National Oceanography Centre, Southampton

Cruise Report No. 40

RV *Ronald H. Brown* Cruise RB0901

15 APR-06 MAY 2009

RAPID mooring cruise report

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2009

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ABSTRACT

This report describes the mooring operations conducted during RV *Ronald H. Brown* cruise RB0901 between 15 April and 5 May 2009.

These mooring operations were completed as part of the United Kingdom Natural Environment Research Council (NERC) funded RAPID-WATCH Programme to monitor the Atlantic Meridional Overturning Circulation at 26.5°N. The primary purpose on this cruise for the UK team was to service the RAPID Western Boundary moorings while the US team worked on the Western Boundary Time Series project.

Cruise RB0901 was from Charleston, South Carolina to Charleston, South Carolina and covered the Western Boundary moorings deployed on cruises SJ08 and RB0701. This cruise was the seventh annual refurbishment of the Western Boundary section of an array of moorings deployed across the Atlantic in order to continuously observe the Atlantic Meridional Overturning Circulation (MOC). This array will be further refined and refurbished during subsequent years.

The instruments deployed on the array consist of a variety of current meters, bottom pressure recorders, and CTD loggers, which, combined with time series measurements of the Florida Channel Current and wind stress estimates, will be used to determine the strength and structure of the MOC at 26.5°N.
(http://www.noc.soton.ac.uk/rapid)

KEYWORDS

26.5°N, Atlantic Ocean, bottom pressure recorder, BPR, cruise RB0901 2009, CTD, current meter, meridional overturning circulation, MicroCAT, MOC, mooring array, moorings, North Atlantic, RAPID, RAPIDMOC, RAPID-WATCH, *Ronald H. Brown*, THC, thermohaline circulation, Western Boundary

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Contents

List of Tables

1 Scientific and Ship's Personnel

Scientific and Technical	
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Carlos Fonseca	AOML – NOAA
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Pedro Pena	AOML – NOAA
Kyle Seaton	AOML – NOAA
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Harry Bryden	SOES – NOCS
Paul Wright	NOCS
Emma Heslop	SOES – NOCS
Robert McLachlan	NMFD – NOCS
Colin Hutton	NMFD – NOCS
Christian Crowe	NMFD – NOCS
Stephen Whittle	NMFD – NOCS
David Childs	NMFD – NOCS
16 persons	

Table 1.1 *Details of science personnel on cruise RB0901*

Ship's Crew	
Capt. Gerd Glang	Commanding Officer
LtCdr. Todd Haupt	Executive Officer
Lt. Nicole Manning	Operations Officer (FOO)
Ens. Loren Evory	Navigation Officer
Ens. John Rossi	Junior Officer (Damage Control Officer)
Ens. Dave Owen	Junior Officer
Lt. Mike Futch	Medical Officer
Frank Dunlop	Chief Marine Engineer
Robert Schwarz	1st Assistant Engineer
Matt Lager	2nd Assistant Engineer
James Reed	3rd Assistant Engineer
Danny Torchio	Junior Engineer
Reginald Glover	Junior Engineer
Travis Martin	Wiper
Bruce Cowden	Chief Bosun
Reginald Williams	Bosun Group Leader
Victoria Carpenter	AB Seaman/Deck Utilityman
Dana Mancinelli	AB Seaman/Deck Utilityman
Roberto Mendez	Ordinary Seaman
Brett Lewis	Ordinary Seaman
Jesse Scott	General Vessel Assistant
Frank Footman	General Vessel Assistant
Richard Whitehead	Chief Steward
Moises Martinez	Chief Cook
Tyrone Baker	2nd Cook
Vasiliy Nam	General Vessel Assistant
Jonathan Shannahoff	Chief Survey Tech.
Jeff Hill	Lead Electronics Tech.
28 persons	

Table 1.2 *Details of ship's crew on cruise RB0901*

2 RV *Ronald H. Brown*

Figure 2.1 *RV Ronald H. Brown off the island of Abaco deploying WB1.*

The RV *Ronald H. Brown* is the 85m flagship of NOAA's fleet of research vessels. She supports up to 30 scientists and is capable of long duration oceanographic cruises. Built in 1997, unlike a conventional ship, she has no rudder or fixed props but is powered by two 360° azimuthal electric thrusters that are in turn powered by generators in the engine room. She is also equipped with a wide angled azimuthal water jet bow thruster. Combined, these give the *Ronald H. Brown* good station keeping ability for mooring operations and CTD work. The *Ronald H. Brown* is also fully equipped for atmospheric research with her characteristic C band Doppler RADAR dome on her main mast. She has a fully integrated computer network and broadband internet access.

3 Itinerary

Departed Charleston, South Carolina 15th April 2009, arriving off Abaco Island, Bahamas 17th April to begin the NOAA/Miami Western Boundary Time Series. Upon completion the UK RAPID moorings were serviced. Returned to Charleston, South Carolina 5th May 2009.

4 Acknowledgements

Darren Rayner

The officers and crew of the *Ronald H. Brown* were extremely helpful throughout the cruise and the busy period of mooring operations would not have gone so smoothly without the good communication between the bridge officers and myself.

This was the third cruise we have completed on the *Ronald H. Brown* for mooring operations and Bruce Cowden has been the Bosun each time. His familiarity with the moorings and instruments that we deploy was invaluable and led to an efficient and safe working deck with the deployment and recovery operations conducted without significant problems.

The moorings team was once again professional and well organized and their experience also helped lead to another very successful cruise for the RAPID-WATCH project.

5 Introduction and Background

Stuart Cunningham

The RAPID-MOC observing system has been operational since spring 2004. The purpose of this cruise was to recover and redeploy the western boundary mooring array deployed off the Bahamas.

This cruise is the 17th in total since Spring 2004. The cruises to date are shown in Table 5.1. The project web site is http://www.noc.soton.ac.uk/rapidmoc. The RAPID-MOC programme has completed the initial four years of planned deployments and has now moved into a second phase (NERC Directed Programme RAPID-WATCH http://www.noc.soton.ac.uk/rapid) through to 2014.

5.1 Scientific Background and Description of the RAPID-MOC Observing System

The Atlantic Meridional Overturning Circulation (AMOC) at 26.5°N carries a northward heat flux of 1.3 PW. Northward of 26.5°N over the Gulf Stream and its extension much of this heat is transferred to the atmosphere and subsequently is responsible for maintaining UK climate about 5°C warmer than the zonal average at this latitude. However, previous sparse observations did not resolve the temporal variability of the AMOC and so it is unknown whether it is slowing in response to global warming as suggested by recent model results. In 2004 NERC, NSF and NOAA funded a system of observations in the Atlantic at 26.5°N to observe on a daily basis the strength and structure of the AMOC. Two papers ([*Cunningham, et al.*, 2007] & [*Kanzow, et al.*, 2007]) demonstrated that not only does the system of observations achieve a mass balance for the AMOC, it reveals dramatic and unexpected richness of variability. In the first year the AMOC mean strength and variability is 18.7±5.6 Sv. From estimates of the degrees-of-freedom the year-long mean AMOC is defined with a resolution of around 1.5 Sv so abrupt changes would be readily identified and long-term changes will be measured relative to the 2004-2005 average.

The NERC contribution to the first four years of continuous AMOC observations was funded under the directed programme RAPID Climate Change. Following an international review of the system NERC will continue funding to 2014 under the programme RAPID-WATCH. The NSF and NOAA have also continued funding and commitments so that the system can continue operating at the same level of activity as during the period 2004-2008.

The objectives of RAPID-WATCH are: To deliver a decade-long time series of calibrated and quality-controlled measurements of the Atlantic MOC from the RAPID-WATCH arrays and; To exploit the data from the RAPID-WATCH arrays and elsewhere to determine and interpret recent changes in the Atlantic MOC, assess the risk of rapid climate change, and investigate the potential for predictions of the MOC and its impacts on climate.

5.2 The AMOC system

The 26.5°N Atlantic section is separated into two regions: a western boundary region, where the Gulf Stream flows through the narrow (80km), shallow (800m) Florida Straits between Florida and the Bahamas, and a transatlantic mid-ocean region, extending from the Bahamas at about 77°W to Africa at about 15°W (Figure 5.1). Variability in Gulf Stream flow is derived from cable voltage measurements across the Florida Straits, and variability in wind-driven surface-layer Ekman transport across 26.5°N is derived from QuikSCAT satellite-based observations. To monitor the mid-ocean flow we deployed an array of moored instruments along the 26.5°N section. The basic principle of the array is to estimate the zonally integrated geostrophic profile of northward velocity on a daily basis from time-series measurements of temperature and salinity throughout the water column at the eastern and western boundaries. Inshore of the most westerly measurement of temperature and salinity, the transports of the Antilles current and deep western boundary current are monitored by direct velocity measurements.

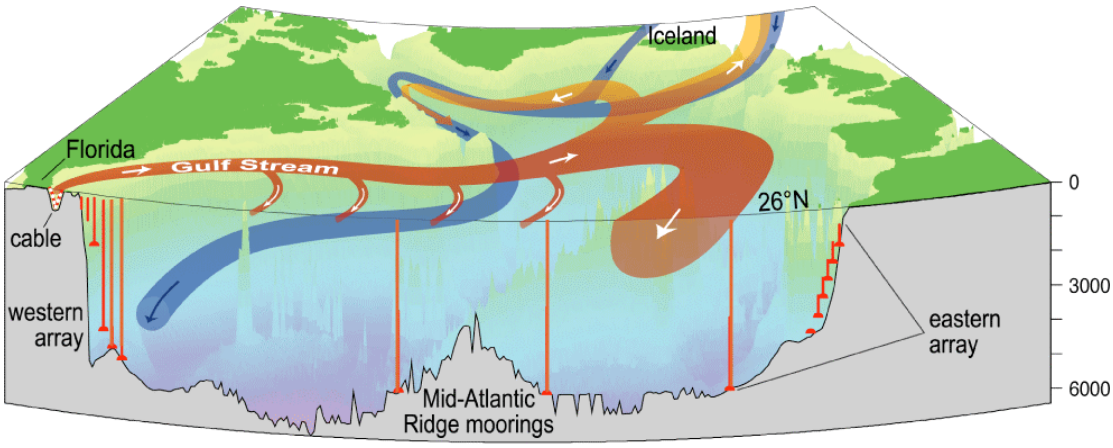

Figure 5.1 *Schematic of the principal currents of the Atlantic meridional overturning circulation. The vertical red lines across the Atlantic at 26.5°N indicate the main areas where moorings instrumented to measure the vertical density profile are located. The Gulf Stream transport is measured by submarine cable and the western boundary array includes current meters to directly measure transports of the shallow and deep western boundary currents. Bottom pressure recorders are located at several sites across the Atlantic to measure depth-independent fluctuations of the basin-wide circulation. Figure courtesy of Louise Bell & Neil White, CSIRO.*

5.3 Array Specification

The array as deployed in 2009-2010 consists of a total of 24 moorings, 16 landers and two inverted echo sounders. There is also an additional mooring deployed for a current meter intercomparison. Figure 5.4 is a schematic showing the mooring array and instrumentation in 2009-2010. Figures 5.2 and 5.3 show the western boundary array as deployed on RB0901. The eastern boundary and MAR moorings were serviced in the Autumn of 2008 by cruise D334 and will be serviced again in Autumn 2009 on cruise D344. Moorings are named in three sub-arrays. Western boundary **WB#** with mooring number increasing to the east; Mid-Atlantic Ridge **MAR#**; Eastern Boundary **EB#**. The letter **H** is a historical reference to moorings originally intended to be HOMER profilers. **M** indicates a mini-mooring consisting of a 10m

length mooring with one CTD instrument. Bottom landers instrumented with pressure recorders are indicated by **L** in the name. **ADCP** indicates an Acoustic Doppler Current Profiler mooring.

5.4 Eastern Boundary Sub-array

The Eastern Boundary sub-array consists of one tall mooring **EB1** consisting of eighteen CTDs and a series of shorter CTD moorings **EBHi**, **EBH1**, **EBH2**, **EBH3**, **EBH4,** and **EBH5** that step up the slope reducing the influence of bottom triangles when combined with the more offshore EB1 mooring. They construct a single full depth density profile. Inshore of EBH5 there are a series of four "mini-moorings", **EBM1**, **EBM4**, **EBM5** and **EBM6** that each consist of a single CTD and are relatively inexpensive meaning likely losses in this heavily fished area have less of an impact on the array. Finally the Eastern sub-array includes four bottom pressure landers; **EBL1** and **EBL3** – comprising two bottom pressure recorders (BPRS) each – at the site of EB1, and **EBL2** and **EBL4** – comprising one bottom pressure recorder each – at the site of EBH1. The landers are serviced in alternate years so that each recovery provides a two-year record with a year's overlap with the previous lander to remove instrument drift. There are also two Inverted Echo Sounders with pressure sensors (PIES) deployed in the eastern boundary sub-array, **EBP1** at the site of EB1 and **EBP2** at the site of EBH4. Data from these are downloaded annually through acoustic telemetry but EBP1 was serviced on cruise D334 with EBP2 planned for turnaround in 2009.

5.5 Mid-Atlantic Ridge Sub-array

The sub-array at the Mid-Atlantic Ridge consists of one full depth mooring (**MAR1**), three shorter moorings (**MAR0**, **MAR2** and **MAR3**), and four landers (**MARL1**, **MARL2**, **MARL3** and **MARL4**). **MAR0** is a recent addition to the array and consists of three CTDs and a BPR to capture the Antarctic Bottom Water (AABW) contribution to the MOC to the west of the ridge. **MAR1** provides a full depth density profile through eighteen CTDs, with MAR2 acting as a backup to 1000m on the west of the ridge. MAR3 is sited to the east of the ridge and allows separation of the eastern and western basin MOC contributions. The landers are deployed as per those for the Eastern Boundary, with two at the site of MAR1, and two at the site of MAR3.

5.6 Western Boundary Sub-array

At the western boundary, **WB2** is the pivotal mooring and provides a full depth density profile very close to the western boundary "wall". The resolution of the profile can be improved by merging data from the nearby **WB1**. As of May 2009, WB2 comprises sixteen CTDs and seven current meters, whereas WB1 comprises fifteen CTDs and four current meters (Figs 5,2 and 5.3). Inshore of WB1 there is **WBADCP** that comprises a Longranger ADCP at a depth of 600m to measure the shallow Antilles current. East of WB2 is **WBH2** consisting of three CTDs and five current meters. At the normal offshore extent of the Deep Western Boundary Current (DWBC) is **WB4**, which comprises fifteen CTDs and seven current meters. Further offshore is **WB6** – comprising five CTDs and a bottom pressure recorder – which combined with MAR0 measures the contribution to the MOC of deep water below 5200m including the Antarctic Bottom Water. There are again four landers in this

sub-array; **WBL1** and **WBL3** (two BPRs each) at the site of **WB2**; and **WBL2** and **WBL4** (one BPR each) at the site of WB4.

In addition to the moorings listed above, the western boundary sub-array also contains three full depth moorings and four landers from the University of Miami. **WB0** comprising four CTDs and current meters and an upward looking ADCP. **WB3** is 22 km west of WB2 and so acts as a critical backup in case of loss of WB2. WB3 consists of seven CTDs and current meters. Combined with the other inshore moorings it provides the thermal-wind shear and measured velocities from the core of the DWBC. **WB5** is located 500 km offshore and is instrumented with seventeen CTDs and provides the thermal-wind shear across the full width of the boundary currents including any recirculation.

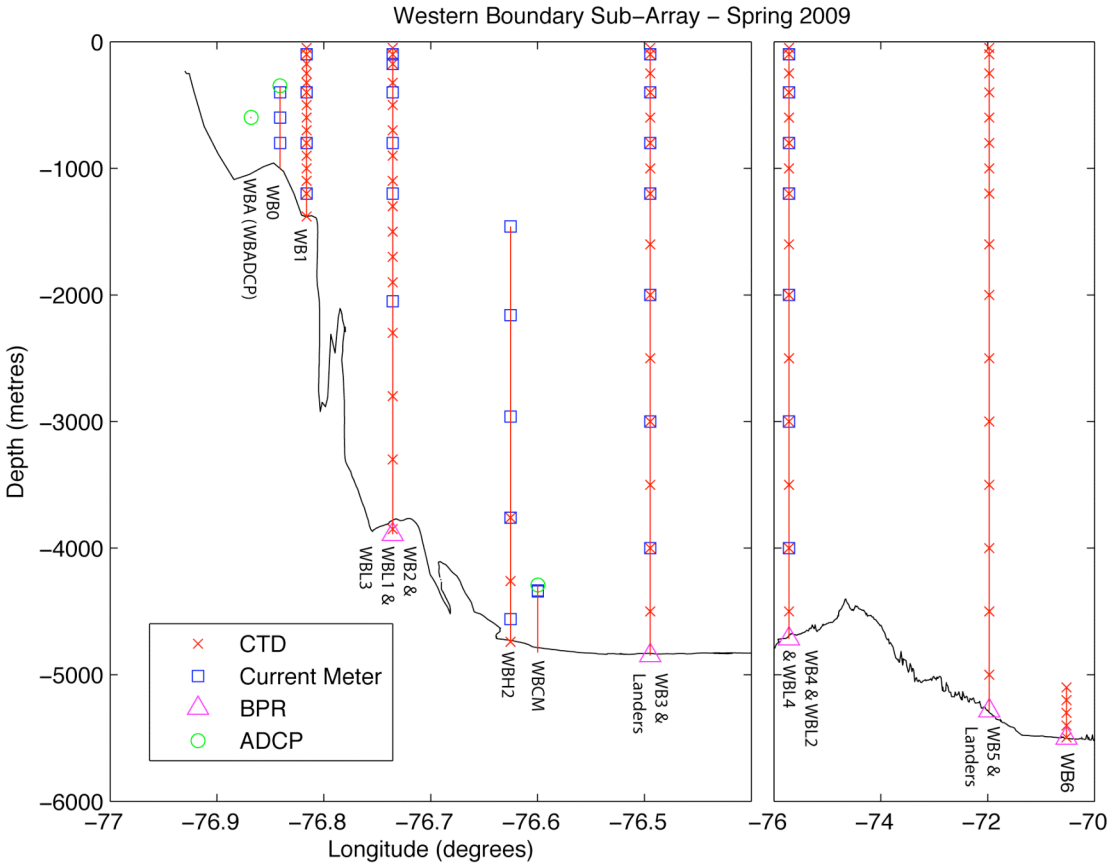

Figure 5.2 *Western boundary sub_array as deployed on cruise RB0901.*

5.7 Data Availability

All instrument time series are available from the Britsh Oceanographic Data Centre within a few weeks of the end of the cruise. The MOC time series and associated data products are available within six months of the cruise and can be found on the RAPID-MOC website: http://noc.soton.ac.uk/rapidmoc.

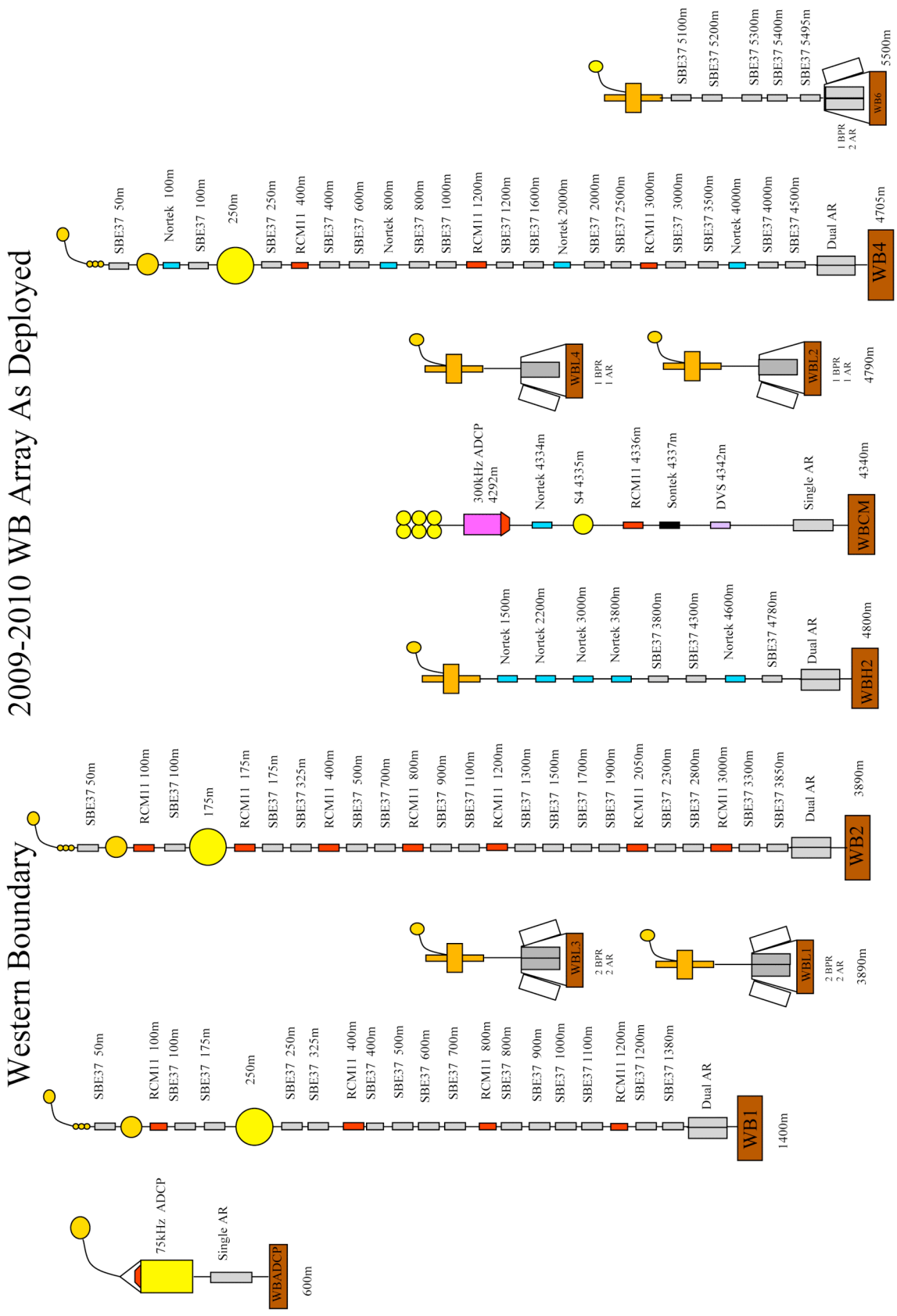

Figure 5.3 *Schematic of the Western Boundary mooring array as deployed during RB0901.*

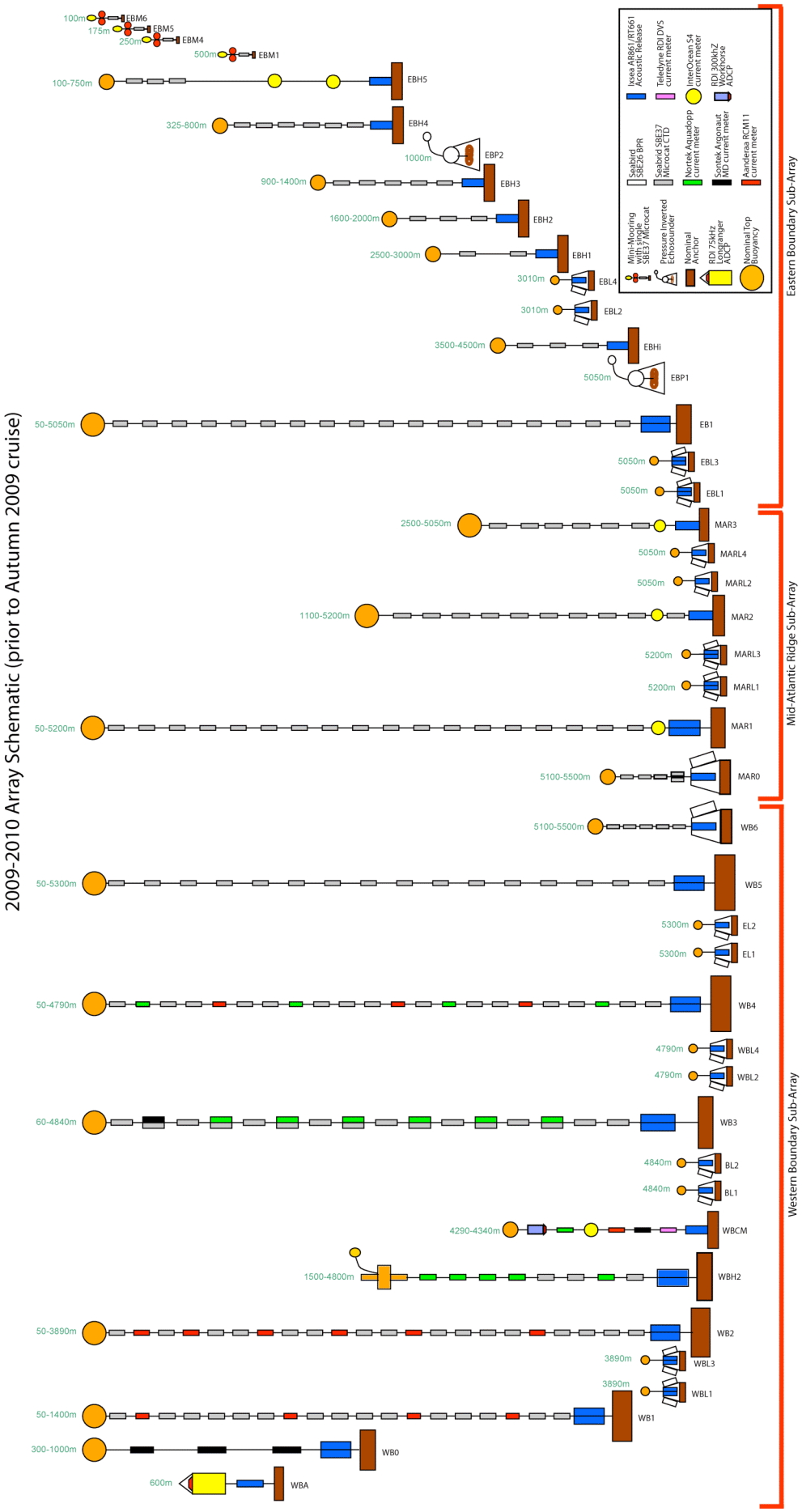

Figure 5.4 *Schematic of the the RAPID array as of May 2009*

Cruise	Vessel	Date	Objectives	Cruise Report
D277	RRS *Discovery*	Feb - Mar 2004	Initial deployment of Eastern Boundary and Mid-Atlantic Ridge moorings	RRS *Discovery* Cruise D277 and D278, Southampton Oceanography Centre, Cruise Report No. 53, 2005
D278	RRS *Discovery*	Mar 2004	Initial deployment of UK and US Western Boundary moorings	RRS *Discovery* Cruise D277 and D278, Southampton Oceanography Centre, Cruise Report No. 53, 2005
P319	RV *Poseidon*	Dec 2004	Emergency deployment of replacement EB2 following loss	Appendix in RRS *Charles Darwin* Cruise CD170 and RV *Knorr* Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
CD170	RRS *Charles Darwin*	Apr 2005	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS *Charles Darwin* Cruise CD170 and RV Knorr Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
KN182-2	RV *Knorr*	May 2005	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	RRS *Charles Darwin* Cruise CD170 and RV Knorr Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
CD177	RRS *Charles Darwin*	Nov 2005	Service and redeployment of key Eastern Boundary moorings	RRS *Charles Darwin* Cruise CD177. National Oceanography Centre, Southampton, Cruise Report No. 5, 2006
WS05018	RV *F.G. Walton Smith*	Nov 2005	Emergency recovery of drifting WB1 mooring	No report published
RB0602	RV *Ronald H Brown*	Mar 2006	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	RV *Ronald H. Brown* Cruise RB0602 and RRS *Discovery* Cruise D304, Southampton Oceanography Centre, Cruise Report No. 16, 2007
D304	RS *Discovery*	May - June 2006	Service and redeployment of Eastern Boundary and Mid-Atlantic Ridge moorings	RV *Ronald H. Brown* Cruise RB0602 and RRS *Discovery* Cruise D304, Southampton Oceanography Centre, Cruise Report No. 16, 2007
P343	RV *Poseidon*	Oct 2006	Service and redeployment of key Eastern Boundary moorings	PS *Poseidon* Cruise P343 and P345, National Oceanography Centre, Southampton, Cruise Report No. 28, 2008
P345	RV *Poseidon*	Dec 2006	Emergency redeployment of EB1 and EB2 following problems on P343	PS *Poseidon* Cruise P343 and P345, National Oceanography Centre, Southampton, Cruise Report No. 28, 2008
SJ06	RV *Seward Johnson*	Sep - Oct 2006	Recovery and redeployment of WB2 and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	Appendix G in RV *Ronald H. Brown* Cruise RB0701, National Oceanography Centre, Southampton, Cruise Report, No. 29
RB0701	RV *Ronald H. Brown*	Mar - Apr 2007	Service and redeployment of UK Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	RV *Ronald H. Brown* Cruise RB0701, National Oceanography Centre, Southampton, Cruise Report, No. 29
D324	RRS *Discovery*	Oct - Nov 2007	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS *Discovery* Cruise D277 and D278, Southampton Oceanography Centre, Cruise Report No. 53, 2005
SJ0803	RV *Seward Johnson*	Apr 2008	Service and redeployment of the Western Boundary moorings	RV *Seward Johnson* Cruise SJ0803, National Oceanography Centre, Southampton, Cruise Report No. 37, 2008
D334	RRS *Discovery*	Oct - Nov 2008	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS *Discovery* D334, National Oceanography Centre, Southampton, Cruise Report No. 38, 2009

Table 5.1 *Summary of previous Rapid-MOC cruises*

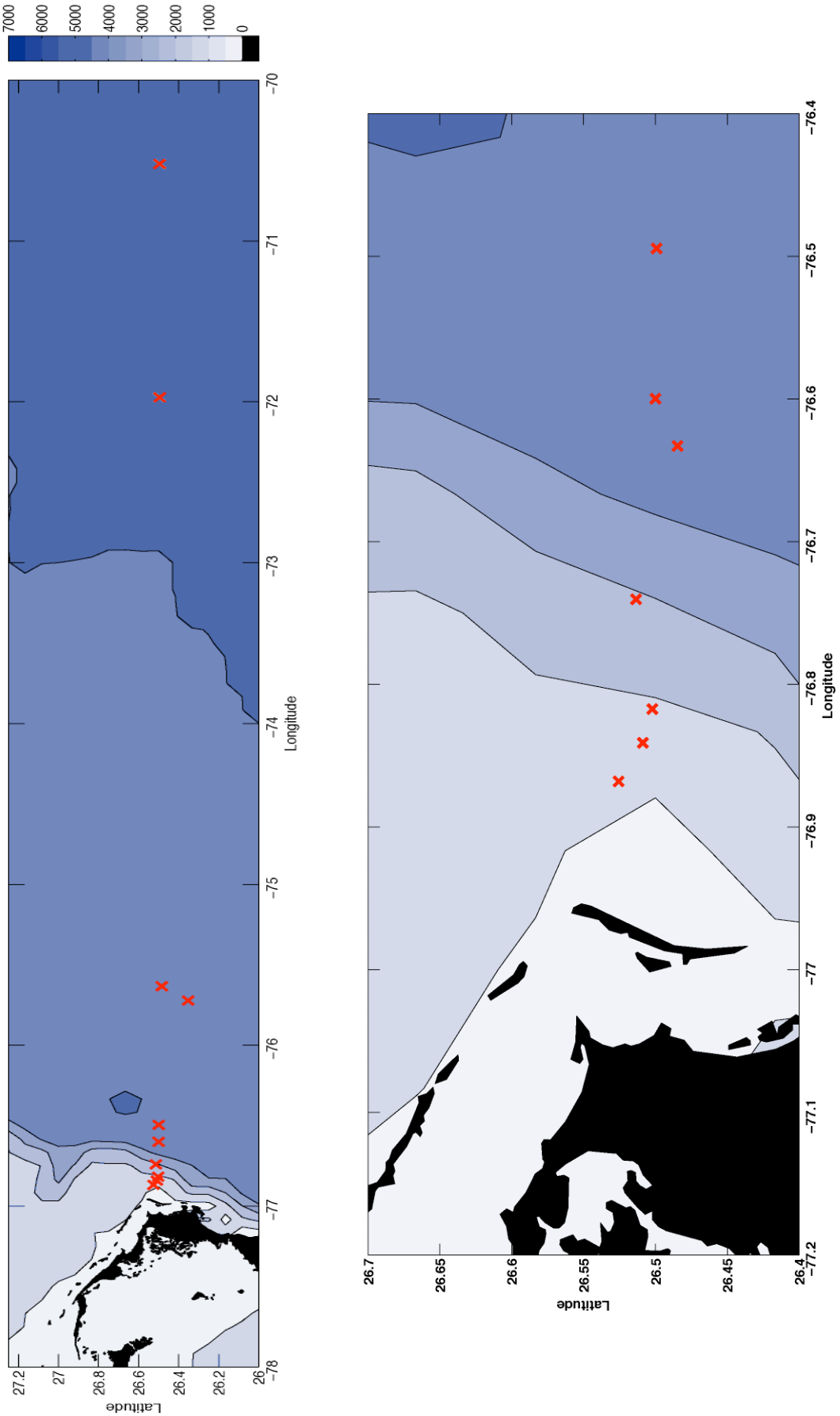

Figure 5.5 *Positions of the western boundary sub-array as deployed during RB0901*

6 Diary of Events

Darren Rayner and Paul Wright

All times are local time (GMT - 4) unless specified

12th April

Darren, Paul and Emma traveled from Heathrow to Charleston via Atlanta (the moorings team traveled the previous day).

