JR158 Cruise Report

ADELIE

Antarctic Drifter Experiment: Links to Isobaths and Ecosystems

RRS James Clark Ross

February 6 - February 19, 2007

Compiled by Andy Thompson from contributions by:

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Contents

List of Tables

List of Figures

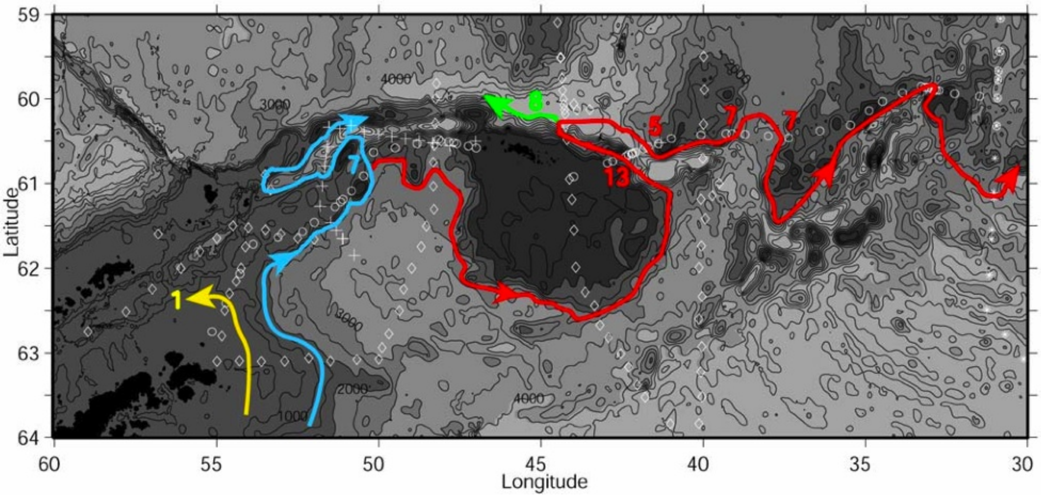

Figure 1: Bathymetry at the Antarctic Peninsula and South Orkneys with paths of Antarctic Coastal Current (yellow), Antarctic Slope Front (blue) and Weddell Front (red). Numbers indicate transport in Sverdrups.

1 ADELIE Cruise Narrative

1.1 Introduction

The goal of the ADELIE research project is to map, for the first time, the near surface currents around the tip of the Antarctic Peninsula and to determine the role of these currents in the retention or dispersion of krill. Specifically, we will test the hypothesis that pathways to the west near the continent link current systems on the western and eastern sides of the the Peninsula. The influence of bathymetry controlling the splitting and steering of these frontal jets will also be studied. Data for the ADELIE project was collected during cruise JR158.

We seek to resolve two important features of the current system around the margin of Antarctica, the Antarctic Slope Front and the Antarctic Coastal Current (see schematic in Figure 1). These currents both flow westward around the continent and are important for the transport of krill, for preconditioning the shelf waters, for the formation of Antarctic Bottom Water, and for supplying waters beneath ice shelves thus melting the underside of the ice shelf. The Antarctic Slope Front defines the boundary between cold, fresh waters filling the Antarctic continental shelf, and the warmer, more saline waters further offshore and is identified by a strong horizontal gradient in temperature and salinity. The Antarctic Coastal Current is a fast, shallow flow over the continental shelf often associated with the front of the ice shelf. The Coastal Current and the Slope Front may merge where the shelf is narrow, but over broad regions of the continental shelf the flows split into two distinct systems.

The study area for JR158 is from the tip of the Antarctic Peninsula across the continental shelf and slope to the east and into the deep Weddell Sea (Figure 2). A CTD and Lowered ADCP section were conducted along this transect moving from east to west. This transect was selected to complement the western end of the WOCE SR4 time series, repeated annually by Eberhard Fahrbach and colleagues at the Alfred Wegener Institut (AWI) during the 1990's. Due to the complexity of the topography in this region, Eulerian measurements at one site are not necessarily representative of the current system a short distance away. Therefore we

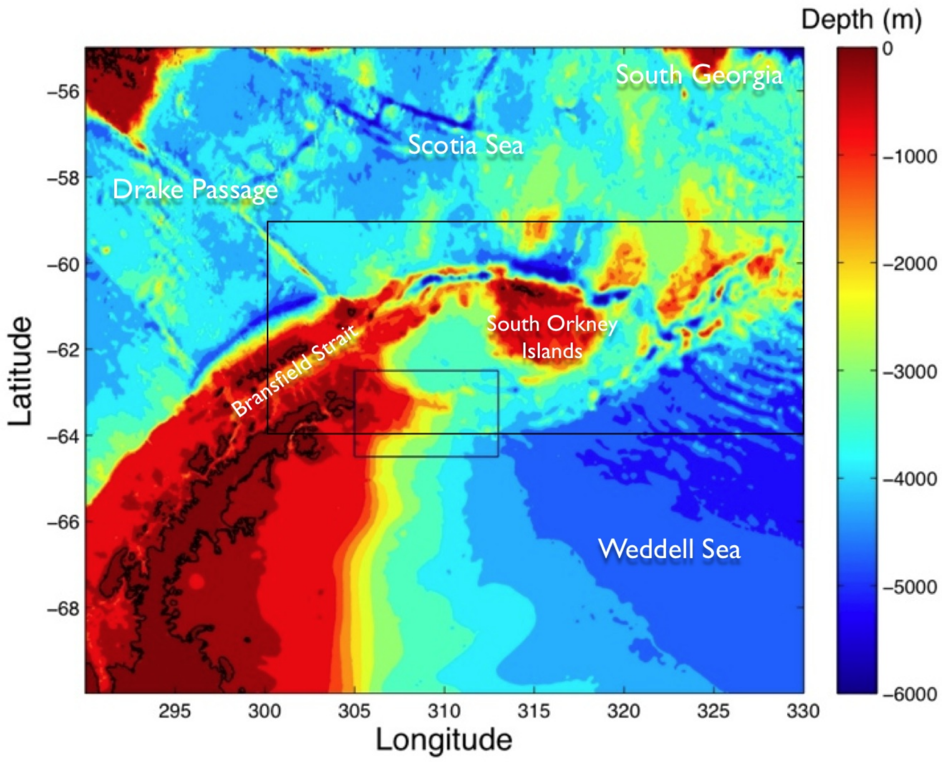

Figure 2: Local bathymetry surrounding the Antarctic Peninsula and important geographical features. The large box corresponds to the region plotted in Figure 1, while the smaller box represents the ADELIE study area depicted in Figures 5 through 8.

also deployed surface drifters and Lagrangian floats as a means of tracking the currents. While surface drifters have been successfully released near the Antarctic continent during previous cruises, these drifters provide the first Lagrangian measurements of the current system on the eastern side of the Antarctic Peninsula.

New instruments were also tested during JR158 including a microstructure profiler and a dissolved gas mass spectrometer. The microstructure profiler, which is used to resolve small-scale diapycnal mixing, will be used extensively during a mixing study near Kerguelen Island in 2008. The mass spectrometer measures dissolved oxygen/argon ratios that allow estimates of net community production over larger spatial scale with high temporal resolution.

Acknowledgments

The ADELIE project is funded by the British Antarctic Survey's Antarctic Funding Initiative (AFI), grant number NE/C50633X/1. We are extremely grateful to all the officers and crew of the JCR for going out of their way to make JR158 such a successful cruise.

1.2 Cruise Participants

Scientific party

The following is a list of the scientific members of the JR158 cruise.

Name	Institute	Email
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UEA	University of East Anglia
BAS	British Antarctic Survey
NOC	National Oceanography Centre
CICESE	Centro de Investigación Científica y de Educación Superior de Ensenada
WHOI	Woods Hole Oceanographic Institution

The following is a list of responsibilities and the watch organization during the ADELIE cruise. The names in bold are the lead PIs for the given instrument. Where jobs require minimal time (for example daily checking), only a single watch has been filled.

Chief Scientist		Karen	
Watch Leaders	Andy	Armando	Angelika
CTD	**Andy**	Adrian	Hanneke
LADCP	Hazel	Armando	**Nuno**
Drifters	James	Patama	**Angelika**
Floats	James	**Patama**	Angelika
018 bottle	**James**	Adrian	Hanneke
Microstructure	**Alberto**	Loic	Kurt
ADCP			**Angelika**
Krill TV			**Angelika**
Bathymetry (swath, echosounder)			**Hanneke**
Salinometer		**Loic**	
Met Data		**Adrian**	
Navigation	**Hazel**		

Watch Members

1st Watch	Andy, Alberto, Hazel, James
2nd Watch	Armando, Adrian, Loic, Patama
3rd Watch	Angelika, Hanneke, Kurt, Nuno

Ship's officers and crew

The following is a list of the crew and officers of the James Clark Ross during JR158 cruise.

Graham Chapman	Master
Robert Paterson	Chief Officer
Calum Hunter	2nd Officer
Douglas Leask	3rd Officer
John Summers	Deck Officer Scientific Operations
Charles Waddicor	ETO (Comms)
David Cutting	Chief Engineer
Gerald Armour	2nd Engineer
Thomas Elliott	3rd Engineer
Steven Eadie	4th Engineer
Doug Trevett	Deck Engineer
Nicholas Dunbar	Electrical Engineer
James (Hamish) Gibson	Purser
George Stewart	Bosun
Marc Blaby	Bosun's Mate
Derek Jenkins	Ablebodied Seaman
Lester Jolly	Ablebodied Seaman
Steven Styles	Ablebodied Seaman
John Macleod	Ablebodied Seaman
Clifford Mullaney	Ablebodied Seaman
Carl Moore	Ablebodied Seaman
Duncan MacIntyre	Chief Cook
Glen Ballard	2nd Cook
Clifford Pratley	Senior Steward
James Newall	Steward
Kenneth Weston	Steward
Derek Lee	Steward
Nick Young	Doctor
Johnny Edmonston	I.T.
Mark Preston	E.T.

Figure 3: Photos of ship's officers and crew. *1st row*: Graham, Robert, Calum, Douglas, John *2nd row*: Charlie, David, Gerald, Tom, Steven *3rd row*: Doug, Nick, Hamish, George, Marc *4th row*: Derek, Lester, Steven, John, Cliff *5th row*: Carl, Duncan, Glen, Cliff, Jimmy *6th row*: Kenny, Derek, Nick, Johnny, Mark

1.3 Cruise Daily Summary

Karen Heywood

Tuesday 6th February (Day 037)

We flew into Rothera, the BAS base, at 3 pm and sailed at 5 pm local time (3 hours behind GMT).

Wednesday 7th February (Day 038)

We steamed northeast all day, west of the Antarctic Peninsula. The shipboard ADCP and Oceanlogger instruments commenced logging data. The 40 surface drifters were brought up from the hold, unpacked, and placed on the open deck. They were switched on by removing their magnets, and left to test whether they were correctly transmitting their positions via Argos satellites.

Thursday 8th February (Day 039)

A storm arrived as forecast. We brought the drifters inside in case they got wet through waves on the deck. Their cardboard packaging might disintegrate prematurely (it is designed to do so on deployment). We arrived at our science site just at the tip of the Antarctic Peninsula amid growing seas. A test CTD was undertaken in a few hundred metres water depth at the location of our first drifter deployment (and where we hope our last CTD station will be at the end of the section). Despite initial fears that the weather would preclude deployment, or that we would have to relocate to the shelter of Ambush Bay, we were able to go ahead as planned. The test CTD was successful apart from two bottles not closing. LADCP profiles also seemed reasonable. Drifter deployments commenced along the SR4 line. The weather deteriorated further and we were unable to deploy drifters after midnight.

Friday 9th February (Day 040)

We were hove to overnight in strong winds (gusting 49 knots), poor visibility and amid large numbers of icebergs. The morning found us steaming back towards the line. Drifter deployments began again in the afternoon.

Saturday 10th February (Day 041)

The last drifter deployment was at 6am where we also undertook our first proper CTD station of the section. This was our deepest station (4200 m) so most of the polystyrene cups were attached here. Immediately prior to deployment we discovered that water had frozen inside the tubes for the Seabird CTD. The sensors had to be removed temporarily and defrosted in a bath. Luckily no sensors were damaged and the CTD went ahead with only 3 hours delay. We then turned back along our line undertaking CTD stations.

Sunday 11th February (Day 042)

CTD stations continued, closely spaced, gradually working up the continental slope. The weather had improved markedly, with less wind and less swell. We undertook the first test deployment of the microstructure profiler, just to make sure that it floated (it did). The first of our four Argo floats was deployed.

Monday 12th February (Day 043)

The CTD section was completed today, and our remaining Argo floats deployed, all close to the Antarctic Slope Front. Then we began a 10 hour steam back along our line towards the middle of the Weddell Sea running the ADCP; this will be the third repeat along the line. We finished the ADCP section after crossing the slope front, and headed north.

Tuesday 13th February (Day 044)

The day began very foggy, but by the afternoon conditions had improved sufficiently to undertake the first profile with the microstructure profiler, a great success. Otherwise data were processed as the ship steamed north over the South Scotia Ridge.

Wednesday 14th February (Day 045)

Today found us deploying the four Argo floats that we had agreed to deploy for Brian King at NOCS. We were requested to deploy them evenly spaced between the Southern ACC Front and the Polar Front. All deployments went smoothly, and the somewhat windy conditions during the morning settled into a calm afternoon. We had two successful deployments of the microstructure profiler in the middle of the Polar Front. These were somewhat exciting because the very strong current (80 cm/s at the surface) carried the profiler as far as 1.4 km from the ship.

Thursday 15th February (Day 046)

We continued steaming northward across the North Scotia Ridge, with the air temperature increasing steadily. We began measurements of salinity in the salt mine, which have proved difficult because of temperature fluctuations in the lab. Clocks were advanced forward by one hour overnight to be in line with Uruguay so were now GMT-2 hours.

Friday 16th February (Day 047)

We continued steaming northward in the Argentine Basin. It was quite foggy in the morning, but calm. Saltmining continued together with data processing. At the weekly lifeboat drill, a video was shown about liferafts and survival at sea in the event of abandoning ship—a sobering subject. In the evening we held an informal session of science talks for everyone to say a little about their own research.

Saturday 17th February (Day 048)

We continued steaming northward in the Argentine Basin. Saltmining and data processing continued. In the evening a highly enjoyable End-of-Cruise dinner was held, followed by an RPC where the Antarctic Circle crossing certificates were presented by Doug the Deck.

Sunday 18th February (Day 049)

Logging of underway data ceased at 0800 local time (10.00 GMT). Data processing continued. In the afternoon a short talk was given about the first results of the cruise.

Monday 19th February (Day 050)

We arrived at Montevideo at 0855 local time—we proceeded straight to the meat market.

1.4 Cruise Track Plots

Hazel Grant

Details of the JCR's cruise track during JR158 are given in Figures 4 through 9.

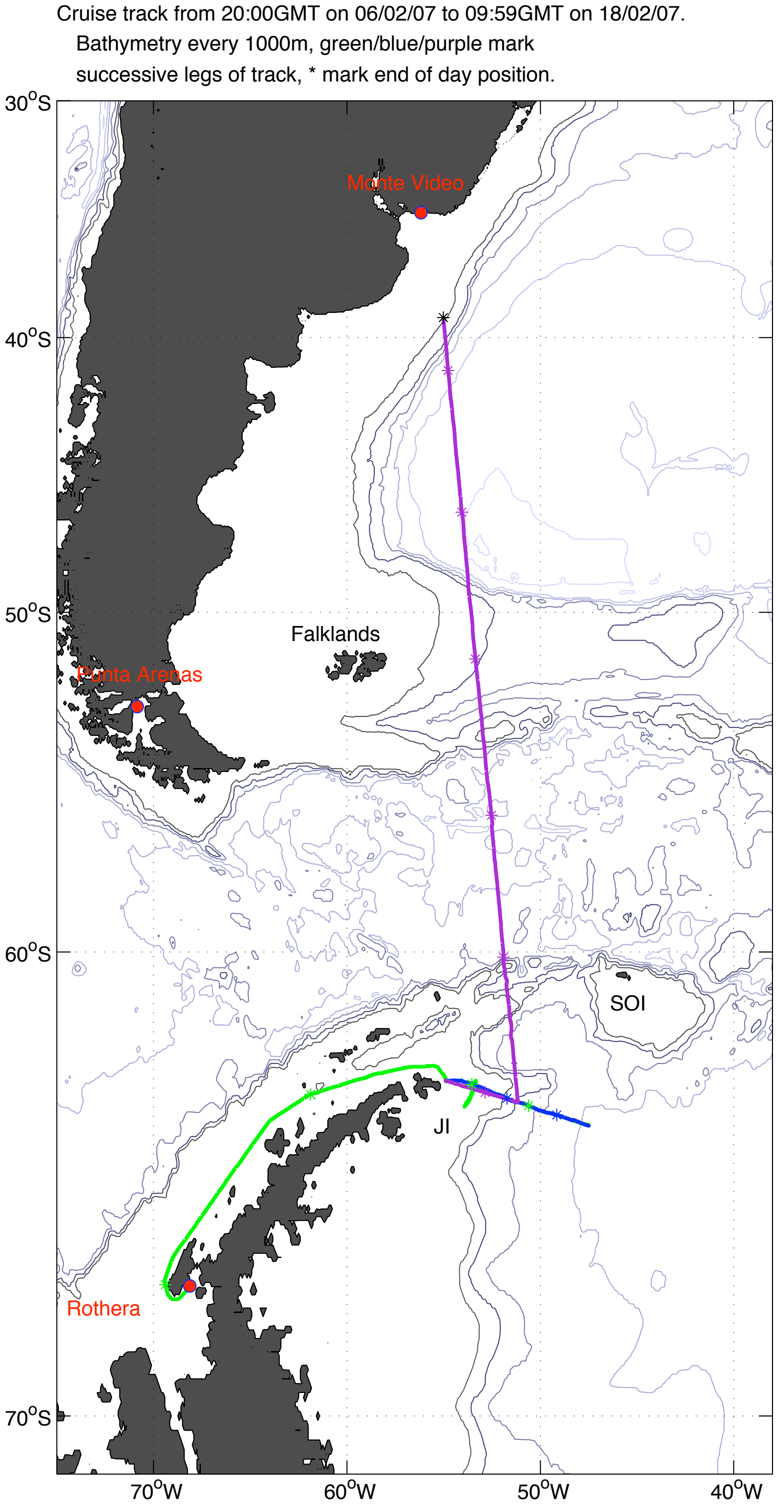


Figure 4: Complete cruise track for JR158. JI and SOI refer to Joinville Island and South Orkney Island respectively.

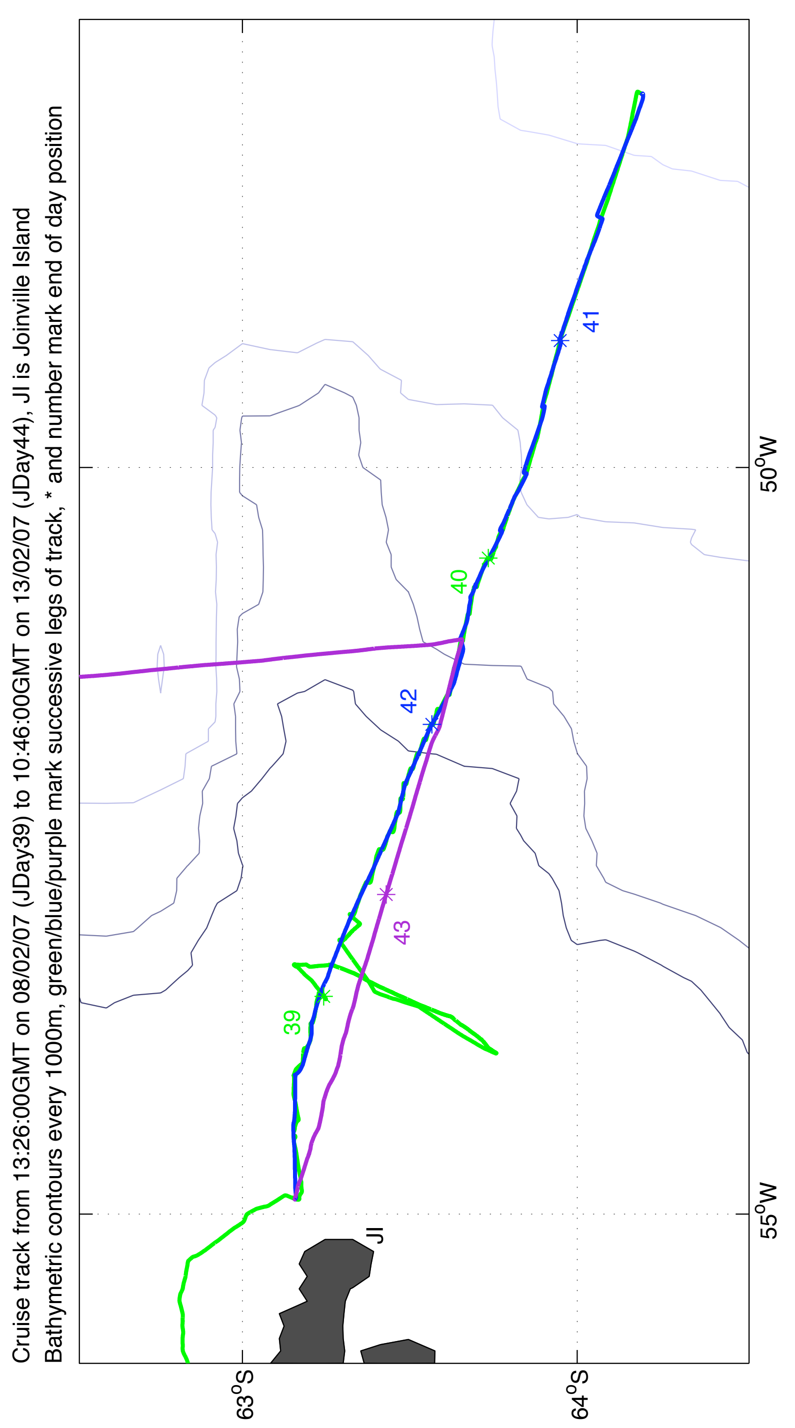


Figure 5: Detail of cruise track within the ADELIE study region.

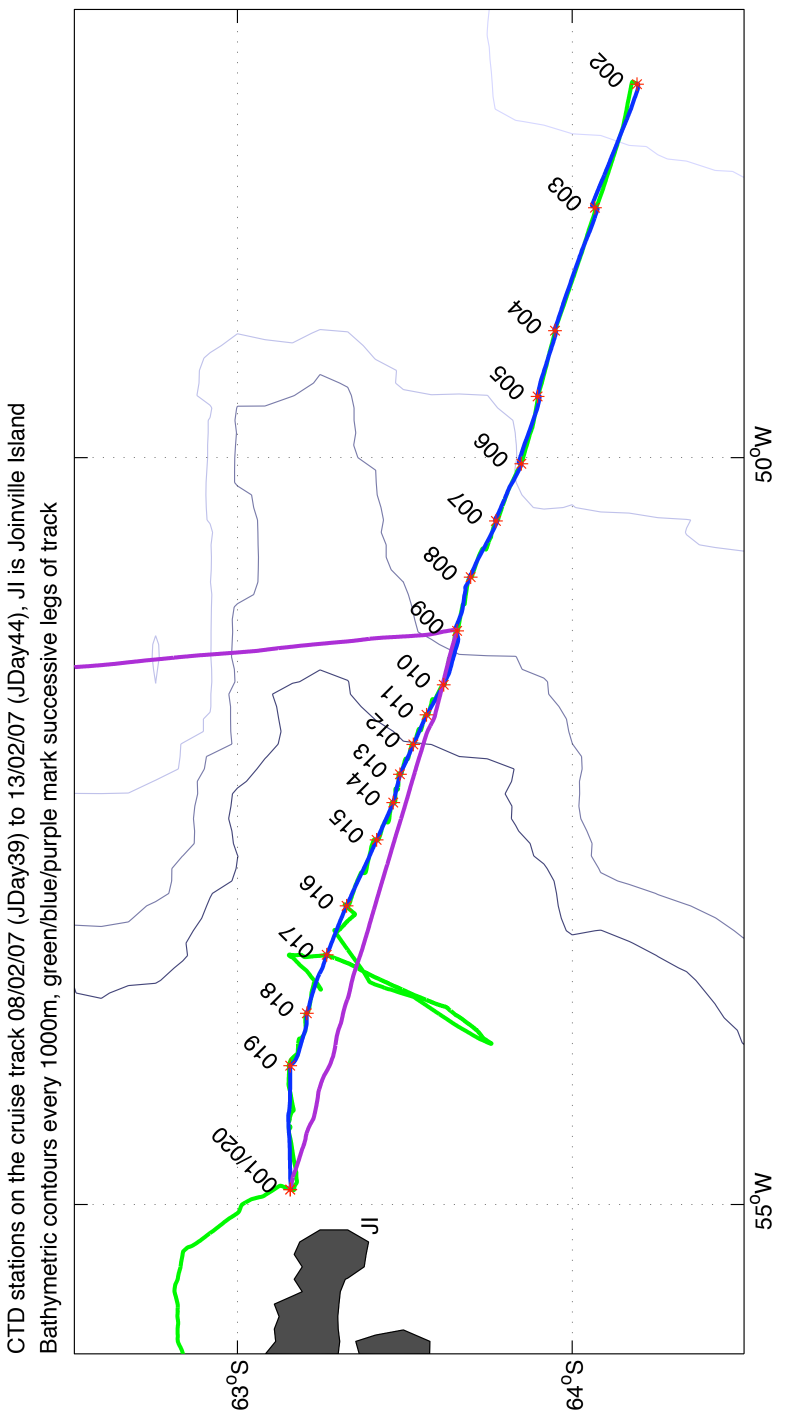


Figure 6: Detail of cruise track with CTD stations labelled.

