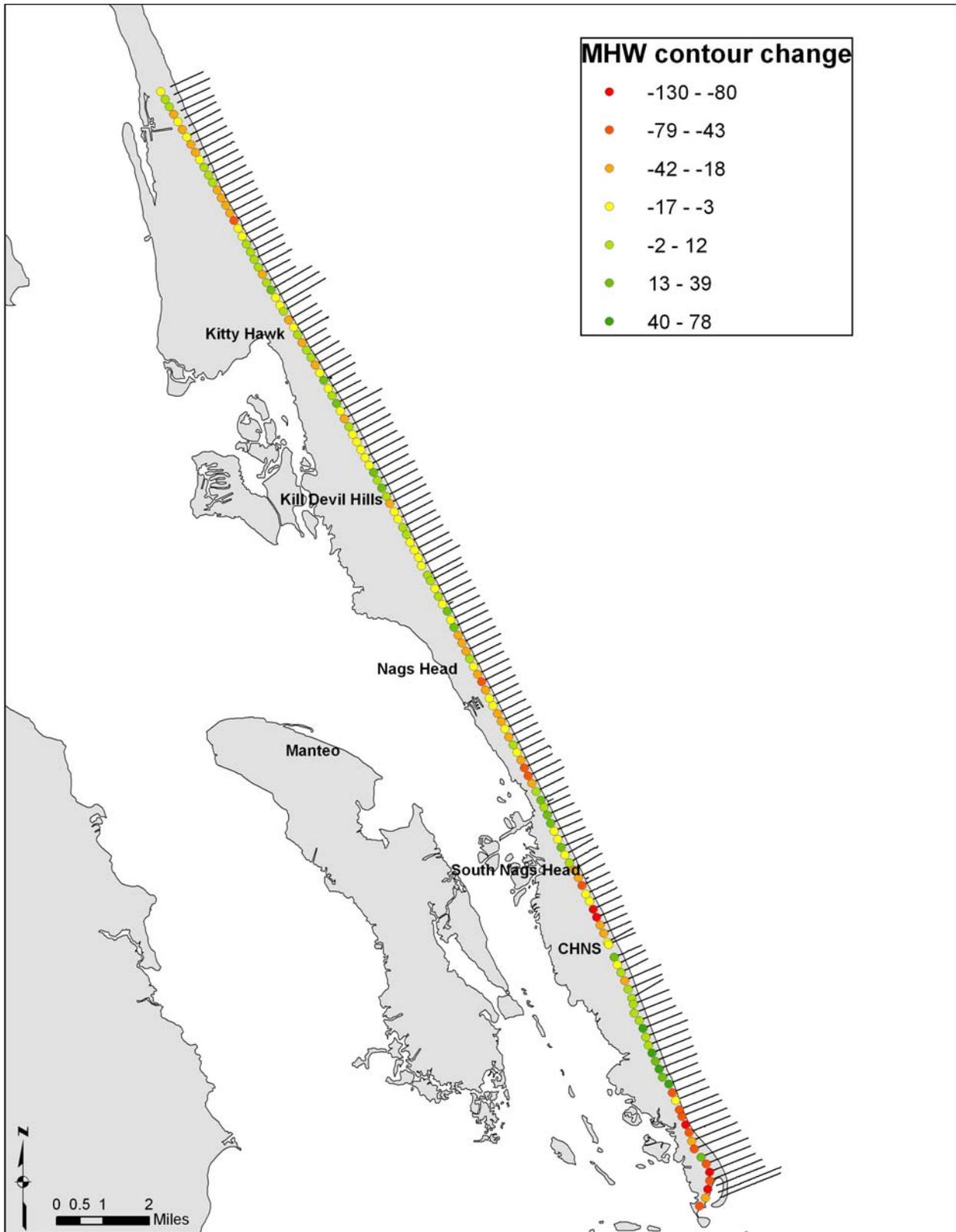


Figure 7a. Plot of 1.18ft NAVD88 or (MHW) contour change from October to December 2006.

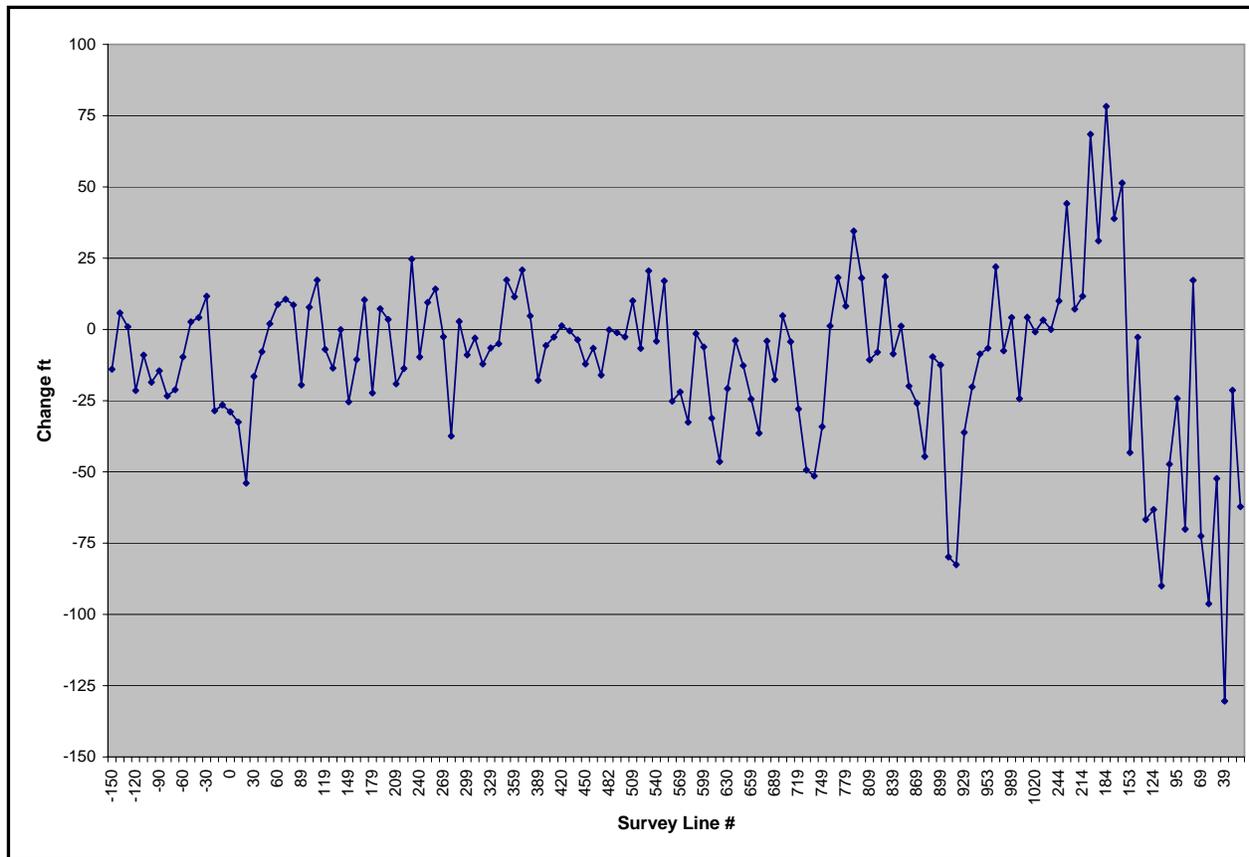


Figure 7b. Beach response to the Thanksgiving Nor'easter at the 1.18ft NAVD88 or (MHW) contour.

In addition to topographic walking surveys, an area stretching approximately 4 miles from line 254 south to line 39 in Cape Hatteras National Seashore was surveyed using an ATV. RTK GPS was used to log points continuously as the ATV drove the base of the scarped dune. See **Figure 8** for aerial view of dune loss. This data will be included with the 3d file.



Figure 8. Near Line 105 in the Cape Hatteras National Seashore displaying dune erosion just three days after storm's passage (Yellow line is base of the dune surveyed using ATV). (Aerial Photo from 2003)

5.1 Data Transfer.

The data products are a 3D file and a BMAP file. The .3D file contains space delimited xyz values. For all of the profiles, each data point is described by 24 columns of information which include: the project location, profile number, survey number, latitude, longitude, northing, easting, distance from baseline, offline distance, depth, date, time and time from midnight. The .bmap file is much simpler and facilitates profile comparisons, see format example to the left. These data along with the data report containing all appendices will be transferred via the CHL Guest FTP site at the following link:

```
BMAP File Example  
DC -150 20041013 COMBINED  
386  
1256.4000      20.2760  
1262.1700      18.2810  
1268.8000      15.4400  
1278.3400      13.4580  
1289.2400      11.4800
```

where the lines are:
location, line number, date
number of data points
distance along line & depth pairs

ftp://134.164.34.99/FRF/Dare_County/2006_Thanksgiving_Noreaster/

This is the fifth in a series of FRF Dare County Beaches, Shore Protection Project Physical Monitoring Program Profile Survey and Sediment Sampling Reports. Future reports will have approximately the same format and content. Suggestions for improving the reports, questions about the contents of this report,

and/or about the data should be directed to Mr. Mike Forte, Survey Specialist, at Michael.f.forte@erdc.usace.army.mil or by phone (252) 261-6840 ext 228.

Appendix A. Profiles numbers, Origins and azimuths

#	LOCATION	STATION	STATION	SEDIMENT	ORIGIN		AZIMUTH
			Abbreviation		LINES	Easting	
				rev Jun06	(ft)	(ft)	(deg)
1	<i>SOUTHERN SHORES</i> (CONTROL rev jul04)	-150+00	-150		2,964,665.00	885,364.00	65.31
2		-140+00	-140	S	2,965,116.00	884,444.00	65.31
3		-130+00	-130	S	2,965,239.00	883,452.00	65.31
4		-120+00	-120		2,965,920.00	882,604.00	65.31
5		-110+00	-110	S	2,966,366.00	881,697.00	62.57
6		-100+00	-100	S	2,966,790.00	880,778.00	62.57
7		-90+00	-90		2,967,110.00	879,895.00	62.57
8		-80+00	-80	S	2,967,533.00	878,988.00	62.57
9		-70+00	-70	S	2,967,951.00	878,106.00	62.57
10		-60+00	-60		2,968,381.00	877,175.00	62.57
11		-50+00	-50	S	2,968,838.00	876,228.00	62.57
12		-40+00	-40	S	2,969,249.00	875,440.00	62.57
13		-30+00	-30		2,969,731.60	874,496.08	62.57
14		-20+00	-20	S	2,970,189.67	873,607.16	62.57
15		-10+00	-10	S	2,970,653.00	872,720.97	62.57
1	<i>KITTY HAWK</i>	0+00.00	0		2,971,224.16	871,890.75	62.57
2		9+99.90	9		2,971,685.80	871,003.31	62.57
3		20+02.68	20	S	2,972,153.17	870,116.67	62.16
4		30+05.52	30		2,972,621.69	869,230.04	62.15
5		40+23.88	40		2,973,097.45	868,329.69	62.15
6		50+28.29	50	S	2,973,566.68	867,441.67	62.15
7		60+50.00	60		2,974,044.04	866,538.35	62.15
8		70+02.90	70		2,974,489.14	865,695.84	62.15
9		80+15.19	80	S	2,974,962.02	864,800.83	62.15
10		89+56.91	89		2,975,401.91	863,968.19	62.15
11	START N. PROJ	99+99.71	99		2,975,900.20	863,052.18	61.46
12	STA 108+30	109+99.46	109	S	2,976,406.09	862,189.91	59.60
13		119+99.14	119		2,976,911.94	861,327.71	59.60
14		130+33.04	130		2,977,435.12	860,435.98	59.60
15	BEGIN MAIN FILL	138+27.64	138	S	2,977,811.33	859,735.48	59.60
16	STA 138+30	149+99.46	149		2,978,430.26	858,740.05	59.60
17		159+99.55	159	S	2,978,966.59	857,895.27	59.60
18		169+70.21	169	S	2,979,427.66	857,040.44	59.60
19		179+87.62	179		2,979,942.69	856,163.07	59.59
20	<i>KITTY HAWK</i>	189+87.10	189	S	2,980,448.64	855,301.16	59.59
21	<i>KILL DEVIL HILLS</i>	199+93.01	199	S	2,980,957.84	854,433.71	59.59
22		209+74.44	209		2,981,440.37	853,579.14	60.55
23		219+99.94	219	S	2,981,944.55	852,686.23	60.55
24		229+83.39	229	S	2,982,428.55	851,830.15	60.52

