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ADCP Mooring System on the Southeast Florida Shelf

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Version 1.0

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Data Report

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1. Introduction

1.1 Long-term Goal

As a part of the South Florida Ocean Measurement Center (SFOMC), NSU and USF deployed a three-dimensional mooring array coordinated with the OSCR with acoustic Doppler current profilers (ADCP) and a combination of inductively coupled and/or self-recording temperature/salinity sensors. In 2004, a data report was written including data from 1999 to 2000 (Soloviev et al. 2004).

The long-term goal of the project is to provide necessary monitoring of the physical-oceanographic environment for the SFOMC Range and to provide access to information on local currents on the Southeast Florida shelf. This report is a presentation of the existing fourteen year data set on the Dania Beach, Florida shelf obtained with an ADCP mooring deployed at an 11 m isobaths, a subsurface buoy deployed at a 240 m isobath on the Miami Terrace, and an AWAC temporarily deployed at an 11 m isobath in Summer 2010.

Continuation of long term observations at the existing mooring locations is expected to help the Broward County, FL and state of Florida resource trustees to monitor the state of the coastal ecosystem. The data will also be useful for numeric models and for research projects. In addition, the array provides data useful for understanding a variety of scientific questions. These questions include: What are the dominant modes of interaction between the nearby Gulf Stream and the shelf/near shore circulation? Are these events driven by the wind, Gulf Stream Meanders, propagating continental shelf waves, or near-shore eddies? What is the structure and temporal variability of the internal-wave field?

1.2 Objective

The objective of this project is to provide ADCP data from the Nova Southeastern University Oceanographic Center (NSUOC) ADCP bottom-mount mooring (off Dania Beach) at 11 m isobath, from the subsurface Calypso ADCP mooring (off Pompano) at 244 m isobath, and from the AWAC bottom mounted system at 11 m isobath.

1.3 Potential Users of Data

Some potential users of this data include Port Everglades related users (small boaters, port pilots, container ships, petroleum tankers), US Coast Guard search and rescue, US NAVY SFTF, hurricane forecasters, commercial and recreational fishers, county pollution regulators, beach erosion specialists, coastal managers, turtle program scientists and managers, FDEP water quality specialists, coastal resource managers, USGS, and water treatment facility managers.

1.4 Data

This Data Report presents an approximately fourteen year dataset collected from a bottom mounted ADCP (NW (W) Bottom Mount) at an 11 m isobath deployed on the Dania Beach shelf and a four year dataset collected from a subsurface ADCP (Calypso subsurface buoy) at a 240 m isobath on the Miami Terrace near Pompano Beach. For a two month period in summer 2010, an AWAC system (AWAC Bottom Mount) was also used to collect data off the Dania Beach shelf at an 11 m isobath. For more details of the experimental design of each unit, see sections 2.1, 2.2, and 2.3. The data from the moorings are provided to users via DVD.

2. Experimental Design

The location of the array is shown in Figures 1 and 2. The NW (W) Bottom Mount and AWAC Bottom Mount are located 11 meters deep on sand stretch between two reef tracks. The Calypso subsurface buoy is located 240 meters deep in open waters; this location was chosen to satisfy requirements by the Calypso Project. Photographs of the NW (W) Bottom Mount, AWAC Bottom Mount and Calypso subsurface buoy are shown in Figure 3. Details of the designs are given below (Table 1):