13th April

Arrived at Charleston and boarded the RV *Ronald H. Brown* at 09:30 following collection of security badges at FLETC visitors centre. The moorings team were already at ship along with Jason Scott as mobilisation officer. The first lorry arrived about 11:30 and the moorings team began the mobilisation of deck components. There was a large delay between lorries as the agent only used one, which meant that it had to unload completely then go back, reload and then pass the security inspection on the way in to the base. The second load arrived at 15:30. We left the ship at 17:30.

14th April

Arrived at ship at 09:30. Final gear was loaded on board. Harry arrived. We set up laboratories, lashed benches down, set up the Macs, and unloaded boxes. The mooring team organised the securing of the winches and gear to the aft deck and tools and instruments in the very chilly main laboratory. We reported aboard with personal gear, then went into Charleston in the evening as no meals served aboard.

15th April

We finished setting up lab. The moorings team moved onboard. Chris worked on preparing current meters that require compass calibration so it could be done off the ship if need be. The ship was delayed an initial 12 hours due to problems with an exciter on the port engine. The new estimated sailing time was to be 07:30. Captain Glang informed PS Chris Meinen that the science would not be compromised and that the cruise would be extended a day longer if required.

16th April

Sailing delayed due to further problems with the port main engine. By the time the work had been finished we had missed the tidal window for leaving the dock. Got under way at 14:30 on the slack tide to a fine first afternoon at sea. The scientists were treated by the sight of racing yachts sailing in the Charleston estuary and some dolphins playing on the bow wave. The weather improved as the front has passed leaving a 15 – 20 kt NE breeze and slight swell. Port main engine failed three times during the late afternoon, which caused some concern and left us drifting for roughly 30 minutes at a time. However, the engineers replaced a control board and all seemed fine by the evening. Ship back at full speed.

17th April

All day at sea on passage for Marsh Harbour, there was a great deal to prepare and get sorted out. Ship hove to at 2300 to undertake the test CTD cast. The pressure sensor found to be inaccurate and so it was changed out. We tested two releases to get one prepared for WBADCP deployment in the morning whilst the launch is clearing customs for the Bahamas. Emma and Wendy were trained up to pilot the CTD and take water samples.

Weather: Glorious day in the tropics. NE 15 – 20 kts, slight swell and some cumulus clouds.

18th April

Arrived off Marsh Harbour, however the swell was too large to launch the RIB therefore we had to clear Bahamian immigration and customs on our return later in the cruise. Proceeded to the WBADCP site to deploy and recover WBADCP giving Chris time to iron out a couple of problems with the CTD prior to starting the hydro section. Both the deployment and the recovery went without a hitch.

The US team then carried out CTD stations 1 - 4 during the day. During a CTD near WB2 it was realised that the positions were very similar and there was the risk of entanglement between the CTD and the mooring. All subsequent mooring positions were checked and found to be ok. It appears that the mooring drifted 0.5nm south of the drop position in 2008 bringing it closer to the usual CTD station position. When redeploying we intend to deploy the mooring further to the north. The CTD was completed without any problems.

Weather: There has been about 15 – 20 kts ENE breeze all day with a 2m swell running, due to the storm off the NE coast of the US moving out to the Atlantic. These NE winds are not actually the trades. Fair weather cumulus clouds and a low humidity, all in all a nice day!

19th April

No moorings work, ship continued with CTD stations 5 - 9 and two PIEs telemetry recoveries for the US team and Emma. Main lab was freezing cold despite the tropical conditions outside. Darren discussed with Chris the possibility of putting some MicroCATs on the CTD frame during his section to save time – this will depend on if we are able to fit them without removing bottles. They also discussed need for deep cast prior to deployment of WB6 so may put a couple of releases on one of the later casts too. Asked the Field Operations Officer to see if the engineers could adjust the main lab temperature.

Weather: The wind has dropped to around 10 – 12 kts from the east, there is still a lazy swell so the ship is maintaining a gentle roll. Usual scattered fair weather cumulus clouds and blue skies.

20th April

No mooring work, although moorings team continued to spool up the wires and load batteries into the instruments. Lt Manning had somehow managed to persuade the engineer to reduce the power of the main labs aircon, so now we could work in shorts and t-shirts rather than fleeces, jumpers and woolly hats! The US team continued with more CTD stations and PIES recoveries. Cast 11 had some MicroCATs (6798 - 6803) strapped on for their calibration dips. Cast 12 had MicroCATs 6804 – 6809. We estimated that there are about 8-10 daylight casts before the end of the section so with six MicroCATs per cast we should be able to eliminate some of the dip casts during the mooring operations. It adds about 30 minutes to the cast as ten bottle stops are extended from two minutes to five minutes, but we will look at how this will affect the timing of the end of the section and the start of mooring ops. On processing it turns out that SeaBird had changed the firmware…. after some research, Darren discovered that using the old software with a few extra commands sorts out the problems. A training directory and files have been set up in the rapid network for practicing processing the MicroCAT data while we were waiting.

Weather: SE 20kts. Sea – lazy… Clouds - high cirrus – and some contrails.

21st April

Another day, another few CTD casts with our MicroCATs strapped to the sides for calibration dips. Cloud cover increasing.

Weather; wind turning to the S – 15 – 20kts. A swell starting to develop – ship rolling a bit.

22nd April

Problems with the pressure sensors on the MicroCATs having a large error when compared to the CTD. US team completed CTD casts 23 – 25. Three MicroCATs were cal dipped on cast 23. Moorings team starting to attach Acoustic Releases to the CTD frame.

Weather: Greyish skies. Wind SW 10 – 15 kts - decreasing, slight swell.

23rd April

Continued CTD section. Combined more CTD casts with calibration dips, and included a couple of releases to test them prior to deployment on WB6.

24th April

The US team completed CTD stations 26 to 28. Each CTD cast since has included an acoustic release (AR). One failed to respond. The ARs are contacted by lowering a transducer (or sometimes a more powerful *super'ducer*) over the side of the ship and a signal sent by means of a deck unit. Each AR replied and a range was established to the AR. When contact was made a signal could be sent to command the AR to open its jaws (to release the anchor). The ranges from an AR can be used to triangulate a

mooring if required. Darren discussed problems with LADCP data caused by the releases on the CTD frame during an overnight CTD. It seems that when the releases power up when being acoustically interrogated they disrupt the LADCP compass and cause the data to be invalid. As long as this is not for too long then the data should be able to be removed from the time series and the problem removed, but if the pause for release testing is too long this won't be possible. For the next cast we are again dipping two releases but with a cut off time of 20 minutes for talking to them.

Weather: Seas and wind increasing.

25th April

UK team up before 05:00 local time to release WB6. Waited until the start of dawn to release mooring. Two planets visible in the dawn sky – Venus and Mars. After nearly half an hour of trying, including using the *super'ducer* and three different deck units it appeared as if the release had failed. The team were getting random ranges back from the release. Then it was decided to move the ship about 0.5 nm and contact was finally established. It was released just after 07:00 rising up at an estimated 89m/min (from ranges to/from the release). Mooring was grapnelled from port side and recovered. On recovery, two of the three MicroCATs were flooded with their end caps blown off. MicroCAT 4471 and the BPR 0392 were downloaded ok. After this it was decided to add two further MicroCATs to mooring wb6_2_2009. The new WB6 mooring was deployed without further problems after a short delay and the ship proceeded downwind to recover Bill John's lander before sunset.

Evening pick up of Bill John's Lander: after a hopeful start, quick connection and release, the mooring surfaced on schedule. However, despite the fairish conditions the *Brown* had difficulty in manoevering to the mooring. There was no pick up line evident so it was difficult to grapple. The glass appeared to go beneath the ship slightly and then sink. Ranging on the releases confirmed that they were sinking rapidly so it seems that some of the glass buoyancy were destroyed by impact with the ship or propellors and there was insufficient left to support the lander.

Weather: ENE 12 – 15 kts. Some swell.

26th April

Spent the morning steaming to the WB4 site in order to deploy the WB4 mooring and the WBL2 lander. All instruments were set and prepared en-route. Meanwhile the mooring team had fully assembled all the relevant float arrangements for the mooring. Streamed the WB4 mooring and deployed at 17:04. There was a ship coming up rapidly astern of us, which failed to respond to hails from the bridge. As there was a danger that the ship might foul the mooring string, it was released slightly earlier than planned. Another problem was that the trawling winch used with the A frame on the stern did not function. As this is used to lift the anchor this was a problem that was overcome by the use of one of the ship's aft cranes. Just as the anchor was about to be released the link holding the anchor to the crane failed, but as the anchor was over the sea, it simply plummeted down to the bottom a few seconds before it was meant to… We remained hove to here for the night to deploy WBL2 and to dip cast some ARs and MicroCATs. WBL2 deployed without a hitch. Two CTD casts were

performed during the night to test six ARs and to calibrate eight MicroCATs. It was noticed that some of the Nortek current meters are deployed very close to the support buoyancy and may not be sufficient distance to remove current disruption effect. Need to think of this for the next moorings. Possibly we could deploy them looking downward instead of looking up.

Weather; excellent. Contrails visible in the sky today.

27th April

WB4 released and recovered with no problems. One glass float had imploded. Two MicroCATs have screws missing (one from the CTD guard and the other from the cable guide). This indicates that the mooring may have suffered from excess vibration. Darren is to look into this.

WBL2 – smooth pick up and recovery. The data has a big step in the bottom pressure that appears to have to the mooring sinking or sliding about 30 cm lower on the bottom. It does not match the previous years data too well (chapter 12)

Cast 31 – 10 MicroCATs. The US team recovered some data from a PIES. Darren commenced a further search for the WB4 mooring from 2006. The first position gave a lot of random positions but three that could be possible and that agreed with each other. We moved north and received no consistent ranges so moved south of the first position and again received no consistent ranges. The search was abandoned as it seems this mooring is not in the immediate vicinity. The AR appears to be dead or not there.

Weather: cloudy in the evening after a lovely crescent moon set.

28th April

Deployed the WBCM test mooring. Five different types of current meter have been deployed on the same mooring to see which is the best. There was a slight delay whilst modifying clamps for the DVS current meter. Deployed WBH2 and recovered WBH2. CTD cast 32 with ARs and eight MicroCATs. One of the releases had severe corrosion at the transducer end cap with some of the bolts having come out. This mooring was lucky to still be on site. No ranges from the corroded release were received and it was later confirmed to be flooded. A late night calibration dip was performed.

29th April

Figure 6.1 *One of the side benefits of working at sea in the tropics! Rob and a mahi-mahi.*

At last, something to write about fish. During the approach to WB2 it was noticed that the large steel buoy (the pick up was tangled around the glass) was surrounded by mahi-mahi. The approach was complicated by an awkward lay of the top section of the mooring meaning we had to start recovery from the steel sphere instead of the top of the mooring. As the moorings team made the task of picking up a two meter diameter steel ball out of the sea from a moving ship look easy one of the crew got busy with the rod and line and reeled in three large fish in rapid succession. WB2 was recovered without further incident as was WBL1 with all instruments intact and full of data. The new WB2 was deployed smoothly but sadly the fish had all been eaten by the crew by the time the mooring work was finished. Conducted a triangulation survey to confirm the final position of the anchor. Calibration cast at 01:30 during the night.

Weather: ENE 15 – 20 kts, varied clouds, cumulus and some cumulo stratos, No contrails due to dry air aloft.

30th April

WB1 recovered and deployed. One flooded MicroCAT. CTD casts 34 and 35 carried out during the night. CTDs had to be scheduled around the ships holding tank discharges. Noted time errors on ships CTD. 3268 not post-deployment dip cast. The start distance for WB1 was in the middle of a fleet of sports fishing boats from Abaco. Possibly a competition. The RIB was launched from the ship to act as a guard boat for the top end of the mooring whilst we steamed offshore during deployment. This worked smoothly, with one boat waved down, and the mooring was deployed without any other problems. Two CTD calibration dips late evening.

1st May

Cleared Bahamian immigration at Port Lucaya. Proceeded to Florida Straits for the US teams CTD stations. The UK team stripped the gear off the aft deck and

continued the data processing and the other paperwork/projects that had taken a back seat for the past week.

2nd May – 3rd May

Completed Northwest Providence Channel section overnight and started first Florida Straits section. Offshore of Miami by about dinner time. Crossed back to Grand Bahama completing an underway ADCP survey before starting the 2nd CTD section again heading west. Finished second Florida Straits CTD section. Started shipboard ADCP sections across the Florida Straits cable.

4th May

Finished ADCP section overnight. Started passage back to Charleston. Packed up computers and lab. End of science.

5th May

Docked in Charleston.

7 Mooring Operations

Robert McLachan

7.1 Mooring Summary

Mooring Number	Mooring ID	Deployed	Recovered
2008/02	WB1	SJ08	RB0901
2008/03	WB2	SJ08	RB0901
2008/04	WB4	SJ08	RB0901
2008/05	WBADCP	SJ08	RB0901
2007/07	WB6	RB0701	RB0901
2008/08	WBH2	SJ08	RB0901
2007/05	WBL1	RB0701	RB0901
2007/06	WBL2	RB0701	RB0901
Mooring Number	**Mooring ID**	**Deployed**	**Recovery**
2009/06	WB1	RB0901	2010
2009/07	WB2	RB0901	2010
2009/08	WB4	RB0901	2010
2009/09	WBADCP	RB0901	2010
2009/10	WBL1	RB0901	2011
2009/11	WBL2	RB0901	2011
2009/12	WBH2	RB0901	2010
2009/13	WB6	RB0901	2011
2009/14	WBCM	RB0901	2010

Table 7.1 *Mooring recovery and deployment summary*

7.2 Diary of Events

Wednesday 15th April
Mobilization complete, everything secured for sea. Calibrated the RDI DVS on shore. Calibrated one of the new Nortek's to try the procedure out on a vessel, this worked well, and we will calibrate the others in due course. Sailing delayed due to engine problems.

16th April
The ship sailed at 14:30 local. Engines failed on a further three occasions but once repaired we continued anyway. Set up lab spaces, installed batteries in to instrumentation and calibrated the sentinel ADCP.

17th April
Configured the 75kHz ADCP ready for deployment. Assembled the ADCP in to the buoy and put the frame on, some modifications to the frame were required. The ADCP mooring is now ready for deployment.
A CTD cast will take place tonight/early hours of the morning to 1000m, we will test two releases, SN's 824 and 825.

18th April
Good communications were received from both releases. Upon recovery both had fired. The trip to Bahamas immigration was cancelled due to the sea being too much for the small boat. We then deployed the ADCP mooring, all went well. We followed this with the recovery of the 2008 ADCP mooring, this also went well.

19th April
Mooring WB4 was wound on to the winch ready for deployment; we then wound on most of WB2. The remaining Seabirds were checked and had new batteries installed, one of the new units, serial number 6830, the internals are out of line so the battery pack will not fit correctly, Seabird have been contacted. The remaining Nortek's were checked and had their batteries installed.

20th April
Finished wire winding WB2, wound on WB1 afterwards and then the rope section of WBH2. We have also started putting the new Seabirds on to the CTD frame for calibration dips; we are doing six at a time during the day.

21st April
Wound the wire section of WBH2. Coiled WB6 ropes in to baskets. Continued Seabird calibration dips.

22nd April
Continued with Seabird calibration dips. Spliced ropes for recovery lines. Checked and installed batteries in to BPR's. Serviced, new batteries and bench tested the release from the ADCP mooring, serial number 318.

23rd April
Continued with the calibration of the Norteks. Made up the glass spheres packs for WB6. Practised splicing polyester ropes. Wire test of two acoustic releases at 16:30 local, serial numbers 367 and 495 to 5200m.

Initially we could not establish communication with either of the releases; we had one good range from serial number 495; we switched deck units from 26 to 27 but this did not improve communication. We decided to use the super-ducer over the side with deck unit 26. 495 responded straight away giving constant ranges and release confirmations. Serial number 367, however, did not respond, giving random ranges and release confirmations, even after lowering the super-ducer deeper. Upon recovery it was confirmed that serial number 367 had not released and that 495 had.

Another two releases are going on for a wire test; serial numbers 359 and 256 to 5200m. Again we had difficulty establishing communication with the releases; we switched deck units and got good ranges from serial number 359, but nothing from serial number 256. We tried the super-ducer on serial number 256 and got random ranges, we tried this set up with 359 and had good ranges, so this proved the set up. Upon recovery 359 had fired and 256 hadn't. The two releases that have now failed (367 & 256) were both recovered from MARL3 on D334, so at least one of them had worked after being deployed for 2+ years.

24th April
Built Lander frame ready for deployment on WB6. The crane has been declared out of action preventing any large lifts. Two more releases lowered to 5200m, serial numbers 358 and 324. Both responded well to communication, both confirming release. Both releases had fired.
Fire and flood drills.
Two more releases were lowered on the frame to 5120m. Serial numbers 318 and 282. Both communicated well, both confirmed release. Both releases had fired.

25th April
Up at 4.30am to fire the release of WB6 at 0500. This proved easier said than done, we could not establish any communication with the release. We tried different deck units and used the super-ducer, all to no avail. We decided to reposition the ship and try again. This solved the problem and communication was established. The mooring was recovered with nothing more than a few tangles to contend with; however two of the seabirds had flooded, serial numbers 4467 and 3283. Following this we readied WB6 for deployment. Two more SBE 37's were added to this mooring at 5300m and 5500m. The mooring was deployed without incident.

We then started unpacking the clamp on floats and assembling them together with the wire shots we have with us. We also started building WBL2, getting the billings float and the glass ready.

26th April
Continued assembling the clamp on floats. Started getting the ARGOS, lights and VHF beacons ready for the Lander and WB4. Moved the 2700kg anchor in to position as well as a 600kg Lander anchor. It appears that the crane is working ok now. We then deployed mooring WB4, all went well, releases confirmed as on bottom. We then got the WBL2 Lander ready and deployed it, all went well. We triangulated WB4.

CTD tonight with 6 releases on, serial numbers 354, 820, 819, 367, 256 and 497. Depth 4556m. 4 of the six releases worked and two failed. The two that failed were serial numbers 367 and 256, these are the releases that have already failed once.

27th April
Fired release for WB4 at 6.45, the mooring was then recovered without any major problems. We then started stripping down and inspecting the recovered glass. We then started to build the sphere packs for WBH2. We arrived at the WBL2 site and released it. It took around an hour to reach the surface where we commenced recovery, all went well.

Started to carry out an acoustic search for the 2006 – 2007 WB4 a lot of inconsistent ranges are being received, though some of them, if you pick the right ones, are close to each other. It was decided that we would steam 2 miles to see if the ranges we like de-crease or increase. No luck with the old WB4.
Wound on the trial WB-CM mooring, and made up glass sphere packs for it. Doubled up two releases for WBH2, serial numbers 819 and 497.

Put 10 Seabirds on the CTD frame for calibration cast, using the start later command.

We had to recalibrate/compass 6 of the Nortek's due to the fact that they are now being deployed looking down. Serviced the recovered RCM11's.

28th April
We started by deploying the WB-CM mooring. We then deployed WBH2. Recovery of the old WBH2 was then started; it took two hours from first sighting to getting hold of the recovery buoy. We then triangulated WBH2 mooring.

Serviced, installed new batteries and tested four releases, these were then put on the CTD frame; serial numbers 264, 926, 354 and 281, 354 has already been tested. 9 Seabirds were put on the frame as well. Depth 3400m.

We made up the glass sphere packs for WB2 and WBL1. One of the releases (serial number 906) from the WBH2 recovery had severe corrosion, we were fortunate that the mooring hadn't broken away.

29th April
All of the releases on the CTD frame had fired ok. Started communication with WB2, the releases were fired and recovery commenced. All went well. We then fired the release for WBL1, whilst this was on its way up we started getting things ready for the WB2 deployment. The Lander was recovered without problems. We then re-positioned the ship and started the deployment of WB2, all went well.

We then started building glass sphere packs, doubling up releases and servicing instrumentation ready for the deployment of WB1 and WBL1 tomorrow.
WB2 was triangulated.

30th April
Communication was established with WB1 releases, the mooring was released and recovery commenced, all went well though some tangles did slow progress slightly.

We then readied the WBL1 Lander for deployment. The Lander was deployed with Bruce filming the operation from underwater. WB1 was the prepared for deployment, the small boat was launched as a look out and warning to other vessels in the area as we were close to the shore. There were a lot of vessels about. The mooring was deployed without incident, we had to tow to position for just under an hour before the anchor was deployed.

End of UK mooring work.

Mooring	NMFD-ID	Cruise	Anchor Drop		Anchor Triangulation		Fallback	Depth	Date	Time	Deployment Duration	Argos IDs	
			Latitude N	Longitude W	Latitude N	Longitude W	(nm)	(m)		(GMT)	(hrs)	1	2
WBADCP	2009/09	RB0901	26° 31.54'	76° 52.08'	-	-	-	593	18/4/09	13:52	00:05	82896	-
WB1	2009/06	RB0901	26° 30.04'	76° 48.97'	26° 30.13'	76° 49.04'	0.11	1390	30/4/09	19:03	02:11	82951	42745
WBL1	2009/10	RB0901	26° 30.37'	76° 44.63'	-	-	-	3882	29/4/09	14:27	00:03	-	-
WB2	2009/07	RB0901	26° 30.27'	76° 44.13'	26° 30.81'	76° 44.43'	0.35	3884	29/4/09	22:04	03:19	93794	22442
WBH2	2009/12	RB0901	26° 29.99'	76° 37.52'	26° 29.08'	76° 37.98'	0.42	4736	28/4/09	16:24	01:58	-	-
WBCM	2009/14	RB0901	26° 30.00'	76° 35.99'	-	-	-	4825	28/4/09	13:16	00:43	-	-
WB4	2009/08	RB0901	26° 21.25'	75° 43.00'	26° 21.18'	75° 43.32'	0.29	4713	26/4/09	21:04	03:56	82895	93793
WBL2	2009/11	RB0901	26° 21.26'	75° 42.95'	-	-	-	4713	26/4/09	22:39	00:03	-	-
WB6	2009/13	RB0901	26° 29.69'	70° 31.31'	-	-	-	5488	25/4/09	13:54	00:14	-	-

Table 7.2 *Mooring positions, depths and times*

8 Instruments

Darren Rayner

8.1 Summary of Instruments Recovered and Deployed

Table 8.1 gives a summary of the instruments recovered and deployed on cruise RB0901. Appendix B gives more detailed information on which instruments were recovered from each mooring along with a summary of the length of record obtained. Complete setup details of deployed instruments can be found in Appendix C.

Instrument type	Manufacturer and model	Total intended for recovery	Total recovered	Total lost	Total deployed
CTD	SeaBird SBE37 SMP MicroCAT	33	33 (1 flooded)	0	54
	SeaBird SBE37 IMP MicroCAT	19	19 (2 flooded)	0	0
Single point current meter	Aanderaa RCM11	23	23	0	15
	Interocean S4	0	0	0	1
	Nortek Aquadopp	0	0	0	10
	Sontek Argonaut MD	0	0	0	1
	TRDI Doppler Volume Sampler	0	0	0	1
Current profiler	RD Instruments 75kHz Longranger ADCP	1	1	0	1
	RD Instruments 300kHz Workhorse Sentinel ADCP	0	0	0	1
BPR	SeaBird SBE26	4	4	0	0
	SeaBird SBE53	0	0	0	4

Table 8.1 *Summary of instruments recovered and deployed.*

8.2 Instrument Problems

8.2.1 Recovered Instruments

There were very few problems with recovered instruments on this cruise; three flooded MicroCATs (serial numbers 3283 and 4467 from WB6 and 5769 from WB1), one jump in the pressure record of a BPR (serial number 393 from WBL2) and a slightly short record from an RCM11 due to possible corruption of the data storage unit (serial number 303 from WB1).

The flooded instruments from WB6 are thought to be due to a weld failure of the Druck pressure sensor as per previous floods. Serial number 5769 has a Paine pressure sensor that should not suffer the same problem as the Druck sensors so the reason for this instrument flooding is at present unknown.

Additionally there was evidence of likely strumming of the WB4 mooring as several of the recovered MicroCATs had screws missing, presumed shaken out. This caused one instrument (serial number 3220) to lose its conductivity guard and another to lose its guide clamp and be supported by only a single wire clamp – the guide clamp was recovered with the instrument beneath as it had slipped down the wire. The

instrument that lost its conductivity guard was not lowered on the CTD frame for a calibration dip.

8.2.2 Deployed and New Instruments

MicroCAT serial number 6830 is a new instrument that arrived from SeaBird with the battery post misaligned. This made it impossible to insert the battery pack and this instrument needs to be returned to SeaBird for repair.

The new MicroCATs that were shipped direct to Charleston have a new firmware (version 3.0f). At first this caused some confusion as the commands and reply format were different to previous firmware versions. A new piece of software was supplied with these instruments (Seaterm V2), which does not allow download of the data in the usual format, and instead downloads in XML format, which can then be converted to ASCII. However this ASCII format would cause problems with running the stage 1 data processing routines, as it is not the same as previous firmware versions. It could be an option in the future if these stage 1 routines are modified, but work will need to be done on the date/time format as the XML format stores time either as seconds since January 1st 2000, or in Julian Day instead of `dd mmm yyy hh:mm:ss` as previously used. Instead the following commands were sent to the instrument to allow them to be downloaded with the previous version of Seaterm.

`OutPutExecutedTag=n` to stop the MicroCAT terminating each reply with `<Executed/>`

`OutPutFormat=3` to change the output data format to match that used previously (although this may only be important for transmitting real-time data)

9 ADCP Processing

Paul Wright

The Longranger ADCP deployed close inshore to Abaco to monitor the Antilles Current on mooring wbadcp_5_200808 was recovered and its data downloaded to a Windows based PC using RDI WINADCP software. As the ADCP has a built in pressure sensor it is possible to establish the depth of the unit for the bin mapping procedure. The raw data from the ADCP is converted by WINADCP into a .mat file and processed using MATLAB routines written by Jon Molina (RSMAS). All codes except for RDI's WINADCP program are found in the exec folder:

Programs: `rapid/data/exec/rb0901/ADCP_processing`

Raw data: `rapid/data/moor/raw/rb0901/adp/DEPL1000.000`

Output from WINADCP:
`rapid/data/moor/raw/rb0901/adp/`
`wbadcp_5_200805_data.mat`

9.1 Stage 1 Processing

The `binmap.m` program, produced by Jon Molina, was edited slightly during the cruise and renamed `binmapWBADCP.m` for use with the wbadcp mooring location. It reads the data from the converted .mat file and determines the depth of the ADCP from the surface reflections. From this 40 bins (layers of ocean) are created and saved as another .mat file. This .mat file was inspected to decide which data need to be removed from the ends of the series. It is possible to then re-run the program having edited the code to change the values of the parameters AA and BB, which top and tail the input matrices.

Output: `rapid/data/moor/proc/wbadcp_5_200805/`
`wbadcp_5_200805_binmap.mat`

9.2 Stage 2 Processing

The MATLAB script `bbmat2rodb.m`, also produced by Jon Molina and edited for RB0901, reads the bin mapped data from the `binmap.mat` file and does the following:

- cuts off the deployment and recovery periods. This is not done via the `info.dat` file as with the other instruments but from inspection of the finished data set and then by changing the indexing on the input matrices. This can also be done during stage 1 (as was the case during RB0901)
- de-spiking, gap filling, correcting for magnetic variation and filtering the data. For this the code reads the `info.dat` file.
- Produces two series of RDB formatted ASCII data files, e.g.
  `wbadcp_5_200805_bin36.cor` - corrected for magnetic variation and speed of sound

`wbadcp_5_200805_bin36.edt` - de-spiked,filtered and interpolated onto 12 hr grid.

Both types of files include the year (*yy*), month (*mm*), day (*dd*), hour (*hh*), east velocity component (*u*), north velocity component (*v*), temperature (*t*) and pressure (*p*). Temperature is only included on the bin file closest to the transducer. Several bins are above sea level due to back scatter from the surface, in addition some of the near-to-surface bins maybe too corrupted to be of use. This is assessed by visual inspection of the .mat files.

9.3 Plotting the Bins

The bins are approximately 16 m apart and the currents can be plotted on a quiver plot for visualization (Fig 9.1). A code from Darren Rayner was adapted for this and named `ADCP_stick_plot.m`. It relies on a '`bin_info.dat`' file that lists the bin depths and the bin sequence. The code will need editing for future uses if the number of bins changes.

Figure 9.1 *Quiver plots of bins 28, 29 and 30 of the wbadcp_5_200805 data.*

10 SBE 37 MicroCAT Processing

Paul Wright

10.1 Introduction

Initial processing of the MicroCAT data was done aboard the ship as soon as the instruments were recovered.

Throughout this section *mooring* will refer to the unique mooring name and the mooring wb2_6_200803 will be used as an example, with an instrument serial number 5772.

An info.dat file was created for each mooring that lists the target depth of each instrument, its type and its serial number. The RCMC numbers refer to the conductivity ranges on the RCM11 current meters.

310 – RC11 Current meter
337 – SBE 37 MicroCAT
465 – SBE 53 BPR

The path for the info.dat file is:
rapid/data/moor/proc/*mooring*/*mooring*info.dat

```
Mooring            = wb2_6_200803
Latitude           = 26 30.62 N
Longitude          = 76 44.36 W
WaterDepth         = 3890
MagDeviation       = -8.2
StartDate          = 2008/04/26
StartTime          = 17:45
EndDate            = 2009/04/29
EndTime            = 10:30
Columns            = z:instrument:serialnumber:RCMC1:RCMC2
    50   337   5772   -999  -999
   100   310    451     47    58
   100   337   5773   -999  -999
   175   310   305    -999  -999
   175   337   5774   -999  -999
   325   337   5775   -999  -999
```

Figure 10.1 *Example of an info.dat file*
Path – */rapid/data/moor/proc/wb2_6_200803/wb2_6_200803info.dat*

10.2 Stage 0 - Download

Raw instrument data are downloaded from the MircoCAT using SeaBird's SeaTerm software and saved as an ASCII file. Details are recorded on paper. After downloading the files are transferred to:

rapid/data/moor/raw/rb0901/microcat/5772_data.asc

under a filename based on their serial number (in this case `5772_data.asc`). There are two types of MicroCAT, the only difference between them is how the data are downloaded. The inductive IMPs require an interface and a loop of wire through the ferrite mooring cable clamp and take a long time to download, while the straight forward cable connected SMP types are quicker and a laptop cable just plugs straight in. The only difference when using the software is that the IMPs need to have every command prefixed by the MicroCATs code number. The inductive IMPs are designed for telemetry uses. Darren Rayner has written a piece of software that speeds up the downloading process by downloading the MicroCATs hex data into a capture file and then converting it afterwards. Prior to use the MicroCAT needs to be stopped using SeaTerm and the number of logged samples established using the DS command.

