Cruise Report
JR16004
24 Jan - 13 Mar 2017

James Clark Ross

PSO: J-B. Sallée

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PART I: Cruise Management

1.1 Scientific Personnel

These came from LOCEAN (Paris, France), LOV (Villefranche, France), Florida State University (FSU, Tallahassee, USA), Uni. Bergen (Bergen, Norway), Uni. Reykjavik (Reykjavik, Iceland), Uni. Las Palmas Gran Canaria (LPGC), and the Association of Polar Early Career Scientist (APECS), as follows:

PSO	Jean-Baptise Sallée	LOCEAN
Physical Oceanography	Hervé Le Goff	LOCEAN
	Antonio Lourenco	LOCEAN
	Peter Lazeravitch	FSU
	Léna Schulze	FSU
	Christopher Chapman	LOCEAN
	Elin Darelius	U. Bergen
Geochemistry	Marion Benetti	U. Reykjavik
	Camille Akhoudas	LOCEAN
	Jerome Demanges	LOCEAN
Biogeochemistry	Diana Ruiz Pino	LOCEAN
	Vincent Taillandier	LOV
	Maria Gelado	LPGC
Birds & Mammals	Sara Labrousse	APECS
	Yves David	APECS
BAS technical support	Pete Lens (ITE)	BAS
	Carson McAfee (AME)	BAS

1.2 Ships Personnel

CHAPMAN Graham P	Master
WALLACE Simon J	Chief Officer
DELPH Georgina M	2nd Officer
TAYLOR Harry J	3rd Officer
JOHNSTON Greg G J	3rd Officer
WADDICOR Charles A	ETO (Coms)
KUBULINS Andris	Chief Engineer
DONALDSON Christopher	2nd Engineer
HARDY Aleksandr J W	3rd Eng
EADIE Steven J M	4th Engineer
KLEPACKI Julian Z	ETO (Eng)
BIGGS Thomas E	Deck Engineer
SUTTON Lloyd S	Purser
MULLANEY Clifford	Bosun Science
FRASER Grant F	Bosun
DYER Martyn P	Bosun's Mate
CAMPBELL Kevin A	SG1
NEWMAN John L	SG1
FEARNS Stephen	SG1
LENNON Craig T	SG1
LEECH Robert R	SG1
VARGAS LEON Carlos E	MG1
PICTOR Stephen J	MG1
MOLLOY Padraig G	Chief Cook
WALTON Christopher I	2nd Cook
LEE Derek W	Sr Stwd
NEWALL James	Stwd
WINTON Brian G J	Stwd
ROUTE Roger	Stwd
JONES Helen V C	Doctor

1.3 Cruise Objectives

Deep water formed around the Antarctic continent drives the world ocean circulation. More than 50% of this deep water is formed within only about 10% of the Antarctic circumpolar band: the Weddell Sea. Subtle changes in the circulation of the Weddell Sea can lead to major changes in floating ice-shelves, with critical implications for global sea-level, the production of deep water, the global ocean overturning circulation, and the associated carbon pumps of the Southern Ocean.

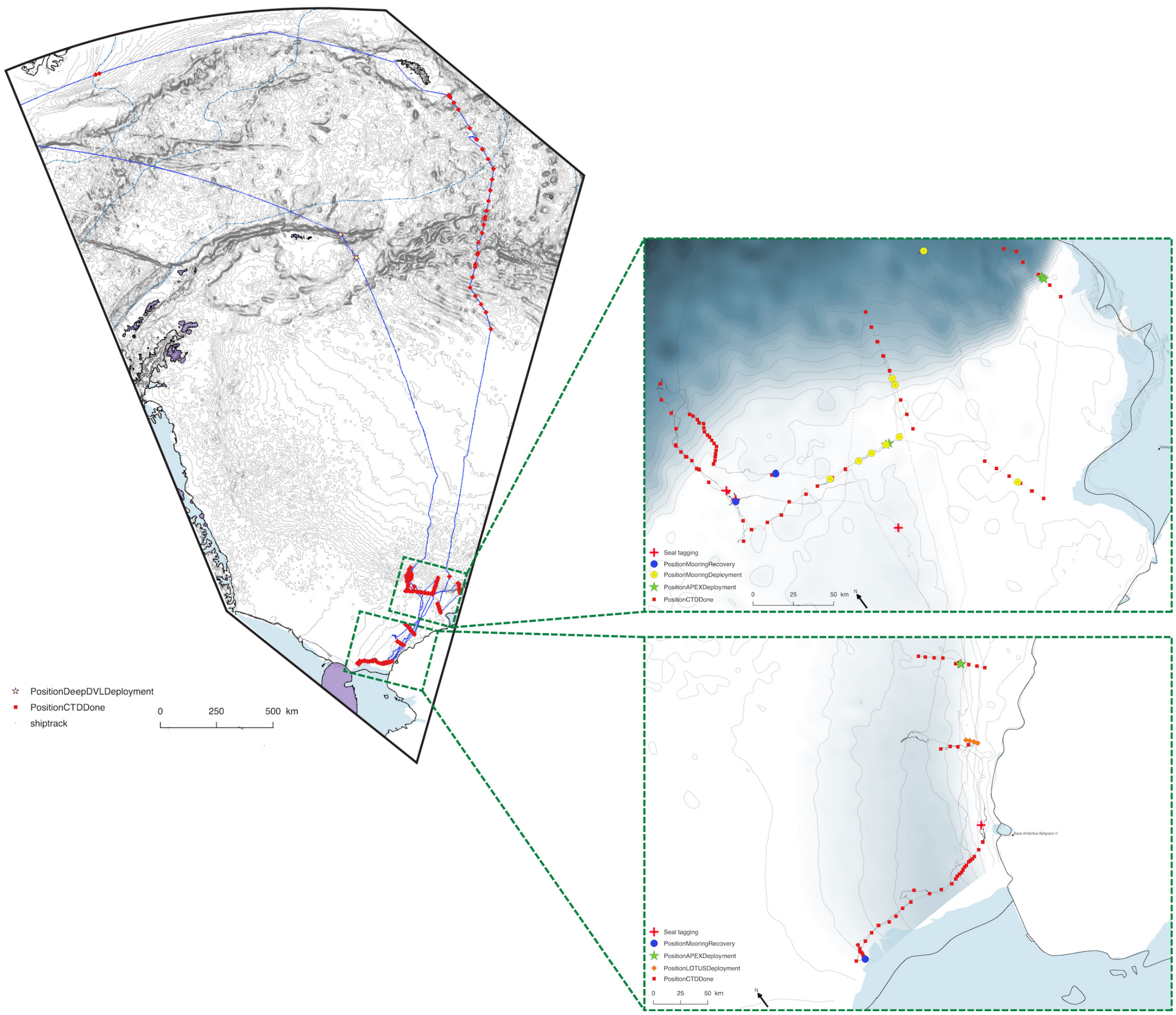
JR16004 had two main components.

One (SME975) in which we will remain north of the Sea-ice zone, in the southern Antarctic Circumpolar Current region. This component of the cruise enters within the framework of the long-term monitoring of this ocean section (A23), as part of BAS core program. It will allow us to assess water-mass modification and changes, and in particular, changes and trends in the Antarctic Bottom Water.

The second component of JR16004 (SME986) aims at zooming onto the source region of Antarctic Bottom Water, where potential changes at A23 would originate. In particular, Antarctic Bottom Water are formed by relatively warm current that enters in contact with ice-shelves. We will investigate the processes controlling the on-shore transport of relatively warm water onto the shelf toward the ice-shelves. Specifically we aim at observing the circulation (seasonality, time-scale) and forcing (tide, sea-ice, air-sea) of the circulation on the continental shelf, and make unprecedented measurements of the biological and physical carbon pumps and associated acidification.

Specifically, involved conducting a one repeat meridional hydrographic section (A23) along ~30°W, south of South Georgia, and a set of small hydrographic and biogeochemical sections across the continental shelf break, and across the Filchner Depression on the continental shelf break, as well as mooring deployment and recovery, float deployments, and seals tagging. Combined, this consisted of more 175 CTD stations, 9 mooring deployments, 3 mooring recovery, 5 tagged seals, 13 floats deployed, plus running underway surface ocean/met sensors.

1.5. Cruise Track



1.6 Cruise Narrative

21 Jan All scientists arrived in Punta Arenas, ready for mobilisation starting tomorrow first thing in the morning. Departure from Punta is scheduled on the 24th 10:00 am

22 Jan Mobilisation started with all gear already brought on deck. Labs have been populated and scientists start to get every box to the right place. Deck has been organised.

23 Jan Mobilisation continues. All instruments are now setup and ready to be run. Some issues with air isotopes instrument have been found, but nothing too serious. We are ready for departure tomorrow.

24 Jan Day started with safety briefing and drill. We then sailed off. The day was calm in the Magellan straight but we are expecting stronger winds in the coming days. The issue on the air isotopes instrument has been solved and it needs to be tested again. Continuous observations will start as soon as we leave Argentinian waters, probably around late afternoon tomorrow.

25 Jan Very nice day; calm and sunny. Final setups have been made, and meetings allowed teams to organise themselves. We are now in International waters. SADCP has been turned on; underway system will be turned on in the morning. We are planning a first CTD casts for test of instruments, but maybe more importantly to allow process (data acquisition and processing) to be tested, and digested.

26 Jan Still steaming westward toward Bird Island. Weather is nice which allow everyone to get his/her sealegs slowly. A first test-CTD down to 1500 m has been done. We had problem with cable on the way up at ~1100 m wire out

27 Jan Calm day in the fog. Gave us time to meet to discuss mooring plan and for biogeochemist to train others to get a hand.

28 Jan Steaming toward bird island. Calm day. Gave us time to try to calibrate the S-ADCP

29 Jan Arrived in Bird Island in the morning with amazing views alternating between fog and opening views on the mountains. We dropped the three scientists and the doctor and the two ecologists of our team visited the base. We then spent the day steaming toward our first station of A23, along the Southern coast of South Georgia with stunning views on the glaciars.

30 Jan Started the day with a stunning shinning sun. The first stations of last night when well. But as the day went we had more an more problems: SADCP seems to not work right, with large differences between stations and steaming; LADCP run short of battery at several stations; after changing the cable, we realized the battery pack is dead; we are now trying to change the cells; and wire issue on the CTD winch started again. Hopefully things will get better. Though weather starts picking up, so we might loose some time in the coming hours.

31 Jan Strong winds and big seas built up today. We stopped working around lunchtime and had to heave pointing to the waves for the rest of the day.

	The weather should calm this night.
01 Feb	The weather calmed down and we could restart working at 6:00 am this morning. The winch wire is working better, though the engineers are waiting for the deepest station to try spooling the wire back nicely on the drum.
02 Feb	We made good progress on CTD casts today, and made the most of a relatively calm weather. The issues we had with instruments over the last few days are slowly solved and allow to keep working at a good pace. Questions remain on a few underway instruments, including pCO2 analyser, as well as the two surface-water oxygen isotope analysers.
06 Feb	We finished the A23 section and are steaming southward to the join the Southeastern Weddell part of the cruise.
08/02	Starting the work in the Southeastern Weddell.
14/02	We finished today the section at ~77 S. We are meeting the Shackelton to give them a spare part and then make our way South. Plan is to go on a position roughly in front of Belgrano, and wait there until we think we can make our way further toward the ice-shelf front. It is hard to estimate a steaming time, but 12h steaming seems reasonable.
15/02	The plan for today was to try to go through the ice but this is harder task than expected, plus we suspect what we thought was open water on satellite image is actually fast ice. We tried flying the drone to better understand and see but the drone flight was aborted because of technical issue. We tried get to an ice floe to tag one seal but could not go through the ice. We are now stuck in the ice, and need to wait for tomorrow for the wind to ease down the ice and make us a way out of where we are. We are lucky enough to have an open water pool on starboard side of the ship, so managed to put the CTD in the water to diagnose ctd sensor issue and sample for biogeocmistry and isotope (CTD 73). Diagnostic of CTD: pump one seems to be faulty; it will be changed from CTD 74; from CTD 74, line 2 is put back to its original state (i.e. same sensors; same pump; pump with same flow rate as before).
16/02	We are still stuck in the ice. The wind started to pick up this morning but is compacting ice rather than easing anything (as forecasted). We will have to wait for the wind to turn, switching to southerly wind (going northward). That might be tomorrow, or even later. Until then, we can't move (though we will try at any opportunity). We finished the 13-hour yoyo CTD, and stop that here. We might be able to re-start the underway for surface monitoring (though the outlet has been freezing, so the risk is that pressure in the pipes rises; but we'll try and keep an eye on it).
17/02	The ice is starting to ease directly north of us (astern), so as soon as they can turn the ship around, we can go back north and leave this mess. What worries me the most is not that much the time we loose, but the fact that the ice is moving up north (near the sill), so that might become difficult to work on the western side near the sill. We'll make plan as we go, but what I'd like to do when we can go north, is, if ice allows, to deploy a couple of floats on the section we did at ~76.5°S, and make our way back on the sill on the western side for mooring recovery and cross slope sect.

18/02 We managed to tag a seal on our way north. Next steps are now deploy 4 LOTUS buoys at ~77°S (please weak up Elin 30 min before station), then move the 76°25.2' S / 32° 54.0' W to deploy two Apex floats. After that, we'll steam more north to join the western side of the sill.

19/02 We deployed the 4 LOTUS buoys last night, did a couple of CTD in the morning, and deployed the two last APEX. Since then, we have been steaming most of the day toward our next CTD station, on the long East-West section at the sill (74.51S; section where we deployed the four line of moorings). We will finish this section that we started from its eastern side; we will do all remaining stations making our way westward, likely through the ice floes. The plan is to do as many as we can, ice-dependent. The station positions are likely to be changed by ice. Tomorrow we will reassess the plan depending on how much of a struggle it is to steam within ice.

20/02 Yesterday was productive, despite the long time steaming: one seal and one mooring recovery. We came back to the east-west section overnight to continue CTDs. We got one done, but we got blocked by ice and had to give up with the east-west section. Frustrating, but I think we got enough of the east-west section to make it very valuable. We are now attempting a south-north section down the slope to catch the plume of outflow of dense water. Same as before, we give it a try and will stop if ice blocks us. There are 11 stations on the section, so that might take up to 24/36 hours to get it done (if we can make our way in the ice). Next steps will be to backup a bit more eastward. We will hopefully have access to reliable ice maps from satellite to refine the plan, but it is likely to be mooring deployment, and maybe one recovery on the way. More later.

21/02 Progress has been slow today. We struggled in the ice, almost decided to give up at some point, but suddenly it cleared up, and steaming is now easier, though still tedious. We will continue to push overnight to try getting station on the slope. Depending on how the night goes, we'll revise our plan tomorrow. Tomorrow is another day.

22/02 We managed to finish the cross slope section despite the issue we had with the gantry (leaks that needed to be repaired, which took a few hours of the day). We clearly see the dense water flowing out onto the slope. However, in order to try to better resolve this outflow, we are returning south, slightly east on the section we just finish, on the slope, between bathymetry contours 1500m and 500m, to do a small high resolution section: one ctd per nautical miles.

23/02 Today was a productive day: in addition to Elin's got offered a position in Bergen (champagne!), we got the second of Svein's mooring recovered, one of Svein mooring deployed on the long East-West section, and completed the high resolution cross slope section last night. We are now steaming to the northernmost station of the cross-slope section we started earlier on the cruise (CTD47-52) but did not have time to finish. We will complete the section and repeat the station on the slope, to have a consistent section on the slope, up to the shelf. The plan is to do as many station as possible overnight, from north to south, starting from the northernmost/deepest one. Then, we stop CTDing in the morning to be on station CTD136 (bathymetry contour ~500 m) at 9 am to deploy one mooring. After this mooring, we will move to station CTD135 to deploy a second mooring. After the two mooring deployment, we will finish all the stations on the section that could not be done overnight.

24/02 We now have all moorings in the water (yeah!). We are finishing the last station of the cross-slope section as I write. We will next give another try at the section close to the ice shelf. Yesterday and today's MODIS image show that the ice shelf is mostly clear, at least the eastern end of it, and weather forecast for the coming day might be favorable to keep the area free of ice. There is about 250 nm to get there, so I would expect we get there in the night 25-26 Feb. We will need to reassess ice images and forecast before entering the area, but I hope we will be able to make it. The risk being we have to abort before even entering the area, which would mean wasting 3-4 days (return way to the area); but I think that it is worth the risk.

25/02 We arrive to the southern section earlier than expected. We started the section down the slope on the eastern side of the section. Sampling has been tiring because we wanted to well resolve the slope with samples. We are now arriving to the bottom of the slope so sampling should be easier (we do not sample all stations). However, one issue we had is niskin freezing because of supercool water leaving the ice-shelf.

26/02 Continuing the ice-shelf section westward. We skipped a few stations in the deep through, so to try to be at the mooring station tomorrow during daytime to attempt recovering.

01/03 We left the ice-shelf front to go back north. We looked for seals on the way north, trying to go westward in the inner pack, but the icepack is too loose and we did not find any seals on nice enough floe.

02/03 Today we spent the another day steaming northward and looking for seals. We were lucky enough and tagged two. We are now steaming westward on the northern edge of the continental shelf. In the morning, we will be in the area where we think is a hotspot for seals and where we think ice will be made of nice floes where we could potentially work.

03/03 We spent a third day looking for seals, and had the chance to tag one. We will now stop seal hunting, and will do a last small CTD section from now until 6:00 am shiptime tomorrow (one station every 2 nm until 6:00 am). At 6:00 shiptime, we will start making our way north toward the South Orkney Island, where we will deploy two bottom-following float in the outflow region of bottom water, out of the Weddell Sea. Two additional CTD will be made at the location of float deployment for float calibration. We will then continue our way north towards Punta.

04/03 We finish the work in the Southeastern Weddellthis morning, as planed. We are now steaming north toward South Orkney Island.

08/03 Today, we finished science stations, after deploying the two Deep-DVL floats (and the two co-located CTD).

10/03 Entering Argentinian waters. We are now cutting all instruments. End of science. Everyone is glad to be soon back to Punta.

PART II: Underway Data

2.1 Navigation

Chris Chapman

Instrumentation

Seapath system

A Seapath 200 system is used on the RRS James Clark Ross. The data are logged via the 'seatex' scs data stream at 1Hz. This system outputs position, speed over ground (SOG), heading, course over ground (COG). Pitch, roll and heave are measured by the tsharp system. These quantities are also measured by the Seapath system, but there is no indication in the metadata which channel corresponds to which measurement. These data are stored in standard ASCII text files. For this cruise, we have made use of the "Compress" stream, which automatically flags bad data and cleans the streams. The streams used during this cruise are summarized in the following table.

Ashtech System

Navigational data are also logged via the Ashtech system. However, the data from this system is considered less robust than that from the Seapath system. As the seapath system performed admirably throughout the cruise, there was no need to supplement the seapath navigational streams with other data streams. Hence, the Ashtech data are not included in the file cruise files.

Data Processing

Data were processed daily using a custom script, written in the Python programming language. This script is located:

legwork/underway_processed/Underway_WAPITI.py

The script parses the navigational, meteorological and oceanlogger uncontaminated seawater streams (see following sections), performs basic automatic error checking using a quartile-quartile filter to remove obvious outliers. Data are then averaged into bins of 5 minute duration, and written to a daily output Netcdf format file.

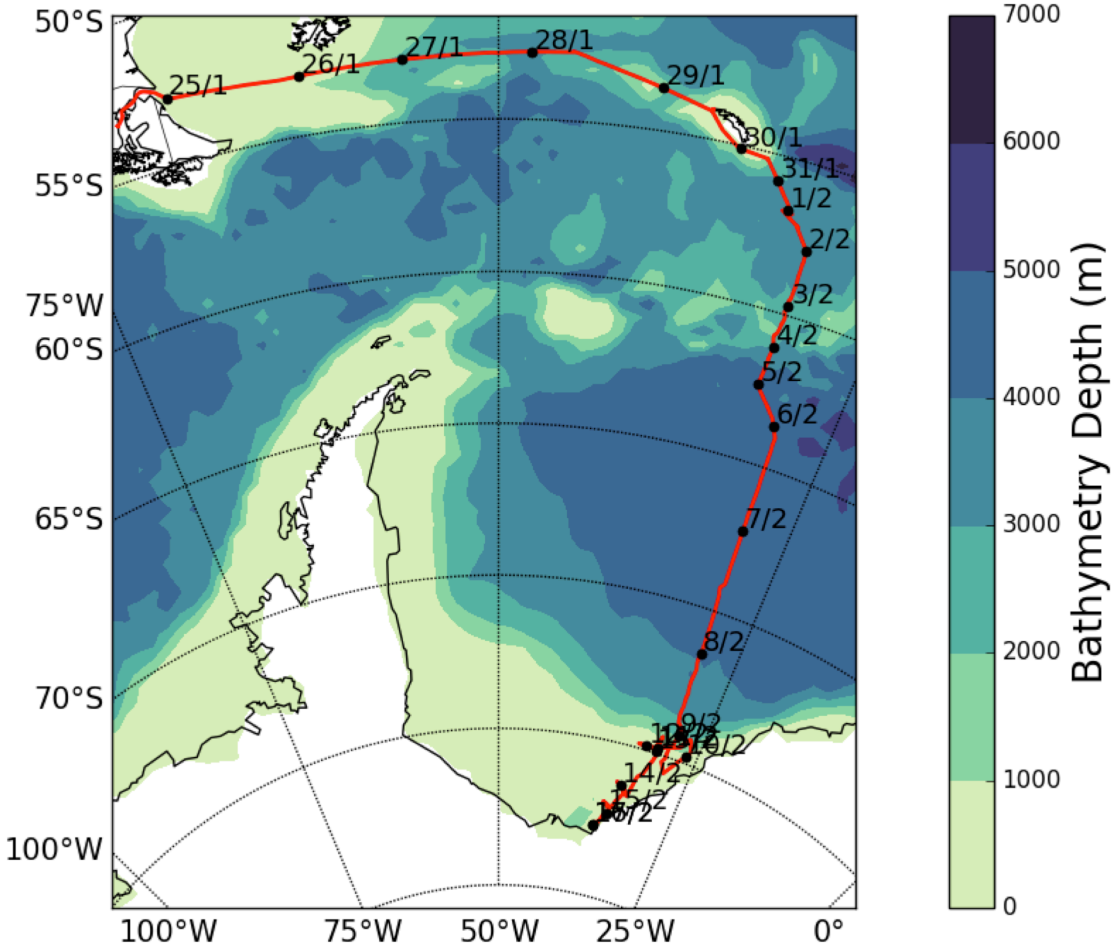
These files have the following location and title format:

legwork/underway_processed/underway_day_<julien_date>_date_<yyyymmdd>.nc

These files include the following navigational fields:

Description	**Variable Name**	**Units**
Time	Time	Julien Day
Latitude	ship_lat	Degrees

Longitude	ship_lon	Degrees
Heading	ship_heading	Degrees
Course made good	cog	Degrees
Speed made good	ship_speed	km/h
Heave	heave	cm
Roll	roll	100^{th} of a degree
Pitch	pitch	100^{th} of a degree



1: Fig1: Ship track plotted with the ETOPO01 Bathymetry

2.2 Oceanlogger And Anemometer

Chris Chapman

<u>Instrumentation</u>

Note that we do not cover the pumped seawater and thermosalinography data in this section. Data from this system is detailed in the following section.

The RRS James Clark Ross is instrumented with a variety of meteorological sensors to measure; air temperature and humidity, atmospheric pressure, short wave radiation (TIR), photosynthetically active radiation (PAR) and wind speed and direction. These are logged as part the ‘oceanlogger’ and ‘met’ systems at 0.5Hz. The oceanlogger system recorded the underway salinity and sea surface temperature.

The meteorological instruments were mounted on the ship's foremast in order to obtain the best exposure. The estimated heights of the instruments above the foremast platform were: Sonic anemometer, 0.65 m; air temperature and humidity 0.25 m and the irradiance sensors 0.2 m. The barometers were located in the ocean logger display cabinet in the UIC.

Data Processing

The majority of the meteorological data are processed in a manner identical to that used to process the navigational data. The streams accessed for data processing are listed in the table below

Variable	**Stream**
Wind speed	data/scs/Compress/anemometer.ACO
Wind direction	data/scs/Compress/anemometer.ACO
Air Temperature (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO
Barometric Pressure (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO
Relative Humidty (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO
Photosynthetically Active Radiation PAR (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO
Shortwave Radiation TIR (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO

These streams are read by the Python script:
legwork/underway_processed/Underway_WAPITI.py

The script averages the 0.5Hz data into five minute intervals and the writes the output to underway Netcdf files where it is combined with the navigational and other underway data. These files have the following location and title format:

legwork/underway_processed/daily_netcdf_files/underway_day_<julien_date>_date_<yyyymmdd>.nc

The variables contained within these files are:

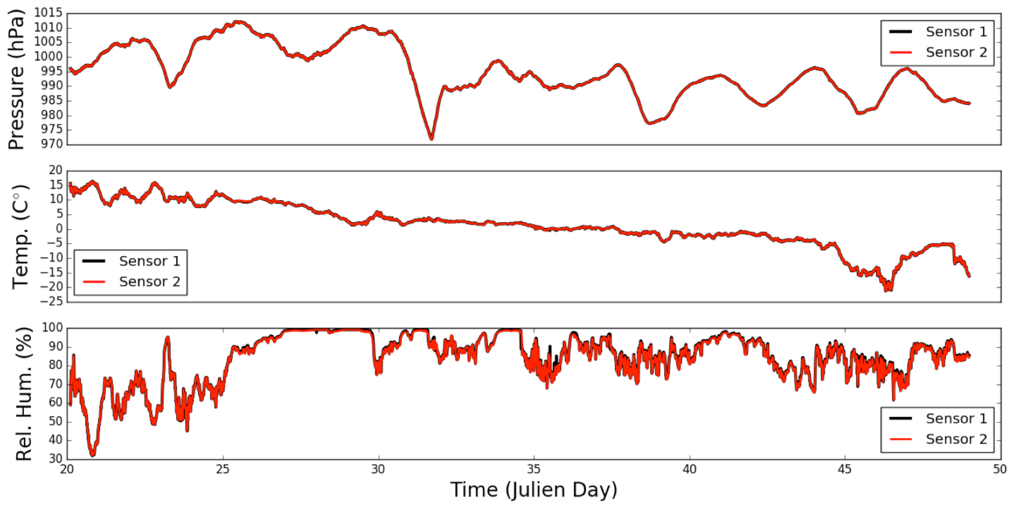
Description	Variable Name	Units
Time	Time	Julian Day
Wind Direction	wind_dir	Degrees
Wind Speed	wind_speed	m/s
Air Temperature (sensors 1 and 2)	air temp 1, air temp 2	Degrees C
Relative Humidity	RH 1, RH 1	%
Photosynthetically Active Radiation (sensors 1 and 2)	Par 1, Par 2	umol/S.m2
Total Incoming Radiation (sensors 1 and 2)	Tir 1, Tir 2	W/m2
Barometric Pressure	Baro press 1, Baro press 2	hPa

A file with more limited data is produced in .csv format. This file is:

legwork/underway_processed/WAPITI_Underway_5_mins.csv

The data availble in this file are identical to those contained in the daily netcdf file. However, this file contains the data series for the whole cruise (ie. It is not split into multiple daily subfiles) and when two functioning sensors are present, the data from both sensors is averaged to produce a single variable.

Example output showing the evolution of barometric pressure, temperature and relative humidity over the course of the cruise are shown in the figure below.



2: The measured barometric pressure (top), air temperature (centre) and relative humidity (bottom) during the WAPITI cruise

True wind correction

Wind speed and direction reported by the met system are measured relative to the fixed ship, and hence, the must be corrected for ship motion and orientation. Converting the wind to “true” speed and directions is accomplished by following the algorithm described in the paper Establishing More Truth in True Winds (Smith et al. 1999). Calculating true winds requires knowledge of the ship's heading, speed over ground (SOG), course over ground (COG), together with the measured wind speed and direction. These are read from the following Seapath streams:

Variable	**Stream**
Wind speed	data/scs/Compress/anemometer.ACO
Wind direction	data/scs/Compress/anemometer.ACO
Speed over ground	data/scs/Compress/seatex-vtg.ACO
Course over ground	data/scs/Compress/seatex-vtg.ACO
Heading	data/scs/Compress/seatex-hdt.ACO

Note that the 1st TIR sensor does not appear to be giving realistic values.

The meteorological and navigational streams are merged and wind speed and directional data are "trued" using the custom Python script:

/Legwork/underway_processed/Truewind_from_seatex.py

The output produced by this script passes all test cases, including the pathological cases, given in the Smith et al (1999) paper.