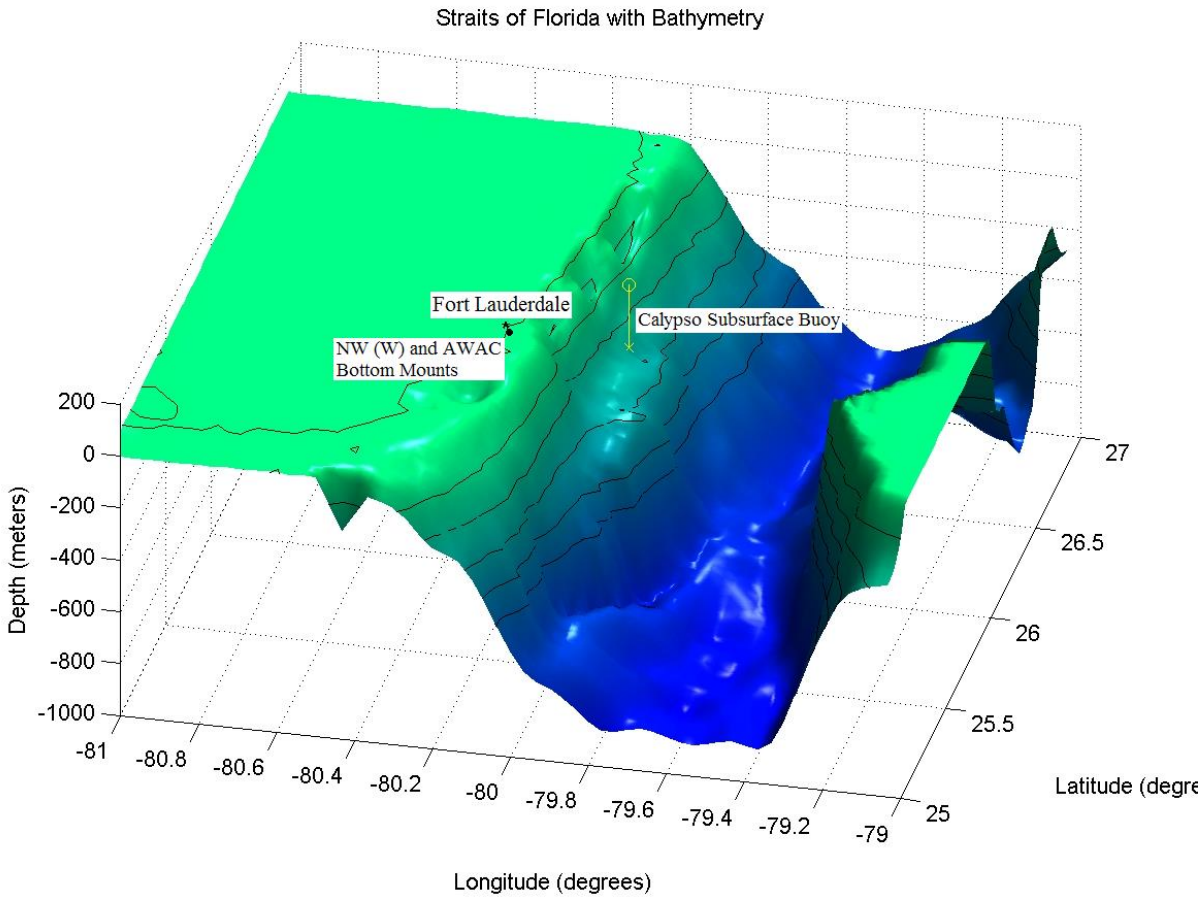

Figure 1. Map of the NW (W) Bottom Mount, AWAC Bottom Mount, and Calypso Subsurface Buoy locations. Coordinates of each mooring are presented in Table 1. The ADCP Bottom Mount is an upward looking WHS600 or WHS300 Acoustic Doppler Current Profiler at an 11 m isobath. The Calypso Buoy is a subsurface buoy 10 m above the sea floor at a 240 m isobaths with an upward facing WHLR ADCP and a downward facing WHS300 ADCP. The Nortek AWAC is an upward looking ADCP located at an 11 m isobath, 30 m north of the ADCP Bottom Mount.