10.3 Stage 1 – Conversion from .asc to the RDB format .raw

Stage 1 processing converts the data for all the MicroCATs on each mooring from the manufacturers ASCII format to the RAPID RDB standard. i.e. header information, a standard date and time format and SI units rather than imperial.

```
rapid/data/exec/rb0901/stage1/microcat/mc_call_2_002.m
```

The MATLAB script `mc_call_2_002.m` runs the conversion code `microcat2rodb.m` as a batch file for each mooring. It uses the `info.dat` file to select the instruments that it needs, therefore it is critical that the `info.dat` files accurately reflect the instruments, positions and times of deployment.

The script opens the files and converts them to .raw files. It also produces summary plots of the data and creates a `stage1_log` file, which has a summary of the operations carried out. Output .raw files are stored in:

```
rapid/data/moor/proc/mooring/microcat/
```

where *`mooring`* is the unique mooring name. e.g.

```
rapid/data/moor/proc/wb2_6_200803/microcat/
wb2_6_200803_5772.raw
```

The plot is stored as a postscript plot:

```
rapid/data/moor/proc/wb2_6_200803/microcat/
wb2_6_200803_5772.raw.ps
```

10.4 Stage 2 – Trimming of Data Record, Basic Statistics and Summary Plots

Stage 2 processing removes the launching and recovery periods of the data, calculates the basic statistics and produces summary plots including 2-day low pass filtered data. The data is still NOT calibrated. The file is converted from `mooring_serialnumber.raw` file to `mooring_serialnumber.use` file using the MATLAB script `microcat_raw2use_003.m`.

```
rapid/data/exec/rb0901/stage2/microcat/
microcat_raw2use_003.m
```

There are few things that need to be changed in the header of the MATLAB script.

- The variable 'moor' needs to changed to the mooring name (e.g. wb2_2_200808)
- The 'operator' needs to be changed (e.g. PW)
- The 'plot interval' changed to make the output summary plots fit - generally the period enveloping the deployment period is fine.
- The paths need to be adjusted to match the directory structure of the cruise.

The output files are placed in the following:

```
rapid/data/moor/proc/mooring/microcat
```

e.g.

```
rapid/data/moor/proc/wb2_6_200803/microcat/
wb2_6_200803_5772.use
```

Three files are produced for each instrument:

`wb2_6_200803_5772.use`	A data file of the truncated time series data
`wb2_6_200803_5772.use.ps`	A postscript plot of the truncated conductivity, temperature and depth time series
`wb2_6_200803_5772.lowpass.ps`	A postscript plot of the truncated and 2-day low pass filtered time series

10.5 Calibration Dips

The MicroCATs are strapped to a CTD frame and dipped before and after deployment for calibration purposes. A total of fourteen calibration dips were made. (see Appendix A for details of which MicroCATs were on which cast.)

The processing technique for pre and post deployment calibration is identical. The MicroCATs are set up using SeaBird's software on the Windows laptops. Care needs to taken with the newer SBE37s as the firmware is slightly different (see 13.2.2). Recovered data is stored in:

```
rapid/data/moor/raw/rb0901/microcat_cal_dip/castX
```

where, X = number of the cast. For each cast an `info.dat` file was constructed containing metadata, serial number and instrument codes for each of the MicroCATs involved in the cast. The file names follow the pattern `castXinfo.dat` and are located in the `proc_calib` directory:

e.g. `rapid/data/moor/proc_calib/rb0901/cal_dip/cast11info.dat`

There is only one stage to calibration dip casts, following a similar pattern to the previous section. However, this depends on whether the CTD data have been made

available or not. If there are no CTD data available, then a quick inspection can be carried out using the MATLAB script `mc_call_calib2_noCTD.m`.

```
rapid/data/exec/rb0901/stage1/microcat/
mc_call_calib2_noCTD.m
```

In the script the paths header information need to be edited to match the current cruise and the cast number needs to be added (`'moor' = castX`). The script converts the ASCII data files into RODB format by calling the `microcat2rodb_2.m` routine. It produces plots of the temperature, conductivity and pressure for quick checks for consistency. In particular it is important to check data consistency at the bottle stops.

If the CTD data are available then the MATLAB code `mc_call_calib2_RB0901.m` performs the same tasks as before but adding the CTD data to the plots. For simplicity on this cruise, the basic (pre-processed) CTD data files, `CTDcastX.dat`, from the US team had their header lines commented out as the format was different from the UK CTD files. The original code is named `mc_call_calib2_zbs.m`.

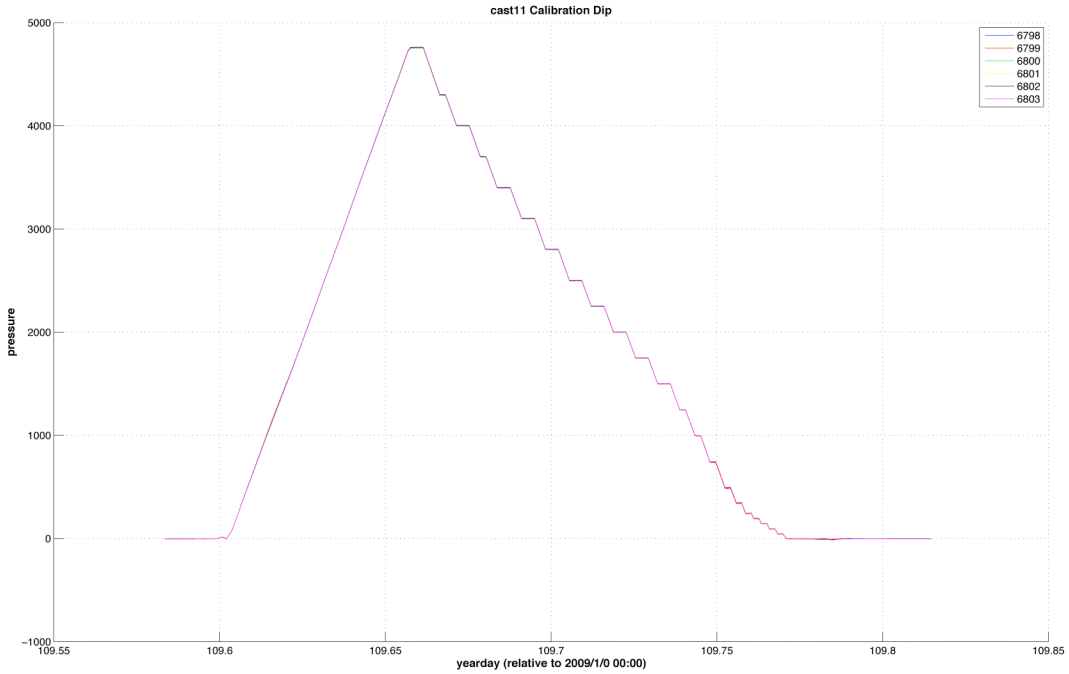

Figure 10.4a *A plot of the pressure calibration cast11 from RB0901. The flat steps are the bottle stops.*

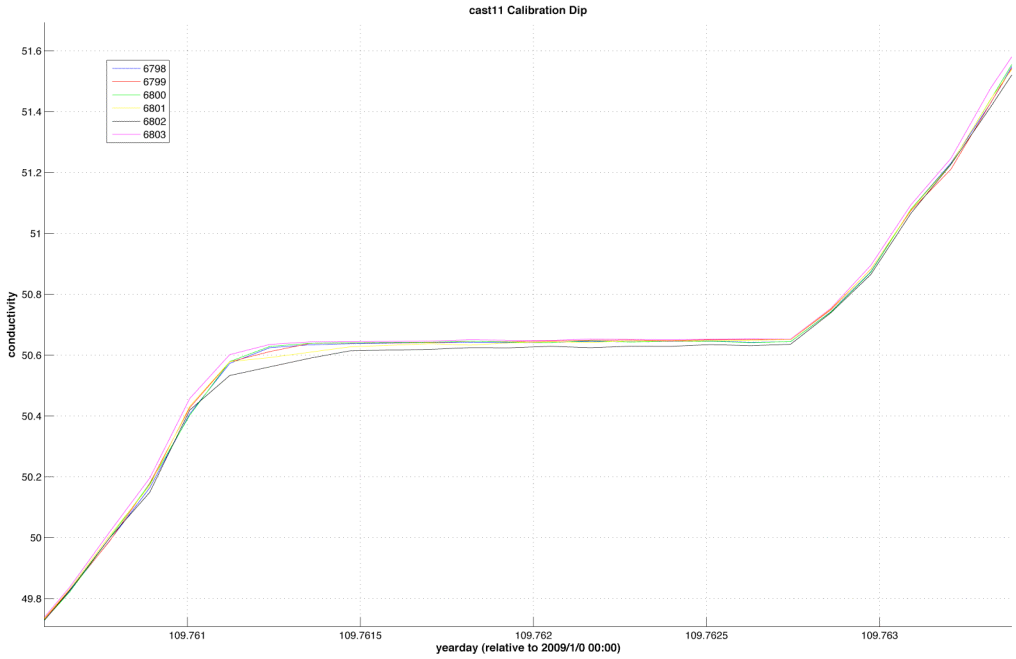

Figure 10.4b *Detail of a conductivity calibration dip cast bottle stop.*

10.6 Problems with the Calibration Dips

Problems that occurred during cruise RB0901 with the calibration dips:

- Two MicroCATs on cast 35 show a constant time offset (5981 and 5982), as this is easily corrected and likely to be due to a set up error this is not discussed further.
- MicroCAT 5768 was not successfully dipped after post-deployment due to a setup error.
- The range of the MicroCATs pressure differences at the shallower bottle stops is rather too large.
- The CTD timing abruptly drifted by wide margins mid-way during the upcasts for four of the 14 casts.

10.6.1 Pressure Sensor Errors

During the first week of the cruise, when no mooring operations were taking place, all the new MicroCATs from SeaBird were dip tested on the US teams CTD frame and compared to their data. At the bottle stops on one of the early casts it was quickly noticed that the pressure readings for the six MicroCATs were widely spread with an unacceptable range of roughly 30 dbars. This was for pressures < 1000 dbars. After some research into this it was discovered that all the MicroCATs display large errors in the pressure readings at depths < 1500 dbar on the upcasts and < 2000 dbar on the downcasts (Fig 10.5). The temperature and conductivity differences are far smaller (Figs 10.6 and 10.7)

The errors are defined as the difference between the MicroCAT pressure, p, and the CTD pressure, p_{CTD}:

$$\Delta p = p - p_{CTD}$$

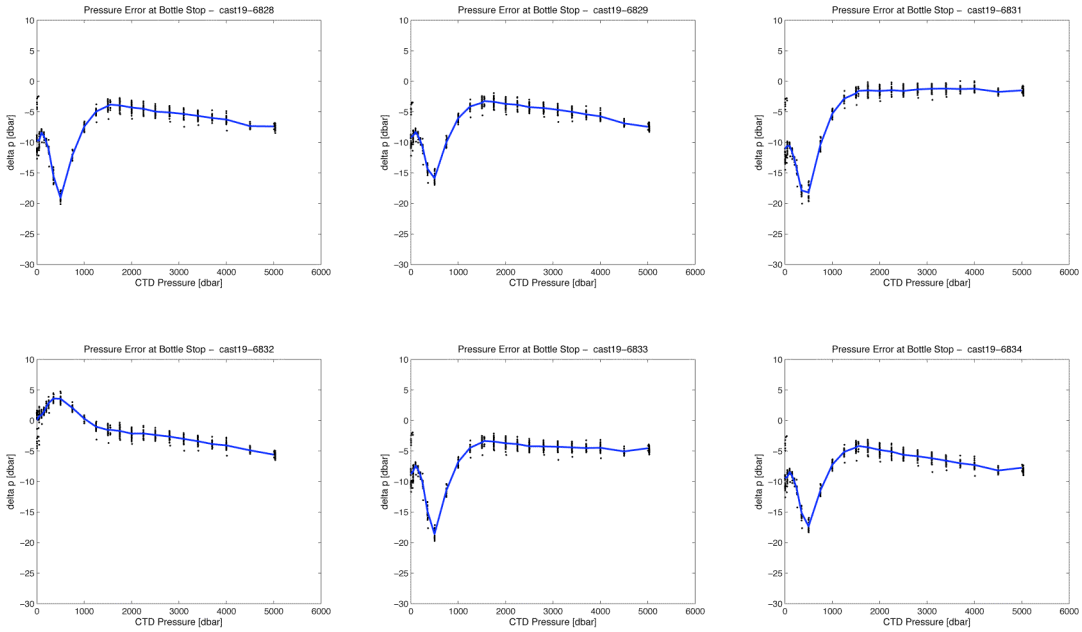

Figure 10.5 *Plots of $\Delta p = p - p_{CTD}$ for the upcast during cast 19. Δp is shown as black data points and the blue curve passes through the mean values of Δp at any given bottle stop. In particular notice the peak at approximately 800 dbar.*

It became clear that the difference in the pressure reading was due to the rapid change in temperature that the sensors go through as they pass through the thermocline (Fig 10.8). However, the temperature sensor appears to respond promptly to the changes in temperature and match the CTD thermometer quite closely. When Δp is plotted on the same graph as the change in temperature dT/dt, it is clear that they are related. The pressure error Δp lags behind the change in the temperature. It was realized that there are two temperature sensors within the MicroCAT, one to measure the temperature directly, and the other to correct the temperature response of the pressure sensor. The latter of these must have a fairly slow response time. This should not affect the overall performance of the MicroCAT as the temperatures are not expected to undergo rapid changes during deployment on a mooring but it affects the calibration and helps to explain why the `insitu_cal.m` routine only really works at pressures greater than 2000 dbar. (Collins 2009 and Kanzow 2006).

These large pressure errors due to sensor reaction time, although concentrated in the upper 2000m of the ocean, would appear to question the validity of calibrating the MicroCATs in this way. The calibration dip method was originally intended to maintain the calibration when turning around instruments during the cruise. However, the RAPID program now has enough MicroCATs not to have to do this, unless there are a large number of failures. As the calibration is pressure dependant, the coefficients are calculated from the mean difference between the MicroCAT measurement and the CTD measurement at the pressure that the MicroCAT will be deployed. For the deep MicroCATs this should lead to small calibration coefficients.

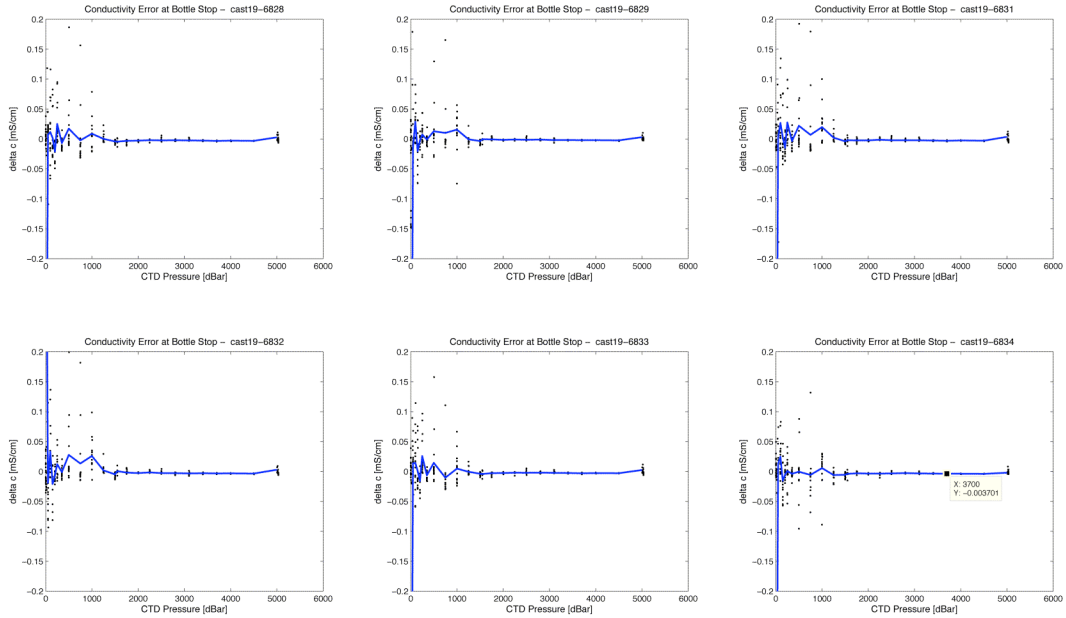

Figure 10.6 *Conductivity errors during the bottle stops on cast 19, $\Delta C = C - C_{CTD}$*

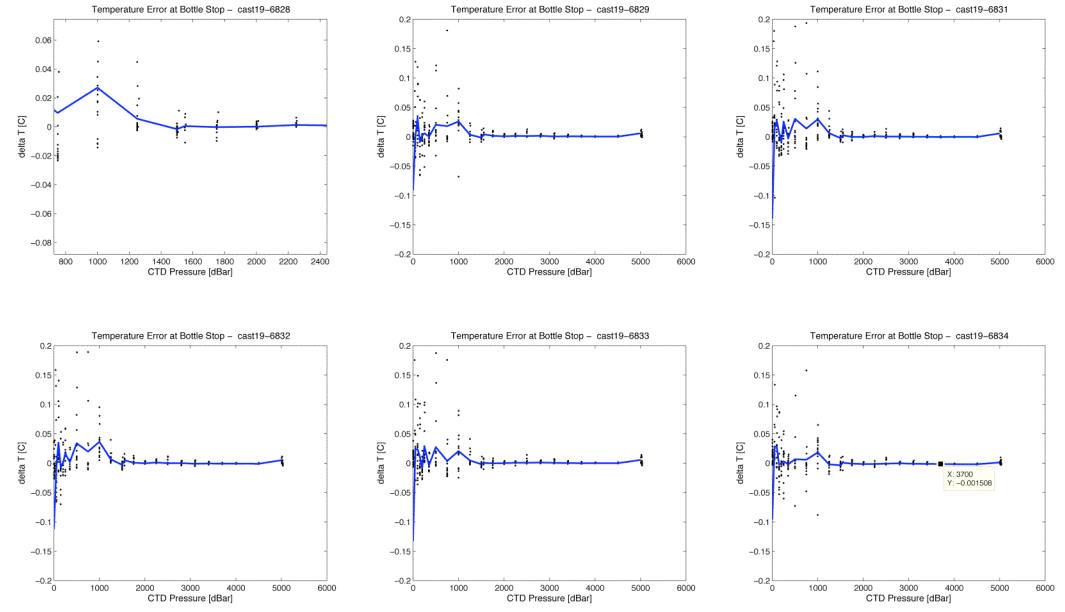

Figure 10.7 *Temperature errors during the bottle stops on cast 19, $\Delta T = T - T_{CTD}$. This is the fast response temperature sensor and not the thermistor associated with the pressure sensor.*

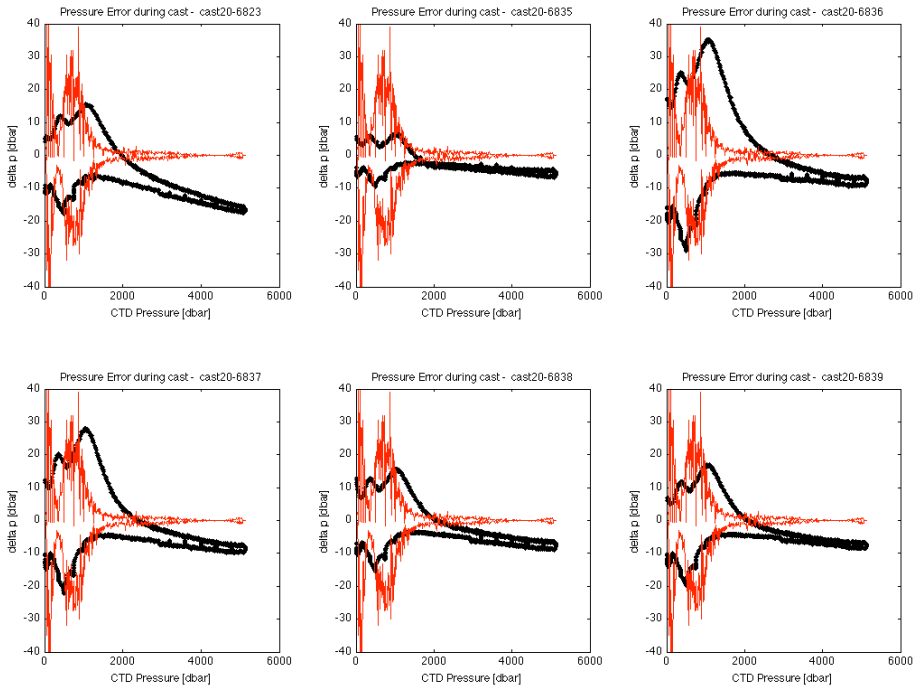

Figure 10.8 *The pressure errors (black) for cast 20 with the rate of change of temperature superimposed in red. The dT/dt curves have been greatly exaggerated, by a factor of 1000, for visibility. Δp is generally positive on the downcast and negative on the upcast.*

The laboratory calibrations have come from the calibration certificates supplied by SeaBird and the coefficients are based the polynomial residuals for the expected values of conductivity and temperature that the MicroCAT at the depth that the MicroCAT is to be deployed.

For example: MicroCAT 6832 is to be deployed at 2800m on mooring WB2 with the expected temperature and conductivity values of approximately 2.8°C and 32.6 mS/cm, which give laboratory calibration offsets of 0.000 mS/cm and 0.0000°C and calibration dip offsets of -0.003mS/cm and 0.000°C (Table 10.1).

The calibration coefficients for the instruments dipped on casts 11, 12, 15, 16 19 and 20 are shown in Table 10.1. In almost all cases the calibration coefficients based on the dip casts are higher than the ones based on the laboratory determined certificates.

s/n	Depth [m]	Pressure [dBar]		Conductivity [mS/cm]		Temperature [°C]	
		Cal-dip	Lab	Cal-dip	Lab	Cal-dip	Lab
6798	5100	0.6**	-1.53	-0.004**	-0.0001	-0.001**	-0.0000
6799	5300	-4.2**	0.00	-0.004**	-0.0000	-0.001**	0.0000
6800	5490	-4.9**	-0.54	-0.004**	-0.0001	-0.001**	0.0000
6801	5200	2.9**	-1.04	-0.004**	-0.0001	-0.001**	0.0000
6802	5500	4.8**	0.00	-0.004**	0.0000	-0.001**	0.0000
6803	250	-5.01	0.00	0.017	0.0000	0.020	0.0000
6804	400	-7.0	-0.04	-0.005	0.0000	0.008	0.0001
6805	600	-20*	0.00	-0.008*	0.0000	0.01*	0.0000
6806	800	-16*	0.00	-0.008*	0.0001	0.038*	0.0000
6807	1000	-4.61	-0.10	0.014	0.0000	0.027	0.0001
6808	1200	-4.5	-0.12	-0.001	-0.0001	0.003	0.0000
6809	1600	-2.8*	-0.16	-0.004*	0.0000	-0.000*	0.0000
6810	2000	-4.01	-0.20	-0.003	0.0000	-0.000	0.0000
6811	2500	-5.97	-0.25	-0.004	-0.0001	0.001	0.0000
6812	3000	-4.2*	-0.30	-0.007*	-0.0001	-0.000*	0.0000
6813	3500	-4.3*	-0.35	-0.005*	-0.0001	-0.001*	0.0000
6814	4000	-6.86	-0.40	-0.005	-0.0001	-0.002	0.0000
6815	4500	-4.4*	-0.23	-0.005*	0.0000	-0.003*	0.0000
6816	3800	-0.0*	0.38	-0.003*	-0.0002	-0.000*	0.0000
6817	4300	0.07*	0.00	-0.003*	-0.0002	-0.001*	0.0000
6818	4780	-4.0**	-0.24	-0.004**	-0.0001	-0.001**	0.0000
6819	50	-8.6	-0.5	-0.078	0.0001	-0.001	0.0000
6820	100	-4.4	-0.02	0.014	0.0001	0.002	0.0000
6821	175	-6.2	-0.02	0.014	0.0001	0.020	0.0000
6823	500	-16.6	-0.05	-0.013	0.0000	-0.007	0.0001
6828	1500	-4.04	0.15	-0.005	-0.0001	-0.002	0.0000
6829	1700	-3.36	0.34	-0.001	0.0000	0.002	0.0000
6831	2300	-1.47	0.69	-0.001	0.0000	0.001	0.0000
6832	2800	-2.63	0.03	-0.003	0.0000	0.000	0.0000
6833	3300	-4.41	0.33	-0.003	0.0000	0.000	0.0000
6834	3850	-7.01	-0.39	-0.004	-0.0002	-0.001	0.0000
6835	50	-5.89	-0.01	-0.003	0.0001	0.007	0.0000
6836	100	-18.09	-0.01	-0.008	0.0002	0.011	0.0000
6837	175	-10.60	-0.02	0.013	0.0001	0.027	-0.0001
6838	250	-8.30	-0.03	-0.008	-0.0001	-0.003	0.0000
6839	325	-15.95	-0.03	-0.009	0.0000	-0.005	0.0000

Table 10.1 *Comparison of pre-deployment calibration constants for the MicroCATs on casts 11, 12, 15, 16, 19, 20.*
** deployment depth not within 50m of a bottle stop so error interpolated.*
*** deployment depths exceed the depth of cast, therefore the error is based on extrapolation.*

10.6.2 CTD Timing Errors

During casts 17, 30, 31 and especially cast 34 there exist sudden deviations in the timings between the MicroCATs and the CTD records. At its worst during cast 34 the CTD is approximately 3.5 minutes behind the MicroCATs (Fig 10.10). This error is not consistent during the cast (Fig 10.11). The gradient deviates from approximately 1 dbar/s of the cast to up to 2 dbar/s before correcting itself back to 1 dbar/s, although remaining offset from the MicroCATs. For three of the four casts affected it is expected that the `insitu_cal.m` routine can work around this, but for cast 34 it is likely that the CTD data will need tweaking to bring it in line with the MicroCAT bottle stops to enable meaningful pressure, conductivity and temperature calibrations.

Carlos Fonseca found the cause of the problem by investigating how the CTD timing worked. The CTD itself does not have a clock, but sends data up the cable at 24 Hz, the system then works on the principle that 24 pieces of data constitutes 1 second in time. As Carlos found that his data record had gaps in it, he realized that the computers timing system was not recognizing these data losses, and only the 24 pieces of data actually received. Thus the problem with the data acquisition led directly to a timing error. For the work of the CTD this is rarely a problem as only a handful of bits of data are usually lost, but on the casts in question the losses were of the order of hundreds of bits. The underlying cause is likely to a fault in the cable connection from the CTD to the PC, possibly at the winch end as the CTD termination was renewed at the beginning of the cruise.

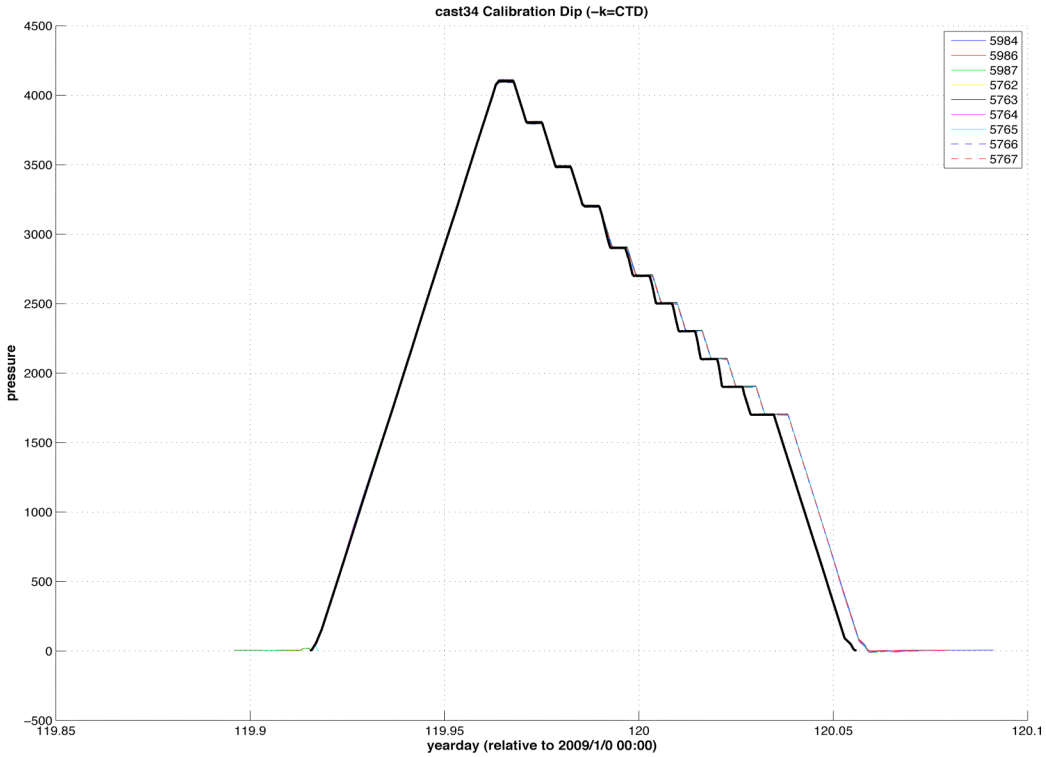

Figure 10.10 *Cast 34 showing the very large timing errors.*

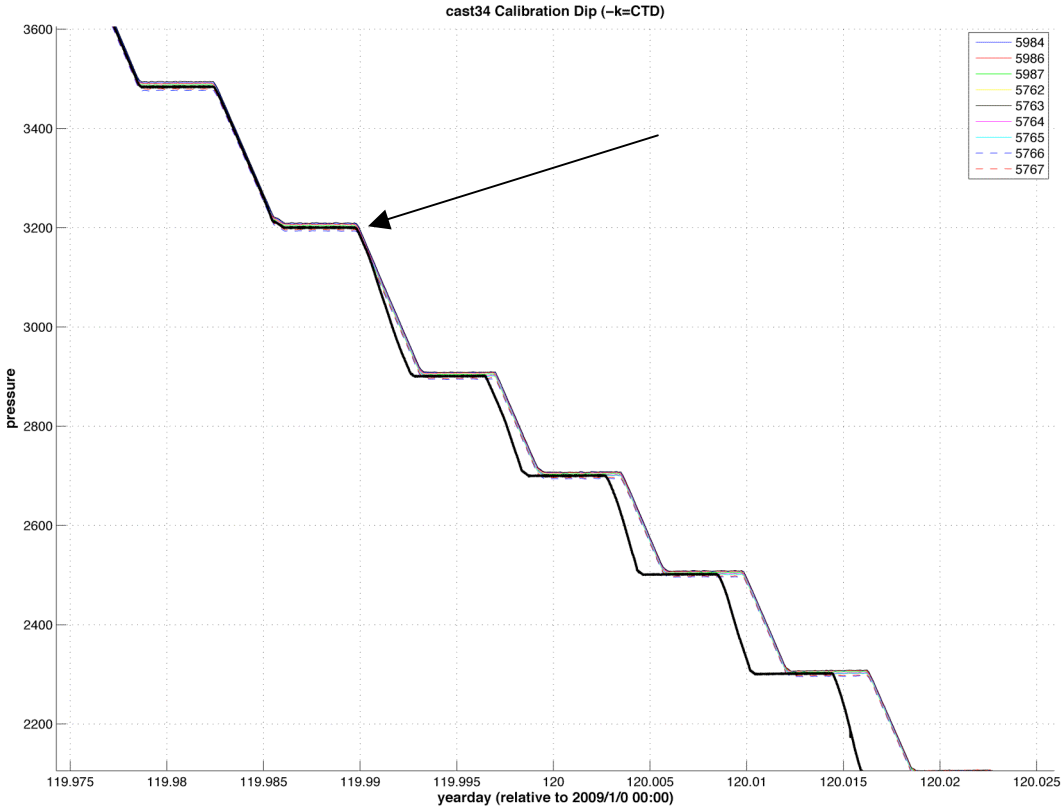

Figure 10.11 *Plot showing the CTD timing drift of cast 31. Note that the drift starts suddenly at one point on the upcast and continues to diverge.*

11 RCM11 Current Meter Processing

Paul Wright

All the current meters recovered during RB0901 were the Aanderaa RCM11 types.