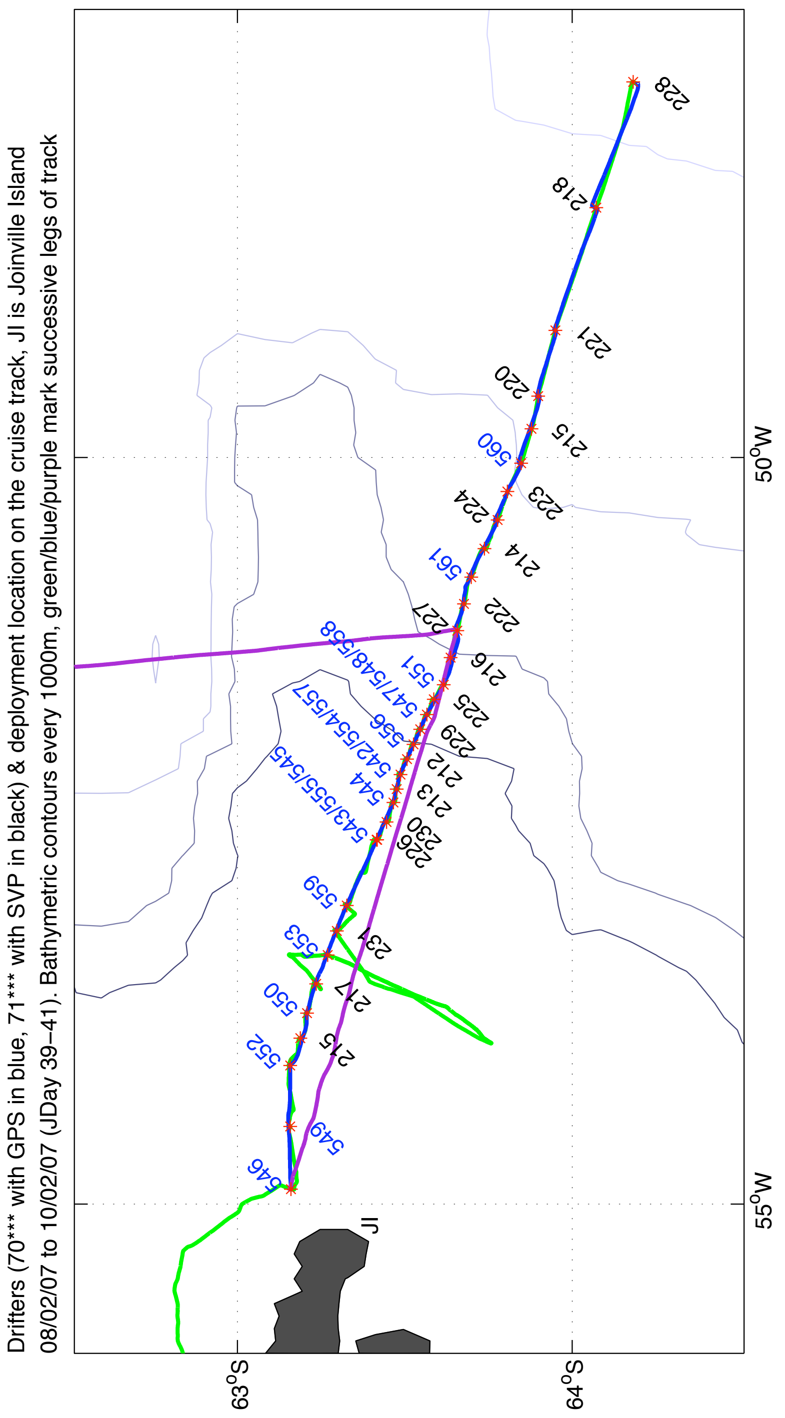


Figure 7: Detail of cruise track with drifter deployments labelled.

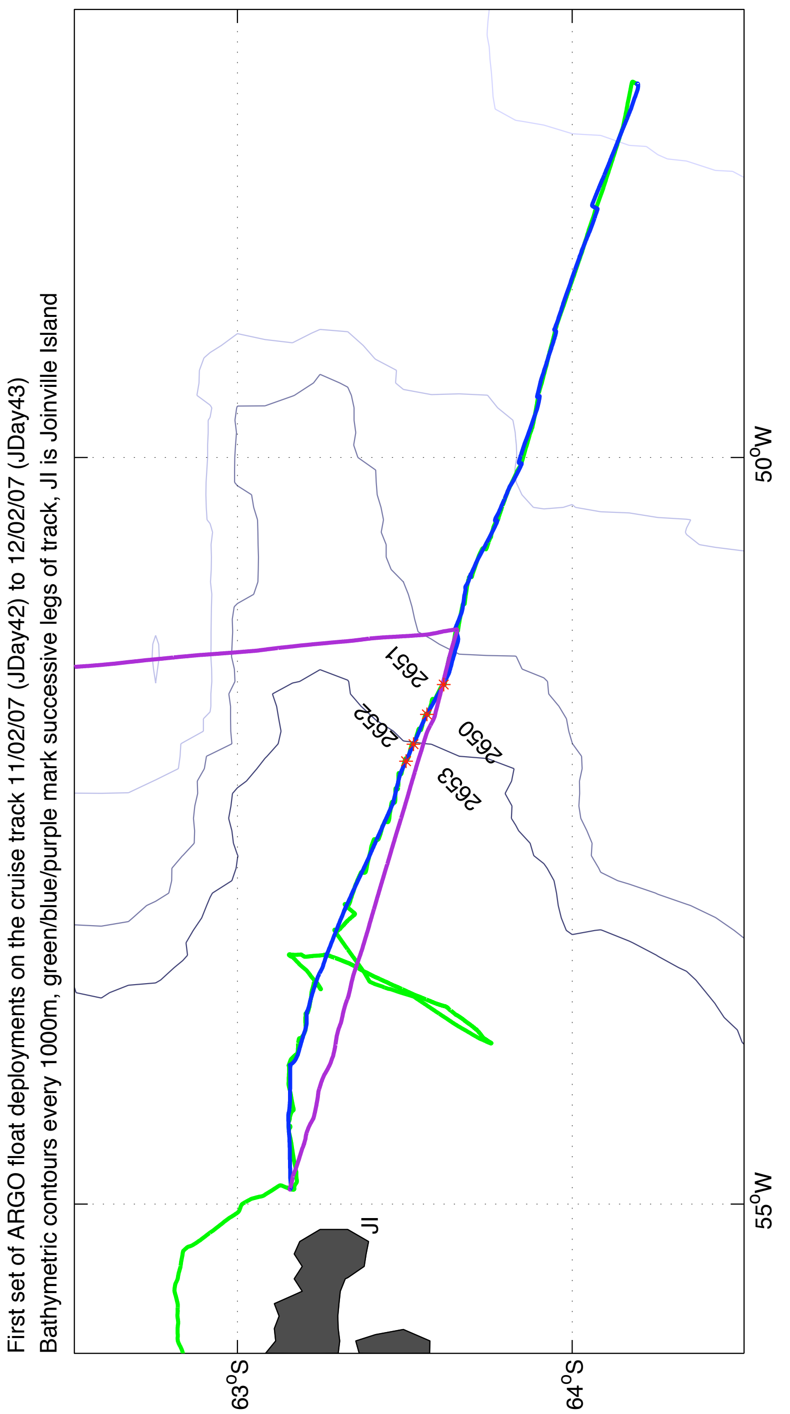


Figure 8: Detail of cruise track with Argo float deployments labelled.

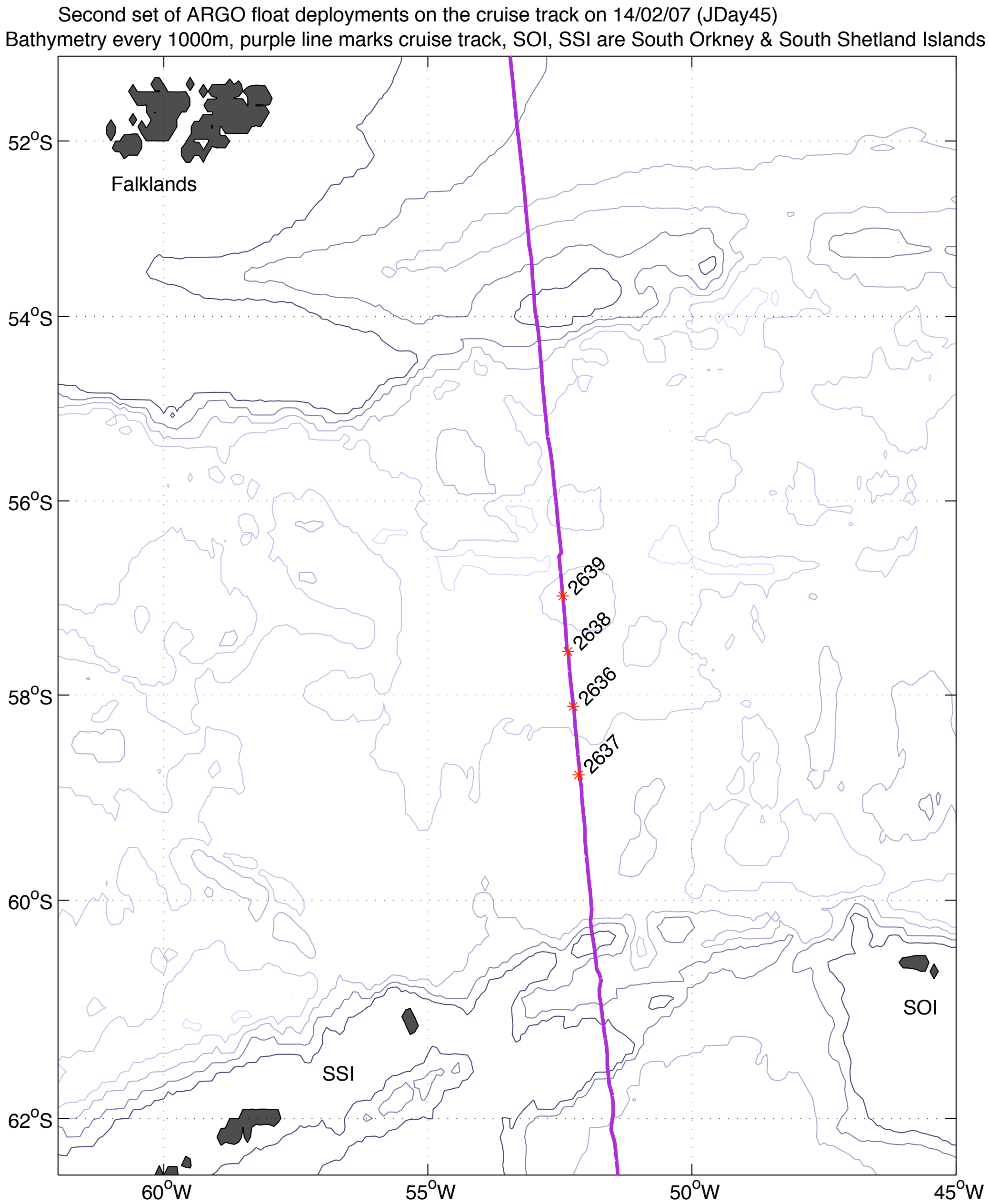


Figure 9: Detail of cruise track with Argo float deployments in Drake Passage labelled.

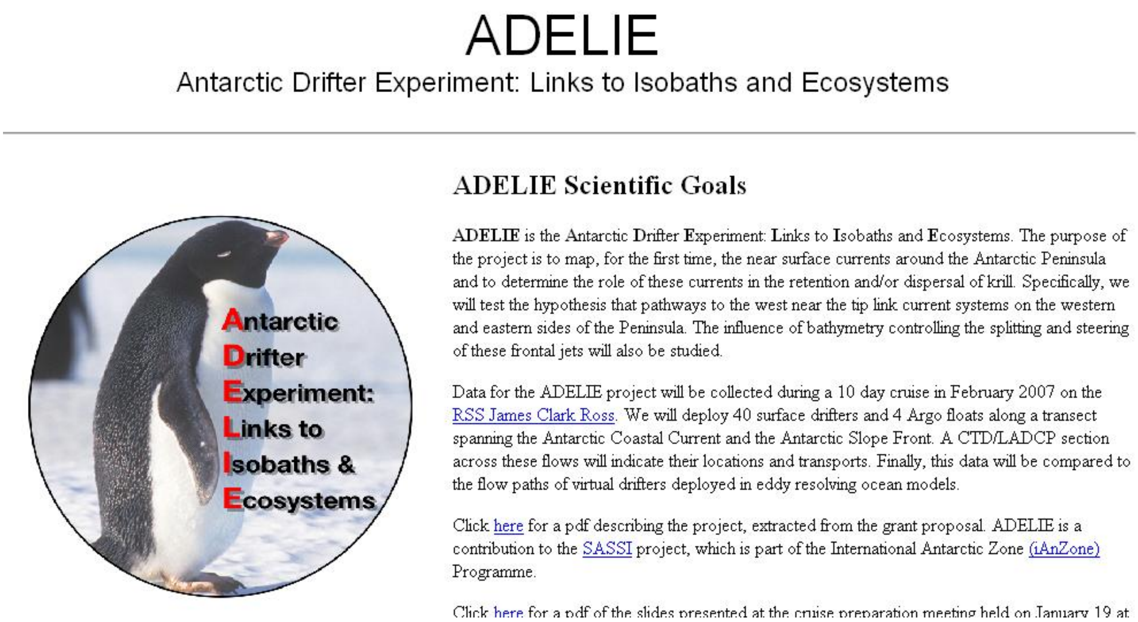


Figure 10: Screenshot of the front page of the ADELIE website.

1.5 Cruise Website

Hanneke Luijting

The cruise website was developed prior to our departure and hosted on the UEA server. It contains information about the scientific goals, the instruments we are using, participants on the cruise, related links, maps and a cruise diary. There is also a special page dedicated to outreach. We have 6 schools following us: 2 middle schools from Norwich, a primary school in the Netherlands, a primary school and a high school in the United states and a high school in New Zealand. We included a mail form on this page, so that the students can email us with questions they had. This was a great success—we answered many questions in this way, and posted the answers on the website for others to read.

During the cruise, a different person was selected to write the diary each day. This was usually done at random, however, sometimes we chose someone who was doing something particularly interesting that day. We had enough days so that everybody had a turn in writing the diary, and it has been fun to read the different entries! Photos were selected to go with the entry, and a photo of the day was also chosen.

During the first days, the page that listed all the participants on the cruise was changed into a photo board with photos all taken on board the ship. Later we also decided that it would be fun to have a similar page for all other people on board: officers, crew and passengers. We managed to take photos of nearly everyone, a nice way of getting to know the other people on board!

We also updated a map with the cruise track every day. When all the drifters were deployed, we posted daily maps with the locations and tracks of the drifters.

Overall, the cruise website has been a great success. Many of the visitors were our friends and families, checking in every day to read the latest diary entry. After a while we also made it onto Google and we had people finding the website on various queries, for example Adelie cruise 2007 and UEA Adelie. On average we are getting about 150 unique visitors every day,

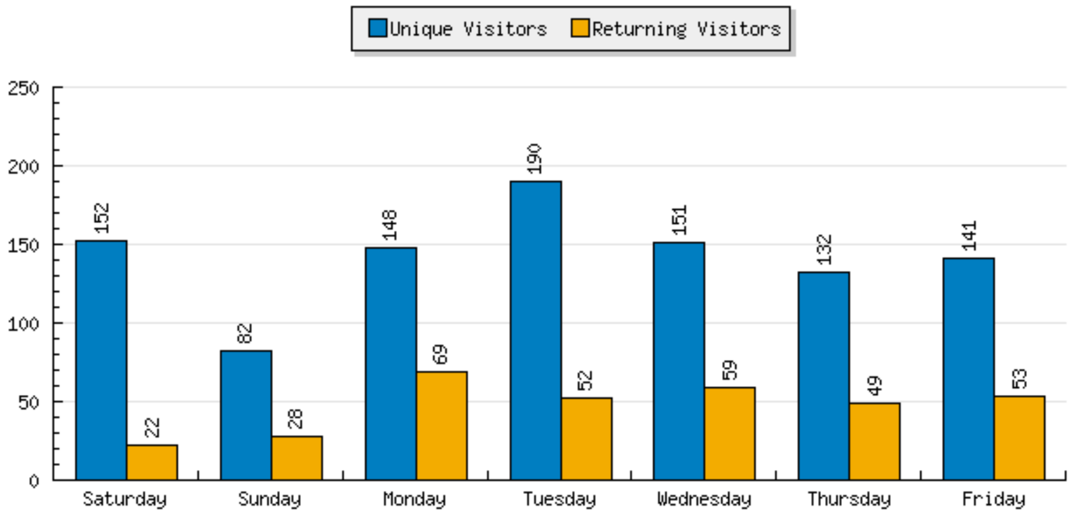


Figure 11: Statistics of ADELIE website visitors from Saturday 11 February until Friday 16 February.

about a third were returning visitors. The nationalities of the visitors reflect the nationalities of the cruise participants: United Kingdom, United States and Mexico had the largest share of visitors.

Making the website has been a lot of fun, and the amount of positive feedback, number of visitors and "thank you's" from family members of the cruise participants has made the hard work worthwhile.

2 CTD Measurements

2.1 CTD Operations

Dougal Mountifield

The CTD transect was commenced at the offshore end of the line following deployment of all drifters. A total of 20 CTD casts at 20 stations were undertaken on the cruise including one test cast to 290m (CTD001), all of which used the 12-way stainless steel frame. There were no major operational issues with the CTD suite during the cruise. The deepest cast was to 4140 m.

12-way stainless steel CTD frame

The stainless steel frame configuration was as follows:

- Sea-Bird 9/11 plus CTD System
- Sea-Bird SBE-35 Deep Ocean Standards Thermometer
- Sea-Bird SBE-32 24 way rosette pylon on NMF 12 way frame
- 8 by 10L General Oceanic 1010 external spring water samplers
- Sea-Bird SBE-43 Oxygen Sensor

- Chelsea MKIII Aquatracka Fluorometer
- Chelsea MKII Alphatracka 25cm path Transmissometer
- NMF LADCP Pressure Case Battery Packs
- RD Instruments Workhorse 300 KHz Lowered ADCP (Downward-looking configuration)
- Benthos Altimeter
- NMF 10kHz Pinger

The pressure sensor is located 70 cm from the bottom of the water samplers, and 157 cm from the top of the water samplers.

12-way stainless steel CTD frame instrument configuration

The Sea-Bird CTD configuration for the stainless steel frame was as follows:

- SBE 9 *plus* Underwater unit s/n 09P-31240-0720
- Frequency 0—SBE 3P Temperature Sensor s/n 03P-2919 (primary)
- Frequency 1—SBE 4C Conductivity Sensor s/n 04C-2571 (primary)
- Frequency 2—Digiquartz Temperature Compensated Pressure Sensor s/n 90573
- Frequency 3—SBE 3P Temperature Sensor s/n 03P-4116 (secondary)
- Frequency 4—SBE 4C Conductivity Sensor s/n 04C-3052 (secondary)
- SBE 5T Submersible Pump s/n 05T-2279
- SBE 5T Submersible Pump s/n 05T-2793
- SBE 32 Carousel 24 Position Pylon s/n 32-31240-0423
- SBE 11 plus Deck Unit s/n 11P-22559-0532

The auxiliary A/D output channels were configured as below:

- V0 — SBE 43 Oxygen s/n 43B-0621
- V1 — Unused – obsolete oxygen temperature
- V2 — Benthos Altimeter s/n 874
- V3 — Chelsea MKIII Aquatracka Fluorometer s/n 088244
- V4 — Unused – usually used for 2PI PAR
- V5 — Unused – usually used for 2PI PAR
- V6 — Unused – usually used for Wetlabs LSS/BBRTD
- V7 — Chelsea MKII Alphatracka 25cm path Transmissometer s/n 161047

The additional self-logging instruments were configured as follows:

- RDI Workhorse 300 KHz Lowered ADCP (downward-looking master configuration) s/n 1855
- Seabird SBE 35 Deep Ocean Standards Thermometer (Y-cable to 9plus & SBE32) s/n 0048

The LADCPs were powered by the NMF battery packs s/n WH002 and WH004 either of which were installed on the CTD frame at any one time.

Configuration and testing

The main Seabird instrument configuration file for this frame was `JR158.con`. This was used by the BAS CTD PC in the UIC which no longer has NMEA navigation data available to mitigate against system crashes should the NMEA drop out. However, the BAS CTD PC has its clock synchronised to the GPS master via NTP. Hence navigation data will have to be sought from the SCS archive to establish CTD positions.

The 25cm transmissometer was calibrated using recent air and blank readings taken at the NOC prior to shipping the instrument. The calibration was applied relative to air (note that on previous cruises the calibration has been applied relative to water).

Prior to the test CTD deployment a deck test was undertaken that included firing of all 8 bottles. This was logged with Seasave as `decktest.dat`.

CTD001 was for wet tests including testing the LADCP and rosette, and also allowed the science party to practise water sampling and analysis. The CTD transect proper commenced with CTD002.

Deep Ocean Standards Thermometer (DOST)

The SBE35 DOST was mounted underneath the 9plus underwater unit between the 3plus temperature sensors and at approximately the same height as them.

A recent manufacturer's linear calibration for slope and offset was programmed into the DOST, using older linearization coefficients following Seabird's recommendation at the last calibration—see separate calibration sheets. The DOST real-time clock was synchronised with GPS time in UTC.

The SBE35 was programmed to average over 5 samples, yielding an averaging period of approximately 5 seconds. The number of samples to average was selected as a compromise between accuracy and time. The SBE35 was configured to sample following the bottle confirmation signal from the pylon via the Y-cable between the 9plus, SBE-32 and the SBE35. The SBE35 hence produces an inter-calibration for temperature during Niskin bottle closing events.

The data from the DOST was uploaded using Seaterm after each cast and the files named in the form SBE35_CTD*nnn*.asc, where *nnn* is the CTD cast number.

Sensor freezing event

After the test CTD, the TC-ducts were inadvertently flushed and filled with MilliQ. During preparation for the first station proper, it was noticed that the ducts had frozen solid due to the unexpected sub-zero temperatures in the covered Water Bottle Annex (WBA). On-deck ambient temperatures had been -6°C overnight.

The whole underwater unit cage was removed from the CTD frame and warmed in a sink of warm water until the ducts ran free. Both pumps and all sensors, but with particular attention to the glass conductivity cells, were visually inspected and found to be intact. The ducts were also leak tested and found to be leak free. Subsequently the underwater cage was replaced in the frame and after a successful deck test all cables were re-secured. This resulted in approximately a two hour delay to the first station.

The deployment confirmed that no damage had been sustained during the freezing event. After this the TC ducts were not flushed and were allowed to drain of seawater between dips. Also an electric heater was installed in the WBA to reduce the risk of freezing sea-water.

Transposed temperature sensors

During the test CTD it became obvious that there was a problem with the temperature sensor calibrations. One sensor was reading approximately +5°C, with the other reading -5°C. This was traced to the sensors being transposed compared to the original build notes. New con files based on `JR158.con` were created as follows:

`JR158_tswap.con`—This has temperature sensor s/n's and calibrations transposed from `JR158.con`. This file was used as the main con file for all casts from CTD002 onwards.

`JR158_tcalswap.con`—This has the temperature sensor calibrations transposed but without transposing the serial numbers to circumvent Seasave's refusal to allow old data files to be replayed using calibrations with different s/n's from those at the time of data acquisition. To be post-applied to CTD001 only.

Sensor failure

Cast CTD006 was aborted during soak at 10m as the primary temperature sensor was reading +96°C. After recovery of the CTD package the problem was traced to a faulty cable between the temperature sensor and the 9plus underwater unit. The cable was replaced, deck-tested ok and the cast was recommenced as CTD006a. This resulted in approximately 1 hr delay for this cast.

Sensor availability and spares

PAR sensors and light backscatter (LSS/BBRTD) were not requested at the cruise planning stage and hence were not supplied. The BAS 12-way Stainless Steel frame and their CTD instruments were available on board as spares, but due to the high reliability of the CTD system on the cruise, use of spares was not required.

Altimetry

The Benthos altimeter worked very reliably, obtaining a good bottom return within 60 m of the bottom. The NMF pinger was also used both as a backup and as a double check on proximity to the bottom. The pinger was also used for working relative to the bottom when outside the altimeter's range, for example firing bottles at 100 m above the bottom.

Table 1: Numbering system for the rosette bottles.

Niskin #	1	2	3	4	5	6	7	8
Rosette #	2	4	6	8	10	12	14	16

The pinger was visualised using the BAS ex-IOSDL PES system and the BAS waterfall display. In calm seas the CTD was worked to around 6 m from the bottom. This was increased to approximately 10 m from the bottom in swell. In deep water the JCR's EA600 echo sounder consistently over-read water depth by approx 50 m, however this is prior to Carter correction for speed of sound.

Niskin deployment notes

Due to the requirement for an uplooking LADCP only 8 Niskins were supplied. This is because the mounting bracket for the LADCP is attached to the rosette, not the frame, and takes up 4 bottle locations. As discussed later in the LADCP section of this report, the uplooking unit was not available and the frame was deployed without the LADCP mounting bracket.

Niskin's #2 and #4 did not seal properly at the bottom end-caps during the test cast (001). Bottle #2's lanyard got caught up on the sample tap which was unfortunate and unavoidable. Bottle #4's lanyard was slightly too short and was subsequently lengthened. Subsequently there were no problems with Niskin sealing.

Part of Niskin #1's bottom endcap broke during cocking prior to CTD002. This bottle was removed for this cast whilst it was repaired with PVC primer and cement and allowed to cure for 36 hours prior to loading. The repair proved adequate and this bottle was used for the rest of the cruise with no problems.

As a 24-way pylon was used on the 12-way rosette, alternate firing positions were used. The system employed is described in Table 1.

Further documentation

A sensor information sheet `JR158 Sensor Information.doc` and calibration and instrument history sheets were included in the main cruise archive in electronic format (Adobe Acrobat and Microsoft Word). Also a rough diary `JR158 Instrumentation Diary.txt` was supplied. NMF will supply copies of all logsheets to BODC.

Station numbering

CTD casts commenced with CTD001, however, the bridge designated this station as TEST-CTD, then started the transect proper from CTD-1. Hence CTD cast numbers identified by data file names are one cast ahead of the bridge Microplot IDs. See Table 2.

Table 2: CTD cast summary.

Cast Number	Bridge Microplot Station ID	Max Depth Wire Out (m)
CTD001	TEST-CTD	290
CTD002	CTD-1	4140
CTD003	CTD-2	3888
CTD004	CTD-3	3468
CTD005	CTD-4	3239
CTD006/006a	CTD-5	2838
CTD007	CTD-6	2602
CTD008	CTD-7	2495
CTD009	CTD-8	2291
CTD010	CTD-9	1991
CTD011	CTD-10	1559
CTD012	CTD-11	1140
CTD013	CTD-12	915
CTD014	CTD-13	705
CTD015	CTD-14	498
CTD016	CTD-15	418
CTD017	CTD-16	385
CTD018	CTD-17	282
CTD019	CTD-18	200
CTD020	CTD-19	300

2.2 CTD Data

Andy Thompson

Twenty CTD stations were occupied during cruise JR158. The first station, 001, was carried out on the shelf just to the east of Joinville Island to test the CTD package. The remaining 19 were carried out in a single transect beginning in the Weddell Sea and moving westward across the slope and shelf break and onto the shelf. Cast 020 was performed at the same location as cast 001. Each cast acquired measurements from a Seabird CTD and dissolved oxygen sensor, beam transmissometer, fluorometer, altimeter and 8x10 litre bottle rosette. Although the CTD package used on this cruise could hold up to 12 bottles, only eight were provided (see discussion in section 2.1).