#	LOCATION	STATION	STATION Abbreviation	SEDIMENT LINES rev Jun06	ORIGIN Easting (ft)	Northing (ft)	AZIMUTH (deg)
25		240+41.84	240		2,982,949.45	850,908.80	60.52
26		249+81.53	249	S	2,983,384.80	850,076.05	61.91
27		260+17.44	260	S	2,983,879.57	849,165.95	61.91
28		269+49.25	269		2,984,314.02	848,341.66	62.21
29		279+80.81	279	S	2,984,795.03	847,429.13	62.21
30	END MAIN FILL	289+99.14	289	S	2,985,305.30	846,547.02	62.20
31	STA 297+30	299+92.48	299		2,985,733.15	845,649.70	62.20
32		309+71.20	309	S	2,986,193.06	844,785.81	61.97
33	STOP NORTH PROJ.	320+05.37	320		2,986,679.03	843,872.99	61.97
34	STA 327+30	329+88.80	329		2,987,138.95	843,003.79	62.12
35		340+20.02	340	S	2,987,621.23	842,092.34	62.12
36		349+69.94	349		2,988,097.30	841,269.59	62.12
37		359+82.85	359		2,988,539.16	840,357.49	62.12
38		369+89.02	369	S	2,989,042.40	839,485.48	62.12
39		380+71.83	380		2,989,558.45	838,533.55	62.12
40		389+70.36	389		2,989,974.18	837,737.02	62.12
41		400+57.86	400	S	2,990,476.49	836,772.51	62.12
42		410+12.16	410		2,990,890.88	835,912.18	62.12
43		420+89.66	420		2,991,438.01	834,982.69	62.12
44	<i>KILL DEVIL HILLS</i>	429+88.10	429	S	2,991,860.77	834,189.98	62.12
45	<i>NAGS HEAD</i>	439+84.62	439		2,992,280.78	833,284.86	62.12
46		450+18.31	450		2,992,764.13	832,371.20	62.79
47		460+03.41	460	S	2,993,260.87	831,519.62	62.07
48		469+90.51	469		2,993,571.24	830,566.97	62.07
49		482+61.53	483		2,994,282.89	829,505.73	62.14
50	START SOUTH PROJ.	489+92.29	489	S	2,994,624.38	828,859.71	62.14
51	STA 491+60	499+97.64	499		2,995,136.62	827,993.36	62.14
52		509+86.74	509	S	2,995,535.43	827,085.76	63.51
53	START MAIN FILL	519+88.58	519		2,995,982.37	826,189.19	63.51
54	STA 521+90	529+92.45	529	S	2,996,546.90	825,348.12	63.84
55		540+41.58	540		2,996,933.15	824,369.30	63.51
56		549+53.69	549	S	2,997,305.24	823,535.68	63.50
57		559+88.71	559		2,997,767.08	822,609.46	63.50
58		569+88.44	569	S	2,998,213.17	821,714.83	63.50
59		580+06.85	580		2,998,666.77	820,803.08	63.55
60		589+92.95	589	S	2,999,105.97	819,920.26	63.55
61		599+65.00	599		2,999,538.91	819,050.02	63.55
62		609+90.87	609	S	2,999,999.13	818,133.25	63.35
63		619+64.56	619		3,000,464.71	817,277.44	63.51
64		630+09.03	630	S	3,000,899.20	816,327.06	63.51
65		640+20.72	640		3,001,350.40	815,421.63	63.51

#	LOCATION	STATION	STATION	SEDIMENT	ORIGIN		AZIMUTH
			Abbreviation		LINES	Easting	
				rev Jun06	(ft)	(ft)	(deg)
66		649+79.72	649	S	3,001,778.10	814,563.41	63.51
67		659+99.80	659		3,002,272.47	813,670.06	63.51
68	START PH-I SO. PROJ.	670+05.57	670	S	3,002,681.61	812,750.29	63.52
69	STA 675+00	679+70.59	679		3,003,111.96	811,886.62	63.52
70		689+93.04	689	S	3,003,567.92	810,971.55	63.52
71	START PH-I MAIN FILL	700+49.12	700		3,004,086.42	810,050.04	63.47
72	STA 705	709+88.06	709	S	3,004,505.80	809,210.02	63.47
73		719+89.21	719		3,004,952.98	808,314.29	63.47
74		729+74.68	729	S	3,005,344.90	807,408.71	63.43
75		739+87.41	739		3,005,797.93	806,503.04	63.43
76		749+23.69	749	S	3,006,216.77	805,665.74	63.43
77		759+89.41	759		3,006,693.51	804,712.69	63.43
78		771+03.13	771	S	3,007,224.84	803,733.28	63.43
79		779+91.07	779		3,007,566.98	802,912.03	65.00
80		789+52.47	789	S	3,007,945.92	802,028.54	66.12
81		800+05.35	800		3,008,360.92	801,060.98	66.79
82		809+84.88	809	S	3,008,747.00	800,160.83	66.79
83		819+75.72	819		3,009,137.59	799,250.30	66.78
84		829+90.14	829	S	3,009,537.47	798,318.10	66.79
85	END PH-I MAIN FIL.	839+63.41	839		3,009,965.04	797,443.87	60.59
86	STA 845+00	850+15.03	850	S	3,010,499.88	796,538.49	59.43
87		859+53.78	859		3,010,977.31	795,730.29	59.43
88	END PH-I PH-I SO PROJ.	869+90.85	869	S	3,011,486.87	794,827.11	62.40
89	STA 875+00	879+84.66	879		3,011,915.10	793,930.36	64.48
90		890+49.20	890	S	3,012,373.81	792,969.80	64.48
91		899+74.97	899		3,012,772.72	792,134.44	64.48
92		909+94.51	909	S	3,013,203.68	791,210.53	65.00
93		920+03.57	920		3,013,608.79	790,286.43	66.33
94		929+76.23	929	S	3,013,999.30	789,395.67	66.33
95		940+08.61	940		3,014,413.78	788,450.22	66.33
96		951+00.34	951	S	3,014,852.11	787,450.42	61.23
97	<i>NAGS HEAD</i>	960+00.00	960		3,015,213.29	786,626.57	66.33
98		970+00.70	970	S	3,015,615.10	785,710.08	66.33
99	END MAIN FILL	978+95.72	978		3,015,974.47	784,890.44	63.09
100	STA 996+50	989+09.57	989	S	3,016,381.55	783,961.97	62.69
101		999+27.65	999		3,016,790.36	783,029.64	66.33
102	END SOUTH PROJ.	1009+83.61	1009	S	3,017,214.37	782,062.62	66.33
103	STA 1025+00	1020+79.29	1020		3,017,623.64	781,046.43	59.32
104		264+00(ZN)	265	S	3,017,811.35	780,343.61	68.00
105	<i>CAPE HATTERAS</i>	254+00(YN)	254		3,017,891.89	779,297.62	68.00
106	<i>N. SEASHORE</i>	244+00(XN)	244		3,018,479.41	778,456.45	68.00
107		234+00(WN)	234	S	3,018,896.90	777,546.60	68.00
108		224+00(VN)	224		3,019,207.51	776,593.56	68.00

#	LOCATION	STATION	STATION Abbreviation	SEDIMENT LINES rev Jun06	ORIGIN Easting (ft)	Northing (ft)	AZIMUTH (deg)
109		214+00(UN)	214		3,019,520.51	775,641.48	68.00
110		204+00(TN)	204	S	3,019,918.65	774,723.81	68.00
111		194+00(SN)	194		3,020,315.78	773,805.72	68.00
112		184+00(RN)	184		3,020,723.12	772,891.76	68.00
113		174+00(QN)	174	S	3,021,118.89	771,973.13	68.00
114		164+00(PN)	164		3,021,859.83	771,193.95	68.00
115		153+00(ON)	153		3,022,228.09	770,198.06	68.00
116		144+00(NNII)	144	S	3,022,602.81	769,299.66	68.00
117		132+00(MN85)	132		3,023,064.07	768,237.19	68.00
118		124+00(MNI)	124		3,023,354.48	767,492.96	68.00
119		114+00(MNII)	114	S	3,023,763.17	766,514.47	68.00
120		105+00(LN)	105		3,024,145.30	765,615.98	68.00
121		95+00(KN85)	95		3,024,459.99	764,666.72	68.00
122		85+00(JN90)	85	S	3,024,774.23	763,732.18	68.00
123		75+00(IN)	75		3,025,510.04	762,803.28	68.00
124		69+00(HN)	69		3,026,141.46	762,028.59	68.00
125		59+00(GN)	59	S	3,026,535.19	761,110.30	68.00
126		49+00(FN)	49		3,026,509.29	760,111.66	68.00
127		39+00(EN)	39		3,026,307.17	759,129.90	68.00
128		29+00(DN)	29	S	3,026,059.89	758,164.18	68.00
129	OREGON INLET	19+00(CN-350)	19		3,025,368.41	757,231.36	68.00

Appendix B Survey Schedule

Dare County 2006 Thanksgiving Storm Survey Schedule						
	LARC	TOPO				
Date	# of Lines This Day	# of Lines This day	LARC % Complete	Topo % Complete	Job Cum %	Notes
25-Nov-06		28		19	10	
26-Nov-06		23		35	18	
27-Nov-06		15		46	23	
28-Nov-06		23		62	31	
29-Nov-06	39		27	62	44	
30-Nov-06	40		55	62	58	
1-Dec-06			55	62	58	
2-Dec-06		46	55	94	74	
3-Dec-06			55	94	74	
4-Dec-06		9	55	100	77	
5-Dec-06	14		65	100	82	
6-Dec-06	28		84	100	92	
7-Dec-06			84	100	92	
8-Dec-06			84	100	92	
9-Dec-06			84	100	92	
10-Dec-06			84	100	92	
11-Dec-06	23		100	100	100	

Appendix C Calibration Station Tables

Name	METERS			FEET			DATE	BASE STA
	Northing Meters	Easting Meters	NAVD88	Northing Feet	Easting Feet	NAVD88		
CURLEW MP 12.4	251501.557	913350.274	2.140	825134.718	2996550.118	7.021		
FILE: 000_1118.RAW	251501.585	913350.254	2.023	825134.808	2996550.054	6.637	28-Nov-06	Clarion
FILE: 000_0758.RAW	251501.549	913350.240	2.068	825134.691	2996550.006	6.785	30-Nov-06	Clarion
FILE: 000_1351.RAW	251501.527	913350.263	2.095	825134.618	2996550.082	6.873	4-Dec-06	Clarion
RMS difference	0.024	0.024	0.083	0.079	0.078	0.274		

Name	METERS			FEET			DATE	BASE STA
	Northing Meters	Easting Meters	NAVD88	Northing Feet	Easting Feet	NAVD88		
FORREST MP 15.5	246331.581	915945.544	2.786	808172.887	3005064.767	9.140		
FILE: 000_1236.RAW	246331.588	915945.542	2.748	808172.909	3005064.760	9.014	27-Nov-06	Comfort Inn
FILE: 000_1706.RAW	246331.586	915945.500	2.740	808172.905	3005064.624	8.988	27-Nov-06	Comfort Inn
<i>ABS(B5-B3)</i>	0.007	0.002	0.039	0.022	0.007	0.126		

Name	METERS			FEET			DATE	BASE STA
	Northing Meters	Easting Meters	NAVD88	Northing Feet	Easting Feet	NAVD88		
NPS PK MP 22	237833.62	919857.93	1.380	780292.493	3017900.654	4.528		
FILE: 000_0939.RAW	237833.634	919857.979	1.351	780292.540	3017900.815	4.433	25-Nov-06	NPS
FILE: 000_0929.RAW	237833.614	919857.922	1.416	780292.474	3017900.628	4.644	26-Nov-06	Comfort Inn
FILE: 000_1530.RAW	237833.679	919857.925	1.404	780292.686	3017900.636	4.605	26-Nov-06	Comfort Inn
FILE: 000_0821.RAW	237833.627	919857.952	1.388	780292.516	3017900.727	4.555	29-Nov-06	NPS
FILE: 000_0743.RAW	237833.773	919857.598	1.323	780292.993	3017899.563	4.342	11-Dec-06	NPS
FILE: 000_0711.RAW	237833.800	919857.621	1.340	780293.085	3017899.640	4.397	12-Dec-06	NPS
square root <i>SQRT(B20)</i>	0.100	0.187	0.035	0.327	0.612	0.116		

Appendix D LARC Field Notes

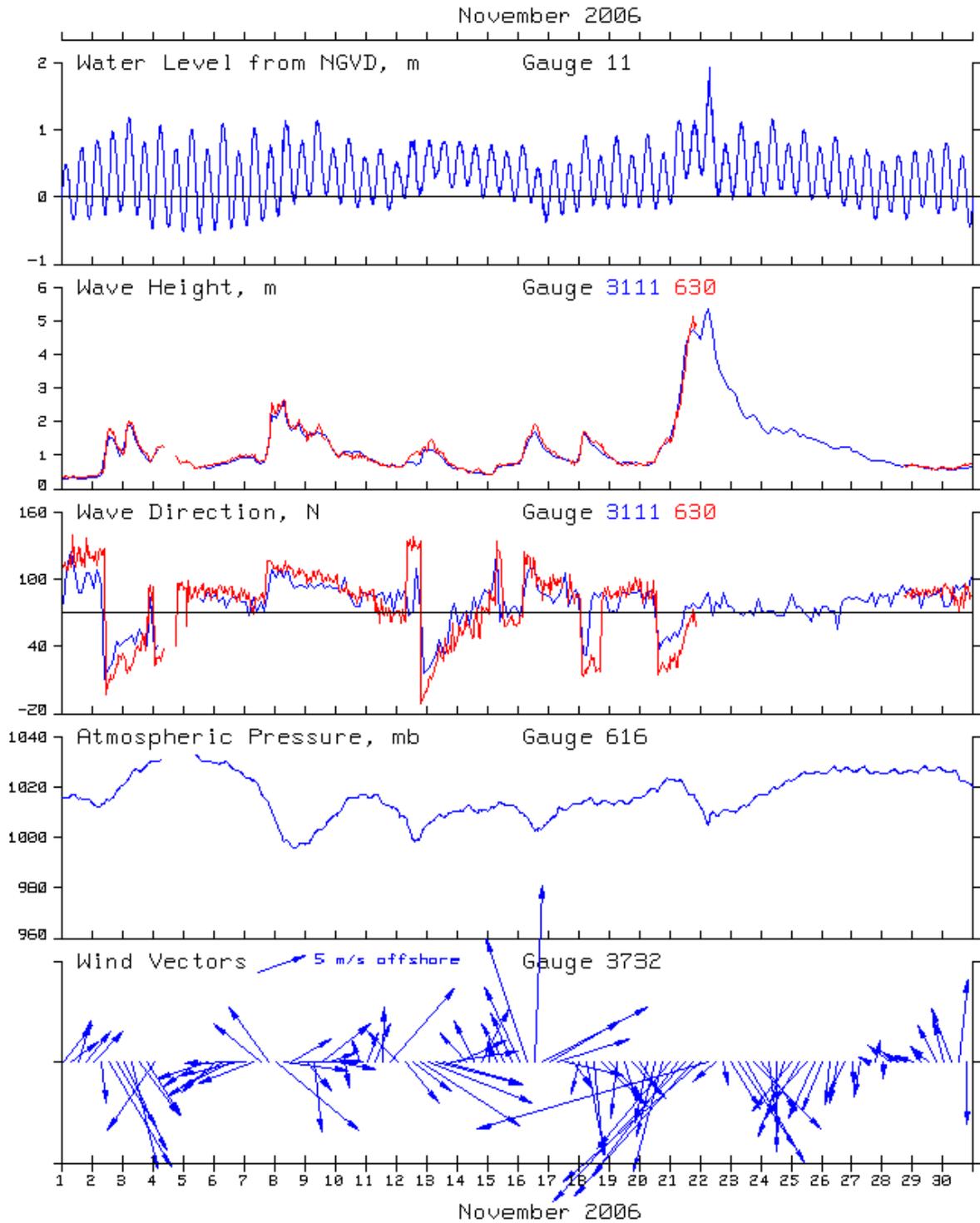
Line #	Date Surveyed	Hypack Raw file 1	vessel (dir)	Notes
-150	20061206	M150B.raw	in	good line
-140	20061206	M140B.raw	out	good line
-130	20061206	M130C.raw	in	good line (minus three digit line numbers from previous survey not being found in FathoPlot)
-120	20061206	M120B.raw	out	good line
-110	20061206	M110B.raw	in	good line, some trouble getting up on beach
-100	20061206	M100B.raw	out	good line took ctd cast at end of this line 200612061757
-90	20061206	-090_1234.raw	in	got stuck during exit from ocean. Backed off beach very steep beach face.
-80	20061206	-080_1223.raw	out	good line
-70	20061206	-070_1211.raw	in	good line
-60	20061206	-060_1200.raw	out	spikes in surfzone and midoffshore need removal.
-50	20061206	-050_1148.raw	in	good line
-40	20061206	-040_1137.raw		good line surfzone needs some spike removal.
-30	20061206	-030_1120.raw	in	good line
-20	20061206	-020_1109.raw	out	good line some spikes in surfzone need removing
-10	20061206	-010_1057.raw	in	good line
0	20061206	000_1047.raw	out	good line significant erosion on north side of pier. Sandbags old wood seawalls and pilings exposed.
9	20061206	009_1031.raw	in	took ctd at end of this line 20061206.1527
20	20061206	020_1017.raw	out	
30	20061206	0301003.raw	in	
40	20061206	040_0953.raw	out	
50	20061206	050_0942.raw	in	
60	20061206	060_0932.raw	out	
70	20061206	070_0922.raw	in	
80	20061206	080_0912.raw	out	
89	20061206	089_0903.raw	in	
99	20061206	099_0855.raw	out	
109	20061206	109_0845.raw	in	good line /plot comparison
119	20061206	119_0826.raw	out	good line/plot comparison
130	20061205	130_1459.raw	in	Ashly pilot beginning of line
138	20061205	138_1441.raw	out	
149	20061205	149_1429.raw	in	
159	20061205	159_1419.raw	out	
169	20061205	169_1408.raw	in	