11. 1 Stage 0

The data storage unit is downloaded to a PC and saved as an ASCII file. E.g. RCM11 current meter number 448 would be stored as:

```
rapid/data/moor/raw/rb0901/rcm/448_data.asc
```

11.2 Stage 1

The program `rcm2rodb_04.m` changes the `.asc` file to the RAPID standard RBD .raw format ASCII file with the relevant header. This is set up as a function with the input arguments: mooring name, proc path, inpath and outpath. A stage1 log file is created noting the time of conversion and any changes that have been made.

```
rapid/data/exec/rb0901/stage1/rcm11/rcm2rodb_04.m
```

The new file, `wb2_6_200803_448.raw` is stored under the moorings name in the `rapid/moor/proc/` directory.

11.3 Stage 2

Stage 2 processing is done by `rcm11raw2use.m` and chops the deployment and recovery periods off the data and produces plots that allow the user to check whether the record is complete, i.e. if any data has been incompletely downloaded from the DSU. As before, a stage2 log file is created. The .use file is stored in the proc (processed data) folder under the relevant mooring name. It is now obvious if the conductivity data has been wrapped. This occurred on a number of instruments during this cruise as the ranges of the conductivity sensors had been set too narrow.

```
rapid/data/exec/rb0901/stage2/rcm11/rcm11raw2use.m
```

Files stored in the proc folder, e.g.

```
rapid/data/moor/proc/wb2_6_200803/wb2_6_200803_448.use
```

11.4 Data Problems

The following moorings and instruments have problems with the data.

Mooring	Instrument s/n	Problem
wb1_5_200802	300	No conductivity record, spike at start
	303	Big spike at start, short record
wb2_6_200803	305	No conductivity record
	306	Conductivity badly wrapped
	445	Conductivity record has a big spike
wb4_5_200804	519	Conductivity badly wrapped
	515	Conductivity badly wrapped
	520	Conductivity wrapped
	443	Conductivity wrapped
	507	No conductivity record
wbh2_2_200808	426	No conductivity record

Table 11.1 *Problems with RCM11 instrument records for RB0901*

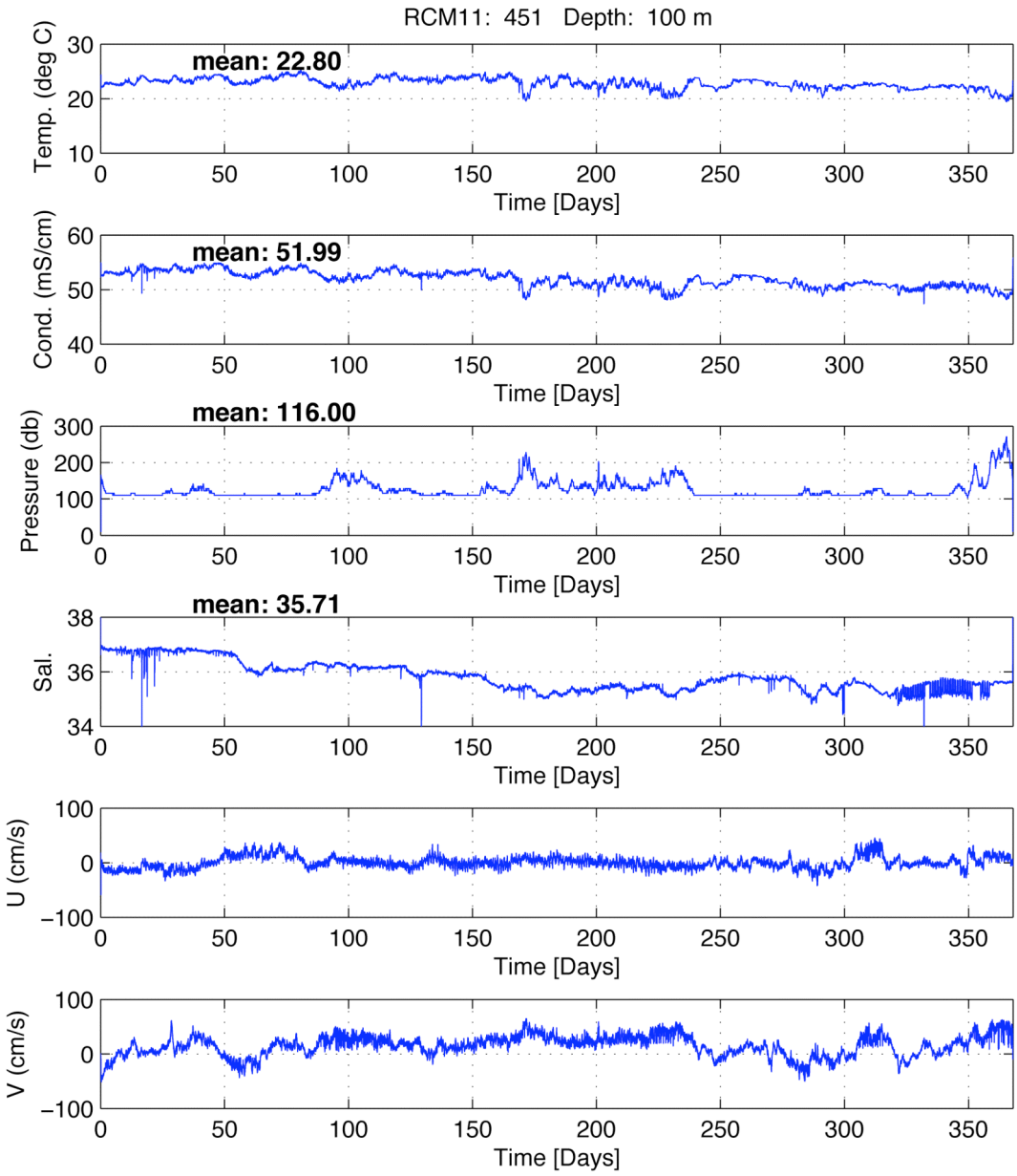

Figure 11.1 *The output plot of stage 2 processing of the RCM11 data from wb2_6_200803*

12 BPR Processing

Paul Wright

RAPID uses the SeaBird SBE26 Seagauge and/or the SeaBird SBE53 BPR to measure bottom pressure. No major modifications were made to any of the file structures, formats or processing on this cruise. The following is based on the RAPID Data processing document (Collins 2009) and uses wb6_1_200707_0392 as an example.

12.1 Stage 0

Raw instrument data is downloaded from the BPR using SeaBird's 'SeaSoft for Waves' software and saved as .hex and .tid files. Relevant details are recorded on paper and kept in the file by Darren Rayner. After downloading the files are transferred to:

```
rapid/data/moor/raw/rb0901/seagauge/0392_data.tid
           and 0392_data.hex
```

under filenames based on their serial number (in this case `0392_data.tid`). An `info.dat` file is created for each mooring (see Chapter 10). In order for the programs to work the necessary empty folders must be created in the relevant directories. The programs do NOT automatically create directories.

12.2 Stage 1

Stage 1 processing takes the ASCII file and converts it into RDB format. The units are changed from psi to dbar. If there has been a clock offset recorded then this is applied at this point. The code is found in:

```
rapid/data/exec/rb0901/stage1/seagauge/
seagauge2rdb_002.m
```

The RDB output file is saved as `wb6_1_200707_0392.raw` with the header information taken from the `info.dat` file. A stage 1 log file is created that records activity. If the data has been "wrapped" this may be fixed. This has not been necessary for RB0901.

12.3 Stage 2

Stage 2 processing takes the .raw file and trims off the deployment and recovery sections and calculates the basic statistics. Additionally the routine applies an exponential-linear drift removal to the data and filters it through a 48-hr low pass filter in order to remove the tidal signals. The empirical fit is calculated by the subroutine `purge_bp.m`. The stage 2 program was renamed from `seaguage_processing_002.m` to `seagauge_raw2use.m` to match the generalized names given in the RAPID Data Processing document (Collins 2009) The previous named file has been kept in the same directory though.

```
rapid/data/exec/rb0901/stage2/seagauge/seagauge_raw2use.m
```

The output file is a `.use` file located in the `moor/proc` directory e.g. `wb6_1_200707_0392.use`. Two postscript graphs are created.

```
rapid/data/moor/procwb6_1_200707/seagauge/
     wb6_1_200707.use(.ps)
```

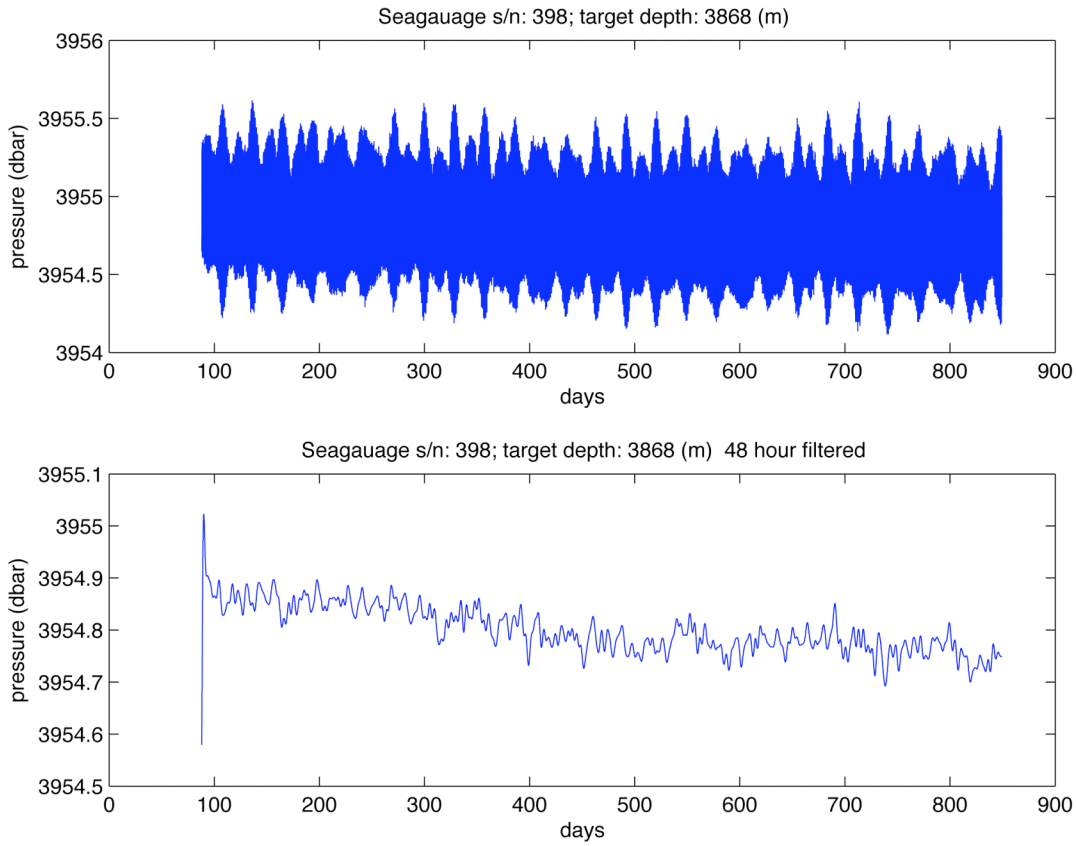

Figure 12.1 *Initial output from wbl1_2_200705_0398.raw. Fig 12.1a – raw data, Fig 12.1b - data after the 48-hour low pass filter has removed the tidal effects.*

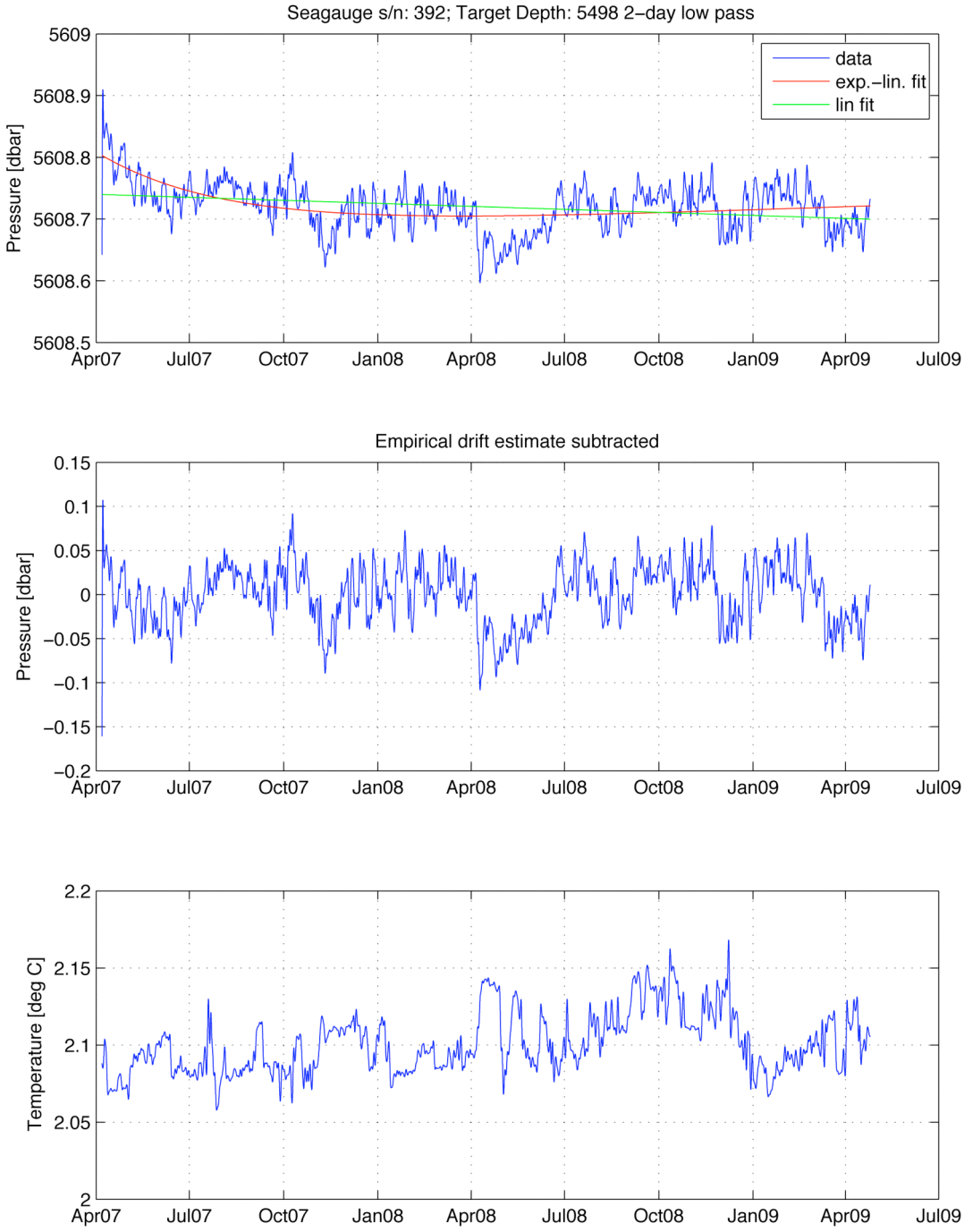

Figure 12.2 *The output from the stage 2 processing of wb6_1_200707. Fig 12.2a shows the raw data with the ends removed; Fig 12.2b shows the bottom pressure with the exponential-linear drift removed. Fig 12.2c is the temperature curve.*

12.4 Correcting wbl2_2_200706

The BPR record, Fig 12.3, at wbl2_2_200706 shows a strong offset at the start of the two-year record, the first 109 days being 0.30 dbar lower than the rest of the record. In order to correct for this it is assumed that this is a constant offset. However, it is clear from Figs 12.4 and 12.7 that the exponential-linear detrending does not work very well. The corrected file uses the suffix `modified` after the filename. The original data with the step change in it is left with the `.raw` name.

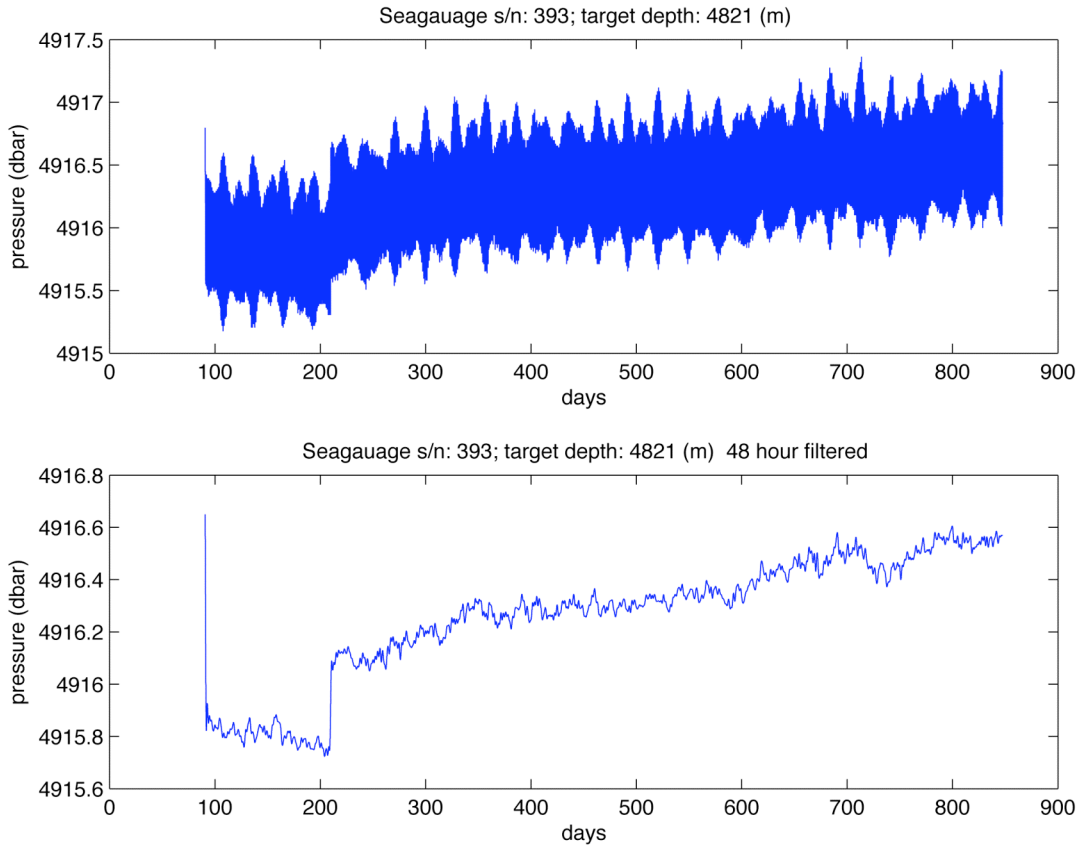

Figure 12.3 *The original data record from the BPR at wbl2_2_200706*

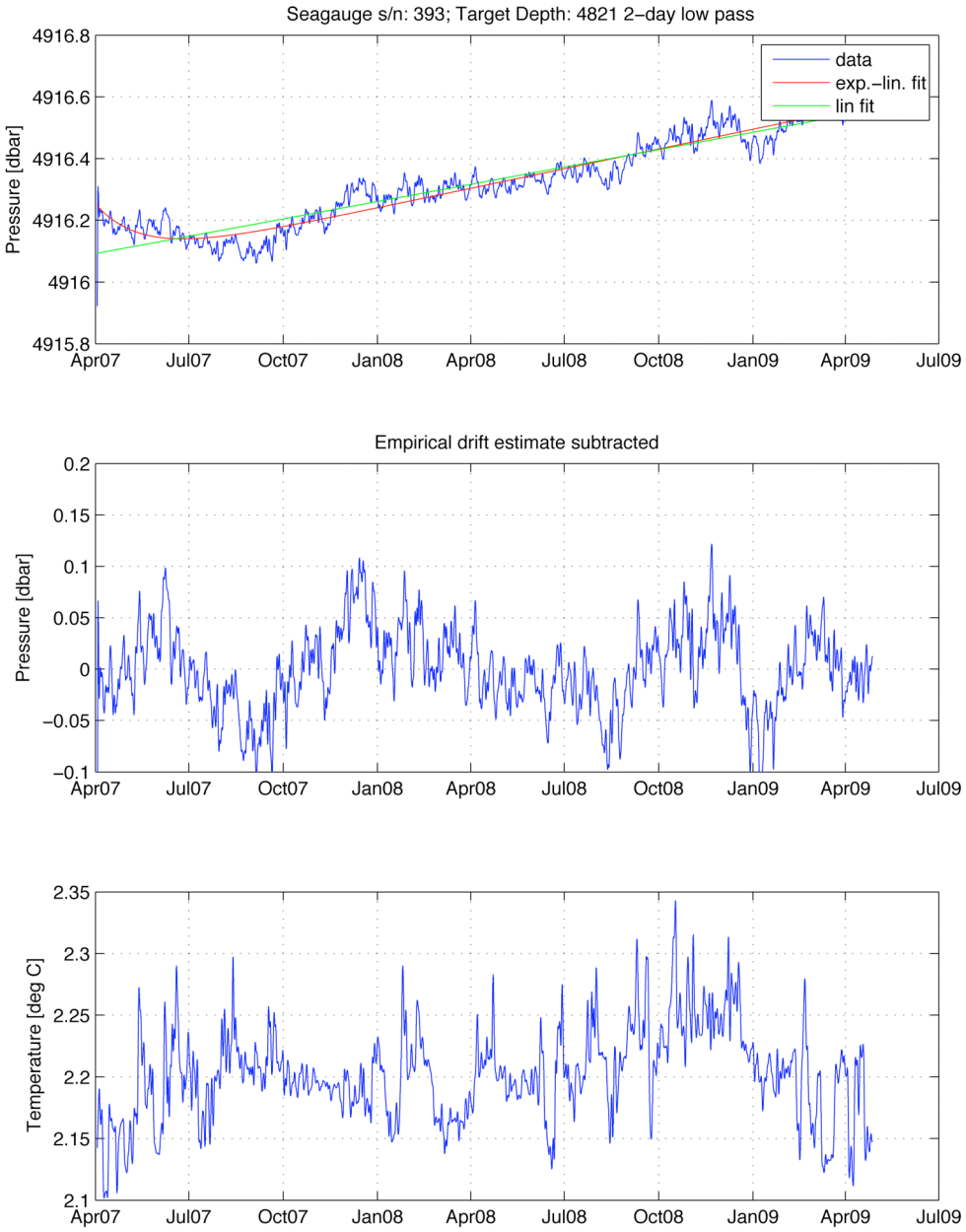

Figure 12.4 *The 'corrected' plot for the BPR at wbl2_2_200706*

12.4 Splicing the WBL Time Series

BPR instruments drift a great deal. It was decided to deploy them for two years at a time, often with two BPRs mounted to the frames, and use the overlapping time series to compare the empirical drift removal procedures. The fundamental problems is that the de-trending drift removal techniques all remove any low frequency signal present in the data – such as would be expected in climate change or variability.

All two year BPR data for the western boundary was collated and compared. There are two locations on the western boundary where there are good length of records, 76° 03'W and 76° 45'W. (Figures 12.5 → 12.9). While it can be seen that the high frequency signals generally compare very well, the drift removal techniques do not enable the overlapping timeseries to match perfectly. It almost appears that there is

still a slight drift in the data. It is also very clear from Figure 12.7 that the correction applied to wbl6_2_200706_0393 did not work as well as had been hoped. The data has been left intact for completeness at this stage.

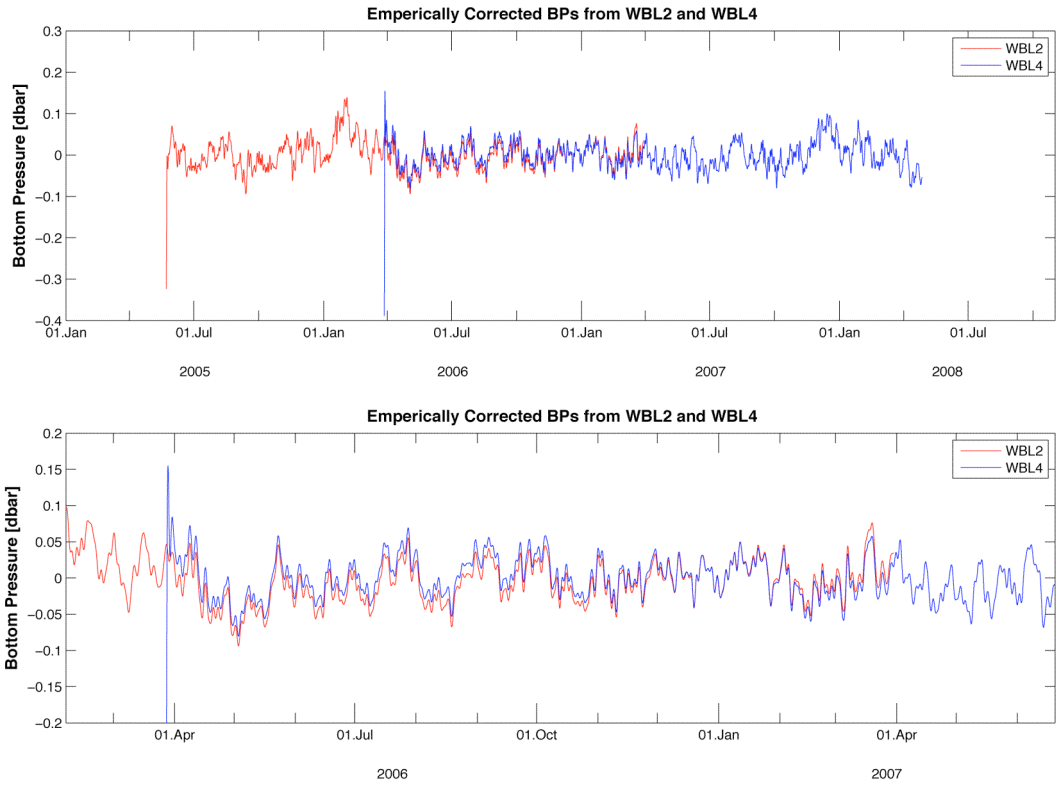

Figure 12.5 *An example of the overlapping segments of two BPR records at 76° 45'W. The lower plot is the detail of the overlap. Moorings used were wbl2_1_200531_0392 and wbl4_1_200605_0004.*

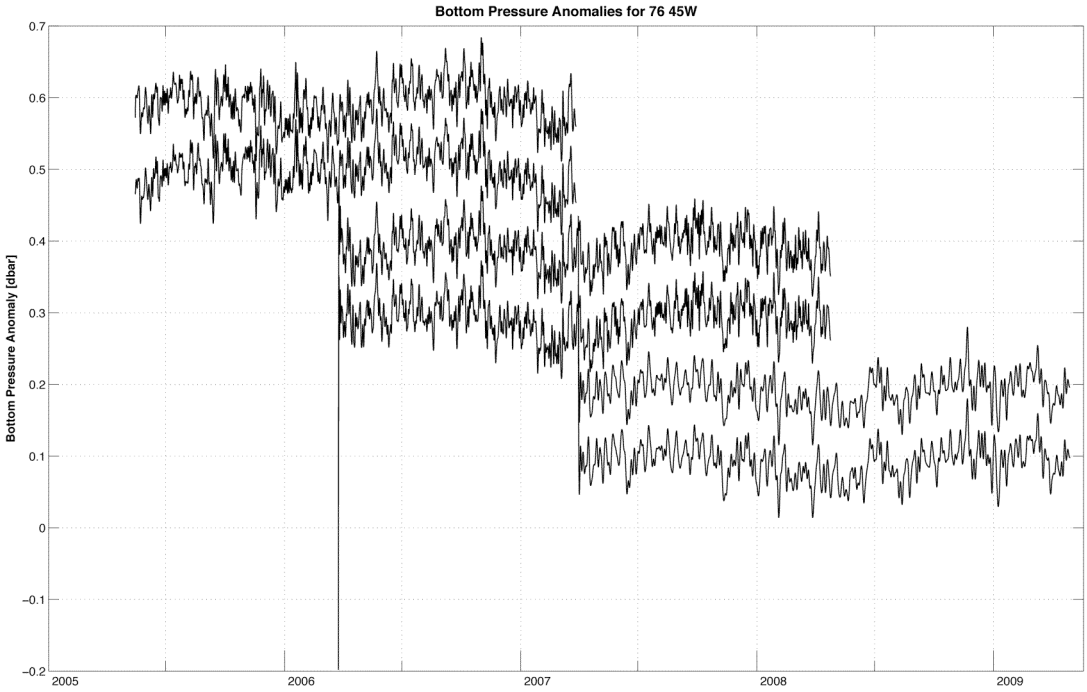

Figure 12.6 *Combined plots of the bottom pressure anomalies for 76° 45'W. The curves have been offset for clarity.*

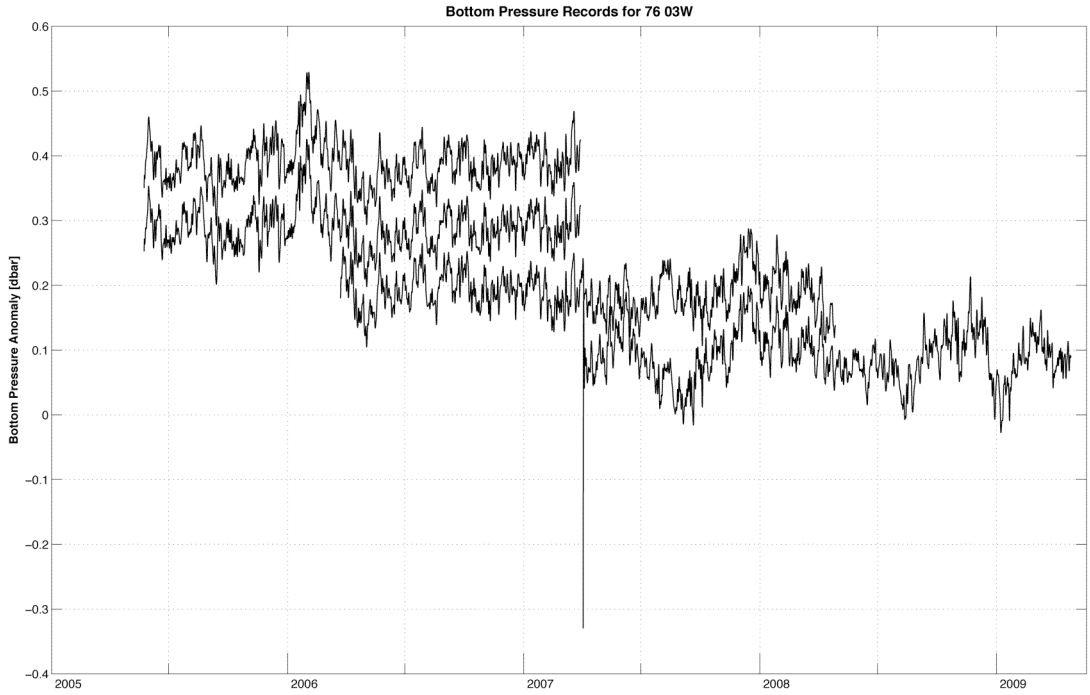

Figure 12.7 *Combined plots of the time series for the bottom pressure anomalies at 76° 03'W. The data that is widely separated is the corrected BPR from wbl2_2_200706. The curves are offset for visibility.*

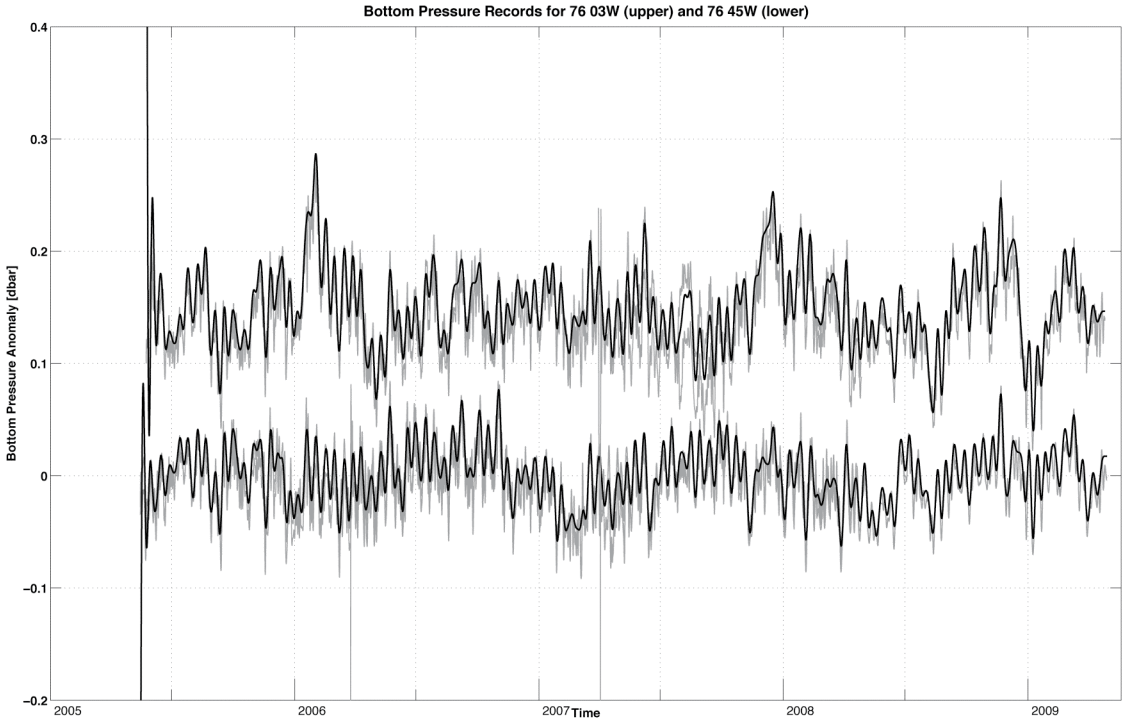

Figure 12.8 *The combined bottom pressure records for 76° 45'W (lower) and 76° 03'W (upper), with a 10-day low pass filter applied to their mean values shown in black. The upper*

curve has been offset for visibility.