Each station was processed initially on a laptop using the Seabird processing software Seasoft. The files output by Seasave have appendices: .DAT, .HDR, .BL, .ROS, .CON. The .CON files for each cast contain the calibration coefficients for the instrument. These are updated when calibration sheets are received back from the manufacturer. The .HDR files contain the information in the header of each cast file. The .DAT files are the data files from each cast and are in binary form. The .BL and .ROS files contain information on bottle firings of the rosette.

For initial data processing we used Seasoft's programmes, SBE Data Processing, Version 5.31b. We used the following options in the given order:

- *Data Conversion*

- *Align CTD*
- *Cell Thermal Mass*
- *Bottle Summary*
- *Ascii Out*

Data Conversion takes the .DAT with the .CON file and outputs a CTD*nnn*.cnv file. During CTD cast 001 the calibrations for the first and second temperature sensor were switched giving obviously erroneous temperature readings for both sensors. The .CON file for cast 001 was changed to `JR158_tcalswap.con`. For all other casts, the appropriate .CON file was `JR158_tswap.con`. Options were chosen such that the output was to a binary file and both bottle and data files were created. *Align CTD* takes the .CNV file and applies temporal shifts to align the sensor readings. The offsets applied were zero for primary and secondary temperature, zero for primary and secondary conductivity, and 6 for oxygen. The output were saved in CTD*nnn*align.cnv files. *Cell Thermal Mass* takes the CTD*nnn*align.cnv files and makes corrections for the thermal mass of the cell (important in strong thermal gradients). The constants used were $\alpha = 0.03$ and $1/\beta = 7$. The output is read into CTD*nnn*aligncelltm.cnv files. *Bottle Summary* take the .ROS file and creates a summary of the bottle firings that is saved in CTD*nnn*.btl files. Finally, *Ascii Out* is applied to CTD*nnn*alignctm.cnv to create both an ascii data files and header files, CTD*nnn*aligncelltm.asc and CTD*nnn*aligncelltm.hdr respectively. The *Loop Edit* option, which removes wakes, was not used here since `wake.m` is similar.

In all our casts the output variables were:

- Scan Count
- Pressure, Digiquartz [db]
- Temperature [ITS-90 deg C]
- Temperature, 2 [ITS-90 deg C]
- Conductivity [mS/cm]
- Conductivity, 2 [mS/cm]
- Oxygen, SBE 43 [μmol/kg]
- Altimeter [m]
- Fluorescence, Chelsea Aqua 3 Chl Con [μg/l]
- Pump Status, on (1) or off (0)
- Beam Transmission, Chelsea/Wetlab CStar [%]

All files were ftp'ed to the ship's Unix machine jrub server where all subsequent processing was undertaken.

The following protocol was followed to read the CTD data into Matlab and produce processed data files. The processing was essentially the same as carried out during JR97 and

JR106s. On the jrub server under the folder /users/soc/work/ctd, we created folders for each cast: 001, 002, 003, etc., that we designate as *nnn*. All the CTD and bottle files at that station were kept in their own numbered directory. A README file was also maintained in each *nnn* directory and was updated manually every time any new version of the data set was created. Since we had two CTD sensors, we kept and calibrated the data from both sensors separately in all files. We did not record time as such, but used *scan*. Start time of data recording is logged as a variable that we carry through the processing as *gtime*. Latitude and longitude were also recorded from the header file. In previous cruises this was obtained from the NMEA data stream. However, the header files during JR158 did not indicate NMEA (see discussion in section 2.1). The Matlab file `hdr2mat.m` was modified appropriately to accomodate this difference in the header file. The latitude and longitude values in the header file were carried through the processing and used as the station locations.

Creation of the CTD files

`ctdcal.m`
This reads in the CTD*nnn*aligncelltm.asc ascii data file and the CTD*nnn*aligncelltm.hdr header file. It runs the routines `cnv2mat.m` and `hdr2mat.m`. They read the file, rename all the variables to something comprehensible and save the data in a Matlab file ctd*nnn*.cal.

`offpress.m`
This reads the ctd*nnn*.cal files, plots the data near the surface, and asks the user to choose a pressure offset to apply. Druing JR158 these offsets were always small, typically between 0 and 0.4 db. The programme also removes any data when the *pumps* variable is zero, indicating that the Seabird pumps were not on. After applying the chosen pressure offset, the resulting data are saved as ctd*nnn*.wat.

`rmbigerror.m`
This is a new programme (written for JR158) that was only used on casts 002 through 005. On these specific casts a loose cable connection caused the first temperature and conductivity sensors to give large incorrect readings primarily near the surface on the upcast (see notes at the end of this section). This programme reads the ctd*nnn*.wat file and first asks for a reasonable range of temperature/conductivity/oxygen values and eliminates any data outside of this range. Then it calls a modified version of `graphedit.m` to enable manual removal of bad points. This was easy to do by inspection since values typically had large spikes before reporting NaNs.

`spike.m`
This checks for, and sets to NaN, large single point spikes in conductivity, temperature, fluorescence, transmittance and oxygen. It uses the despiking routine `dspike.m`. Generally there are few points that are removed in this process, however, for casts 002-005 it looks like a large number of points have been removed because of the points set to NaNs in `rmbigerror.m`. The resulting file is ctd*nnn*.spk.

`wake.m`
This 'wake' programme underwent the greatest modification since both upcasts and downcasts

were found to be significantly affected by wakes. The wakes are easy to detect from plots of *press* against *scan*. The programme sets to NaN any data when the rate of change of pressure falls below a threshold, or when the package has slowed down. A brief description of the modified `wake.m` file follows this section. Currently, the new wake file only runs on the downcasts (on JR80 wake was also used on downcasts, however, on JR106 it was only used on the upcasts). There is still some rubbish data near the bottle firings on the upcast which will most likely be removed manually using `graphedit.m`. The resulting file is ctd*nnn*.wke.

`interpol.m`
This programme finds any data set to NaN in any of the temperature, conductivity, fluorescence, transmittance and oxygen variables, and interpolates across them to produce a continuous data set. The output file is ctd*nnn*.int. At this point we have 24 Hz data for the up and down casts. We then need the bottle salinity data to calibrate salinity. However, the next steps can be (and were) undertaken on the data even if salinity is uncalibrated.

`makebot.m`
This reads in the CTD*nnn*.BL file created by Seasoft. The .BL file contains the scan numbers to be used for extracting CTD data during bottle firings. The start and end scan numbers from this file are used to read the ctd*nnn*.int file and extract CTD data when the bottle was fired. The reason that we do not use the Seasoft values is that we have despiked the .int files already and therefore know the quality of the data going into the bottle average. Median values for each CTD variable are calculated as representative of the CTD data during the firing. The standard deviations of the temperatures and conductivities are calculated as a means of determining if the bottle was fired in a region of strong gradient. A warning is given to the user if large standard deviations are found. All standard deviations are stored alongside all the other extracted variables in the output file, bot*nnn*.sal. Makebot also creates variables for bottle salinity, *botsal*, initally set to NaN, and a salinity bottleflag, *salflag*, initially set to 0.

`makeox2.m`
Eight bottles were fired for each cast, however these were recorded as bottles 2 through 16 increasing by 2. Therefore, the Seabird processing software produced bottle files that have 16 entries rather than 8. The odd numbered entries contain meaningless data. `makeox2.m` was written to read in the 16 value bottle files, remove the meaningless values and save files ctd*nnn*.ox2 with only 8 entries for each variable. Both the 16 value and the 8 value files were saved since the 16 value files are easier to merge with the salinity measurements and the eight value files are easier to use with the oxygen measurements.

`newvar.m`
This calculates salinity from conductivity and temperature, and also derives potential temperature and a variety of different densities. The output is ctd*nnn*.var.

`splitcast.m`
This splits the data from ctd*nnn*.var into an upcast and a downcast file—ctd*nnn*.var.dn and ctd*nnn*.var.up.

`ctd2db.m`
This does a 2 decibar binning of the CTD downcast data in ctd*nnn*.var.dn to produce ctd*nnn*.2db.

Salinity calibration

`getsalts.m`
This adds bottle sample salinity, *botsal*, to the bot*nnn*.sal file to create a bot*nnn*.slt file. Bottle salinities are read from the text file `/users/soc/work/ctd/autosal/`ctd*nnn*salinity.txt. The salinity flag, *salflag*, is set to 1 where there are data, and 0 where data are absent. Salinity and conductivity offsets are also calculated and saved to bot*nnn*.slt. Note that on previous cruises the bottle salinity has been appended to the bot*nnn*.sal file, whereas here we create a new file with appendix .slt.

`setsalflag.m`
This checks the standard deviations of the CTD temperature and salinity data in bot*nnn*.slt. If either of these for the *secondary* sensor exceeds a threshold of 0.002, *salflag* for that bottle is set to 0. The output file is bot*nnn*.flg.

`salplot.m`
This reads in the bot*nnn*.flg file and plots the bottle salinity and CTD salinity, which is read in from the ctd*nnn*.int file. These have been plotted and printed and will be analysed when we return to UEA.

`salanalyse.m`
Plots the offsets of bottle salinity against CTD salinity (from the bot*nnn*.flg files) for all bottle firings against pressure, temperature, salinity and station number. The variable *salflag* is used to ignore values with a high standard deviation. Also plots the conductivity offsets against the same things. This programme also suggests a linear fit to calculate salinity calibrations. We did not have time to look at these results closely and this Matlab script will be reviewed again when we return to UEA. We also did not understand some of the plots generated by this programme since it appeared that only two data points were used to generate some of the linear regressions.

As mentioned above, because of the problems with the temperature in the salt mine, very little time was left for salinity calibration during the steam to Montevideo. Therefore the bulk of the salinity processing and calibration will be performed at UEA when we return.

Notes

On casts 002-005 a loose or faulty cable was found to give large incorrect temperature values (as large as 98°C) in sensor 1 only. This problem also affected the conductivity and the oxygen readings. On casts 002-004 these values only occurred near the surface on the upcast. However, on cast 005 there were also bad values near the surface during the downcast. Unfortunately this problem was not noticed until the beginning of cast 006 when the CTD was giving temperature values of nearly 100°C on the deck. Therefore 006 was aborted and replaced by 006a. After the cable was replaced, there were no further problems of this sort. The Matlab programme `rmbigerror.m` has been introduced into the processing routine to deal with these errors (see description above).

Table 3: List of CTD stations completed during JR158. Cast 006 was aborted due to a loose cable. This cast was replaced by 006a.

Station	**Julian Day**	**Date**	**Bottom Time (GMT)**	**Latitude (°S)**	**Longitude (°W)**	**Max. Pressure (db)**	**Max. Depth (m)**	**Min. Distance Off (m)**	**Water Depth (corrected) (m)**	**Salinity samples**	**Dissolved O_2 samples**	**O18 samples**
001	039	08/02/2007	18:14	63 09.59	54 53.99	297	294	12	296	5	3	5
002	041	10/02/2007	13:23	64 11.38	47 30.00	4238	4156	6	4168	8	7	8
003	041	10/02/2007	18:19	64 04.00	48 19.60	3978	3902	6	3912	7	6	7
004	041	10/02/2007	23:07	63 56.97	49 08.99	3546	3482	10	3494	8	8	8
005	042	11/02/2007	02:49	63 53.95	49 35.40	3313	3256	9	3265	8	8	8
006(a)	042	11/02/2007	07:33	63 51.01	50 02.41	2896	2848	5	2852	8	4	8
007	042	11/02/2007	10:55	63 46.50	50 25.40	2655	2612	5	2615	8	4	8
008	042	11/02/2007	14:53	63 42.01	50 48.01	2546	2506	5	2508	8	4	8
009	042	11/02/2007	18:18	63 39.62	51 09.57	2333	2297	15	2292	8	4	8
010	042	11/02/2007	20:02	63 37.21	51 31.20	2029	2000	5	2000	8	4	8
011	042	11/02/2007	23:17	63 34.16	51 43.25	1587	1566	5	1562	7	4	7
012	043	12/02/2007	01:17	63 31.77	51 55.19	1161	1147	4	1145	8	3	8
013	043	12/02/2007	03:20	63 29.40	52 07.20	932	921	4	920	8	0	8
014	043	12/02/2007	04:58	63 28.20	52 18.56	721	713	4	710	8	4	8
015	043	12/02/2007	06:45	63 25.21	52 33.55	510	504	3	501	8	0	8
016	043	12/02/2007	09:04	63 19.80	53 00.00	430	426	9	428	8	3	8
017	043	12/02/2007	10:39	63 16.20	53 19.70	397	393	5	391	8	0	8
018	043	12/02/2007	12:34	63 12.60	53 43.20	289	286	4	284	8	4	8
019	043	12/02/2007	14:49	63 09.60	54 04.19	206	204	5	200	8	3	8
020	043	12/02/2007	17:55	63 09.60	54 54.00	308	305	10	300	8	8	8

The only processing file that underwent significant modification was the `wake.m` file. The wakes are easiest to detect in plots of *pressure* against *scan*. They appear as plateaus or changes in sign in the rate of change of pressure. In some cases the CTD package samples the same depth twice. The wakes result in characteristic fin-shaped anomalies in the .spk profiles. The first update to `wake.m` was to remove data where the same pressure level was sampled twice. A second criterion was then introduced to determine when to begin accepting the CTD values again. These criteria attempt to select a point that has a temperature similar to that measured at the start of the wake. However, it also accounts for the fact that temperature is weakly stratified below the thermocline so as not to throw out too much data.

2.3 SB35 Deep Ocean Standards Thermometer

Loic Jullion

The rosette was equipped with a SB35 Deep Ocean Standards thermometer to calibrate the two temperature sensors from the CTD. The thermometer measures the temperature at which the bottles were fired and the data are stored for each station in an ASCII file sbe35_ctd*nnn*.asc using the Seabird's Seaterm programme.

Matlab functions that had been written for the JR097 cruise were used to process the data. The functions had to be modified to suit our needs.

`sb35read.m`: Reads the ASCII file and extracts the information about the bottle numbers, date and time at which the bottles were fired, the temperature measured by the thermometer when the bottles were fired. The extracted information is then stored in a file named bot*nnn*.sb35.

`sb35comp.m`: Calculates the difference between the SB35 temperature and the CTD temperature sensors and stores them as *sb35t1* and *sb35t2* in the bot*nnn*.sb35.

`sb35runall.m`: Runs the previous two functions together for all the station so that it does not need to be done manually for each station.

`sb35diff.m`: Plots the difference between the CTD temperature and the SBE35 temperature for all the bottles of all the stations and calculates the median (*medsb35t1* and *medsb35t2*) that are then saved into a tempcal.mat file into a directory named `calvalues` in the `ctd` root directory. Figure 17 shows that both sensors were pretty stable during the cruise. The median of the differences for sensor one was -0.0005 and for sensor two, the median of the differences was -0.0011.

`sb35tempoffset.m`: Function that goes into each station directory, loads ctd*nnn*.spk and applies the temperature offsets for both sensors:

$$temp1 = temp1 - 0.0005 \qquad \text{and} \qquad temp2 = temp2 - 0.0011.$$

All the variables saved in ctd*nnn*.spk are then saved in a file named ctd*nnn*.tct with the updated temperatures. Figure 17 shows that the difference between the SBE thermometer's temperature and the CTD's temperatures after the offsets were applied are in better agreement than before.

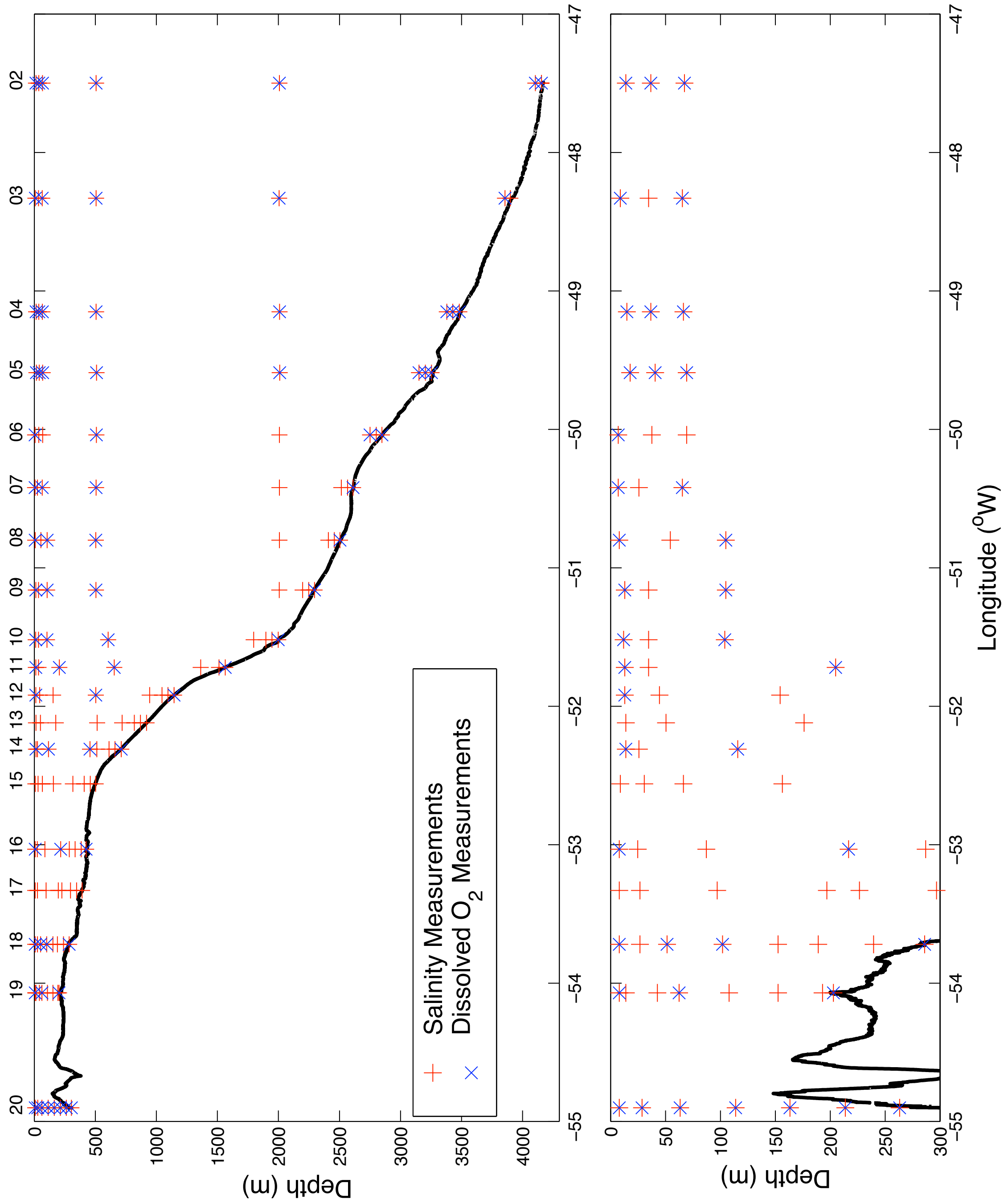


Figure 12: Positions of bottle firings on the CTD leg of JR158. The lower panel is a detailed view of the upper 300 m of the transect.

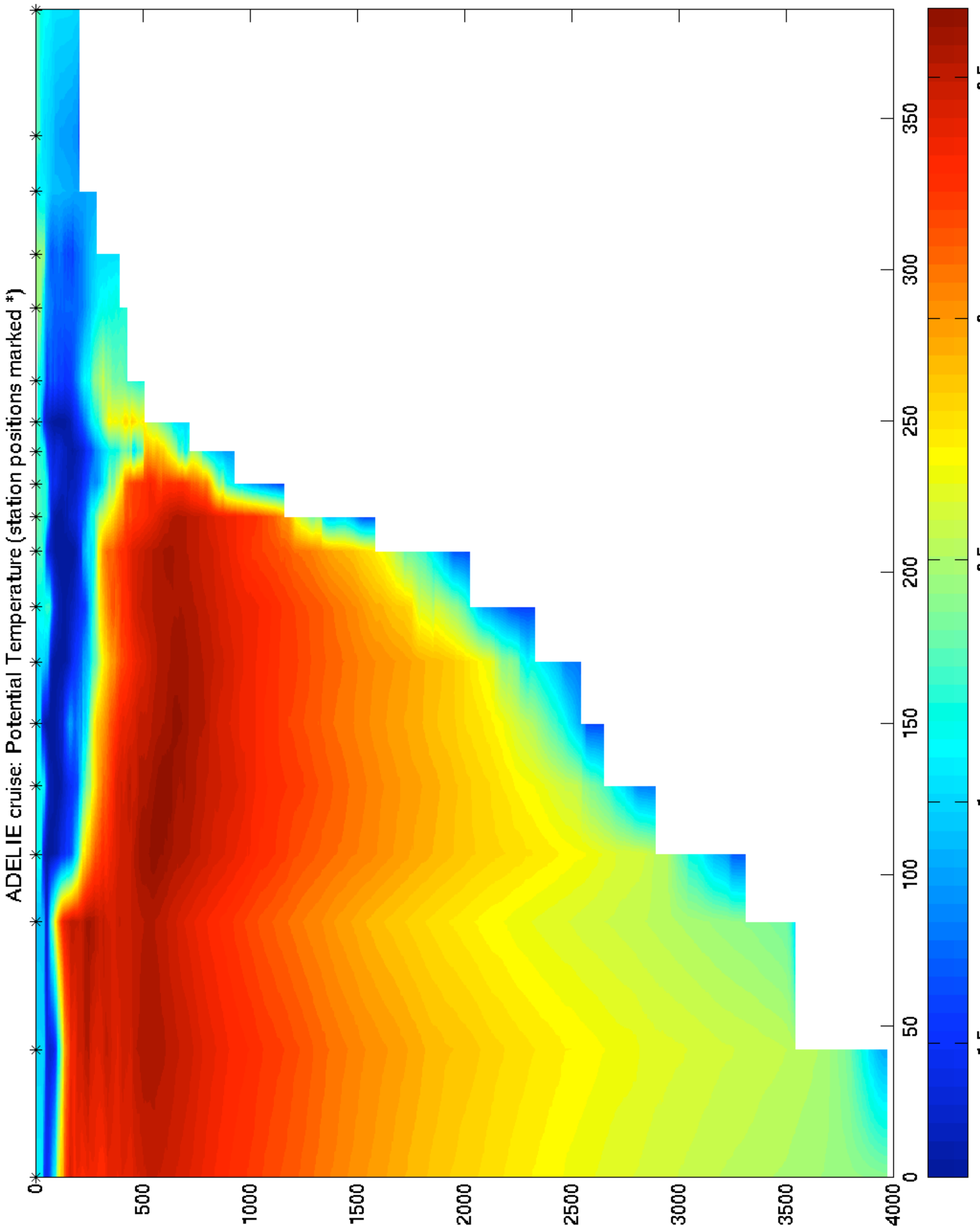


Figure 13: ADELIE potential temperature section. The starred points near the surface indicate CTD cast locations.

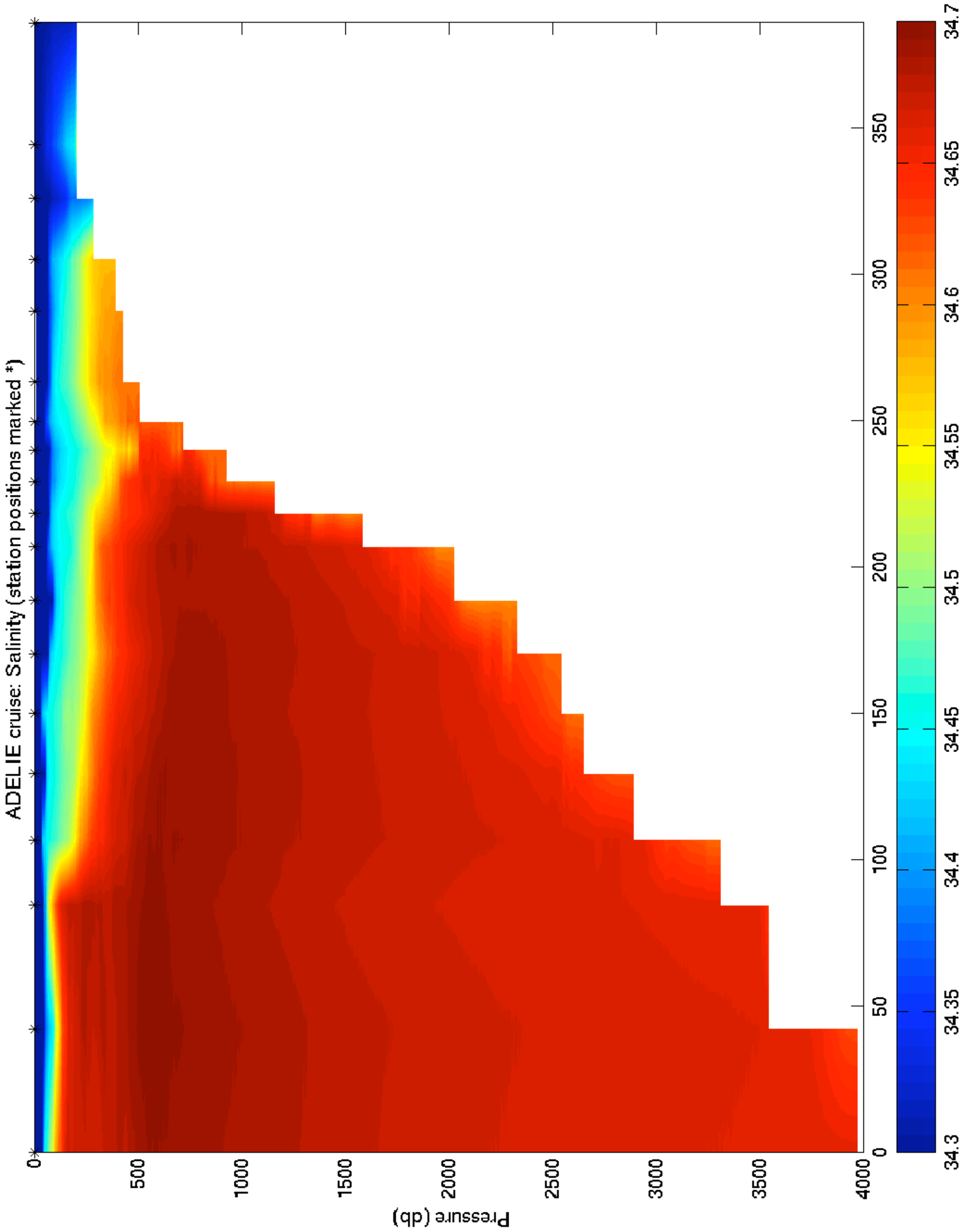


Figure 14: ADELIE salinity section. The starred points near the surface indicate CTD cast locations. The salinity scale is adjusted to indicate subsurface variations. Surface salinities are much fresher than 34.3.