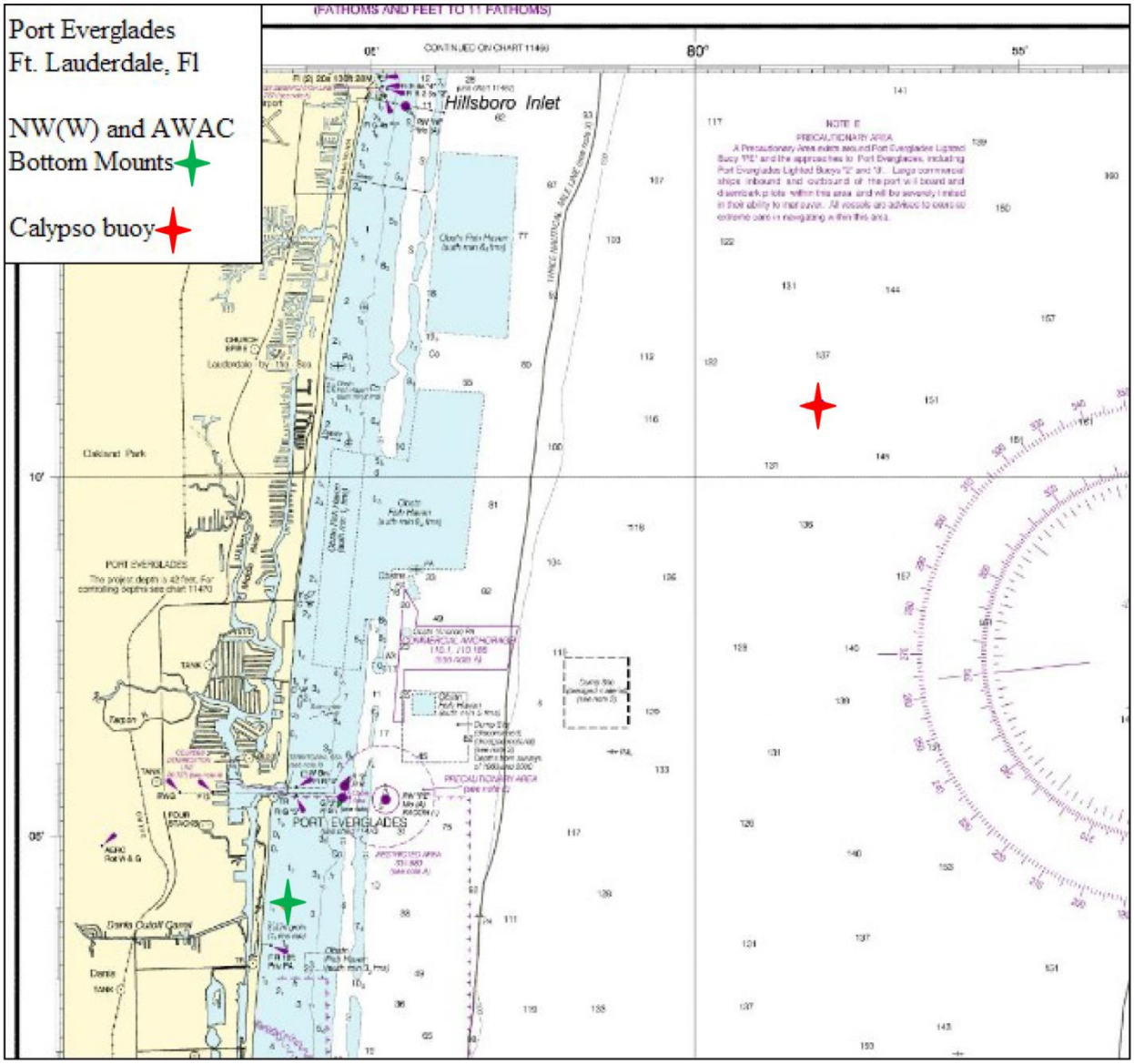

Figure 2. The same array presented on a nautical map. Map acquired from nauticalchartsonline.com.