Line #	Date Surveyed	Hypack Raw file 1	vessel (dir)	Notes
179	20061205	179_1354.raw	out	
189	20061205	189_1342.raw	in	
199	20061205	199_1326.raw	out	
209	20061205	209_1312.raw	in	
219	20061205	219_1259.raw	out	
229	20061205	229_1247.raw	in	
240	20061205	240_1235.raw	out	
249	20061205	249_1221.raw	in	CTD at end of line 260
260	20061130/20061205	260_1207.raw	in/out	80 lines in 2 days! Yeah Capt Mike.../Black Pelican Base/Pause in surf zone hi hdop
269	20061130	269_1621.raw	out	Surf zone needs editing. Some drop outs.
279	20061130	279_1609.raw	in	
289	20061130	289.1558.raw	out	good line
299	20061130	299_1544.raw	in	good line
309	20061130	309_1534.raw	out	good line
320	20061130	320_1521.raw	in	good line
329	20061130	329_1508.raw	out	good line take ctd at end of this line 20061130.2017.53_LARC.ctd
340	20061130	340_1455.raw	in	good line
349	20061130	349_1444.raw	out	good line
359	20061130	359_1433.raw	in	good line
369	20061130	369_1421.raw	out	good line
380	20061130	380_1409.raw	in	good line
389	20061130	389_1358.raw	out	good line
400	20061130	400_1344.raw	in	good line
410	20061130	410_1334.raw	out	good line
420	20061130	420_1321.raw	in	had trouble coming out of water. Backed off beach and tried again. Good line
429	20061130	429_1308.raw	out	good line took ctd cast at end of this line 20061129.1837.17
439	20061130	439_1248.raw	in	good line
450	20061130	450_1237.raw	out	
460	20061130	460_1224.raw	in	good line
469	20061130	469_1213.raw	out	good line
482	20061130	482_1159.raw	in	Good line
489	20061130	489_1149.raw	out	Good line
499	20061130	499_1138.raw	in	Good line
509	20061130	509_1128.raw	out	Good line
519	20061130	519_1107.raw	in	
529	20061130	529_1056.raw	out	surfzone needs editing. Plenty of bottom return on the screen but clouds need removal. Offshore bar present here just south of the NH pier.

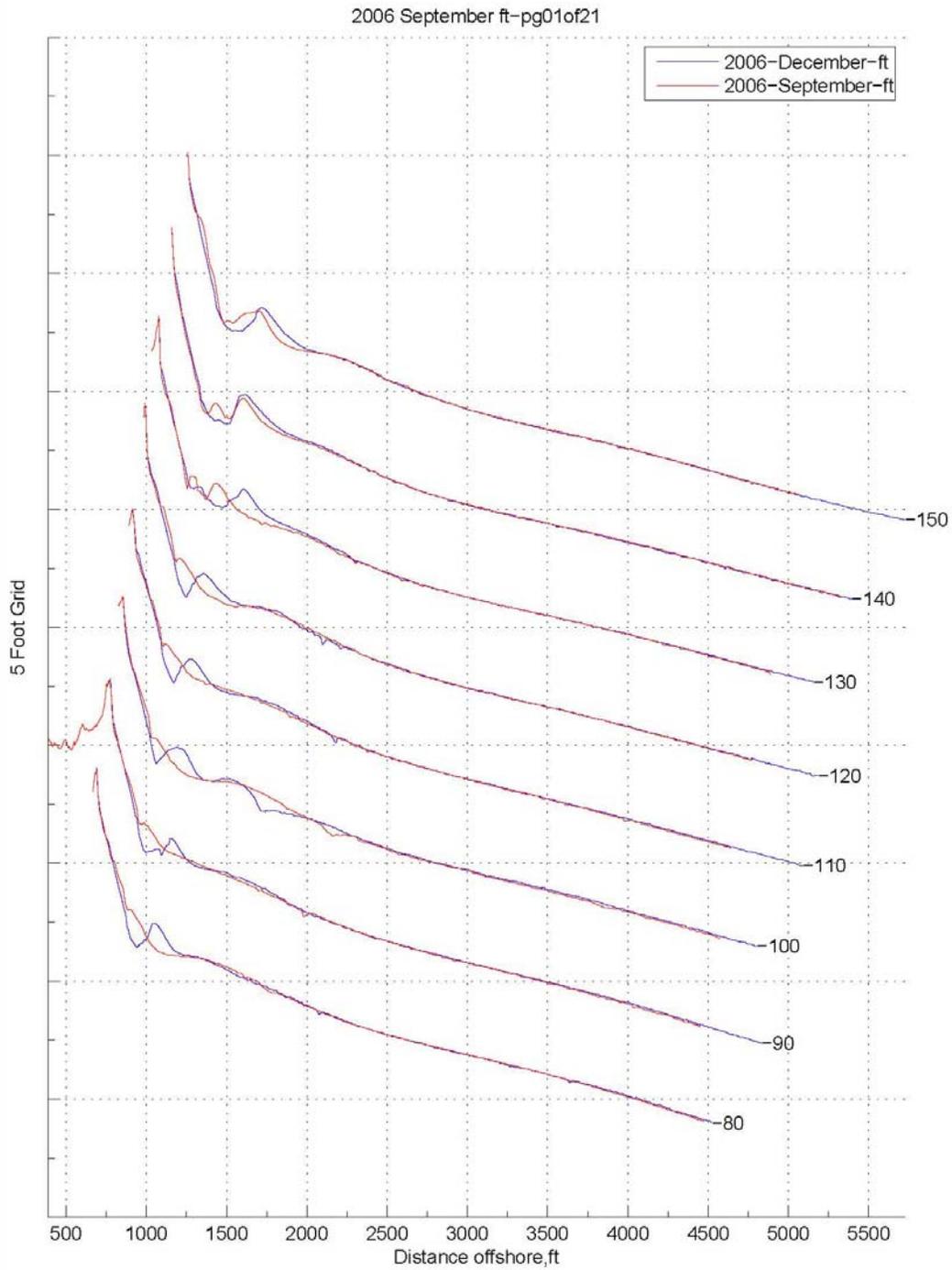
Line #	Date Surveyed	Hypack Raw file 1	vessel (dir)	Notes
540	20061130	540_1045.raw	in	good line
549	20061130	549_1033.raw	out	some surfzone edits needed.
559	20061130	559_1018.raw	in	lost gps momentarily.good line took ctd at end of this line
569	20061130	569_1004.raw	out	20061130.1513.46
580	20061130	580_0953.raw	in	good line
589	20061130	589_0943.raw	out	good line
599	20061130	599_0932.raw	in	
609	20061130	609_0919.raw	out	Log paused along track 1 time
619	20061130	619_0909.raw	in	
630	20061130	630_0853.raw	out	Log paused along track 3 times
640	20061130	640_0842.raw	in	
649	20061130	649_0832.raw	out	
659	20061130	659_0819.raw	in	20061130.1316.41_LARC.ctd; Had to back up when exiting ocean up on to beach.
670	20061129	670_1626.raw	out	20061129.2134.02_LARC.ctd
679	20061129	679_1615.raw	in	
689	20061129	689_1606.raw	out	good line
700	20061129	700_1556.raw	in	
709	20061129	709_1547.raw	out	had some dropouts in surfzone.
719	20061129	719_1538.raw	in	
729	20061129	729_1527.raw	out	
739	20061129	739_1517.raw	in	
749	20061129	749_1508.raw	out	
759	20061129	759_1458.raw	in	
771	20061129	771_1447.raw	out	20061129.1954.11_LARC.ctd
779	20061129	779_1434.raw	in	
789	20061129	789A1423.raw	out	Dropped out logging on entry - close to base
800	20061129	800_0815	in	
809	20061129	809_0830	out	20061129.1340.13_LARC.ctd
819	20061129	819_1336.raw	out	good line. Pause on this line to move cars up the road. need some edits in the surfzone. Lots of bubbles on surface but still a faint bottom return.
829	20061129	829_1326.raw	in	
839	20061129	839_1318.raw	out	
850	20061129	850_1309.raw	in	
859	20061129	859_1301.raw	out	
869	20061129	869_1252.raw	in	
879	20061129	879_1243.raw	out	
890	20061129	890_1234.raw	in	
899	20061129	899_1225.raw	out	
909	20061129	909_1215.raw	in	

Line #	Date Surveyed	Hypack Raw file 1	vessel (dir)	Notes
920	20061129	920_1203.raw	out	20061129.1711.13_LARC.ctd
929	20061129	929_1152.raw	in	
940	20061129	940_1144.raw	out	
951	20061129	951_1133.raw	in	good line
953	20061129	953_1124.raw	out	good line tide beginning to fill in creating less of a surfzone
970	20061129	970_1111.raw	in	good line
978	20061129	978_1101.raw	out	took some waves in surfzone
989	20061129	989_1049.raw	in	took some waves in surfzone
999	20061129	999_1038.raw	out	took some waves in surfzone
1009	20061129	1009B.raw	in	took some waves in surfzone
1020	20061129	1020B.raw	out	20061129.1522.49_LARC.ctd
265	20061129	265_0959.raw	in	took some waves in surfzone
254	20061129	254_0945.raw	out	took some waves in surfzone
244	20061129	244_0931.raw	in	took some waves in surfzone
234	20061211	234_1257.raw	in	good line
224	20061212	224_0724.raw	out	good line good plots, ctd end of line 200612121233
214	20061212	214_0738.raw	in	good line good plots
204	20061212	204_0750.raw	out	good line good plots
194	20061212	194_0801.raw	in	good line good plots
184	20061212	184_0813.raw	out	lost gps just outside surf zone, good line good plots
174	20061212	174_0830.raw	in	good line good plots
164	20061212	164_0842.raw	out	good line good plots, ctd 200612121350
153	20061211	153_1234.raw	out	good line
144	20061211	144_1221.raw	in	good line
132	20061211	132_1208.raw	out	good line
124	20061211	124_1156.raw	in	good line
114	20061211	114_1145.raw	out	good line
105	20061211	105_1129.raw	in	lost rtk momentarily just outside surfzone.good line
95	20061211	095_1109.raw	out	.good line, good plots, ctd end of line 200612111626
85	20061211	085_1047.raw	in	.good line, good plots
75	20061211	075_1035.raw	out	.good line, good plots
69	20061211	069_1018.raw	in	fathoplot terminated w/ exit code 1, nothing noteworthy during line
59	20061211	059_1005.raw	out	.good line, good plots
49	20061211	049_0945.raw	in	.good line, good plots
39	20061211	039_0928.raw	out	good line, good plots
29	20061211	029_0906.raw	in	on wheels sandbar, then trough then beach, good line plots match offshore
19	20061211	019_0847.raw	out	good line, good plots, ctd at end of this line 200612111402