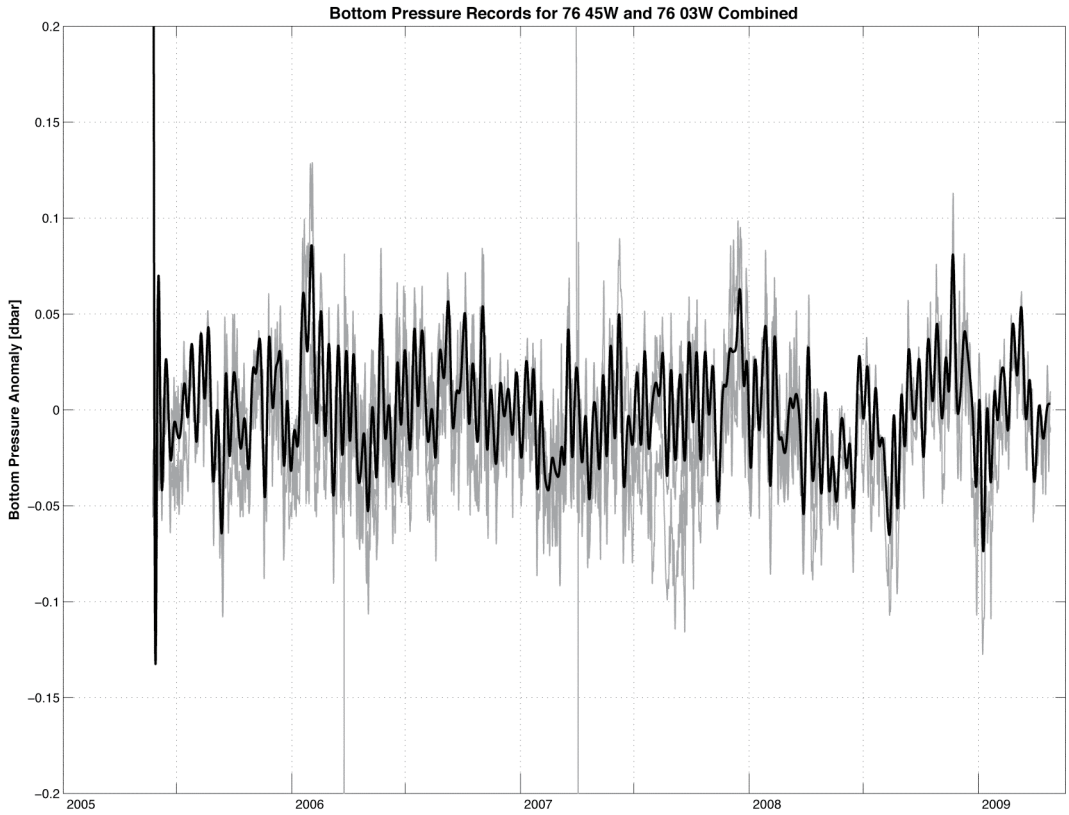

Figure 12.9 *The combined bottom pressure records for the locations 76° 45'W and 76° 03'W, with a 10-day low pass filter applied to the mean value shown by the black curve.*

References

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Appendix A - Details of Instruments Lowered on CTD Calibration Casts

Cruise Cast Number	Instrument Details			
	Type	s/n	pre- or post-deployment calibration	comments
11	SMP	6798	Pre-deployment	
	SMP	6799	Pre-deployment	
	SMP	6800	Pre-deployment	
	SMP	6801	Pre-deployment	
	SMP	6802	Pre-deployment	
	SMP	6803	Pre-deployment	
12	SMP	6804	Pre-deployment	
	SMP	6805	Pre-deployment	
	SMP	6806	Pre-deployment	
	SMP	6807	Pre-deployment	
	SMP	6808	Pre-deployment	
	SMP	6809	Pre-deployment	
15	SMP	6810	Pre-deployment	
	SMP	6811	Pre-deployment	
	SMP	6812	Pre-deployment	
	SMP	6813	Pre-deployment	
	SMP	6814	Pre-deployment	
	SMP	6815	Pre-deployment	
16	SMP	6816	Pre-deployment	
	SMP	6817	Pre-deployment	
	SMP	6818	Pre-deployment	
	SMP	6819	Pre-deployment	
	SMP	6820	Pre-deployment	
	SMP	6821	Pre-deployment	
17	SMP	6822	Pre-deployment	
	SMP	6823	Pre-deployment	Not logging fast enough – redone cast 20
	SMP	6824	Pre-deployment	
	SMP	6825	Pre-deployment	
	SMP	6826	Pre-deployment	
	SMP	6827	Pre-deployment	
19	SMP	6828	Pre-deployment	
	SMP	6829	Pre-deployment	
	SMP	6831	Pre-deployment	
	SMP	6832	Pre-deployment	
	SMP	6833	Pre-deployment	
	SMP	6834	Pre-deployment	
20	SMP	6823	Pre-deployment	
	SMP	6835	Pre-deployment	
	SMP	6836	Pre-deployment	
	SMP	6837	Pre-deployment	
	SMP	6838	Pre-deployment	
	SMP	6839	Pre-deployment	
23	SMP	6840	Pre-deployment	
	SMP	6841	Pre-deployment	
	SMP	3247	Pre-deployment	

30	SMP	3225	Pre-deployment	3500m rated
	SMP	3234	Pre-deployment	3500m rated
	SMP	3209	Pre-deployment	3500m rated
	SMP	3215	Pre-deployment	3500m rated
	SMP	3216	Pre-deployment	3500m rated
	SMP	3217	Pre-deployment	3500m rated
	SMP	3224	Pre-deployment	3500m rated
	SMP	4471	Post-deployment	
31	SMP	5783	Post-deployment	
	SMP	5784	Post-deployment	
	SMP	5785	Post-deployment	
	SMP	5786	Post-deployment	
	SMP	5787	Post-deployment	
	SMP	5788	Post-deployment	
	SMP	5789	Post-deployment	
	IMP	5991	Post-deployment	
	IMP	5992	Post-deployment	
	IMP	5993	Post-deployment	
32	SMP	3206	Pre and Post-deployment	3500m rated
	SMP	3219	Pre and Post-deployment	3500m rated
	SMP	3221	Pre and Post-deployment	3500m rated
	SMP	3222	Pre and Post-deployment	3500m rated
	IMP	5988	Post-deployment	
	IMP	5989	Post-deployment	
	IMP	5990	Post-deployment	
33	SMP	5772	Post-deployment	
	SMP	5773	Post-deployment	
	SMP	5774	Post-deployment	
	SMP	5775	Post-deployment	
	SMP	5776	Post-deployment	
	SMP	5777	Post-deployment	
	SMP	5778	Post-deployment	
	SMP	5779	Post-deployment	
	SMP	5780	Post-deployment	
	SMP	5781	Post-deployment	
	SMP	5782	Post-deployment	
	IMP	5983	Post-deployment	
34	IMP	5984	Post-deployment	
	IMP	5986	Post-deployment	
	IMP	5987	Post-deployment	
	SMP	5762	Post-deployment	
	SMP	5763	Post-deployment	
	SMP	5764	Post-deployment	
	SMP	5765	Post-deployment	
	SMP	5766	Post-deployment	
	SMP	5767	Post-deployment	
35	SMP	5770	Post-deployment	
	SMP	5771	Post-deployment	
	IMP	5978	Post-deployment	
	IMP	5797	Post-deployment	
	IMP	5980	Post-deployment	
	IMP	5981	Post-deployment	
	IMP	5982	Post-deployment	
	IMP	5985	Post-deployment	

Table A.1 *Details of instruments lowered on CTD calibration casts.*

Appendix B - Instrument Record Lengths

Mooring	Instrument	Serial Number	Depth (m)	Date of first usable record	Date of last usable record	Comment
WBADCP	ADCP	1767	598	24/4/2008 00:00	18/4/2009 00:00	40 bins (34 usable)
wbl1_2_200705	SBE 26	0398	3868.9	30/3/2009 21:15	29/4/2009 14:00	
	SBE 26	0399	3868.9	30/3/2009 21:00	29/4/2009 14:00	
wbl2_2_200706	SBE 26	0393	4821	2/4/2007 18:30	27/4/2009 16:30	step change @109 dy
wb1_5_200802	SBE37	5762	50	23/4/2008 21:00	30/4/2009 09:30	
	RCM11	300	100	23/4/2008 21:30	30/4/2009 09:50	
	SBE37	5763	100	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5764	175	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5765	250	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5766	325	23/4/2008 21:00	30/4/2009 09:30	
	RCM11	301	400	23/4/2008 21:30	30/4/2009 09:50	
	SBE37	5767	400	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5768	500	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5769	600	-	-	Flooded
	SBE37	5770	700	23/4/2008 21:00	30/4/2009 09:30	
	RCM11	302	800	23/4/2008 21:30	30/4/2009 09:50	
	SBE37	5771	800	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5978	900	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5979	1000	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5980	1100	23/4/2008 21:00	30/4/2009 09:30	
	RCM11	303	1200	23/4/2008 21:30	10/4/2009 00:00	Short record
	SBE37	5981	1200	23/4/2008 21:00	30/4/2009 09:30	
	SBE37	5982	1380	23/4/2008 21:00	30/4/2009 09:30	
wb2_6_200803	SBE37	5772	50	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	451	100	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5773	100	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	305	175	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5774	175	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5775	325	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	306	400	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5776	500	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5777	700	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	445	800	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5778	900	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5779	1100	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	448	1200	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5780	1380	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5781	1500	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5782	1700	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5983	1900	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	449	2050	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5984	2300	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5985	2800	26/4/2008 18:00	29/4/2009 10:00	
	RCM11	450	3000	26/4/2008 18:00	29/4/2009 10:30	
	SBE37	5986	3300	26/4/2008 18:00	29/4/2009 10:00	
	SBE37	5987	3850	26/4/2008 18:00	29/4/2009 10:00	
wbh2_2_200808	RCM11	381	1500	27/4/2008 00:00	28/4/2009 16:45	
	RCM11	383	2200	27/4/2008 00:00	28/4/2009 16:45	
	RCM11	395	3000	27/4/2008 00:00	28/4/2009 16:45	
	RCM11	399	3800	27/4/2008 00:00	28/4/2009 16:45	
	SBE37	5988	3800	27/4/2008 00:00	28/4/2009 16:30	
	SBE37	5989	4300	27/4/2008 00:00	28/4/2009 16:30	
	RCM11	426	4600	27/4/2008 00:00	28/4/2009 16:45	No conductivity
	SBE37	5990	4780	27/4/2008 00:00	28/4/2009 16:30	

Mooring	Instrument	Serial Number	Depth (m)	Date of first usable record	Date of last usable record	Comment
wb4_5_200804	SBE37	3206	50	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	519	100	28/4/2008 16:25	27/4/2009 10:25	Wrapped conductivity
	SBE37	3219	100	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	3220	250	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	515	400	28/4/2008 16:25	27/4/2009 10:25	Wrapped conductivity
	SBE37	3222	400	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	3221	600	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	516	800	28/4/2008 16:25	27/4/2009 10:25	
	SBE37	5783	800	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	5784	1000	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	520	1200	28/4/2008 16:25	27/4/2009 10:25	Wrapped conductivity
	SBE37	5785	1200	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	5786	1600	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	443	2000	28/4/2008 16:25	27/4/2009 10:25	Wrapped conductivity
	SBE37	5787	2000	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	5788	2500	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	444	3000	28/4/2008 16:25	27/4/2009 10:25	
	SBE37	5789	3000	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	5991	3500	28/4/2008 16:00	27/4/2009 10:30	
	RCM11	507	4000	28/4/2008 16:25	27/4/2009 10:25	No conductivity
	SBE37	5992	4000	28/4/2008 16:00	27/4/2009 10:30	
	SBE37	5993	4500	28/4/2008 16:00	27/4/2009 10:30	Large pressure change
wb6_1_200707	SBE37	3283	5100	-	-	Flooded
	SBE37	4467	5300	-	-	Flooded
	SBE37	4471	5495	5/4/2007 19:00	25/4/2009 10:30	Large pressure drift
	SBE26	392	5498	6/4/2007 18:10	25/4/2009 09:30	

Table B.1 *Record of the instrument record lengths recovered by RB0901*

Appendix C - Instrument Setup Details

WBADCP_6_200909

RDI Longranger	75kHz Workhorse ADCP s/n:	**5817**
	System frequency:	76.8 kHz
	Beam angle:	20 degrees
	Water salinity:	36
	Depth of transducer:	600 m
	Heading alignment:	0
	Heading bias;	0
	Depth cell size:	1600 cm
	Number of depth cells:	40
	Blank after transmit:	0704
	Pings per ensemble:	00010
	Ambiguity velocity:	170 cm/s radial
	Time per ensemble:	00:30:00
	Start date:	17 April 2009 @ 15:05:25

WBL1_3_200910

SBE53	BPR, s/n:	**0034**
	User info line:	WBL1_deployed_2009_RB0901
	Tide interval:	30
	Tide duration:	30
	Frequency (reference):	96
	Instrument started:	29 April 2009
	Target depth:	3890 m

SBE53	BPR, s/n:	**0036**
	User info line:	WBL1 _2009_RAPID
	Tide interval:	30
	Tide duration:	30
	Frequency (reference):	96
	Instrument started:	29 April 2009
	Target depth:	3890 m

WBL2 _3_200911

SBE53 BPR	BPR unit, s/n:	**0033**
	INITLOGGING:	Y
	Info header:	wbl2_2009
	Tide interval:	30 mins
	Tide Measurement Duration:	30 mins
	Reference sample freq:	96
	Start:	26 April 2009 @ 20:00:00
	Target depth:	

WB1_6_200906

SBE37 MicroCAT	SMP CTD unit, s/n:	**3206**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	50 m
RCM11	Current Meter, s/n:	**381**
	Pings per ensemble:	600
	Temperature range:	High
	Conductivity range:	Broken
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	30 April 2009
	Target depth:	100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3219**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6837**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	175 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6838**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	250 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6839**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	325 m

RCM11	Current Meter, s/n:	**383**
	Pings per ensemble:	600
	Temperature range:	High
	Conductivity range:	45 - 49
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	30 April 2009
	Target depth:	400 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6840**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	400 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6841**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	500 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3209**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	600 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3215**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	700 m
RCM11	Current Meter, s/n:	**395**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	35 - 38
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	30 April 2009
	Target depth:	800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3216**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3221**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	900 m

SBE37 MicroCAT	SMP CTD unit, s/n:	**3224**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	1000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3225**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	1100 m
RCM11	Current Meter, s/n:	**399**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	33 - 35
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	30 April 2009
	Target depth:	1200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3234**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	1200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3222**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	1380 m

WB2_7_200907

SBE37 MicroCAT	SMP CTD unit, s/n:	**6819**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	50 m
RCM11	Current Meter, s/n:	**519**
	Pings per ensemble:	600
	Temperature range:	High
	Conductivity range:	46 - 56
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:30
	Target depth:	100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6820**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	100 m
RCM11	Current Meter, s/n:	**515**
	Pings per ensemble:	600
	Temperature range:	High
	Conductivity range:	45 - 55
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:45
	Target depth:	175 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6821**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	175 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6822**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	325 m
RCM11	Current Meter, s/n:	**516**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	37 - 49
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:45
	Target depth:	400 m

SBE37 MicroCAT	SMP CTD unit, s/n:	**6823**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	500 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6824**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	700 m
RCM11	Current Meter, s/n:	**520**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	34 - 39
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:45
	Target depth:	800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6825**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	900 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6826**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	1100 m
RCM11	Current Meter, s/n:	**443**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	32 - 35
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009
	Target depth:	1200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6827**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	1300 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6828**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	1500 m

SBE37 MicroCAT	SMP CTD unit, s/n:	**6829**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	1700 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**3247**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	1900 m
RCM11	Current Meter, s/n:	**444**
	Pings per ensemble:	600
	Temperature range:	Arctic
	Conductivity range:	32 - 34
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:45
	Target depth:	2050 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6831**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	2300 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6832**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	2800 m
RCM11	Current Meter, s/n:	**426**
	Pings per ensemble:	600
	Temperature range:	Arctic
	Conductivity range:	BAD SENSOR
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	-
	Instrument started:	29 April 2009 at 17:45
	Target depth:	3000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6833**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	3300 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6834**
	Sample interval:	1800 seconds
	Start Date:	29 April 2009
	Start time:	17:00
	Target depth:	3850 m

WBH2_3_200912

Nortek Aquadopp	Current Meter, s/n:	**5889**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	1500 m
Nortek Aquadopp	Current Meter, s/n:	**5884**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	2200 m
Nortek Aquadopp	Current Meter, s/n:	**5897**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	3000 m
Nortek Aquadopp	Current Meter, s/n:	**5879**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	3800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6816**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	3800 m

SBE37 MicroCAT	SMP CTD unit, s/n:	**6817**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	4300 m
Nortek Aquadopp	Current Meter, s/n:	**5890**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	4600 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6818**
	Sample interval:	1800 seconds
	Start Date:	30 April 2009
	Start time:	15:00
	Target depth:	4780 m

WBCM_1_200914

RDI 75kHz Workhorse Longranger ADCP	Serial number	**5817**
	System Frequency	76.8kHz
	Beam angle	20 degrees
	Transmit power	High
	Water salinity	36ppt
	Depth of transducer	600m
	Heading alignment	0
	Heading bias	0
	Mode 1 bandwidth	Narrow
	Depth cell size	16.00m
	Number of depth cells	40
	Blank after transmit	7.04m
	Pings per ensemble	10
	Ambiguity velocity	175 cm/s
	Time between ping groups	3 mins
	Time per ensemble	00:30:00
	Start date	17 April 2009
	Start time	20:00:00
	Deployment name	WB_09
Nortek Aquadopp	Current Meter, s/n:	**5893**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	4334 m
Interocean S4	Current Meter, s/n:	**35612564**
	Header:	WB-CM 2009
	Sampling period:	1 min
	Channels to average:	2 (Hx), 3 (Hy), 4 (Con), 5 (T), 6 (z)
	Special record block count:	48 Channels: 2,3,4,5,6
	Write mode:	Internal
	Log mode:	North/East
	Start date:	28 April 2009
	Tart time:	04:00
	Target depth:	4335 m
	NB: responded battery fail but didn't reset flag	
RCM11	Current Meter, s/n:	**507**
	Pings per ensemble:	600
	Temperature range:	Arctic
	Conductivity range:	-
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	7869
	Instrument started:	28 April 2009 @ 02:30
	Target depth:	4336 m

Sontek Argonaunt	Current meter:	**D303**
	Baud rate:	9600
	Deployment name:	DRF01
	Start date:	28 April 2009
	Start time:	04:00
	Target deph:	4337 m
Teledyne RDI DVS (Doppler Volume Sampler)	Serial number	**12358**
	Project name	DVS Deployment
	Version	1.0.0.0
	Range	2.50 m
	Ensembles per hour	4
	Time per ensemble	15 mins
	Pings per ensemble	25
	Duration	220
	Salinity	35ppt
	Temperature	5
	Depth	4350
	Magnetic correction	0
	Samples per hour	25
	Number of bins	5
	Bin size	0.5 m
	Autosample interval	yes
	Time between pings	36 s
	Blank	0.15 m
	Start date	28/04/09
	Start time	04:00:00

WB4_6_200908

NOTE: all the RCM11 conductivity ranges are too narrow… This was found out after processing the recovered moorings. The following was based on last years cruise report.

SBE37 MicroCAT	SMP CTD unit, s/n:	**6835**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	50 m
Nortek Aquadopp	Current Meter, s/n:	**2087**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6836**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6803**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	250 m
RCM11	Current Meter, s/n:	**304**
	Pings per ensemble:	600
	Temperature range:	high
	Conductivity range:	43 – 54 *
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	14385
	Instrument started:	26 April 2009 at
	Target depth:	400 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6804**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	400 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6805**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	600 m

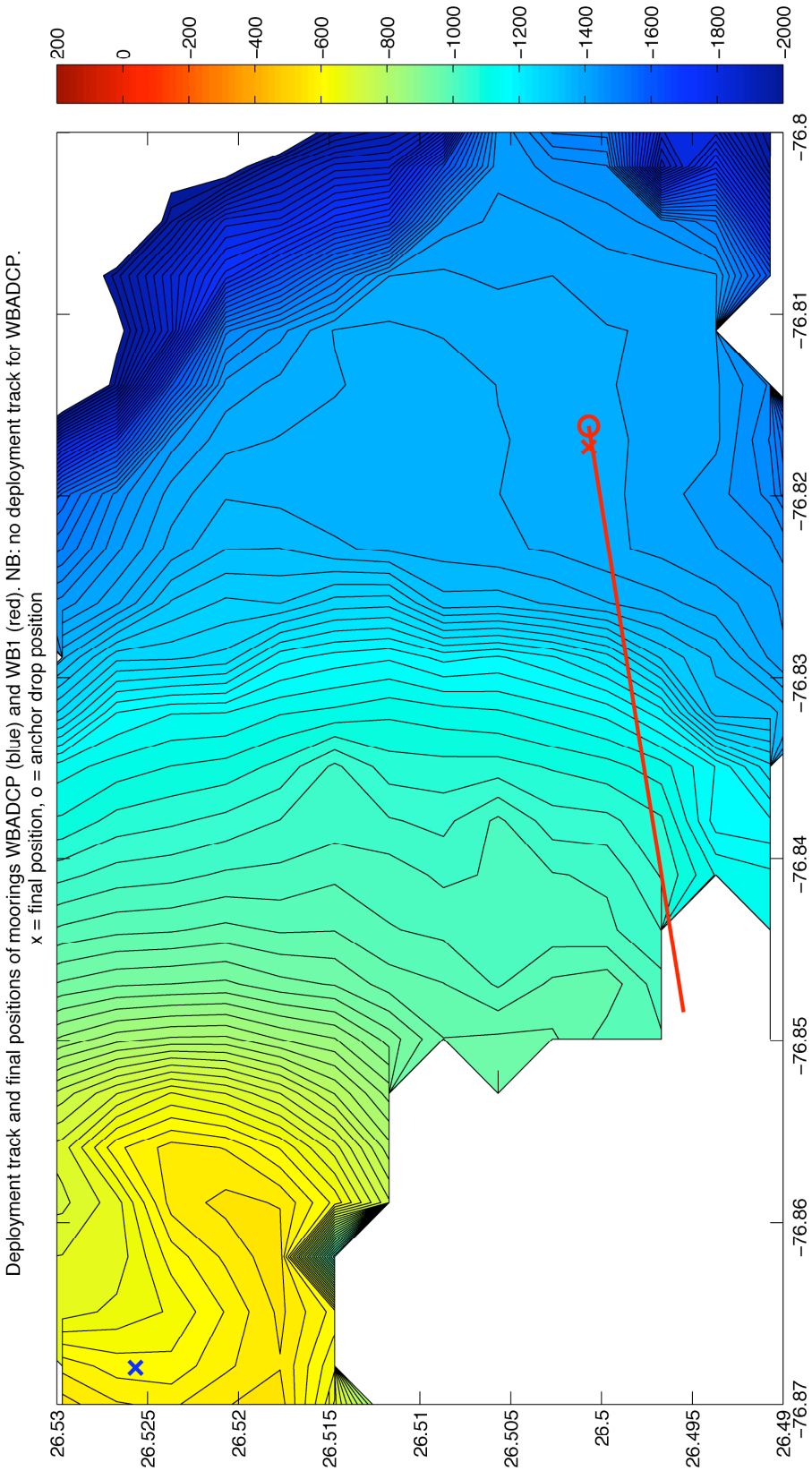
Nortek Aquadopp	Current Meter, s/n:	**3550**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6806**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	800 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6807**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	1000 m
RCM11	Current Meter, s/n:	**428**
	Pings per ensemble:	600
	Temperature range:	Low
	Conductivity range:	32 – 36 *
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	7872
	Instrument started:	26 April 2009 at
	Target depth:	1200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6808**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	1200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6809**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	1600 m
Nortek Aquadopp	Current Meter, s/n:	**3551**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	2000 m

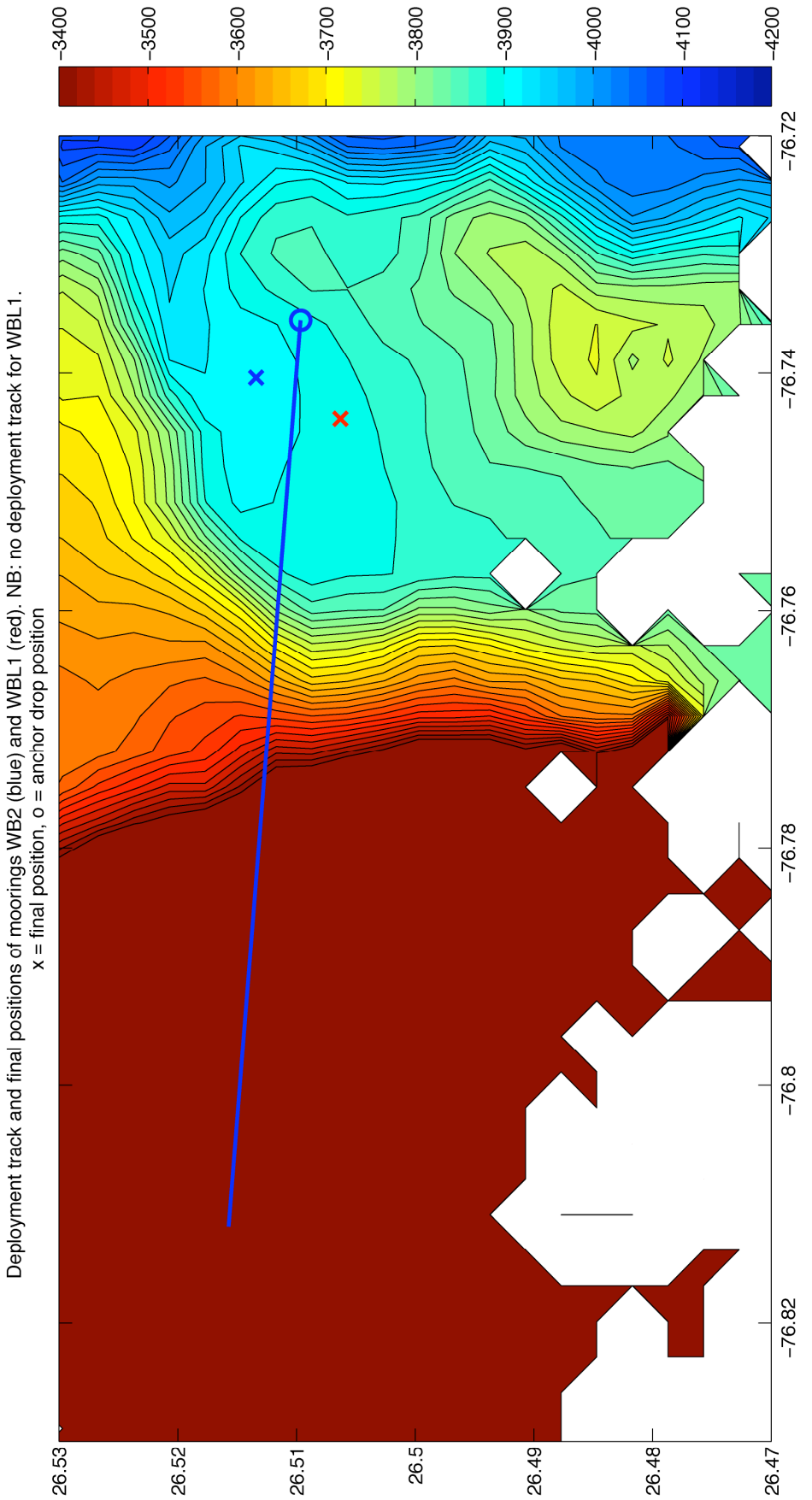
SBE37 MicroCAT	SMP CTD unit, s/n:	**6810**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	2000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6811**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	2500 m
RCM11	Current Meter, s/n:	**518**
	Pings per ensemble:	600
	Temperature range:	Arctic
	Conductivity range:	32 – 34 *
	Recording interval:	30
	No of channels:	8
	Mode:	Burst
	DSU serial number:	14695
	Instrument started:	26 April 2009 at
	Target depth:	3000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6812**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	3000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6813**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	3500 m
Nortek Aquadopp	Current Meter, s/n:	**3552**
	Measurement interval:	1800 s
	Average interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of Sound:	Measured
	Salinity:	35
	Co-ordinate system:	ENU
	Diagnostic Interval:	720 min
	Diagnostic samples:	20
	Target depth:	4000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6814**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	4000 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6815**
	Sample interval:	1800 seconds
	Start Date:	26 April 2009
	Start time:	16:30:00
	Target depth:	4500 m