Figure 2. Photographs of the ADCP Bottom Mount (a), AWAC Bottom Mount with battery on the right (b) and Calypso subsurface buoy on the deck of the towboat *Becker* (c).

Table 1. Platform, type, location, depth, and period of deployment of the mooring arrays.

Platform	Type	Coordinates	Depth of Location	Period of Deployment
Calypso buoy	Subsurface Buoy	26° 11.280N 079° 58.278W	240m	Jan 2007 – Nov 2010
NW (W)	Bottom Mount	26° 04.226N 080° 05.660W	11m	June 1999 – May 2013
AWAC	Bottom Mount	26° 04.226N 080° 05.660W	11m	June 2010 – July 2010

2.1 NW (W) Bottom Mount

The NSUOC bottom ADCP mooring was deployed in June 1999 on the Southeast Florida Shelf (Dania Beach, FL) as a part of a working relationship between NSU and USF in the framework of South Florida Ocean measurement Center (SFOMC). In 1998, the Office of Naval Research provided initial 5-year funding to NSUOC for this project. The mooring was maintained by the NSUOC using a combination of internal NSUOC funding and other ongoing projects. At this point, almost a 14 year data set has been collected at this mooring location.

The NW (W) bottom mount consists of a concrete anchor, and an upward looking RDI Workhorse Sentinel ADCP mounted on a trawl resistant bottom rack. The concrete anchor was manufactured at the USF marine shop. The NW (W) bottom mount was deployed from the R/V *Stephen* (FAU) on 25 June 1999 at an 11-m isobath (26° 04.226 N 080° 05.660 W) and was installed in an internal recording mode. The ADCP bottom mount has been maintained continuously since its deployment in 1999; the data from all sensors are periodically downloaded. The concrete rack was re-aligned and redeployed on November 19, 2005 (26° 04.1344 N 080° 04.134 W) after being moved by Hurricane Wilma and was again re-aligned in 2010.

2.2 Calypso Subsurface Buoy

The Calypso subsurface buoy consists of an acoustic modem, a Workhorse LR 75-1-2 ADCP, a Flotation Technologies flotation buoy, a submersible strobe light, an ARGOS satellite transmitter, a Workhorse Sentinel 300 ADCP, and a 2000 pound anchor system. A diagram of the buoy design can be seen in Figure 4.

It was constructed for Calypso LNG LLC Project and deployed from the R/V *Stephan* on January 23, 2007 at 26° 11.280 N 079° 58.278 W. The Calypso subsurface buoy sits 10 m above the ocean floor at approximately 240 m depth. It was installed in an internal recording mode with near real-time access by an acoustic channel. The buoy has been serviced several times since its deployment in 2007 through 2010. The data from all sensors were periodically downloaded.

The project was funded by Calypso LNG LLC (SUEZ North America Inc.).

2.3 AWAC Bottom Mount

The AWAC bottom mount consists of a battery pack, an Acoustic Wave And Current Profiler, a circular polystyrene platform for the battery pack and AWAC, and a rebar anchoring system. The AWAC system is a NortekUSA product, and the configuration was assembled in-house. It was deployed from the R/V *Panacea* in June 2010 at 26° 04.243 N 080° 05.660 W. The AWAC bottom mount was installed in an internal recording mode. It was deployed temporarily during June and July 2010 (Figure 2b).