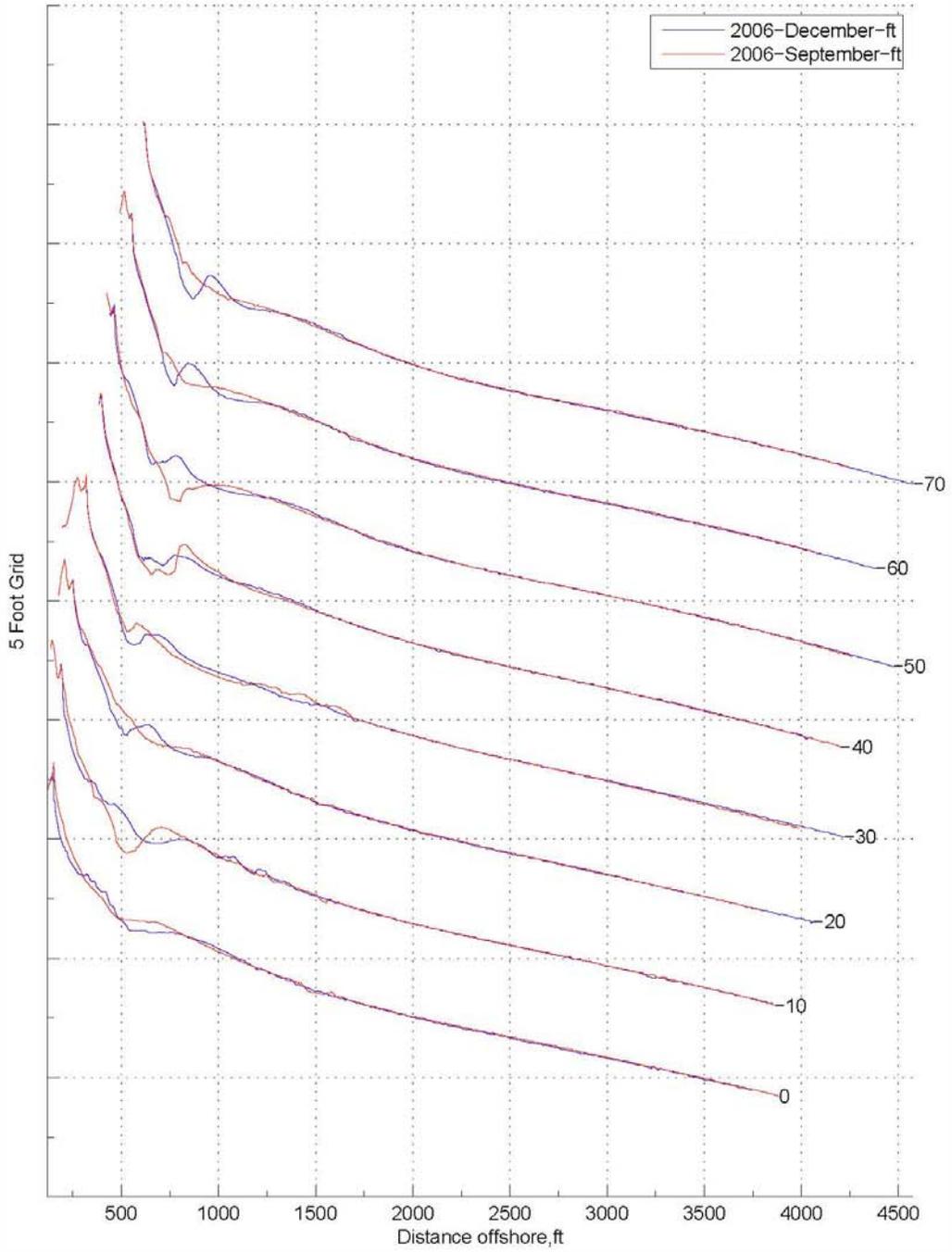
Appendix E FRF Monthly Observations



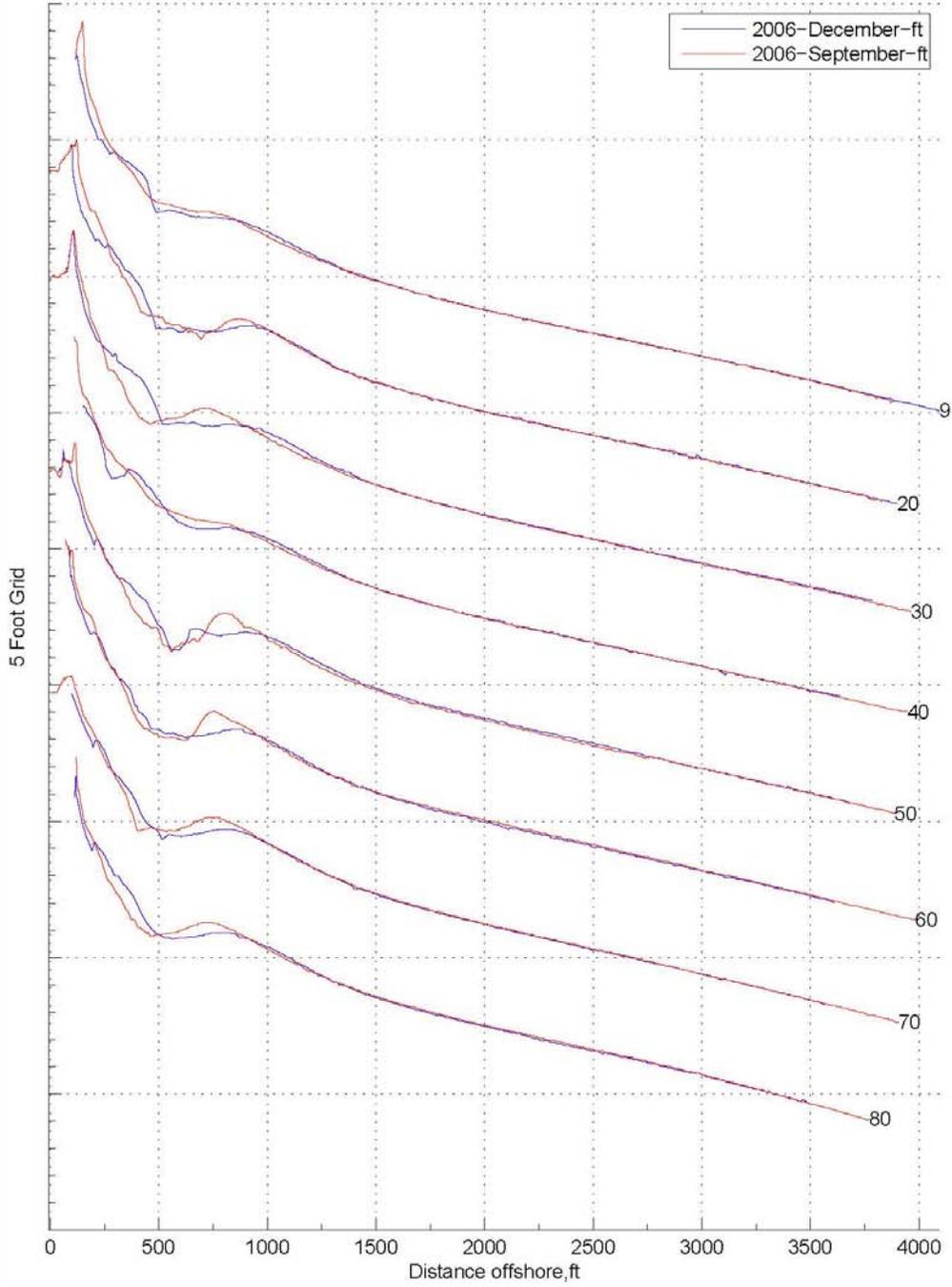
Appendix F Profile Stackplots Sept/October to Nov/Dec 2006.



2006 September ft-pg02of21



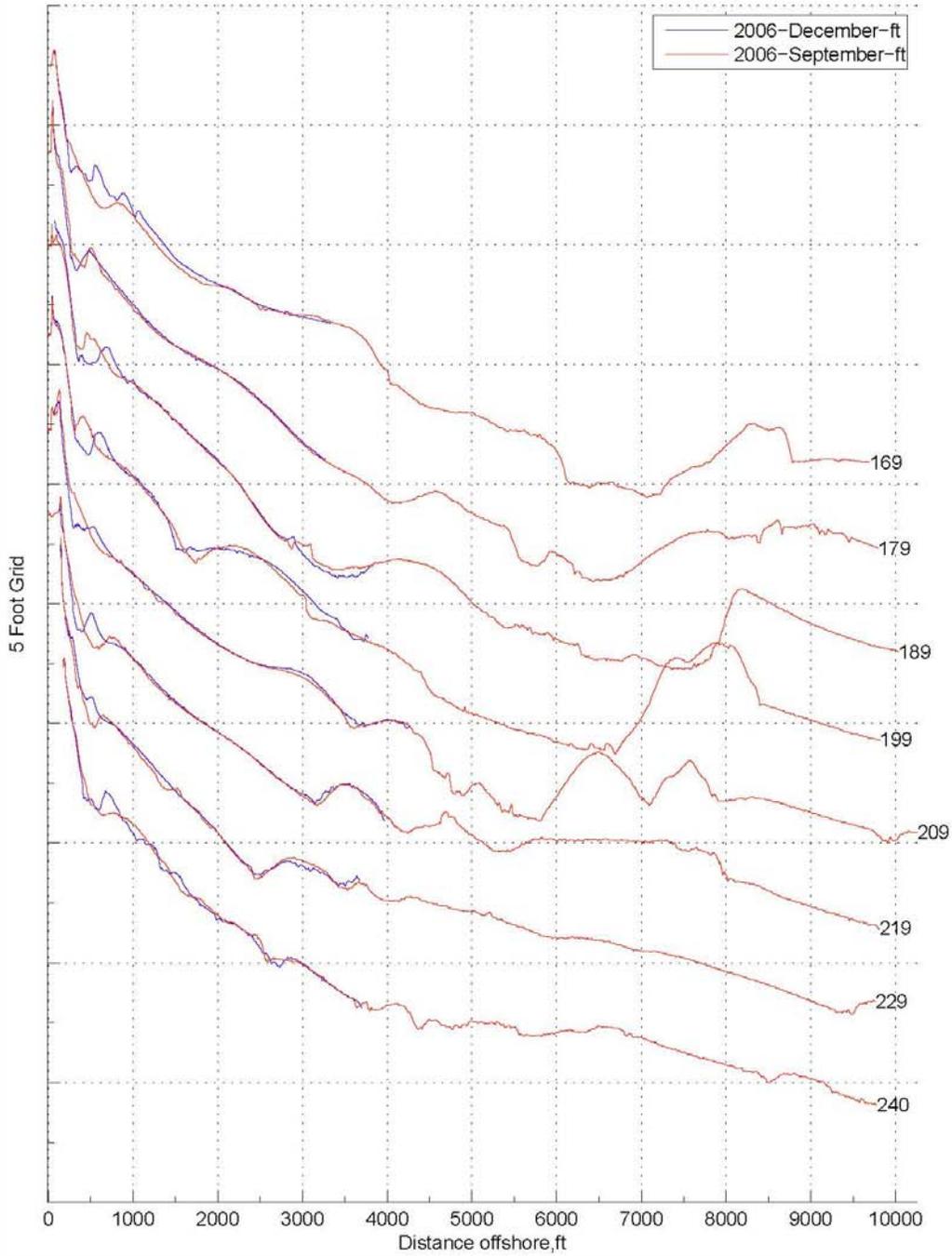
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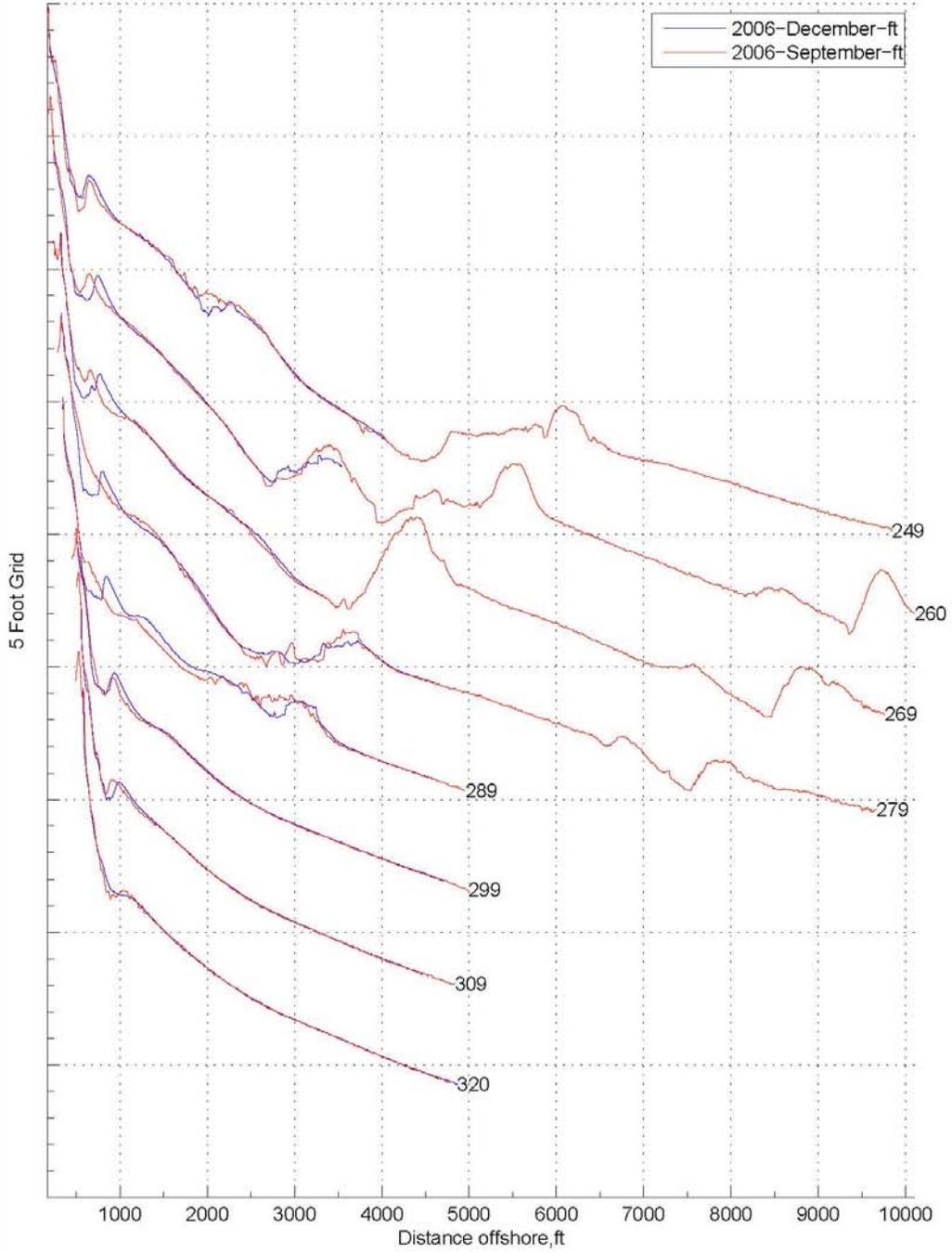
2006 September ft-pg04of21