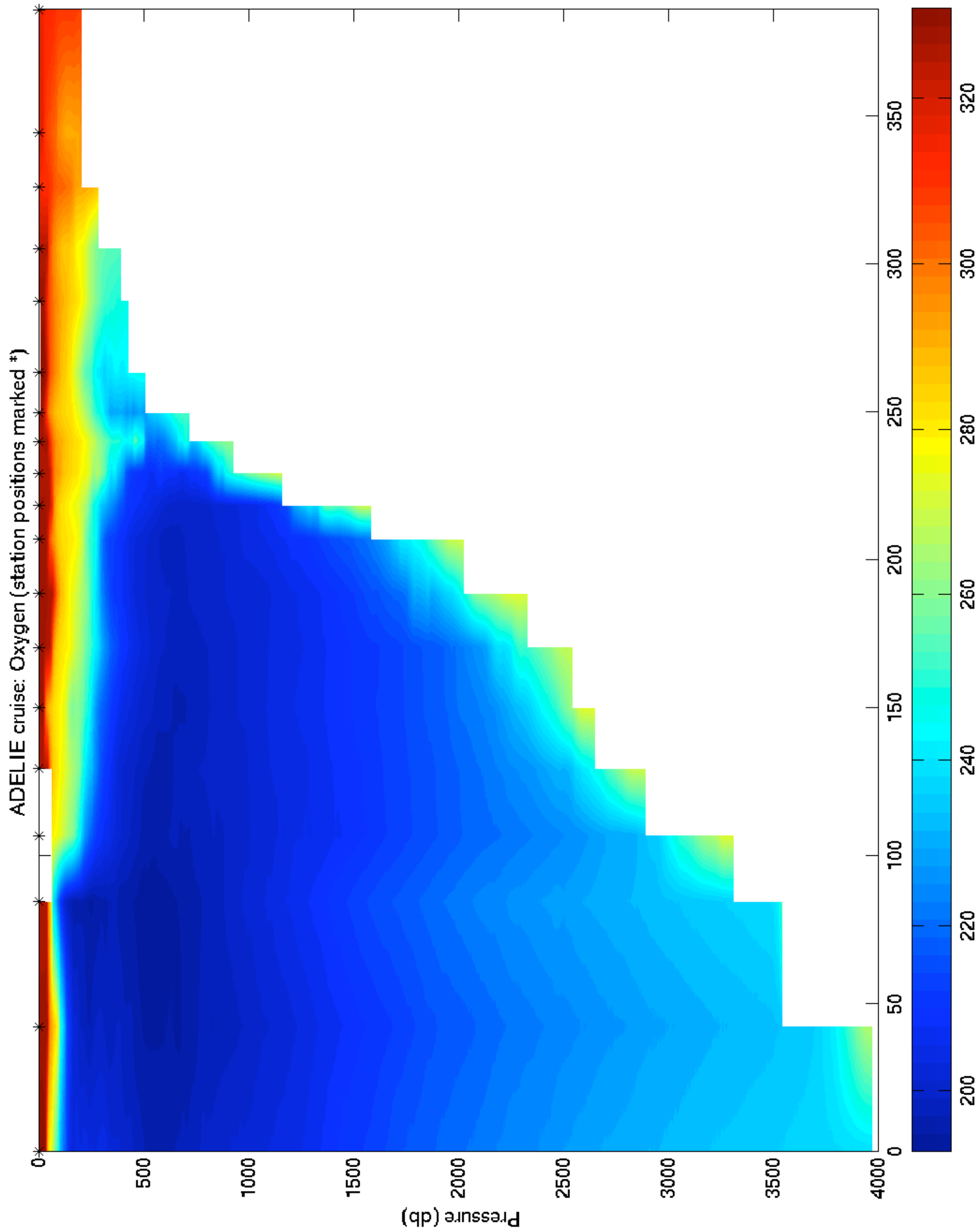


Figure 15: ADELIE oxygen section. The starred points near the surface indicate CTD cast locations. The blank area near the surface is due to a loose or faulty cable connection affecting the first temperature and salinity sensor and the oxygen sensor.

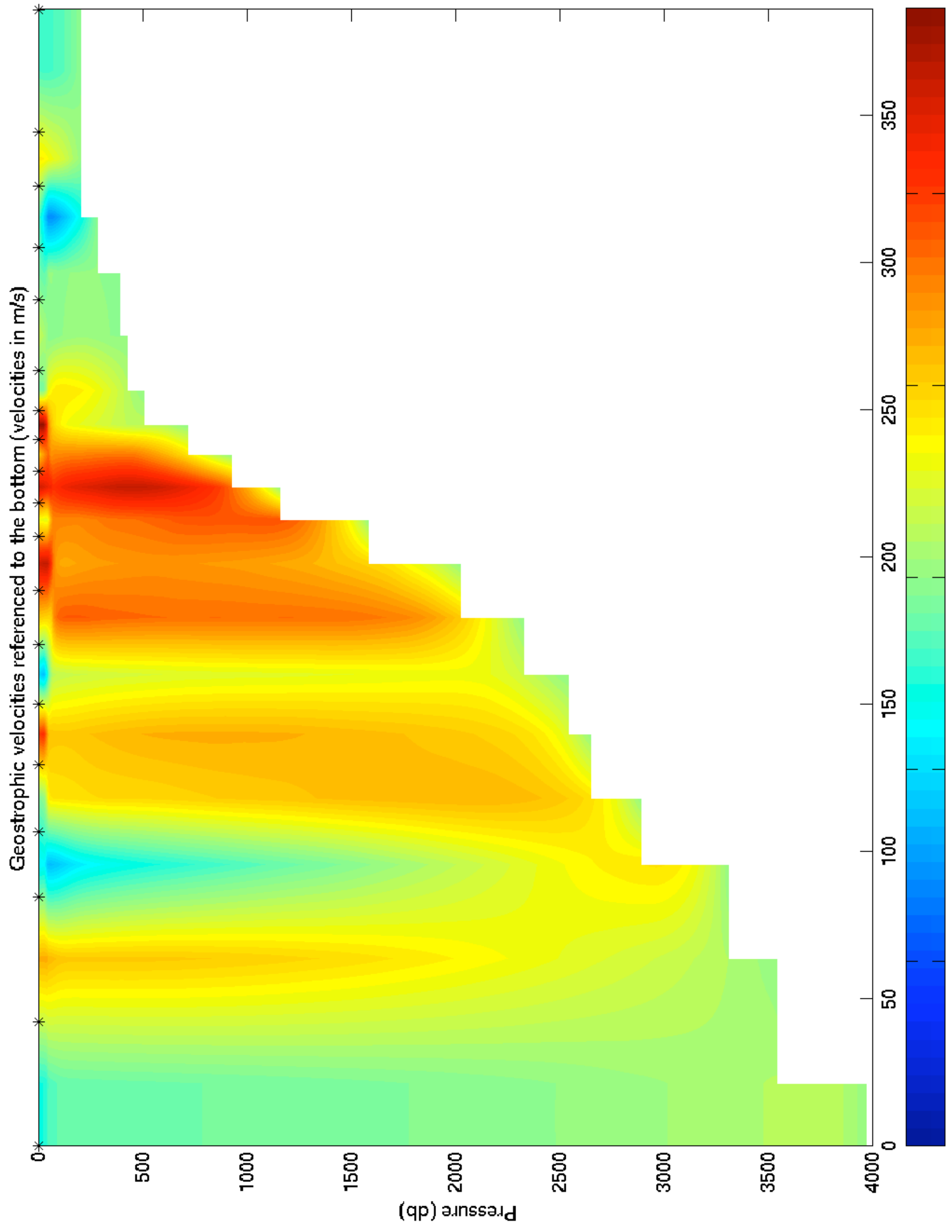


Figure 16: Geostrophic velocities for the ADELIE section. The values are referenced to zero bottom velocity, which is known to be a poor choice in this region because of the deep Weddell outflow.

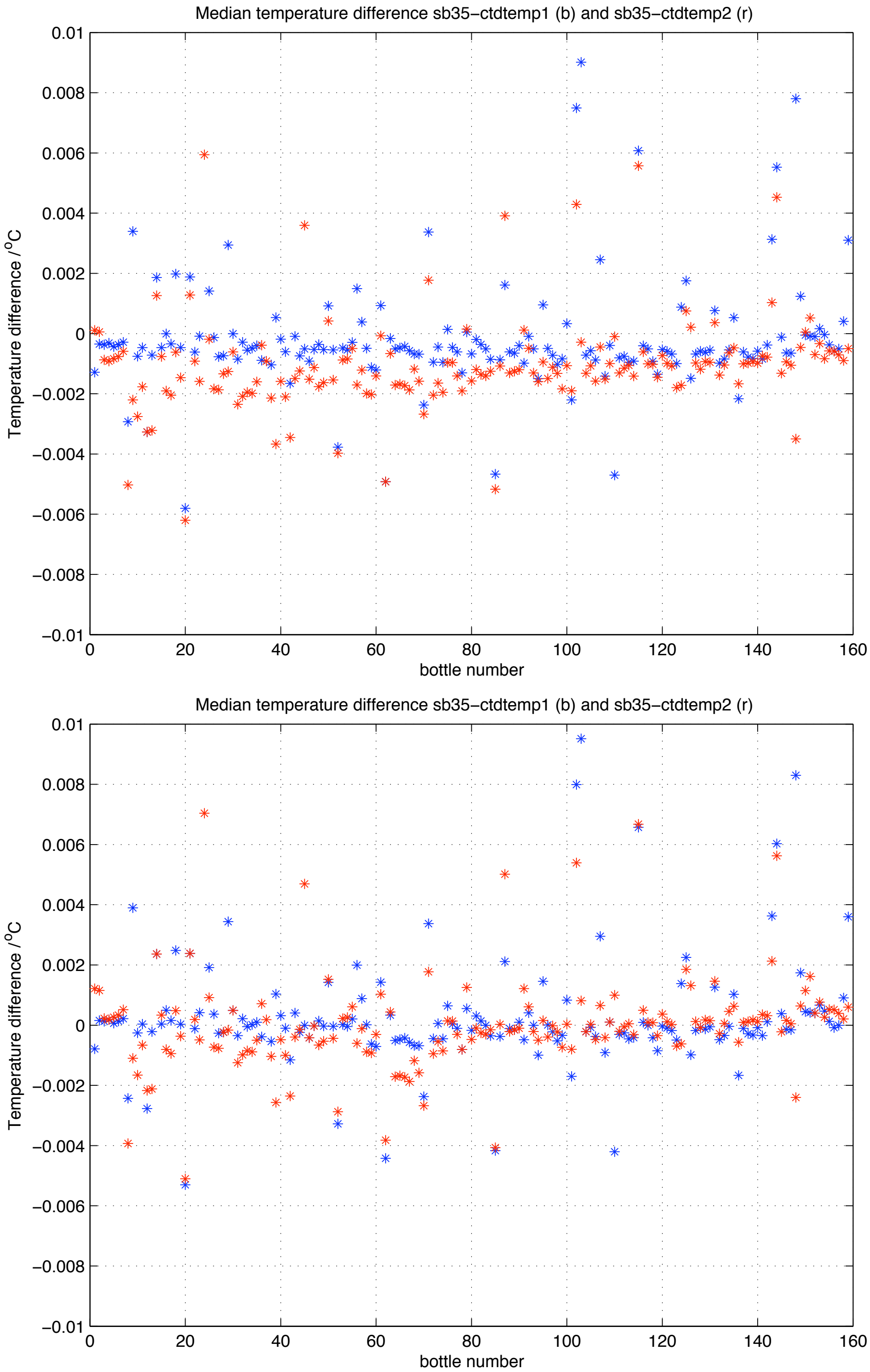


Figure 17: Temperature differences between SB35 deep ocean thermometer and CTD bottle temperatures. The upper panel shows the difference before any offset is applied and the lower panel includes the temperature offset. The blue symbols indicate differences from the first CTD sensor, while the red symbols indicate differences from the second CTD sensor.

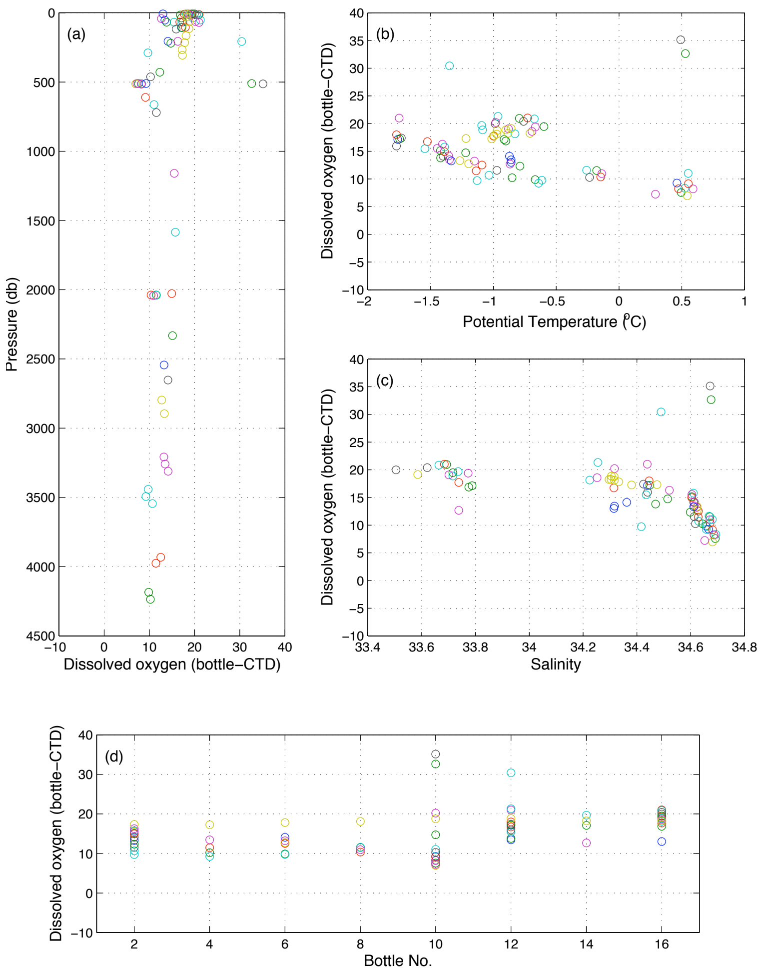


Figure 18: Differences in dissolved oxygen between water sample values and those obtained from the CTD cast plotted against (a) pressure (b) potential temperature (c) salinity and (d) bottle number.

2.4 Oxygen calibration

James Screen & Andy Thompson

Dissolved oxygen concentrations in the CTD bottle samples were derived by the Winkler method (see section 10.1). These concentrations were compared with the oxygen concentrations recorded directly during the CTD cast. The difference between the bottle oxygen concentrations and the oxygen concentrations recorded by the CTD sensor are plotted in Figure 18 as functions of (a) pressure (b) potential temperature (c) salinity and (d) bottle number. When we return to UEA we will use these plots to determine an oxygen offset and if this offset has any functional dependence on the properties in Figure 18.

3 Rosette Water Sample Analysis

3.1 Salinometry

Dougal Mountifield

Two BAS operated Guildline Autosal 8400B salinometers were available for use having serial numbers 65763 and 68533. Unit s/n 65763 was used for all samples with unit s/n 68533 being reserved as a spare.

Both salinometers were located in the Bio or "Cross" lab and operated at 24°C bath temperature in 22-23°C ambient lab temperature. The CTD and underway samples were taken and run manually by the science party. All samples were processed according to WOCE standards and protocols.

During the steam north to Montevideo, the ambient temperature in the Cross lab rose to 25°C and both salinometers began to suffer from instability in bath temperature. Both units were subsequently changed to 27°C bath temperature with much improved stability. The Cross lab is not a dedicated temperature-controlled environment and hence requires careful monitoring of ambient temperature and bath stability.

157 salinity samples were taken from CTD Niskin bottles.

3.2 Salinity Samples and Analysis

Loic Jullion

At each station, in order to calibrate the CTD's conductivity sensor, water samples have been collected from eight Niskin bottles fired at selected depths. Underway measurements were also made every four hours using the JCR uncontaminated underway supply to calibrate Oceanlogger. The samples were collected in 200 ml flat bottles. Before each collection, the bottles were washed two times with the sampled water in order to eliminate eventual salinity residual. The bottles were filled just under the shoulder and the bottle necks were wiped to prevent salt crystallization that could induce error during the measurements. The bottles were then closed by single-use plastic insert caps and stored in open crates.

We used an autosal salinometer (Gildline Instrument Ltd., serial number: s/n 65763) equipped with an Ocean Scientific International ltd. peristaltic pump. The salinometer was kept in a room with an initial constant temperature of 24°C. The samples were kept in the same room as the salinometer in order to adjust to the temperature. Keeping the temperature constant is critical as the conductivity is temperature sensitive. Keeping the room at a constant temperature of 24°C was hard as the room was not equipped with a separate air conditioning system and the temperature tended to rise to 25°C.

At the beginning of the sample analysis, the salinometer was calibrated using IAPSO standard seawater (batch 144, K_{15} = 0.99987, S = 34.995). The standardizing potentiometer was then fixed for the duration of the cruise and conductivity ratio corrections were applied in post-processing.

When not in use, the conductivity cell was filled with milliQ water to prevent the formation of salt crystals in the cell. Before and after each set of two crates, conductivity was measured in standardized seawater to evaluate the drift of the salinometer. As all the samples were not analysed during the same time period, at the beginning of each measurement period, eventual corrections of the conductivity ratio were made and recorded for post-processing. The sample bottles were inverted to reduce any salinity gradients that might have formed over time. The salinometer was then flushed three times with the sample before the actual measurement is made. Four readings per sample were made, and the average of the three most consistent were calculated to determine the sample conductivity. Between each sample, the collection tube was wiped dry in order to prevent a contamination of the following sample by the previous one.

The conductivity cell was kept in a bath at a constant temperature of 24°C but the bath temperature had to be raised to 27°C because of the difficulty of keeping the room at a temperature below 24°C. The recommendation from the salinometer manufacturer was to keep the bath temperature one to two degrees above the room temperature for stable measurements. A set of test samples, collected at the same time, was first analysed to control the sensitivity of the salinometer to the room and bath temperature. With a bath at 24°C, the quality of the measured conductivity was poor and the successive readings of the same sample were not consistent. However, with a bath at 27°C, the quality of the measurements was much better and consistent readings were made for the test samples.

3.3 Oxygen Isotope Measurements

James Screen

Sampling for oxygen isotope analysis was performed at each of the 20 CTD casts made during the cruise. The CTD was equipped with 8 Niskin bottles all of which were sampled—except for CTD001 when 2 bottles misfired. Samples were drawn directly from the Niskins into 150ml Winchesters that had rubber seals in the caps. The bottlenecks were wiped dry with blue roll. The bottles were further sealed with parafilm to prevent equilibration of the sample with the atmosphere. The bottles were numbered and indexed on the CTD logsheets. All samples will be analysed at the UEA Stable Isotope Laboratory to determine the ratios of stable oxygen isotopes. Samples were returned to UEA onboard the ship in the 4°C cold store.

4 Lowered Acoustic Doppler Current Profiler (LADCP)

4.1 RDI Workhorse LADCP Configuration

Dougal Mountifield

Comments on Unavailability of Uplooking Slave LADCP

NMF LADCPs 4275 and 4908 which were aboard the JCR prior to JR158 unfortunately both developed faults and had to be returned to the manufacturer. On January 11 two further units (1855 and 5415) were sent to the JCR in replacement for the faulty instruments. 1855 was sent from the NOC in Southampton ex-Polarstern via RAF, Brize Norton. 5415 was sent from RDI San Diego USA via Lan Chile. On the advice of BAS at the time, both replacement LADCPs were sent to Stanley, Falkland Islands.

Considerable effort was expended by NMF both in Southampton and in Rothera to secure the arrival of the replacement LADCPs in Rothera for mobilisation on JR158. Eventually the

Dash flight carrying the science party was delayed a few hours to ensure the embarkation of LADCP 1855. Unfortunately, after all efforts, the arrival of LADCP 5415 could not be secured in time for JR158. Hence only one LADCP was available for the cruise.

Deployment Comments

The LADCP was deployed in a down-looking orientation to allow bottom tracking. The science party was responsible for all configuration and data management.

As requested, due to the cold environment and short times between stations on the CTD transect, two LADCP battery packs were available. We had planned to fit a fresh battery pack after each cast, charging the exhausted one during the subsequent cast. This proved to be unnecessary and the battery was charged between stations to full capacity. This was probably only possible due to the reduced operating load of one LADCP instead of the originally planned Master/Slave pair.

Two complete packs of spare LADCP battery cells were also available but it was not necessary to utilise them.

Unfortunately after CTD cast 008 the LADCP developed a weak beam on transducer #4. This was diagnosed following this beam failing the beam continuity "rub" test and was confirmed by comparing echo intensities of all four beams using RDI's WinADCP software. The science party were advised to remove beam #4 from their post-processing and use a 3-beam solution. LADCP 1855 was returned to RDI for repair after JR158.

4.2 LADCP Data

Nuno Nunes

Setup

A down-looking 300 kHz RDI WorkHorse (WH) ADCP s/n1855 was mounted on the CTD frame. Communication for deployment and downloading data was done using BBTALK software on a dedicated PC. The battery pack was recharged to 58 V between stations using an Isotech power supply. Initially two battery packs were alternated (one being recharged while the other was in use), but this was found to be unnecessary and abandoned. The command sequence used for deployment was as follows (for a description of their effect see RDI's "WorkHorse Commands and Output Data Format" manual):

```
CR1 CF11101 EA00000 EB00000 ED00000 ES35 EX11111 EZ0011111 TE00:00:01.00
TP00:01.00 LD111100000 LF0500 LN016 LP00001 LS1000 LV250 LJ1 LW1 LZ30,220
SA001 SW05000 CK CS
```

Navigation data were retrieved from the ship's Seatex 3D GPS system.

Operation

Before cast 008, a crackling noise and a flash near the LADCP were reported by the crew. The instrument case and leads were checked for damage. Communication with the instrument was also checked. Nothing unusual was noticed and so operation was continued. The last thirteen casts (no. 8 to 20) were done in the 28 hours following this event.

Later, during data processing, it became clear that the event coincided with a failure of beam 4. Further investigation revealed a decrease of the echo intensity on beam 4, preliminarily diagnosed as being caused by flooding of the transducer. The unit will be sent to RDI for repair.

The following sections describe the protocol for deployment and data recovery, and a sample logsheet is included below (Figure 19). They are largely based on those used during JR97.

Deployment

1. Make sure that battery pack and communication cables are connected to the WH.

2. From BBTALK, wake up the WH. This is done by sending a break signal (press <END>) to get a command prompt (>), indicating that the WH is listening. When started, BBTALK automatically sends a break signal and gives you a prompt.

3. Press <F3> to start a log file. The naming scheme used for the cruise was j158m*nnn*.txt, where *nnn* is the three digit station number. Check in the status bar (bottom of window) that logging is ON.

4. Send command 'ts?' to retrieve internal clock time. If it does not match the scientific clock time, reset it using 'tsYYMMDDhhmmss'.

5. Send command 'rs?' to check that there is enough space left in the PCMCIA card for storing the cast data. As rough guidance, a 4000 metre cast will use around 5 MB. Erase data if needed ('re ErAsE').

6. Send command 'pa' to run pre-deployment tests. Note that the Receive Loop-Back and Wide Bandwidth tests may fail because the WH is not in water (check notes for tests PT3 and PT6 in the command mannual).

7. Switch off the power supply and measure the battery voltage. (Due to time constraints, and in order to speed up deployment, the battery pack voltage was monitored by technicians Dougal Mountifield and Mark Preston.)

8. Press <F2> to read the command file. The file used for this cruise contained the command sequence listed above. The WH will start pinging when the 'cs' command is sent. At this point, data is being recorded and BBTALK does not return a prompt.

9. Press <F3> to close the log file. The status bar will show that logging is OFF. You can exit BBTALK.

10. Disconnect the comms cable and replace with dry plug. The WH is now ready for deploying.

Data recovery

1. Reconnect the comms cable.

2. Send a break signal to stop data collection.

3. Check battery voltage and switch on the power supply.

4. Send command ‘ra?’ to check number of deployments.

5. Send command ‘cb811’ to switch the WH baud rate to 115200 (fastest). The corresponding setting in BBTALK has to be changed. (The version used on this cruise did this automatically.)

6. Press <Ctrl>+<Page Down> to download the cast data. Get a cup of tea or go help with water sampling...

7. When data transfer is finished, switch back to the default baud rate (‘cb411’), and power down the WH (‘cz’).

8. Rename the data file and copy it (and also the log file) to the backup storage. For this cruise, the naming scheme was j158m*nnn*.000 and the files were copied to the ship’s fileserver jrua.

9. As a safeguard, open the file with BBLIST and write down the file size and number of ensembles recorded.

Data processing

The LADCP data was processed using both the University of Hawaii (UH) and Lamont Doherty Earth Observatory (LDEO) software, kindly supplied by Brian King (NOC), who also provided initial training and support throughout. The software was run on a PC (AMD K7) under Ubuntu GNU/Linux 6.10 (kernel 2.6.17). Matlab version 7.4.0.1626 (R2007a) was used.

Only casts 1 (test cast) to 8 were processed with the UH software; for stations 9 to 20, the software failed, presumably because of bad data from beam 4. All stations were processed with the LDEO software, with warnings of “weak beam 2” (stations 1 to 7), “weak beam 4” (station 8), “broken beam 4” (stations 9 to 20) and “3 beam solutions” (stations 8 to 20).

The data processing sequence using the UH software is similar to that followed in JR97, apart from a few differences related to running the software on a Linux machine rather than on the ship Sun machines. After the software is setup, for the processing of cast data the major difference is related to the retrieval of navigation data.

At the command line prompt, issue the commands (commands are given in `type font` with comments following the arrow):

1. `tcsh` → shell scripts are written for tcsh

2. `cd /data/ladcp/uh/` → base directory for raw and processed data

3. `source LADall` → setup variables and paths

4. `cd proc` → main processing directory

5. `cd Rlad` → link to raw LADCP data

6. `./linkscript` → make symbolic links to the data files following the UH naming scheme

7. `cd proc; perl -S scan.prl NNN_cc` → outputs start and end times of casts and max depth, amongst other stuff; check if values are sensible. NNN is the station number. cc is NOT the cast number; instead, we follow the NOCS convention of using cc=02 to identify a down-looking WH.

8. `cd Rnav` → link to raw GPS data; make sure file update2 is correct! For JR158 update2 was created in jrua with the command 'listit -s$stime -e$etime -i$int seatex lon lat > ./update2'

9. `./updatesm.exec` → append GPS update to files all and sm.mat

10. `cd proc; ./putpos3 NNN cc` → get geomagnetic variation correction and update files stations.asc and mag_var.tab

11. `perl -S load.prl NNN_cc` → load data into database. Do this step only once! If you need to repeat this step, first delete the database files in casts/pNNN_cc/scdb/

12. `perl -S domerge.prl -c0 NNN_cc` → merge single pings into shear profiles; option -c0 means no CTD derived depths available yet. Output to casts/pNNN_cc/merge/

13. In Matlab: `plist = NNN.cc; do_abs` → integrate shear profiles to get velocities; produce a set of standard plots. Data is saved in:
matprof/h/pNNN_cc and uvwNNN_mean.mat.