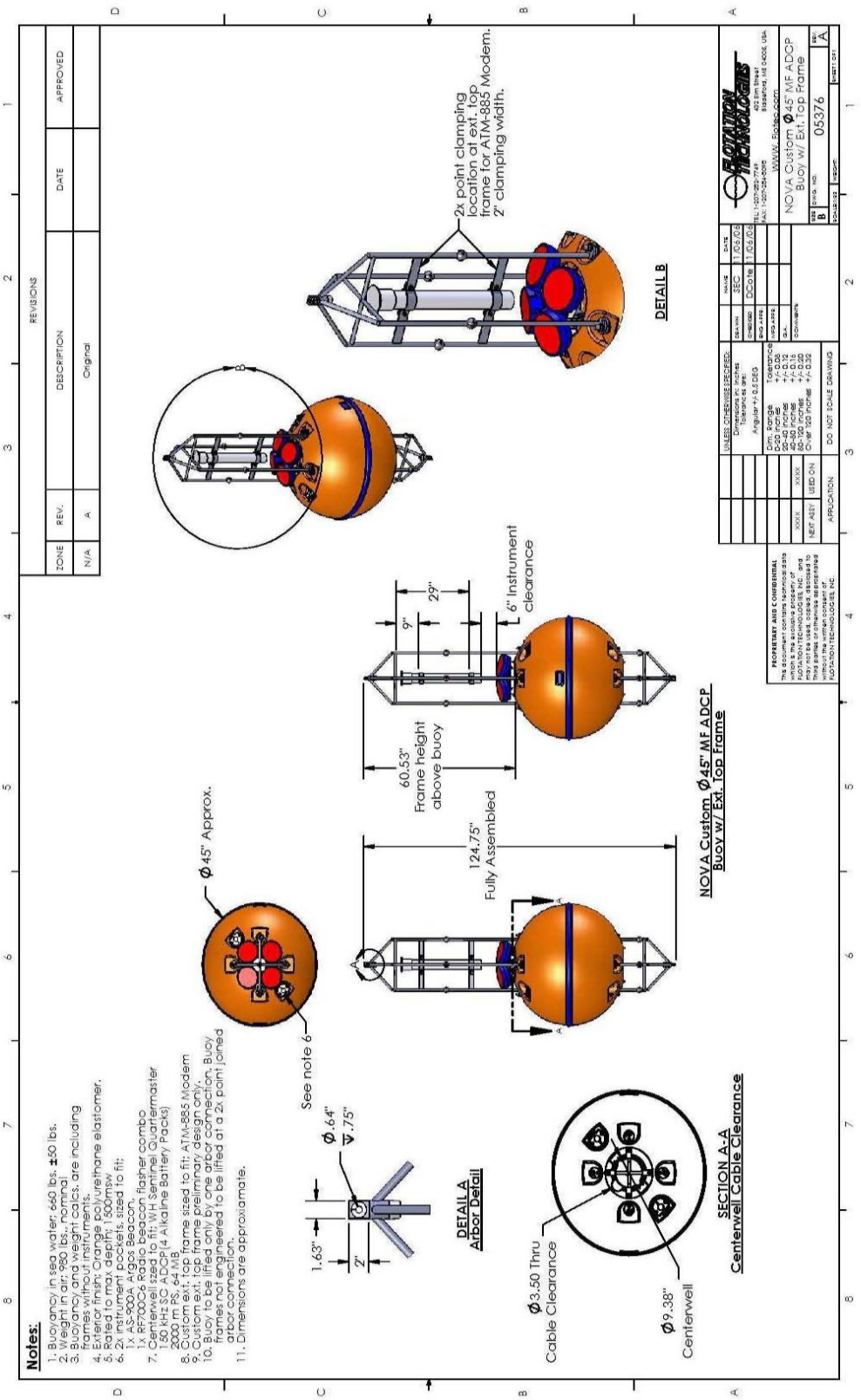

Figure 4. Diagram of subsurface buoy design.

3. Data Sets

3.1 NW (W) Bottom Mount

This section describes the contents of the ADCP Bottom Mount directory structure and contains the data from the NW (W) Bottom Mount. See Figures 1, 2 and Table 1 for more details about the array configuration on the Southeast Florida Shelf.

The DVD sub-directory labeled \data\W-buoy contains folders with data from the bottom-mounted Workhorse ADCP in two different formats: Binary (Raw) and Matlab (.mat). Each folder is labeled by the date at the beginning and end of the record. For example: the record se666000.000 is in the folder '25Jun99_10Aug99' because the beginning of the record is June 25, 1999 and the end of the record is August 10, 1999.