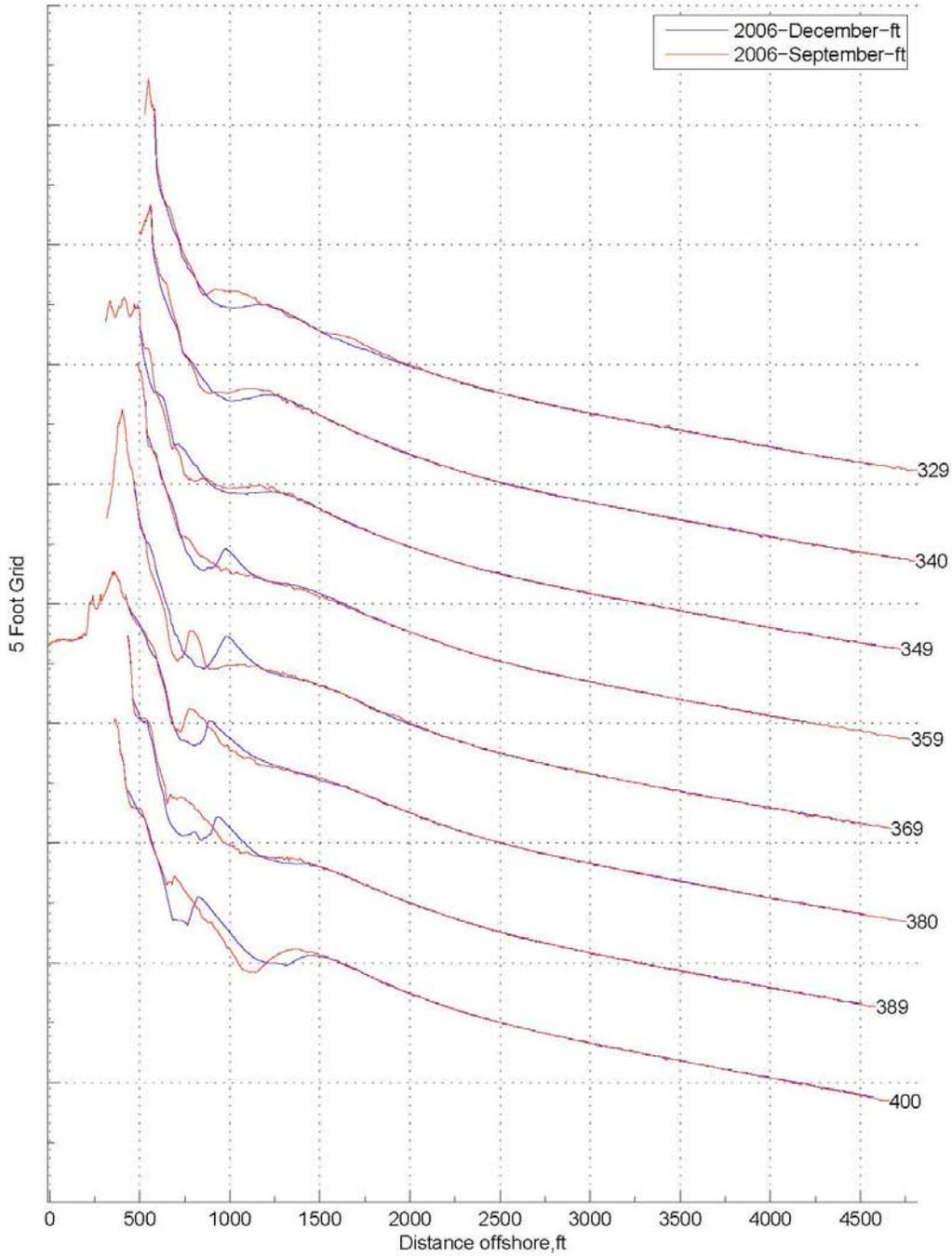
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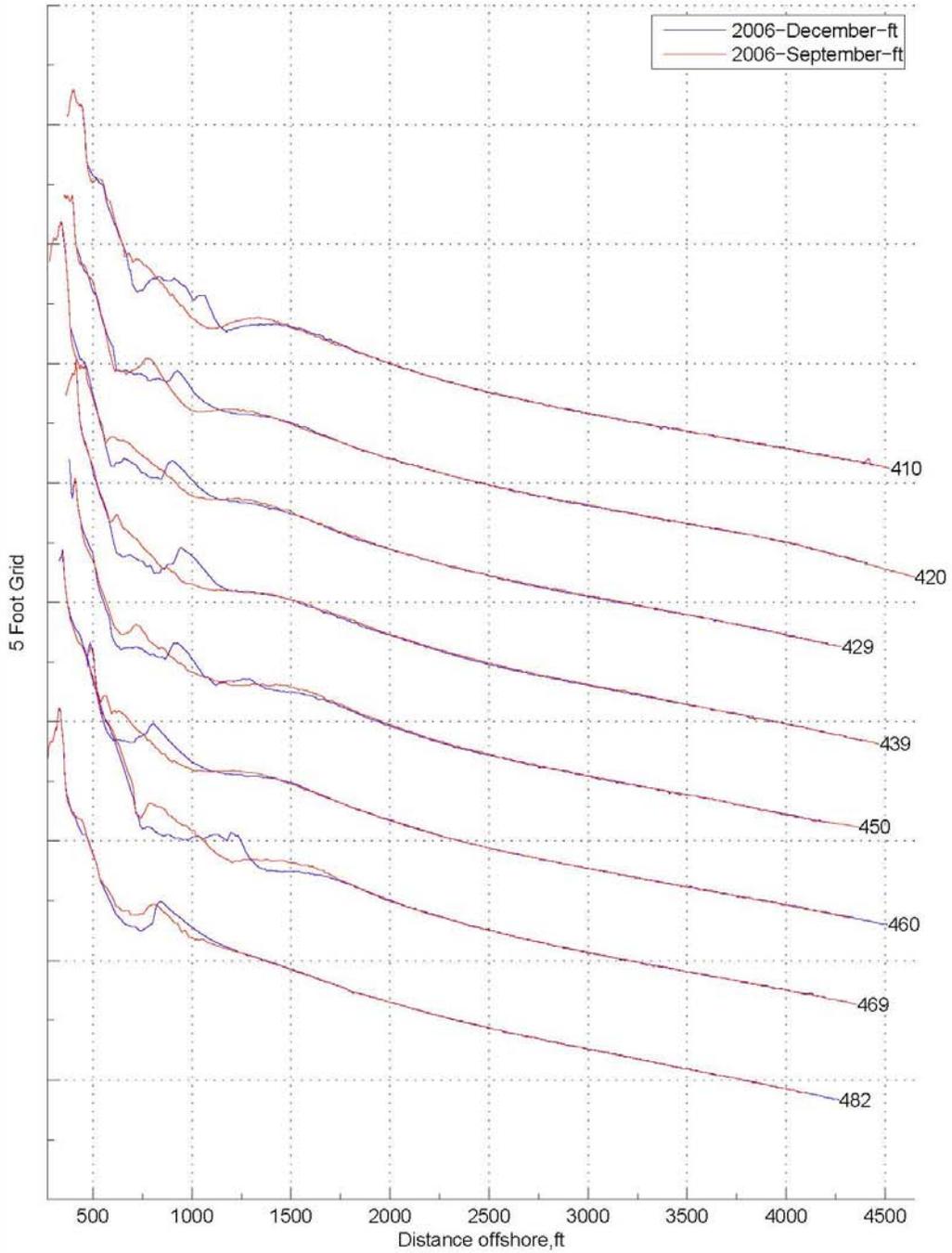