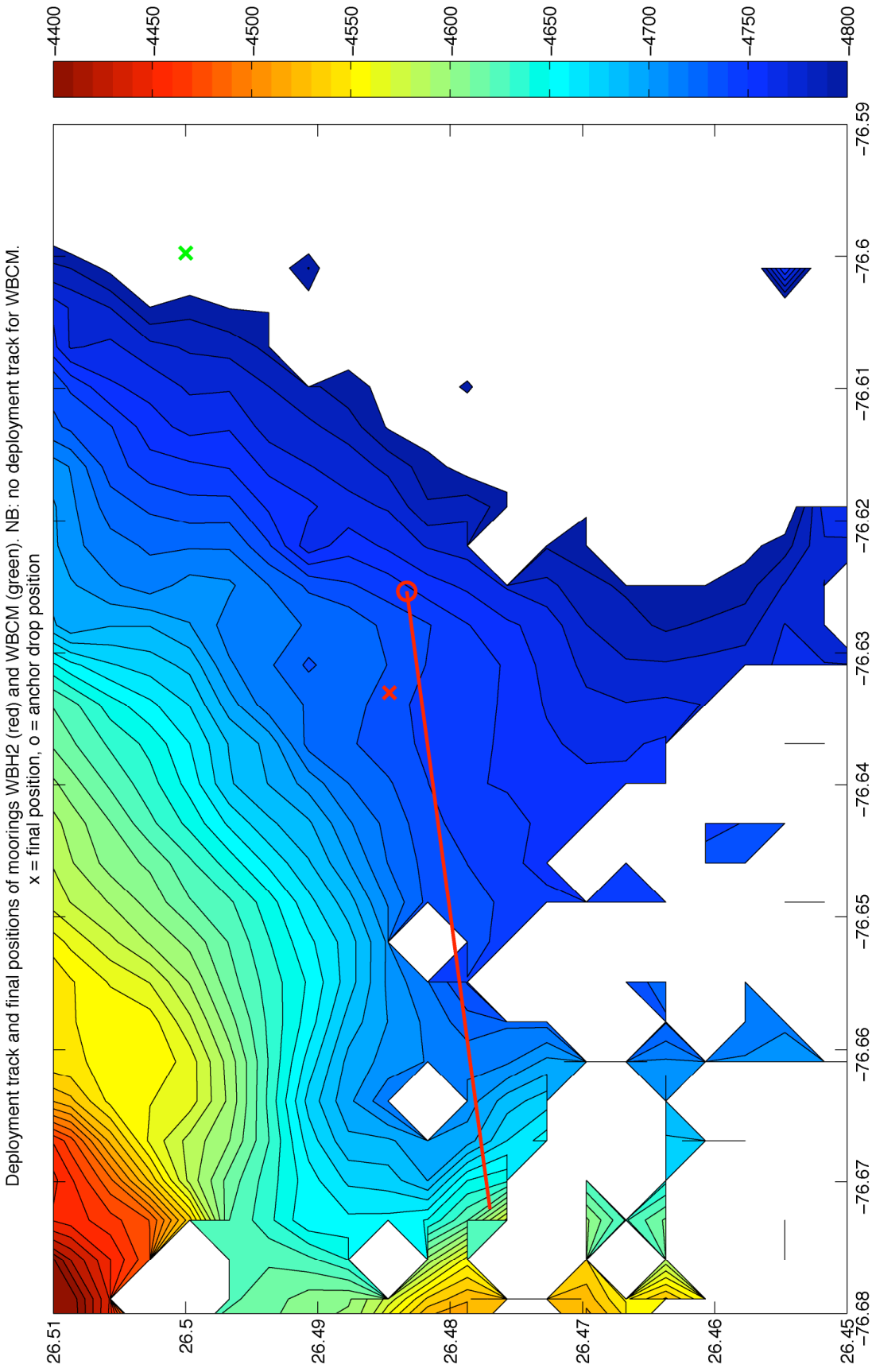
WB6_2_200913

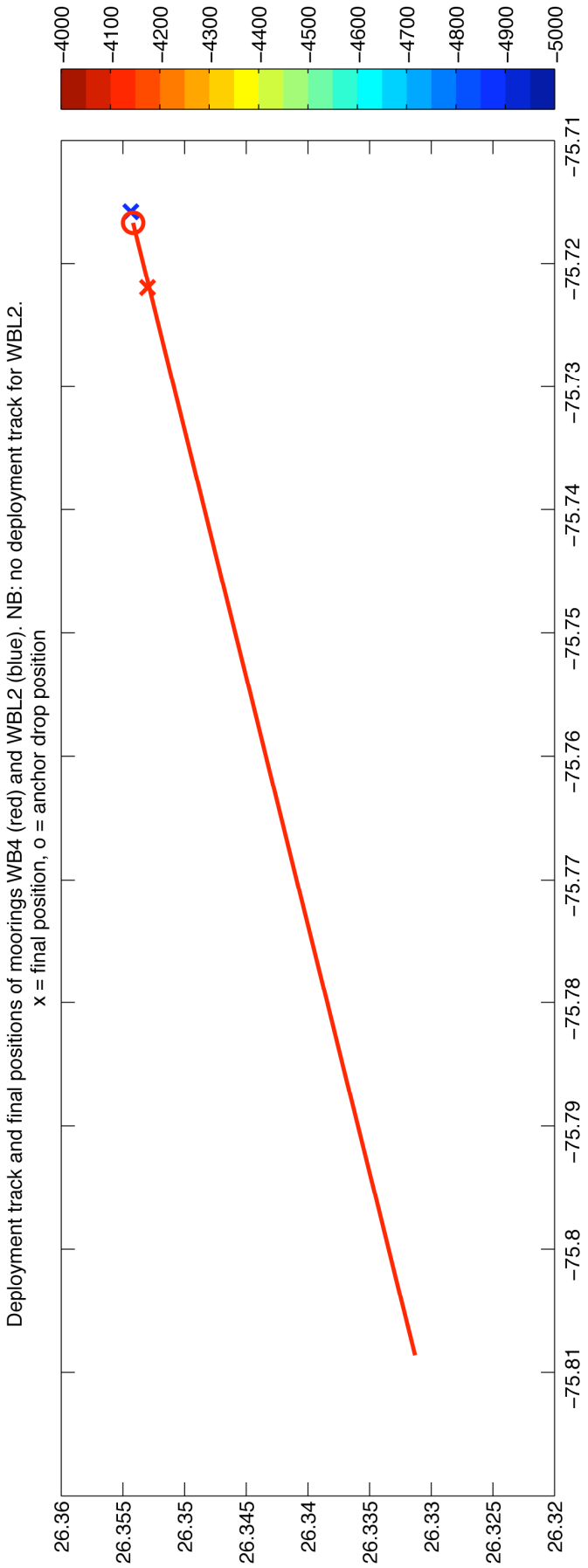
SBE37 MicroCAT	SMP CTD unit, s/n:	**6798**
	Sample interval:	1800 seconds
	Start Date:	25 April 2009
	Start time:	12:00
	Target depth:	5100 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6801**
	Sample interval:	1800 seconds
	Start Date:	25 April 2009
	Start time:	12:00
	Target depth:	5200 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6799**
	Sample interval:	1800 seconds
	Start Date:	25 April 2009
	Start time:	12:00
	Target depth:	5300 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6802**
	Sample interval:	1800 seconds
	Start Date:	25 April 2009
	Start time:	12:00
	Target depth:	5500 m
SBE37 MicroCAT	SMP CTD unit, s/n:	**6800**
	Sample interval:	1800 seconds
	Start Date:	25 April 2009
	Start time:	12:00
	Target depth:	5490 m
SBE53 BPR	BPR unit, s/n:	**0032**
	INITLOGGING:	Y
	Info header:	WB6_2009_deployment_RB0901
	Tide interval:	30 mins
	Tide Measurement Duration:	30 mins
	Reference sample freq:	96
	Start:	25 April 2009 @ 12:00:00
	Target depth:	

Appendix D – Deployment Tracks

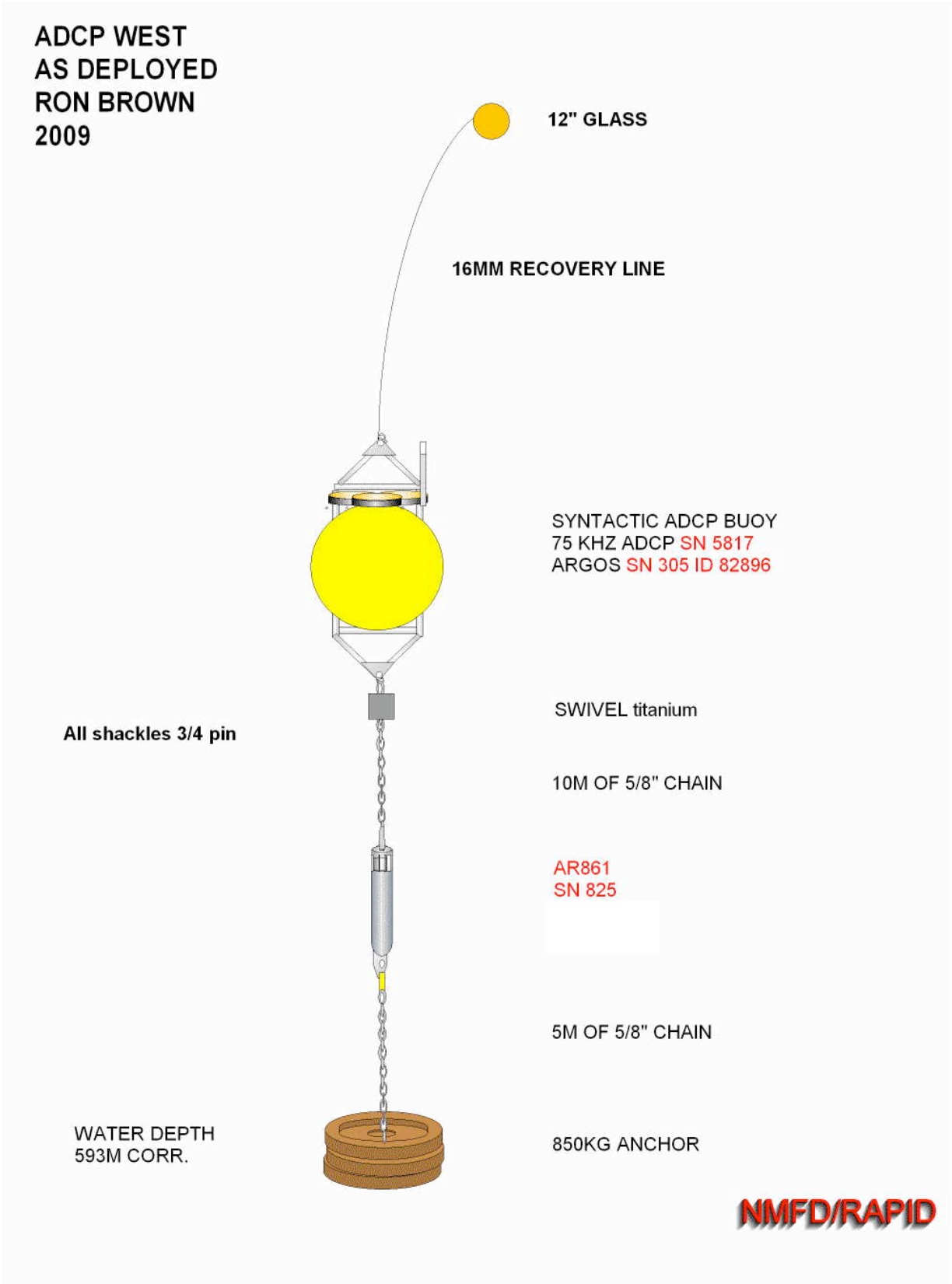


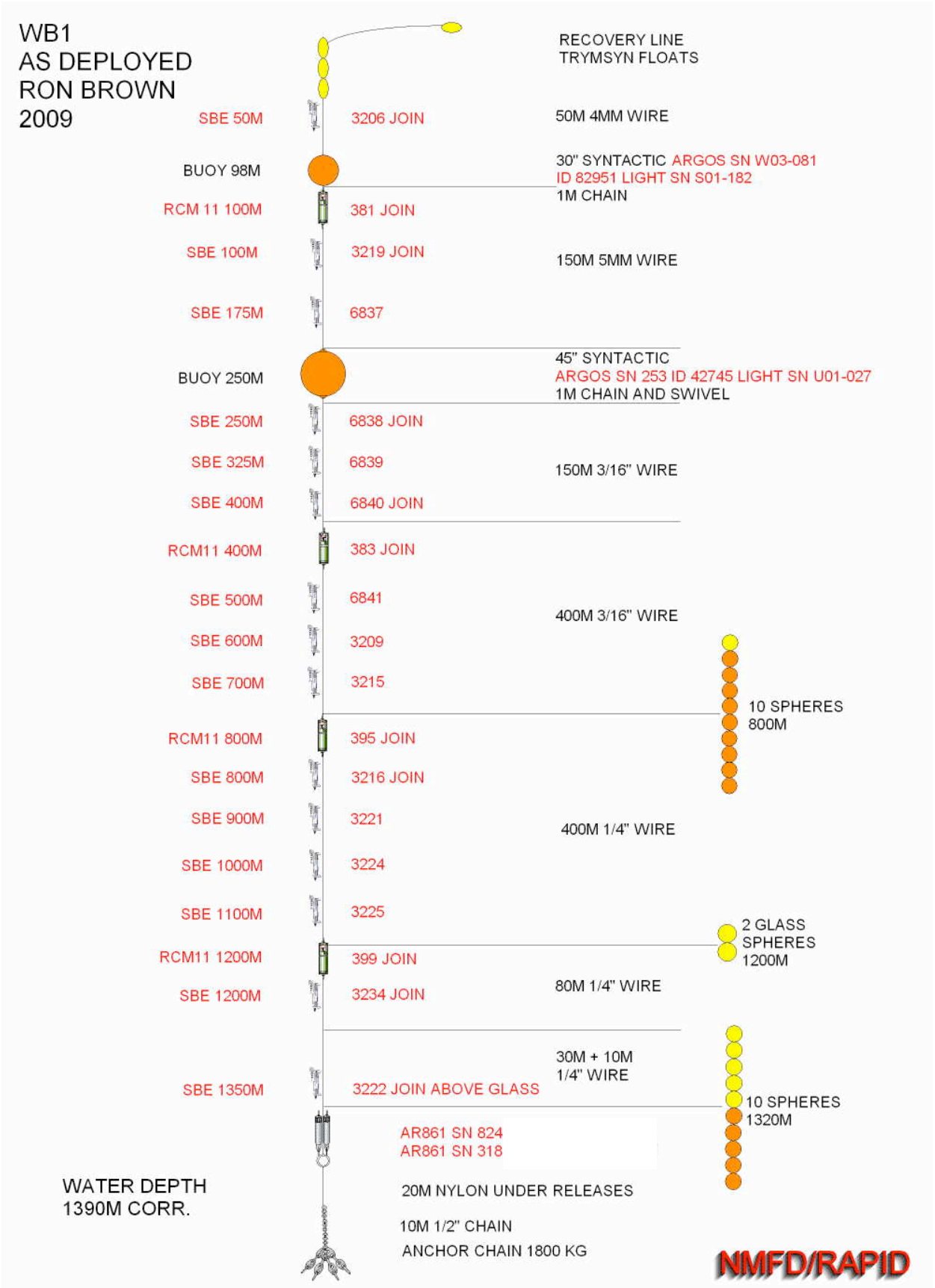

Deployment track and final positions of moorings WB2 (blue) and WBL1 (red). NB: no deployment track for WBL1.
x = final position, o = anchor drop position
-3400
-3500
-3600
-3700
-3800
-3900
-4000
-4100
-4200
-76.72
-76.74
-76.76
-76.78
-76.8
-76.82
26.53
26.52
26.51
26.5
26.49
26.48
26.47

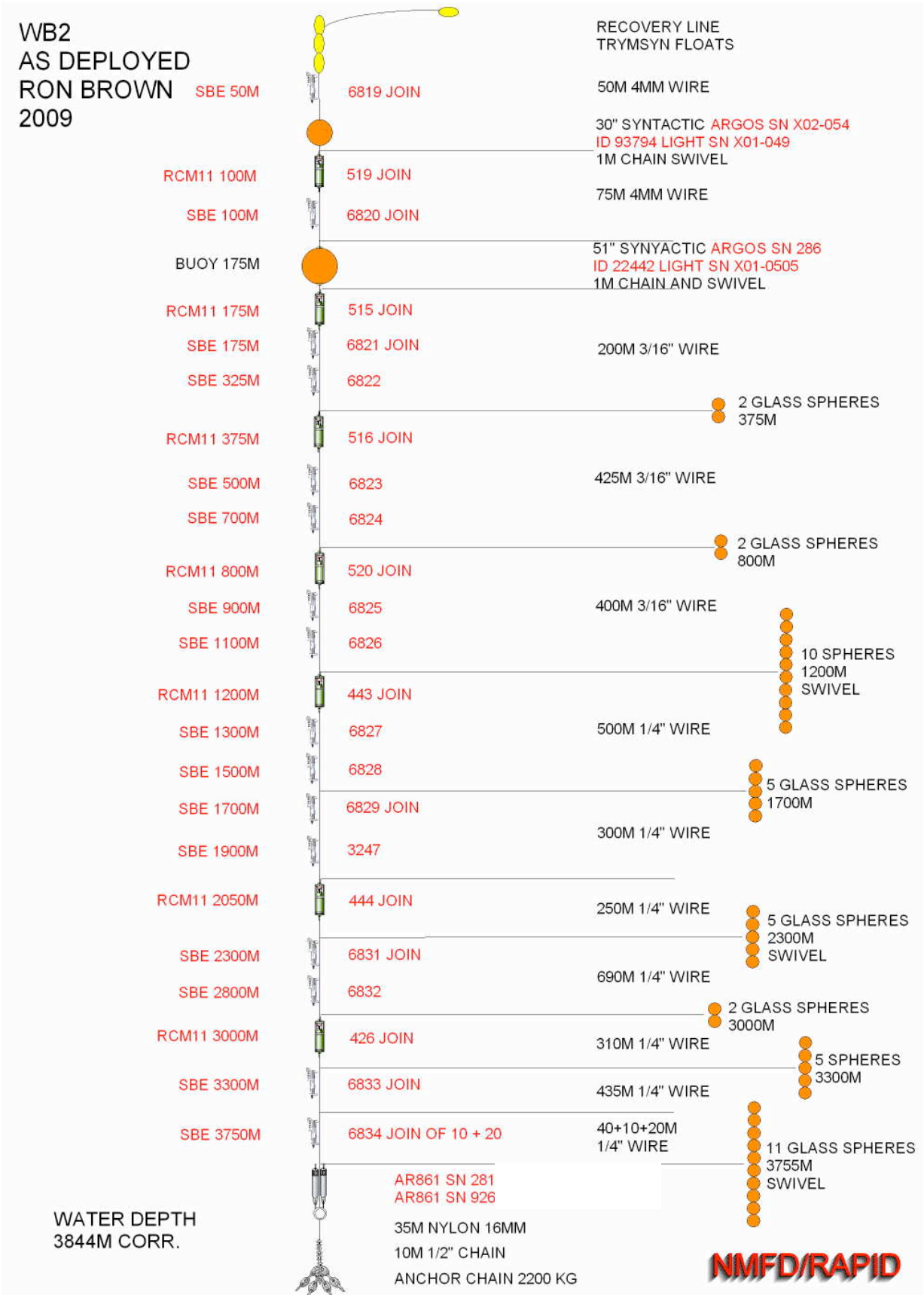

Deployment track and final positions of moorings WBH2 (red) and WBCM (green). NB: no deployment track for WBCM.
x = final position, o = anchor drop position
−4400
−4450
−4500
−4550
−4600
−4650
−4700
−4750
−4800
26.51
26.5
26.49
26.48
26.47
26.46
26.45
−76.59
−76.6
−76.61
−76.62
−76.63
−76.64
−76.65
−76.66
−76.67
−76.68

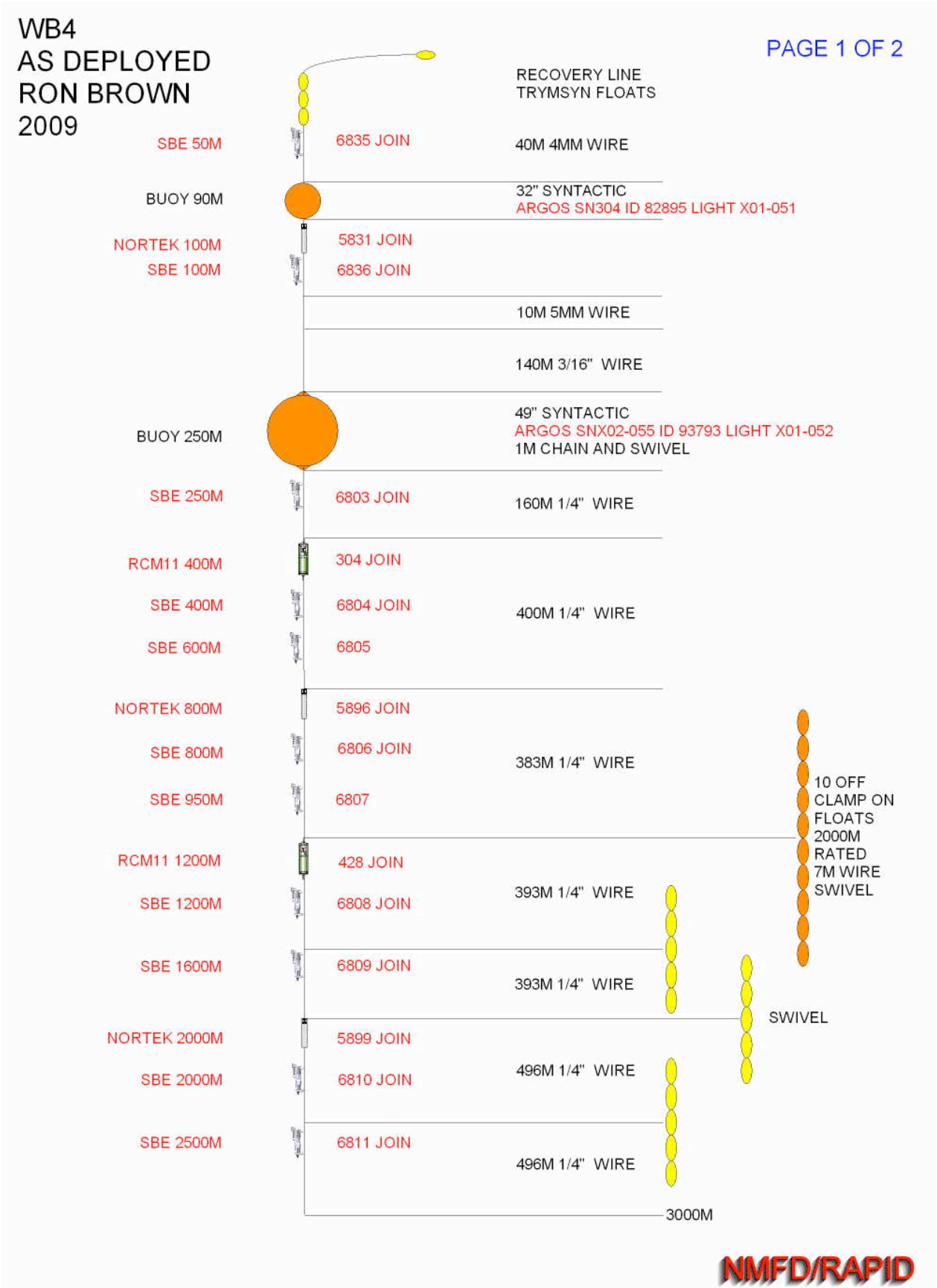

Deployment track and final positions of moorings WB4 (red) and WBL2 (blue). NB: no deployment track for WBL2.
x = final position, o = anchor drop position
−4000
−4100
−4200
−4300
−4400
−4500
−4600
−4700
−4800
−4900
−5000
−75.71
−75.72
−75.73
−75.74
−75.75
−75.76
−75.77
−75.78
−75.79
−75.8
−75.81
26.36
26.355
26.35
26.345
26.34
26.335
26.33
26.325
26.32

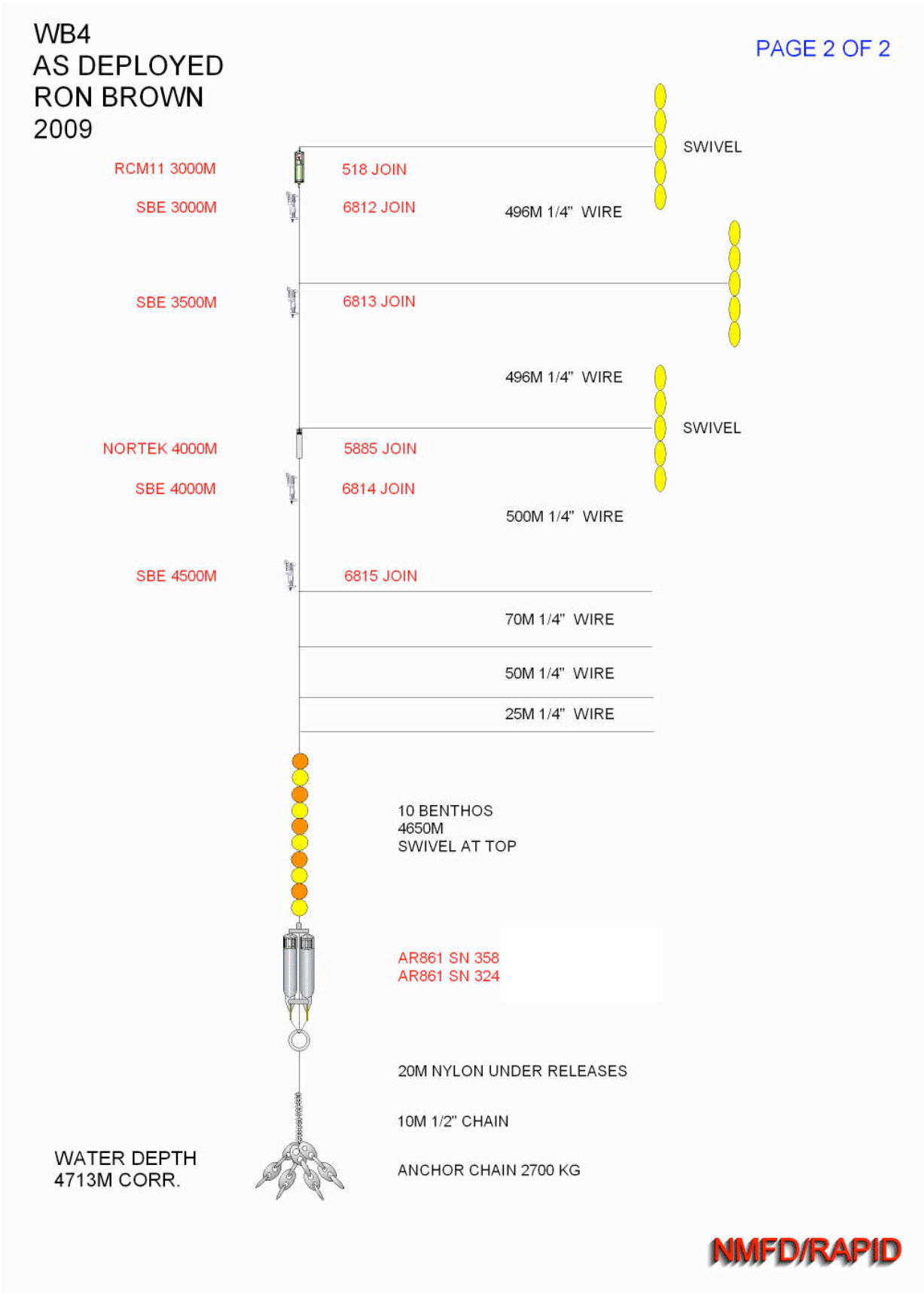
Appendix E - Mooring Diagrams

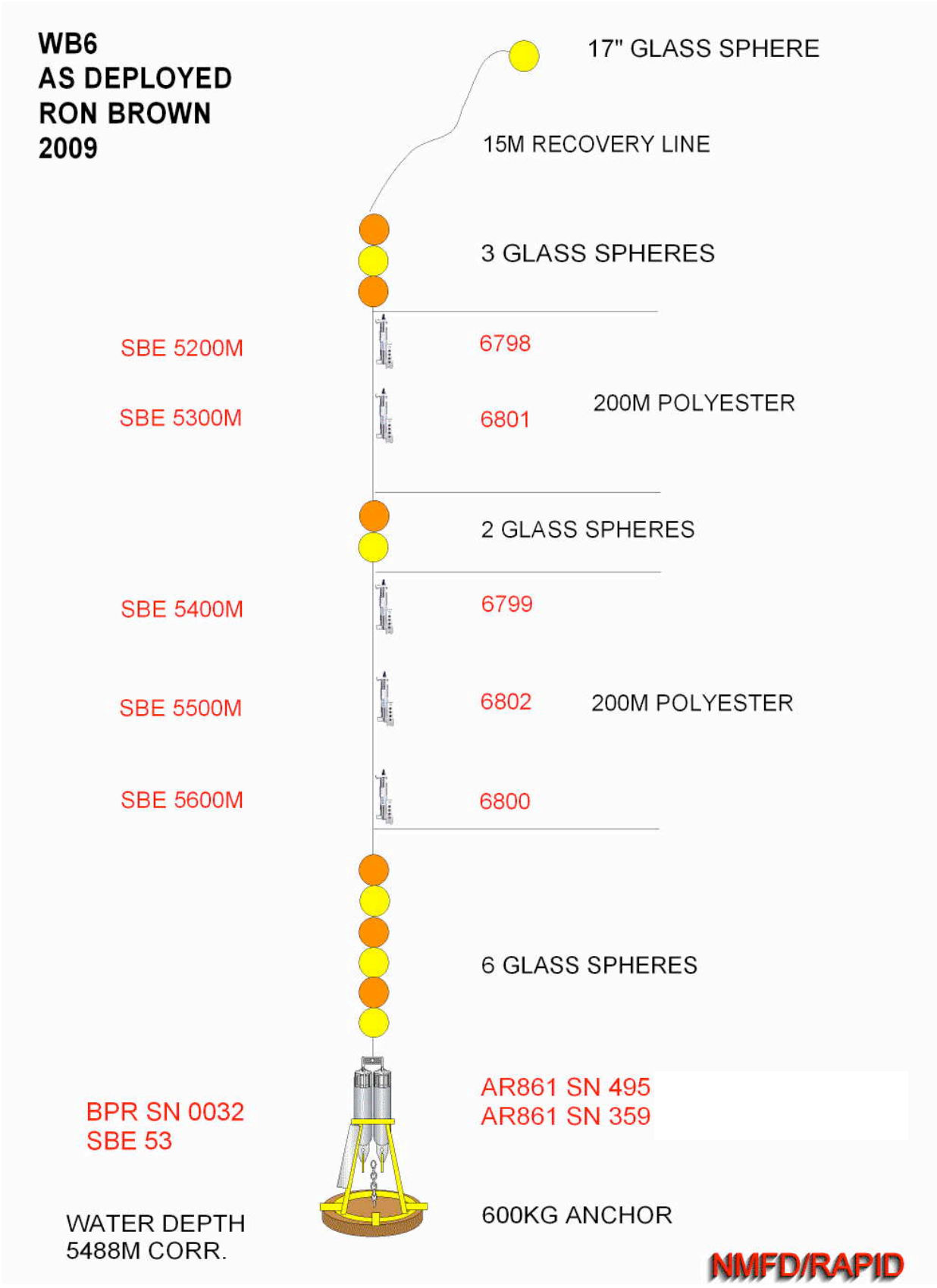


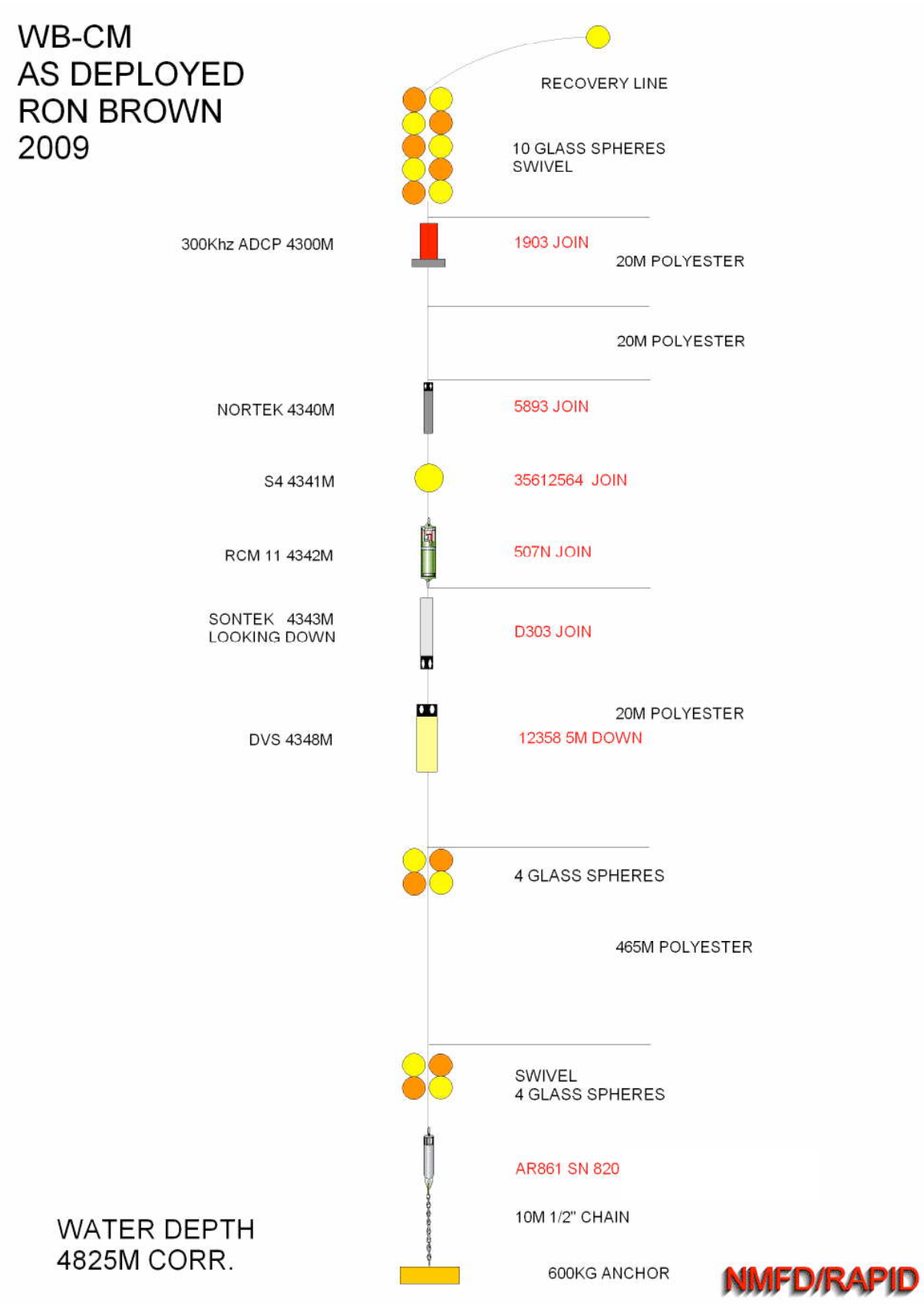

WB1
AS DEPLOYED
RON BROWN
2009
RECOVERY LINE
TRYMSYN FLOATS
SBE 50M
3206 JOIN
50M 4MM WIRE
BUOY 98M
30" SYNTACTIC ARGOS SN W03-081
ID 82951 LIGHT SN S01-182
1M CHAIN
RCM 11 100M
381 JOIN
SBE 100M
3219 JOIN
150M 5MM WIRE
SBE 175M
6837
BUOY 250M
45" SYNTACTIC
ARGOS SN 253 ID 42745 LIGHT SN U01-027
1M CHAIN AND SWIVEL
SBE 250M
6838 JOIN
SBE 325M
6839
150M 3/16" WIRE
SBE 400M
6840 JOIN
RCM11 400M
383 JOIN
SBE 500M
6841
400M 3/16" WIRE
SBE 600M
3209
SBE 700M
3215
10 SPHERES
800M
RCM11 800M
395 JOIN
SBE 800M
3216 JOIN
SBE 900M
3221
400M 1/4" WIRE
SBE 1000M
3224
SBE 1100M
3225
2 GLASS
SPHERES
1200M
RCM11 1200M
399 JOIN
SBE 1200M
3234 JOIN
80M 1/4" WIRE
30M + 10M
1/4" WIRE
SBE 1350M
3222 JOIN ABOVE GLASS
10 SPHERES
1320M
AR861 SN 824
AR861 SN 318
WATER DEPTH
1390M CORR.
20M NYLON UNDER RELEASES
10M 1/2" CHAIN
ANCHOR CHAIN 1800 KG
NMFD/RAPID