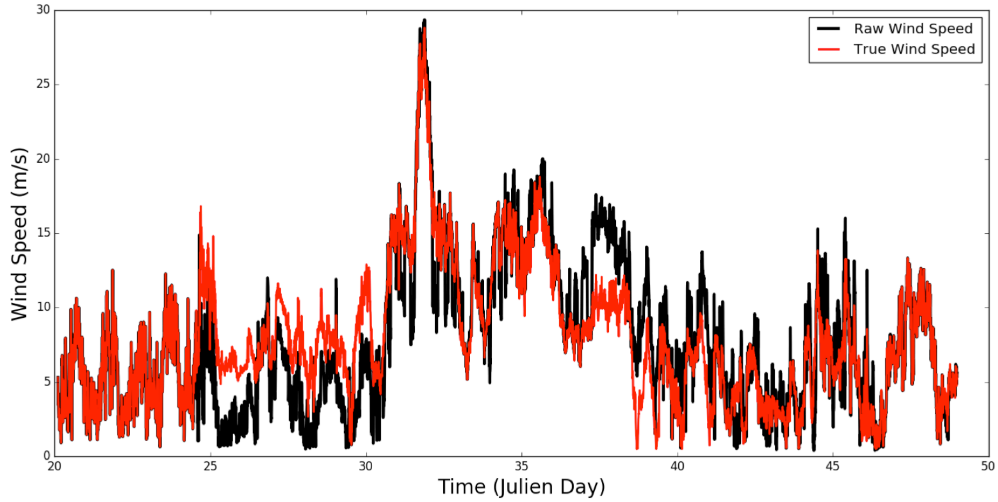
The true wind speed and direction, as well as several additional meteorological variables of interest, such as the west-to-east (u) and south-to-north (v) velocities, and the pertubation correlation covariances (u'u', v'v' and u'v') are averaged over a 5 minute windown and written to daily output files in Netcdf format, with a full path format:

/Legwork/underway_processed/true_wind_jday_<juilen date>_date_<yyyymmdd>.nc

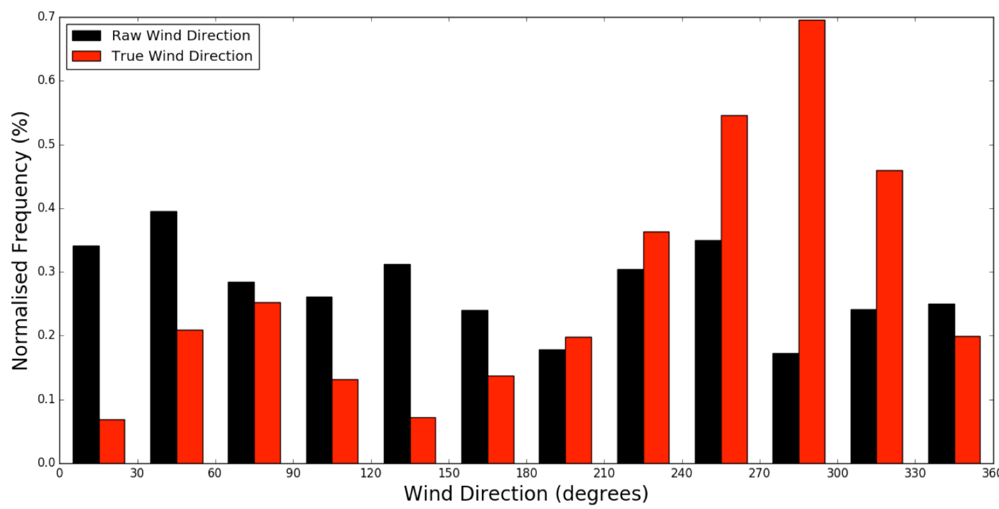
Note that there are still errors in the wind speed data due to ship acceleration. Periods when this may be an issue can be identified by periods where the SOG's standard deviation is high. We have included this field, as well as a Quality Control (QC) flag, which indicates potentially bad data as a True value (that is equal to 1) at times when the ship's SOG standard deviation exceeds 1m/s, a threshold identified in the Smith et al. (1999). The output files are described in the table below.

Description	**Variable Name**	**Units**
Time	Time	Julian Day
True wind direction	true wind direction	Degrees
True wind speed	true wind speed	m/s
West-to-east velocity	u	m/s
South-to-north	v	m/s
uu eddy covariance	eddy uu covar	m2/s2
vv eddy covariance	eddy vv covar	m2/s2
uv eddy covariance	eddy uv covar	m2/s2
Ship speed standard deviation	ship speed std	m/s
Bad data flag	qc flag	1 or 0

Example output from the raw and trued wind speeds are shown in the figures below



3: Raw (black) and "true" (red) wind speeds



4: Raw (black) and "true" (red) wind direction histograms

2.3 EA600 bathymetry

Chris Chapman

Bathymetry data were measured every 7 seconds by a Kongsberg EA600 single beam echo sounder was operated throughout the cruise, except during mooring recovery when it was turned off to facilitate interrogation of the previously deployed instrument. Data were processed daily. The data were transferred from the scs system to Netcdf format using the Python script:

legwork/underway_processed/Underway_WAPITI.py

The processing steps are identical to those for the navigational fields described in Section 2.1. Note that we have only processed the depth in metres. As with the navigational data, the EA600 bathymetric data is included in the underway Netcdf files, with the full path format:

legwork/underway_processed/underway_day_<julien_date>_date_<yyyymmdd>.nc

Description	**Variable Name**	**Units**
Depth	Bathy depth	Meters

EA600 data quality were quite poor throughout the cruise, being frequently in error by more than 100m when compared to the deployed CTD altimeter. This problem may be improved by introducing a sound speed correction by using the on-station CTD profiles of temperature and salinity. This correction has not yet been implemented, but should be performed should the EA600 data be used.

Perhaps more worryingly, the EA600 data is frequently contaminated by spikes, where the data series will rapidly change from a seemingly true depth value to either a shallow depth (generally near 200m) of a deeper depth (often 1000m deeper than the "true" depth). When the EA600 is noisy, it is often very difficult to infer just from the digitised records whether the instrument was finding the bottom or simply returning random noise close to the last known good depth.

As such, additional processing was performed using the processed data contained in the Netcdf files. The primary steps used in the analysis are:
- Depths outside the range of 0.0001 to 6000 m were flagged and set to NaN;
- Automated despiking using a simple gradient thresholding routine. Data that show changes of more than 150m over a 5 minute interval are flagged and set to NaN;
- The remaining data, which now has many data gaps, is smoothed and the missing data is infilled by convolving the bathymetric time-series with a normal (Gaussian)-window function with a standard deviation of 75 minutes. Data set to NaN is ignored by the convolution routine.

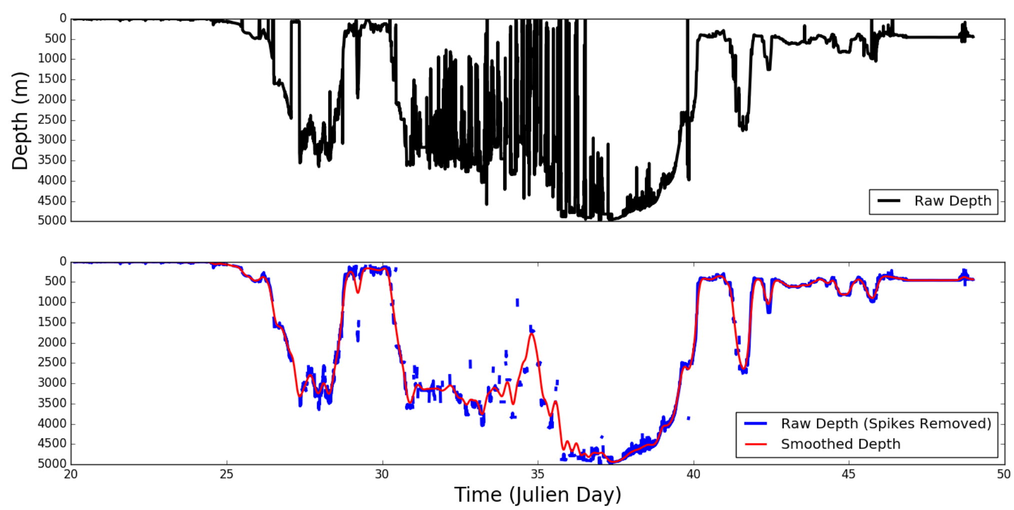
The raw data, the cleaned data and the smoothed data are then placed in the Netcdf file:

legwork/underway_processed/EA600_Bathymetry_processed.nc

This file contains the following variables:

Description	Variable Name	Units
Time	time	Julian days
Ship longitude	ship lon	Degrees longitude
Ship latitude	ship lat	Degrees latitude
Raw bathymetric depth	bathymetry_raw	meters
Clean (despiked) bathymetric depth	bathymetry_clean	meters
Smoothed and cleaned bathymetric depth	bathymetry_smooth	meters

The raw and cleaned data represent rapid, small scale changes in the underlying bottom topography, but contain many gaps or poor data. The smoothed bathymetry is a complete series, but is unable to represent the small scale structure in the bottom topography.



2.5 Surface Pumped Seawater And Thermosalinigraph

Chris Chapman

Instrumentation

Near surface oceanographic parameters were measured by sensors located on the non-toxic supply. These included a Fluorometer, which measures fluorescence and a SBE45 thermosalinograph measuring conductivity and water temperature at the point it reaches the instrument. The salinity was calculated in real time using the SBE45 housing temperature and conductivity measurements. The sea surface temperature (SST) was measured by a PRT100 temperature sensor located close to the uncontaminated supply intake on the hull at a depth on 6m.

Data Processing

Underway data were accessed from the relevant streams using the same Python script that was used for processing both the navigational and surface meteorological streams. The relevant streams and their sources are listed in the table below.

Variable	**Stream**
Conductivity	data/scs/Compress/oceanlogger.ACO
Salinity	data/scs/Compress/oceanlogger.ACO
TS sensor temperature	data/scs/Compress/oceanlogger.ACO
Sound speed	data/scs/Compress/oceanlogger.ACO
Chlorophyll	data/scs/Compress/oceanlogger.ACO
Sample Temperature	data/scs/Compress/oceanlogger.ACO
Flow rate	data/scs/Compress/oceanlogger.ACO
Sea temperature (sensors 1 and 2)	data/scs/Compress/oceanlogger.ACO
Transmissivity	data/scs/Compress/oceanlogger.ACO

The underway system frequently failed when the ship was in ice conditions. These periods can be easily recognised by a low or zero flow rate. As we spent a large portion of the cruise in sea ice in the southern Weddell sea, there are long periods with no underway data.

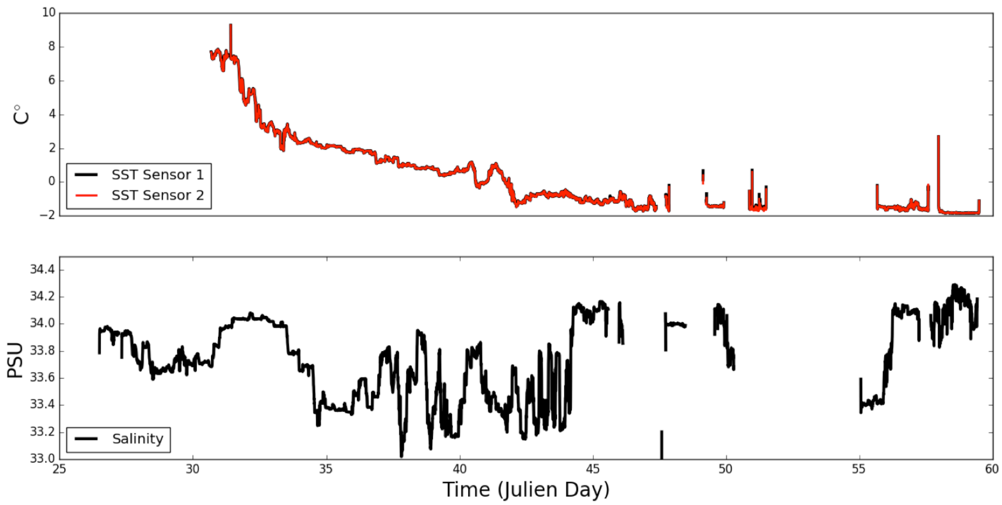
Processing is performed using the same Python script used for navigational and surface meteorological data:

/legwork/underway_processed/Underway_WAPITI.py

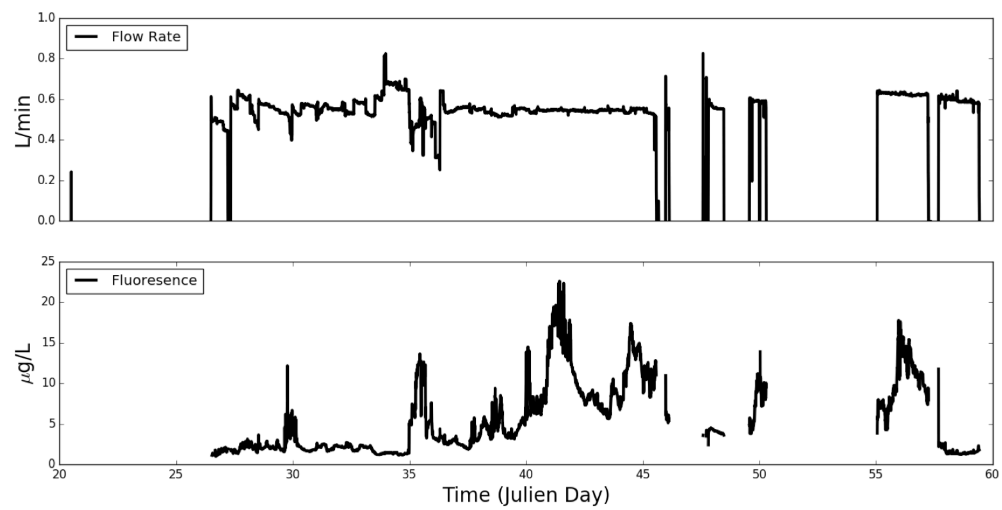
Basic error checking and outlier detection is performed. As before, the underway data is averaged over five minute windows to produce subsampled data with a five minute sampling period. The output is written to daily Netcdf files with the following variables.

Description	**Variable Name**	**Units**
Time	Time	Julien Day
Temperature at temperature/conductivity sensor	ts_temp	Degrees Celius
Conductivity	conductivity	S/ma
Salinity	salinity	psu
Sound speed in water	sound vel	m/s
Chlorophyll	Cla	ug/L
Sampling Temperature	sample temperature	Degrees C
Flow Rate	flow rate	L/min
Sea Surface Temperature (sensors 1 and 2)	SST 1, SST 2	Degrees C
Transmissivity	Transmissivity	0<T<1

As mentioned above, the uncontaminated seawater system frequently failed in sea ice conditions. This can be seen in the following plots of sea surface temperature, salinity, flow-rate; and fluorescence, which show large data gaps towards the middle and end of the campaign (days 45 through to 55).



5: The underway sea-surface temperature (top) and salinity (bottom)



6: The underway flow rate (top) and fluorescence (bottom). Periods of underway failure are easily identified by a 0 or very low flow rate.

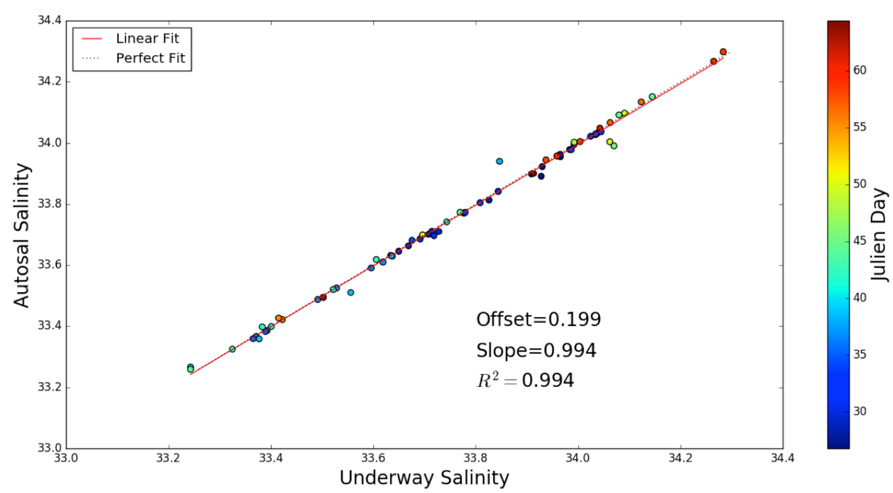
Salinity Calibration

Discrete salinity samples were taken from the pumped sea-water system throughout the cruise for the purpose of calibrating underway TSG data. These were then analysed using a salinometer on board using a procedure identical the that described in detail in Section 4.1.

Underway samples of the salinity were taken approximately every 4 hours when the underway system was operating as part of the watch-keepers' duties. The tap supplying the underway water was open constantly and the flow rate was monitored and logged every 4 hours as part of the underway data logging procedure. The sample bottle, labelled by crate number and by a unique bottle number, was filled and emptied 3 times to ensure minimum contamination before being filled. Bottles were filled in order to leave minimal air for evaporation to occur whilst leaving enough air to allow for adequate mixing of the sample before sampling, in order to counteract any stratification that may have developed. Once filled, the bottles immediately capped with plastic stoppers supplied by OSIL, in order to seal the air within the bottles to counteract evaporation and placed in the uniquely numbered crate. Once a case of sample bottles was full, it was transferred to the temperature-controlled laboratory, where it remained a minimum of 24 hours before being sampled. This was to ensure that all samples were at the same temperature on sampling for consistency of measurements.

Samples were then analysed with the salinometer following the manfacturer's instructions, as described in Section 4.1. In order to arrive at a value of salinity in Practical Salinity Units (PSU), the three sample conductivity estimates were averaged together and the UNESCO (1980) algorithm was applied.

The results of the basic salinity callibration are shown below in Figure. This figure has been produced after the removal of obvious outliers which prevented the least-squares method from obtaining parameters that



7: Underway Salinity Calibration: Points show the salinity calculated by direct measurement and the corresponding value from the thermosalinograph. The red line is the best fit determined by linear least-squares. Black dots show the 1:1 perfect fit.

The calibration coefficients are as follows:

slope = 0.99399
offset = 0.19942

The data taken from the thermosalinograph and the sampled pumped sea-water show strong correlation, with the slope being close to unity, and a (squared) Pearson correlation coefficient of 0.994.

However, there is a relatively large offset (0.19942) that could indicate a potential problem with the thermosalinograph. However, the there is limited drift of the instrument throughout the cruise and the offset remains stable throughout.

2.6. Vessel-Mounted Acoustic Doppler Current Profiler

Herve Le Goff

2.6.1 Abstract

A 75 kHz RD Instruments Ocean Surveyor (OS75) VMADCP (also called SADCP for Ship ADCP) was used during this cruise. We were told from previous cruises that SADCP data were only usable on station, because while in motion the ship velocities were inducing bias impossible to correct for.

Our conclusion for JR16004 is as following:

- SADCP is producing valuable data on station, in good correlation with LADCP profiles, with or without bottomtrack available, as long as sea state is less than Beaufort 6.
- on bathymetry < 600-700m , SADCP in bottomtrack mode gives valuable data in motion, except when sea state is rough and/or icing problems below hull occur. These were the average conditions during most of Leg2 (Weddell sea) , where in consequence we obtained good SADCP profiles most of the time .
- on motion in deep waters when bottom track is lost for long periods , SADCP data become impossible to correct for ship velocity , especially with rough sea state. Hence most of the A23 section has no valid SADCP velocity data.

Those conclusions are issued from the CASCADE processing. It might be worth running CODAS processing on section A23 data, to check if those poor results are process-depending or -most probably- instrument depending.

2.6.2 Instrumentation

The OS75 unit is situated in the transducer well in the hull of the *JCR*. This is flooded with a mixture of 90% de-ionised water and 10% monopropylene glycol.

Ocean Surveyor instruments use a phased array transducer that produces all four beams from a single aperture at specific angles.

A consequence of the way the beams are formed is that horizontal velocities derived using this instrument are independent of the speed of sound (vertical velocities, on the other hand, are not), hence speed sound correction is not required for the present study limited to horizontal velocities.

The OS75 transducer on the *JCR* is aligned at approximately 60 degrees relative to the centreline. Transducer depth is assumed at 6.3m. Those are the values declared for the real time VMDAS acquisition process, but as seen later, they will be corrected by the secondary CASCADE process.

During trials tests (on JR16004 and previous cruises), it was noted that the OS75 causes interference with most other acoustic instruments on *JCR,* including the EM122 swath bathymetry system. To circumvent this, the ADCP pinging can be synchronised with the other acoustic instruments using the SSU.

During JR16004 we decided to stop the swath , hence running the 0S75 unsynchronised, which allows increased ping rate .

In shallow water the ADCP was set in bottom track mode with varying depths (and therefore ping rates).

The heading feed to the OS75 is the heading from the Seapath GPS unit, converted to custom RDI format ($PRDID) for input to VMDAS

2.6.3 Configuration

The OS75 was controlled using Version 1.42 of the RDI VmDas software. The OS75 ran in two modes during JR16004: narrowband with bottom-tracking on and narrowband with bottomtracking off. While bottom tracking the maximum water depth was set to 800m (100 bins, each 8 metres). Water-tracking was always 100bins of 8 metres. SSU was not used. Narrowband Profiling was enabled with an 8 metre blanking distance.

Salinity at the transducer was set to zero, and Beam 3 misalignment was set to 60.08 degrees
Data logging was stopped and restarted around once every 2 days (or when switching from BTK to WTK) to keep files to a manageable size for processing.

The two configuration files used during the cruise (with and without bottom track) can be found at the end of this section.

2.6.4 Outputs

VMDAS writes files to a network drive that is samba-mounted from the Unix system. The raw data (.ENR and .N1R) are also written to the local PC hard drive. For use in the matlab scripts the raw data saved to the PC would have to be run through the VMDas software again to create the .ENX files. When the Unix system is accessed (via samba) from a separate networked PC, this enables post-processing of the data without the need to move files.

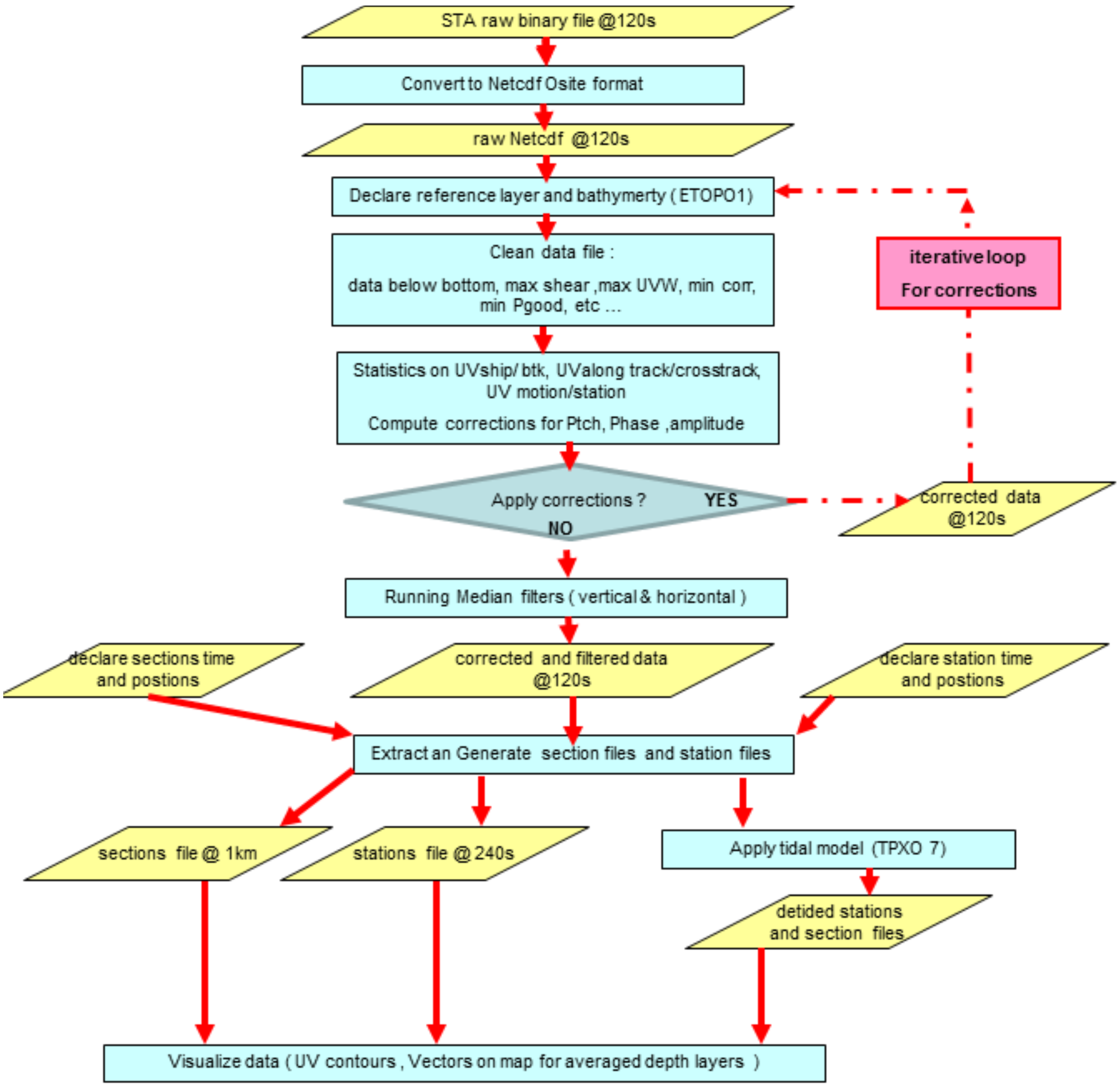
Output files are of the form JR281_XXX_YYYYYY.ZZZ, where XXX increments each time the logging is stopped and restarted, and YYYYYY increments each time the present filesize exceeds 10 Mbyte.

ZZZ are the filename extensions, and are of the form:-
.N1R (NMEA telegram + ADCP timestamp; ASCII)
.ENR (Beam co-ordinate single-ping data; binary). These two are the raw data, saved to both disks.
.VMO (VmDas configuration; ASCII)
.NMS (Navigation and attitude; binary)
.ENS (Beam co-ordinate single-ping data + NMEA data; binary)
.LOG (Log of ADCP communication and VmDas error; ASCII)
.ENX (Earth co-ordinate single-ping data; binary). This is read by matlab processing
.STA (Earth co-ordinate short-term averaged data; binary)
.LTA (Earth co-ordinate long-term averaged data; binary).
.N1R and .ENR files are saved to the secondary file path and can be reprocessed by the software to create the above files.

2.6.5 CASCADE processing

Processing raw STA files issued from VMDAS was achieved with the french (LPO/Brest) code *CASCADE [ref1]*.

The general flowsheet for this process appears below:



Before running CASCADE we have concatenated single STA raw files by group or leg (see tables 2.6.3 & 2.6.6 for A23/leg1 and WAPITI/Leg2).

Final output of the process for each elected leg consists of Netcdf files of georeferenced UV profiles:

- Averaged every kilometer for the SADCP profiles on sections (ship in motion)
- Averaged every 240 s for the SADCP profiles on stations (ship stopped on station)

Like CODAS process, CASCADE makes statistical analysis of the UV water and bottomtrack data, correlations of cross-track and along-track velocities with ship navigation data , in order to propose corrections on misalignment (phase) and amplitude .***Unlike CODAS***, CASCADE proposes as well a correction on pitch angle which modifies both vertical and horizontal velocities.

Table 2.6.1 gives corrections values obtained from the CASCADE process during JR16004.

Table 2.6.2 gives corrections values obtained from the CODAS process during previous JCR cruises, where the same SADCP OS75 was used. A broad variability appears between those corrections and ours!! We cannot assess clearly where this variability comes from, nor which is right or wrong.

We will only discuss in the next chapters about our own JR16004 SADCP data compared to simultaneous LADCP data.

cruise/leg	date	Bot/Wat	mean pitch	mean amplitude	mean angle	comments on Cascade process
JR16004/tests	janv-17	bottomtrack	0.9	1.43	0.991	includes a square track for calibration
JR16004/A23	feb 2017	watertrack	0.7	0.990	0.96	useless data
JR16004/Leg2	feb/march 2017	bottomtrack	0.8	0.982	0.960	good data

Table 2.6.1: corrections derived from CASCADE process during JR16004 legs

cruise	date	bot/water	mean amplitude	mean angle	notes
JR281	April 2013	Bottom	1.001	0	CODAS processing
JR276	April 2011	bottom	1.0116	-1.0564	CODAS processing
JR195	Nov 2009	Water	1.0155	-0.2060	CODAS processing
JR195	Nov 2009	bottom	1.0381	+0.6080	CODAS processing
JR200	Mar-Apr 2009	water	1.0150	-0.0876	
JR177	Jan 2008	water	1.0124	-0.0559	
JR165	Mar-Apr 2007		1.0127	-0.0078	
JR158	Feb 2007	water	1.0161	+0.1245	

Table 2.6.2: corrections derived from CODAS process during previous JcR cruises using the same OS75

2.6.6 Preliminary results for section A23 (JR16004 / Leg1)

Table 2.6.3 details STA files and associated corrections values obtained from the CASCADE process for SADCP data on section A23 from South Georgia to Weddell Sea.

During that section, we had mostly heavy weather with rough seas, and bottom depth >1000m, hence no bottom track available for the OS75. As a consequence, corrections issued from CASCADE were statistically unconsistent on each individual STA file : after several iterations the process never converged towards acceptable values.

As a desperate tentative, we processed concatenated LTA files (long time averaged on 10mn) supposed to be a more robust –low resolution-output from VMDAS : the bottom line in *Table 2.6.3* shows again bad results . Comparing those LTA processed data to LADCP-only data on the stations of section A23, we conclude that:

- Angle and module offsets show high median values with broad standart deviation and non gaussian distributions (*upper figure 2.6.4)*
- UV profiles contours show large discrepancies between LADCP and SADCP (*lower figure 2.6.4)*
- Same discrepancies appear on compared LADCP/SADCP vectors averaged in the surface layer, particularly when ship is in motion between stations. *(map 2.6.5*),

As a matter of consequence, SADCP data on section A23 were considered as useless, and were not used for LADCP constraint.