At this stage, the LDEO processing consists of running two Matlab scripts, `sp.m` and `lp.m`, from /data/ladcp/ldeo/j158. The scripts call the processing routines and need to be edited beforehand (to check paths are correct, etc.).

Results

Figures 20 and 21 show the across-section velocities obtained with both the UH and LDEO. These are preliminary results without CTD corrections for depth and speed of sound. There are discrepancies in the results obtained, namely for stations 003 and 004 (first station plotted is station 002, as station 001 was a test station), where the UH processing shows a strong deep current (30 cm/s) flowing northwards of the section, while the LDEO processing gives a weaker flow in the opposite direction. The LDEO result shows good agreement with the bottom-referenced geostrophic calculation (16), in terms of feature location.

JR158 ADELIE LADCP Deployment / Recovery Log Sheet

Station number (nnn) …………..…Date (dd/mm/2007) ………..…..... Jday…..................

Latitude ……………………… Longitude ……………………Water depth (m) ……..……..

LADCP instrument: RDI WorkHorse 300 kHz S/N 1855 (downlooking)

Pre-Deployment (Comms. And Charge leads should be in place)

In BBTALK

1. Log file name (F3) j158m……………….. **.txt**
2. Time check (TS?) GMT …………………......

   Time correction made, if necessary (TSYYMMDDhhmmss) Y / N
3. Memory unused (RS?) …………………...… Mb

   Erase if necessary (RE ErAsE). Erased? Y / N
4. Run tests (PA) Y / N
5. Battery Voltage (maximum 52V) measure across charger ……………………...…V

Deployment

6. Command file (F2)
7. MASTER deployment time (start pinging), from master clock GMT.....…………………….
8. Close log file (F3)
9. At bottom of cast Time ……………… Lat ………….….. Long ………………

   CTD depth ……………. m Seabed …………………… m

Recovery (in BBTALK)

10. Time of stopping MASTER logging/pinging GMT………………………..
11. Battery Voltage, measure on charge ………………………………... V

Data Transfer (in BBTALK)

12. Number of deployments (RA?) …………………...….
13. Set baud rate to 115200 (CB811)
14. Default filename (Ctrl+Page Down) -RDI-…………….**.000**
15. Set baud rate to 9600 (CB411) and power down (CZ)
16. Renamed file j158m…………….**.000**

In BBLIST

17. File size ……………………b
18. Number of ensembles ………………………
19. Copy station data and log files to U:\data (jrua) Y / N
20. Comments …………………………………………………………………………….

Figure 19: LADCP logsheet used for JR158.

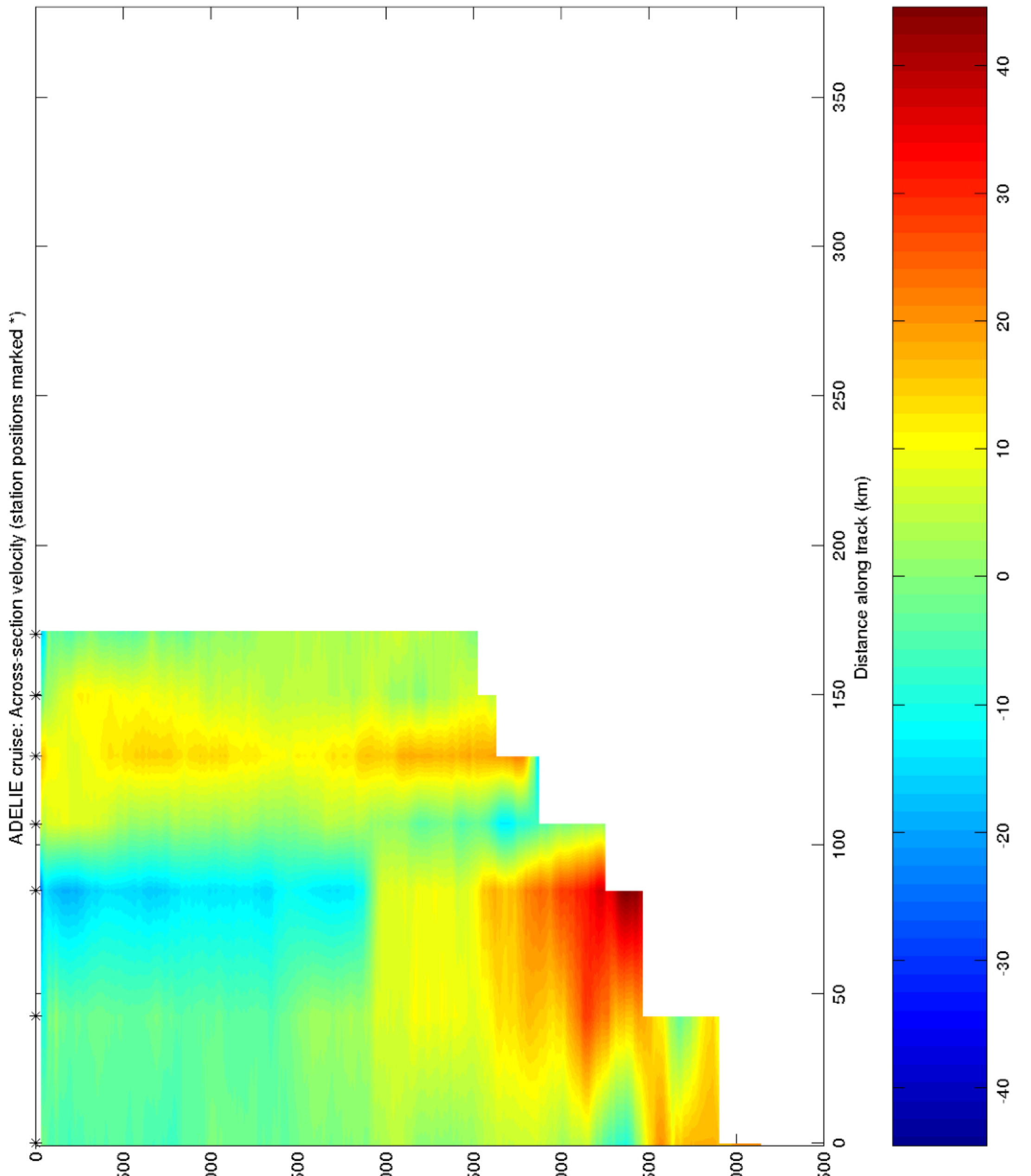


Figure 20: LADCP across-section velocity, UH software. Only stations 2 to 8 are plotted, see main text for explanation.

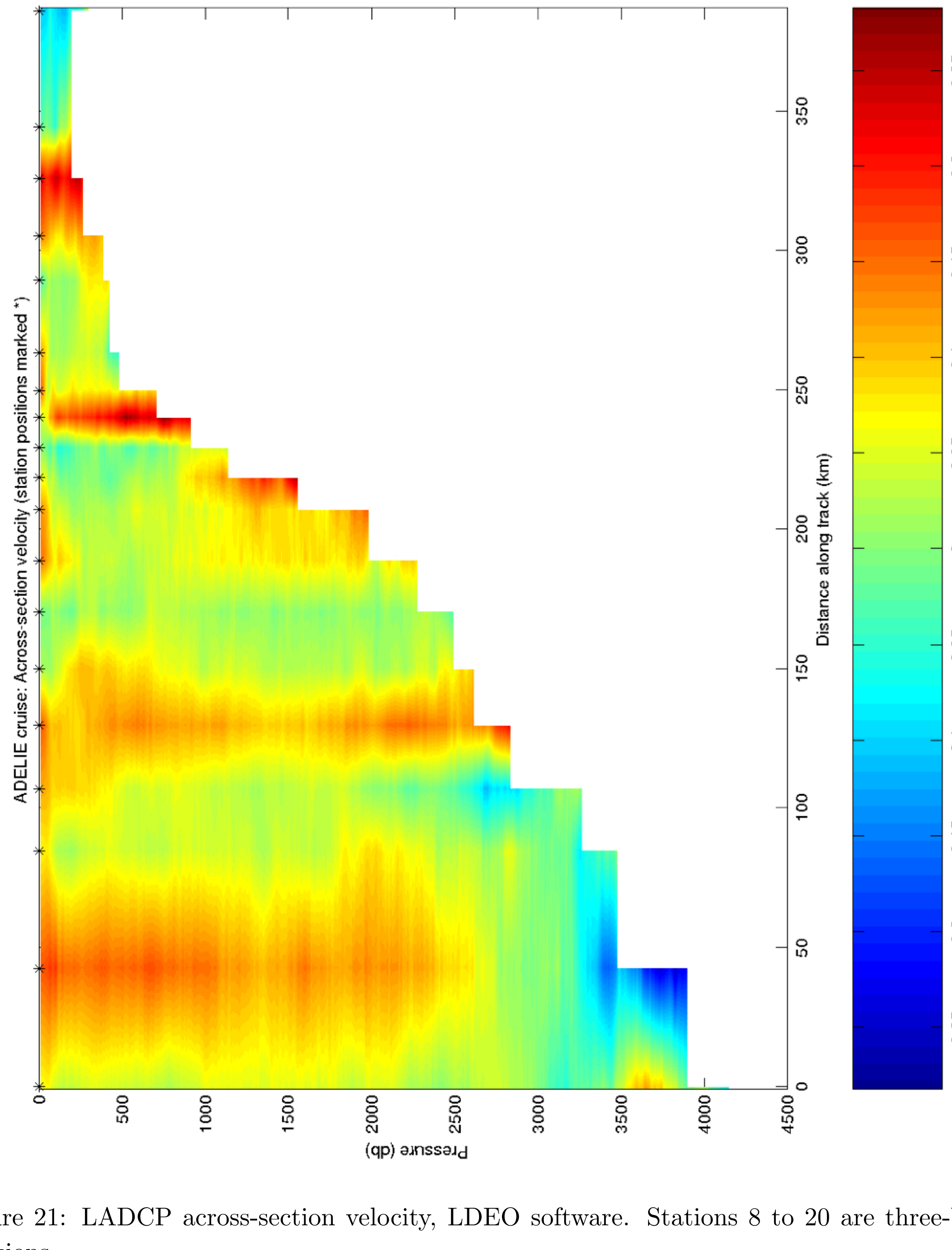


Figure 21: LADCP across-section velocity, LDEO software. Stations 8 to 20 are three-beam solutions.

Figure 22: (*a*) Drifters on the back deck after having been activated by removing the magnet on the buoy. (*b*) Drifter deployment off the stern of the JCR. (*c*) Drifter floating in the water shortly after deployment. The cardboard hood covering the buoy has fallen off, but the cardboard bands can take hours to dissolve.

5 Drifters and Floats

5.1 Surface Drifters

Andy Thompson & Armando Trasviña

Forty surface drifters were deployed during the cruise. The drifters were all Clearsat-15-III surface drifters, twenty of which included a Global Positioning System (GPS) navigation option. All drifters are drogued at 15 m depth and employ a holey sock technique to track the surface currents and minimize slip due to wind forcing on the buoy. Communication is through the Argos satellite system and the data is obtained from NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML).

The drifters came packed in cardboard boxes from Clearwater and were individually wrapped in plastic. We decided to turn on each drifter both to detect any faulty drifters and also for future error checking as the position on deck could be referenced to the GPS position provided by the JCR. During the steam from Rothera towards Joinville Island, on the morning of February 7, all drifters were removed from the hold and placed on deck. The weather was sunny and calm. The plastic was removed from each drifter, but the cardboard coverings of the buoy and the cardboard wrappings on the holey sock were not. These are designed to dissolve in water and aid in the deployment of the drifters (they can simply be thrown over the side). Finally, the drifters were switched on by removing a small magnet on the underside of the buoy. These magnets are also designed to fall off in salt water. The activation of all the drifters began at approximately 13:30 GMT (Julian day 038) at 64 49.20°S and 65 19.80°W.

All SVP (without GPS) drifters immediately began transmitting both position and sensor data. The SVPG (with GPS) drifters were providing fewer fixes and no GPS or sensor data. Through email correspondence with Gary Williams (wgwill@clearsat.net) at Clearwater Drifters we learned that the SVPG drifters are more sensitive to buoy orientation and need an unobstructed view to the sky to transmit properly. He suggested that the SVPG drifters would work properly when deployed. In the afternoon the drifters were covered with a net as stronger winds and stronger swell were predicted that night. Upon waking in the morning, we found that a significant amount of spray was reaching the back deck and wetting the drifters. After breakfast we decided to move all drifters to the wet lab so that the cardboard packaging would not be damaged before deployment.

Through email correspondence with Peter Niiler at Scripps Institution of Oceanography we were told that ideal conditions for deploying the drifters requires the ship to turn into the wind and reduce its speed to 2-3 knots. The drifter should be deployed over the stern from the lowest deck in order to avoid tangling with the screws and having the wind blow the drifter back onto the hull. This advice seemed to contradict the instructions provided by Clearwater which suggested that drifters could simply be heaved over the side at speeds up to 25 knots. Our hope was to avoid having to turn the ship into wind in order to obtain a clean shipboard

Table 4: Drifter deployment summary. SVPG drifters include GPS navigation, while the SVP drifters do not. All drifters were activated on 07/02/2007 (Julian day 038) at 13:30 (GMT) at 64 49.20°S and 65 19.80°W. Note that these are not corrected depths and thus may have large errors due to large fluctuations in the EA600 readings.

Drifter No.	**Drifter ID**	**Julian Day**	**Date**	**Time (GMT)**	**Latitude (°S)**	**Longitude (°W)**	**Depth (m)**	**Drifter Type**
001	70546	039	08/02/2007	18:49	63 09.74	54 53.95	325	SVPG
002	70549	039	08/02/2007	20:12	63 09.61	54 28.79	201	SVPG
003	70552	039	08/02/2007	21:35	63 09.58	54 04.31	n/a	SVPG
004	71215	039	08/02/2007	22:22	63 11.43	53 53.34	260	SVP
005	70550	039	08/02/2007	22:57	63 12.64	53 43.22	301	SVPG
006	71217	039	08/02/2007	23:47	63 14.33	53 31.47	370	SVP
007	70553	040	09/02/2007	02:48	63 16.38	53 19.93	401	SVPG
008	71231	040	09/02/2007	14:25	63 18.03	53 10.21	291	SVP
009	70559	040	09/02/2007	16:05	63 19.82	53 00.03	343	SVPG
010	71226	040	09/02/2007	16:49	63 22.80	52 46.80	458	SVP
011	70543	040	09/02/2007	17:33	63 25.30	52 33.63	525	SVPG
012	70555	040	09/02/2007	17:33	63 25.30	52 33.63	525	SVPG
013	70545	040	09/02/2007	17:33	63 25.30	52 33.63	525	SVPG
014	71230	040	09/02/2007	17:59	63 27.00	52 26.41	580	SVP
015	70544	040	09/02/2007	18:16	63 28.22	52 18.65	734	SVPG
016	71213	040	09/02/2007	18:47	63 28.82	52 13.26	835	SVP
017	70542	040	09/02/2007	19:10	63 29.48	52 07.39	947	SVPG
018	70554	040	09/02/2007	19:10	63 29.48	52 07.39	947	SVPG
019	70557	040	09/02/2007	19:10	63 29.48	52 07.39	947	SVPG
020	71212	040	09/02/2007	19:39	63 30.66	52 01.22	1057	SVP
021	70556	040	09/02/2007	19:55	63 31.82	51 55.30	1176	SVPG
022	71229	040	09/02/2007	20:17	63 33.01	51 49.22	1329	SVP
023	70547	040	09/02/2007	20:42	63 34.23	51 43.26	1603	SVPG
024	70548	040	09/02/2007	20:42	63 34.23	51 43.26	1603	SVPG
025	70558	040	09/02/2007	20:42	63 34.23	51 43.26	1603	SVPG
026	71225	040	09/02/2007	21:03	63 35.44	51 37.18	1737	SVP
027	70551	040	09/02/2007	21:26	63 37.22	51 31.28	2048	SVPG
028	71216	040	09/02/2007	21:58	63 38.46	51 20.42	2408	SVP
029	71227	040	09/02/2007	22:28	63 39.63	51 10.00	2342	SVP
030	71222	040	09/02/2007	22:58	63 40.82	50 58.83	2468	SVP
031	70561	040	09/02/2007	23:28	63 42.13	50 48.04	2886	SVPG
032	71214	041	10/02/2007	00:01	63 44.46	50 36.62	2646	SVP
033	71224	041	10/02/2007	00:45	63 46.83	50 25.13	2791	SVP
034	71223	041	10/02/2007	01:23	63 48.59	50 13.66	2957	SVP
035	70560	041	10/02/2007	02:04	63 50.99	50 02.28	2839	SVPG
036	71219	041	10/02/2007	02:49	63 52.82	49 48.50	2911	SVP
037	71220	041	10/02/2007	03:29	63 54.01	49 35.30	2930	SVP
038	71221	041	10/02/2007	04:52	63 57.02	49 08.94	2818	SVP
039	71218	041	10/02/2007	07:15	64 04.23	48 19.61	3758	SVP
040	71228	041	10/02/2007	09:14	64 10.70	47 29.10	4207	SVP

ADCP transect, however, because of the rough weather during our drifter leg of the cruise, at most sites the JCR did turn into wind. Also, the crew of the JCR performed most of the deployments because the spray had frozen on the deck making for slippery conditions. It was initially estimated that our drifter leg would take between 20 and 24 hours, however, there was a gap of about 14 hours between drifter 007 and 008 when the JCR turned into wind to ride out a storm. The entire drifter leg was completed in roughly a day and a half.

We obtained surface drifter fixes from AOML's anonymous FTP site. Files are posted daily with the data obtained from Argos. Since we are only concerned with our 40 drifters, we extracted data from a smaller file under programme 5325. To obtain the data:

```
ftp ftp.aoml.noaa.gov
username: anonymous
password: your e-mail address
cd /phod/pub/pazos/daily_5325
```

This same method for obtaining data can be continued following the cruise. Each daily file is roughly 500KB in size and any questions can be directed to Mayra Pazos at AOML (mayra.pazos@noaa.gov).

The data is in Argos format, which for each entry consists of one line of transmitter identification and multiple lines of data collection messages. The data has the form:

Transmitter ID

1. programme no. (for us this is 05325)
2. Drifter ID no. (70542 - 70561, with GPS and 71212 - 71231, without GPS)
3. No. of lines in entry (includes both transmitter ID and data collection lines)
4. No. of sensors (we have 3 for SVP drifters and 31 for SVPG drifters)
5. Satellite ID (this is a single character)
6. Location class obtained
7. Date (yyyy-mm-dd)
8. Time (HH:MM:SS)
9. Latitude (-90 to 90)
10. Longitude (0 - 360)
11. Location altitude (usually zero)
12. Calculated frequency

Data collection message

1. Date (yyyy-mm-dd)

2. Time (HH:MM:SS)
3. Compression index
4. Value of sensor 1 (strain gauge)
5. Value of sensor 2 (battery, VDC)
6. Value of sensor 3 (air/sea surface temperature)
7. Value of sensors 4 - 31 (related to GPS navigation in the SVPG drifters)

The sensor data are returned as integer numbers and are then converted to their physical values using a linear equation with two coefficient $A0$ and $A1$. The following table gives the relevant coefficients for the sensors on the ADELIE.

	Integer Range		Physical Range		Coefficients	
	Low	High	Low	High	$A0$	$A1$
Strain Gauge	0	255	4	157	4	0.60
Battery, VDC	0	63	0	12.6	0	0.2
Air/Sea Surface Temperature	0	1023	-5	46.15	-5	0.05

A few rough Matlab routines were written to read and plot the Argos data. The Matlab script `ARGOSposition.m` reads the daily AOML file, which has the form `DDMMMYY.LOG` (e.g. `09FEB07.LOG`), line by line, and pulls out the relevant data for drifters 70542-70561 and 71212-71231. The Argos data sometimes has entries where sensor readings are given, but no latitude and longitude fix is provided; these sensor readings are currently ignored in the Matlab programme. The script `drifterplot.m` produces a plot of the drifter tracks using the m_map Matlab routines. Drifters 70546, 71217, 71230, 70554, 70551 and 71223 were selected to participate in the Great Drifter Race as part of our outreach programme. Each of six schools are assigned one drifter and the distance from the deployment site is tracked against time. The Matlab script `schoolplot.m` generates the Great Drifter Race figure.

As of the completion of our cruise on the 20th of February, only one drifter had stopped responding, drifter 71214. It only transmitted nine position fixes before going silent. A number of the SVPG drifters took as long as a few days before sensor data and GPS navigation began transmitting properly. As of February 20, all remaining drifters appear to be transmitting reasonable sea surface temperature values. Gary Williams is currently working a short programme to decipher the GPS data from the parsed and unparsed Argos output.

Sea surface temperature (SST) from Argos drifters

Raw data from the ftp site was downloaded daily. This report shows all available data until February 15, 2007. All Matlab scripts are kept in `/users/soc/work/drifters/` directory generated during cruise JR158. The following steps are used to interpret the SST data:

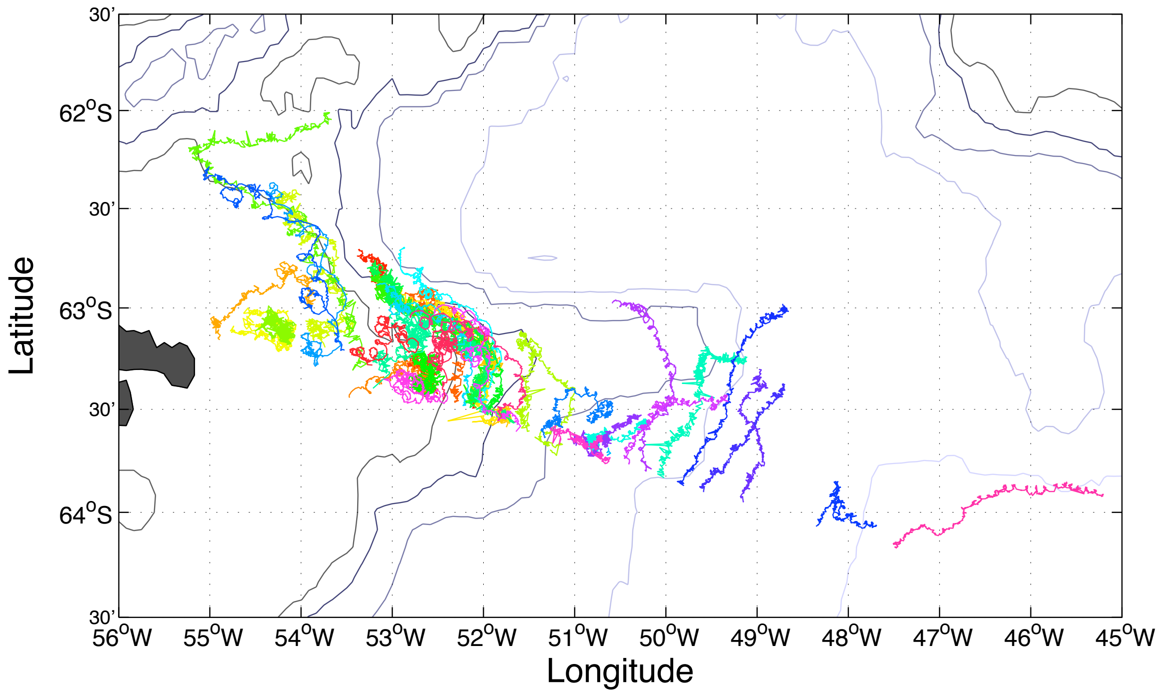


Figure 23: Drifter paths as of 24/02/2007.

1. The raw data was read using programme `leedrif.m`. This data includes all drifters sending data to Service Argos and it becomes necessary to restrict the geographic area. (output: *allADELIEdrif.mat*)

2. programme `areaseldrif.m` reads *allADELIEdrif.mat* and selects the area of interest. It also eliminates large errors or outliers using a simple criterion (SST range).

3. programme `seltem.m` is used to select valid SSTs by eliminating entire time series after visual inspection. It also eliminates large spikes using a simple de-spiking function. OUTPUT: *ADELIEdrsel*. This file only contains the following variables: *ID LAT LON SST dd ho mi mo ss yy*.

4. Finally in programme `mapasst.m` the de-spiking is used for a second time to eliminate the last outliers (24) and horizontal maps are produced. The maps obtained are shown in Figure 25.

5.2 ARGO Float Deployments

Patama Singhruck

Eight Argo floats were deployed during the cruise. They are APEX-SBE profilers produced by Webb Research Corporation, USA. They are programmed to drift with the current at a depth of 1000 m. The floats are equipped with temperature and conductivity sensors and a pressure gauge. Every 10 days they descend to 2000 m, and then measure temperature, conductivity and

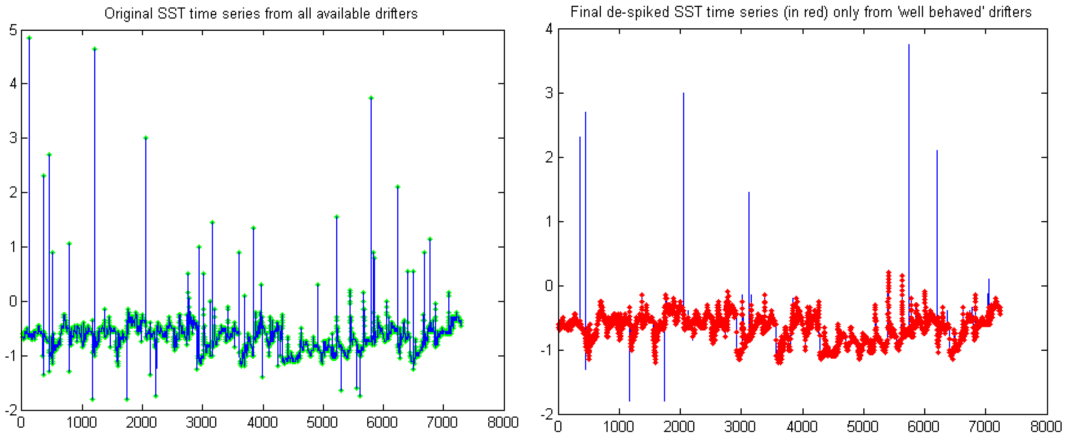
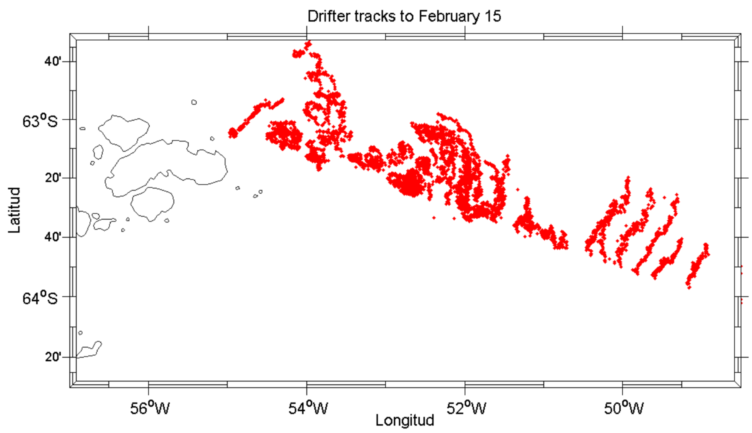


Figure 24: Left: original SST time series including data from all available drifters in the region of interest. Right: the data in red results after selection of the valid time series and three different de-spiking steps. These are used to produce the SST maps.