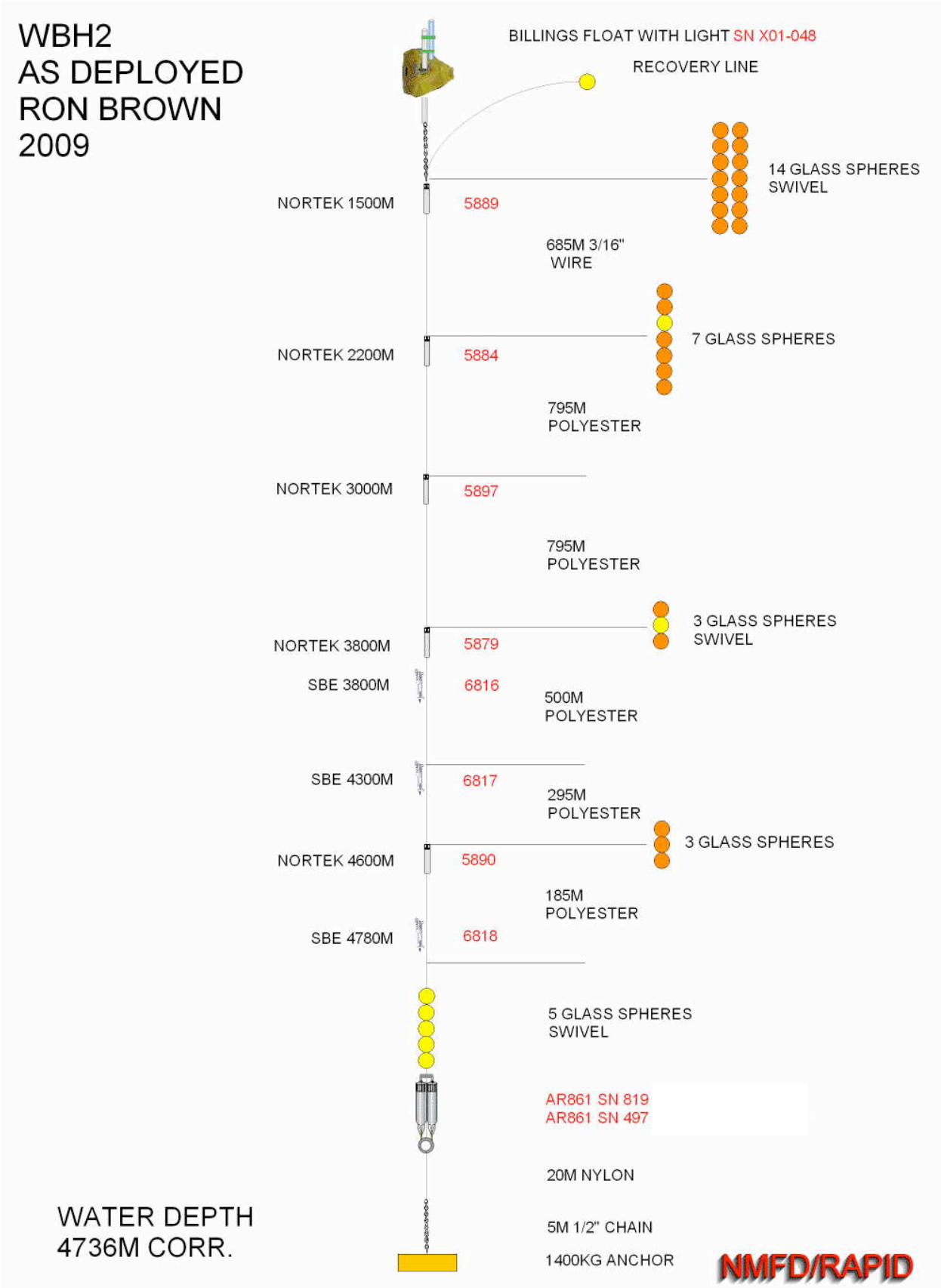

WB2
AS DEPLOYED
RON BROWN
2009
SBE 50M
6819 JOIN
RECOVERY LINE
TRYMSYN FLOATS
50M 4MM WIRE
30" SYNTACTIC ARGOS SN X02-054
ID 93794 LIGHT SN X01-049
1M CHAIN SWIVEL
RCM11 100M
519 JOIN
75M 4MM WIRE
SBE 100M
6820 JOIN
BUOY 175M
51" SYNYACTIC ARGOS SN 286
ID 22442 LIGHT SN X01-0505
1M CHAIN AND SWIVEL
RCM11 175M
515 JOIN
SBE 175M
6821 JOIN
200M 3/16" WIRE
SBE 325M
6822
2 GLASS SPHERES
375M
RCM11 375M
516 JOIN
SBE 500M
6823
425M 3/16" WIRE
SBE 700M
6824
2 GLASS SPHERES
800M
RCM11 800M
520 JOIN
SBE 900M
6825
400M 3/16" WIRE
SBE 1100M
6826
10 SPHERES
1200M
SWIVEL
RCM11 1200M
443 JOIN
SBE 1300M
6827
500M 1/4" WIRE
SBE 1500M
6828
5 GLASS SPHERES
1700M
SBE 1700M
6829 JOIN
300M 1/4" WIRE
SBE 1900M
3247
RCM11 2050M
444 JOIN
250M 1/4" WIRE
5 GLASS SPHERES
2300M
SWIVEL
SBE 2300M
6831 JOIN
690M 1/4" WIRE
SBE 2800M
6832
2 GLASS SPHERES
3000M
RCM11 3000M
426 JOIN
310M 1/4" WIRE
5 SPHERES
3300M
SBE 3300M
6833 JOIN
435M 1/4" WIRE
SBE 3750M
6834 JOIN OF 10 + 20
40+10+20M
1/4" WIRE
11 GLASS SPHERES
3755M
SWIVEL
AR861 SN 281
AR861 SN 926
35M NYLON 16MM
10M 1/2" CHAIN
ANCHOR CHAIN 2200 KG
WATER DEPTH
3844M CORR.
NMFD/RAPID

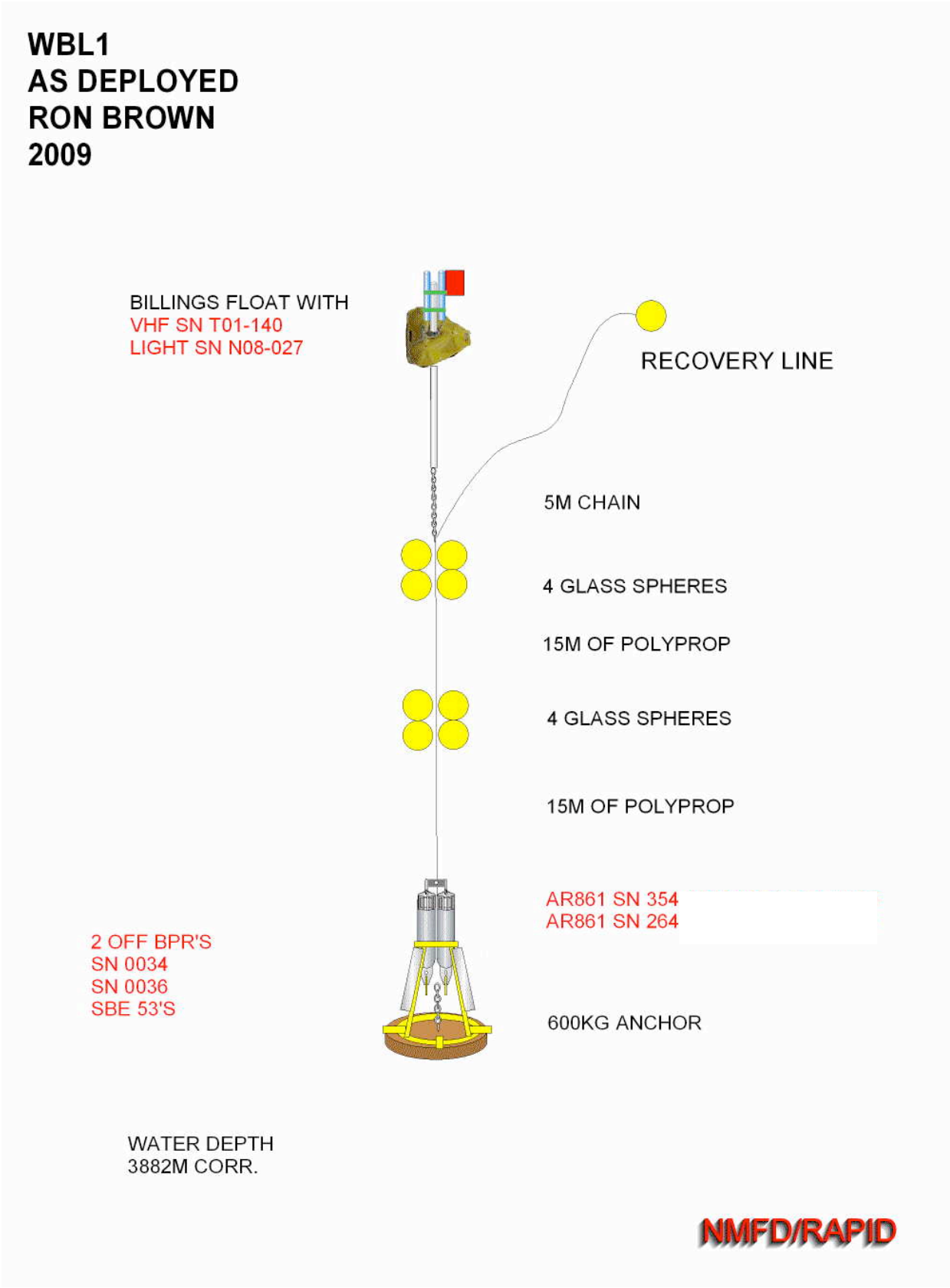

WB4
AS DEPLOYED
RON BROWN
2009
PAGE 1 OF 2
RECOVERY LINE
TRYMSYN FLOATS
SBE 50M
6835 JOIN
40M 4MM WIRE
BUOY 90M
32" SYNTACTIC
ARGOS SN304 ID 82895 LIGHT X01-051
NORTEK 100M
5831 JOIN
SBE 100M
6836 JOIN
10M 5MM WIRE
140M 3/16" WIRE
BUOY 250M
49" SYNTACTIC
ARGOS SNX02-055 ID 93793 LIGHT X01-052
1M CHAIN AND SWIVEL
SBE 250M
6803 JOIN
160M 1/4" WIRE
RCM11 400M
304 JOIN
SBE 400M
6804 JOIN
400M 1/4" WIRE
SBE 600M
6805
NORTEK 800M
5896 JOIN
SBE 800M
6806 JOIN
383M 1/4" WIRE
SBE 950M
6807
10 OFF
CLAMP ON
FLOATS
2000M
RATED
7M WIRE
SWIVEL
RCM11 1200M
428 JOIN
SBE 1200M
6808 JOIN
393M 1/4" WIRE
SBE 1600M
6809 JOIN
393M 1/4" WIRE
SWIVEL
NORTEK 2000M
5899 JOIN
SBE 2000M
6810 JOIN
496M 1/4" WIRE
SBE 2500M
6811 JOIN
496M 1/4" WIRE
3000M
NMFD/RAPID


WB4
AS DEPLOYED
RON BROWN
2009
PAGE 2 OF 2
SWIVEL
RCM11 3000M
518 JOIN
SBE 3000M
6812 JOIN
496M 1/4" WIRE
SBE 3500M
6813 JOIN
496M 1/4" WIRE
SWIVEL
NORTEK 4000M
5885 JOIN
SBE 4000M
6814 JOIN
500M 1/4" WIRE
SBE 4500M
6815 JOIN
70M 1/4" WIRE
50M 1/4" WIRE
25M 1/4" WIRE
10 BENTHOS
4650M
SWIVEL AT TOP
AR861 SN 358
AR861 SN 324
20M NYLON UNDER RELEASES
10M 1/2" CHAIN
ANCHOR CHAIN 2700 KG
WATER DEPTH
4713M CORR.
NMFD/RAPID

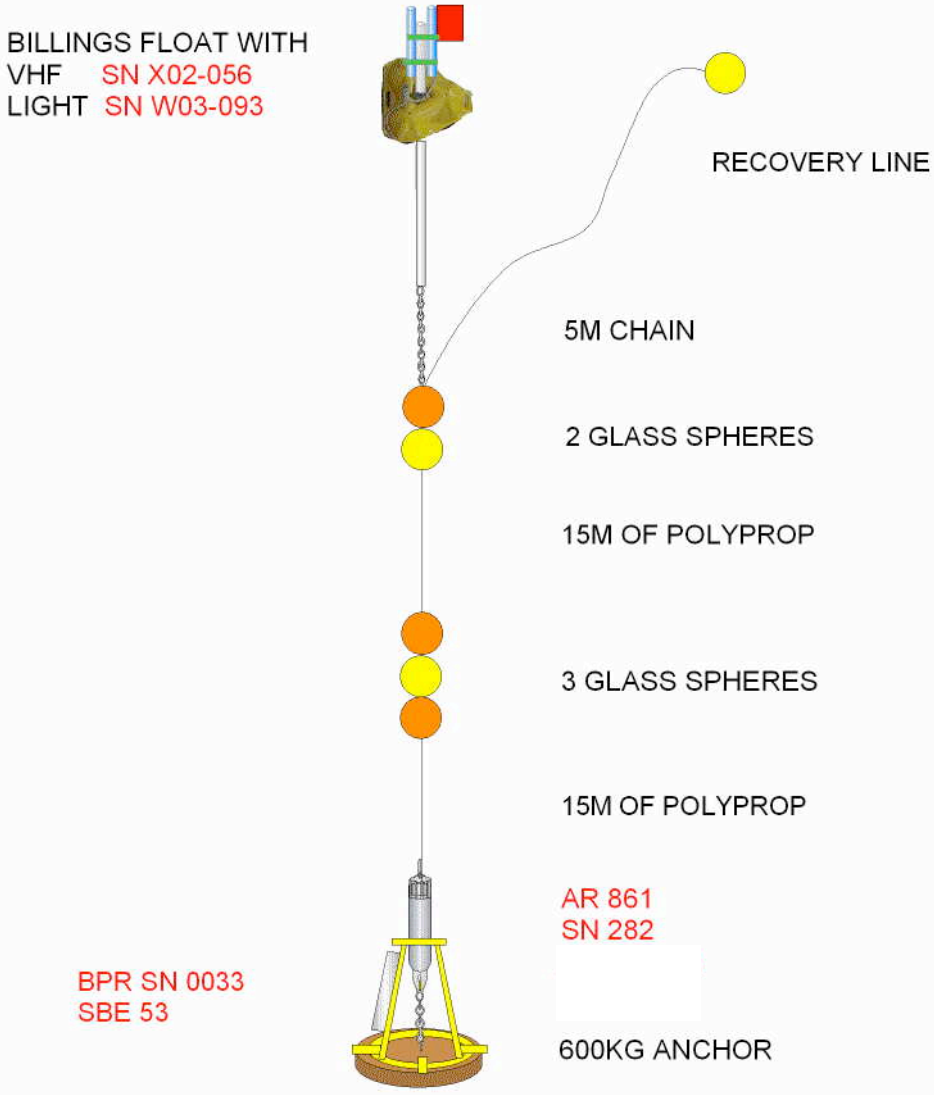

WB6
AS DEPLOYED
RON BROWN
2009
17" GLASS SPHERE
15M RECOVERY LINE
3 GLASS SPHERES
SBE 5200M
6798
SBE 5300M
6801
200M POLYESTER
2 GLASS SPHERES
SBE 5400M
6799
SBE 5500M
6802
200M POLYESTER
SBE 5600M
6800
6 GLASS SPHERES
AR861 SN 495
AR861 SN 359
BPR SN 0032
SBE 53
600KG ANCHOR
WATER DEPTH
5488M CORR.
NMFD/RAPID


WB-CM
AS DEPLOYED
RON BROWN
2009
RECOVERY LINE
10 GLASS SPHERES
SWIVEL
300Khz ADCP 4300M
1903 JOIN
20M POLYESTER
20M POLYESTER
NORTEK 4340M
5893 JOIN
S4 4341M
35612564 JOIN
RCM 11 4342M
507N JOIN
SONTEK 4343M
LOOKING DOWN
D303 JOIN
20M POLYESTER
DVS 4348M
12358 5M DOWN
4 GLASS SPHERES
465M POLYESTER
SWIVEL
4 GLASS SPHERES
AR861 SN 820
10M 1/2" CHAIN
600KG ANCHOR
WATER DEPTH
4825M CORR.
NMFD/RAPID


WBH2
AS DEPLOYED
RON BROWN
2009
BILLINGS FLOAT WITH LIGHT SN X01-048
RECOVERY LINE
14 GLASS SPHERES
SWIVEL
NORTEK 1500M
5889
685M 3/16"
WIRE
7 GLASS SPHERES
NORTEK 2200M
5884
795M
POLYESTER
NORTEK 3000M
5897
795M
POLYESTER
3 GLASS SPHERES
SWIVEL
NORTEK 3800M
5879
SBE 3800M
6816
500M
POLYESTER
SBE 4300M
6817
295M
POLYESTER
3 GLASS SPHERES
NORTEK 4600M
5890
185M
POLYESTER
SBE 4780M
6818
5 GLASS SPHERES
SWIVEL
AR861 SN 819
AR861 SN 497
20M NYLON
5M 1/2" CHAIN
1400KG ANCHOR
WATER DEPTH
4736M CORR.
NMFD/RAPID


WBL1
AS DEPLOYED
RON BROWN
2009
BILLINGS FLOAT WITH
VHF SN T01-140
LIGHT SN N08-027
RECOVERY LINE
5M CHAIN
4 GLASS SPHERES
15M OF POLYPROP
4 GLASS SPHERES
15M OF POLYPROP
AR861 SN 354
AR861 SN 264
2 OFF BPR'S
SN 0034
SN 0036
SBE 53'S
600KG ANCHOR
WATER DEPTH
3882M CORR.
NMFD/RAPID

WBL2
AS DEPLOYED
RON BROWN
2009



WATER DEPTH
4713M CORR.

NMFD/RAPID

Appendix F - Acoustic Release Record

Serial No	Type	Previous Location	Current Location	Date Deployed	Position		Water Depth	Serviced	New Batts	Bench tested	Wire tested	Depth tested
					Lat	Long						
253	AR861	ADCP 07	WBL4 08	28/4/08	26 24.25	75 42.59	4705	Y	Y	Y	Y	4000
318	AR861	ADCP 08	WB1 09	30/4/08	26 30.132	76 49.038	1309	Y	Y	Y	Y	5120
364	AR861	WBL1 07	ON BOARD									
322	AR861	WBL1 07	ON BOARD									
916	AR861	WB1 08	ON BOARD									
264	AR861	WB4 08	WBL1 09	30/4/09	26 30.378	76 44.629	3882	Y	Y	Y	Y	3320
251	AR861	WBL2 – 07	ON BOARD									
249	AR861	WB1 08	ON BOARD									
917	AR861	WB2 08	ON BOARD									
281	AR861	WB6 07	WB2 09	29/4/09	26 30.805	76 44.425	3884	Y	Y	Y	Y	3320
918	AR861	WB2 08	ON BOARD									
363	*AR861*	*WB4 – 06*	*WB4 – 06*	*3/06*	*NO COMMS*	*N/A*	*N/A*					
215	*RT661*	*WB4 – 06*	*WB4 – 06*	*3/06*	*NO COMMS*	*N/A*	*N/A*					
926	AR861	WB4 08	WB2 09	29/4/09	26 30.805	76 44.425	3884	Y	Y	Y	Y	3320
906	AR861	WBH2 08	ON BOARD					Y	Y	Y		
907	AR861	WBH2 08	ON BOARD									
920	AR861	NOC	WBL3 08	24/4/08	26 30.41	76 44.66	3887	Y	Y	Y	Y	4000
919	AR961	NOC	WBLB 08	24/4/08	26 29.93	76 29.64	4857	Y	Y	Y	Y	4000
498	AR861	NOC	WBLB 08	24/4/08	26 29.93	76 29.64	4857	Y	Y	Y	Y	4000
163	RT661	NOC	WBL3 08	24/4/08	26 30.41	76 44.66	3887	Y	Y	Y	Y	4000
282	AR861	NOC	WBL2 09	26/4/09	26 21.261	75 42.949	4713	Y	Y	Y	Y	5120
256	AR861	NOC	ON BOARD					Y	Y	Y	FAIL	5200
359	AR861	NOC	WB6 09	25/4/09	26 29.691	70 31.313	5488	Y	Y	Y	Y	5200
324	AR861	NOC	WB4 09	26/4/09	26 21.180	75 43.320	4713	Y	Y	Y	Y	5200
497	AR861	NOC	WBH2 09	28/4/09	26 29.076	75 37.980	4736	Y	Y	Y	Y	4550
820	AR861	NOC	WB-CM 09	28/4/09	26 30.0	76 35.986	4825	Y	Y	Y	Y	4550
819	AR861	NOC	WBH2 09	28/4/09	26 29.076	75 37.980	4736	Y	Y	Y	Y	4500
495	AR861	NOC	WB6 09	25/4/09	26 29.691	70 31.313	5488	Y	Y	Y	Y	5200
358	AR861	NOC	WB4 09	26/4/09	26 21.180	75 43.320	4713	Y	Y	Y	Y	5200
367	AR861	NOC	ON BOARD					Y	Y	Y	FAIL	5200
825	AR861	NOC	ADCP 09	18/4/09	26 31.54	76 52.08	593	Y	Y	Y	Y	1100
354	AR861	NOC	WBL1 09	30/4/09	26 30.378	76 44.629	3882	Y	Y	Y	Y	3320
824	AR861	NOC	WB1 09	30/4/09	26 30.132	76 49.038	1390	Y	Y	Y	Y	1100

Table F.1 *Record of the acoustic released recovered, used and tested on RB0901*

Appendix G - Logsheets

These are scanned images due to past cases of typos being discovered in the logsheets.

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WBADCP** Cruise **RB0901**

NB: all times recorded in GMT

Date 18/4/09 **Site arrival time** 13:56

Time of first ranging 1401

Time of release 1402

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	Correct?	COMMENT	TIME
2 x Trimsyn	n/a	✓		14:29
15m Polyprop 24mm	n/a			
Syntactic ADCP Buoy	n/a			14:31
75kHz ADCP				↓
Argos Beacon	286		ID 22442	
Titanium swivel	n/a			
10m 5/8" chain	n/a			
Single Release	318			14:35

Ascent rate 120m/min

Time at end of recovery 14:35

Ranging

Time	Range 1	Range 2	Command /comment
1401	601		TELE
140125	601	603	TELE
1402	599	599	REL OK.
1403			

14:07 SPOTTED ON SURFACE APPROX 30-40m FROM SHIP AFT ON PORT SIDE

⇒ 120m/min

GRAPNELED 14:27

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WB1** Cruise **RB0901**

NB: all times recorded in GMT

Date 30/04/2009 **Site arrival time** OVERNIGHT

Time of first ranging 10:29.

Time of release 10:31

ON SURFACE: 10:62 APPROX
APPROACH: 11:07.
GRAPPLED: 11:33.

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	COMMENT	TIME
1x Trimsyn	n/a		11·34
Recovery line	n/a		
TRYMSYN floats	n/a		11:35
SBE37 Microcat	5762	5762	11:36
30" Syntactic with	n/a		11:39
Light and		WIRE TWISTED.	11:39
Argos Beacon	82954	LIGHT GOING OFF.	11:39
1m chain and swivel			
RCM11	300	300	11:39
SBE37 Microcat	5763	5763	11:42
SBE37 Microcat	5764	5764	11:45
41" steel buoy with	n/a		11:49
Light and	U11-018		11:49
Argos beacon	285		11:49
1M chain and swivel	n/a		
SBE37 Microcat	5765	5765.	11·56
SBE37 Microcat	5766	5766	11:58.
RCM11	301	301	12:00
SBE37 Microcat	5767	5767	12:00
SBE37 Microcat	5768	5768	12:05
SBE37 Microcat	5769	5769	12:07
SBE37 Microcat	5770	5770	12:11
10 x 17" glass	n/a	TANGLED UP.	12:16
RCM11	302	302.	12:16
SBE37 Microcat	5771	5771	12:30.
SBE37 Microcat	5978	5978	12:35
SBE37 Microcat	5979	5979	12:39
SBE37 Microcat	5980	5980.	12:42
2 x 17" glass	n/a		12:45
RCM11	303	303.	12:45
SBE37 Microcat	5981	5981	12:47

~~TOP CONNECTOR SHEARED OFF~~ {CONE ATTACHMENT BLOCK IN WATER & FLOODED INSTRUMENT

SBE37 Microcat	5982	5982.	12:51
10 x 17" glass	n/a		12:52 – 12:54
Acoustic release	916	916	12:55
Acoustic release	249	249.	12:55

Ascent rate
Time at end of recovery 12:55.

Ranging

Time	Range 1	Range 2	Command /comment
10:29	4796	1029.	RANGING.
	1375	-54.8	"
	1374	-506.7	"
	1375		"
10:31	1373	-508.4	FIRE COMMAND. - RELEASE OK.
10:32	1260	1246	ON WAY UP - CONFIRMED RELEASE.
	[redacted]		

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WB2** Cruise **RB0901**

NB: all times recorded in GMT

Date 29/4/09 **Site arrival time** OVERNIGHT

Time of first ranging ~~10:33~~ 10:33

Time of release 10:42 &10

SURFACE : 10:47.
APPROACH : 11:49.
GRAPPLED : 12:00

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	COMMENT	TIME
1 x Trimsyn	n/a		12:11
Recovery line	n/a		
3 x Trimsyns	n/a		12:10
SBE37 Microcat	5772	5772.	12:00
30" Syntactic with	n/a		12:08
Light and			12:09
Argos Beacon			12:08
1m 5/8" chain	n/a		12:08
Swivel			
RCM11	451	451	12:09
SBE37 Microcat	5773	5773	12:06
48" steel buoy with	n/a		12:19
Light and			
Argos beacon			
1M chain	n/a		
Swivel	n/a		
RCM11	305	305	12:21
SBE37 Microcat	5774	5774	12:26
SBE37 Microcat	5775	5775	12:33
RCM11	306	306.	12:36
SBE37 Microcat	5776	5776	12:41
SBE37 Microcat	5777	5777	12:46
2 x 17" glass	n/a	COMING UP BELOW SURFACE.	12:49
RCM11	445	445	12:49
SBE37 Microcat	5778	5778	12:54
SBE37 Microcat	5779	5779	12:59
12 x 17" glass	n/a		13:02
RCM11	448	448	13:05
SBE37 Microcat	5780	5780	13:09
SBE37 Microcat	5781	5781	13:13
5 x 17" glass	n/a	[redacted]	13:17
SBE37 Microcat	5782	5782	13:18
SBE37 Microcat	5983	5983	13:24

MICROCAT, 12:06

13:05

63 FISH CAUGHT

(1) MOORING SURFACED IN A LOOP - GRAPPLED 48" STEEL 15" - HAULED IN OPEN PORTION OF MOORING BY HAND.

RCM11	449	449	13:26
7 x 17" glass	n/a		13:32
SBE37 Microcat	5984	No mark, instrument put ~50m below joint 5984	13:48
SBE37 Microcat	5985	5985	13:53
RCM11	450	450	13:58
7 x 17" glass	n/a		14:07
SBE37 Microcat	5986	5986	14:11
SBE37 Microcat	5987	5987	14:19
9 x 17" glass	n/a		14:22
Acoustic release	317	Record both serial numbers 917	14:22
Acoustic release	318	918	14:22

Ascent rate
Time at end of recovery 14:22

Ranging

Time	Range 1	Range 2	Command /comment
10:33	—	—	NORMAL XDUCR ARM
10:38	820	3853 ✓	SURFACE DUCER
10:39	3186	825	
	3861	—	
10:40	—	—	ARM
		3863	
10:42:10	3862	3862	NOT CONFIRMED ARM + RELEASE
10:42:50	3803	3789	NOT CONFIRMED
10:43:40	3705	3690	

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WBL1** Cruise **RB0901**

NB: all times recorded in GMT

Date 29/04/2009 **Site arrival time** 15:15

Time of first ranging 15:20

Time of release 15:24 ON SURFACE 16:11.