2006 September ft-pg06of21

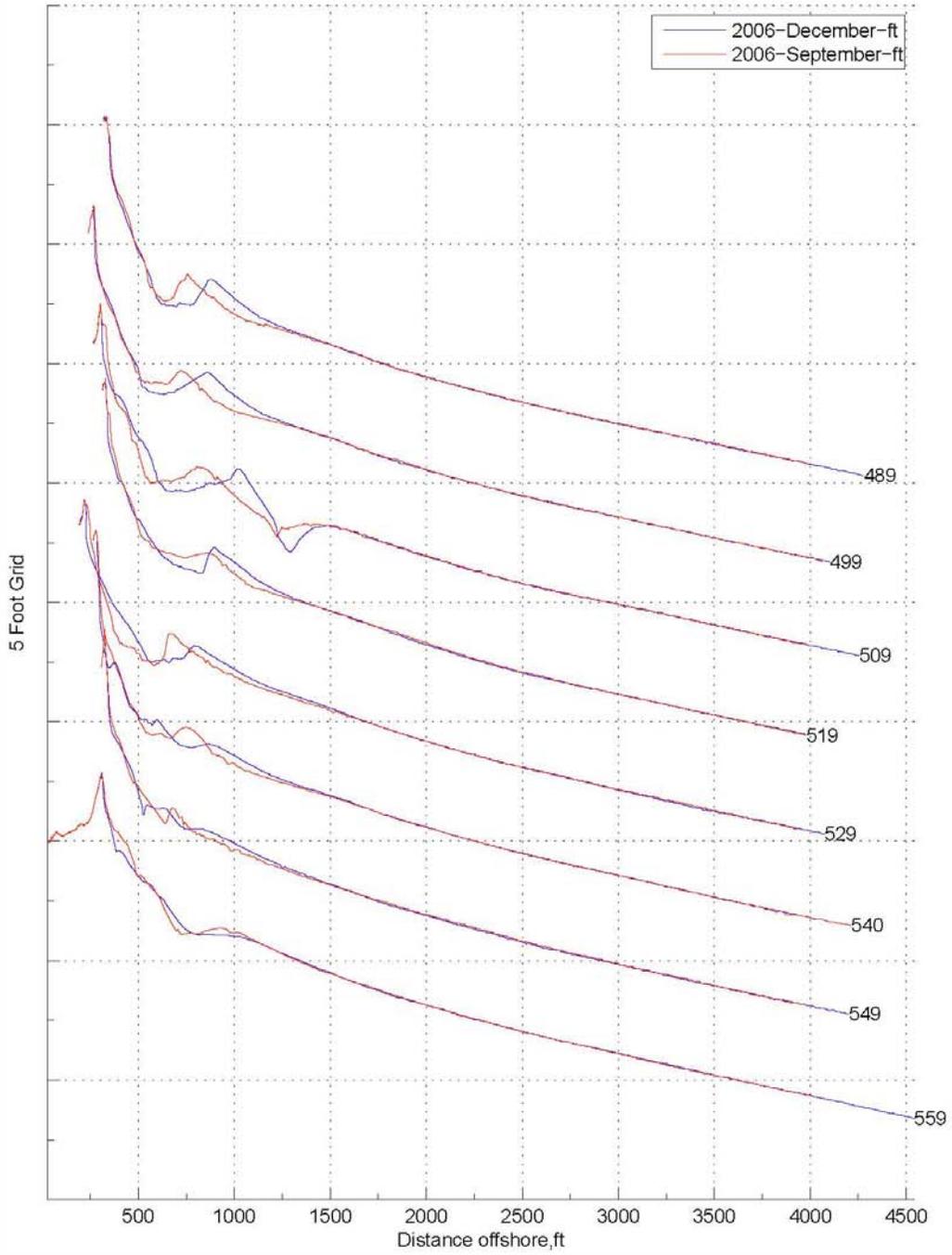


2006 September ft-pg07of21

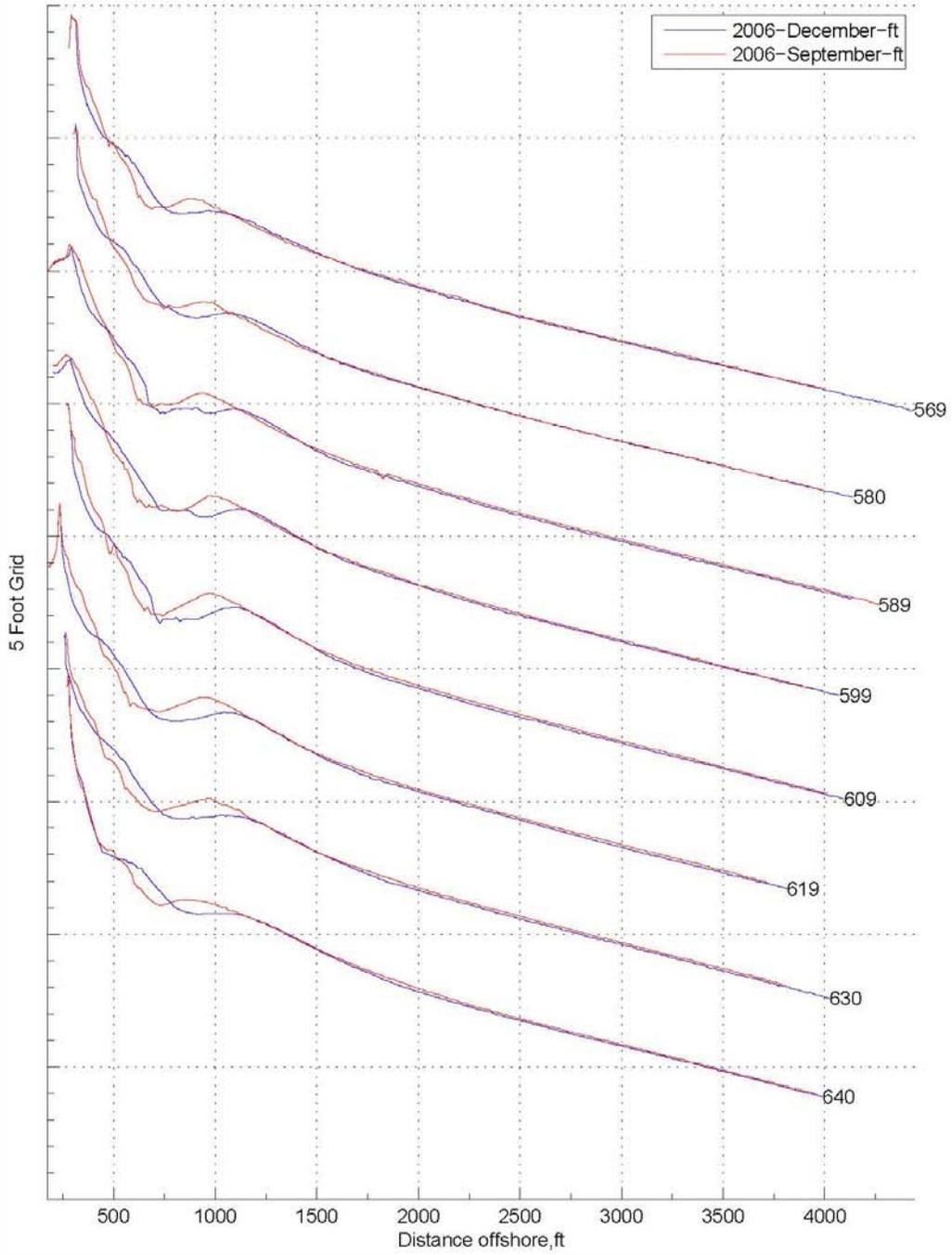




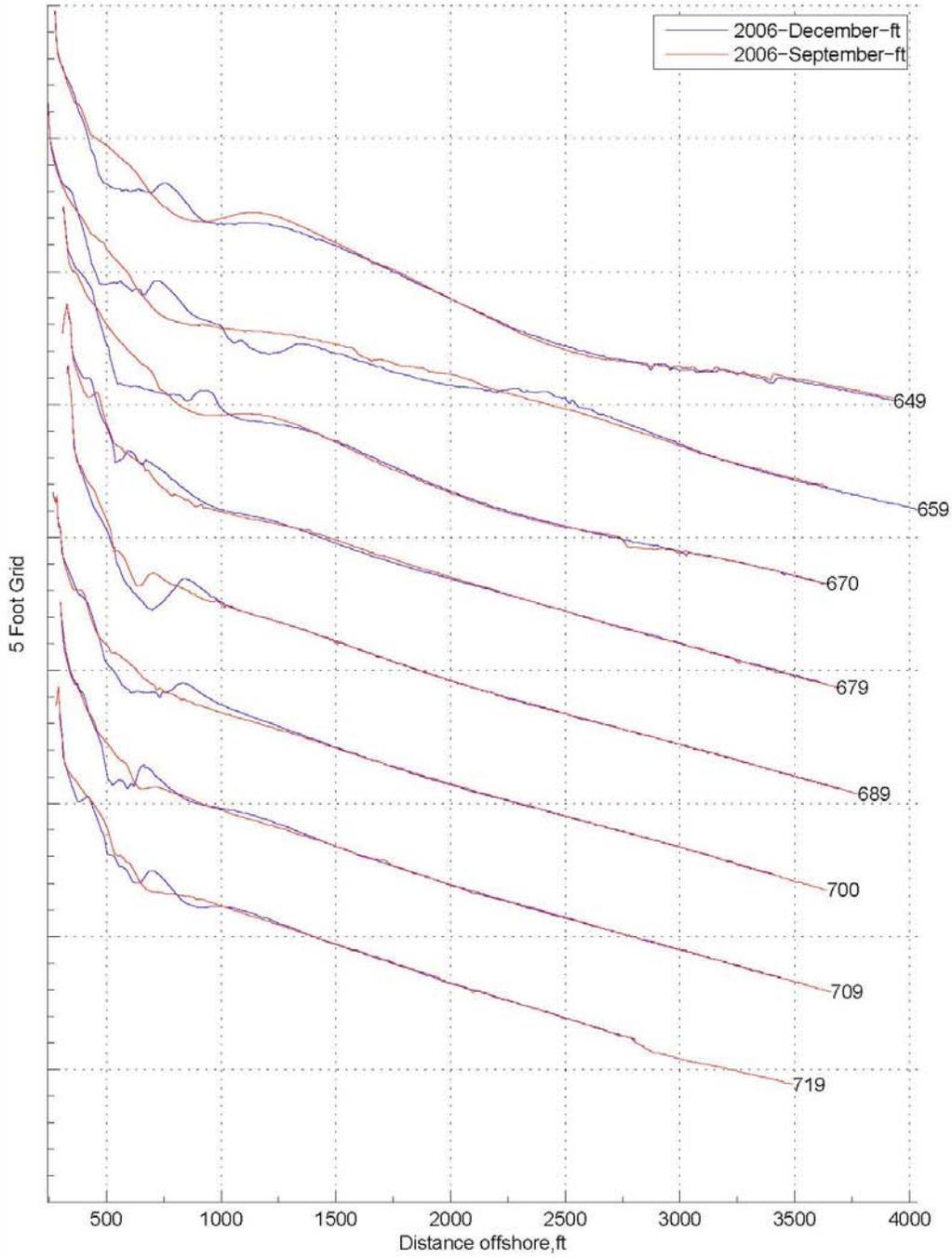
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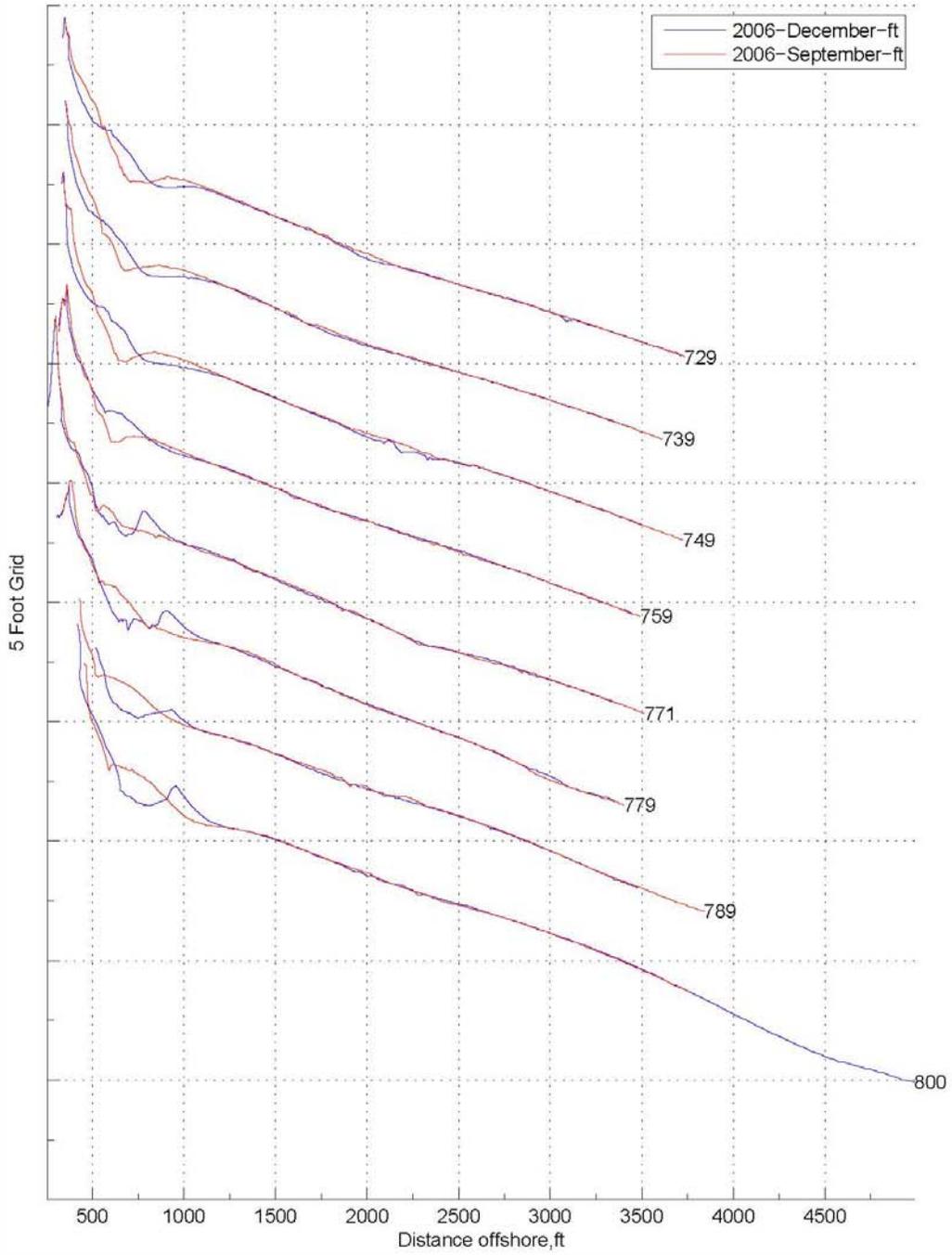
2006 September ft-pg10of21