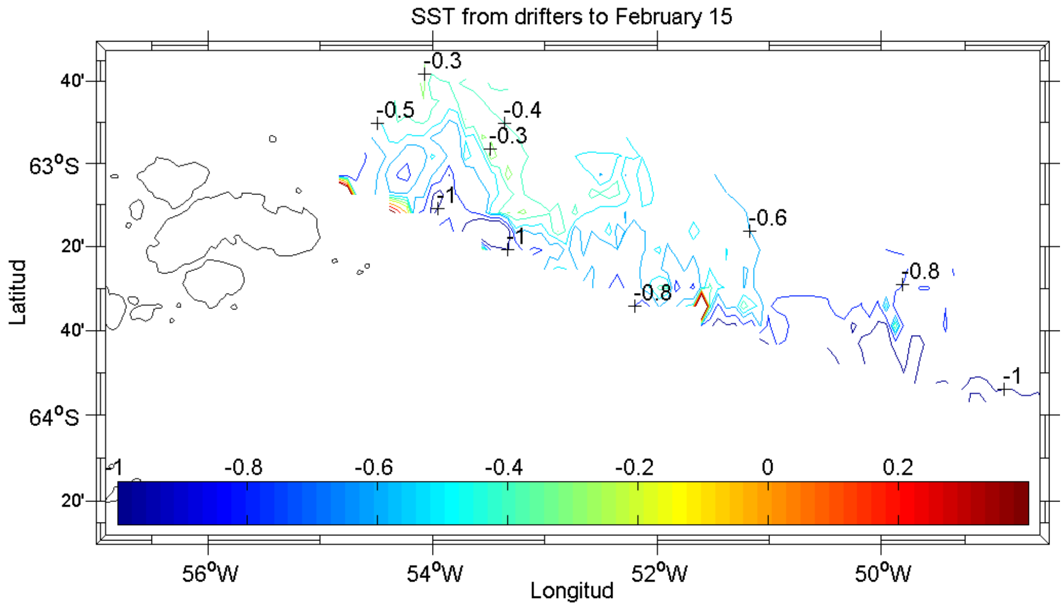


Figure 25: The lower map shows SST contours obtained from drifter data. The map on top contains the positions of all available drifters.

Table 5: Details of Argo float deployments in the Weddell Sea.

Float Reference	**WMO ID**	**Julian Day**	**Date**	**Time (GMT)**	**Latitude (°S)**	**Longitude (°W)**	**Depth (m)**
APEX-SBE 2651	7900152	042	11/02/2007	21:57	63 37.2042	51 31.2250	2048.38
APEX-SBE 2650	7900151	043	12/02/2007	00:06	63 34.2022	51 43.2243	1602.00
APEX-SBE 2652	7900153	043	12/02/2007	01:56	63 31.8093	51 55.2132	1178.75
APEX-SBE 2653	7900154	043	12/02/2007	02:30	63 30.4792	52 02.0059	1043.13

Figure 26: (*a*) Argo float carried over the side of the JCR using the winch. (*b*) Argo float just before release. The metal bar is pulled out quickly releasing the rope knot. (*c*) Argo float immediately after deployment. All floats remained in a horizontal position as the JCR steamed away. This occurred because new floats have smaller holes to minimize sediment intake and thus take longer to fill with water and flip up vertically.

pressure on the way up. At the surface, they transmit their locations and vertical hydrographic profiles back to the Argo data centre via ARGOS satellite before sinking to a parking depth and repeat the cycle again. Floats are designed to make about 150 such cycles. Of the eight Argo floats we deployed, four have an ice detection feature.

Argo floats were shipped to the deployment site in hibernate mode. Approximately one hour before deployment, the float was activated by holding a magnet for 5 seconds on the RESET location marked on the float hull. Once activated it began self testing and put the float in mission mode. After approximately 10 seconds the float sent six ARGOS transmissions at 8 seconds intervals. This transmission can be detected by placing the ARGOS receiver/beeper close to the antenna. The hydraulic piston pump began to move to full extension and the oil bladder expanded. It took approximately 12-25 minutes for the oil bladder to reach full inflation. The float then began transmitting its test massage and the air bladder began to inflate. This took up to 12 operations of the air pump to reach full inflation. Each operation of the pumps was followed by a transmission. The test messages were sent approximately every 45 seconds. The messages can be heard as beeps similar to those heard before by using the transmission detector. Deployment took place on the aft deck with the ship being stationary. The float was lowered into the water gently.

Four floats were deployed in the Weddell Sea along the continental slope. They were floats with ice detection feature. The floats were deployed immediately following the completion of the CTD station. Four remaining floats were deployed evenly in Drake Passage between the Polar Front and the Southern Antarctic Circumpolar Current Front on the steaming leg to Montevideo.

During the cruise, Prof. Heywood was able to confirm, by e-mail, that the first four Argo floats had successfully sent test signals to UK Argo data centre at British Oceanographic Data Centre (BODC).

References

APEX float deployment instruction (bare) for floats with lithium batteries, Ver 1.3 October 2006.

Table 6: Details of Argo float deployments in Drake Passage between the Polar Front and the Southern Antarctic Circumpolar Current Front on the steaming leg to Montevideo.

Float Reference	WMO ID	Julian Day	Date	Time (GMT)	Latitude (°S)	Longitude (°W)	Depth (m)
APEX-SBE 2637	1900940	045	14/02/2007	07:40	58 47.5150	52 08.8505	3908.01
APEX-SBE 2636	1900939	045	14/02/2007	10:57	58 06.9288	52 14.7805	4138.39
APEX-SBE 2638	1900941	045	14/02/2007	14:08	57 33.8586	52 20.7273	4521.94
APEX-SBE 2639	1900942	045	14/02/2007	17:28	56 59.5877	52 26.6777	4331.74

6 Microstructure Measurements

6.1 Rockland VMP-5500 Microstructure Profiler

Dougal Mountifield

The Rockland VMP-5500 full ocean depth microstructure profiler was deployed opportunistically for evaluation prior to its programmed use during 2008. Five deployments were undertaken to build confidence and understanding of the instrument.

The instrument was deployed over the starboard waist using the main crane and was released with a toggle. Recovery was also over the starboard waist using a clip-stick to attach the recovery line. Prior to free deployment, a single buoyancy test was undertaken with the instrument made fast to the crane. Subsequently two tethered casts were completed to 50m using a 200m Kevlar rope safety line. Shear probes were installed from the second tethered cast onwards. The VMP had a constant fall speed of approximately 35 metres per minute. The instrument overshoots its programmed depth by approximately 20 metres due to a 38 second delay before it releases its ballast at the end of the downcast.

Some problems were encountered with setting the instrument for deployment. When the deck cable was removed, the ballast release kept triggering, dropping the steel weights on deck. The solution was to power the instrument down after programming, remove the deck cable, then install the submersible "on/off" switch cable blank. The installation of the large black blanking plug switches the instrument on for deployment. Following the successful tethered dips, three free deployments were carried out, the deepest to 800m.

6.2 Deployment and Recovery Notes for VMP

Graham Chapman

The Vertical Microstructure Profiler is a small autonomous freefall device with 6 kg negative buoyancy for sinking and only 6 kg positive buoyancy for ascent. It is therefore very wind, wave and current affected and could easily be sucked under ship by propeller and thrusters wash.

Ship's crane and toggle slip were used for launching off the starboard side where view from the DP consol is best. The ship would come on station, head to wind and make a quick assessment of surface current/expected drift, heading would then be adjusted (within capabilities of vessel) to ensure VMP drift to starboard. The propeller and rudder would be de-selected and the VMP deployed. If the expected drift were slight or uncertain, the vessel would start to move to port during deployment with speed increased as the toggle was released.

A predicted position for the VMP to surface was calculated and if within a couple of hundred metres the vessel would stop and wait for it to surface. On the deepest cast we did, an estimated 800-1000 metres drift NE'ly was calculated so the vessel was moved 700 metres NE during the VMP descent and rise. It actually surfaced a further 700 to 800 metres away.

With the VMP being almost neutrally buoyant it rises and sinks quite a lot at the surface; sinking below the surface, but rising quite proud to be easily seen and easily hooked onto once alongside. The VHF radio beacon worked well and could easily have guided the vessel toward the VMP if it were not seen.

During recovery the prop and rudder would be de-selected and the VMP put right on the starboard beam clear of any thrusters wash. The vessel would be brought sideways up to the VMP for the deck crew to snap a hook and line to the top ring. The crane was then used to lift it on board. The crane was preferred to gantry for more flexibility and better outreach. As soon as the crane was attached to the VMP, vessel would be stopped and crane would slew to keep VMP off ships side. VMP would then be lifted onto deck.

There are a number of very exposed and delicate instruments on the unit and it can only be handled in certain places. Also as it sits in its cradle it is important to check instruments and cables are clear.

6.3 VMP Operation and Data

Kurt Polzin & Alberto Naveira Garabato

Cruise narrative

The cruise started from Rothera at 17:00 on 6 February 2007. The VMP was assembled during 7-8 February. Bad weather during a test station on 8 February did not permit deployment of the profiler. The weather degraded further and winds exceeded gale force the next two days. The weather was again good for use of the instrument by 11 February, but issues with the precise interpretation of the instruction manual precluded use of the instrument until the following day (see section 6.1). Over the side operations on 11 and 12 February included a check for gross buoyancy (the instrument floated without weights) and a short (50 m) profile to check performance of the weight release mechanism (it fired and weights dropped). Three profiles followed the two subsequent days.

Over-the-side operations were conducted with the ship's crane on the aft section of the 01 deck. This appeared to work reasonably well, though higher sea states will require two tag lines to limit swing of the instrument. The ship was large enough that ship motion will not be a huge factor. Recovery time was significantly longer than with the High Resolution Profiler. The ship drivers should be encouraged to approach the instrument at 0.5-1.0 knots and pick the instrument as it walks down the starboard side. If the instrument is to be hoisted with the crane (rather than recovery rig on the stern) the crane can be kept outboard so that the profiler streams aft and is kept away from the hull as the ship slows.

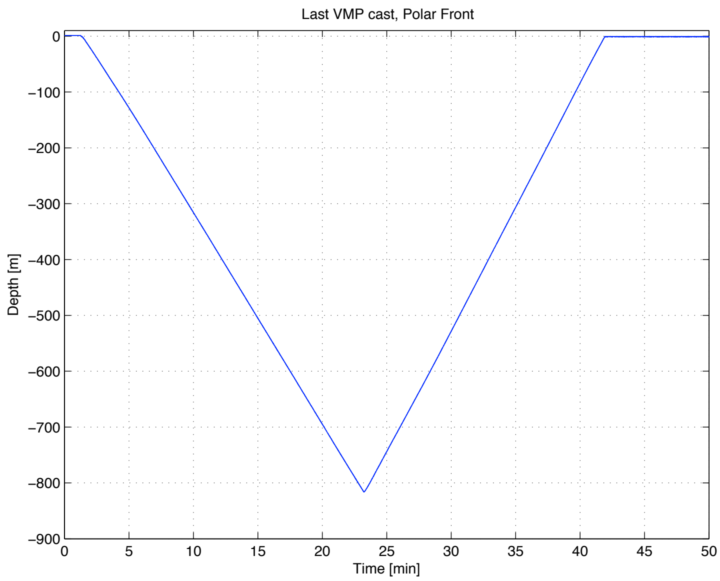


Figure 27: Fall/rise rates for the microstructure profiler (VMP).

Operations

The instrument was assembled by Dougal Mountifield at the National Oceanography Centre, Southampton prior to shipping to Port Stanley, Falkland Islands. Dougal noted that welds on the nose guard assembly interfered with the mating of the pressure case end cap. If the nose guard was snugly in place on the end cap, the end cap could not be fully tightened. Consequently the welds on the nose guard assembly were filed flush. The bolts holding the syntactic foam sections together were also noted to be of poor quality. One of the bolts failed during this initial assembly. Another of the bolts was to fail during assembly of the instrument at sea. Corrective action is simply that higher-grade stainless bolts should be used.

We used the VMP in the following ballasting/drag configuration: all foam flotation, two (of four) drag brushes. Fall/rise rates were roughly the nominal 0.65 m s^{-1} expected for this configuration (Figure 27). We used the following recovery aids: Novatech strobe and radio direction finding (RDF), and an improvised flag attached to the antenna. We had also intended to have an Argos beacon on the instrument, but FEDEX delivery to our agent in Punta Arenas was a day too slow. In the future, we intend to have all these recovery aids on the instrument as well as a pinger. The possibility of adding Iridium is being discussed.

In addition to the issues mentioned at the start of this subsection, we noticed one other problem. There was minor corrosion on the dummy cap of the E/CRG cable, likely resulting from the cap not being positioned snugly against the O-ring prior to deployment. A word of caution to the user is that this connection needs to be fully tightened. The caps and cables should be cleaned as appropriate at home.

This is the recommended sequence for launch, established with Rolf Lueck's advice:

1. Prepare the instrument with everything mounted and connected except the weights.

2. Connect the E/CRG cable and make sure that there is enough free file space for the next profile. This step can come before #1.

3. If you have changed the setup.txt file, test it by running `odas4ir` manually once and look for error messages, in case you made some sort of mistake.

4. If everything is fine (the new setup.txt files seems to work and there is enough free space for a profile), then turn off the instrument. Issue "shutdown now - h", and wait about 30 seconds to power down the instrument. It is also OK to simply turn off the instrument.

5. Disconnect the E/CRG cable and install the dummy plug. The release solenoid will activate in 36 seconds.

6. Move the instrument to your launch site (or where the crane can pick it up).

7. Install the weights, make sure that the cable holding the weights has about 10 pounds of tension.

8. Install the"ON" switch—data acquisition will start automatically within about 2.5 minutes.

9. Put instrument into the water and launch it any time after the 2.5 minutes since installing the ON switch.

As ancillary information, these are the weight release conditions:

- Generated and logged by computer:
    1. P > max_pressure.
    2. t > max_time.
    3. P > 100dBar AND dP/dt < 0.2 dBar/s.
- Generated by firmware on release board:
    1. V_Battery < 9 V (this is also the condition when the instrument is turned off, in which case V_Bat = 0V).
    2. t > 4.5 hours since instrument was turned on.
- Generated by chemical corrosion:
    1. Link in the cable holding the weights breaks after about 24 hours. Be sure to replace this link if the instrument has been in the water for more than 12 hours.

Operations summary

Date	**Time (GMT)**	**Latitude (°S)**	**Longitude (°W)**	**Area**	**Action**	**Depth (m)**	Max P **(db)**
11/02	13:21	-63.70	-50.80	CTD 7	tethered	2600	surface
12/02	14:15	-63.16	-54.07	CTD 18	tethered	210	50 +
13/02	12:13	-62.24	-51.46	Powell Basin	tethered	3140	150 +
13/02	16:21	-61.55	-51.60	Powell Basin	free-fall	2310	400 +
14/02	20:04	-56.58	-52.52	Polar Front	free-fall	4160	200 +
14/02	21:22	-56.57	-52.51	Polar Front	free-fall	4160	800 +

Sensor	s/n	Cal	Date	C(pF) on/off	R(MΩ) on/off
ms1	M389	0, 0.0713	12/02	875 / 90%	? / ?
ms2	M390	0, 0.0857	12/02	870 / 90%	? / ?
mt1	T272	-35, 0.99853	12/02	-	-
mt2	T273	-39, 0.99853	12/02	-	-
mc	C25	-0.784, 175	12/02	-	-

The serial numbers of the micro-probes were verified upon dismantling the instrument. Shear probe capacitances were not measured prior to initial mounting. Instead, capacitances were measured at the end of the cruise, and were about 90% of the nominal values on the calibration sheets. Several unused probes were checked and found to have the same disparity with the nominal capacitances on the calibrations sheets. Resistances were not measured due to the unavailability of an ohmeter with an appropriate scale.

Data quality

Noise levels of the microstructure suite were the high quality variety expected of a free-fall profiler. Illustrative, preliminary plots of temperature microstructure and a shear-derived (ms1) estimate of the turbulent kinetic energy dissipation rate are shown in Figures 28 and 29, respectively. The conductivity cell is an unpumped SeaBird, and consequently with fall rates of 0.65 m s^{-1} there are time constant mismatches (thermal mass issues) with the CTD temperature sensor. In the coming months, we plan to use the data set gathered in JR158 to establish a detailed processing procedure for all VMP data streams.

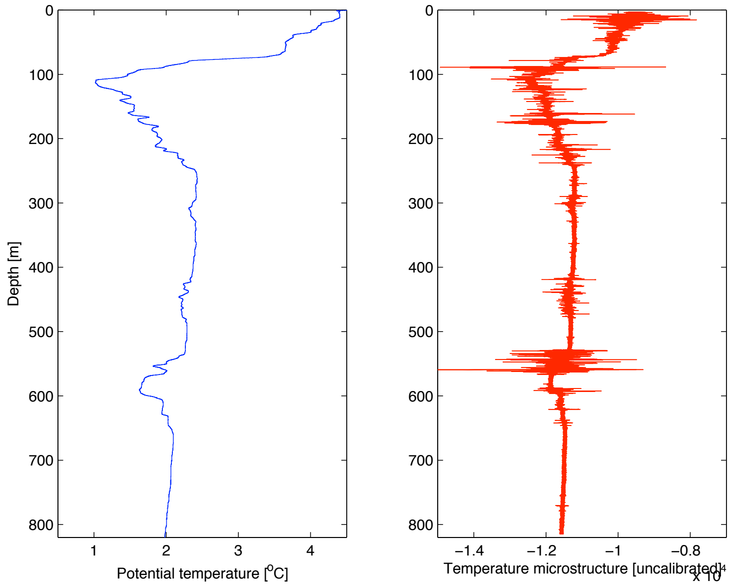


Figure 28: Preliminary plot of temperature microstructure (right panel). The left panel shows the potential temperature profile from the CTD at the same location.

7 Navigation

Hazel Grant

Bestnav data from the ship's RVS data stream are logged every 30 seconds. Daily streams from the previous day were downloaded manually using the `get_best` script used in JR106. The data available were latitude (deg), longitude (deg), velocity north (knots), velocity east (knots), course made good (deg), speed made good (knots), heading (deg) and distance run (km). When prompted the Julian day was entered (without extra zeros). `get_best` wrote these variables in their 30 second intervals to an ascii file `bestnav.xxx` where `xxx` was the 3 digit Julian day.

Bestnav data for the current incomplete day was also downloaded at times using the `listit` command manually:

```
listit -s 07xxxHHMMSS -e xxxhhmmss -w -h bestnav vars >
 bestnav.07xxxHHMMSS_07xxxhhmmss.asc
```

where 07 is the year, `xxx` the Julian day, `HHMMSS` the start time, `hhmmss` the end time, `vars` the variables to extract.

The cruise track was then plotted using the `cruisemap.m` programme. This utilized the `loadbestnav.m` programme created by Glen Richardson on the JR106 cruise. The ascii files of bestnav were concatenated into one file (called `bestnav.sofar`) of all the previous day's bestnav data by editing and then running the `cat_files.sh` script. The extra current day's readings could also be drawn by loading up (with `loadbestnav.m`) that data. Full instructions were included in the `cruisemap.m` file.

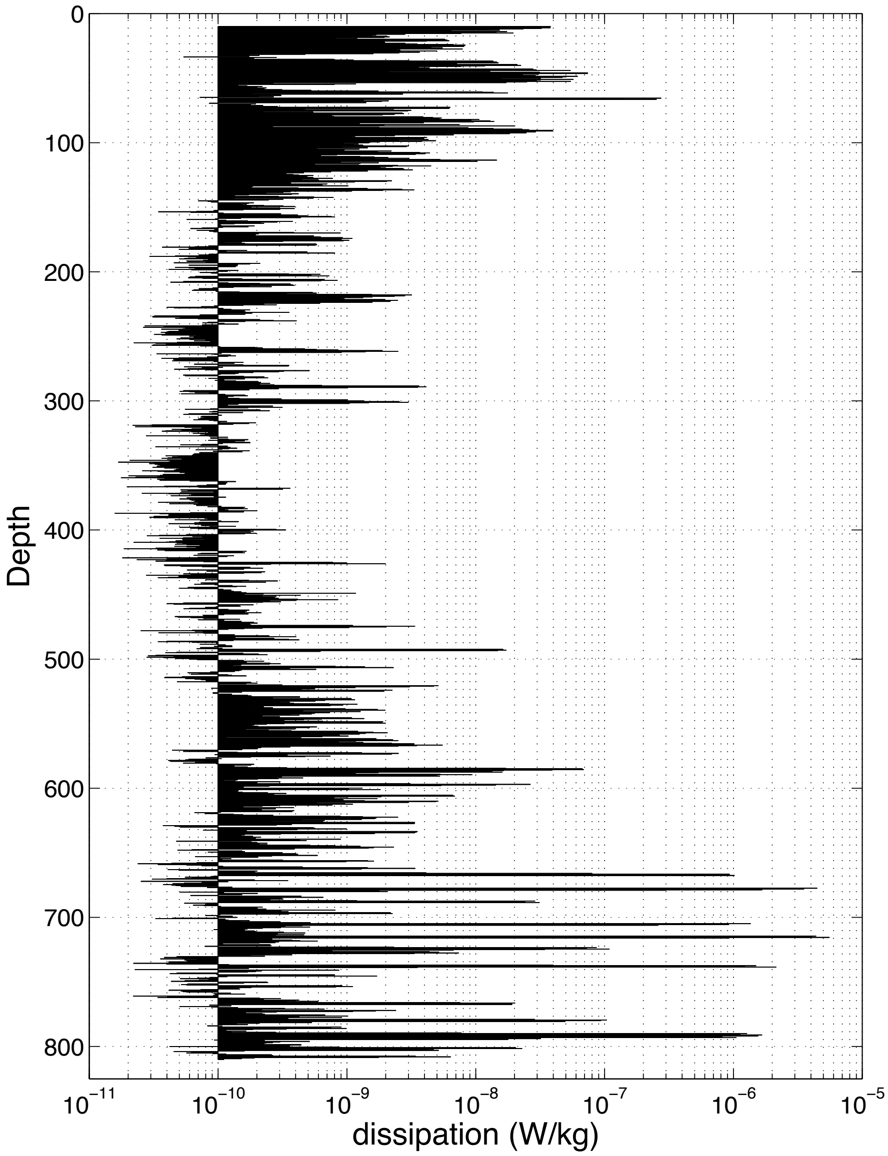


Figure 29: Preliminary estimate of turbulent kinetic energy.

8 Vessel-Mounted Acoustic Doppler Current Profiler (ADCP)

Angelika Renner

A 75 kHz RD Instruments Ocean Surveyor (OS75) ADCP was installed onboard RRS James Clark Ross in August 2005. It is capable of profiling to comparatively deep water levels of up to 800 m depth in the type of conditions the JCR is likely to encounter. Under ideal conditions, i.e. bubble-free water, low noise, good scattering, it should even be able to reach 1000 m. It can be run in broadband or narrowband modes, providing the choice of very high-resolving shallow profiles or less resolving deep profiles.

Instrument and software

The OS75 is sited in the transducer well in the hull of the JCR. The well is flooded with 90% de-ionised water and 10% monopropylene glycol. The transducer is at a depth of 6.3 m, but that value can change slightly depending on ship load. It is aligned at approximately 60 degrees, thus differing from the recommended 45 degrees. The instrument is controlled using the RDI VmDas v. 1.42 software, which is installed on the ADCP-PC in the UIC.

Settings

The OS75 was run throughout the cruise in narrowband mode with bottom tracking switched off and using 16 m bins. Time between pings was set to 2 seconds, misalignment was set to 60.08 degrees. These values are following advice from Deb Shoosmith (BAS) and Liz Hawker's report from JR161. The command file was copied from the corresponding JR161 file and is added in Appendix A.

SSU

For part of the cruise, namely from 09/02/2007 to 12/02/2007, the OS75 was run through the SSU to synchronise it with the EM120 swath bathymetry system and the EK60 fishery echosounder (see section 9.3). From discussions with Deb Shoosmith and Sophie Fielding, it was known that there are interference issues between the different acoustic instruments. The repeat of the section after the end of the CTDS was therefore undertaken with the OS75 pinging independently from the SSU and the EK60 and the EM120 were switched off. In order to set the OS75 to be run through the SSU, a line at the end of the command file has to be uncommented (or added):

```
; Set to trigger by SSU
CX1,3
```

The VmDAas software

VmDas was used to log the data and control data acquisition, archiving, display and reporting. For instrument setup the following steps were undertaken (following Liz Hawker's report):

Open VmDas
→ file → collect data → options → edit data options

- ADCP setup tab:
  - ADCP setup from file (→ command file to be used is specified here)
  - set time between ensembles to 2 seconds
- Recording tab:
  - name: JR158_
  - number: 1 (changed manually at each stop and restart of logging)
  - max size: 10
  - dual output directories:
    * U-drive (samba-mounted Unix drive, primary drive)
    * C: local (as secondary drive)
- Transform tab
  - heading source: nmea/prdid
  - tilt source: fixes tilts 0,0 (tilt correction not enabled)

Outputs

The raw data were written directly to a network drive which was samba-mounted from the Unixsystem. The local directory was used to preserve data when the network failed and until the link was restored. Details of the output files are given in Appendix B.

"To do": things that should be done regularly (Deb Shoosmith's advice)

- Check file size and content of .LOG files: error messages are logged here. If the file becomes larger than 10KB it should be monitored, there might be an error which has to be solved.
- List all files with main setup used.
- Check N1R data: `nav_ gaps.pl` is a script that does a sequential time check on the N1R data. When the ADCP resets itself, the ping number is set back to 1. That may cause problems during post-processing.
- Check that GPS data is being logged to N1R files: check that the $INGGA string is there as expected.