The data in the Matlab format have been preliminary processed, which was accomplished by reviewing the data in WinADCP (supplied by RDI). The beginning and end of each data file was trimmed to exclude any data during a time that the instrument was disturbed by boat and/or divers' operations (Table 2).

The Matlab files contain the converted data processed from the raw data by the WinADCP software. The user is cautioned that a few of the Matlab files contain a small error in the time interval that is introduced in the conversion to Matlab format. These errors have been corrected manually. The correct ensemble intervals can be found in Table 2.

The Matlab files are named according to the date (bin/ensemble) of deployment when the instrument was determined to be taking appropriate measurements. The Binary (raw) data does not, however, follow this convention. The data files' name and extension differ between the Raw and Matlab files; associated files are listed in Table 2. The Matlab variables are described in Table 3 below.

Table 2. All raw and processed files from the NW Bottom Mount.

Date/Time of First Data (Ensemble Number)	Date/Time of Last Data (Ensemble Number)	Binary Files (Raw)	Converted Matlab (.mat) files	Ensemble Interval (s)	Folder Name
99/06/25 21:00:00 (37)	99/08/10 15:00:00 (4429)	se666000.000	mat990625.mat	900	25Jun99_10Aug99
99/08/11 12:14:57 (19)	99/10/19 12:14:57 (1675)	SE667000.000	mat990811.mat	3600	11Aug99_19Oct99
99/10/23 17:00:00 (6)	00/04/17 19:00:00 (4256)	666C5000.000	mat991023.mat	3600	23Oct99_17Apr00
00/04/19 19:00:00 (8)	00/11/10 16:00:00 (4925)	666C6000.000	mat000419.mat	3600	19Apr00_10Nov00
01/05/16 15:00:00 (42)	02/02/05 14:00:00 (6401)	666C8001.000	mat010516.mat	3600	16May01_05Feb02
02/02/06 21:00:00 (4)	02/10/22 14:00:00 (6189)	666C9000.000	mat020206.mat	3600	06Feb02_22Oct02
02/10/22 18:00:00 (5)	03/06/19 13:00:00 (5760)	80710000.000	mat021022.mat	3600	22Oct02_19Jun03
03/06/19 16:00:00 (25)	03/12/11 14:00:00 (4223)	80811000.000	mat030619.mat	3600	19Jun03_11Dec03
03/12/11 17:00:00 (18)	04/06/06 13:00:00 (4286)	80711000.000	mat031211.mat	3600	11Dec03_06Jun04