Table 2.6.3 : SADCP process on A23 section

STA file	CTD station	date SADCP	config SADCP	SADCP agregated section	Cascade corrections on STA raw			result after corrections		
					pitch	Phase	amplitud	pitch	Phase	amplitud
003 to 006	01 to 02	25/01/2017 20:57:41 31/01/2017 05:31:13	BTK 500m,8m bins no sync,EM122 off & on	tesst & calibration	0.9	1.43	0.991	0	0.17	1.000
007	03 to 07	17/01/30 05:31:55.45 17/01/30 19:17:55.88	BTK 800m,8m bins no sync,EM122 ON	sec 1	0.9	0.88	0.993	0	0.05	1.008
008	08	17/01/30 19:19:13.92 17/01/30 23:27:15.36	Watertrack 800m, 8m bins no sync,EM122 OFF	sec 2	0.7	1.57	0.970	0	0.44	0.976
009	no	17/01/30 23:27:52.09 17/01/30 23:43:52.49								
010	09 to10	17/01/30 23:46:09.01 17/01/31 22:06:11.45								
011	11 to 13	17/01/31 22:07:12.80 17/02/02 00:07:14.13	Watertrack 800m	sec3	0.5	-0,02	0.976	0	0.04	0.983
012	14 to 20	17/02/02 00:08:41.66 17/02/03 11:30:43.16	Watertrack 800m	sec 4	0.8	0.53	0.990	0	0.12	1.001
013	20 to 26	17/02/03 11:31:19.87 17/02/04 14:55:20.86	Watertrack 800m	sec5	0.6	0.34	0.964	0	-0.48	1.012
014	27 to 32	04/02/2017 14:58:27 06/02/2017 11:10:01	Watertrack 800m	sec6	0.9	0.97	0.986	0	0.19	1.00
LTA file				***A23 section***						
6 to 14	03 to 32	17/01/29 01:52:57.31 17/02/05 11:57:31.01	BTK500 & 800m at start,Watertrack800m on A23	sec A23	0.7	0.96	0.99	0	-0.47	0.995

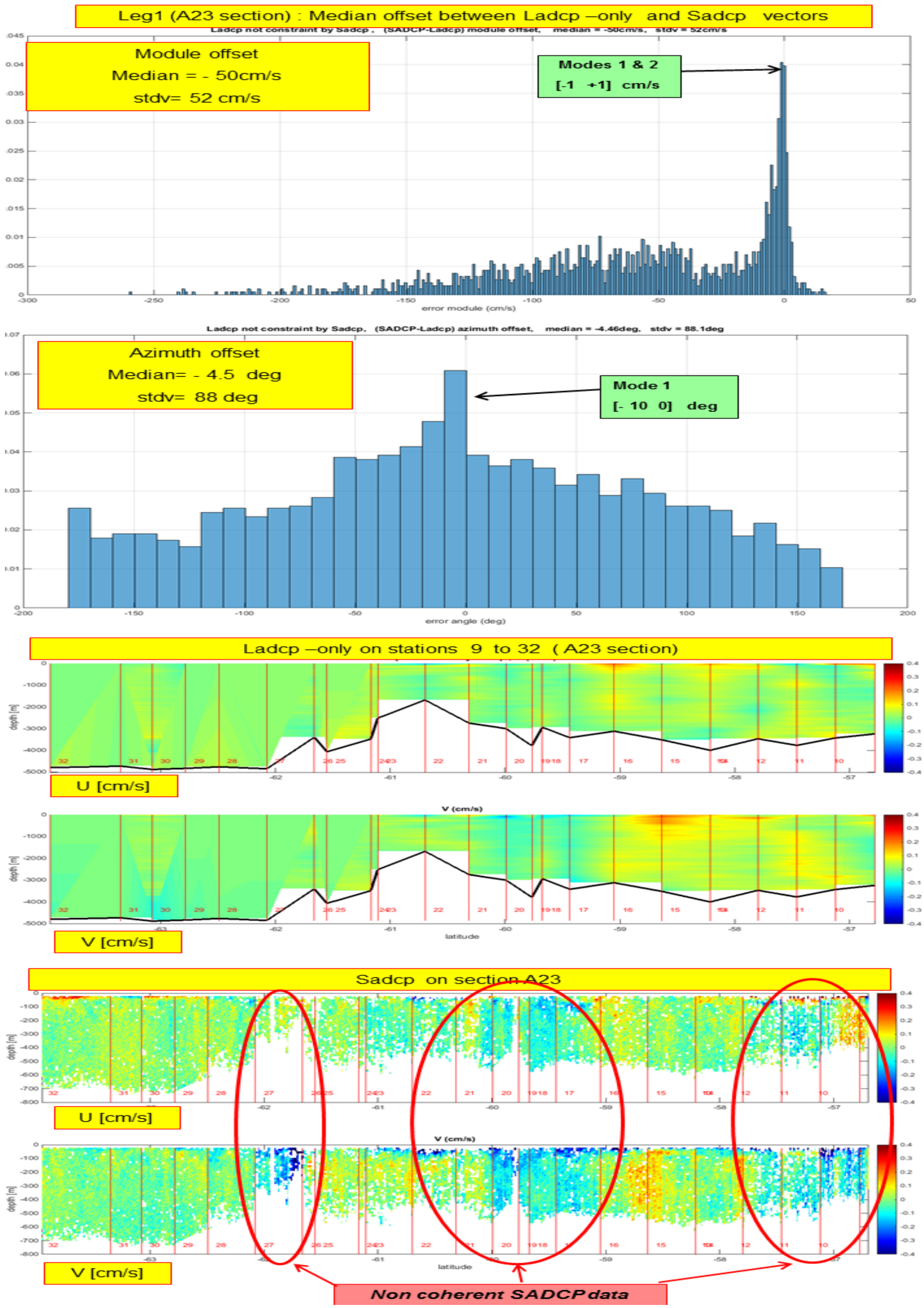

Leg1 (A23 section) : Median offset between Ladcp –only and Sadcp vectors
Module offset
Median = - 50cm/s
stdv= 52 cm/s
Modes 1 & 2
[-1 +1] cm/s
error module (cm/s)
Azimuth offset
Median= - 4.5 deg
stdv= 88 deg
Mode 1
[- 10 0] deg
error angle (deg)
Ladcp –only on stations 9 to 32 (A23 section)
U [cm/s]
V (cm/s)
V [cm/s]
latitude
Sadcp on section A23
U [cm/s]
V (cm/s)
V [cm/s]
latitude
Non coherent SADCP data

Figure 2.6.4 : comparison of LADCP and SADCP (LTA files) velocity data on A23 section .

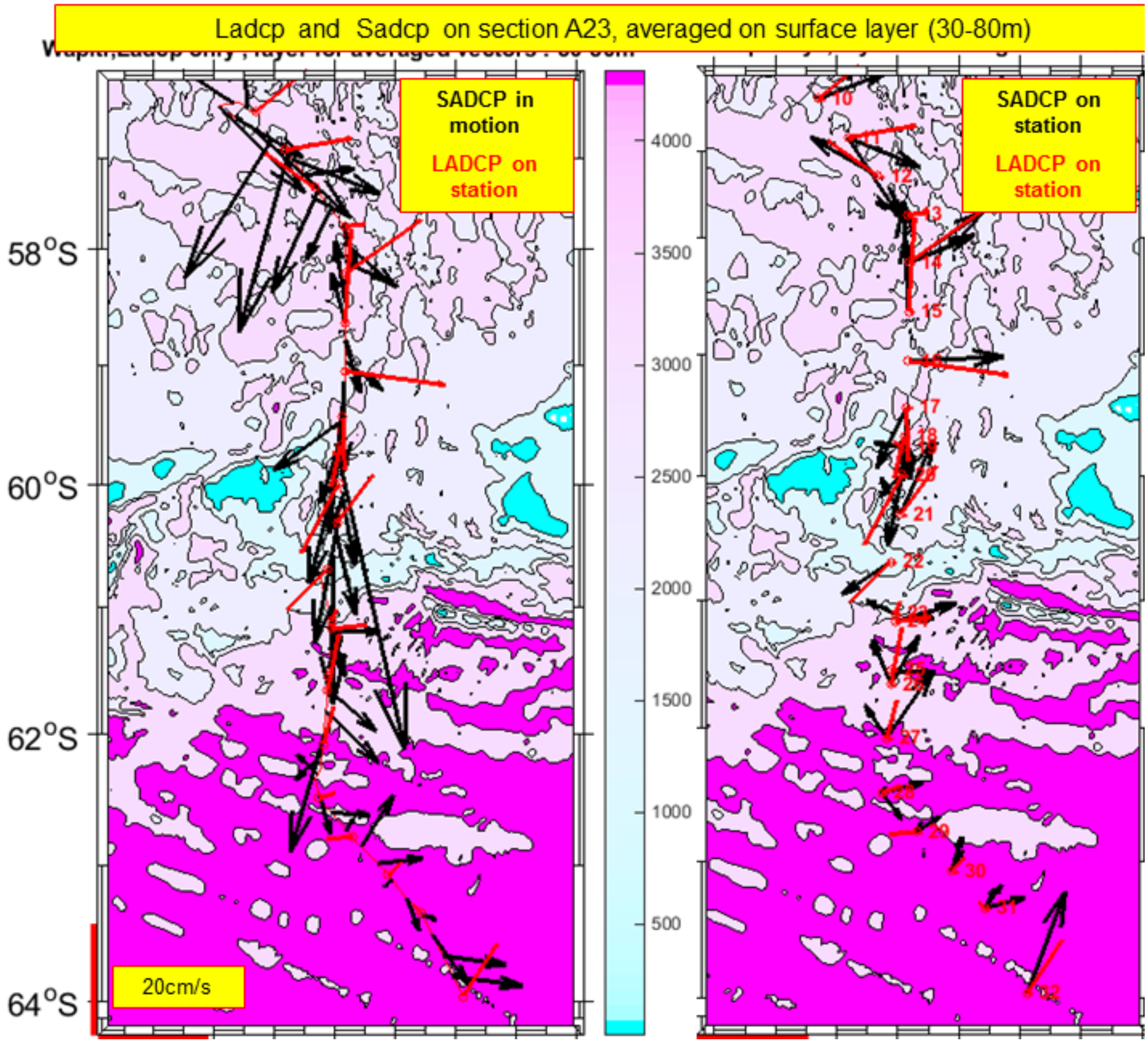


Figure 2.6.5 : comparison of LADCP and SADCP (LTA files) velocity data on A23 section .

2.6.7 Preliminary results for WAPITI sections (JR16004 / Leg2)

Table 2.6.6 details STA files, concatenated into 1 single section and associated corrections values obtained from the CASCADE process for SADCP data on Leg 2 (Weddell Sea .and Filchner basin).

During Leg2 we mostly had light to moderate winds with calm seas, due to sea ice. Bottom depth on the shelf were generally less than 600m, allowing bottom track for the OS75. As a consequence, corrections issued from CASCADE were statistically consistent, a single set of corrections being valid for the entire Leg2.

Angle and module offsets between LADCP and SADCP vectors on the 140 stations show excellent statistics: quasi-Gaussian distributions, small median values and stdv (*figure 2.6.7).*

As seen on *map 2.6.8,* and discussed in detail in the LADCP chapters, SADCP velocities in motion correlate very well with LADCP data on stations; As a matter of consequence, SADCP data on Leg 2 were fully validated , and were used for LADCP constraint.

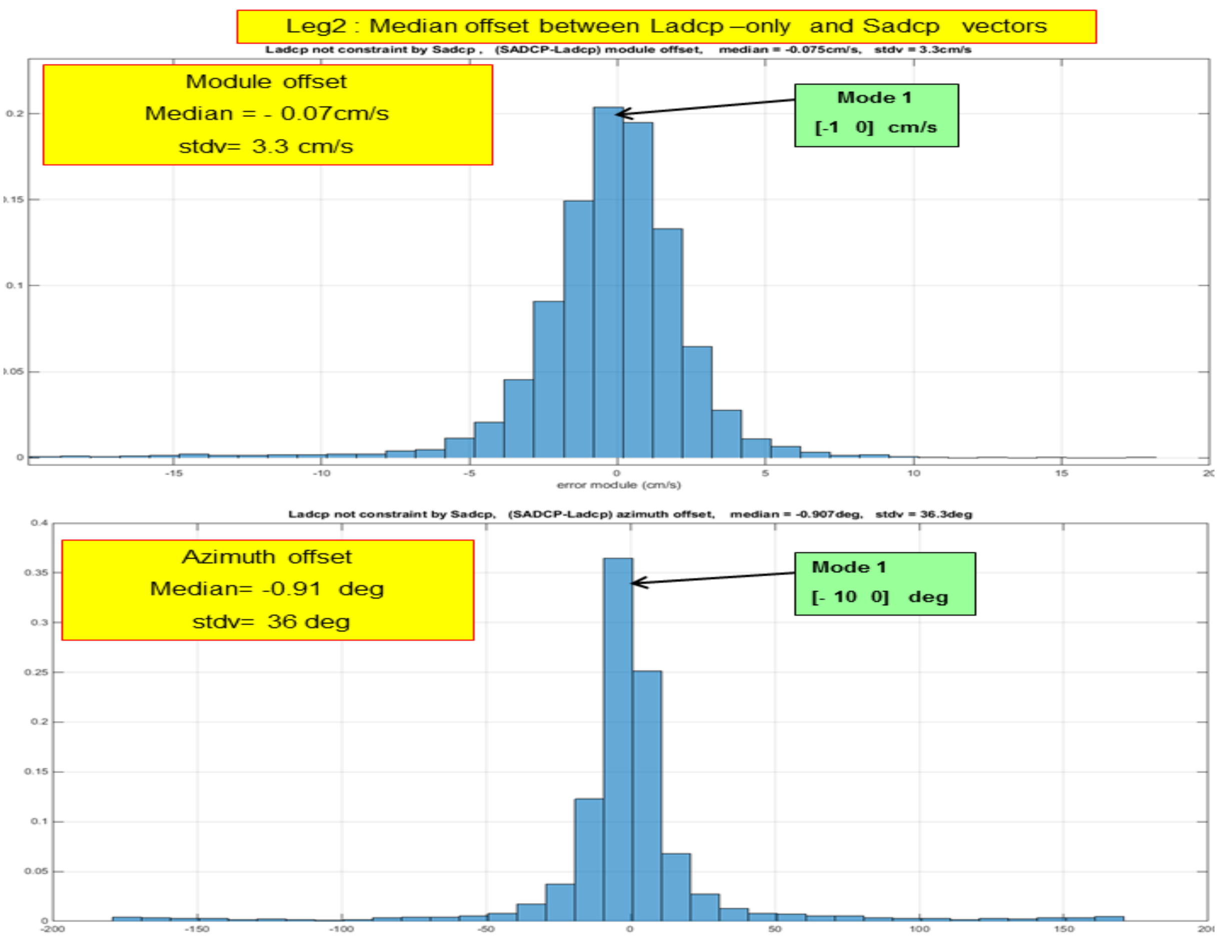


Figure 2.6.7 : comparison of LADCP and SADCP velocity offsets for all Leg 2.

Table 2.6.6 : SADCP process on WAPITI leg2 sections										
STA file	**CTD station**	**date SADCP**	**config SADCP**	**SADCP agregated section**	**Cascade corrections on STA raw**			**result after corrections**		
					pitch	**Phase**	**amplitude**	**pitch**	**Phase**	**amplitude**
015	nan	17/02/06 11:10:56.21 17/02/08 10:24:58.84	Watertrack 800m,8m bins no sync,EM122 OFF	Leg2 section	0.8	0.960	0.982	0	0.11	0.998
016	33	17/02/08 10:25:31.26 17/02/09 01:39:32.42								
017	nan	17/02/09 01:39:47.22 17/02/09 02:15:47.32								
018	34 to 44	17/02/09 02:19:04.11 17/02/10 10:49:07.59	Bottomtrack 800m							
019	45 to 46	17/02/10 10:52:06.82 17/02/11 00:08:09.51	Watertrack 800m							
020	47 to 62	17/02/11 00:09:56.32 17/02/13 15:48:00.08	Bottomtrack 800m							
021	63 to 72	17/02/13 15:49:52.23 17/02/14 22:15:56.39								
022	73 to 91	17/02/14 22:16:24.95 17/02/16 17:54:25.78								
023	nan	17/02/16 17:55:20.95 17/02/17 19:53:24.71								
024	92 to 101	17/02/17 19:54:42.50 17/02/20 14:02:47.09								
025	102 to 109	17/02/20 14:04:05.98 17/02/21 14:36:06.93								
026	110 to 120	17/02/21 14:38:32.70 17/02/22 22:44:33.60	Watertrack 800m							
027	121 to 140	17/02/22 22:47:06.22 17/02/26 00:05:09.32	Bottomtrack 800m							
028	141 to 158	17/02/26 00:07:20.24 17/02/27 11:01:22.23	Watertrack 800m							
029	159	17/02/27 11:03:23.19 17/02/27 14:09:27.08	Bottomtrack 800m							
030	160 to 168	17/02/27 14:33:06.50 17/02/28 23:03:11.57								
031	nan	17/02/28 23:04:03.92 17/03/02 22:54:04.54								
032	nan	17/03/02 22:55:08.56 17/03/03 11:47:09.52								
033	nan	17/03/03 12:37:55.45 17/03/03 23:18:00.19								
034	169 to 173	17/03/03 23:18:24.40 17/03/04 12:24:24.68								
035	nan	17/03/04 12:27:18.43 17/03/04 13:11:21.2	Watertrack 800m							
036	174-175	17/03/05 22:10:07.13 17/03/10 11:34:09.35								

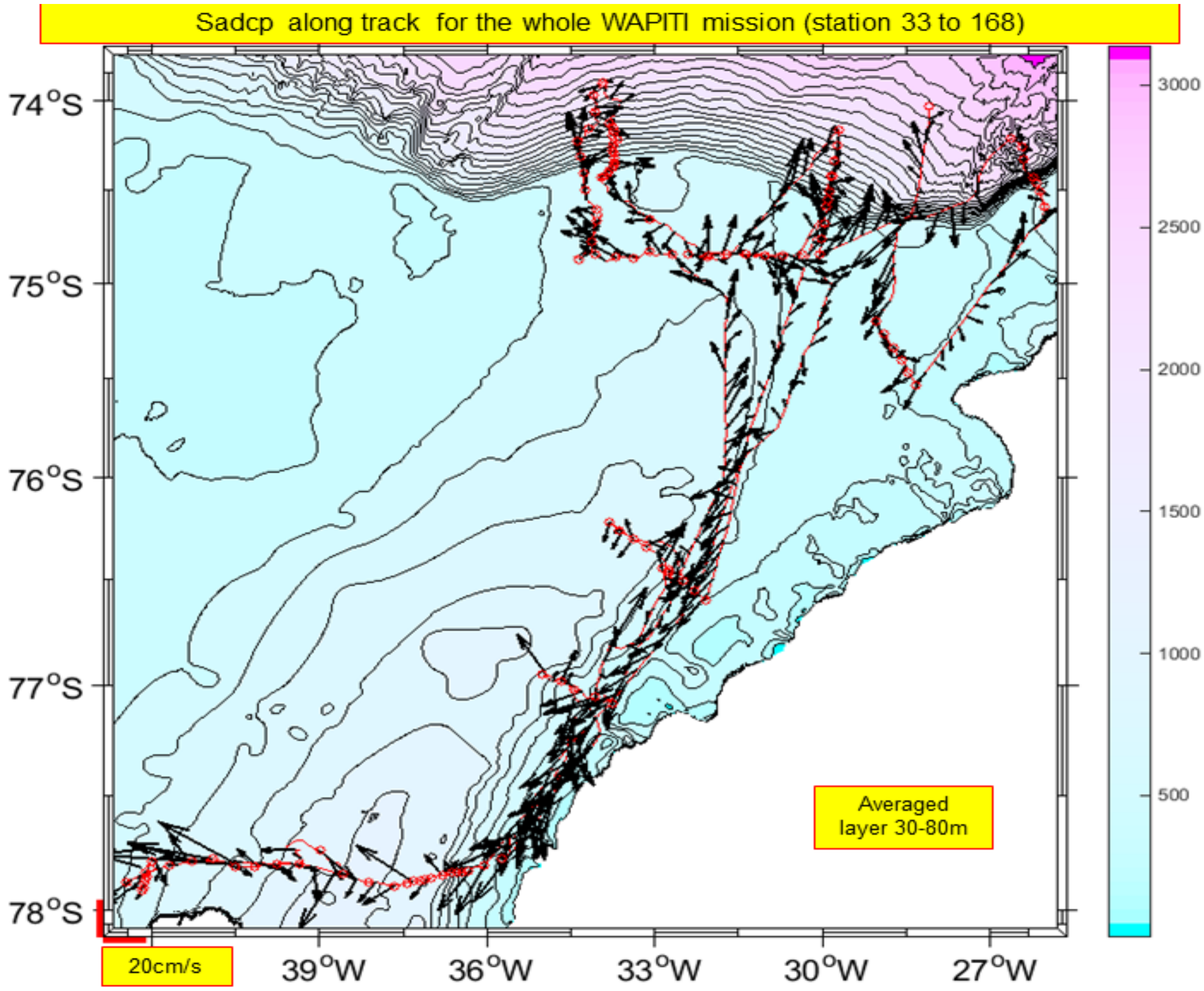


Figure 2.6.8 : LADCP and SADCP vectors averaged in surface layer for all Leg 2.

2.6.8 Deliverables

2.6.8.1 Processed files (Leg2 only)

WAPITI sections (Leg2) :

SADCP profiles @240s on all stations (33 to 173), file name (structure) :
SADCP_stations_Leg2.mat

SADCP profiles @ 1km on Leg2(06/02 to 04/03/2017) ,file name (structure) :
SADCP_sections_Leg2.mat

2.6.8.2 Raw files (Leg1 +Leg2)

YY = [06 to 36]

SADCP raw STA file @120s from VMDAS : JR160040YY_000000.STA

2.6.9 References

[1] P.le Bot, C. Kermabon, P.Lherminier, F.Gaillard , “Cascade V6.1:Logiciel de validation et de visualisation des mesures ADCP de coque , document utilisateur et maintenance » , *Rapport OPS/LPO 11-01*

2.6.10 Configuration files used in JR16004

JR 800m BottomTrack 8mBins NotThruSSU.txt

```
;-----------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type: 75 Khz Ocean Surveyor
; Setup name: default
; Setup type: low resolution, high range profile(narrowband) 800 m
;
; 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: 13January2006 (for JR141: routing through the SSU)
;----------------------------------------------------------------------------/
; Restore factory default settings in the ADCP
cr1
; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE: VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611
; Set for narrowband single-ping profile mode (WP), one hundred (WN) 8 meter bins (WS),
; 8 meter blanking distance (WF), 390 cm/s ambiguity vel (WV)
; Switch on Narrowband NP0
NP1
nn100
ns800
nf0800
; Switch off Broadband WP1
WP000
WN100
WS800
WF0800
WV390
; Enable single-ping bottom track (BP),
; Set maximum bottom search depth to 1000 meters (BX)
BP01
BX10000
; output velocity, correlation, echo intensity, percent good
WD111100000
; Two seconds between bottom and water pings
TP000050
; Three 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
TE00000100
; 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) [= 6.3m on JCR]
ED00063
; Set Salinity (ppt) [salinity in transducer well = 0]
ES0
; Set Trigger In/Out [ADCP run through SSU]
CX0,0
; save this setup to non-volatile memory in the ADCP
CK
```

2.7. Stable isotopes in seawater and water vapor

Camille Akhoudas, Marion Benetti, Jerome Demanges

2.7.1. Stable isotopes in the atmospheric marine boundary layer water vapour

Aim

The stable isotopic composition of the water vapor ($^{1}H_2{}^{16}O$, $H_2{}^{18}O$ and $^{1}H_2H^{16}O$) was continuously measured during the cruise, at ~20 m above the sea surface. The water vapour in the lower atmosphere, and especially in the marine boundary layer, is a key component of earth's climate system. Stables isotopes are an efficient tool providing an integrated perspective on the hydrological history of an air mass. In particular, we expect that the dataset acquired during the cruise will contribute to:

1. Better understand the isotopic signature of the polar marine air mass before going to the Antarctica continent, and its link with the present oceanic surface conditions (e.g humidity, SST, Wind speed). This purpose will help the paleoclimate researches, which measure the water stable isotopes in Antarctica ice-core to reconstruct past humidity and temperature of the moisture source region.
2. Better understand the atmospheric processes and their effects on the humidity in the marine boundary layer (e.g. horizontal advection, deep or shallow convection, surface evaporation, snow event). In particular, we will investigate the isotopic fractionation process during oceanic evaporation at low temperature.
3. Calibration of water stable isotopes observations from satellites.
4. Evaluation and improvement of simulations from isotope-enabled General Circulation Models.

Method

A cavity-Ring-Down-Spectroscopy analyzer L2120i from Picarro Inc. was installed in the bridge. The air is sampled from the atmosphere using ~10 m perfluolkoxy (PFA) tubing (outer diameter 13 mm, inner diameter 9 mm) with a 6 L/min airflow. The PFA tube was permanently heated to 25°C or above to avoid condensation. The air has been sampled at ~20 m above the sea surface. A protective inlet was installed at the beginning of the tube to prevent rain/snow from being sucked into the tube and affecting the vapor measurements.

For the calibration of the raw data, we follow the protocol elaborated by Steen-Larsen et al. (2013). i. The first step is to correct the raw measurements of the concentration effect. ii. The second step is to convert the measurements to the international VSMOW-SLAP scale by using different references of known isotopic composition. iii. Then, the measurements must be corrected for the instrumental drift by regularly injecting a reference standard to the analyzer. We used a custom-made calibration system described previously by Gkinis et al. (2010) with compressed dry air (less than 100 ppmv). For this cruise, the humidity-isotope response calibrations carried out before the cruise and will be re-estimated when the instrument will back in the LOCEAN laboratory in Paris. To evaluate the instrumental drift, the measurements of the reference standard were carried out every 12 hours. Most of the time, we integrated the standard measurement over a period of approximatively 10 min. Moreover, calibrations with several standards to convert the measurements into the international VSMOW scale have been done at the begining and at the end of the cruise.

Preliminary results

The instrumental drift is presented in Figure 2.7.1.1 for both isotopes. During the entire cruise, the drift is less than 0.4 ‰ for Oxyen 18 and less than 1.5 ‰ for Deuterium.

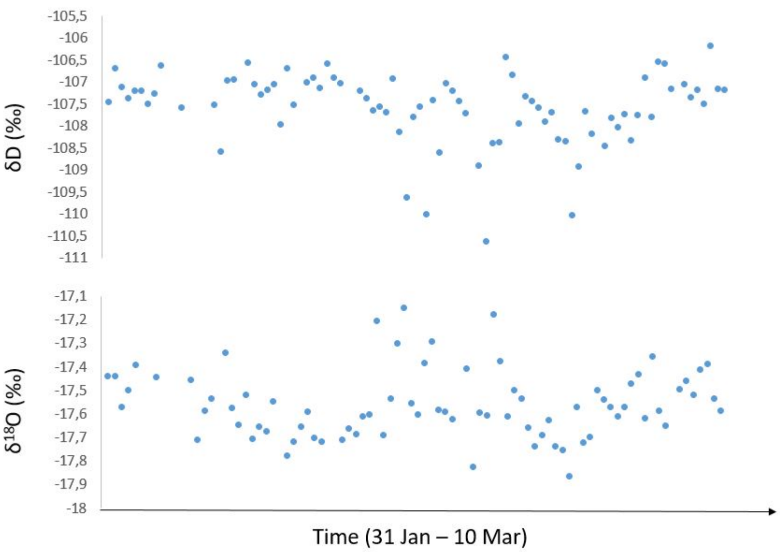


Figure 2.7.1.1: Instrumental drift of the CRDS analyser L2120i for Oxyen 18 and Deuterium, during the full cruise.

In the following, we present the raw data measured during the time of the cruise (Figure 1.1.1.2). The water isotopic composition is given in per mil (raw data) whereas the humidity is reported in ppm.

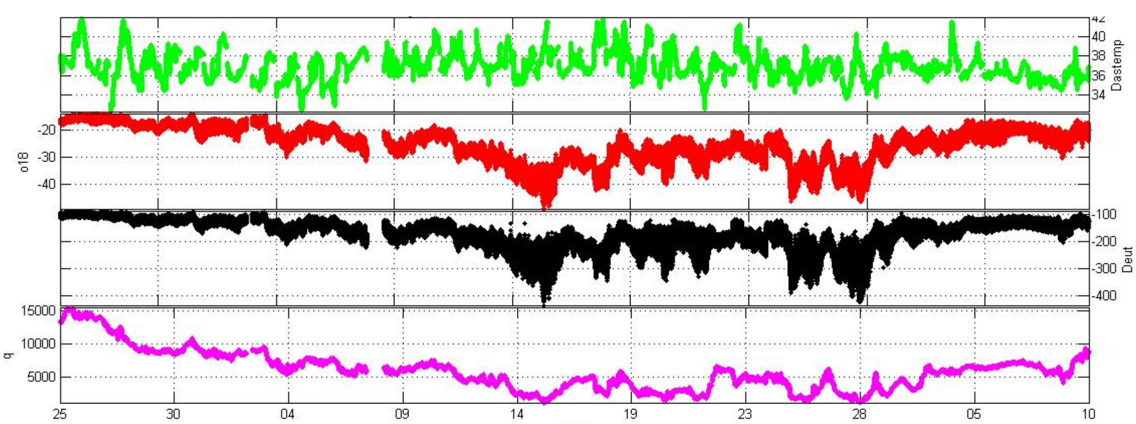


Figure 2.7.1.2: Evolution during the cruise of (from the top to bottom panels) : 1. The DAS temperature, 2. the oxygen 18 isotopic composition, 3. The deuterium isotopic composition, 4.the humidity measured by the Picarro,

The ambiant temperature (DAS temperature) inside the instrument (due to temperature fluctuation of the bridge) varied mostly between 34 and 42 °C. We conclude (as expected for this instrument type) that there was no influence of ambient room temperature variations on the water vapor isotope observations during the cruise.