Post-processing

Raw data were processed using Matlab code provided by Deb Shoosmith. It originated from IFM Kiel and was adapted by Mark Inall and Deb Shoosmith for the JCR systems. The master file is OS75_JCR_FINAL_JR158.m. It calls a sequence of routines to

1. read the raw data,
2. remove missing data and data with bad navigation,
3. merge Seapath altitude data with single-ping ADCP data,
4. correct for transducer misalignment and velocity scaling error (calculated during first run-through of code, applied during second),
5. derive ship velocity,
6. perform quality control on data,
7. average data into ensembles of pre-defined length (here: 120 seconds),
8. calculate transducer misalignment and velocity scaling error (see above),
9. discharge velocities from depths deeper than 86% of the bottom-tracking depth (does not apply for JR158),
10. determine absolute velocities from Seapath GPS (or bottom-track ship velocity).

Processed data are stored in Matlab format.

Problems encountered

During processing of file sequence 007 a large percentage (>80%) of pings were discharged due to missing data for heading. The reason for that has not been found yet, but it coincides with the only period during the cruise when the ADCP was set to be run through the SSU. Also, the OS75 kept resetting itself often. The error message preceeding these events says:

```
[2007/02/09 15:22:04.546]: ADCPCOMMTMO:  PrevPingTime=[15:21:52.359]
EnsBufIndex=0  Hdr=[7f 7f 5e 07]
[2007/02/09 15:22:04.625]:,
[2007/02/09 15:22:06.734]:  Timeout waiting for response from ADCP!
```

Deb Shoosmith is working with us on the processing of the affected raw data.

Another error message occured frequently:

```
[2007/02/07 23:59:51.562]: NMEA [Nav] serial buffer level OK.
[2007/02/07 23:59:52.234]: NMEA [Nav] serial buffer full:
 Storing 300 bytes without processing.
```

Jeremy Robst (BAS) replied that on previous occasions this error did not seem to affect the data.

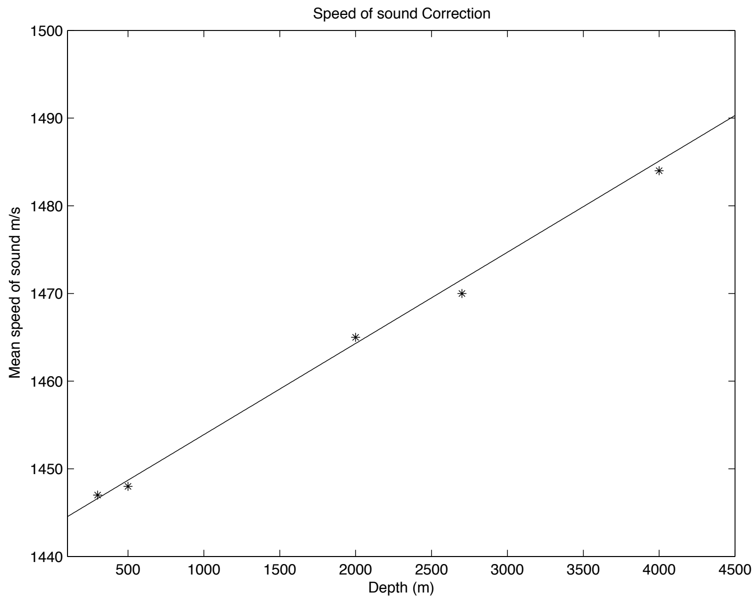


Figure 30: Mean sound speed at CTD stations 001, 002, 007, 010 and 015 as a function of depth of the CTD cast. The linear equation given in section 9.1 is used to find the correction to the sound speed.

9 Underway Observations

9.1 Bathymetry

Hanneke Luijting

There are 2 streams for bathymetry: sim500 and prodep. We had to ask to have prodep turned on. Sim500 is the uncorrected bathymetry (assuming a constant speed of sound of 1500 m/s), prodep is corrected bathymetry.

The streams are downloaded daily by using the scripts `get_sim500` and `get_prodep`. Both these scripts download the data in a file called `(pro)bathy.jullianday`. This file contains the year number (07 for 2007), Julian day, hour:minute:second, the depth in metres and a quality flag.

We used two Matlab scripts called `loadbathy.m` and `loadprodep.m` to load the data files in Matlab. The data was saved in .mat files called `(pro)bathy.jullianday`, containing the depth, `newtime` (time in decimal Julian days) and `bigtime` (time in seconds from 01 January 2007 00:00 GMT)

The `saveall(pro)bathy` script was used to read in several of those .mat files and combine them into one .mat file (`bathymetry` and `probathymetry`). In the `saveallbathy` file, we corrected the sim500 data with our own calculation of the speed of sound. In the output file, both depths (corrected and uncorrected) are saved.

From Figure 30 we derived the following equation:

$$\text{Soundspeed} = 1443.5 + 0.0104 \times \text{depth}.$$

The corrected bathymetry is then calculated as

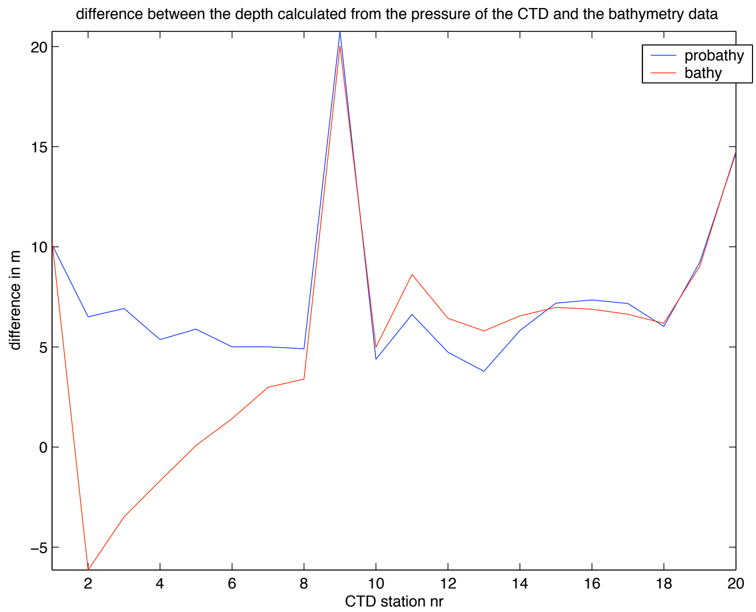


Figure 31: Difference between the uncorrected (corrected by us instead) and corrected depths and the depth as measured by the pressure measurements on the CTD. Probathy (blue curve) is the corrected bathymetry and bathy (red curve) is the uncorrected bathymetry.

$$\text{corrected depth} = \text{uncorrected depth} \times \frac{\text{soundspeed}}{1500}.$$

We found that we had to despike the data before we could calculate the depths for the CTD stations. While steaming, the bathymetry does not show many spikes, but while stationary there are many, and this results in wrong CTD depths. We used a script called `graphedit` that allows you to plot your data and then manually remove the spikes. This was necessary as most despiking scripts only look at 1 point being different from its neighboring points, while in the bathymetry plots the spikes consisted of many data points. The results are stored in `(pro)bathymetry_despiked.mat`

To get the depths of the CTD stations, we transformed the GMT time into decimal Julian days for the time the CTD reached the bottom and the time the CTD started its upcast. For this time interval, we could then get the depth from `(pro)bathymetry.mat` using the scripts `getdepthsctd.m` and `getdepthsctd_pro.m`. For station number 009, we had to change the times as there was no data after the despiking for the correct time interval. These scripts result in a .mat file (`depthsCTD(pro)`) each containing 20 depths for the 20 CTD stations. There is also a .mat file called `allCTDdepths` containing both the depths plus the depth as calculated by the pressure measurements from the CTD.

The average absolute difference is 6.61 m for the 'uncorrected' data (corrected by us) and 7.37 m for the prodep bathymetry data (see Figure 31). Based on this outcome, we will use our own corrected dataset from now on.

To link the bathymetry data to the latitude/longitude data, we need to interpolate. The bathymetry data has a very irregular time interval, ranging from 2-30 seconds. All underway datasets have therefore been interpolated to a 5 seconds interval, making it possible to link the bathymetry to the navigation data.

The interpolated datafiles are called `bathy_Interpol.julianday`. They can be read into Matlab with `loadbathy_interpol`, and the files are called `bathyjulianday_interpol.mat`. `saveallbathy_interpol` saves all the .mat files into a file called `bathymetry_interpol.mat`. There are similar files for the navigation data, called `bestnav_interpol.julianday`. These can be read in a similar way using `loadnav_interpol` and `saveallnav_interpol`, resulting in `nav_interpol.mat`. This file has the same time steps as `bathymetry_interpol.mat` and therefore has been combined into one file called `bath_nav.mat`, containing time, latitude, longitude and the depth.

Another file has been created that contains the latitude and longitude along the CTD track, starting at CTD 002 and ending at CTD 020. This file is called `bath_nav_CTD.mat` and has been created using `get_nav_bat_ctd`.

9.2 Oceanlogger

Adrian Matthews

The `work/oceanlog/get_ocea` script on jrub was run manually every day to download the oceanlogger time series data from the previous day. This was then stored as an ascii file in work/oceanlog/ocean.XXX, where XXX is the Julian day, e.g., 038. This was plotted using the `work/oceanlog/plot_ocean.m` Matlab script.

Similarly, the `work/oceanlog/get_anem` script was run manually every day to download the shipboard anemometer data from the previous day. This was then stored in an ascii file /work/oceanlog/anemom.XXX. This needs to be combined with the navigation data to calculate the true wind, relative to the fixed Earth.

The different data streams have a different time resolution: 1 s for the anemometer data, 30 s for the navigation data, 5 s for the oceanlogger data, and a variable interval of 2-25 s for the bathymetry data. There were missing data, especially for the anemometer and oceanlogger data, such that their 1 s and 5 s time resolution was nominal. The missing data were not just in the form of missing records. Instead, there might be a gap of 11 seconds in the oceanlogger data before the next record. Hence, all four data streams were interpolated onto a common time coordinate, with units of seconds, and with constant time interval of 5 s, using `work/oceanlog/interp_data.m`. The base time (t=0) corresponded to 0000:00 on 1 Jan 2007. The interpolated data was written to ascii files in

- work/nav/bestnav_interp.XXX
- work/oceanlog/ocean_interp.XXX
- work/anemom_interp.XXX
- bathy/bathy_interp.XXX.

The `true_wind.m` script was then used to calculate the true wind velocity using the interpolated navigation and anemometer data. The data were saved each day in

- work/oceanlog/wind.XXX.

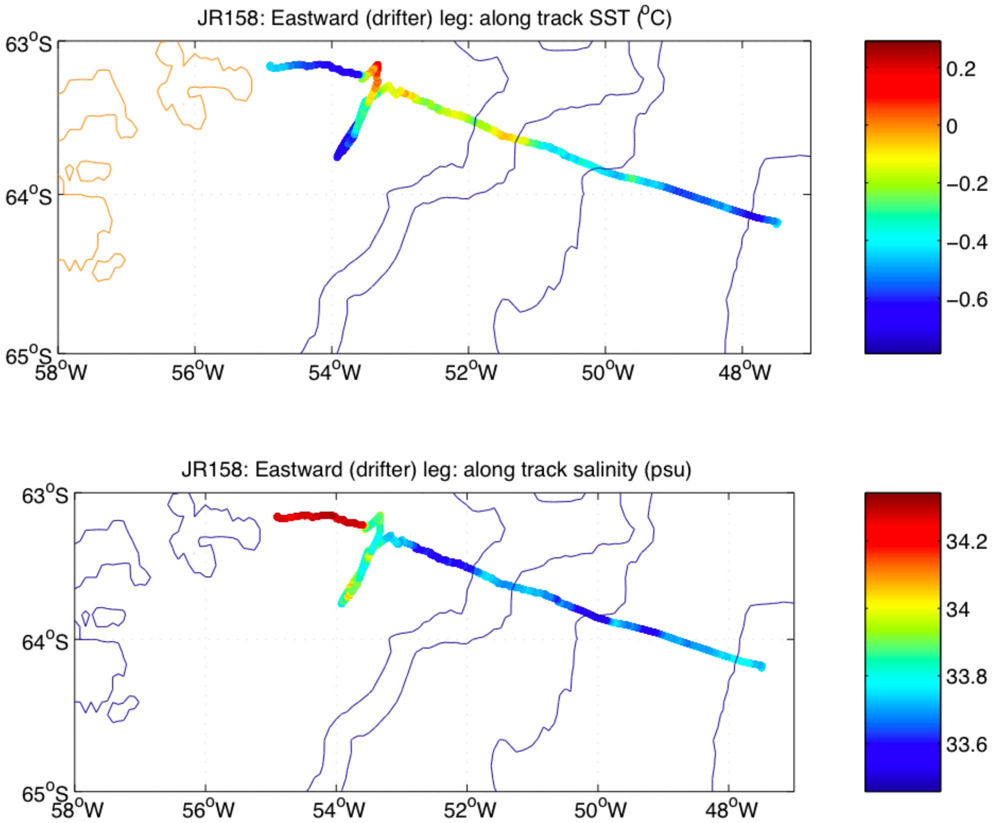


Figure 32: Alongtrack surface temperature and salinity for the eastward (drifter) leg.

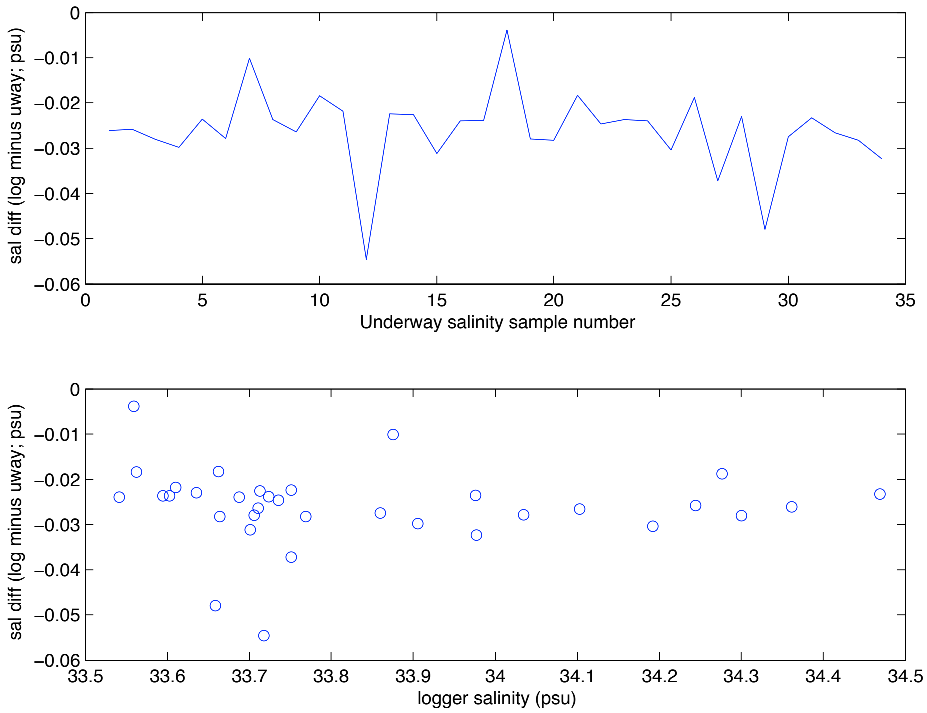


Figure 33: Salinity difference (oceanlogger minus salinometer), as a function of (*a*) sample number (effectively time) and (*b*) salinity.

The `cat_daily` unix script then concatenates all the daily oceanlogger files (ocean.038, ocean.039,) into one file (ocean.sofar). Similarly for the daily anemometer, and interpolated ocean, anemometer, wind, navigation, and bathymetry data sets.

The `plot_track.m` script uses the interpolated data to plot a section of the cruise track, coloured by an oceanlogger variable, such as SST or salinity.

The `sal_log_uway.m` script compares the salinity measurements from the oceanlogger with salinity measurements of the underway samples as determined by the salinometer. It takes an ascii input file of the 34 times and values of the underway salinity samples from the ship's intake (work/oceanlog/uway_sal.txt). These have been measured accurately by the salinometer. It then reads in the oceanlogger interpolated salinity data, and calculates a 1-minute running mean for each of those values at the same times as the underway samples (the oceanlogger salinity instrument and its seawater input are in the wet lab, next to the sample pipe for the underway salinity measurements, hence the two samples are simultaneous in time). There is a clear systematic difference, with the oceanlogger salinity values being an average of 0.026 psu below the (correct) salinometer values. This difference appears to be constant, and is independent of time (Figure 33(*a*)) and salinity (Figure 33(*b*)). Hence a correction factor of -0.026 psu is added to all the salinity values, which are then stored in sal_corrected.mat.

The `sst_log_ctd.m` script compares the SST values of temp2 at depth 9 m for the 20 CTD downcasts, against the 20 simultaneous (1-minute averaged) SST values from the oceanlogger. The CTD temperatures sensors have been calibrated against the accurate SBE35 deep ocean

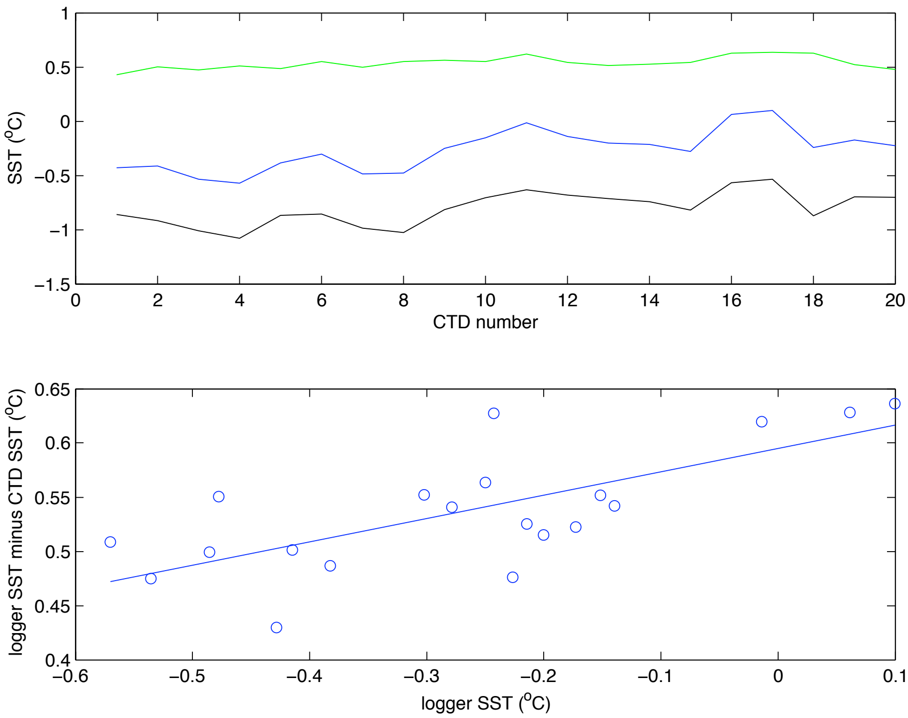


Figure 34: (a) The 9 m temperature (temp2) for each CTD downcast (black). Corresponding (1-minute average) SST from oceanlogger. (blue). Difference (oceanlogger minus CTD; green). (b) The difference as a function of oceanlogger SST. Straight line is best fit by linear regression.

thermometer, and found to have negligible errors, of less than 0.001 K. There is a clear difference between the oceanlogger SST and the CTD SST, with the oceanlogger SSTs being about 0.5°C warmer (Figure 34). This difference is temperature dependent (Figure 34). A linear regression of the difference (logger SST minus CTD SST) against logger SST gives a temperature dependent correction factor which should be made to the logger SST. Hence, if SST0 is the original logger SST (in °C), and SST1 is the corrected logger SST:

$$\mathrm{SST1} = \mathrm{SST0} - (0.22 \times \mathrm{SST0} + 0.59)\,.$$

N. B. This correction is only valid over the small temperature range from -0.6 to 0.1 °C. Hence, a corrected oceanlogger data set (`sst_weddell.mat`) was just calculated for the W-E legs in the Weddell Sea, from jday 39, 18:49 UTC to jday 44, 04:31 UTC.

Table 7: Settings for the EK60 Fishery sounder based on WCB protocol.

Channel	Mode	Pulse duration/ Sample interval/ Bandwidth	Power (W)	Depth (m)
GPT 38 kHz 009072033fa5* 1 ES38	Active	1024us / 256us / 2425Hz	2000	0.00
GPT 120 kHz 00907203422d* 1 ES120-7	Active	1024us / 256us / 3026Hz	500	0.00
GPT 200 kHz 009072033f91* 1 ES200-7	Active	1024us / 256us / 3088Hz	300	0.00

9.3 EK60

Angelika Renner

While the programme of ADELIE/JR158 focused on physical measurements, the scientific objective has implications for ecosystem studies in the study region. For a crude observation of links between the currents observed and measured during the cruise and the distribution of krill, the echosounder EK60 was run during part of the cruise on recommendation of Jon Watkins (BAS) and with support from Sophie Fielding (BAS).

Instrument and Software

- Simrad EK60 fishery sounder
- Simrad ER60 v. 2.0

The EK60 is a Simrad EK60 fishery sounder, operating at 38, 120 and 200 kHz. It is run from two computers in the UIC, labelled EK60 Main Processor (APC10) and EK60 Workstation. They are both integrated into the ship's LAN. We followed the operation procedures written down for the Western Cor Box (WCB) acoustic survey and the JR159 Western Core Box Acoustics Report.

Main switch for the EK60 itself is on the wall to the left of the EK60 Main Processor PC, labelled EK60 remote on/off switch. To start the measurements, the EK60 has to be switched on first using this switch. The software then used to control the instrument is Simrad ER60 v. 2.0. It is installed on the EK60 Main Processor.

All raw data files were written to a folder on a Sun workstation:
`jrub.jcr.nerc-bas.ac.uk:/users/soc/cruisedata/ek60/jr158_ek60_raw`.

Settings

Following the WCB protocol, settings in the 'Operation → Normal' menu were as listed in Table 7.

The EK60 was calibrated on the cruise JR159 (see their cruise report). We used the settings obtained during the calibration and used during JR161 (see Table 8).

Table 8: Settings for the EK60 fishery sounder from JR161 calibrations.

Variable	**38 kHz**	**120 kHz**	**200 kHz**
Ping interval (s^{-1})	2	2	2
Salinity (PSU)	34	34	34
Temperature (°C)	1	1	1
Sound velocity (m/s)	1453	1453	1453
Mode	Active	Active	Active
Transducer type	ES38	ES120-7	ES200-7
Transceiver Serial no.	009072033fa5	00907203422d	009072033f91
Transducer depth (m)	0	0	0
Absorption coef. (dB/km)	10.07	26.27	39.8
Pulse length (ms)	1.024	1.024	1.024
Max Power (W)	2000	500	300
2-way beam angle (dB)	-20.70	-20.70	-19.60
Sv transducer gain (dB)	24.07	21.38	22.03
Sa correction (dB)	-0.63	-0.39	-0.31
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	-0.02	-0.12	0.17
3 dB Beam athwart	0	-0.07	-0.24
Along offset	6.96	7.48	6.44
Athwart offset	6.88	7.48	6.43

SSU settings

The EK60 was run through the SSU the whole time. Settings were changed on Jday 40 (09/02/2007) at around 15:00 GMT when the EK120 was switched off and the ADCP was added to the SSU until the last CTD station was reached on 12/02/2007. The time interval between pings was changed in the ER60 software from 2 to 2.5 seconds on that occasion. At the end of the CTD section the EK60 was switched off.

Changes in the SSU settings were made by Mark Preston (ET). Settings for the period when EK60, EA600 and ADCP were run through the SSU in the same group are given in Table 9.

Processing

No processing was done during the cruise. It will be undertaken back in the UK with the help of Sophie Fielding.

Table 9: Settings for the SSU when EK60, EA600 and ADCP were run through the SSU in the same group.

Instrument	**Trigger**	**Time usage**
EA600	external	Tx pulse
EK60	external	calculated (set to 2.5 seconds in ER60 software)
ADCP	external	Tx pulse

10 Ocean Chemistry Measurements

10.1 Calibration of $CTDO_2$ and underway oxygen sensors by Winkler titration Continuous O_2 concentration measurements in pumped ocean surface waters

Jan Kaiser and Karel Castro-Morales

Objectives

- To measure dissolved oxygen concentrations in discrete samples drawn from Niskin bottles in order to calibrate the oxygen sensor on the CTD
- To measure dissolved oxygen concentrations in discrete samples drawn from the scientific seawater supply in order to calibrate the underway oxygen optode (*Aanderaa* Model No. 3835, Serial No. 329)
- To measure dissolved oxygen concentrations in ocean surface water pumped from the ship's scientific seawater intake at a nominal depth of 6 m using the above oxygen optode

Calibration of $CTDO_2$

93 samples (including duplicates) were collected from Niskin bottles into BOD bottles and analysed by whole-bottle Winkler titration with photometric endpoint detection. A thiosulphate concentration of 0.2 mol dm^{-3} was used, standardized by iodometry against a 2.339 mmol dm^{-3} KIO_3 solution (prepared gravimetrically at UEA and shipped as a solution). The bottle volume was corrected to the sample temperature from the CTD*nnn*.BTL file. The reagent blank was (0.0019±0.0003) μl ($n = 4$) with distilled water and (0.0035±0.0002) μl ($n = 5$) with seawater. In accord with recommended WOCE procedures (Dickson, 1996), we used the reagent blank measured with distilled water to correct the measurements. The typical standard deviation of a duplicate analysis was 0.16 μmol kg^{-1}. The discrete samples were used to calibrate the SBE O_2 sensor mounted onto the CTD. Figure 35 shows a linear regression of the Winkler results versus the averaged result of 14 CTD scans around the corresponding bottle firing times.

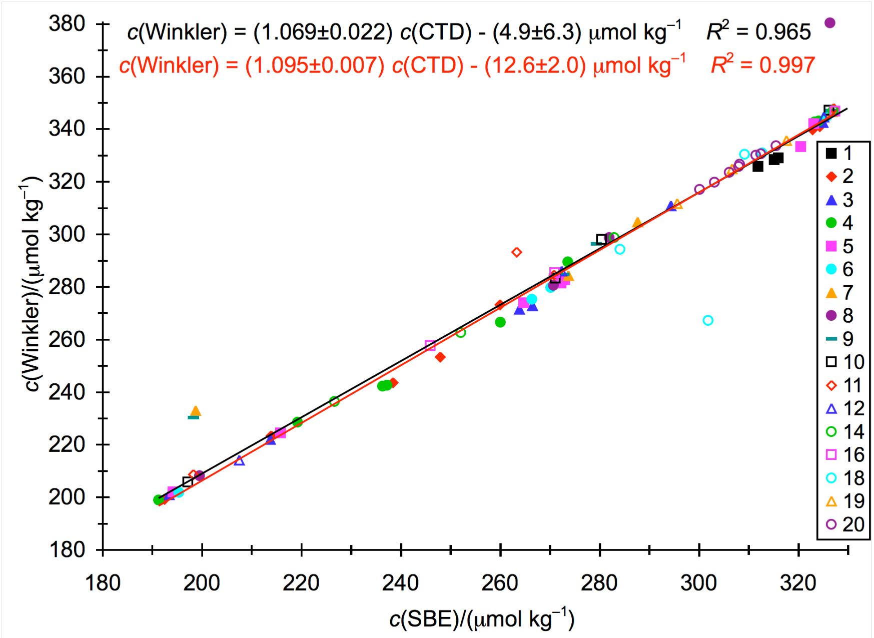


Figure 35: Linear regression of Winkler O_2 measurements versus averaged result of 14 CTD scans around the corresponding bottle firing times. The black regression line includes all measurements; for the red regression line, five outliers were removed. Numbers in the legend correspond to cast numbers.