04/06/06 15:03:39 (4)	04/06/08 15:03:39 (52)	June2004test1_ CurrentsData.000	mat040606.mat	3600	06Jun04_08Jun04
04/06/08 18:03:39 (55)	04/06/23 13:03:39 (410)	June2004test2_ CurrentsData.000	mat040608.mat	3600	08Jun04_23Jun04
04/06/23 16:08:19 (65)	05/07/22 15:48:19 (28432)	DPL3_000.000	mat040623.mat	1200	23Jun04_22Jul05
05/07/22 16:35:10 (25)	05/09/17 13:35:10 (16405)	DPL3_000.000	mat050722.mat	300	22Jul05_17Sep05
05/09/17 17:23:04 (10)	05/11/19 15:08:04 (18127)	DPL5_000.000	mat050917.mat	300	17Sep05_19Nov05
05/11/19 21:58:56 (26)	06/05/15 12:43:56 (50891)	DPL6_000.000	mat051119.mat	300	19Nov05_15May06
06/06/21 23:05:17 (19)	06/11/19 13:15:17 (43389)	DPL7_000.000	mat060621.mat	300	21Jun06_19Nov06
06/11/19 19:07:58 (20)	07/04/09 20:22:58 (40643)	DPL8_000.000	mat061119.mat	300	19Nov06_09Apr07
07/04/09 21:58:22 (46)	07/07/31 22:08:22 (32592)	DPL_1000.000	mat070409.mat	300	09Apr07_31Jul07
07/07/31 23:43:21 (23)	07/09/12 12:33:21 (12273)	DPLA_000.000	mat070731.mat	300	31Jul07_12Sep07
07/09/12 17:26:20 (22)	08/03/28 14:26:20 (57010)	DPL2_000.000	mat070912.mat	300	12Sep07_28Mar08
08/03/28 21:29:31 (24)	08/07/14 15:09:31 (31052)	DPL3_000.000	mat080328.mat	300	28Mar08_14Jul08
08/09/17 18:16:33 (20)	09/01/19 14:51:33 (35691)	DPL2_000.000	mat080917.mat	300	17Sep08_19Jan09
09/01/19 21:36:23 (23)	09/06/15 12:46:23 (42253)	DPL9_000.000	mat090119.mat	300	19Jan09_15Jun09
09/06/15 22:07:43 (21)	09/08/17 16:37:43 (18099)	DPL8_000.000	mat090615.mat	300	15Jun09_17Aug09
09/12/09 18:57:42 (24)	10/04/06 09:07:42 (33890)	BMOUN000.000	mat091209.mat	300	09Dec09_06Apr10
10/07/30 16:21:36 (22)	10/09/27 11:06:36 (16951)	73010000.000	mat100730.mat	300	30Jul10_27Sep10
11/06/14 13:30:00 (13)	11/08/10 15:04:59 (16448)	DPL10000.000	mat110614.mat	300	14Jun11_10Aug11
11/08/10 18:15:29 (9)	12/03/18 01:20:29 (63454)	DPL2_000.000	mat110810.mat	300	10Aug11_18Mar12
12/11/07 15:25:00 (54)	13/05/03 14:29:59 (51019)	DPL7_000.000	mat121107.mat	300	07Nov12_03May13

Table 3: WinADCP parameters and their Matlab equivalents

WinADCP parameters	**Matlab equivalents**
Velocity East (mm/s)	SerEmmpersec
Velocity North (mm/s)	SerNmmpersec
Velocity Vertical	SerVmmpersec
Velocity Error	SerErmmpersec
Velocity Magnitude	SerMagmmpersec
Velocity Direction	SerDir10thDeg
Correlation Bm1	SerC1cnt
Correlation Bm2	SerC2cnt
Correlation Bm3	SerC3cnt

Correlation Bm4	SerC4cnt
Correlation Avg	SerCAcnt
Echo AmplitudeBm1	SerEA1cnt
Echo Amplitude Bm2	SerEA2cnt
Echo Amplitude Bm3	SerEA3cnt
Echo Amplitude Bm4	SerEA4cnt
Echo Amplitude Avg	SerEAAcnt
Percent Good PG1	SerPG1
Percent Good PG2	SerPG2
Percent Good PG3	SerPG3
Percent Good PG4	SerPG4
Anc Data Types Pitch	AnP100thDeg
Anc Data Types Roll	AnR100thDeg
Anc Data Types Heading	AnH100thDeg
Anc Data Types Temperature	AnT100thDeg
Anc Data Types Depth	AnDepthmm
Anc Data Types Orientation	AnOrienUP
Anc Data Types BIT	AnBIT
Anc Data Types Battery	AnBatt
1st Bin Range (m)	RDIBin1size
Bin Size (m)	RDIBinSize
First Ensemble Date	RDIEnsDate
Ensemble Interval (s)	RDIEnsInterval
First Ensemble Time	RDIEnsTime
Raw File Name	RDIFileName
Instrument Frequency	RDISystem
Bin Numbers	SerBins
Ensemble Number	SerEnsembles

3.2 Calypso Subsurface Buoy

This section describes the contents of the Calypso Subsurface Buoy directory structure and contains the data from the Calypso Subsurface Buoy. See Figures 1, 2 and Table 1 for more details about the array configuration. The Calypso Subsurface Buoy directory (\data\Calypso) contains data from the subsurface Workhorse ADCPs (LR and WH) in two different formats: Binary (Raw) and Matlab (.mat).