The specific humidity of the air varied between 1000 and 15000 ppm. In a first approximation, the specific humidity measured by the Picarro instrument has been calibrated using the specific humidity measured by the BAS weather station located on the foremast (~ 25 m above sea surface). The linear correlation between both specific humidity is very high (r=0. 9987), revealing the good quality of the Picarro measurements. The comparison of both humidity is presented in Figure Figure 2.7.1.3.

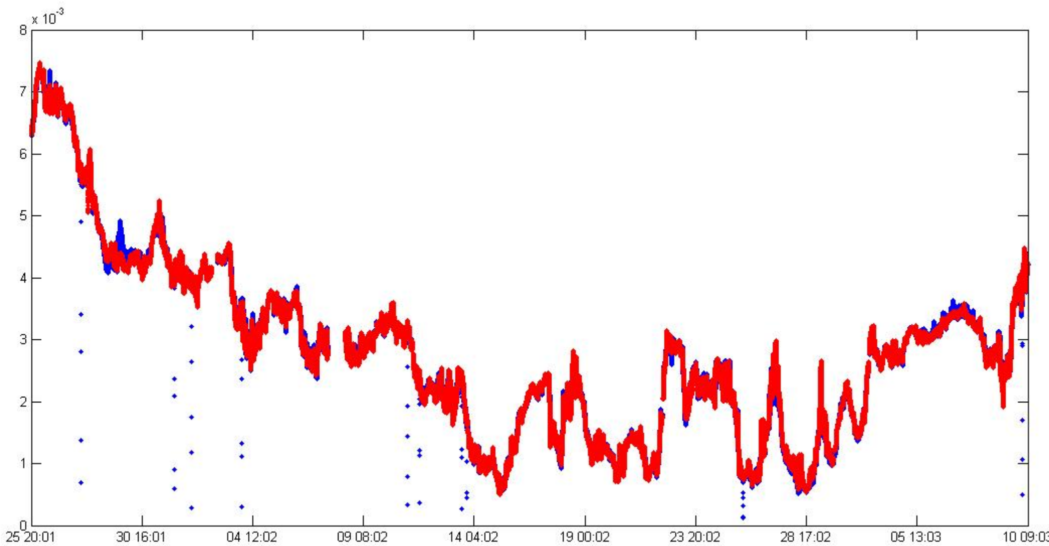


Figure 2.7.1.3: Specific humidity in g/kg measured by the Picarro (red) and by the weather station located on the foremast (in blue).

Moreover, the low specific humidities recorded during the cruise should have a strong effect on the raw measurements and has to be corrected by evaluating the concentration effect of the instrument. A part of these tests have been done before the cruise, but will be reestimated after the cruise at the LOCEAN, over the complete range of humidity. Thus, the raw isotopic composition presented in Figure 2.7.1.2 are not representative of the true isotopic composition. Nevertherless, the data show already a strong variability due to the different atmospherical conditions encountered during the cruise (e.g. isotopic depletion during convetion event and/or during an advanced Raileygh distillation at low temperature). We also noticed a weaker precision of the measurements during low humidity events (below 2000 ppm).

2.7.2. Stable isotopes in seawater

Introduction

Rates of warming are increasing and have the potential to impact the water balance in the Sourthern Ocean by altering freshwater-seawater interactions *via* changes in precipitation, evaporation and sea ice formation and melting. To characterize these interactions, high resolution of water isotope measurements (oxygen 18 and deuterium) help to reveal insights into surface hydrological processes as well as reflecting the delineation of water mass boundaries and contribute to better understand the magnitude and spatial distribution of freshwater inputs in the Weddell Sea.

For this purpose, a Continuous Water Sampler (CWS) paired with a CRDS L2130*i* from Picarro was deployed to allow continuous measurements of stable water isotopes (d18O and dD).

Method

The seawater was pumped at ~7 m below the surface through an underway water supply of the sea chest of the ship to a 5L plastic container used as intermediate reservoir. Then, from this reservoir, an extra-pump (within the CWS) was used to supply the necessary amount of seawater to the instrument. The length of the tube from the reservoir to the CWS is 65 cm. A 1L foil/plastic bag (variable volume to keep the same pressure along the use of the standard) contains the liquid reference (internal fresh reference from the LOCEAN, with an isotopic composition close to the sea water). The length of the tube from the reference to the CWS was 130 cm (Figure 2.7.2.1).

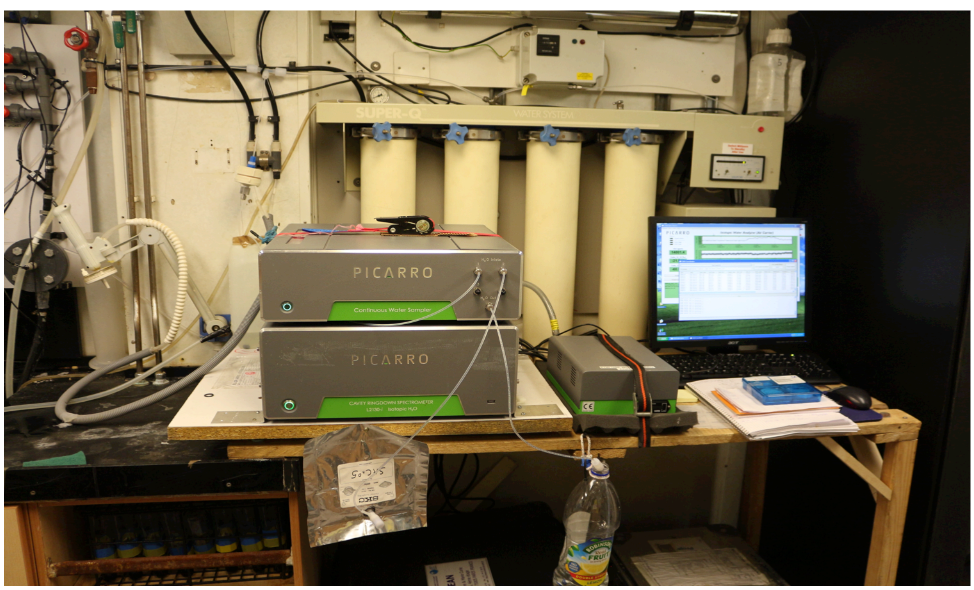


Figure 2.7.2.1: Design of the instrument

Both reference and seawater are mixed with a regulated dry air flow, along a semi-permeous membrane, with a constant temperature of 45°C.

The operation program was set up to alternate between the seawater and reference water supply (most of the time 25 minutes calibration and 240 minutes seawater measurements). Changing between water sources (seawater and reference) requires a period of several minutes before a reliable reading of the isotope composition can be achieved. We choose to remove the first 12 minutes to eliminate the memory effect.

Regarding the post-treatment, raw data have to be calibrated :

1. First, the instrumental drift effect on the measurements will be corrected by the reference standard regularly measured by the CWS (every 240 minutes).
2. Then, we have to convert the d18O and dD raw values to the V-SMOW scale. For this purpose, samples of surface seawater have been regularly collected fom the TSG. These samples will be measured at the LOCEAN using the three in and will be used to convert the CWS measurements in the V-SMOW scale.

Seve

ral issues were encountered regarding the setup of the instrument :

- Initially, we directly connected the CWS to the underway supply water (the tube length was about 3 m). We noticed that the humidity was anormaly low (around 8000 ppm) during seawater measurements (while during calibration it was approximately 17000 ppm). We also noticed a stronger drain during the period of seawater measurement compared to the reference measurements (less than 1ml/hour). We think that with this setup, the seawater flux was too high for the CWS and we then used a 5L plastic container, as an intermediate reservoir allowing the instrument to pump into it by itself.
- In normal operation, the air flow should report around 500 sccm but since the beginning of the cruise, it was recorded about -900 sccm in the datafile. The air flow sensor was checked and we fixed a cable connection of a wire connecting to the board from the sensor that was not in good contact.
- Periodic cycles were reported during calibration and seawater measurements. We changed the membrane of the CWS (we noticed a small leak arount it). We think that the membrane was damaged due to the previously high water flux. Since we still observed sometimes periodic cycles (but this time only during seawater measurements), we decided to shorter the PVC tubing line design for seawater and the instrument was set up next to the 5L container. Then, the PVC tubing line was approximately of ~130 cm length and the cycles disappeared.
- We also installed a 5 um filter on the seawater line above the plastic container allowing the CWS to pump clean water and avoiding accumulation of plankton that could caused membrane damages.

Recommendations to prevent a reoccurrence of the problems we encountered: The CWS should be set up in order to design a PVC tubing line as short as possible. An intermediate reservoir should be used allowing the instrument to pump into it by itself and to ensure water sampled is always the most recently collected by the instrument. Several membranes are needed. To check as much as possible (one or twice a day) the isotopic composition of the standard and the specific humidity and also other parameters such as the cavity pressure, the DAS temperature, the air flow rate and the membrane and water temperature to be aware if something goes wrong.

If issues regarding the air flow rate of the system are encountered, the air pump (Figure 2.7.1.2 - left) and the air flow sensor (Figure 2.7.1.2 - right) can be checked. In normal operation, the purple knob on the air pump should turns when the system is running. Position of polyethylene tubing line should also been verified. Regarding the air flow sensor, cable connections of the wires (Figure 2.7.1.2) have to be checked as well to prevent any bad contact.

Regarding post-treatment, potential changes in stable isotope compositions will be analysed alongside the trajectory of the cruise. The combined salinity/temperature and isotopic data to delineate spatial interaction between sea-ice formation-melting and to detect discrete water masses will be used. Furthermore, significant gaps in the data occurred due to frequent failures in the underway water supply from 14th of February and 3rd of March because of sea ice stucking the system regularly.

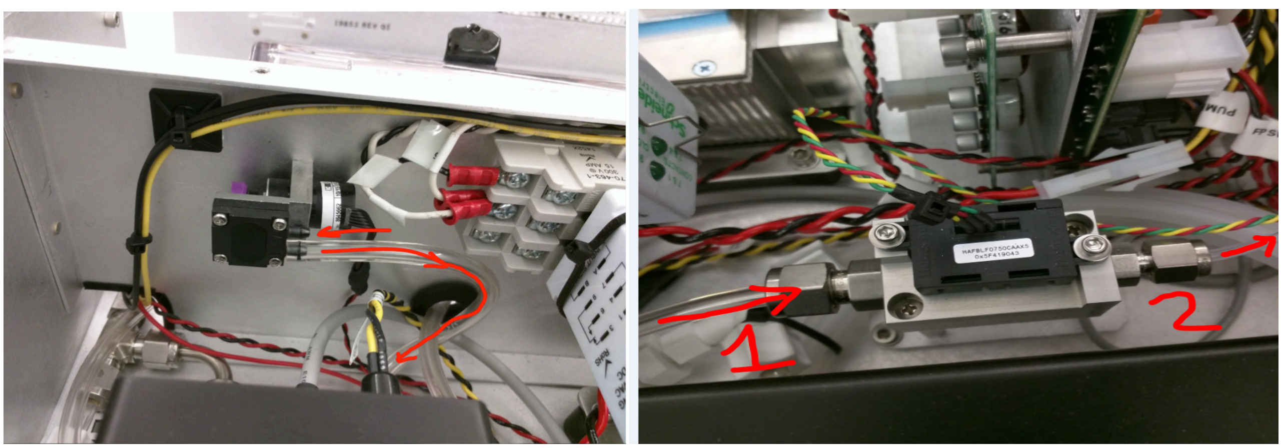


Figure 2.7.1.2: Air pump (left) and air flow sensor (right)

2.8 Fluorescence and FluoROprobe

Vincent Taillandier, Diana Ruiz Pino (in collaboration with Felipe Artigas, not on board)

Aim: to evaluate the high frequency variability (including meso- and submesoscale) of total chlorophyll biomass and the main groups of phytoplankton at the sea-surface across the documented Austral Ocean and Weddell sea. The total/multispectral fluorometry from continuous pumping surface seawater data will be also used to be compared with ocean optics signals from satellite allowing the development of new color ocean algorithms.

FLUORESCENCE

Fluorescence continuous measurement was done during cruise. A turner sensor was installed on board the JCR, under the BAS responsibility. This sensor was used when the seawater flow rate was higher than a proposed threshold of 0.3 (Fig 2.8.1).

The total chlorophyll pigment measured by HPLC after the cruise (see section 4) will be used to calibrate the fluorescence sensor installed in the underway by BAS.

From the underway sea surface water arriving at the chemical laboratory were sampled regularly discrete samples, every 6 hours for the beginning of the cruise (local time 8h, 14h, 20h and 2h) between south of Falkland Island (55°S) and 75°S, then every 4 hours (local time 8h, 12h, 16h, 20h, 24h and 4h) at the end of the cruise. The discrete samples were stopped during the stations (cf figure A.1.1). The surface collected samples to measure total chlorophyll pigment by HPLC, after the cruise will be used to calibrate the fluorescence sensor installed in the underway by BAS. The sampling and storage protocols are described in annex N°3.3. Once calibrated the obtained continuous data from fluorescence will be also compared to the total chlorophyll obtained by the Fluoroprobe sensor (see following section).

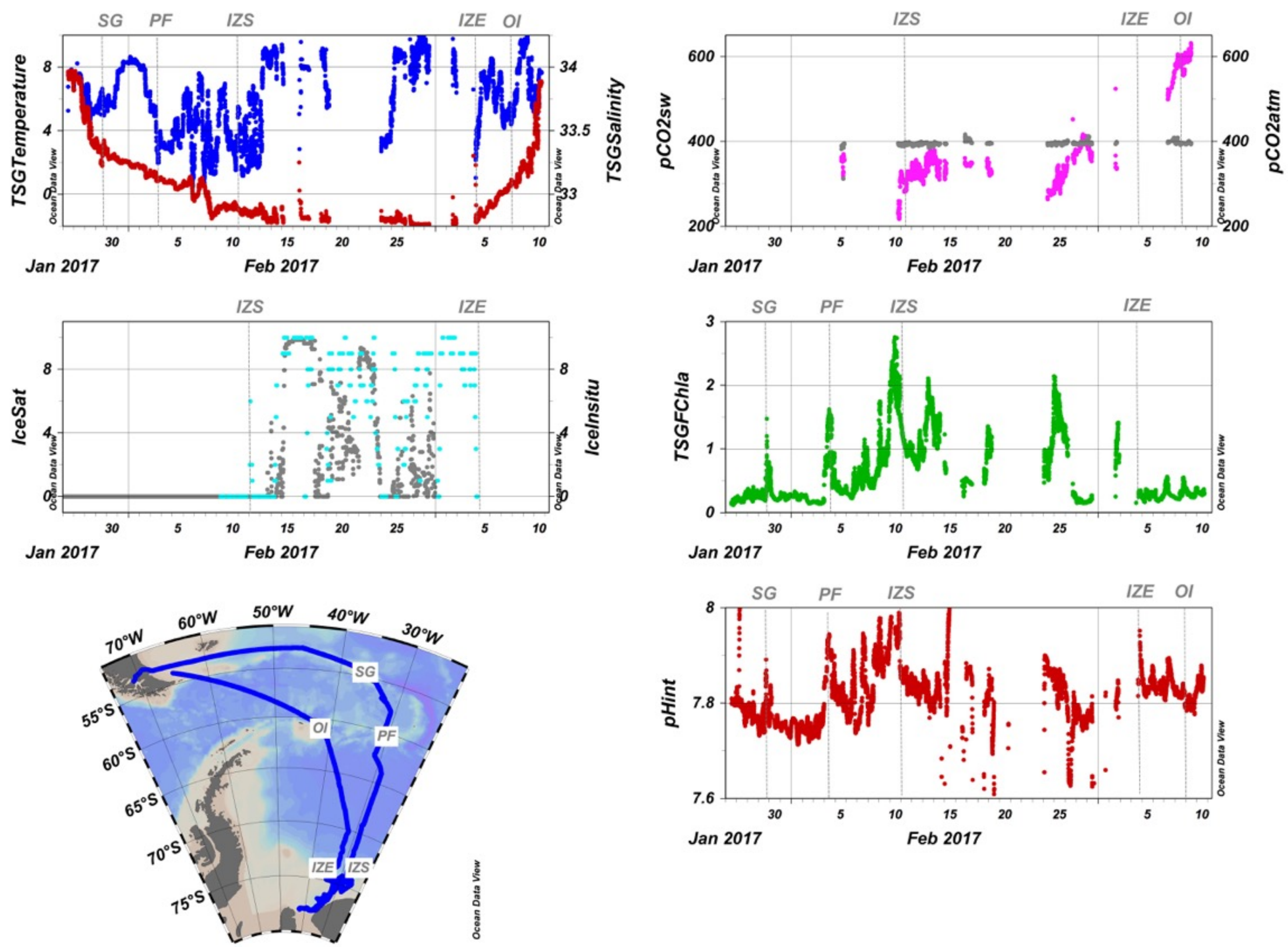


Fig. 2.8.1. Data obtained from the underway system a) temperature and salinity TSG, b) Sea ice cover from AMRS satellite

FLUOROPROBE

Aim: To quantify the sea surface regional variability of main phytoplankton groups, and Yellow Substances (CDOM) in the Austral Atlantic Ocean and in the Weddel Sea.

A fluoroprobe sensor bbE+ was installed in the chemical laboratory and connected with the underway seawater flow during the entire cruise. The data frequency acquisition is 1 value/minute. The recorded raw data are the led 3 to 8 assumed to be used to evaluate the distribution of 5 groups of phytoplankton: diatoms, crysophites, yellow substances, green and bleu algae and also paheocystise. This method is based on the discrimination of spectral groups of algae characterised by specific composition of pigments and consequently, by a specific excitation spectrum of the chlorophyll-a a fluorescence, following sequential light excitation by different ligth-emitting diodes (LEDs) emitting at different wave length following the fluoroprobe.

Fluoroprobe allow determining total chlorophyll. Its principles are due to the fact that algae of the same division contains a similar quantity and quality of photosynthetic pigments, their fluorescence excitation spectrum (with a fixed emission wavelength at 680nm) is significant. Thus, it is possible to differentiate divisions of algae by their fluorescence excitation spectrum. In addition to this, other fluorescing matter (for example, yellow substances) is detected to enhance the accuracy. The bbe fluorometers use 6 LEDs for fluorescence excitation for algae differentiation. The LEDs emit light at 6 selected wavelengths (370nm, 470nm, 525nm, 570nm, 590nm and 610nm).

The used algorithm to evaluate the groups from the row data and visualized by the +bbE software used the calibration provided by the instrument. After the cruise and once measured pigments and abundance of phytoplankton (taxonomic technic) it will be possible to determine and to adapt mathematic algorithm to the specific phytoplankton group and yellow subtances occurring in the Antarctic waters. Data were stored in ASCII files every days of cruise. Each file contains the raw 6 LEDS data available to be used with different algorithms to calculate the variability of 6 phytoplankton groups.

The determination of the different Algae classes with the fluoroprobe is based on the following hypothesis. The division of *chlorophyceae* (green algae) shows a broad maximum of fluorescence at the 470nm LED, which is caused by chlorophyll-a and -b. The *cyanophyceae* (blue-green algae) have their maximum at 610nm due to the photosynthetic antenna pigment *phycocyanin*. *Cyanophyceae* also contains chlorophyll-a if there is low intensity at 470nm. This is due to the masking effect of the *phycocyanin*. Furthermore, the high peak at the 525nm region for the *bacillariophyceae* originates from *xanthophyll fucoxanthin* and for the *dinophyceae* from *peridin*. The maxima at 470nm are caused by chlorophyll-a and -c. In our last analysed group, *cryptophyceae*, a significant maximum can be found at 570nm, which originates from *phycoerythrin*.

The different divisions of algae was first measured separately to calibrate the instrument an optics lab of Wimereux by Pr. Felipe Artigas. The measured spectra, or fingerprints, are then stored in the FluoroProbe. During the measurement, the spectrum of the sample is loaded into the storage device of the instrument and sent to an external computer. The computer calculates the content of the different divisions of algae in the sample from the sample spectrum and the spectra of the separately measured algae divisions. The concentration of every algae division is given in µg chlorophyll-a/l.

After subtracting the offset from the measured fluorescence signals, the remaining signals have to be assigned to the different algae classes. A statistical calculation procedure in the software finds the best combination of concentrations of algae classes for the measured pattern of signals. **The total chlorophyll concentration is the sum of all detected concentrations of algae classes.** The row LED measured signal hasi8t'e calibrated after the cruise. The different algae classes used for the statistical fit need to have significantly different fluorescence spectra. Moreover the different pigment signal measured at the discrete sample collected from the underway system will be used to calibrate the Fluoroprobe to reproduce the specific Antarctic algae groups.

Yellow substances may fluorescence and a priori abundant in the Ice Shelf of the Weddell sea could be also determined by the Fluoroprobe. The UV LED (370nm) is used to measure yellow substances in the water. At 370nm it is possible to differentiate between algae (low signal) and yellow substances (high signal). The result of this measurement is given in relative units and not in weight/volume, because very different substances are detected. The result is mainly used to obtain a more accurate determination of algae classes – but it is also possible to determine the variations of the yellow substances.

The transmission of the water is measured with a 710nm LED opposite the detector. It is measured in per cent, where 100% is pure water and complete "black water" is 0%. The transmission can be used to compensate errors in the chlorophyll measurement that are caused by particles in the water which absorb either the excitation light or the fluorescence light. The seawater sample temperature and temperature of the sensor were also measured.

The post-calibration of Fluoroprobe will be done again after the cruise using a strategy based on 2 sets of data. We will use first the 6 LED signals measured in a continuous way by the fluoroprobe together with the pigments to calibrate the fluoroprobe. Then a validation will be done comparing the variability of main phytoplankton groups determined by the fluoroprobe with the distribution obtained in key Antarctic region by taxonomy (optical microscope and SEM) and genomic (polar front, weddell gyre, marginal ice zone, ice shelf).

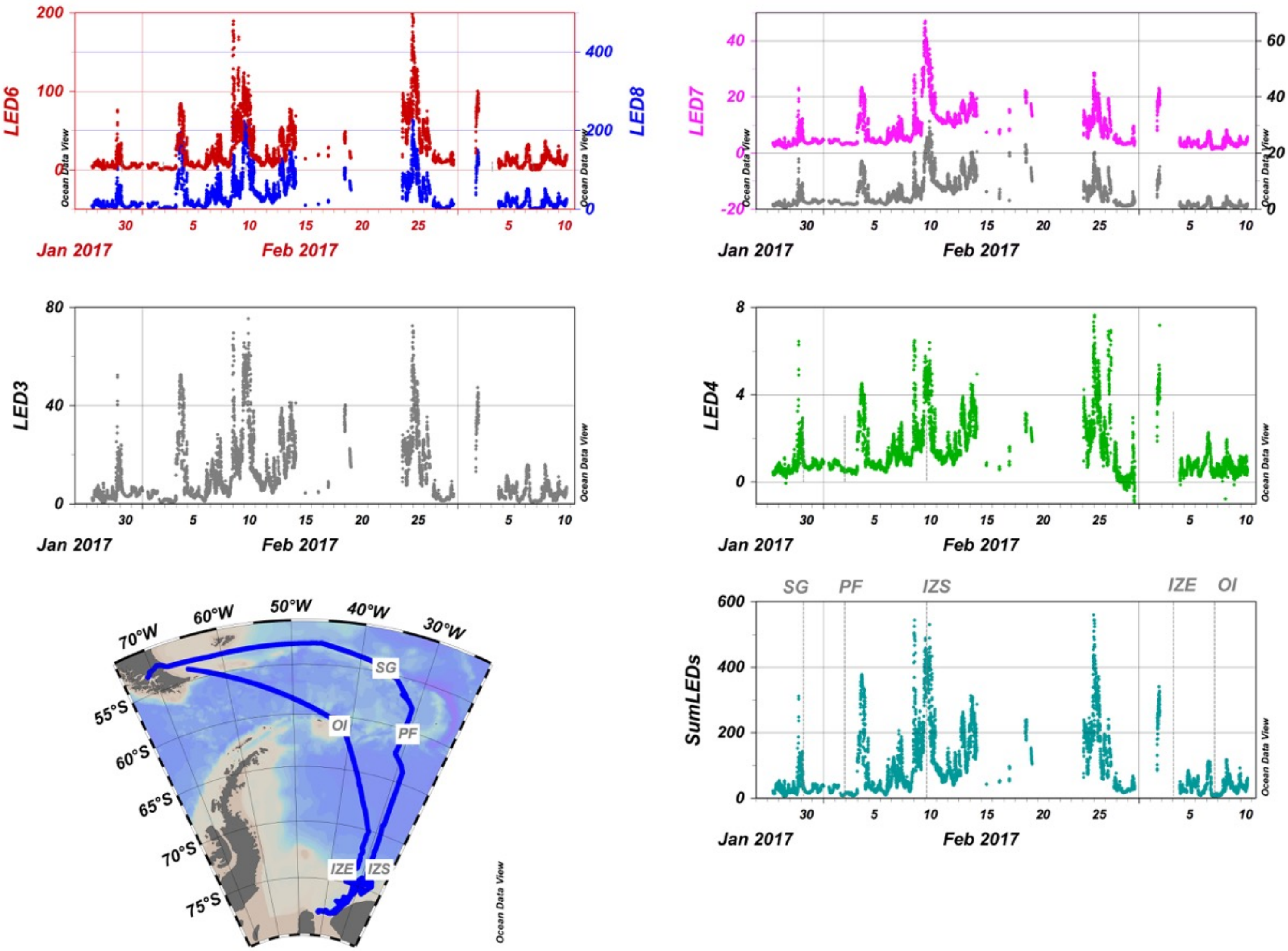


Fig. 2.8.2. Raw Fluoroprobe LED data a) the sum of all LEDs assumed to correspond to total Chl-a signal, and for the other LED : LED 3, 4, 5, 6, 7, 8 corresponding to different phytoplankton groups.

2.9. Oxygen

Maria Gelado, Vincent Taillandier

Sampling Contribution : *Marion Benneti, Camille Akhoudas*

Aim : to evaluate the surface variability in key regions *of the* Weddell sea of biological net production of Oxygen (DeltaO2) and to compare with the net Carbon biological pump evaluated from DIC and pC02 (DeltaDIC, DeltapC02).

Continuous measurement of Oxygen (02) from the underway sea surface water were obtained using an Optode sensor. This sensor is connected to the PLM (UK) PC02 instrument. The Optode system was collecting data during a large part of the cruise, from February 10 until March 10 (see Figure 2.9.1). No oxygen seasurface data were obtained during shorts periods due to the stop of seawater pump when the Vessel was in areas surrounded by sea ice. In the same flow of seawater were collected discrete Oxygen samples, on duplicate during the first part of the cruise, then on triplicate during the last part. A total of 141 samples of 02 analyzed following the Winkler method will be used to calibrate the Optode sensor (see Table 3.1). This calibration uses also the continuous temperature data obtained by the underway TSG.

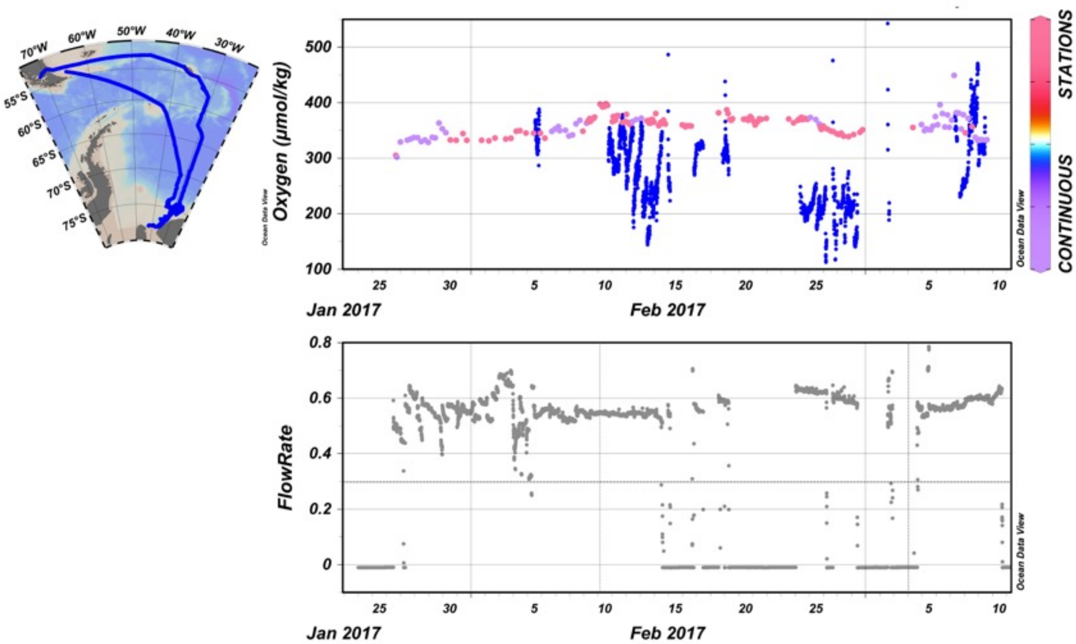


Figure 2.9.1: Underway Oxygen-continuous data from Optode sensor and discrete data measured on board by Winkler titration (top) , Underway Sea water Flow rate (below).