Calibration of the underway oxygen optode

To calibrate the optode, 90 samples (including duplicates) were collected from the scientific seawater system, using the same sampling point as for the optode O_2 measurements (i.e., forward starboard sink of the main lab on the upper deck). The typical standard deviation of a duplicate analysis was 0.16 μmol kg^{-1}. Using the temperature-dependent fourth-order calibration polynomial stored in the optode, the Winkler measurements were converted to phase values, as measured by the optode. These "inverted" phase values were regressed linearly against the phase values measured by the optode closest to the sampling time of the discrete sample. The resulting calibration function was used to compute the calibrated optode data. The average root-mean-square deviation of the calibrated optode data from the Winkler data was 0.7 μmol kg^{-1}. The difference originates both from uncertainties in the optode and in the Winkler measurements.

Underway oxygen measurements by an *Aanderaa* optode

For the duration of the cruise, O_2 concentrations from the scientific seawater supply were measured by an *Aanderaa* optode, giving a data-set of more than 90 000 individual readings at 10 s-resolution. The readings from the sensor proved to be stable throughout the cruise. However, after modifications to the flow management on 11 February 2007 (JD 42), the amplitude of the blue LED in the optode dropped by 25 %. This does not appear to have adversely affected the quality of the measurements, though. Also, the optode calibration with respect to the Winkler measurements drifted noticeably throughout the cruise. This was adjusted for to exploit the good precision of the optode of about 0.03 % over short time-scales (60 s). The drift of the optode stayed within the accuracy of 5 % (for O_2 concentration >160 μmol dm^{-3}) stated by the manufacturer.

At the beginning of the cruise, the optode data were very variable. This was attributed to bubbles entrained by the ship and pumped up by the intake probe for the scientific seawater supply. The probe has three positions: up, mid, and down. In the mid-position the intake is flush with the hull of the ship, in the down-position, the probe extends about 0.5 m below the hull. Due to heavy seas, ice floes, and/or the speed of the ship, it was not permissible to lower the seawater intake probe below the hull of the ship. Later on, the probe could be lowered, which significantly improved the data quality, as evidence by the difference in O_2 concentrations measured while travelling and while occupying a CTD station. The difference the lowering of the probe made is illustrated in Figure 36.

Comparison between CTD and underway data

On previous cruises on RRS Discovery (AMT-16 and AMT-17), it was noted that the O_2 concentrations in the scientific seawater supply (SSS) were systematically lower than the CTD data (between 1 and 2 μmol kg^{-1}). O_2/Ar measurements showed a similar difference, indicating a loss of O_2 due to biological processes. We therefore compared the data from the scientific seawater supply to results from near-surface Niskin bottles from 17 of the 20 CTD casts. The mean difference, $c(CTD) - c(SSS)$, was (-0.2±0.6) μmol kg^{-1}, indicating that the O_2 concentration of the water was not altered by pumping the water through the ship's scientific seawater piping. This may be due to the lower ambient temperatures encountered on the present cruise (around 0°C), as compared to the AMT transects (14 to 29°C). A limited number of simultaneous O_2/Ar measurements from surface Niskin bottles and SSS samples will be used to verify this result.

References

Dickson, A. G.: Determination of dissolved oxygen in seawater by Winkler titration, in WOCE Operations Manual. Volume 3: The Observational Programme. Section 3.1: WOCE Hydrographic Programme. Part 3.1.3: WHP Operations and Methods, edited by World Ocean Circulation Experiment, Woods Hole, Massachussetts, USA, 1996.

10.2 Net community production estimates from dissolved oxygen/argon ratios measured by membrane inlet mass spectrometry (MIMS) Gross productivity estimates from $^{17}O/^{16}O$ and $^{18}O/^{16}O$ isotope ratios of dis-solved oxygen

Jan Kaiser and Karel Castro-Morales

Rationale and objectives

The dissolved oxygen (O_2) concentration of seawater varies because of fundamental physical and biological processes. These include photosynthesis (P) and respiration (R), diffusive and bubble-mediated gas exchange, temperature and pressure changes, lateral mixing and vertical diffusion. In the absence of physical effects, dissolved O_2 constrains the difference between P and R, i.e., net community production (N). Thus, O_2 can be used as a geochemical tracer

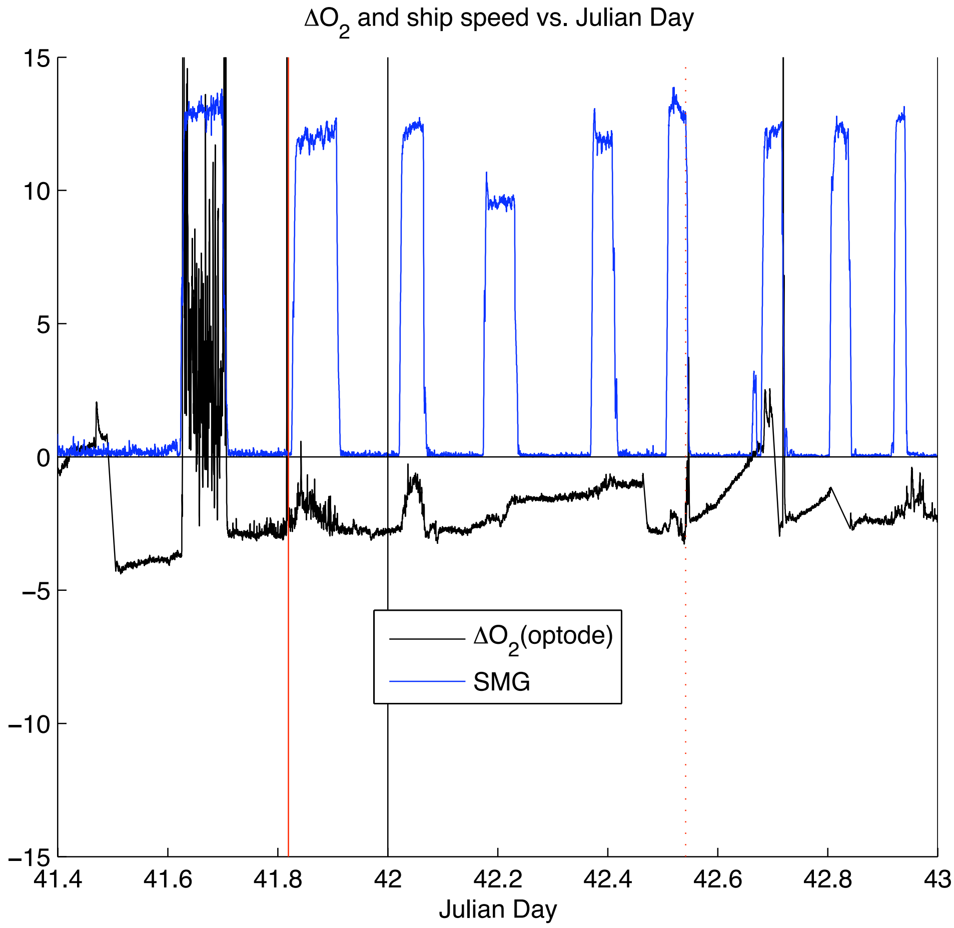


Figure 36: O_2 supersaturation (ΔO_2 in %, provisional calibration) and ship speed over ground (SMG = speed made good, in knots) versus Julian Day (JD). Fractions of JD correspond to times during the corresponding day, i.e., 41.5 is noon on JD 41.The scientific seawater intake was lowered at JD 41.825. CTD stations were occupied whenever SMG is close to zero. The period prior to JD 41.62 correspond to station 2, etc. The difference between the probe in mid-position and down-position is clearly seen during the time the ship is travelling from station 2 to 3, in contrast to the less spiky ΔO_2 signal between stations 3 and 4.

that reflects carbon fluxes integrated over characteristic response times. Warming and bubble injection lead to O_2 supersaturation, posing a challenge to this approach.

Craig and Hayward (1987) used oxygen/argon (O_2/Ar) ratios to separate O_2 supersaturations into a biological and a physical component. This method is based on the similar solubility characteristics of O_2 and Ar with respect to temperature and pressure changes as well as bubble injection. One can define an O_2/Ar supersaturation, $\Delta O_2/\mathrm{Ar}$, as:

$$\Delta O_2/\mathrm{Ar} = \frac{\left(\frac{c(O_2)}{c(\mathrm{Ar})}\right)}{\left(\frac{c_{\mathrm{sat}}(O_2)}{c_{\mathrm{sat}}(\mathrm{Ar})}\right)} - 1 \quad (1)$$

$\Delta O_2/\mathrm{Ar}$ essentially records the difference between photosynthetic O_2 production and respiration. c is the dissolved gas concentration (in mol m^{-3}) and c_{sat} is the saturation concentration. c_{sat} is a function of temperature, pressure and salinity. This method, in which discrete samples are collected at sea, stored, and analyzed in the lab, has been widely used in subsequent work (Hendricks et al., 2004; Luz and Barkan, 2000; Quay et al., 1993; Spitzer and Jenkins, 1989).

We recently presented an advance of this method for continuous underway measurements of O_2/Ar by membrane-inlet mass spectrometry (MIMS) (Kaiser et al., 2005), extending earlier oceanographic MIMS applications (Kana et al., 1994; Tortell, 2005). The measured $\Delta O_2/\mathrm{Ar}$ values can be used in conjunction with suitable wind-speed gas-exchange parameterizations to calculate biologi-cally induced air-sea O_2 fluxes and, where conditions are appropriate, N. The inferred N values represent rates integrated over the characteristic mixed layer gas exchange times (ratio of mixed layer thickness and piston velocity), typically between 2 and 4 weeks.

The O_2/Ar method has the advantage not to involve potential biases associated with incubating water samples in a bottle. The N estimates from the ADELIE cruise will be used to quantitatively study the autotrophic or heterotrophic nature of different marine ecosystems in the Southern Ocean.

In addition to the underway measurements, discrete samples were taken for calibration purposes and to measure the $^{17}O/^{16}O$ and $^{18}O/^{16}O$ isotope ratio analysis of dissolved oxygen. Triple oxygen iso-tope measurements combined with O_2/Ar data can be used to estimate the ratio of net community production (N) to gross production (P) and the ratio of gas exchange to gross production. Again, in combination with suitable wind-speed gas-exchange parameterizations this can be used to estimate gross production over large regional scales at timescales of weeks to months.

Methodology

Continuous measurements of dissolved N_2, O_2, Ar and CO_2 were made by MIMS on board RRS Discovery. The ship's underway sampling system was used to pump water through an exchange chamber with a tubular Teflon AF membrane (*Random Technologies*) mounted on the inside. The membrane was connected to the vacuum of a quadrupole mass spectrometer (*Pfeiffer Vacuum* Prisma). The intake of the underway sampling system is located at the bow of the ship at a nominal depth of 6 m. The water from the underway sampling system passed through an open bucket at several litres per minute to remove macroscopic bubbles and to avoid pressure bursts. A flow of about 75 ml/min was continuously pumped from the bucket through the membrane chamber, using a gear pump (*Micropump*). In order to reduce O_2/Ar variations due to temperature effects and water vapour pressure variations, the exchange chamber with the membrane was held at a constant temperature of 2.5°C. However, it later turned out that the water flowing through the membrane chamber was not in thermal equilibrium with the water bath. This has to be improved in future deployments, as it complicates the calibration procedure. The flight tube was in a thermally insulated box maintained initially at 100°C.

The O_2/Ar and N_2/Ar ratio measurements will be calibrated with discrete water samples taken from the same seawater outlet as used for the MIMS measurements. 200 - 300 cm^3 samples were drawn into pre-evacuated glass flasks poisoned with 7 mg $HgCl_2$ (Quay et al., 1993). These samples will be later analyzed with an isotope ratio mass spectrometer at Princeton University (IRMS, *Thermo Finnigan*) for their dissolved O_2/Ar ratios and the oxygen triple isotope composition relative to air (Hendricks et al., 2004). Raw O_2/Ar ion current ratio measurements were made every 5 s and had a short-term stability of 0.05%. Absolute Ar and N_2 supersaturations will be calculated from the absolute O_2 supersaturations measured by Winkler titration and the N_2/Ar and O_2/Ar ratios measured by MIMS.

Results

37 discrete water samples were taken for calibration purposes and to analyze oxygen triple isotopes. The water was sampled into evacuated bottles with compression o-ring valves (*Glass Expansion*). From JK's experience, this type of valve is more leak-tight than previously used high-vacuum valves (*Louwers Hapert*). These samples will be analyzed at Princeton University after their return from the South.

Membrane inlet mass spectrometry (MIMS) was used to analyze dissolved gases continuously, namely O_2, nitrogen (N_2), argon (Ar), and carbon dioxide (CO_2). We had problems with the instrument almost throughout the cruise. A list of the problems encountered is given below. They were only solved completely two days prior to arrival in Montevideo (see Figure 37) as an illustration of this period of "good data") Nevertheless, we will endeavour to post-calibrate the data that were taken during the earlier stages of the cruise. Towards the end of the cruise, a direct online-calibration against water samples equilibrated with air was tried out and gave relatively stable results. However, only a few measurements were taken and it is too early to draw any conclusions on the success of this approach. Similar measurements will be carried out by KCM during the cruise following JR158, i.e., JR165 (Bellingshausen Sea and Amundsen Sea).

- bubbles entrained by ship and drawn up by scientific seawater system were not purged automatically from the membrane exchange chamber.
- 50 μm-filter to protect membrane clogged after less than two hours in water with high particle concentrations (eastern part of Weddell Sea transect).
- mass spectrometer ion currents were spiky for the first three days of the cruise, likely a result of the fact that the evacuated glass bottles had to be pumped out using the mass spectrometer, because of unfit connections for the vacuum pump taken for this purpose.
- mass scale calibration of the mass spectrometer was initially off.
- membrane in the membrane exchange chamber was not stable (this was solved by increasing the back pressure in the membrane box).

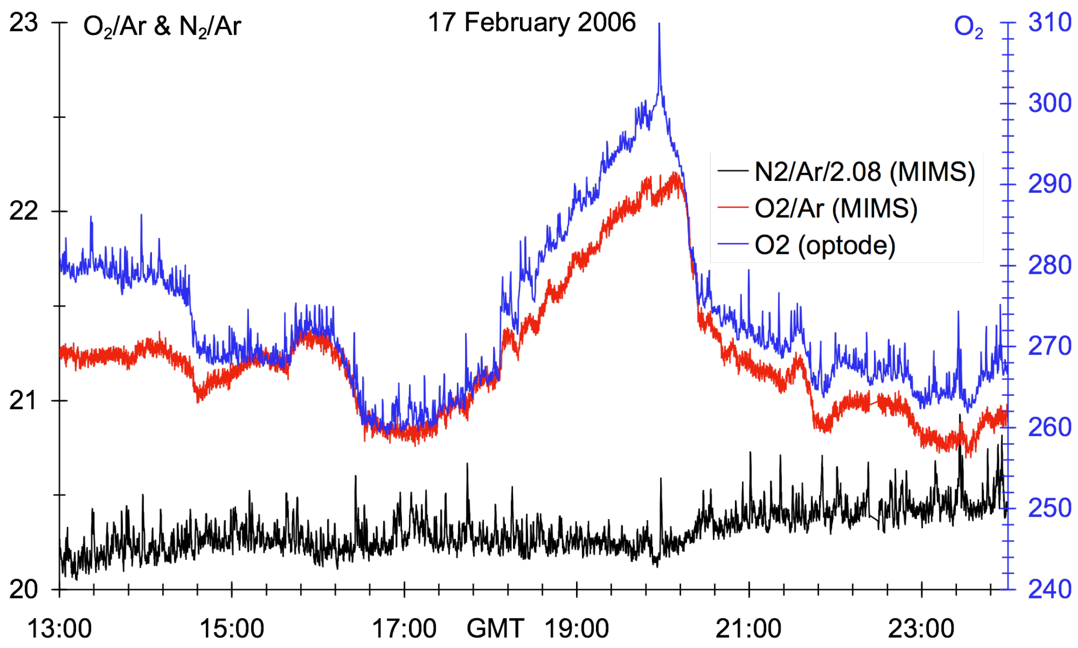


Figure 37: Comparison of MIMS N_2/Ar and O_2/Ar ratios with uncalibrated optode O_2 concentrations (in μmol dm^{-3}). The influence of bubbles entrained by the ship is clearly visible in the spikes seen for the N_2/Ar ratios, with corresponding spikes at exactly the same times in the O_2 signal. The O_2/Ar data are, as expected, less affected by bubbles because the O_2/Ar ratio in seawater (about 20.5) is similar to the ratio in air (about 22). In contrast, for N_2/Ar, the corresponding ratios are about 40 and 80.

Acknowledgments

Many thanks to crew, officers and scientific party of RRS James Clark Ross cruise JR158 (ADELIE). In particular, we would like to thank Deck Engineer Doug Trevett for his great commitment and straightforward help and Karen Heywood for the invitation and logistical support to join this cruise.

References

Craig, H. and Hayward, T.: Oxygen supersaturation in the ocean: Biological versus physical contributions, Science, 235, 199-202, 1987.

Hendricks, M. B., Bender, M. L., and Barnett, B. A.: Net and gross O2 production in the Southern Ocean from measurements of biological O_2 saturation and its triple isotope composition, Deep-Sea Res. I, 51, 1541-1561, 2004.

Kaiser, J., Reuer, M. K., Barnett, B., and Bender, M. L.: Marine productivity estimates from continuous oxygen/argon ratio measurements by shipboard membrane inlet mass spectrometry, Geophys. Res. Lett., 32, L19605, doi:10.1029/2005GL023459, 2005.

Kana, T. M., Darkangelo, C., Hunt, M. D., Oldham, J. B., Bennett, G. E., and Cornwell,

Table 10: Summary of the NOX uncontaminated sea water system.

UNCONTAMINATED SEA WATER SYSTEM EVENTS FOR _February 2007

DATE TIME LOCAL	TIME GMT	TIME ZONE	FILTER	PUMP	PROBE POSITION	EVENT	REMARKS	LOCATION CRUISE No
1/2/07 08:10	1/2/07 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 157 (ISIS)
2/2/07 08:10	2/2/07 11:10	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 157 (ISIS)
3/2/07 08:10	3/2/07 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 157 (ISIS)
4/2/07 08:10	4/2/07 11:10	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 157 (ISIS)
4/2/07 18:50	4/2/07 21:50	GMT -3	-	-	Up	Water Off	Due to Ice	JR 157 (ISIS)
5/2/07 00:00	5/2/07 00:00	GMT -3	-	-	Up	Water Off		Rothera
6/2/07 00:00	6/2/07 00:00	GMT -3	-	-	Up	Water Off		Rothera
7/2/07 08:00	7/2/07 11:00	GMT -3	1	1	Mid	Water On		JR 158
7/2/07 10:54	7/2/07 13:54	GMT -3	1	2	Mid	Pump Changeover		JR 158
8/2/07 08:10	8/2/07 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 158
9/2/07 08:10	9/2/07 11:10	GMT -3	1	2	Mid	Filter Changeover and Clean		JR 158
10/2/07 08:10	10/2/07 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 158
10/2/07 16:40	10/2/07 19:40	GMT -3	2	2	Down	Probe position Change		JR 158
11/2/07 08:10	11/2/07 11:10	GMT -3	1	2	Down	Filter Changeover and Clean		JR 158
11/2/07 10:00	11/2/07 13:00	GMT -3	1	2	Mid	Probe position Change		JR 158
12/2/07 08:10	12/2/07 11:10	GMT -3	2	2	Mid	Filter Changeover and Clean		JR 158
13/2/07 06:58	13/2/07 09:58	GMT -3	2	2	Down	Probe position Change		JR 158
13/2/07 08:10	13/2/07 11:10	GMT -3	1	2	Down	Filter Changeover and Clean		JR 158
13/2/07 16:13	13/2/07 19:13	GMT -3	1	2	Mid	Probe position Change	Due to Ice	JR 158
13/2/07 16:23	13/2/07 19:23	GMT -3	1	2	Down	Probe position Change		JR 158
13/2/07 17:04	13/2/07 20:04	GMT -3	1	2	Mid	Probe position Change	Due to Ice	JR 158
13/2/07 17:11	13/2/07 20:11	GMT -3	1	2	Down	Probe position Change		JR 158
13/2/07 17:17	13/2/07 20:17	GMT -3	1	2	Mid	Probe position Change	Due to Ice	JR 158
13/2/07 19:06	13/2/07 22:06	GMT -3	1	2	Down	Probe position Change		JR 158
14/2/07 08:10	14/2/07 11:10	GMT -3	2	2	Down	Filter Changeover and Clean		JR 158
15/2/07 01:00	15/2/07 04:00	GMT -2	2	2	Down	Clock Advanced to GMT-2		JR 158
15/2/07 08:10	15/2/07 10:10	GMT -2	1	2	Down	Filter Changeover and Clean		JR 158
16/2/07 08:10	16/2/07 10:10	GMT -2	2	2	Down	Filter Changeover and Clean		To Montevideo
17/2/07 08:10	17/2/07 10:10	GMT -2	1	2	Down	Filter Changeover and Clean		To Montevideo
18/2/07 08:10	18/2/07 10:10	GMT -2	-	-	Up	Water Off	Entry to River Plate Basin	To Montevideo
19/2/07 00:00	19/2/07 00:00	GMT -2	-	-	Up	Water Off		Montevideo
20/2/07 00:00	20/2/07 00:00	GMT -2	-	-	Up	Water Off		Montevideo
21/2/07 00:00	21/2/07 00:00	GMT -2	-	-	Up	Water Off		Montevideo

J. C.: Membrane inlet mass spectrometer for rapid high-precision determination of N_2, O_2, and Ar in environmental water samples, Anal. Chem., 66, 4166-4170, 1994.

Luz, B. and Barkan, E.: Assessment of oceanic productivity with the triple-isotope composition of dissolved oxygen, Science, 288, 2028-2031, 2000.

Quay, P. D., Emerson, S., Wilbur, D. O., and Stump, C.: The δ^{18}O of dissolved oxygen in the surface waters of the subarctic Pacific: A tracer of biological productivity, J. Geophys. Res., 98, 8447-8458, 1993.

Spitzer, W. S. and Jenkins, W. J.: Rates of vertical mixing, gas exchange and new production: Estimates from seasonal gas cycles in the upper ocean near Bermuda, J. Mar. Res., 47, 169-196, 1989.

Tortell, P. D.: Dissolved gas measurements in oceanic waters made by membrane inlet mass spectrometry, Limnol. Oceanogr.: Methods, 3, 24-37, 2005.

10.3 NOX System

Doug Trevett (a.k.a. Doug the Deck)

Table 10 provides a summary of the uncontaminated sea water system maintained by the JCR Deck Engineer. The file is logged daily and separated by month as opposed to separated by research cruise. The events from February 6 through February 19 correspond to the ADELIE/JR158 cruise.

A ADCP Command File

JR158 OS75 NB BT_off deep 16 m bins

```
;--------------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     75 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    low resolution Longrange profile(Narrowband) deep water,
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (e.g. courier).
; Modified Last: 28August2005
;-------------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps
; no parity onestop bit, 8data bits,
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file sothat it is not made permanent by a CK command.,
cb611

; Set for narrowband single-ping profile mode (NP) , seventy (NN) 16 meter bins (NS)
; 8 meter blanking distance (NF) , 390 cm/s ambiguity vel (WV)

; Switch Narrowband ON   NP1
NP1
nn70
ns1600
nf0800



; Switch Broadband  OFF   WP0

WP000
WN065
WS800
WF0200

WV390
```

```
; Disable single-ping bottom track (BP)
; Set maximum bottom search depth to 1200 meters (BX)

; Bottom track OFF
BP00
BX12000


; output velocity , correlation , echo intensity , percent good
WD111100000

; One and half seconds between bottom and water pings
TP000150

; Two seconds between ensembles
; Since VmDas uses manual pinging , TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas Communication options
TE00000200

; Set to calculate speed-of-sound , no depth sensor , external synchro heading
; sensor , no pitch or roll being used , no salinity sensor , use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA6008

; Set transducer depth (decimeters) [= 6.5m on JCR]
ED00063

; Set Salinity (ppt) [salinity in transducer well = 0]
ES0

; Set to trigger by SSU
; CX1 , 3,

; save this setup to non-volatile memory in the ADCP
CK
```

B ADCP File List

```
command file directory:
C:\ADCP\Command files

command file name:
JR158 OS75 NB BT_off deep 16m bins.txt

output files:
directory on U drive:
U:\data   (directory path on jrub: /users/soc/cruisedata/adcp/)

overflow directory:
C:\ADCP_Data_Secondary\test

files:
JR158_xxx_xxxxxx.enx
JR158_xxx_xxxxxx.enr
JR158_xxx_xxxxxx.ens
JR158_xxx_xxxxxx.n1r
JR158_xxx_xxxxxx.nms
JR158_xxx_xxxxxx.sta
JR158_xxx_xxxxxx.lta
JR158_xxx_xxxxxx.log

(times in GMT)
ensemble no. start end
 day time day time
002 07/02/2007 00:39 dismissed!
003 07/02/2007 00:44 08/02/2007 12:48
004 08/02/2007 12:49 08/02/2007 13:12
005 08/02/2007 13:21 09/02/2007 14:46
006 09/02/2007 14:45 09/02/2007 14:51
007 09/02/2007 14:51 12/02/2007 17:37   (changed to run through SSU; CTD section)
008 12/02/2007 17:38 13/02/2007 04:30   (set back to internal trigger; adcp section)
009 13/02/2007 04:31 13/02/2007 15:25
010 13/02/2007 15:26 13/02/2007 15:30
011 13/02/2007 15:30 13/02/2007 20:26
012 13/02/2007 20:26 14/02/2007 00:43
013 14/02/2007 00:44 14/02/2007 04:12
014 14/02/2007 04:13 14/02/2007 12:23
015 14/02/2007 12:23 14/02/2007 17:19
016 14/02/2007 17:19 14/02/2007 21:23
017 14/02/2007 21:24 ongoing
```

(as of 16/02/2007, 13:57),