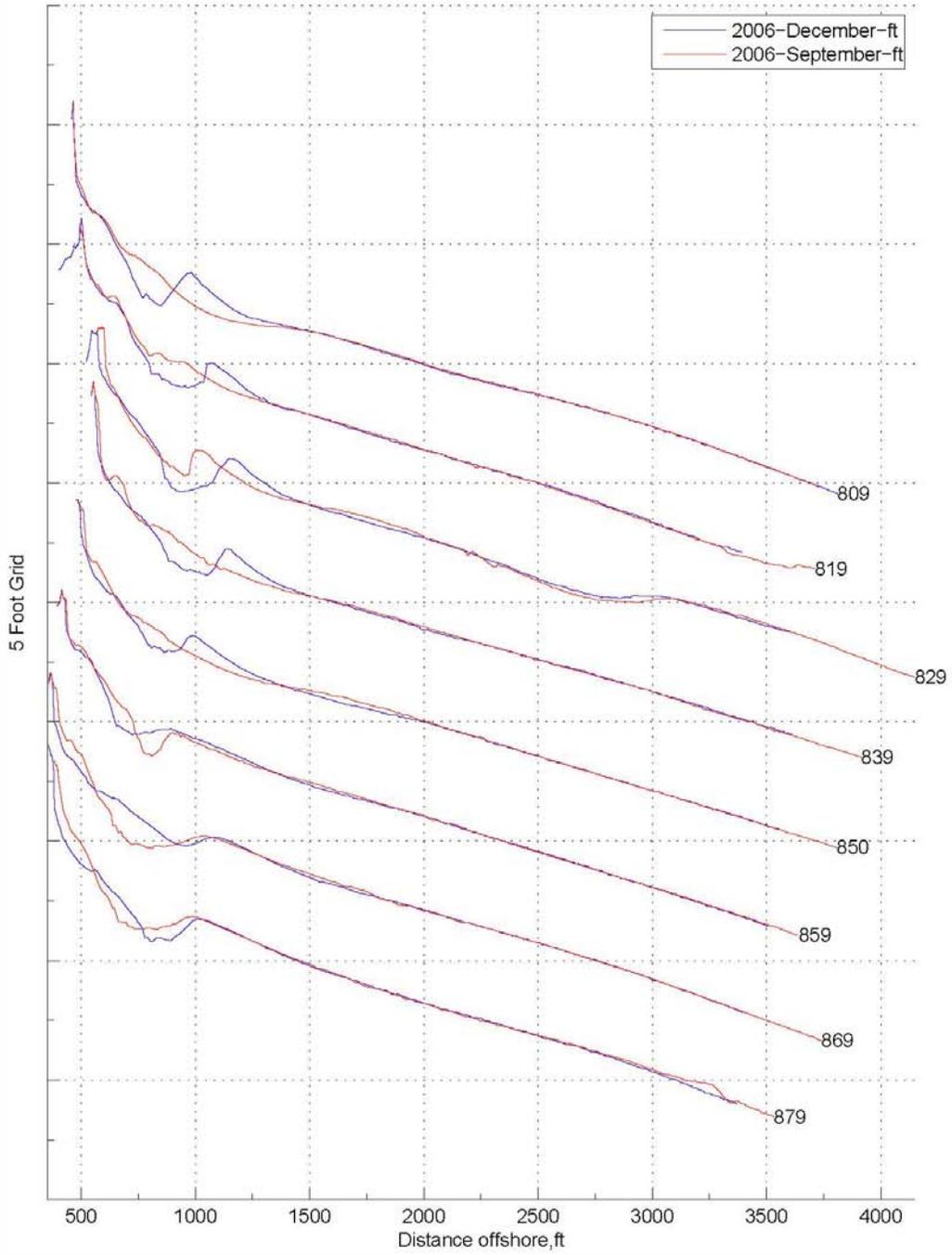
2006 September ft-pg1 1of21



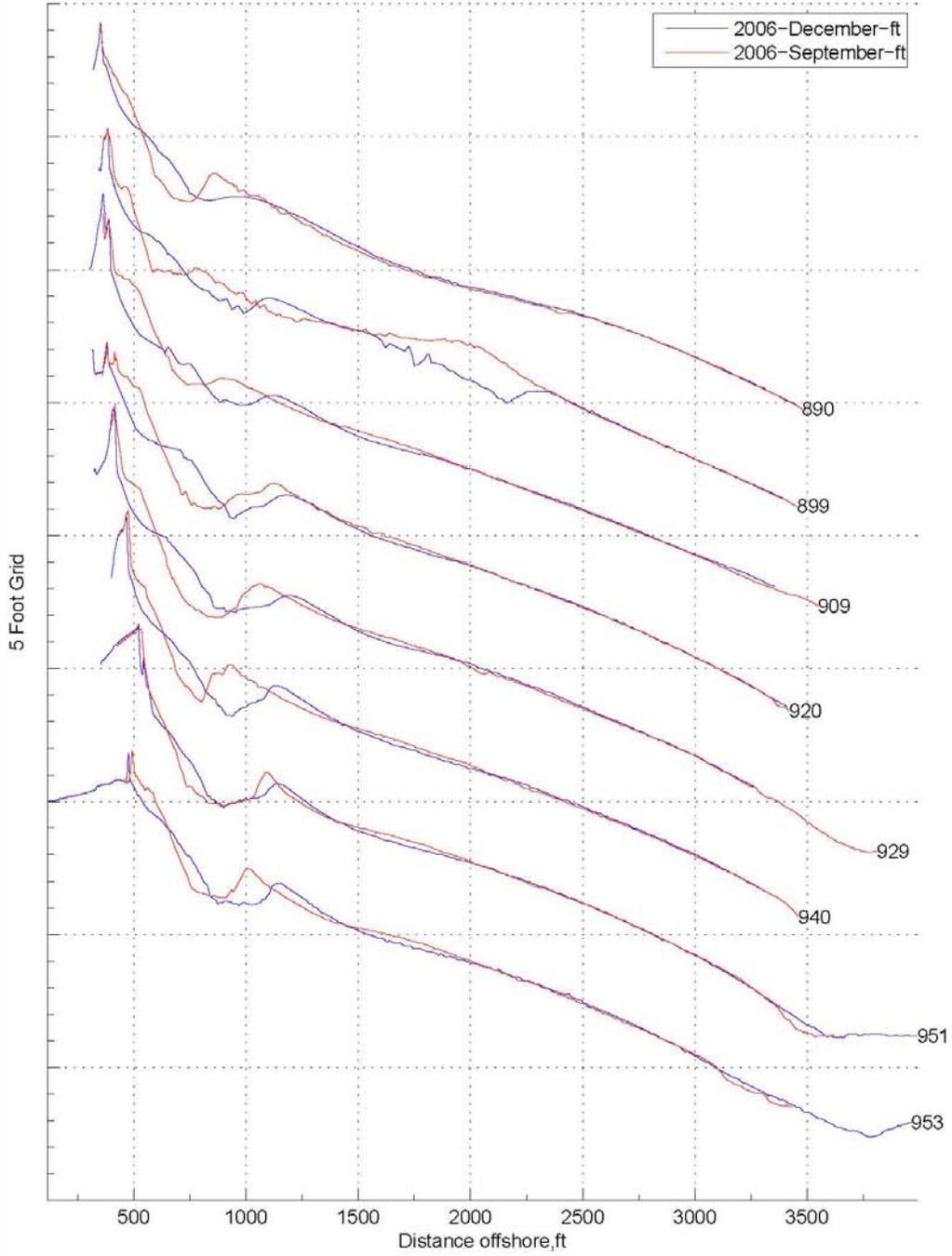
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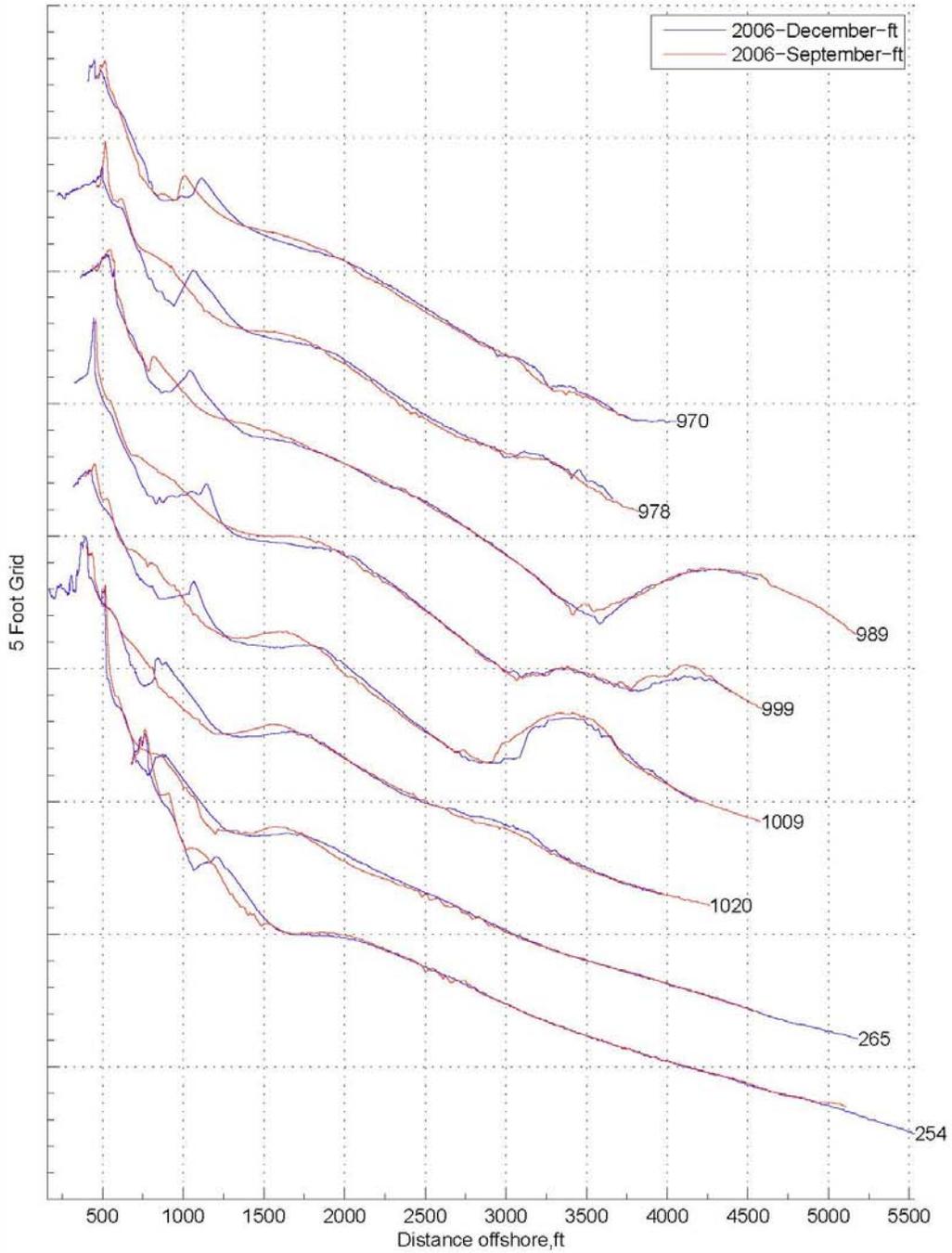
2006 September ft-pg13of21