2.10 pCO2

The continuous measurement of atmospheric seawater and atmosphere were measured using the LICOR system, under the responsibility of PML (Vassilis Kitidis). This instrument was used several days later than the other underway system. Our team observed that this system was switched off, after all other sensors connected to the underway system were switched on. At the start period (see figure 2.8.2), we observed a big abundance of bubbles inside the equilibrator. Moreover, taken into account the high abundance on Krill inside the cells, our team proposed to install a pre-filter of 200um mesh. All changes of the filter and operation made to reduce the bubbles air inside the equilibrator are described in the report of Carson McAfee. We have received a large part of pCO2 data, showed in figure 2.8.2, the 11 March, end of the cruise. Calibration with the standard and comparison with calculated pCO2 from carbonates (DIC/ALK measurement has to be done after the cruise).

2.11. Sea Ice Observations

Chris Chapman, Sara Labrousse, Yves David

Observations of sea-ice concentration, type, thickness and floe size were made manually throughout the data following the ASPeCt protocol. Observations were made on a volunteer basis and were considered a secondary duty for watch keepers. Two ice watches were organised: midnight until 8am (ship time), with observations made from the aft deck of the ship, and 8am until 6pm (ship time), with observations made from the bridge. This left a period from 6pm until midnight with few observations. Watches were made every hour, on the hour, during these watches, although there were gaps when the the watch keepers were occupied with other duties.

Observations were recorded on a log sheet taken from the ASPeCt website. The concentration, ice type, floe size and, where possible, thickness of the primary, secondary and tertiary ice types were recorded, as well as the latitude, longitude Although the ASPeCt protocol seeks both ice topography and snow observations, these were not recorded as insufficient training left the ice observers ill-equipped for making these observations. Direct observations of ice thickness were made with a 1 meter long wooden pole divided into 10cm increments using coloured electrical tape. In situations where the ship was breaking ice, some floes would turn sideways as the ship passed, allowing an observer to measure the thickness of the ice as it passed the measuring stick. One of these ice measuring sticks was lashed directly below the bridge outdoor observing deck, a second was left available to be carried by an observer on deck. Many observations were also accompanied by a photograph.

Photograph taken from the starboard side bridge observing deck at 11h30 (GMT) on the 28th of February, during ice breaking. The ice measuring stick can be seen in the centre of the image

Observations were logged on a printed logsheet taken directly from the ASPeCT website. The following table lists the variables logged.

Variables	Description
Latitude	Latitude at observation time
Longitude	Longitude at observation time
Total Ice Concentration	The sea ice coverage, measured in tenths. For example, if 40% of the sea-surface was ice covered, the concentration would be logged as 4
Primary/Secondary/Tertiary Ice Concentration	The coverage due to the primary ice type, measured in tenths. The primary ice type is the thickest type present, secondary is the next thickest, and tertiary the third thickest. A maximum of three ice types were logged.
Primary/Secondary/Tertiary Ice Type	The type of primary, secondary and tertiary ice present. Ice type is logged by the ASPeCT code (described later)
Primary/Secondary/Tertiary Ice Thickness	The thickness of the primary, secondary and tertiary ice. This value was only logged in situations where the ship was breaking ice and when such observations were possible – that is ice was turning past the callibrated ice measuring stick as the ship passed.
Primary/Secondary/Tertiary Floe Size	The size of the primary, secondary and tertiary ice floes. Floe size was logged using the ASPeCt code.
Open Water	The open water (leads, narrow breaks, small cracks, etc..) present was logged using the ASPeCt code.

The following table presents a list of ASPeCt codes used to log ice type, floe size and open water type.

Ice Type	**Code**
Frazil	10
Shuga	11
Grease	12
Nilas	20
Pancakes	30
Young Grey Ice	40
Young Grey-White Ice	50
First Year Ice (0.3-0.7m thick)	60
First Year Ice (0.7-1.2m thick)	70
First Year Ice (>1.2m thick)	80
Multiyear Ice	85
Brash	90
Fast Ice	95
Floe Size	**Code**
Pancakes	100
New Sheet Ice	200
Brash/Broken Ice	300
Cake Ice (<20m)	400
Small Floes (20-100m)	500
Medium Floes (100-500m)	600
Large Floes (500-2000m)	700

Vast Floes (>2000m)	800
Open Water	**Code**
No openings	0
Small Cracks	1
Very Narrow Breaks (<50m)	2
Narrow Breaks (50-200m)	3
Wide Breaks (200-500m)	4
Very Wide Breaks (>500m)	5
Leads/Coastal Leads	6
Polynya/Coastal Polynya	7
Open Water broken by small scattered floes	8
Open Water – no ice	9

Manual observations were digitized. The raw observations were placed in a CSV format file availble here:

legwork/Sea_Ice/Sea_Ice_Observations/Raw_Sea_Ice_Obs_WAPITI.csv

Additionally, these data were combined with related navigational, underway and meteorological data. As ice observations are collected, at their most frequent, at hourly intervals, the relevant underway and meteorological data are averaged over hourly time-spans, centered on the ice observation time. Where thickness data were not available, a thickness value was estimated from the ice type. Whether or no a direct thickness observation was available was also included in the file. These data were placed together with the sea-ice observations in a file in netcdf format.

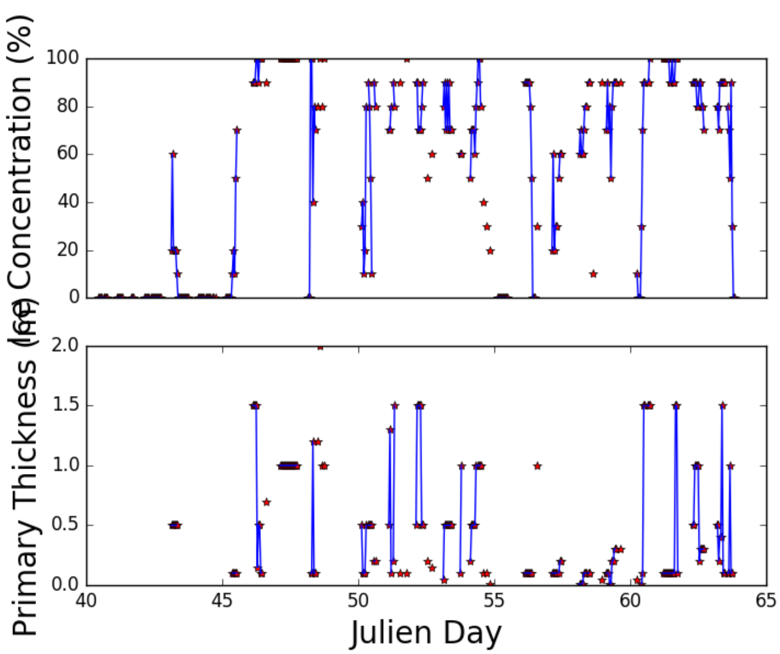
legwork/Sea_Ice/Sea_Ice_Observations/Raw_Sea_Ice_Obs_WAPITI.nc

This file contains the following variables.

Description	**Variable Name**	**Units**
Time	time	Julian Day
Ship Latitude	ship_latitude	Degrees latitude
Ship Longitude	ship_longitude	Degrees Longitude
Total Sea Ice Concentration	total_sea_ice_concentration	Tenths

Primary Ice Type Concentration	primary_concentration	Tenths
Secondary Ice Type Concentration	secondary_concentration	Tenths
Tertiary Ice Type Concentration	tertiary_concentration	Type
Primary Ice Type	primary_type	ASPeCt Code
Secondary Ice Type	secondary_type	ASPeCt Code
Tertiary Ice Type	tertiary_type	ASPeCt Code
Primary Ice Thickness	primary_thickness	Meters
Secondary Ice Thickness	secondary_thickness	Meters
Tertiary Ice Thickness	tertiary_thickness	Meters
Thickness measured or estimated from type	primary_thickness_measure	Boolean 1- direct measurement
Thickness measured or estimated from type	secondary_thickness_measure	Boolean 1- direct measurement
Thickness measured or estimated from type	tertiary_thickness_measure	Boolean 1- direct measurement
Primary Ice Floe Size	primary_floe_size	ASPeCt Code
Secondary Ice Floe Size	secondary_floe_size	ASPeCt Code
Tertiary Ice Floe Size	tertiary_floe_size	ASPeCt Code
Ship Speed	ship_speed	Km/h
Air Temperature	air_temperature	Degrees C
Air Pressure	air_pressure	hPa
Sea Surface Temperature	SST	Degrees C
Total Incoming Radiation	Total Incoming Radiation	W/m2

Example output showing the total ice concentration and the thickness of the primary ice type is shown below.



PART III: Discrete samples

3.1 Salinity

Lena Schulze

Discrete salinity samples were taken throughout the cruise in order to calibrate the CTD salinity profiles. The samples were analyzed on board using a salinometer.

3.1.1 Sampling methods

All samples were taken using 200 ml glass sample bottles with plastic lids in crates of 24 bottles. Each bottle and crate were labeled with a unique number. Log sheets were used to note the case number and
bottle number of each sample. When sampling, the sample bottles were first rinsed a minimum of three times using the water from the niskin to be sampled. This was to minimize contamination of the sample from anything on the inside surface of the bottle. Bottles were filled in order to leave minimal air for evaporation to occur whilst leaving enough air to allow for adequate mixing of the sample before sampling, in order to counteract any stratification that may have developed. Immediately after sampling plastic caps were placed inside the bottle neck to prevent evaporation.
On average 3 – 5 samples were taken per cast. However, after noticing a significant drift in one of the conductivity sensors after cast 147 we change the sampling strategy and took two samples from the same niskin at five different depths, mainly in the deep, well mixed regions of the salinity profile.

3.1.2 Sample processing

Once a case of sample bottles was full, it was transferred to the temperature-controlled laboratory, where it remained a minimum of 24 hours before being sampled. This was to ensure that all samples were at the same temperature when sampling, hence to ensure consistency of measurements. The temperature of the room was set to 20^{o}C since the bath within the salinometer was set to 21^{o}C.

Salinity measurements were taken using a Guildline[1] AutoSal Salinometer, model 8400B. Before sampling a bottle, it was agitated to remove any stratification. Before any measurements were taken, the measurement cell was filled and flushed three times with the relevant sample in order to avoid any contamination from previous samples. The analyst ensured that no bubbles were present in the cell before measuring the sample. The cell was flushed, filled and then measured a further two times in order to
have a total of three measurements for each sample. If any of the three measurements varied by more then 0.0003 from the other two measurements the analyst would take three new measurements.

At the beginning and end of each measurement session, and between crates, one standard was run using a bottle of IAPSO Standard Seawater, batch P159 with conductivity ratios of K15 = 0.99988.

Unfortunately we did not have access to any software to record the measurements, so they were noted on logsheets and later transferred into excel tables. One .xlsx data file was created for each crate in which the station, depth, niskin number, and bottle ID were noted as well as the three measurements taken for each bottle and the time at which the measurements were obtained. Each file was named after the crate it contains plus a sequential number as we used the same crate multiple times (e.g. Crate9_3 for measurements from crate 9 that was used a third time).

3.1.3 Drift adjustements

The .xlsx file were read into Matlab and analyzed. The machine was standardized several times during the cruise using the IAPSO Standard Seawater, batch P159. However, for some crates this was not done and an offset was applied according to the reading of the standard that was run at the beginning of each crate. This correction was never larger than 0.0009.

Additionally, for each crate a linear correction was applied using the measurements of the standards at the beginning and end of each crate as well as the noted time for which each salinity bottle was analyzed.

Original and corrected data from all crates was combined into a single matlab file (including a header) and loaded into the legwork/CTD_data folder.
The file lists: Station, approximate Depth of bottle stop, Niskin that was sampled, the Crate and Bottle ID that was used for this sample, the three values from the Autosal, and the hour and min when the sampels were taken (in this order).

Note that the file includes samples that were taken for the TSG calibration. For these samples the station number is noted as -10.
Some Crate ID's were letters instead of numbers. If that is the case crate numbers are 2 for Crate U2, 3 for Crate U3, 24 for Crate Z.

3.1.4 Additional Notes

During the cruise several problems occurred with the AutoSal. During the crate that included samples for Station 43 – 48 the ppump broke and had to be replaced. At the beginning of sampling the crate that included samples from stations 48 – 49 bubbles occurred that could not be removed through flushing of around 40 min. The Autosal had to be opened up to remove bubbles and was cleaned thoroughly at this time as well.

3.1.5 Recommendations

Unfortunately there was no computer with the needed software available for this cruise and all data had to be logged manually. We recommend to check that the software is available or that one person is in charge of bringing it onto the cruise.

Also, at the beginning of the cruise the AutoSal bath temperature was set to 21C while the room temperature was set to 20C. There were several occasions when the room temperature rose due to e.g. multiple people being in the room at the same time. The room temperature was consequently set lower and stayed much more stable.

In the future we recommend that the AutoSal bath temperature is set to 23 or 24C and the that the room is kept at 21C. If possible monitor and record the room temperature as variation in this temperature during sampling can introduce noise.

[1] Guildline Instruments Ltd.
P.O. Box 99, 21 Gilroy St.
Smith Falls, Ontario,
K7A 4S9

3.2 Oxygen

Maria Gelado, Vincent Taillandier
Sampling contribution : Marion Benetti et Camille Akhoudas
Analysis on board : Maria Gelado, ULPGC

Aim : to evaluate the surface variability in key regions of the Weddell Sea of biological net production of Oxygen (ΔO_2) and to compare with the ne net Carbon biological pump evaluated from DIC and pCO_2 (ΔDIC, ΔpCO_2)

3.2.1 Introduction

According to the main goals of the Wapiti project, the oxygen has been determined during the JR16004 cruise to trace the water masses involved in the circulation of the Weddell Sea and the effect of ice-shelves in the production of deep water. Moreover, the distribution of the oxygen concentration depends on the relative rates of aerobic respiration and photosynthesis as compared to those of the gas exchange across the air-sea interface and water movement via turbulent mixing and advection.
Task 1. Calibration: Calibrate the oxygen sensors on CTD and the underway uncontaminated seawater supply.
Task 2. Biogeochemical sampling: Improve the understanding of the biogeochemical process related to the carbon pump in the seasonally ice-capped region of the Weddell Sea.
Activities: Traditional sampling/analysis for calibration/validation of automated sensor plugged into the continuous surface water sampling system and the CTD with a vertical discrete sampling of the water column from Nisking bottles.

3.2.2 Winkler Tritation using the Amperometric Technique

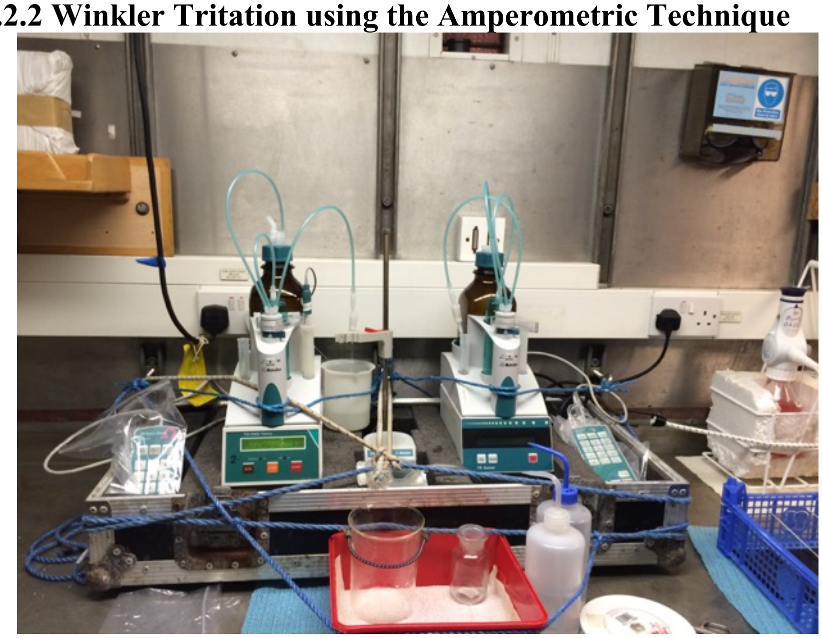


Fig. 3.2.1. Winckler titration system provided by Southampton Laboratory (Dr. Yvonne Firing) and installed and used during all WAPITI cruise in the radioactivity laboratory by M. Gelado (ULPGC, Spain)

Specific guidelines for measuring dissolved oxygen concentrations in seawater were given by WOCE (Culberson 1991) to maximize the quality of the data collected. Oxygen concentrations were to be determined titrametrically using the Carpenter modification of the Winkler (1888) method. These modifications reduced the loss of I_2 during the tritation due to the volatization by optimizing the concentrations of the “pickling” reagents to encourage the formation of the more stable triiodide complex I_3^- and adopting the whole-bottle tritation method which eliminates the loss of I_2 during transfer of aliquots. The techniques developed by Carpenter (1965) maximized overall precision and accuracy and were reproducible (two standard deviations) to within +/- 0.4 (Culberson 1991), which translates to a precision of approximately 0.2 % of air saturated dissolved oxygen concentrations.

The basic methodology for measuring bottle dissolved oxygen was the Winkler titration (Winkler 1888). In essence, the dissolved oxygen present within a seawater sample is coerced under alkaline conditions to quantitatively oxidize divalent manganese to a trivalent state. The solution is then acidified, which converts iodide ion to iodine in an amount stoichiometrically proportional to the amount of dissolved oxygen contained within the original sample. The amount of iodine is then determined by titration with a thiosulfate solution of known concentration. The end result of the chemical reactions involved is that one mole of dissolved oxygen in the seawater sample will manifest as four moles of thiosulfate, and the original oxygen concentration of the seawater sample can be calculated.

3.2.3 Tritation Procedures

3.2.3.1 Amperometric endpoint detection

The endpoint of the tritation is detected by the sudden increase or decrease in the current flow between two similar electrodes immersed in a solution due to the polarization effects known as the dead-stop endpoint. The typical precision that can be achieved using automatic amperometric endpoint detection systems is +/- 0.15 µmol/kg.

3.2.3.2 Equipment

Wide neck borosilicate glass bottles with an approximate volume of 110 ml were used. The volume of bottles were calibrated to three decimal places.

Repeat pressmatic dispensers (0.4-2 ml) supplied by Stuart were used for sulfuric acid, manganous chloride and sodium hydroxide/iodide set to dispense 1 ml with a reproducibility of 0.1%

A thermometer (HI 9555502, Hanna Instruments) was used to determine water temperature at the time of sampling with an accuracy of 0.1%

A motorized piston burette (or exchange unit) with a capacity of 5 ml capable of accurately dispensing the thiosulfate and the potassium iodate in small increments supplied by Metrohm. For automated titration setups 716 DMS Titrino was used. A 776 Dosimat was used for a high precision dispense of 1.0 and 10 ml aliquots of the potassium iodate standard.

3.2.4 Sampling

Dissolved oxygen concentrations were determined in 818 samples including 25 duplicates and 3 triplicates taken from different depths during the casts. Using a silicon tube, glass bottles were rinsed, overfilled at least 3 times and finally filled to capacity. The seawater temperature was recorded during sample collection. To each bottle, 1 ml of manganese chloride and 1 ml of alkaline iodide was added and capped immediately, ensuring no air bubbles were trapped in the bottle. The bottle was shaken for 30 seconds, allowing light brown precipitate of manganese (III) hydroxide to develop. Bottles were stored underwater until analysis in order to prevent significant temperature change and prevent exchange between the bottle content and atmosphere. Analysis was performed within 1 day of sample collection.

3.2.5 Reagent blank and standardization of thiosulfate solution

The Winkler titration method is an indirect measurement for dissolved oxygen determination. Due to the lack of a stable dissolved gas reference standard, standardization of the process is based upon a potassium iodate (KIO3) solution prepared to a known molarity (0.001667 M). Solutions of the KIO3 standard are then used to determine the exact normality of the sodium thiosulfate ($Na_2S_20_3.5H_2O$) titrant (near 0,2 M).

Reagent blank and standardization were daily performed at a temperature close to the temperature at which the oxygen samples were analyzed (near 18°C). Thiosulfate solutions were prepared during the cruise.

3.2.6 Sample measurement

Determination of oxygen concentration in the samples involved the addition of 1 ml of 5 M sulphuric acid to dissolve the manganese (III) hydroxide precipitate and titration with sodium thiosulphate. The end point was determined using an electrode (Metrohm, part number 6.0341.100) connects to the Titrino unit.

The total number of moles of oxygen (sample + O2 dissolved in the reagents) is given by the expression:

$n(O2) = (Vsam\text{-}Vblk) .M(Na_2S_2O_3,t_L)*(1 L/10^6 \mu L) . (1 mol O_2/4 mol Na_2S_2O_3)$

$C(O2) = [n(O_2)\text{-}7.6x10^{-8}]/m(sample)$

Where $7.6x10^{-8}$ mol O_2 is the amount of O_2 dissolved in the 2 ml of reagents ($MnCl_2$ + NaI/NaOH)

added to the seawater sample and m(sample) is the mass of the seawater sample in kg. m(sample) is given by:

$m(sample) = \{V(O_2\text{-flask},20 °C) . [1+9.75x10\text{-}5(t_S\text{-}20)]\text{-}2\}. \rho_{SW}(t_S,S)$

where t_S is the temperature of the sample at the time it was pickled, 2 is the volume of seawater displaced by the addition of the pickling reagents and ρ_{SW} is the density of the seawater at the time of pickling.

The conversion to volumetric to weight concentrations of the dissolved oxygen was carried out using the density of seawater at the temperature at which the oxygen sample was pickled according to Culberson (1991).

3.2.7 Calibration

An oxygen sensor SBE43 was interfaced with the CTD system during the cruise. It has been changed twice: once from Sensor 1 to Sensor 2 at station 93, and second from Sensor 2 back to Sensor 1 at station 129. In total, 818 samples were collected to calibrate the dissolved oxygen sensor on the CTD. No outliers were removed in the calibration of sensor 1. For the calibration of the sensor 2 (casts 94 to 110), 13 points were removed in total due to the difference between the titration and CTD values was greater than 2 standard deviations from the average difference. These outliers mainly occurred on samples taken from casts 94 and 95. The final calibration data are shown in Figure 3.2.7. The standard deviation of the sensor 1 presented a different trend during the cruise. Consequently, the calibration equation was calculated in two groups, casts 1 to 93 and 94 to 128. Figure 3.2.7 shows the distribution of the standard deviation (ΔO2) as the difference between the titration and CTD oxygen values during the cruise and its trend during the cruise.

Corrections of CTD oxygen using Winkler oxygen were performed (Figure 3.2.7).

Comparison was drawn in 3 sets given the average difference (panel upper right).

Set 1: linear behaviour of sensor 1 is checked at 1.6%, offset is -6 umol/kg

Set 2: linear behaviour of sensor 2 is checked at 1%, offset is -12 umol/kg

Set 3: linear behaviour of sensor 1 is lost (7%), indicative offset is -18umol/kg.
This diagnostic underlines dammage on sensor 1 after cast 93. Corrections on sets 1&2 are effective.
The precision is here reported as a coeficient of variance (CV%) which is defined as the standard deviation of the replicate samples divided by the sample mean and then multiplied by 100%. **The final obtained precision is 0.16% (±0,48 mmol/kg).**

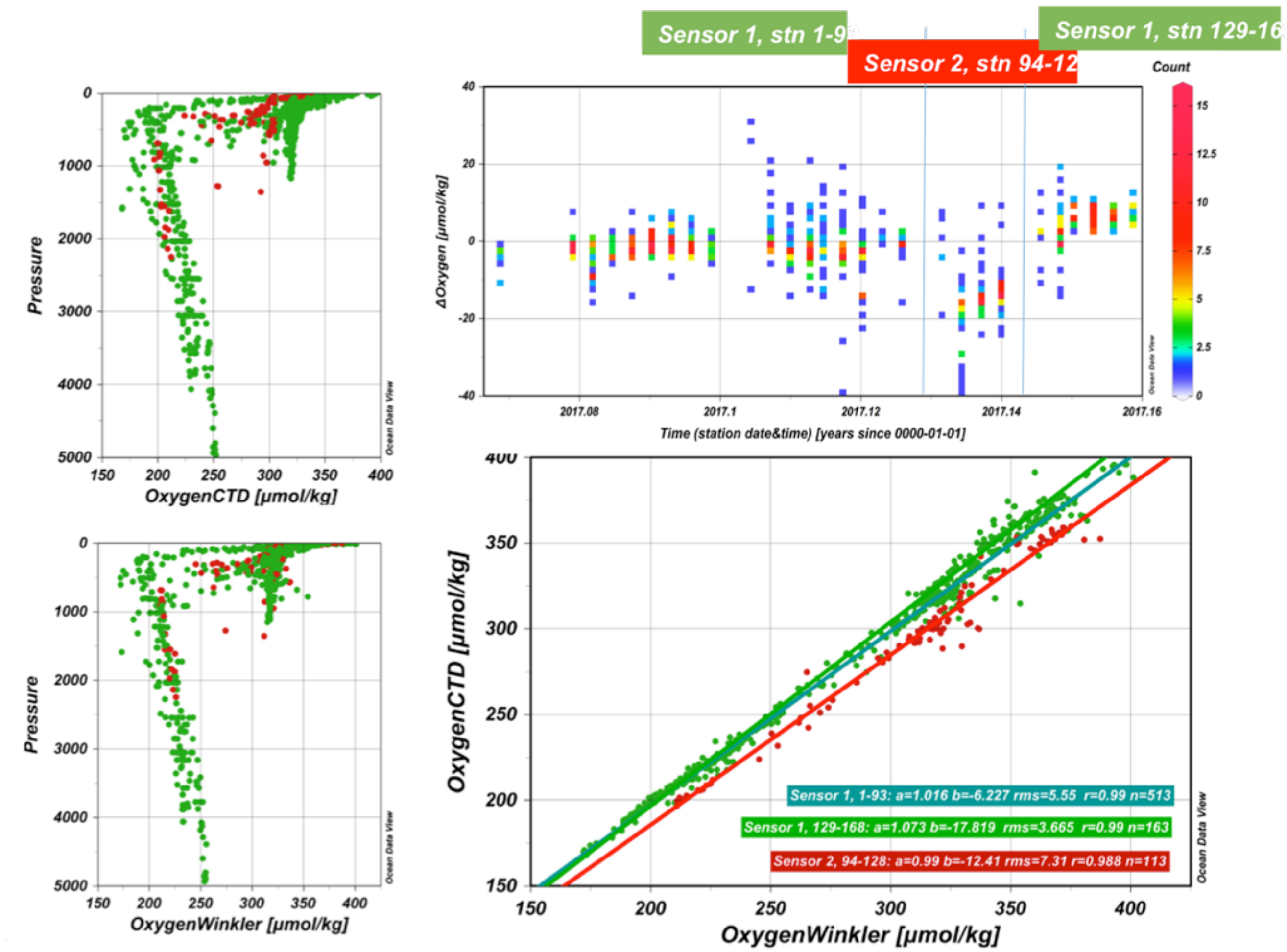


Figure 3.2.7: a) Vertical distribution of the bottle oxygen data collected and oxygen CTD sensor b) Standard deviation (ΔOxygen) as the difference between the titration and CTD oxygen values during the cruise. c) CTD oxygen calibration data and equation of the sensor 1 and 2. In blue, the equation for the sensor 1 on casts 1-93 and 129-168, in red on casts 1-93, in green on the casts 129-168 and in grey, the equation of the sensor 2 on the casts 94-128.

3.3 Carbonate System Parameter DIC-ALK

Diana Ruiz Pino

Sampling Contribution : Jerôme Demanges, Camille Akhoudas
Analysis after the cruise : SNAPO-LOCEAN UPMC-France (Diana Ruiz Pino et Fin Jhonatan)

3.3.1. Simultaneous determination of total alkalinity (TA) and total carbon (TC or DIC) in sea water: potentiometric titrationby a strong acid in a closed cell

To measure collected samples during the WAPITI cruise will be used the potentiometric system developpes by LOCEAN and used currently by SNAPO-CO2, descrived in annexe 3). 500 mL of seawater were collected in a borosilicate glass bottle with ground glass stoppers and classical caps, by taking care to prevent the introduction of air bubbles in the sample, and to limit contact with the air. To this aim, allow the sample to overflow for about 10 seconds in order to get rid of both bubbles and the water which was in contact with the air when the bottle was being filled. The samples are kept at low temperature (around 4°C) after being poisoned with HgCL2 to prevent changes in concentrations through biological (phytoplankton and bacteria activity): Note: Without addition of HgCL2, the sample must be analyzed within a few hours. During the WAPITI cruise were used two kinds of wide neck borosilicate glass bottles (withouth carbon) : i) with ground glass stoppers which need the use of apiezon L grass, around the Cap before close the bottles. Those kind of samples could be analyzed 8 or 10 months after the sampling ii) with classical caps it is necessary to protect the close system with parafilm to minimize the exchanges between the seawater sample and the air around the bottles. This kind of samples has to be analyzed soon as possible (maximum 6 months after the end of the cruise). The sampling strategy for DIC/ALK consisted in collecting samples inside the deep and bottom waters (together with nutrient, oxygen isotopes). Samples were also collected in surface waters in order to document the variability of DIC associated to sea-surface phytoplankton biomass (Chlorophyll-a, CHNS, and Fluorescence) and phytoplankton groups (Taxonomy and Fluoroprobe sensor). DIC data obtained in sea-surface will be used to evaluate if the deltaDIC is positive or negative and to correlate to other collected biogeochemical information (phytoplankton biomass and abundance, AOU, deltatO2, deltaPhosphate, deltapCO2, deltapO2…). This sampling strategy allowed to get a total of 691 DIC/TA samples, distributed as follow: 206 samples collected the A.23 transect and 467 in South Weddell sea (South of 75°S). All samples were fixed with HgCl2 and stored in the JCR scientific fridge (+4°). The samples will arrive in June at UK and be transported in same cold condition from UK to Paris. Those samples will be analyzed at SNAPO- LOCEAN before autumn 2017.