APPROACH 16:30 APPROACH 2 16:47

GRAPPLED 16:48

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

Ascent rate 86 m/MIN

Time at end of recovery 17:07.

ITEM	SER NO	COMMENT	TIME
Floater with VHF and	U11-017		16:52
Light	U11-020		16:52
1M of 3/8" chain	n/a		
Recovery line	n/a		
17" glass	n/a		16:50
15M polyprop	n/a		
4 x 17" glass	n/a		16:59
15M polyester 12mm	n/a		
4 x 17" glass	n/a		17:02
15M polyester 12mm	n/a		
BPR	398	0398	17:07
BPR	399	0399	17:07
Acoustic release in tripod	364	364	17:07
Acoustic release in tripod	322	322	17:07.

Ranging

Time	Range 1	Range 2	Command /comment
15:20	—	—	ARM
	—	—	
	—	—	
15:22	—	3849	ARM
15:23	3848.5	3845	
15:24:45	3850	3848	ARM + RELEASE NOT CONFIRMED
15:25:30	3805	3794	REL OK
15:26:30	3719	3710	

86 m/min

GA 16:09

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WBH2** Cruise **RB0901**

NB: all times recorded in GMT

Date 28/04/2009. **Site arrival time** 17:02

Time of first ranging 17:05

Time of release 17:45:30

SURFACE 17:32.
APPROACH 18:29. 2ND APPROACH. 19:14
GRAPPLED 19:17

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

Ascent rate 97m/min

Time at end of recovery 21:34.

ITEM	SER NO	COMMENT	TIME
1 x 17" glass	n/a		19:18
Recovery line	n/a		
Billings float with	n/a	TANGLED UP.	19:22
Light and	W08-027		19:22
Argos Beacon			19:22.
14 x 17" glass	n/a		19:22
Swivel	n/a		
RCM11	381	381	19:23
7 x 17" glass	n/a	TANGLED UP	19:41
RCM11	383	383	19:41
RCM11	395	395	20:18
3 x 17" glass	n/a		20:44.
Swivel	n/a	TANGLED UP	
RCM11	399	399	20:44
SBE37 Microcat	5988	5988	20:39
SBE37 Microcat	5989 ✓	5989	21:03
3 x 17" glass	n/a	DRUM FULL REMAINING LAST 2 LENGTHS	21:16
RCM11	426 426.	OF WIRE INTO BASKET	21:16
SBE37 Microcat	5990 5990	TANGLED.	21:31
5 x 17" glass	n/a		21:33
Swivel	n/a		
Dual Release	907	907	21:34
	906 906	CORRODED - BOLT OUT. - LIKE THE BOLTS WERE BURNING THROUGH - DIFFERENT METALS ?	21:34

Ranging

Time	Range 1	Range 2	Command /comment
17:05	4881	9220	ARM
17:06	9139	9212	
	9494	986	

	6724	9181	ARM
	4479	9199	
17:09:30	3841	9199	
	7446	256-1	
17:14 30	4789	4788	SUBCANCEL
17:15:30	/	4789	ARM + RELEASE – UNCONFIRMED
17:16:20	4721	1941 X	RELEASE OK
17:17:20	2389 X	1068 X	REL OK
17:17:40	/	/	
17:18:20	/	/	
17:19:30	/	/	ARM
17:20:15	/	/	

17:21:00 /

17:22:00 4174 4161

17:23:00 4077 4066

97 m/m in.

4077 − 3200 = 877

$$\frac{877}{97}$$

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WB4** Cruise **RB0901**

NB: all times recorded in GMT

Date 27/4/09 **Site arrival time** OVERNIGHT

Time of first ranging 10:30

Time of release 10:45. ON SURF 10:52 APPROX. APPROACHING 11:33 SEADOGG 11:52.

Latitude 26° 24.3344 N **Longitude** 075° 42.7472 W

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	COMMENT	TIME
Single Trimsyn	n/a	F	11:54
Recovery line	n/a		
4 x Billings	n/a		
SBE37 Microcat	3206	3206	11:57
3x17"	n/a		
Light and	So1-182		11:57
Argos Beacon	W03-81		11:57
RCM11	519	519	12:03
SBE37 Microcat	3219	3219	12:05
8x17"Benthos	n/a		12:09
swivel	n/a		
SBE37 Microcat	3220	3220 CONDUCTIVITY CAGE MISSING.	12:18
6x17" Benthos			12:25
RCM11	515	515	12:25
SBE37 Microcat	3222	3222	12:29.
SBE37 Microcat	3221	3221	12:37
RCM11	516	516	12:42
SBE37 Microcat	5783	5783	12:42
SBE37 Microcat	5784	5784	12:50
12 x 17" glass	n/a		12:55
Swivel	n/a		12:58
RCM11	520	520	12:58
SBE37 Microcat	5785	5785	13:01
4 x 17" glass	n/a		13:09
SBE37 Microcat	5786	5786	13:10
4 x 17" glass	n/a		13:20
RCM11	443	443	13:20
SBE37 Microcat	5787	5787	13:23
4 x 17" glass	n/a		13:34
SBE37 Microcat	5788	5788	13:43
4 x 17" glass	n/a	ONE SMASHED	13:53

RCM11	444	444	13:53
SBE37 Microcat	5789 5789	ONLY ATTACHED BY ONE CLIP	1355
4 x 17" glass	n/a		
SBE37 Microcat	5991 /5991	~~MISSING CLIP SLID DOWN~~ [illegible] RETURNED	14:10
4 x 17" glass	n/a		14:19
RCM11	507 507	RCM11 +	14:20
SBE37 Microcat	5992 5992.	MICROCAT + GLASS TANGLED UP.	14:19.
SBE37 Microcat	5993 5993	.	14:32
10 x 17" glass	n/a	GLASS TANGLED UP.	
Acoustic release	926 926	Releases deployed in line #926 above 264 => #264 should be released first *	14:37
Acoustic release	264 264		14:37.

WIRE TWISTED + DAMAGED

Ascent rate
Time at end of recovery 14:38 .

Ranging

Time	Range 1	Range 2	Command /comment
10:41	4653		NO RANGES WITH NORMAL X-DECK
10:44	4655		

← VALID RANGES WITH SUPER DECK

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WBL2** Cruise **RB0901**

NB: all times recorded in GMT

Date 27/4/09 **Site arrival time** 17:00

Time of first ranging 17:01

Time of release 17:28

ON SURFACE : 18:09.
APPROACH : 18:38
GRAPPLED. 18:41

Latitude 26° 30.7432 **Longitude** 76° 09.7491 W

(record positions at time of pickup only if likely to be very different from deployment position)

Ascent rate 80 m/min

Time at end of recovery 18:55.

FLOAT ON DECK. 18:46

ITEM	SER NO	COMMENT	TIME
Floater with VHF and	T01-140		18:47
Light	U01-027		18:47.
1M of 3/8" chain	n/a		
Recovery line	n/a		
2x 17" glass	n/a		18:49
15M polyprop	n/a		
4x 2 x 17" glass	n/a		18:52
15M polyester 12mm	n/a		
4 x 17" glass	n/a		
15M polyester 12mm	n/a		
BPR in tripod	0393	0393.	18:54
Acoustic release in tripod	251	251	18:54.

Ranging

Time	Range 1	Range 2	Command /comment
17:07	4762	4761.9	VICATIVE DIAGNOSTICS
17:07:30	4764.5	4764.	
17:08	4762.3	4761	RELEASE NOT CONFIRMED
	4725		
17:10:00	4674	4665	RANGES DECREASING
17:11:00	/	/	
17:12:00	4501		173m IN 130 SECS.
			=> 79.8 m/min
			∴ 8 MINS TO SURFACE
			= 18:08 ETA

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **E-Lander** Cruise **RB0901**

NB: all times recorded in GMT

Date 25/04/2009 **Site arrival time** 20:22

Time of first ranging ① 20:32 / ② 20:48

Time of release ① [redacted] 20:36 / ② [redacted]

Latitude 26° 30.5182N **Longitude** 71° 58.3778 W.

(record positions at time of pickup only if likely to be very different from deployment position) SIGHTED — 21:38 - GRAPPLED BUT LOST 22:17 SUNK ? —

Ascent rate 1-8 m/s

Time at end (of recovery) 22:33.

" " " (OF RE-RANGING) 23:15.

22:23 - RANGED & SINKING.
22:31 - 2ND RANGE SINKING -

ITEM	SER NO	COMMENT	TIME
Float with VHF and light	RS1001	ALL LOST.	
Recovery line	n/a		
10 x 17" glass	n/a		
5m 3/16" wire	n/a		
BPR in frame	1001		
Acoustic release in frame	710099		
Acoustic release in frame	015617		

WIRE - THE BALLS CRACKED AS THE MOORING WAS GRAPPLED AROUND THE BACK OF THE SHIP.

22:32 - 140 OOM DOWN AND SINKING

②
26° 30.846N
71° 59.1672W.

22:40 SOME CONFUSION AS TRANSLENG 2-WAYS WHEN RANGED MOVING BACK TO GREY LOCK TO TRY RANGING AGAIN.

ON SITE AGAIN
22:57
26° 30.7975 N
71° 58.[redacted]8W
3 OOOm AWAY
RANGED
3375m 23:00
3396m 23:04
∴ SINKING
BOTH RELEASES DISABLED.

Ranging

Time	Range 1	Range 2	Command /comment

1ST RELEASE COMMUNICATION ESTABLISHED, RELEASED BUT NO APPARENT CHANGE IN RANGE ∴ NO ASCENT.

2ND RELEASE COMMUNICATION ESTABLISHED - RANGE ALTERED RELEASING SOON AFTER

RECOMMENDATIONS BUOYANCY BROUGHT ALONGSIDE SHIP IN FUTURE - NOT REVERSED ONTO ALONG STERN

SEEMS MOST LIKELY THAT GLASS BUOYANCY BALLS COMPROMISED AS MOORING BROUGHT AROUND STERN OF SHIP -

RAPID-WATCH MOORING LOGHSEET RECOVERY

Mooring **WB6** Cruise **RB0901**

NB: all times recorded in GMT

Date 25/4/09 **Site arrival time** 08:40 ISH

WAITING FOR 1ST LIGHT

Time of first ranging 09:01

Time of release 09:14 X

10:48

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	COMMENT	TIME
Pick Up float			12:17:03
15m polyprop			
3 x 17" glass			12:21:08
Microcat at join	3283 ✓	3283 FLOODED.	12:22:23
200m polyester			
2 x 17" glass			12:33
Microcat at join	4467	4467 FLOODED.	12:33
200m polyester			
Microcat at join	4471	4671	12:49
4 x 17" glass			12:50
BPR on tripod	0392	0392	12:50
Single release in tripod			12:50

Ascent rate 89 m/min

Time at end of recovery 12:51

Ranging ARM 1489

Time	Range 1	Range 2	Command /comment
09:01	3158	3473	DECK UNIT 26
	2328	3161	
09:04	1655		DECK UNIT 26
09:09	3206	835	UNIT 26
09:10	5415 ✓	8756 X	NO RESPONSE ON TRUCK
~~09:14~~			LOTS OF NO RESPONSES
09:14			1ST RELEASE SENT BUT NO REPLY
~~09:24~~ 09:41	10565	—	LOWER SUPER DUCK FURTHER
09:35	8050m		
09:39	8378m		
09:42	9670m		

HAND DUNKER

SUPER DUCK

REPOSITIONED SHIP OVER MOORING POSITION AND TRY AGAIN.

10:48 5409 RELEASE OK DECK UNIT 26 WITH SUPER DUCK

10:49 ✓

10:50:40	5797		
10:52:23	5053		
10:54:23	4976		177 m/2min ⇒ 89m/min
10:58	4592		

$\frac{4976}{89}$ = 54 mins. 10:54 + 54 mm = 11:48 ETA

LCSJ 400m = 50 mins

⇒ 11:44 ON SURFACE ETA.

11:45 SPOTTED ON SURFACE

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WBADCP** Cruise **RB0901**

NB: all times recorded in GMT

Date 18/4/09 **Site arrival time** 13:30

Setup distance 0

Start time 13:47 **End time** 13:52

Uncorrected water depth 584 (at anchor launch)

Corrected water depth 593 (at anchor launch)

Latitude 26° 31.54 N **Longitude** 76° 52.08 W

ITEM	SER NO	COMMENT	TIME
2 x TRIMSYN	/	NOT TRIMSYN — 1X GLASS	13:47
15m POLYPROP 24mm	/		
SYNTACTIC ADCP BUOY	/		13:49
75 KHZ ADCP	5817		
ARGOS BEACON	305	Record PTT below	
Titanium swivel	/		
10m 5/8" chain	/		
Release	825		13:52
5m 5/8" chain	/		
Anchor 850 KG	/		13:52

Argos beacon #1 ID (PTT) 82896 ← FROM ROB

Release #1 arm code

Release #1 release code

Mooring **WB1** Cruise **RB0901**

NB: all times recorded in GMT

Date 30/04/2009. **Site arrival time** 16:45.

TUP AWAY — WOM SITE OUT FISHING CRAFT. **Setup distance** ~~N/A~~ 2.5NM.

Start time 16:52 **End time** 19:03

Start Position

Latitude 26° 29.7287N **Longitude** 76° 50.9050W

	ITEM	SER NO	COMMENT	TIME
	Recovery line + float			16:52
	3 TRYMSYN floats		3X YELLOW	16:53
	SBE37 Microcat	3206		16:53
*1	30" SYNTACTIC	W03-081	ORANGE	16:56
	ARGOS	[redacted]	Record beacon ID [redacted] 82951	16:56
*1	Light	S01-182		16:56
	1m chain and swivel			
	RCM11	381		16:56
	SBE37 Microcat	~~3206~~	3219	16:58
	SBE37 Microcat	~~3219~~	6837	17:02
	45" syntactic buoy	[redacted]	ORANGE	17:11
	ARGOS	253	Record beacon ID 42745	17:11
*1	LIGHT	U01-027		17:11
	1m chain and swivel			
	SBE37 Microcat	6838		17:13
	SBE37 Microcat	6839		17:16
	SBE37 Microcat	6840		17:21
	RCM11	383		17:21
	SBE37 Microcat	6841		19:26
	SBE37 Microcat	3209.		17:31
	SBE37 Microcat	3215		17:36
	10 x 17" glass		1X YELLOW 9X ORANGE	17:42 – 17:44
	RCM11	395		17:46.
	SBE37 Microcat	3216		17:49
	SBE37 Microcat	3221		17:53
	SBE37 Microcat	3224		17:59
	SBE37 Microcat	3225		18:04
	2 x 17" glass		2X YELLOW	18:10
	RCM11	399		18:10
	SBE37 Microcat	3234		18:[redacted]13 — LOST ½ CLAMP OVERBOARD.
	SBE37 Microcat	3222		18:23
	10 x 17" glass		5X YELLOW 5X ORANGE	18:25 – 18:27
#2	Acoustic release #1	824	Record release codes	18:32
#2	Acoustic release #2	318	Record release codes	18:32
	20m nylon			
	10m 1/2" chain			

*1 NOS TAKEN FROM ROB CHECK SHEET.

#2 RELEASE CODES FOR 318 TAKEN FROM INVENTORY, CONFIRMED FOR 824 FROM INVENTORY, CABLE DAMAGE

Anchor 1800 KG			19:03

Release #1 arm code _____
Release #1 release code _____ – CHECK.
Release #2 arm code _____ – OBTAINED FROM INVENTORY.
Release #2 release code _____
Argos beacon #1 ID 82951
Argos beacon #2 ID 42745
Anchor Drop Position
Latitude 26 30.0416 **Longitude** 76 48.9686 W
Uncorrected water depth 1379 (at anchor launch) (EXPECTED DEPTH AFTER FALLBACK 1390 M.
Corrected water depth _____ (at anchor launch)

TRIANGULATION

(1) 26° 30.157 N
76 48.128 W

ARM	
1483	2059
1929	2059
76	
413	
83	
1946.	

ECHOSOUNDER STILL ON

2059
2058
2059
2058

(2) 26° 30.769 N
76° 49.938 W

2325.6	2325
2325.7	272 x
	2325
	2325

(3) 26° 29.004 N
76° 49.656 W

2584	2586
2586	2587

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WB2** Cruise **RB0901**

NB: all times recorded in GMT

Date 29/04/2009. **Site arrival time** 18:00 APPROX.

Setup distance 4.2 miles

Start time 18:45 **End time** 22:04

Start Position

Latitude 26° 30.9427N **Longitude** 76°48.7144W

ITEM	SER NO	COMMENT	TIME
Recovery line			18:45
3 x TRYMSYN floats		YELLOW	18:45
SBE 37 Microcat	6819.		18:46
30" SYNTACTIC			18:49
ARGOS beacon	X02054	Record Argos ID	18:49
Light	X01049		18:49
1m chain and swivel			
RCM11	519		18:49
SBE 37 MICROCAT	6820		18:51
51" syntactic buoy			
Argos	286	Record Argos ID	18:59
Light	X01050		18:59
1m chain with swivel			18:59
RCM11	515		18:59
SBE 37 MICROCAT	6821		19:00
SBE 37 MICROCAT	6822		19:08
2 x 17" glass		ORANGE.	19:12
RCM11	516.		19:12
SBE 37 MICROCAT	6823		19:17
SBE 37 MICROCAT	6824		19:25
2 x 17" glass		ORANGE	19:31
RCM11	520		19:31
SBE 37 MICROCAT	6825		19:35
SBE 37 MICROCAT	6826		19:42
10 x 17" glass		ORANGE.	19:48 – 19:50
Swivel			
RCM11	443		19:52
SBE 37 MICROCAT	6827.		19:56
SBE 37 MICROCAT	6828		20:02
5 x 17" glass		ORANGE.	20:14
SBE 37 MICROCAT	6829.		20:16
SBE 37 MICROCAT	3247.		20:22
RCM11	444		20:27
5 x 17" glass		ORANGE	20:37

829.
515.

	SBE 37 MICROCAT	6831		20:39
	SBE 37 MICROCAT	6832		20:55
	2 x 17" glass		ORANGE	21:04
	RCM11	426		21:04
	5 x 17" glass		ORANGE	21:17.
	SBE 37 MICROCAT	6833		21:19
	SBE 37 MICROCAT	6834		21:42
ORANGE 10m 20m FLOW TO 35m NYLON →	11 x 17" glass		ORANGE.	21:49 – 21:52
	Swivel			
	Release #1	281	Record release codes	21:54
	Release #2	926	Record release codes	21:54.
35	20M nylon			
	25M 1/2" chain			
	Anchor 2200 KG			22:04

Release #1 arm code _____
Release #1 release code [redacted]
Release #2 arm code _____
Release #2 release code _____
Argos beacon #1 ID 93794
Argos beacon #2 ID 22442
] FROM ROB NOT SEEN DIRECTLY

Anchor Drop Position
Latitude 26° 30.5786 **Longitude** 76° 44.1322 W
Uncorrected water depth 3865 m (at anchor launch)
Corrected water depth 3884 (at anchor launch)

(SHALLOWING TO EAST DUE TO COARSE BUT SHALL BE DEGAUSS AT FALL BACK SITE).

23:47 ~~BLACK RELEASE~~ / RELEASE PROGRAM

NOTE: RELEASE NEEDS A SERVICE ON RETURN.

① 26° 28.690 N
76° 44.685 W

1311 ×
796 ×
1573 ×
797 ×
3423 ×
531 ×
1588 ×
796 ×
5377
5376
5377
5377

5378 ✓
4542 ×
5379 ✓

② 26° 31.716 N
76° 46.493 W

5554
3271
5541
3837
5540
2760

573 ×
957 ×
1536 ×
219 ×
2598 ×
917 ×
5538
2821 ×
5538
2782

③ 26° 32.293 N
76° 43.389 W

1886 ×
420 ×
5000.2
5000.4

5000.5
5000.4

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WBL1** Cruise **RB0901**

NB: all times recorded in GMT

Date 30/04/2009 **Site arrival time** 13:36 (STILL BUILDING LANYARD)

Setup distance N/A.

Start Position

Latitude 26°30.3783 **Longitude** 76° 44.6705W

Start time 14:17. **End time** 14:27.

Uncorrected water depth 3863m (at anchor launch)

Corrected water depth _____ (at anchor launch)

ITEM	SER NO	COMMENT	TIME
Billings Float with VHF and	[redacted]	T01 - 140 Yellow	14:24
Light	N08-027		14:24
5m of 3/8" chain			
Recovery line			
17" glass		Yellow	14:24
4 x 17" glass		Yellow.	14:25
15m polyprop			[redacted]
4 x 17" glass		Yellow	14:25
15m polyprop			
BPR #1 in tripod	0034		14:27
BPR #2 in tripod	0036		14:27
Release #1 in tripod	354 [redacted]	Record release codes	14:27
Release #2 in tripod	264	Record release codes	14:27.
Anchor 500 KG			

Release #1 arm code _____

Release #1 release code _____

Release #2 arm code [redacted] CHECKED ON INVENTORY NOT CLEAR ON RELEASE

Release #2 release code _____

Anchor Drop Position

Latitude 26° 30.3783 **Longitude** 76° 44.6290 W

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WBH2** Cruise **RB0901**

NB: all times recorded in GMT

Date 28/05/2009 **Site arrival time** 14:00

Setup distance 2.5NM

Start Position

Latitude 26° 28.6193 N **Longitude** 76° 40.3232W

Start time 14:26 **End time** 16:24

ITEM	SER NO	COMMENT	TIME
1 x 17" glass		YELLOW	14:26
Recovery line			
Billings float		YELLOW	14:27
Light			
14 x 17" glass		ORANGE	14:27 — 14:31
Swivel			
NORTEK	~~ARD~~ 5887	13564 DWD LOOKING	14:38
7 x 17" glass		6 x ORANGE 1 x YELLOW	14:58 — 15:00
NORTEK	~~ARD~~ 5889	13554 DWD LOOKING.	15:01
NORTEK	~~ARD~~ 5879	13565 DWD LOOKING	15:16
3 x 17" glass		2 x ORANGE 1 x YELLOW	15:33
Swivel			
NORTEK	~~ARD 5884 13563~~	ARD 5884 13563	15:34
SBE37 Microcat	6818		15:37
SBE37 Microcat	6817		15:47
3 x 17" glass		ORANGE	15:58
NORTEK	ARD 5890	13566 DWD LOOKING	15:58
SBE37 Microcat	6816		16:06
5 x 17" glass		YELLOW	16:10
Swivel			
Release #1	497	Record release codes – DONE	16:12
Release #2	819	Record release codes – DONE.	16:12
20m Nylon			
5m ½" chain			
Anchor 1400kg			16:24

Release #1 arm code

Release #1 release code

Release #2 arm code

Release #2 release code

Anchor Drop Position

Latitude 26° 28.9966 N **Longitude** 76° 37.5201 W

Uncorrected water depth 4699m (at anchor launch)

Corrected water depth 4736 (at anchor launch)

FALLBACK 0.42 NAUT. MILES

①	26° 29.691 N 76° 39.715 W	5729.8 5729.9	3319 x 987 x 1421 x 1149 x 5730.2 5731.0
②	26° 31.068 N 76° 37.407 W	5949.0 5563 x	5947.8 5948.6
③	26° 27.088 76° 37.816	1477 x 791 x 1261 x 650 x 5867.4 5867.5	5867.1 5866.8

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WB-CM** Cruise **RB0901**

NB: all times recorded in GMT

Date 28/05/2009 **Site arrival time** 11:53

Setup distance 500m

Start time 12:30 **End time** _____

Start Position

Latitude 26° 29.9279 **Longitude** 76° 36.2962

Uncorrected water depth 4785 ~~4775~~ m (at anchor launch) ~~4795~~

Corrected water depth 4825 (at anchor launch)

ITEM	SER NO	COMMENT	TIME
Pick Up float			12:33
15m polyprop			
10 x 17" glass			12:34
300kHz ADCP in frame	1903	Downward looking	12:34
2 x 20m polyester			
Nortek in frame	3553	Upward looking Aquadopp AL6	12:43
InterOcean S4	35612564		12:43
RCM11	507	SIDEWAYS	12:43
Sontek (clamped on)	303	Downward looking — 1m down from acm	12:43
DVS (Aux instrument)	12358	Upward looking 5m below Sontek	12:47
4 x 17" glass			12:50
465m polyester			
4 x 17" glass			13:11
Swivel			
Single acoustic release	820	Record release codes	13:11
Anchor 600 KG			13:16

RDI – 300kHz ADCP in frame

Aquadopp – Nortek in frame

1m rope – InterOcean S4

Teledyne RDI* – DVS (Aux instrument)

Release #1 arm code

Release #1 release code

Anchor Drop Position

Latitude 26°30.000cN **Longitude** 76° 35.9860W

* REQUIRED CLAMP TO BE MACHINED DOWN + EXTRA WASHERS TO CLAMP 10 mm ROPE.

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WB4** Cruise **RB0901**

NB: all times recorded in GMT

Date 26/4/09 **Site arrival time** 16:55

Setup distance 5 MILES into WIND – ~~NEGLIGIBLE~~ CURRENT

Start time 17:08 **End time** 21:07

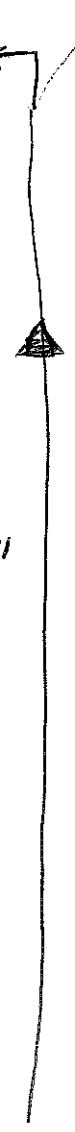
Start Position

Latitude 26° 19.8788N **Longitude** 75° 48.5161W 4694.70m START.

Uncorrected water depth 4677m (at anchor launch)

Corrected water depth 4713m (at anchor launch)

ITEM	SER NO	COMMENT	TIME
Recovery line			17:08
3 TRYMSYN floats			17:08
SBE37 Microcat	6835		17:09
32" syntactic buoy			17:10
ARGOS	304	Record beacon ID 82895	17:10
LIGHT	X01051	[redacted]	17:10
1m Chain and swivel			17:10
Nortek Aquadopp	3D 5831	8612087 HEAD ID / P22325-9.	17:10
SBE37 Microcat	6836.		17:10
49" syntactic buoy			17:31
ARGOS	X02-055	Record beacon ID 93793	17:31
LIGHT	X01052		17:31
1m chain and swivel			17:31
SBE37 Microcat	6803		17:31
RCM11	~~[illegible]~~	304	17:50
SBE37 Microcat	6804		17:50
SBE37 Microcat	6805		18:00
Nortek Aquadopp.	3D 5896	~~3550~~	18:12
SBE37 Microcat	6806		18:12
SBE37 Microcat	6807		18:17
10x 2000m rated rugby floats			18:28 / 18:31
RCM11	428		18:34
SBE37 Microcat	6808.		18:34.
5x 5000m rated rugby floats			18:47
SBE37 Microcat	6809.		18:48
5x 5000m rated rugby floats			18:59
Nortek	3551 - 3D 5899		19:02
SBE37 Microcat	6810.		19:02
5x 5000m rated rugby floats	~~[illegible]~~		19:15
SBE37 Microcat	6811		19:17
5x 5000m rated rugby floats			19:31



1STONE

RCM11	518		19:34
SBE37 Microcat	6812		19:34
5x 5000m rated rugby floats			19:48
SBE37 Microcat	6813	ADD 5885	19:50
5x 5000m rated rugby floats	~~3552~~ 3552	A99365-9	20:03
Nortek Aquadopp	~~AQD 5831~~ Hw.ID /	~~861087~~ Head ID	~~20:07~~
SBE37 Microcat	6814		20:07
SBE37 Microcat	6815		20:24
10x Benthos glass			20:38 -20:42
Acoustic release #1	358	Record release codes / DONE	20:45
Acoustic release #2	324	Record release codes / DONE	20:45
20m nylon			
10m 1/2" chain			
Anchor 2700 KG			21:04

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 82895
Argos beacon #2 ID 93793
Anchor Drop Position
Latitude 26°21.2497 **Longitude** 75° 43.0032 W

STARTED TOWING ≈ 20:45

SHIP ON HORIZON POSSIBLY MOM HORIZON.
SHIP 3.7NM AWAY CHANNEL RANGER -

8413

CONFIRMED ON BOTTOM 21:51 4642m ~~EQUIPMENT~~

(RELEASES 30m ABOVE STARTED IN 4677m u/c SO SPOT ON)

TRIANGULATED POSITION
26° 21.180N 75°43.320 W => FALLBACK = 0.29 MILES

① 26° 22.689 N
75° 42.161 W

5675.4
5675.8

5676.7
5676.8
5676.5
5676.5

LOSS OF SIGNAL - 406.5 RANGES.

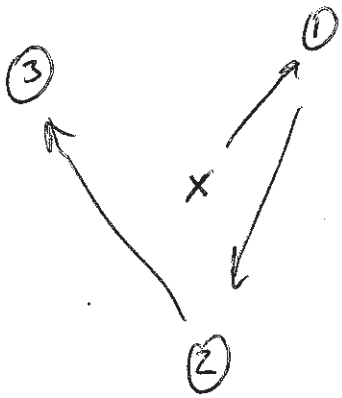
② 26° 19.511 N
75° 42.341 W

5703.8
5701.6
5700.6

5700.6

③ 26° 21.397 N
75° 45.389 W

5871.6
5872.3
5872.6
5871.8



WB4_2006

4186
5089
5733
11807

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WBL2** Cruise **RB0901**

NB: all times recorded in GMT

Date 26/4/09 **Site arrival time** 21:05 (MOVE TO AFTER WB4 DEPLOY)

Setup distance N/A.

Start Position

Latitude 26° 21.2567 **Longitude** 75° 42.9625

Start time 22:36 **End time** 22:39

Uncorrected water depth 4677 (at anchor launch)

Corrected water depth 4713 (at anchor launch)

ITEM	SER NO	COMMENT	TIME
Billings Float with VHF and Light			~~22:37~~ 22:37
5m of 3/8" chain			
Recovery line			
2 x 17" glass			22:37
15m polyprop			
3 x 17" glass			22:38
15m polyprop			
BPR in tripod	53497	57-0033	22:39
Single release AR861	282	Record release codes	
Anchor 500 KG			

Release #1 arm code

Release #1 release code

Anchor Drop Position

Latitude 26°21.261 **Longitude** 75° 42.949

RAPID-WATCH MOORING LOGHSEET DEPLOYMENT

Mooring **WB6** Cruise **RB0901**

NB: all times recorded in GMT

Date 25/04/2009 **Site arrival time** 13:11

Setup distance 0.25 Nm

Start time 13:40 **End time** 13:54

Start Position

Latitude 26° 29.691 N **Longitude** 70° 31.313 W

Uncorrected water depth 5429 m (at anchor launch)

Corrected water depth [redacted] m (at anchor launch)

5488 m

ITEM	SER NO	COMMENT	TIME
Pick Up float			13:40 ?
15m polyprop			
3 [redacted] x 17" glass			13:40
Microcat at join	6798		[redacted] 13:41
100m polyester			
Microcat about halfway	[redacted] 6801		13:44
100m polyester			
2 x 17" glass			13:46
Microcat at join	[redacted] 6799		13:47
100m polyester			
Microcat about halfway	[redacted] 6802		13:50
100m polyester			
Microcat at join	6800		13:52
6 [redacted] x 17" glass			13:52
BPR on tripod	0032	AR861	13:54
Single release in tripod	495	Record release codes	13:54
DUAL RELEASE x2 Anchor [redacted] KG	359	AR861 — "	13:54
Anchor 500kg			13:54.

Release #1 arm code _____

Release #1 release code _____

Anchor Drop Position

Latitude 26° 29.7835 N **Longitude** 70° 31.2694 W