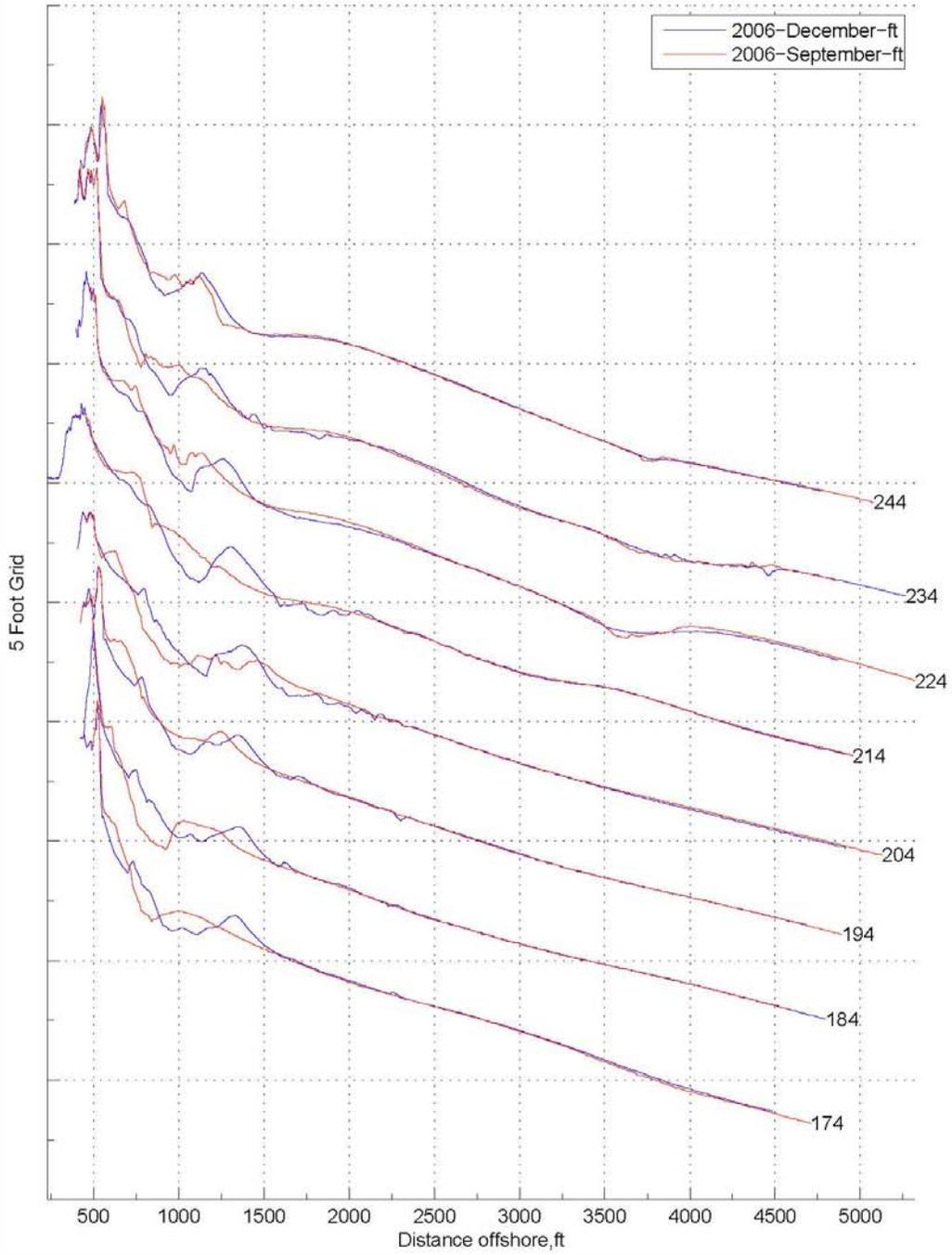
2006 September ft-pg14of21



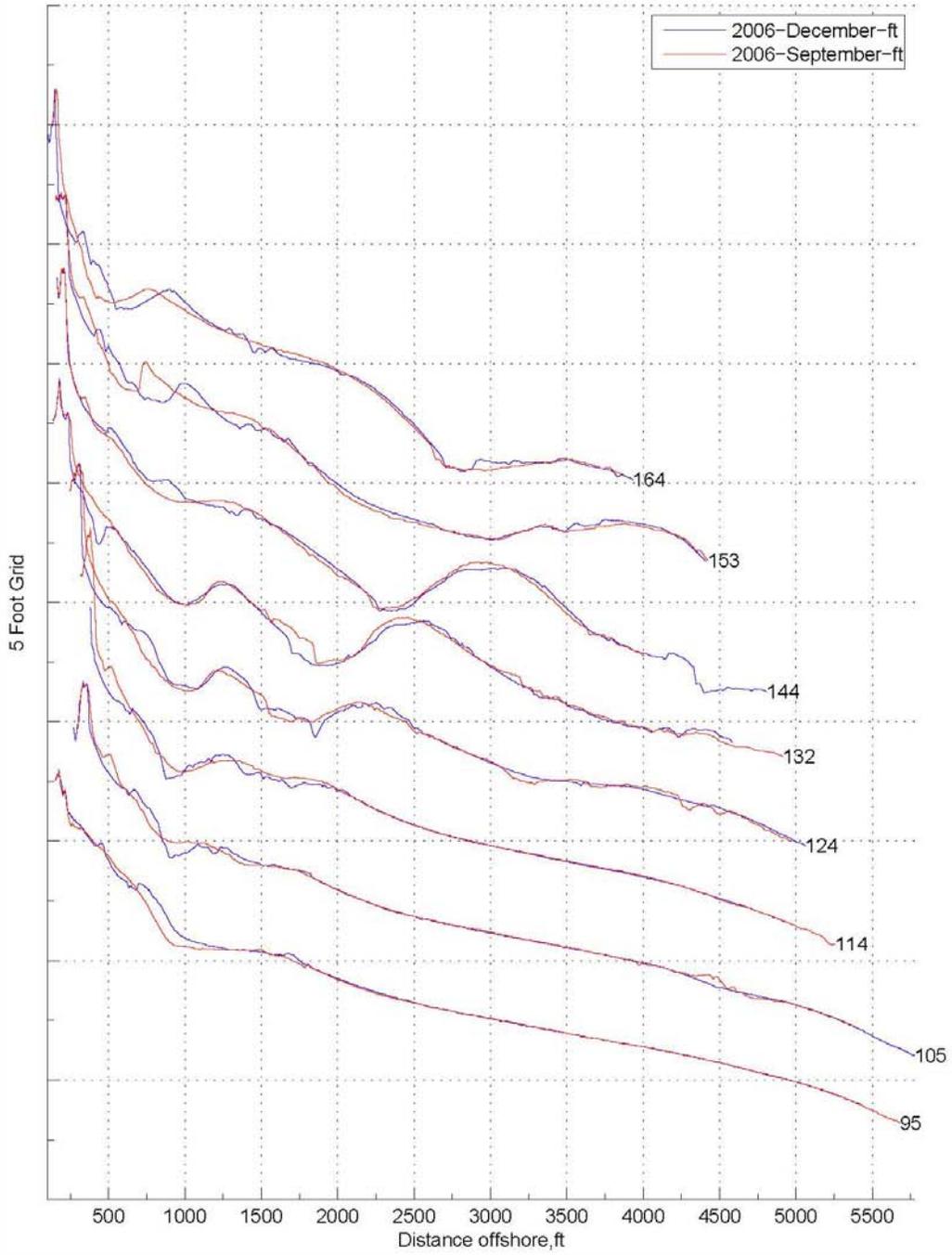
2006 September ft-pg15of21



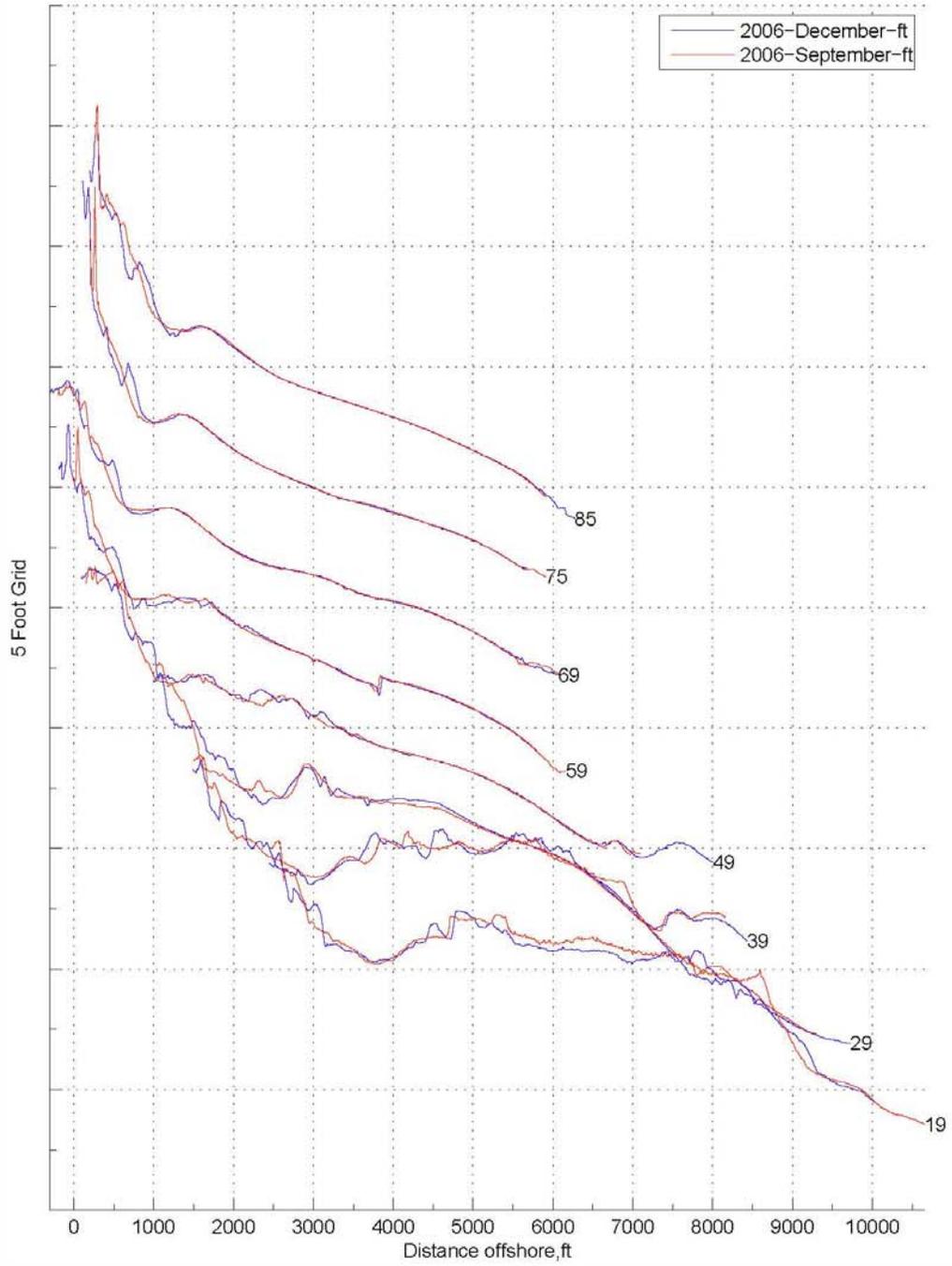
2006 September ft-pg16of21



2006 September ft-pg17of21



2006 September ft-pg18of21



Appendix G Photos

South Nags Head 22 November 2006



Cape Hatteras National Seashore



Cape Hatteras National Seashore





**Just North of Nags Head
Fishing Pier Near line 519**

North of Nags Head Fishing Pier



Just South of Nags Head Fishing Pier



South Nags Head 22 November 2006



South Nags Head 22 November 2006



Appendix H Metadata Files

Identification_Information:

Citation:

Citation_Information:

Originator: USACE Field Research Facility

Publication_Date: 20070118

Title:

RTK-GPS Shoreface and Nearshore Topographic and
Bathymetric Data

Geospatial_Data_Presentation_Form: Map

Publication_Information:

Publication_Place: Duck, North Carolina

Publisher: USACE Field Research Facility

Larger_Work_Citation:

Citation_Information:

Originator: USACE Field Research Facility

Publication_Date: 20010613

Title:

Dare County Beaches, Shore Protection Project
Physical Monitoring Program

Publication_Information:

Publication_Place: Duck, North Carolina

Publisher: USACE Field Research Facility

Other_Citation_Details:

This data is x,y,z of the shoreface
and nearshore area collected with a Real Time Kinematic GPS
system.

Description:

Abstract:

The USACE Wilmington District initiated a physical monitoring program associated with the Dare Co Beaches project. The physical monitoring consists of four parts: beach profile surveys, beach sediment sampling, aerial photography and wave/current/water level measurements.

The surveys include 144 profiles starting 3 miles north of Kitty Hawk and extending south 30 miles to Oregon Inlet. Each profile began at a stable location landward of the dune and ended at the -30-ft isobath. Swath surveys were used to supplement the profiles in regions with complicated morphology. Sediment samples were obtained along every other profile. Five samples below MSL and 5 above. The physical monitoring will include pre-, during- and post construction phases of the project.

Purpose:

To collect process and analyze data to assess the beach response to the fill placement and serve as the basis for maintaining the project. To also provide data in support of the biological monitoring effort

Supplemental_Information:

Weather/Survey Conditions:

Land based observations:

Sky:N/A

Wind:N/A

Temp:N/A

Precipitation:N/A
Notes:

Ocean based observations:

Seas:N/A

Wind:N/A

Swell Direction:N/A

Tides:

low (am):N/A

low (pm):N/A

high (am):N/A

high (pm):N/A

Notes:Base Station NPS DUNE. BM Check NPS PK Nail using
LARC DELTA Z=0.04m Dare County Project Profile Lines 174
thru 224. LARC survey only.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 20061212 0700

Ending_Date: 20061212 0900

Currentness_Reference: Publication Date

Status:

Progress: Complete

Maintenance_and_Update_Frequency: Unknown

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: 75.71

East_Bounding_Coordinate: 75.52

North_Bounding_Coordinate: 36.1

South_Bounding_Coordinate: 35.8

Keywords:

Theme:

Theme_Keyword_Thesaurus: None

Theme_Keyword: Shoreline

Theme_Keyword: Beach Profiles

Theme_Keyword: Beach Renourishment

Theme_Keyword: Erosion

Theme_Keyword: Beach Data

Theme_Keyword: Nearshore Bathymetry

Theme_Keyword: GIS

Theme_Keyword: GPS

Place:

Place_Keyword_Thesaurus: None

Place_Keyword: North Carolina

Place_Keyword: Atlantic Coast

Place_Keyword: Southeast Coast

Access_Constraints: None

Use_Constraints: Not for Navigational Purposes

Point_of_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: USACE Field Research Facility

Contact_Person: Mike Forte

Contact_Position: Survey Specialist

Contact_Address:

Address_Type: mailing and physical address

Address: 1261 Duck Road
City: Kitty Hawk
State_or_Province: North Carolina
Postal_Code: 27949
Country: USA
Contact_Voice_Telephone: (252)261-6840 x.228
Contact_Facsimile_Telephone: (252)261-4432
Contact_Electronic_Mail_Address: Michael.F.Forte@erdc.usace.army.mil
Hours_of_Service:
Monday-Friday, 8am-5pm, Eastern Standard
Time
Native_Data_Set_Environment:
Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report:
GPS quality was checked by
determining the difference in RTK-GPS baseline solution to
a known geodetic benchmark.
Logical_Consistency_Report:
GPS data was overlaid with
previous Dare County profile data and aerial imagery to
visualize logical consistency.
Completeness_Report:
Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
Base station horizontal position was established by MKimm &
Creed (2004)
Control points were tested by determining the horizontal
difference in an RTK-GPS baseline solution to a known
geodetic benchmark.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
Base station vertical position was determined by Mkimm &
Creed (2004) and met specifications
for geometric relative positioning techniques, 1st order.
This was tested by determining the vertical difference in
an RTK-GPS baseline solution to a known geodetic benchmark.
Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator:
SAW Dare County Beaches Physical Monitoring
Project
Publication_Date: 2003
Title:
Dare County Beaches, Shore Protection Project
Physical Monitoring Program
Edition:
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Kitty Hawk, North Carolina
Publisher: USACE Field Research Facility
Source_Scale_Denominator:
Type_of_Source_Media:
Source_Time_Period_of_Content:

Time_Period_Information:
 Range_of_Dates/Times:
 Beginning_Date: 2003
 Ending_Date: Present
 Source_Currentness_Reference: Publication Date
Source_Citation_Abbreviation:
Source_Contribution:
 Used to determine erosion rates,
 volumes, and set-back lines
Process_Step:
 Process_Description:
 Beach and nearshore (-11m NAVD88) shore-perpendicular
 survey lines are acquired with Trimble 4000 and
 4700 dual frequency Real-Time-Kinematic Global Positioning
 Satellite (RTK-GPS) system. Land-based survey
 lines are collected with a backpack and rangepole while
 bathymetric profiles are collected using a Knudsen
 310 survey-grade fathometer, TSS motion sensor, and
 RTK-GPS.
 Processing software consists of a custom built FORTRAN
 routine that combines the GPS and echosounder data
 in order to remove the motion of the vessel due to the wave
 motion. The survey software also adjusts the
 measurements to the changes in speed of sound over the
 survey area. This program also correctly aligns the
 time of the echosounder and GPS data. This is accomplished
 by dynamically adjusting the time or "latency"
 of the GPS data, relative to the echosounder data, until a
 best fit is obtained.
 Process_Date: 20070105
 Process_Contact:
 Contact_Information:
 Contact_Organization_Primary:
 Contact_Organization: USACE Field Research Facility
 Contact_Person: Mike Forte/Carl Miller
 Contact_Position: Survey Specialist
 Contact_Address:
 Address_Type: mailing and physical address
 Address: 1261 Duck Road
 City: Kitty Hawk
 State_or_Province: North Carolina
 Postal_Code: 27949
 Country: USA
 Contact_Voice_Telephone: (252) 261-6840 x.228
 Contact_Facsimile_Telephone: (252) 261-4432
 Contact_Electronic_Mail_Address:
Michael.F.Forte@erdc.usace.army.mil
 Hours_of_Service:
 Monday-Friday, 8am-5pm, Eastern Standard
 Time
 Spatial_Reference_Information:
 Horizontal_Coordinate_System_Definition:
 Planar:
 Grid_Coordinate_System:
 Grid_Coordinate_System_Name:
 State_Plane_Coordinate_System:
 SPCS_Zone_Identifier: 3200

Lambert_Conformal_Conic:
 Standard_Parallel:
 Longitude_of_Central_Meridian:
 Latitude_of_Projection_Origin:
 False_Easting:
 False_Northing:
 Planar_Coordinate_Information:
 Coordinate_Representation:
 Abscissa_Resolution:
 Ordinate_Resolution:
 Planar_Distance_Units:
 Planar_Coordinate_Encoding_Method:
 Geodetic_Model:
 Horizontal_Datum_Name:
 North American Datum of 1983
 Elevations are referenced to NAVD88 and recorded in meters
 Ellipsoid_Name: WGS 1984 (Geoid 2003)
 Semi-major_Axis: 6378.137km
 Denominator_of_Flattening_Ratio: 1/298.25722
 Entity_and_Attribute_Information:
 Detailed_Description:
 Entity_Type:
 Entity_Type_Label: profiles, shoreface and nearshore
 Entity_Type_Definition:
 Entity_Type_Definition_Source:
 Overview_Description:
 Entity_and_Attribute_Overview:
 Entity_and_Attribute_Detail_Citation:
 Distribution_Information:
 Distributor:
 Contact_Information:
 Contact_Organization_Primary:
 Contact_Organization: USACE Field Research Facility
 Contact_Person: Mike Forte/Carl Miller
 Contact_Position: Survey Specialist
 Contact_Address:
 Address_Type: mailing or physical address
 Address: 1261 Kitty Hawk Road
 City: Kitty Hawk
 State_or_Province: North Carolina
 Postal_Code: 27949
 Country: USA
 Contact_Voice_Telephone: (252) 261-6840 x.228
 Contact_Facsimile_Telephone: (252) 261-4432
 Contact_Electronic_Mail_Address: Michael.F.Forte@erdc.usace.army.mil
 Hours_of_Service:
 Monday-Friday, 8am-5pm, Eastern Standard
 Time
 Resource_Description:
 This dataset is part of the Dare
 County Beaches, Shore Protection Project
 Distribution_Liability:
 Users must assume responsibility to
 determine the appropriate use of these data.
 Standard_Order_Process:
 Digital_Form:
 Digital_Transfer_Information:

Format_Name: 3d file containing xyz
Digital_Transfer_Option:
Offline_Option:
Offline_Media: none
Recording_Format:
Compatibility_Information: unknown
Fees: none
Metadata_Reference_Information:
Metadata_Date: 20070118
Metadata_Review_Date: 20070118
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: USACE Field Research Facility
Contact_Position: Survey Specialist
Contact_Address:
Address_Type: mailing and physical address
Address: 1261 Duck Road
City: Kitty Hawk
State_or_Province: North Carolina
Postal_Code: 27949
Country: USA
Contact_Voice_Telephone: (252) 261-6840 x.228
Contact_Facsimile_Telephone: (252) 261-4432
Contact_Electronic_Mail_Address: Michael.F.Forte@erdc.usace.army.mil
Hours_of_Service:
Monday-Friday, 8am-5pm, Eastern Standard