3.3.2. Carbonate System Calibration

The measurements of the carbonate system will be calibrated with Certified Reference Materials (CRMs) bought to Pr. Dickson (SIO, Univ. California" USA). The precision of the potentiometric system, evaluated from the analysis of CRMs, is usually around ±3 umol/kg for both TA and DIC. The reproducibility of measurements, based on the analysis of replicate samples, has to be better than 5 umol/kg for both TA and DIC. Once calibrated the obtained DIC and Alk will be used to calculate pC02, pH and the other parameter of the carbonate system ($C03^{=}$, $HC03^{-}$, Omega, Revel factor) using the C02sys program (CDIAC and SOCAT International data base). The calculated pC02 and pH values at the sea surface from the Niskin samples will be used to compare to continuous measurements from the underway to calibrate LICOR-IR (Infrared system, from PML) and SEAFET sensor (from LOCEAN, see section 4 - Calibration).

3.4 HPLC

Vincent Taillandier

Sampling contribution : Maria Gelado, Diana Ruiz Pino
Analysis : Joséphine Ras, LOV-SAPIGH , UPMC-CNRS, Villefranche sur mer, France

We followed the HPLC analytical procedure proposed by Van Heukelem and Thomas (2001). Briefly, photosynthetic phytoplankton pigments were sampled at 3 to 6 depths at different sites a total of 357 stations) in the upper 200 m of the water column, in mainly of the station only samples from the surface (0-5m) and deep chlorophyl-a maximum (DCM) were obtained. Seawater aliquots ranging from 0.1 to 2.27L were filtered through 25 mm Whatman GP/P filters (nominal pore size of 0.7 um) and frozen immediate -80°C in the corresponding JCR freezer. Analysis will be performed the SAPIGH (French National service for pigment analysis) of laboratoire d'Oceanographie de Villefranche (LOV, UPMC/CNRS). Filters will be extracted in 3mL methanol (100%) for 2h, disrupted by sonication, centrifuged and filtered (Whatman GP/P). The extracts will be injected within 24 h onto a reversed phase C8 Zorbax Eclipse colum (dimensions: 3 x 150 mm; 3.5 um pore size). Instrumentation comprised an Agilent Technologies 1100 series HPLC system with diode array detection at 450 nm (carotenoids and chlorophyll c and b) 676nm (chlorophylla and derivatives)and 770nm (bacteria, chlorophyll a). The concentrations of 21 pigments, including chlorophyll-a (ChI a), will be then obtained and, used in the study of calibration of fluoroprobe, fluorescence sensor at both sea surface (underway system) and water column (see part 4-Calibration for details of calibration). The limits of detection (3x noise) for the different pigments, based on a filtered volume of 2L, ranged from 0.0001 to 0.0006mgm^{-3}. The precision of the instrument will be tested unsing injected standard with a usual variation coefficient of 0.35%. Moreover, previous test of the precision of the instrument will be conducted on field samples replicates. A coefficient of variation of 3.2 and 4 % will be acceptable. For the primary and secondary pigment, the precision has to be in accordance with the 3 % standard high precision required in the analysis of field samples (Hooker et aI., 2005).

3.4.2. Sampling Strategy

Seawater was collected on Niskin Bottles at 2 to 6 depths in the euphotic layer following the structure of fluorescence and transmittance observed on the downcast CTD profiles. The surface bottles and the deep chlorophyll maximum were collected at all stations where DCM was observed. The Deep clorophyll maximum depth correspond to a simultaneous fluorescence and transmittance maxima. An extra bottle was also added to determine a blank at the low fluorescence signal. In some station a secondary peak of fluorescence determined the depth of the HPLC sampling. The number of the sampled station for HPLC is a total of 357 samples for the 2 region North-East (Transec A23 with 82 Pigment sampled) and South Weddell Sea (with 275 samples). The sampling and storage protocol are provided on annex N°3. Y The volume recognized for the HPLC samples is of 2,27L, however during the cruise this volume was adapted to the abundance of phytoplancton in seawater. Thus, South of the Weddell sea when the fluorescence associated to total chlorophyll (coming from both underway and rosette fluorometer) suggested high concentration, the volum filtered was reduce to 1 or 1,5 liter. The corresponding filtered volume of each sample is reported the logsheet files.

Fig. 3.4.1. Filtration system for a) pigment (HPLC, LOV-UPMC) and taxonomy b) for CHNS used in the Chemical laboratory during the Wapiti cruise.

3.5 CHNS

Diana Ruiz Pino (In collaboration with F. Prévot; not on board)
Sampling Contribution : Jerome Demanges, Camille Akhoudas, Marion Benetti (LOCEAN)
Analysis after the cruise : Hassiba Lazar (IPGP Paris-France)

Aims: To evaluate the particulate carbon uptake and Biomass produces phytoplankton. The material used to collected samples are : tubes FALCON 5OmL, tubes FALCON 16mL and 30 quartz filter prepared before the cruise.

<u>Parameter measured in the filter (47mm)</u>
• C,H,N&S measured with the elementary analyser. Are measured the total particulate carbon and the organic carbon after destruction of the inorganic Carbon (by acidification). Then is obtained the inorganic carbon by calculation TCarbon.
Particulate Organic Carbon = Particulate Inorganic Carbon, similar measurement and calculation could be done for particulate Nitrogen and Sulphur.
• Possibility to measure Stable isotope of same element C, N and S (Neptune IPGP)
<u>Parameter measured on the filtrated seawater:</u>

- **50ml storage 40°**, **Chromatography** : $N03^-$, $N02^-$, $S04^=$, $P04^{---}$ .... (L. Cordier, IPGP-Paris).
- **14 ml, ICP Optique**: All inorganic chemical element (Mendelief table) including Sulphur. These samples were all acidify to be preserved with HN03 (2ml) suprapure and concentrated and preserved at +4°.

To measure the total particulate composition C//H/N/S and corresponding stable isotopes are used glass filter. The protocol provided in annex N°3 shows that the volume of seawater filtered has to be higher than 2L. Thus, during WAPITI cruise were filtered 2L when the fluorescence signal was high, like in the South Weddell sea, or South or Georgia Island, but reach 4L when fluorescence was very low like in the middel of the Weddell Gyre or close to the Antarctic Ice shelf (78°S). The strategy to chose the collected depth is to get data on the same depth than HPLC at surface and first and some station secondary peak. Then, the number of samples by station range between 2 and 3; and reach a total of 222 for the all station and are distributed 26 across the transect A23 and 196 in the region cover by sea ice in the South Weddell sea.

3.6 Taxonomy

Vincent Taillandier, Diana Ruiz Pino (In collaboration with Angela Oviedo; not on board)

Analysis post cruise: Angela Oviedo, Universidad Autonoma de Barcelona and Luc Beaufort CREGE Aix en provence.).

Aim: To determine the variability of main group of phytoplankton dominating the Weddell ecosystem and to evaluate the carbon content of each phytoplankton group.

3.6.1. Taxonomic Method

Two to three depths at different sites were sampled in the upper 100m of the water column. To get taxonomic identification and enumeration of phytoplankton cells will be used polarized light microscopy and complementary SEM (Scanning Electron Microscopy). Two different methods will be used to identify and to count the phytoplankton cells of different size.

i) the classical optical microscopy, which allow to identify known Antarctic speces and to provide a quantification of a large size range of phytoplankton. It will permit to identify and count the following Phytoplankton: Diatoms, coccolithophores, silicoflagellates and armed dinoflagellates. Delicate forms like athecate dinoflagellates will probably get destroyed during the filtration. Loose of Phaeocystis could occur using this method, but colonies might collapse. To preserve them, air drying or critical point drying of samples seem to be better.

Samples in cellulose filters can be seen under light microscope, phase contrast, fluorescence and scanning electron microscope (SEM). Samples in polycarbonate can be seen in SEM with high image quality. The best will be to have the two types of filters of the same samples. Filters can be stored for years after dry.

Advantages:

- Under SEM you see everything that has not been broken during filtration
- Is a way to contrast and to complement HPLC data
- Taxonomical identification until species level is possible.
- Monitoring of changes in the phytoplankton community structure (species resolution level) is possible
- Allows you to estimate biomass
-

Disadvantages:

- SEM time can be expensive, but if light microscopy is used this is not a concern.
- Counting is long time consuming.

ii) The second method is automatic recognizion and counting. Image analyses will be performed on all frames (2403180 mm with a pixel area of 0.0225 mm^2) per microscooe slide, selected using and automated micrsocope (Leica DMRBE). Coccoliths and coccospheres and diatoms detected, classified and morphometrically analyses by the SYRACO software, which performs pattern recognition using artifical neuronal networks (Beaufort et al 2011). Mass will be estimated by measuring brightness in cross-polarized light (birefringence), with brightness being convertes into mass after calibration with calcite micrsopheres of know mass.

Sampling Strategy

To make phytoplankton taxonomy were used Cellulose Membrane filters of 25mm Diameter (Whatman). the protocol provided in annex N°3 suggests that the volume of seawater filtered has to be adapted to the abundance of phytoplankton. During WAPITI cruise were filtered between 250ml and 2L. The small volume corresponds to the station where the fluorescence signal was high, like in the South Weddell sea, or South or Georgia Island, but reach 2L when the Fluorescence was very low like in the center of the Weddell Gyre or North of the polar front (60°S). The performed strategy to choose the sampled depth has as goal to sample the same seawater (same depth) than for HPLC at surface, DCM and secondary peak. Then, the number of samples by station were 2- 4 and reach a total of 340 samples, distributed as follow: 43 across the transect A23 and 297 in the region surrounded by sea ice in the South Weddell sea and across the ice shelf.

3.7 Biodiversity And Genetic

Diana Ruiz Pino and Vincent Taillandier (In collaboration with *FELIPE ARTIGAS, FERNADO GOMEZ; NOT ON BOARD)*

Contribution to sample: Yves David, Sara Labrousse

Aim: To determine the phytoplankton abundance with identification of new species and phytoplankton diversity.

Two kinds of collected samples will be used to reach this goal: seawater at the sea surface and DCM from the Niskin bottles *I*and surface sea water samples collected from a NET. Cells like phaeocystis could be analyzed buy this technic.

Light microscopy and Utennohl method (from Niskin Bottles and NET)

Collection of water sample for sedimentation in chambers; Ütermohl or other chambers can be performed.

3.8. Seawater stable isotopes

Camille Akhoudas, Marion Benetti, Jerome Demanges

Introduction

The interactions between atmosphere, ocean, sea ice and ice shelf are important for the formation of global ocean deep water and thus relevant to the Earth's climate. In this context, the Weddell Sea plays a prominent role in the formation and export of the deep and bottom waters. Moreover, these processes are very sensitive to fluctuations in the freshwater balance and, in an era of climate change, the investigation of stable isotopes of seawater will help to better understand the expected modified hydrological cycle.

Water samples were collected on several full-depth CTD sections between 73°S and approximately 78°S on the continental shelf adjacent to the Filchner Ice Shelf edge and also the A23 repeat station for which oxygen isotope data already exist (see Section 4.1 for location of ocean sections). A total of 543 isotope samples were collected on 8 sections, with a ~100-200 m vertical resolution, in addition to 240 samples that were collected for the British Antarctic Survey as part of the A23 repeat section (in collaboration with Povl Abrahamson & Mike Meredith). Since the ratio of stable isotopes of seawater are extremely useful when collected alongside measurements of salinity in term of freshwater inputs, it will enables us to quantify the different freshwater sources (continental glacial ice melt from and sea-ice melt) using mass balance calculations. Furthermore, as conservative tracers in the ocean interior, d18O and dD data will allow us to investigate the freshwater composition of the different water masses in the Weddell Sea.

Sampling method

Sampling for oxygen and deuterium isotope analysis was performed throughout the cruise via the CTD/rosette from surface to bottom depth. All samples were drawn directly from the niskins into mainly 30 ml glass sample vials and kept cool at 4°C until further treatment on shore. Bottles were filled in order to leave minimal air for evaporation to occur whilst leaving enough air to allow for adequate mixing of the sample before measurement, in order to counteract any stratification that may have developed.

3.9. Nutrients

Camille Akhoudas, Marion Benetti, Jerome Demanges

Introduction

Nutrients concentrations can be used as a conservative water-mass tracer. Indeed, Broecker 1974 proposed that O2 and NO3 (and also PO4) data be combined in such manner that the alteration by respiration is cancelled. Studies have shown that for O2 consumed, molecules of NO3- and PO43- are released to the water as dissolved ions. Thus the sums [O2]*X[NO3] ('NO') and [O2]*Y[PO4] ('PO') are quasi-conservative properties (where X and Y are multiplicative coefficients). As these parameters are useful tracers away from the surface layers, they will be used as additional end-members in a four-component mass balance with salinity and isotopes enabling to quantify the different freshwater sources in the Weddell Sea. But due to the non-conservative nature of 'PO' and 'NO' in the surface, a standard three-end member mass balance will be used for waters in this layer.

Sampling method

Sampling for nutrient analysis was performed during the cruise via the CTD/rosette from surface to bottom depth. All samples were collected in the same niskins as for isotopes into mainly 20 ml bottles (FisherScientific ref 11738839, X500 fiole HDPE 20 ml 22MM PP) and stored at -20°C. Regarding some bottles, leaks were observed since sample have been filled slightly too much. From the CTD 73, bottles for nutrients were filled in order to leave more air. Finally, analysis will be done on shore by Patrick Raimbault at the Marseille Institut of Oceanography.

3.10. Underway and CTD Sensor Calibration

3.10.1. Physical parameters

3.10.1.1. Pressure and Depth

Test performed with CTD in deck, on January 29 2017. Barometer reading was 10.09dbar (1009hPa), Gage pressure reading was -0.8dbar, ie absolute reading of 9.32dbar. **The measured offset is equal 0.77 dbar.**

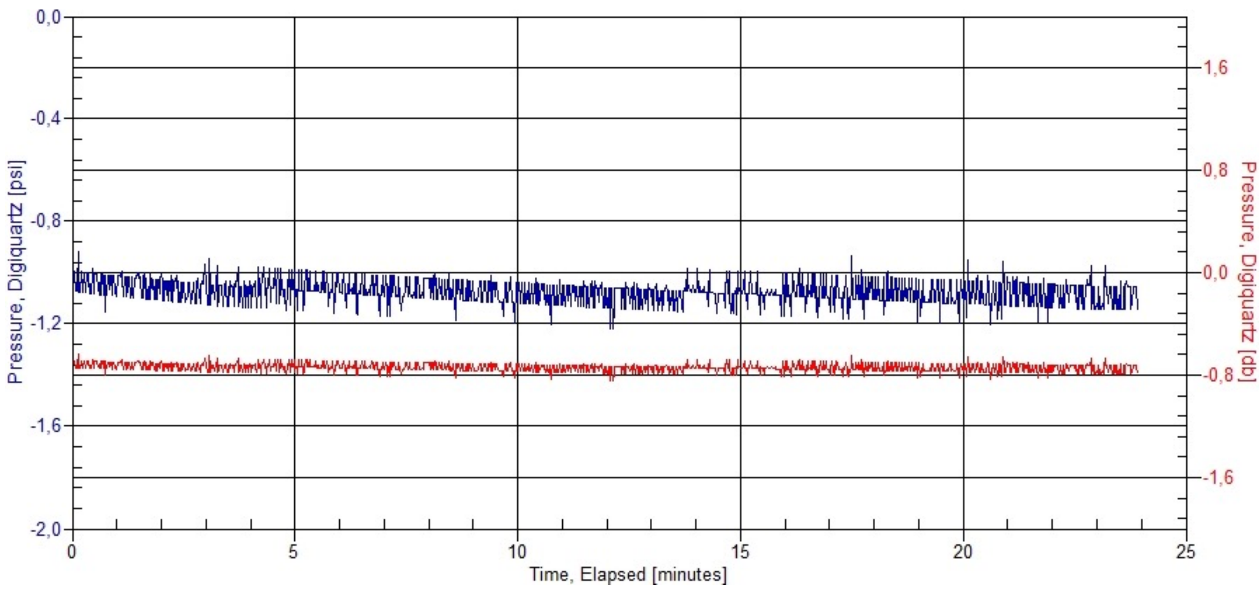


Figure 3.10.1. Pressure measure by CTD sensor on deck during 25 minutes, on 29 January.

3.10.1.2. Transmissiometer CSTAR

Test performed with CTD on deck, in the full dark, on January 29 2017. Transmission was measured with beam crossing the air, then with beam blocked. Voltage values corresponding to these two states were in very good agreement with factory calibration coefficients. ***No sensor drift was reported.***

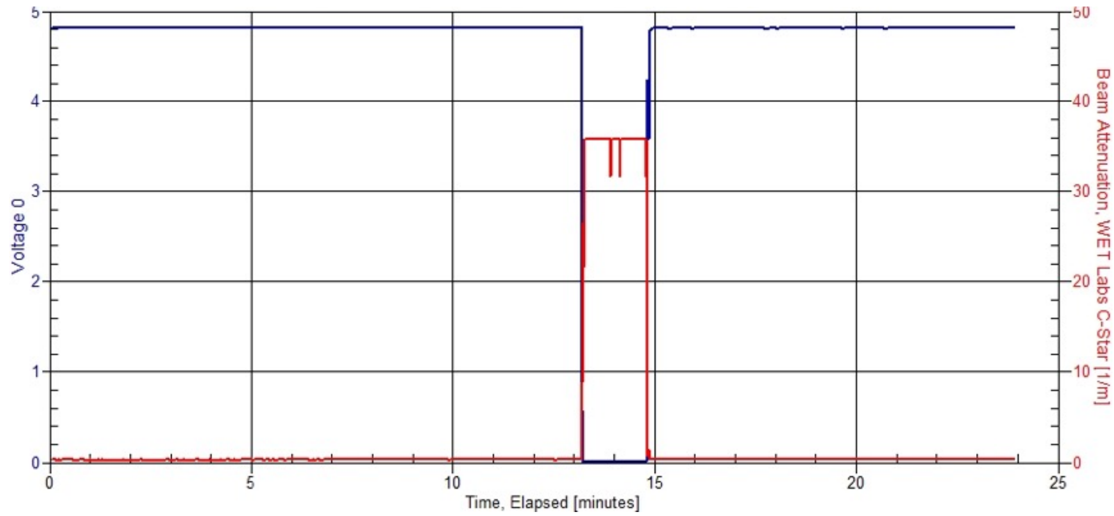


Figure 3.10.2. Transmission measured with beam crossing the air and with beam blocked

3.10.1.3. Calibration of TSG temperature and salinity

Quality checks of TSG temperature and salinity were performed comparing CTD temperature and salinity at surface bottles of every stations. The values with TSG near-zero flowrate were not considered. **With CTD sensors as reference, slope corrections are unsignificant and measured offsets are -36m°C and 0mg/kg.**

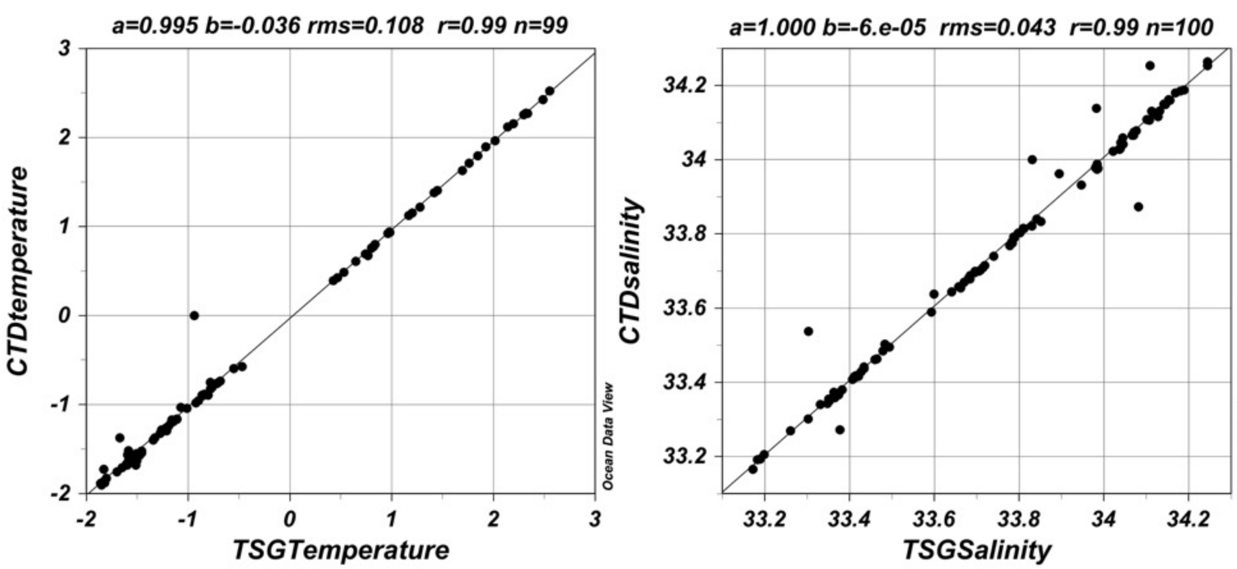


Figure 3.10.3. Temperature and Salinity measured by the 2 sensor on the CTD and compared with the Temperature and Salinity measured by TSG (underway system).

3.10.2. Biogeochemical Instrument

3.10.2.1. Fluorescence quality check

Quality checks of underway fluorometers are performed with FChl-a values at surface bottles of every stations. Because of possible effects of non-photochemical quenching, day (in red) and night (in blue) pairs are separated in the comparison. The values with TSG near-zero flowrate were not considered.

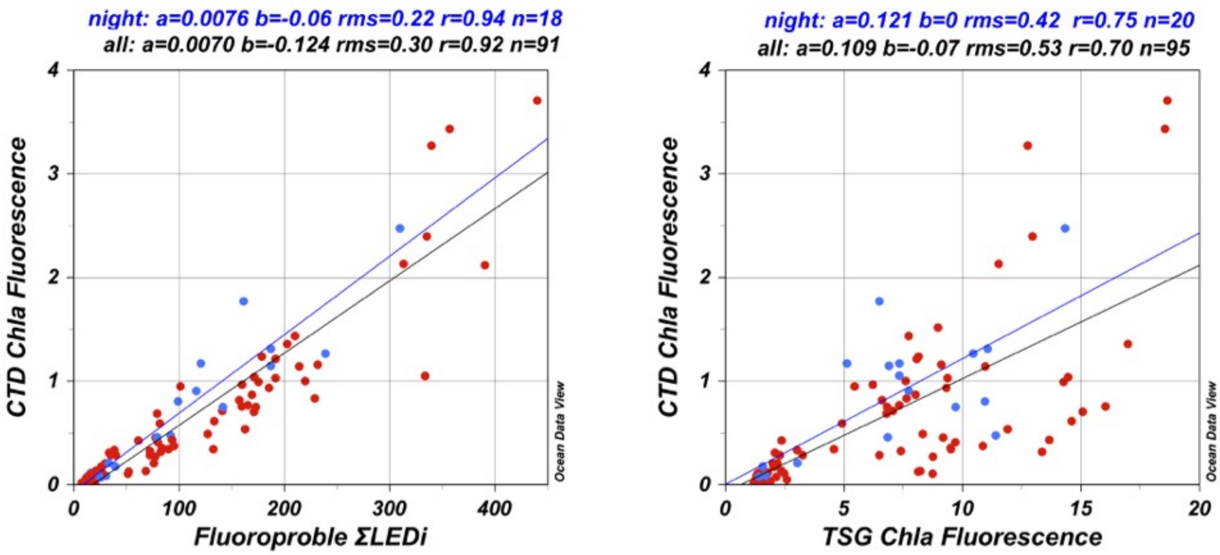


Figure 3.10.2.1. Comparison between Fluorescence signal obtained by CTD sensor and by the 2 sensor connected to the underway system : TSG and Fluoroprobe.

Correlation between CTD sensor and Fluoroprobe appears revelant. On the other hand, correlation between CTD and TSG fluorimeters is not effective. ***This diagnostic indicates the poor quality of TSG fluorimeter in the underway.***
To be revisited with Total Chl-a concentrations measured from the pigment method.

3.10.2.2. Transmissiometer Quality Check

Quality check of transmissiometer were performed with C-Star values at surface bottles of every stations. The values with TSG near-zero flowrate were not considered.

Poor correlation with Underway transmissiometer nor Fluoroprobe transmission signal is reported, although correlation between the 2 signals in the underway system becomes effective. The two types of measurements might be considered separately, to be confirmed from SPM samples.

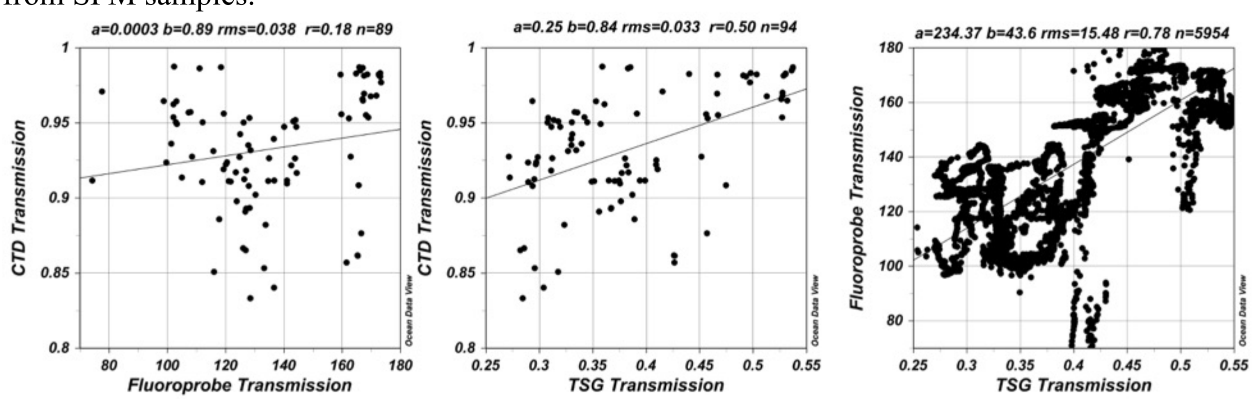


Figure 3.10.2.2. Comparison of transmission signal measured by CTD at sea surface with

transmission measured by fluorescence sensor connected to the TSG and the Fluoroprobe.

4. 2.3. Calibration Optode sensor (underway)

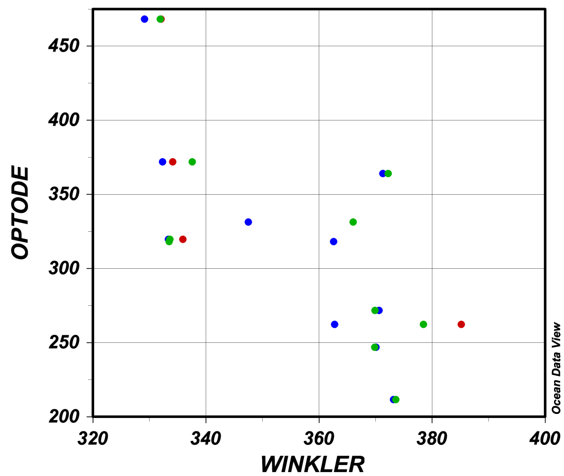


Fig. 3.10.2.3. Comparison between Oxygen measurement obtained with the Optode sensor connected to the underway system by PML-UK and the classical O2 measured by Winkler system with discrete collected samples (underway system)

References

Bresnahan Jr., P.J., Martz, T.R., Takeshita, Y., Johnson, K.S., LaShomb, M., 2014. Best practices for autonomous measurement of seawater pH with the Honeywell Durafet. Methods Oceanogr. 9 (0), 44–60.

Carpenter, James H. 1965. The accuracy of the Winkler method for dissolved oxygen analysis. Limnology and Oceanography, 10: 135-140.

Culberson, C. H. 1991. Dissolved oxygen. WHP Operations and Methods -- July 1991.

Langdom, C., 2010. Determination of dissolved oxygen in seawater by Winkler Titration using the amperometric technique. IOCCP Report No.14, ICPO Publication Series No. 134, Version 1, 2010

Martz, T.R., Connery, J.G., Johnson, K.S., 2010. Testing the Honeywell Durafet for seawater pH applications. Limnol. Oceanogr. Methods 8, 172–184.

Winkler, L.W. 1888. Die Bestimmung des in Wasser gelosten Sauerstoffen. Berichte der Deutschen Chemischen Gesellschaft, 21: 2842-2855.

PART IV: Deployed Equipment

4.1 CTD

Lena Schulze

4.1.1 CTD Operations

The basic CTD/hydrographic measurements consisted temperature, salinity, dissolved oxygen, fluorescence and beam transmisson from the sensors on the CTD, plus salinity, dissolved oxygen, DIC, isotopes nutrients, taxonomy, HPLC and CHNS from water samples.