The data in the Matlab format have been preliminary processed, which was accomplished by reviewing the data in WinADCP (supplied by RDI). The beginning and end of each data file was trimmed to exclude any data during a time that the instrument was disturbed by boat and/or divers' operations (Table 4).

The Calypso data were processed in the same manner as the NW (W) mooring data, and follow the same naming convention (see section 2.1). The WinADCP parameters and Matlab variables

are described in Table 3. Raw file information, Matlab files, Ensemble intervals and other information are in Table 4. Please refer to section 3.1 for more details.

Table 4. All raw and processed files from the Calypso Subsurface Buoy.

Date/Time of First Data (Ensemble Number)	Date/Time of Last Data (Ensemble Number)	Binary Files (Raw)	Converted Matlab (.mat) files	Ensemble Interval (s)	Folder Name
07/01/23 23:00:00 (9)	07/06/15 12:00:00 (3430)	DEPL1000.000	mat070123.mat	3600	23Jan07_15Jun07_lr
07/01/23 22:40:00 (10)	07/06/15 12:40:00 (10276)	DP1WH000.000	mat070123.mat	1200	23Jan07_15Jun07_wh
07/06/15 20:00:00 (5)	07/11/28 13:00:00 (3982)	DEPL2001.000	mat070615.mat	3600	15Jun07_28Nov07_lr
07/06/15 18:00:00 (6)	07/11/28 14:40:00 (11948)	DP2WH000.000	mat070615.mat	1200	15Jun07_28Nov07_wh
07/11/29 16:00:00 (11)	08/11/20 12:00:00 (8575)	DPLR3000.000	mat071129.mat	3600	29Nov07_20Nov08_lr
07/11/29 16:00:00 (11)	08/11/20 10:00:00 (8573)	DPWH3000.000	mat071129.mat	3600	29Nov07_20Nov08_wh
08/11/21 16:00:00 (17)	10/09/19 22:00:00 (16031)	DPLR4000.000	mat081121.mat	3600	21Nov08_19Sep10_lr
08/11/21 16:00:00 (17)	10/11/16 09:00:00 (17410)	DPWH4000.000	mat081121.mat	3600	21Nov08_16Nov10_wh

3.3 AWAC Bottom Mount

This section describes the contents of the AWAC Bottom Mount directory structure (\data\AWAC) and contains the data from the AWAC Bottom Mount. See Figures 1, 2 and Table 1 for more details about the array configuration. The AWAC Bottom Mount directory contains data from the Acoustic Wave And Current Profiler in two different formats: the raw files (.wpr) and the processed data files (.dat). The preliminary processing was accomplished by reviewing the data in the program STORM (supplied by NortekUSA). The beginning and end of each data file was trimmed so as not to include any data during a time that the instrument was disturbed by boat and/or divers (Table 5).

Table 5: All raw and processed files from the AWAC Bottom Mount.

Date/Time of First Data	Date/Time of Last Data	Raw File	Processed Files	Folder Name
10/06/04 12:00:00	10/06/13 14:20:00	040610.wpr	040610_eastvelocity.dat 040610_northvelocity.dat	04Jun10_13Jun10
10/06/13 07:00:00	10/06/30 20:11:01	130610.wpr	130610_eastvelocity.dat 130610_northvelocity.dat	13Jun10_30Jun10
10/07/01 20:00:00	10/07/26 12:20:00	010710.wpr	010710_eastvelocity.dat 010710_northvelocity.dat	01Jul2010_26Jul10

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5. References

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