A total of 175 CTD/rosette casts were made, usually to within 10 m of the bottom. A second stop was usually made at 50 m above the bottom to provide better bottom tracking for the LADCP. No major problems were encountered during the CTD operations. Cast 74 – 91 were part of a YOYO deployment. Each downcast was saved as a new file but only every third cast samples were taken and the CTD was retrieved. This was necessary to recharge the LADCP and to give everybody a break.

The usual procedure was to lower the CTD to around 10 m for the pumps to switch on and the sensors to stabilize. The CTD was then brought back up close to the surface (2 to 5m) before starting the cast. The niskin bottles were fired on the way up, and the CTD package was stopped for at least 20 seconds before firing.
Samples were taken for station 1, 3 – 41, 43 – 73, 76, 79, 82, 85, 88, 91, 93 - 98, 100 – 110, 128 – 138, 140 – 141, 144, 146 – 162, 164 – 175.

4.1.2 Significant events and general comments

Table 4.1 refers to significant events that occurred during, prior and/or after a CTD stations. During the first cast we noticed that the wire had jumped half a turn during spooling. This problem was not resolved until cast 31 since the jump had occurred at a depth of 4700 m. For cast 1 – 31 the CTD had to be slowed to as much as 15 m/min between certain depths (e.g. 1100 - 700 m, 300 – 350 m, 1800 – 2000 m, 3300 – 3330 m). The problem was finally resolved when a cast was deployed in water deeper than 4800 m (cast 31). No other problems with the wire occurred after this.

Table 4.1.1 Significant events and bottle problems during JR16004

8	Niskin 12 and 9 leaking
12	Niskin 6 and 7 lose on rosette but undamaged.
13	Niskin 13 lose on rosette but undamaged
14	Niskin 12 leaking
20	O2 sampled after DIC on Niskin 13
31	Niskin 21 leaking
38	O2 sampled after DIC on Niskin 3
45	Niskin 9 opened for couple seconds before O2 sampling
66	CTD had to be retrieved because pumps did not turn on. Ice in pumps. It was cleared and pumps worked during second deployment
66 -68	Niskins frozen. Defrosted with hot water
69-71	Niskins defrosted with hot gun
72	Ice in pumps, had to be cleared and CTD redeployed C1 really noisy
72-73	Frozen Niskins. Waiting before sampling

74	Pump on line 1 was replaced previous to this cast. No change on line 2
79	Niskin firing order changed.
82	Niskin firing order changed
85	Niskin firing order changed
88	Niskin firing order changed
91	Niskin firing order changed
93	Niskin 16 small leak
94	New dissolved oxygen sensor.
94 - 98	Niskin firing order changed
95	Small leak Niskin 6
100-101	Niskin firing order changed
110	New C1 and dissolved oxygen sensor installed CTD had to be brought back to deck to defrost the pumps. Fine for redeployment
110	Frozen Niskins, waiting before sampling
124	Reinstallation of original dissolved oxygen sensor (used for cast 1 - 93).
137	New Niskin 1
140	Bad data for line 2. Line most likely got kinked.
140-141	Frozen Niskins, waiting before sampling
141	New line on pump 2. No change to pump speed or instruments.
144	Frozen Niskins, waiting before sampling Niskin 5 did not fire, small leak Niskin 8
145	Pump 2 completely frozen. Clearing them and redeployment twice.
146	Pump frozen but got defrosted before cast. Pressure sensor responded slowly at beginning but recovered during soak.
147	Frozen Niskins, waiting before sampling
153 - 158	Niskin 2 broken. It was fired but not used during sampling.
154	Niskin 8 was sampled for other things before 02
158-168	Frozen Niskins, waiting before sampling
159	New Niskin 2 Problem with firing bottles. Only 1-3 were recorded in the bottle files. Data is bad! CTD was redetermined
161	Pumps did not turn on initially but CTD was deployed nonetheless. Top 20 m bad data. Pumps turned on below that and data is fine.
162	Frozen pumps. CTD recovered and redeployed
166	Only 3 Niskins out of 10 fired (3 8 and 10).
168	Pumps frozen. CTD recovered, lines cleared and CTD redeployed

During cast 93 the oxygen data was very noisy and drifted significantly between down and upcast and a new dissolved oxygen sensor was installed. However, the new sensor was drifting significantly at depth and the original sensor was reinstalled before cast 124. It performed okay for cast 124 to the end.

After cast 105 we noticed the C1 to be very noisy and we decided to install a new sensor for cast 110.

There were several problems with the pumps freezing during extremely cold days/nights (temperatures often dropped below -15°C). The pump for sensors 1 was replaced after cast 73 but no change was made to the instruments or sensors themselves. The change of pumps meant a different alignment coefficient was used from cast 74 onwards. The oxygen sensor failed during cast 93 and was replaced. However, the new sensor was also not performing well and the original sensor was put back in place after cast 110. We suspect that cold temperatures during cast 93 caused the sensor to temporarily freeze but not obtain damage in the long term.

For stations that took place in extremely cold temperatures the CTD was left in the garage until the last minute and put back in right away after the cast was finished. Both pumps were flushed with warm water and all water was removed from them right after and before each cast. Heaters were installed in the garage to keep the CTD as warm as possible between casts.

In addition water in the Niskin bottles also tend to freeze in these temperatures. For sampling water from frozen niskins, they were defrosted using hot water. Unfortunately this affected the dissolved oxygen samples and so sampling had to be postponed until bottles defrosted by themselves (usually between 10 – 15 minutes after the end of the cast.)

During cast 140 a problem with the pump for sensor 2 was not discovered in time and the cast was performed without the pump working, so that the data of the secondary sensors for this cast cannot be used.

During cast 159 a problem with firing of the bottles was noticed and the data was bad of the top 150 m (and possible below) was also found to be bad for both sensors. After re-determinating the CTD no more problems were observed.

4.1.3 Bottle firing and bottle files

For each bottle stop the CTD records the depth and temperature (1 and 2) and conductivity (1 and 2). In addition an additional SBE35 temperature probe also collected temperatures at the bottle stops. This file was downloaded and saved after each cast and its memory cleared.

NOTE: Usually niskins were fired starting at position 1. However for some casts (63, 79, 82, 85, 88, 91, 94-98, 100, 101 and 106) the order of niskin to be fired was changed, (e.g. Niskin 1-4 were skipped and 5 was the first one to be fired). Unfortunately the CTD bottle files (.bot and .ros) do not reflect this. In these files the first bottle that was fired is always numbered 1 no matter what position on the rosette it had. In order to correct for this all **.ros file were loaded into Matlab** and the position of the bottles for cast 63, 79, 82, 85, 88, 91, 94-98, 100, 101 and 106 corrected. Hence, please be aware of this and **use the matlab bottle file (bottle_data.mat) rather than the .ros, or .bot.**

The bottle lists: Station, Pressure, Temperature 1 and 2, Condactivity 1 and 2, Raw Oxygen, Flourescence, Bean Transmission, PAR, Scan Count, Number of Niskin, and a flag, (in this order).

Some bottles had to be replaced during the cruise (see table 4.1).

4.1.4 Initial data processing

The files output by Seasave (version 7.18) have appendices: .HEX, .HDR, .BL, .XMLCON.

The .XMLCON files for each cast contain the calibration coefficients for the instrument. The .HDR files contain the instrument configuration and set up information of each cast. The .HEX files contain the data in hex format for each cast and the .BL file contains the information for the bottle firing of the rosette.

The initial data processing was performed on a PC using the Seabrid processing software SBE Data Processing.

The data was processed in two different versions: 1.) Where the end product was binned in 1 db bins and only the downcast was processed. 2.) Where the end product was binned in 1 Hz bins and both, down and up cast, were processed.

The processing follows the GoShip Manual for CTD processing and the following steps were run after each cast.

- datcnv
- alignctd
- wildedit
- filter
- celltm
- loopedit
- derive
- binavg
- bottlesum

DATCNV converts raw hex data into binary .cnv files units and also produces a bottle .ROS file. Only the down cast was processed for the 1 db end product, but both down and up casts were processed for the 1 Hz end product. Variables that were exported were pressure [db], temperature and temperature2 [ITS-90, deg C], conductivity and conductivity2 [mS/cm], oxygen [mg/l], fluorescence [µg/l], beam transmission [%], and PAR.

ALIGNCTD aligns temperature, conductivity, and oxygen measurements in time relative to pressure to compensate for sensor time-lag. The primary sensors are automatically advanced un the deck unit by 0.073 seconds. After analyzing some of the cast and trying different alignments it was found that the primary sensors had to be advanced a total of 0.093 (0.073 + an extra 0.02) seconds until and including cast 73. After the pump on line 1 was changed the alignment was changed to 0.06. For the secondary sensor 0.06 was found to work well for all 175 casts.

WILDEDIT was run to detect and remove major spikes in the data. The function runs through the program twice: for the first pass it removes data points that are outside a two standard deviation envelop within each 100 scan bin, while the second pass removes data that is outside a 20 standard deviation envelop.

FILTER applies a low-pass filter (value of 0.2) to pressure which smoothes the high frequency data. To produce zero phase (no time shift) the filter is first run forward through the profile and then backwards. This removes any delays that may be caused by the filter.

CELLTM uses a recursive filter to remove conductivity cell thermal mass effects from measured conductivity. The value used for the thermal anomaly amplitude (alpha) was 0.03 C. The value used for the thermal anomaly time constant (1/beta) was 7.0 C.

LOOPEDIT removes scans associated with pressure slowdowns and reversals. If the CTD velocity is less than 0.20 m/s or the pressure is not greater than the previous maximum scan, the scan is omitted.

DERIVE is applied to calculate potential temperature 1 and 2, salinities 1 and 2 (psu), and density 1 and 2 (kg/m^3).

BINAVG averages the data into bins. This function was run to calculate a set of profiles with 1 db bins and another set with 1 Hz bins. Each bin is centered on an integer pressure/time value, e.g. the 1 dbar bin averages scans where pressure is between 0.5 dbar and 1.5 dbar. There is no surface bin. The number of points averaged in each bin is included in the data file.

ROSSUM creates the bottle file averaging salinity, theta, sigma-theta, and oxygen (umol/kg) over 8 seconds for each bottle stop.

4.1.5 Despiking

Package slowdowns and reversals owing to ship roll can move mixed water in tow to in front of the CTD sensors and create artificial density inversions and other artifacts that can last several seconds and are not removed by the LOOPEDIT routine. This was especially the cast during the first 32 stations when weather caused strong swell and resulted in strong ship movement. To remove these artificial features as well as occasional large spikes we manually despike the 1 Hz processed data in Matlab. For each the primary and secondary pressure, temperature and salinity were closely examined and manually despiked.

When a spike occurred in pressure, temperature or salinity data for all three variables was interpolate between the two neighboring points.

The removal of the artificial density inversions mentioned above explains the sometimes irregular data intervals observed in the 1 Hz and 2 db dataset and the user should therefor use caution then interpreting the data.

4.1.6. Salinity Sensors

Several problems were noted regarding the salinity sensors. As mentioned above the C1 sensor was replaced after cast 110 to address noise that was noted in the data. However, this noise was still present after the instillation of the new sensor (see Figure 4.1.7.1. for two examples).

Additionally we noted a strong divergence between C1 and C2 after station 140. The median difference between salinity 1 and salinity 2 at each station is shown in Figure 4.1.7.2. We see several points at which one of the sensors experienced a significant drift; during cast 73, 112, 141, 160, and 166. The difference of 0.03 psu between the two conductivity sensors is significant and is addressed below using the bottle salinities.

We will show below that it was sensor 1 that experienced the most significant drift and due to its noisy data and this drift we recommend the **use of data obtained from the secondary sensors only** with the correction for salinity described below.

Figure 4.1.1.: Example of noise in Sensor 1 compared to Sensor 2. Left shows an extract of cast 105. Right shows an extract of cast. The black extract of a profile shows the density calculated from the primary sensors and the red line the density calculated from the secondary sensors.

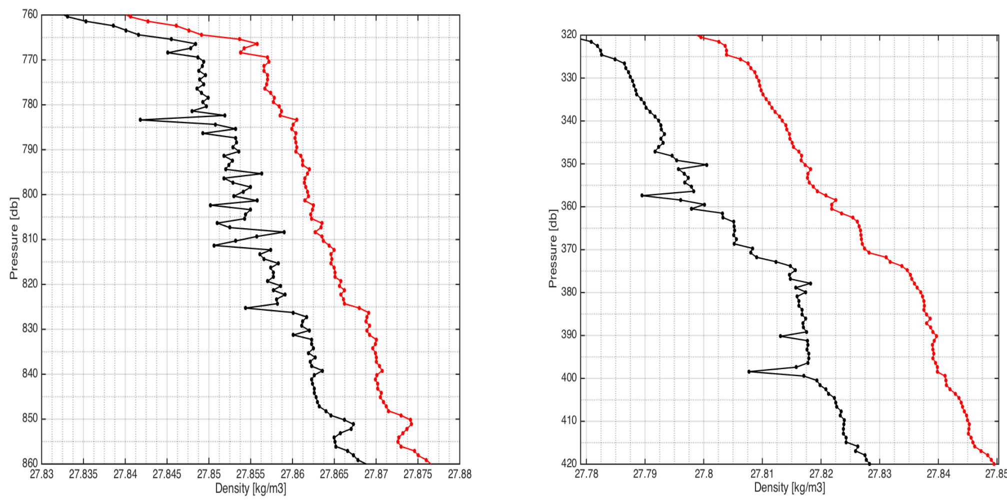
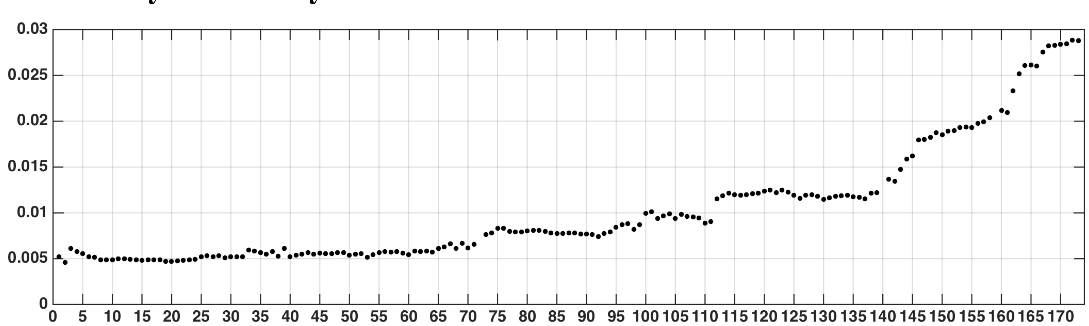


Figure 4.1.2. Salinity 1 – Salinity 2 below 100 m for each cast.



4.1.8. Salinity Calibration: Bottle versus Sensor Salinity

The salinity difference between bottle salinity and sensors showed a large amount of noise throughout the cruise with differences often falling outside of +/-0.002 psu (Figure 4.1.3). Several steps had to be takes to analyze any patterns of pressure dependence and/or drift over time. For each sensor we first find all points that are within one standard deviation of all points (blue point in Figure 4.1.5). We repeat this and find points that are within one standard deviation of these points (red points in Figure 4.1.5). Lastly we investigate possible reasons for the large amount of noise in the bottle data. We calculate the freezing point at each bottle stop and compare it to the temperature of the sample (Figure 4.1.4). For many of the stations that had noisy bottle data, the water was sampled at a temperature that was very close to its freezing point. It is likely that under these circumstances ice crystals formed within the Niskin. This process would in turn reject salt resulting in the bottle samples with higher salinity values. This in turn also explains why much of the noisy data is positive rather than negative (hence larger bottle salinities than CTD salinities).

Therefor as a final step to reduce noise we filter data by how close the samples were to their freezing point. Only data with a difference larger than 0.2C is considered in the analysis (black points in Figure 4.1.5).

Figure 4.1.3. Top: Bottle salinity minus CTD Salinity from Sensor 1 at each station. Bottom: Same for CTD salinity for Sensor 2.

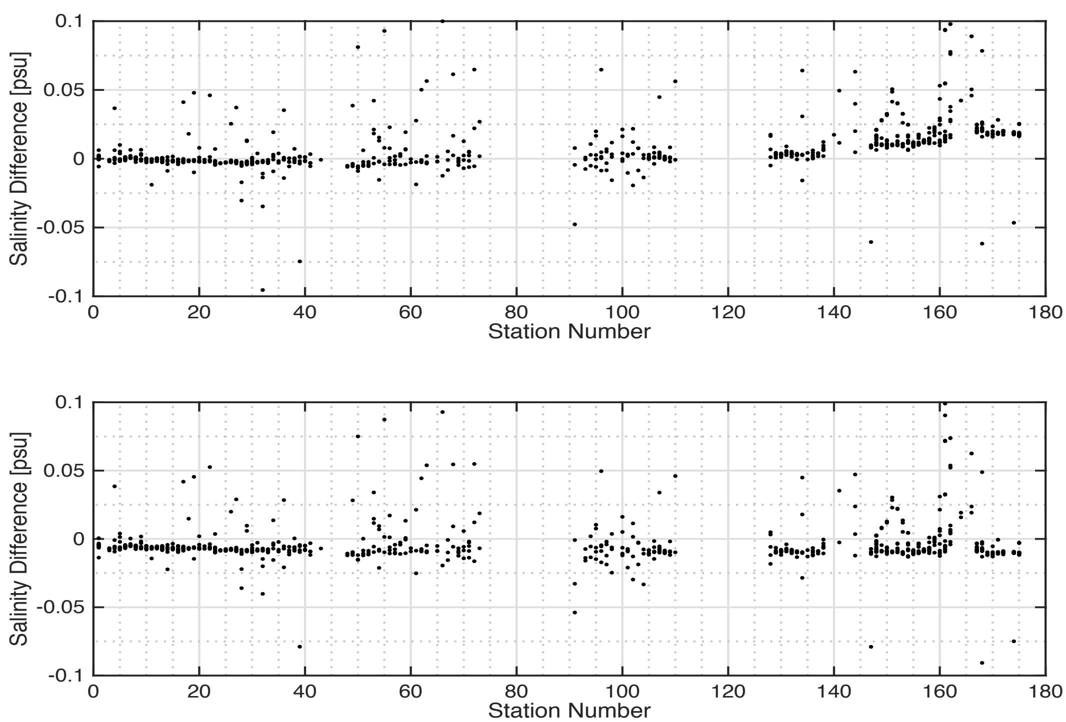


Figure 4.1.4 Top: Bottle – CTD salinity for Sensor 1, where each point is coloured by the difference between the freezing point of the Niskin and the actual temperature.

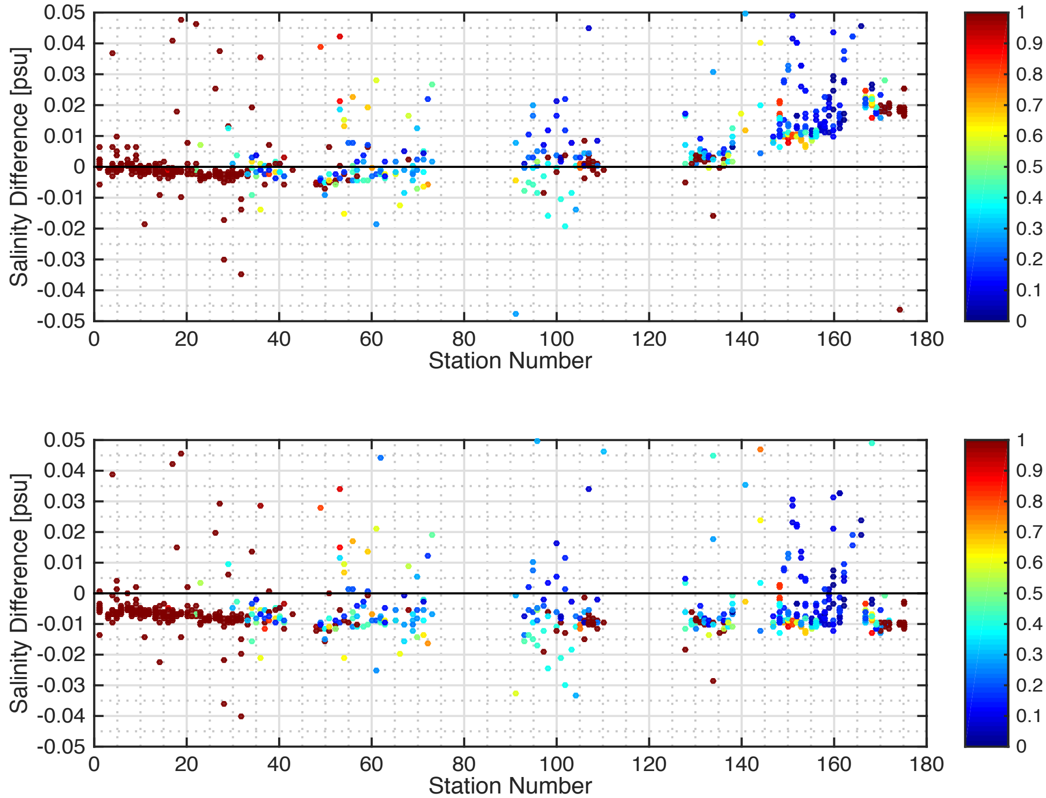


Figure 4.1.5: Top: Bottle salinity minus CTD Salinity from Sensor 1 at each station. Bottom: Same for CTD salinity from Sensor 2. Blue points show all points that are within one standard deviation. Red points show all points that are within one standard deviation of the blue points. Black points are bottle – CTD salinities for which the temperature of the sampled water is 0.2 C larger than the freezing point at the time of sampling.

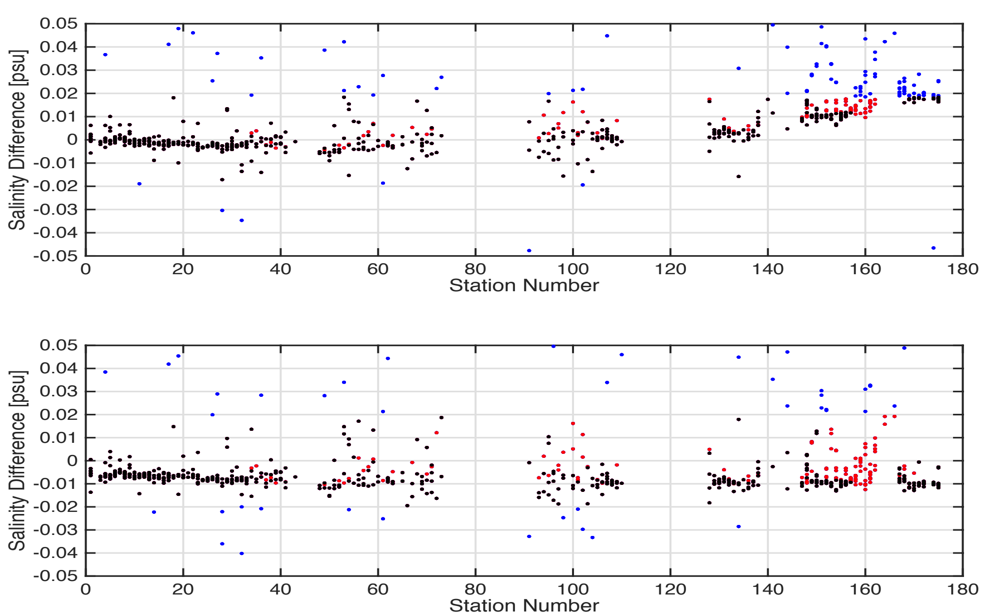
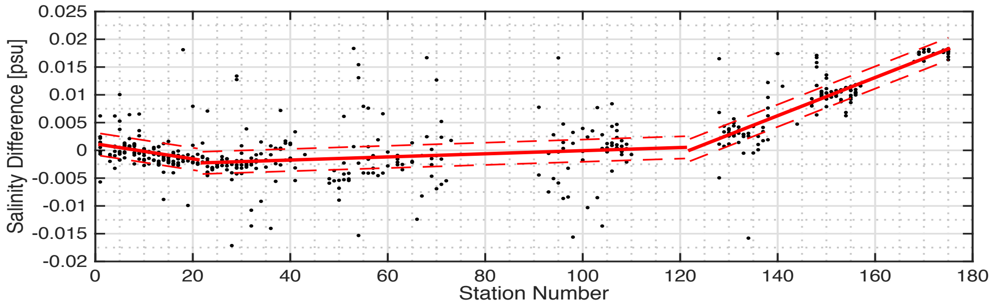
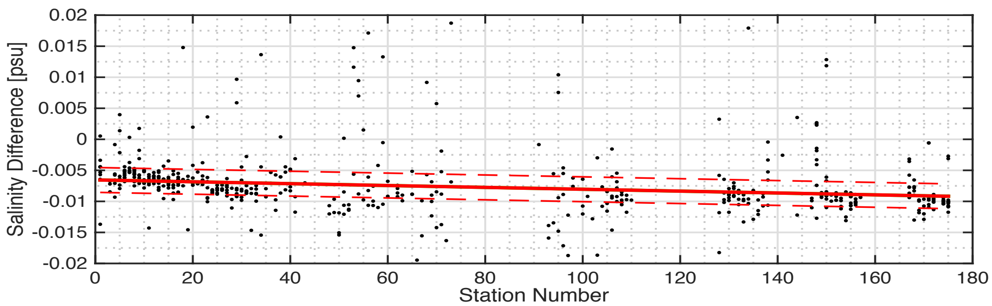


Figure 4.1.6 Top: Bottle salinity minus CTD Salinity from Sensor 1 at each station. The solid red line shows linear fits for station 1 – 21, 22-121, and 122-175. The broken red line shows a +/-0.002 psu envelope. Bottom: Same as top but for data from the secondary sensor and a fit for station 1 – 175.





No dependency of salinity to pressure was found.

However, it is clear from Figure 4.1.6 that sensor 1 experienced significant drift during the cruise. As mentioned above we will recommend using sensor 2 for all future work. There was a slight drift detected in the salinity data measured by sensor two, as well as an offset. **The slope and offset are -0.000015 and -0.006542, respectively. We therefore correct the 1Hz despiked salinity data using these values.**

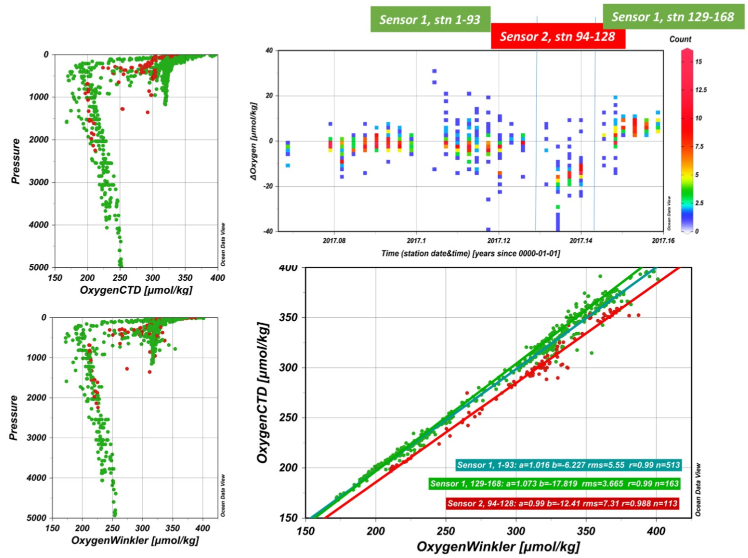
4.1.9. Oxygen Calibration:

As mentioned above and explained in more detail in other sections of this report the oxygen sensor was replaced twice and is calibrated against samples that were taken throughout the cruise.

The values that will be applied for the final data set are: -6 umol/kg for stations 1-93. -12 umol/kg for stations 93 – 110, and 18 umol/kg for station 111 – 175.

NOTE: These corrections are a preliminary calibration on the dissolved oxygen. A final step should be applied in the future, that uses the Vsbe43 for calibration rather than the oxygen concentration.

Figure 4.1.7



Corrections of CTD oxygen using Winkler oxygen were performed.

Comparison was drawn in 3 sets given the average difference (panel upper right).

Set 1: linear behaviour of sensor 1 is checked at 1.6%, offset is -6 umol/kg

Set 2: linear behaviour of sensor 2 is checked at 1%, offset is -12 umol/kg

Set 3: linear behaviour of sensor 1 is lost (7%), indicative offset is -18umol/kg.

This diagnostic underlines dammage on sensor 1 after cast 93. Corrections on sets 1&2 are effective.

4.1.10. Pressure Calibration:

A pressure calibration was run on the 29th of Jan, 2017 (at the beginning of the cruise), and on the 9th of March (at the end of the cruise). The pressure was converted to absolute pressure following instructions in the SeaBird SBE9 plus manuel. (10.13 has to be added to the value measured by the CTD).

At the beginning of the cruise the offset between the barometric value and the pressure measured by the CTD was 0.7537 db. At the end of the cruise the difference was 0.7292 db. Considering that there was no significant drift during the cruise, **no correction is applied to the pressure data**.

4.1.11. Temperature Calibration:

To find any drift, offset or failure in the temperature sensors the temperature measured by the CTD during bottle stops was compared to the temperature measured by the SBE35 probe. The SBE35 probe is a high accurate temperature sensor that logs the mean temperature during bottle stops.

No offset, drift of failure was detected in the two temperature sensors and **no correction is applied to the temperature data.**

4.1.11. Final Data set

The desiked and corrected 1 Hz data is binned into a 2db dataset (called **Wapiti_CTD_2db.m and Wapiti_CTD_1Hz.mat**), listing Pressure [db]. Temperature 1 and Temperature 2 [its-90, deg C], Conductivity 1 and Conductivity 2 [S/m], Raw Oxygen [V], Fluorescence, [ug/l], Beam Transmission [%], PAR, Corrected Dissolved Oxygen [umol/Kg], Potential Temperature 1 [its-90, deg C], Corrected Salinity 1 [psu], Density 1 [sigma-theta Kg/m^3], Potential Temperature 2 [its-90, deg C], Corrected Salinity 2 [psu], Density 2 [sigma-theta Kg/m^3].

4.2. Lowered Acoustic Doppler Current Profiler (LADCP)

Chris Chapman; Herve Le Goff

The LADCP system used during Cruise JR16004 consists of two Teledyne/RDI Workhorse ADCPs, an external battery, inter-connection cables, two communication/charging cables, a battery charger. The LADCPs were mounted on the main CTD sampling rosette.

LADCP profiles were attempted to be collected at all CTD stations in order to derive full-depth profiles of ocean velocity, as well as profiles of finescale vertical shear of horizontal velocities. Preliminary processing was performed immediately following data download using the LDEO LADCP processing software. Both raw and processed data can be found in the final LADCP data set.

4.2.1. LADCP System

Two Teledyne/RDI Workhorse 300kHz ADCPs were mounted on the CTD rosette, one pointing downward (downlooker, master) and one upward (uplooker, slave). Data acquisition was carried out using the Teledyne BBTalk terminal, installed on the main CTD control computer in the UAC. Communications between the acquisition computer and the ADCPs used direct serial communication via a serial cable to the CTD control computer, with a serial to USB converter used to connect the serial cable to the computer itself.

The instruments configurations were based on scripts supplied by Dr. Andreas Thurnherr at LDEO. Small modifications were made to these scripts: specifically the internal clocks of the instruments were synchronised with PC clock before each cast. All casts were configured to have bin depths of 8m, operated in beam-coordinates, zero blanking distance, narrow bandwidth, 4.0 ambiguity velocity, 1.3s/1.5s staggered ping rate. Scripts are listed in Appendix 1 (Section 4.2.9).

During deployment, a “LADCP stop” was made during the upcast at approximately 50m above the deepest depth the CTD reached during the cast. This stop was made whether or not water sampling was to be undertaken at this depth. The LADCP stops generally lasted one minute, and we made to help the instrument obtain a high-quality bottom-track series for eventual determination of the full-depth velocity profiles.

4.2.2. Processing Methods

Data were processed in batches after each section using version 9 of the LDEO LADCP processing software ***[ref 2].***

The LDEO LADCP processing software requires MATLAB file named “set_cast_params.m”. This file contains many cruise-specific parameters, such as ship draft, instrument type, metadata configuration, etc. A sample of the “set_cast_params.m” can be found in the Appendix section (Section 4.2.9). We note that after the oxygen sensor after cast 93 was changed on the CTD the number of lines in the header of the CTD output files was modified, and the variables **f.ctd_header_lines;** (line 99) and **f.nav_header_lines** (line 120) needed to be changed from 290 to 333 to reflect the change in the output files.

To obtain high-quality full-depth velocity profiles, three auxiliary data are usually needed: 1) the bottom-tracking data, which can provide constraints for the velocity near the seabed; 2) the GPS data, which can provide constraints for the depth-integrated velocity; and 3) shipboard-ADCP (SADCP) data, which can be used to constrain the velocities near the sea surface. In addition to these, another useful auxiliary data are the CTD time-series, which can be used to improve the accuracy of the depth estimation from LADCP data. Since the bottom-track data were included in the raw LADCP data, before processing LADCP data, only CTD time-series, GPS and SADCP data were firstly prepared.

CTD time-series at 1Hz were produced by the standard Sea Bird Instruments post-processing scripts run routinely after each CTD cast. For the preliminary processing, the salinity of the CTD data was not calibrated, which is OK as TS profiles are only used for sound velocity in the Ladcp process. The GPS time series with the same temporal resolution of the CTD time-series was merged with the CTD data for each cast by the post-processing scripts, so only a single file including both the CTD and GPS time-series was produced.

4.2.3 Data coverage and quality

LADCP profiles were collected for all CTD casts, except as noted below. The raw LADCP profiles are numbered so as to correspond with the CTD cast numbers.

1.Cast 3. Only a partial profile was recovered.

2.Casts 5 to 9: Failure of the LADCP battery led to the loss of ADCPs on this part of the A23 section, although a partial profile was recovered on cast 5 before the instruments failed. With no small amount of effort, the batteries were replaced and the LADCP system was returned to good working order.

3. Cast 46: The uplooker failed, as such this profile has only the downlooker;

4. Cast 143: The downlooker failed to start on this cast. Since the uplooker synchronises it's pinging with the downlooker, the uplooker failed to ping on this cast, so no data was returned.

5. Casts 65, 69, 70, 92, 95,113, 139, 148, 155, 158,166.
Numerous casts had synchronisation problems between the uplooker and downlooker that only became apparent on post-processing. This problem was remedied by opting to use the Julien data, as opposed to elapsed time, as the time value in the instruments. Full details about LADCP processing and data quality analysis (including SADCP constraint) are given *in Appendix 2* (Section 4.2.10).

4.2.4 Preliminary Results for A23 section (Leg 1)

LADCP profiles showed good agreement with the SADCP data on station but as discussed in the SADCP section, SADCP data without bottomtrack in rough seas are not reliable. Therefore for preliminary results on A23 we processed LADCP-only data (ie not constraint by SADCP) . The LDEO LADCP processing software reported current velocity errors generally around 3.5cm/s for the majority of the casts. LADCP data also showed good spatial coherence with adjacent casts.
Figure 4.2.1 shows the current (U meridian V zonal) measured at each station on the A23 section, and in the eastern Weddell Sea(stations 1 to 32) . *Chart 4.2.1* shows the near surface current (that is averaged from 30-80m depth) and the near bottom current (that is averaged

over the bottom 50m of the profile) obtained at each station. These results have not yet been detided.

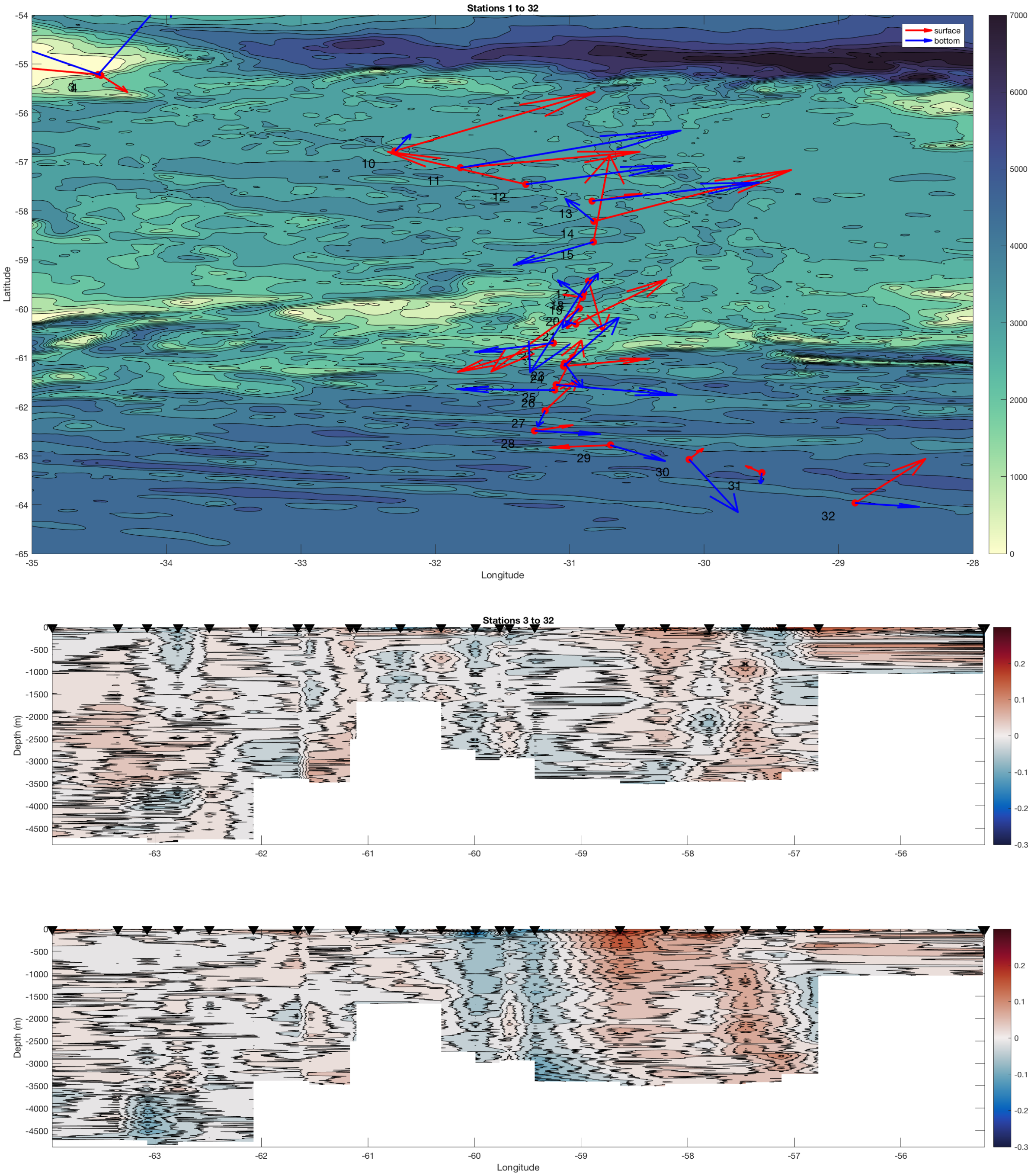


Figure 4.2.1: LADCP profiles on stations (3 to 32) from A23 section

4.2.5 Preliminary results for WAPITI sections (Leg 2)
Chart 4.2.2 shows all the CTD /LADCP stations (33 to 173) achieved in the Weddell sea and Filchner basin from 8 to 04/03/17 . They are listed in detail in ***Table 4.2.15***.

Those stations are grouped in sections, corresponding to specific scientific goals (cross-slope, zonal , yoyo station …).

With shallow grounds (generally less than 600m on the shelf) and calm sea state due to sea ice SADCP was generally providing reliable data which were successfully processed both on station and motion. *Chart 4.2.3* shows the SADCP surface vectors (layer 30-80m) for the whole Leg2.

SADCP profiles on station were used for cross check with LADCP profiles: correlation is generally good, so that SADCP constraint was applied on most LADCP profiles with adapted weights (see discussion in Appendix 2; Section 4.2.10).

The next chapters show a detailed analysis of the 9 LADCP/SADCP sections appearing on *chart 4.2.2*. ++ the very last section (stations 174-175) near South Orkneys where we deployed the 2 Provor/DVL floats .

UV velocities contours are plotted against distance or lat/long for:

- LADCP data constraint by SADCP and linearly interpolated between stations.
- SADCP data averaged every kilometre on the corresponding section

Correlation between S and LADCP is good: the same patterns appear on the contours. Sea bottom (black line on the contours) is derived from LADCP bottom track data.
For each section charts show SADCP vectors (black arrows) and LADCP vectors (red arrow) averaged on various ocean layers from surface to bottom. Again, SADCP and LADCP show good correlation.

Bathymetry is derived from GEBCO 1mn database, supposed to be the best bathymetry available for this area. Visual checks show honest correlation between GEBCO and bottom track values on LADCP stations.

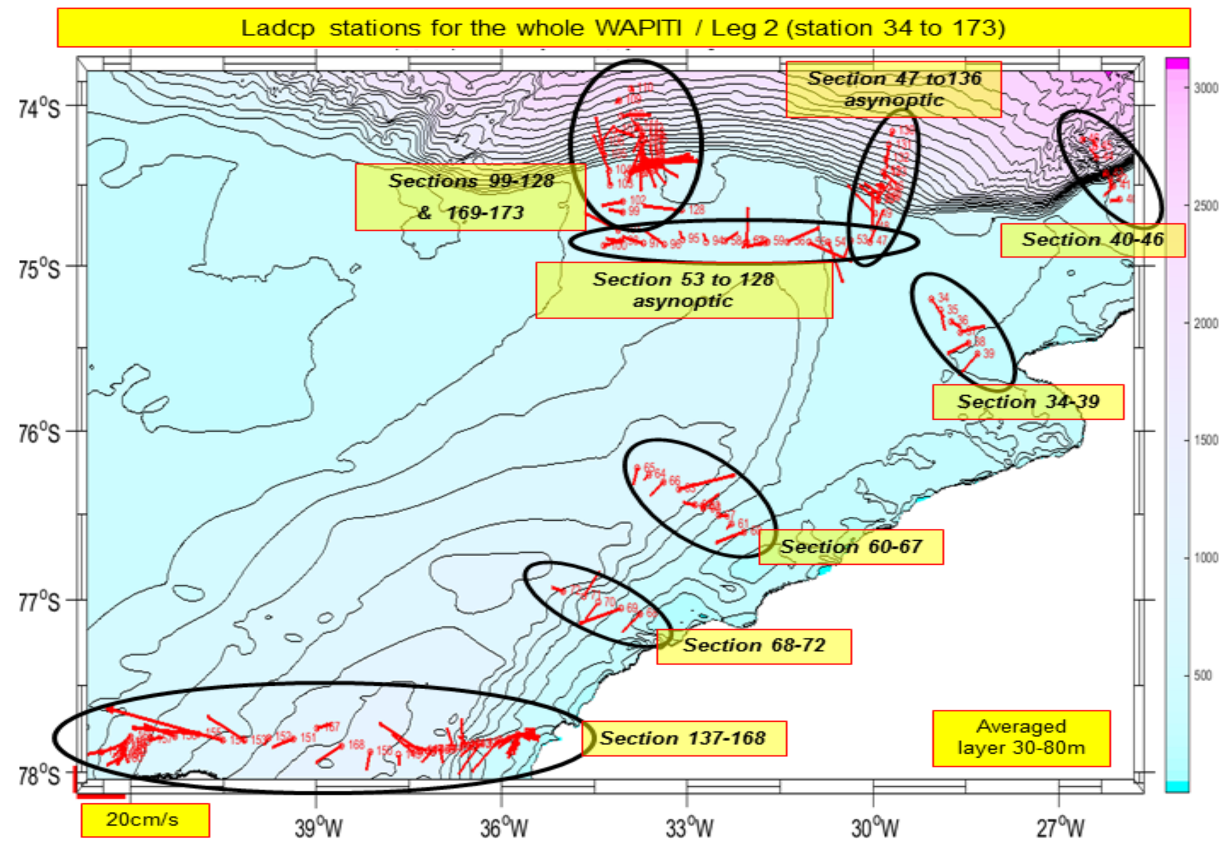


Figure 4.2.2: LADCP profiles on stations (33 to 169) from WAPITI /leg2 sections

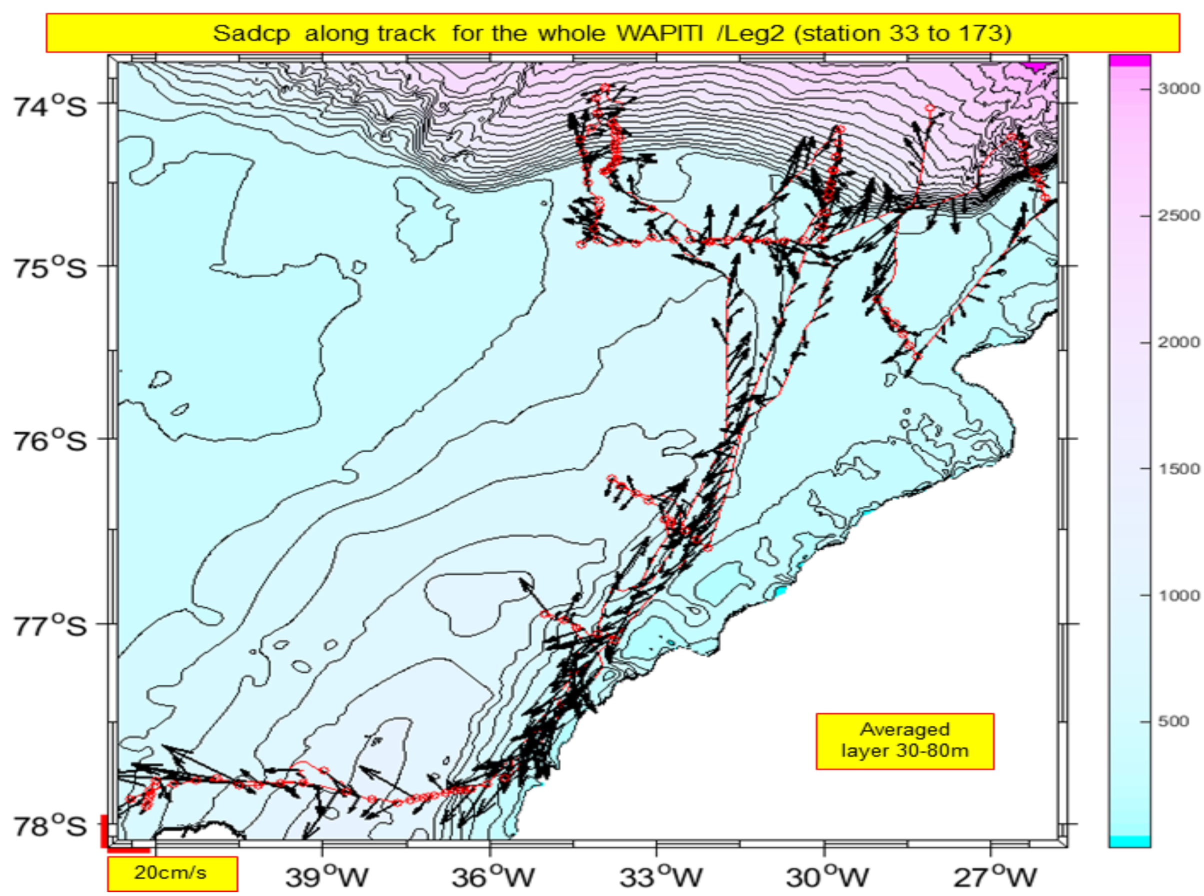
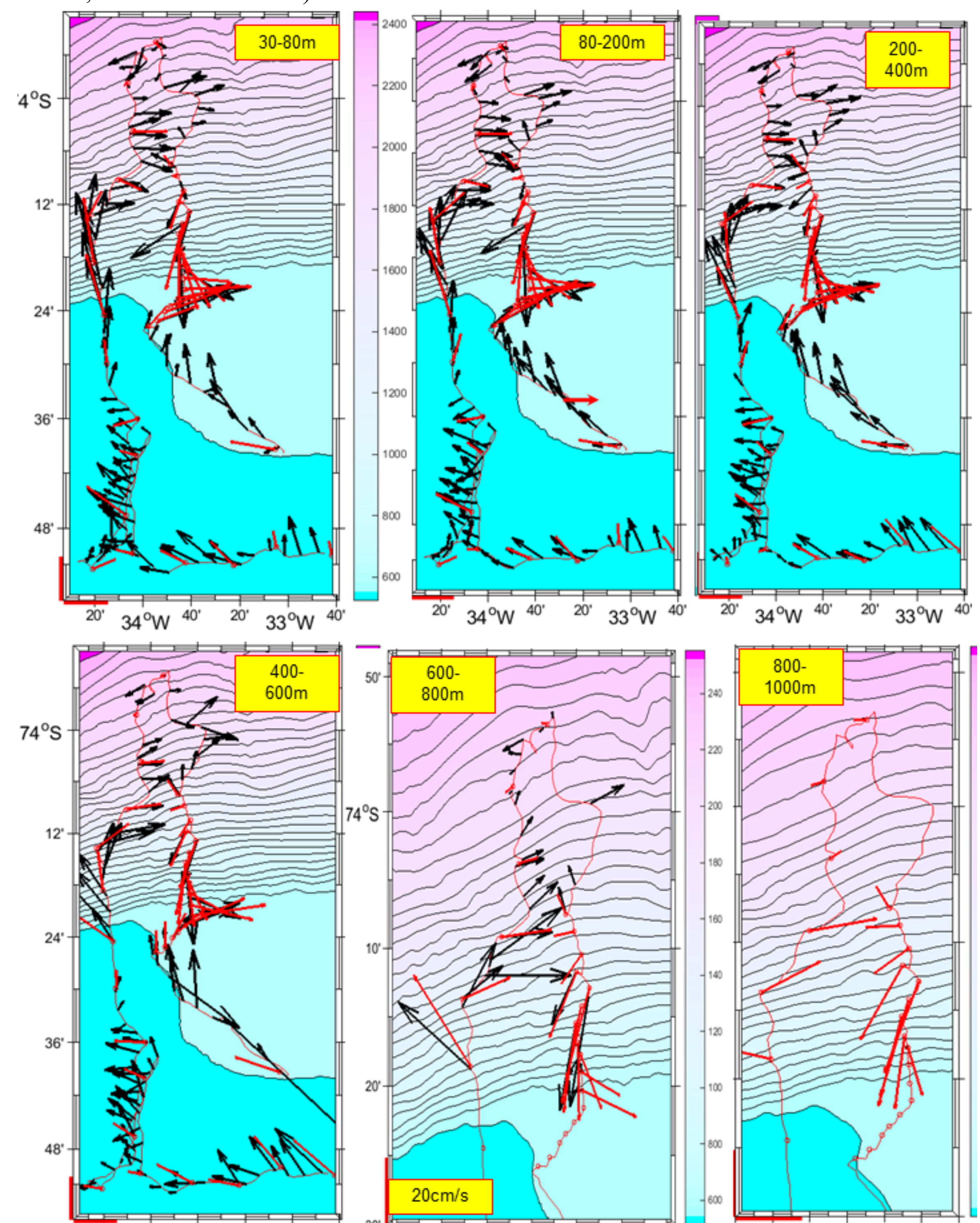


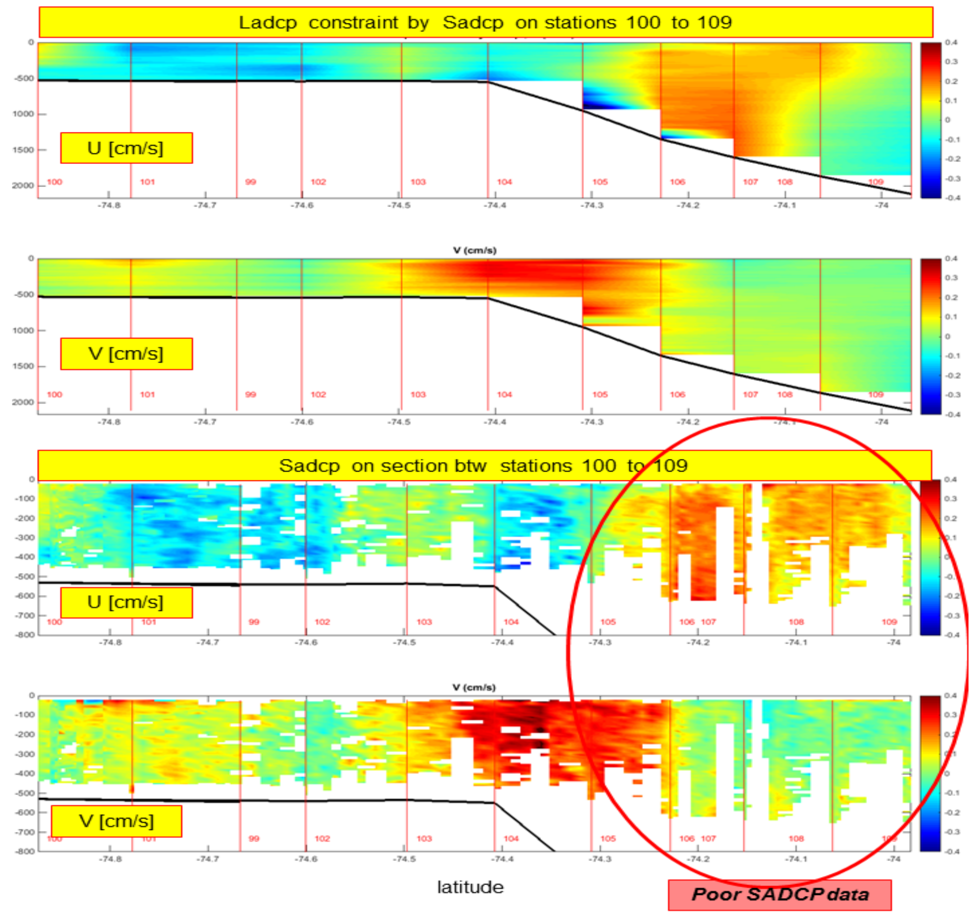
Figure 4.2.3: SADCP profiles on WAPITI /Leg2 sections

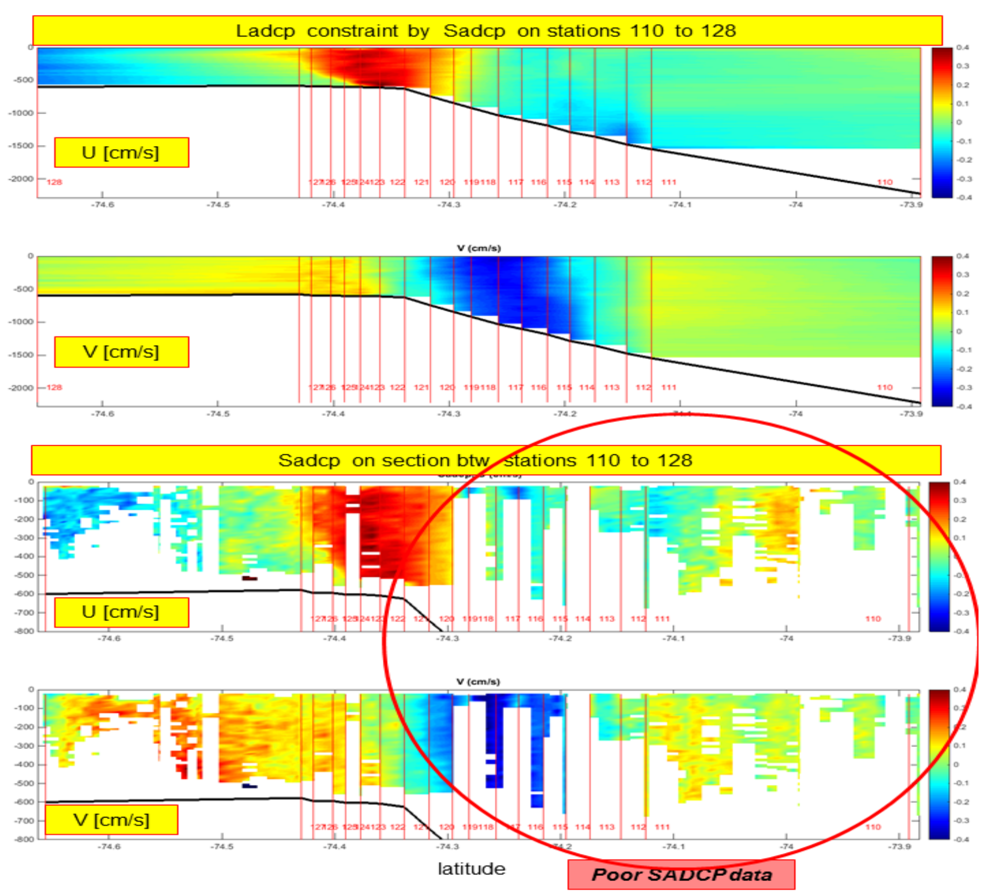
Crossslope section (stations 99-128) around 74°20 S 34°W

LADCP and SADCP velocities contours are given for both successive Northbound (sta 99-110, 20-21/02) and Southbound sections (sta 111-128, 22-23/02). Poor SADCP data on the deep parts of those sections are due to lack of bottom track AND probable icing on the OS75 transducer. Vectors are averaged on various layers from surface to bottom (black arrows SADCP, red arrows LADCP).



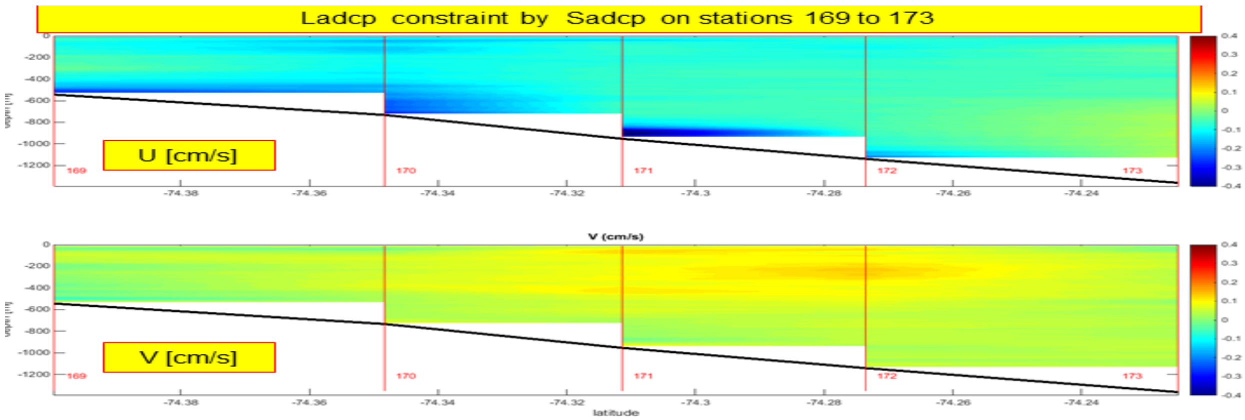
Ladcp and Sadcp on stations 94 to 128, averaged on layers from surface to 1000m

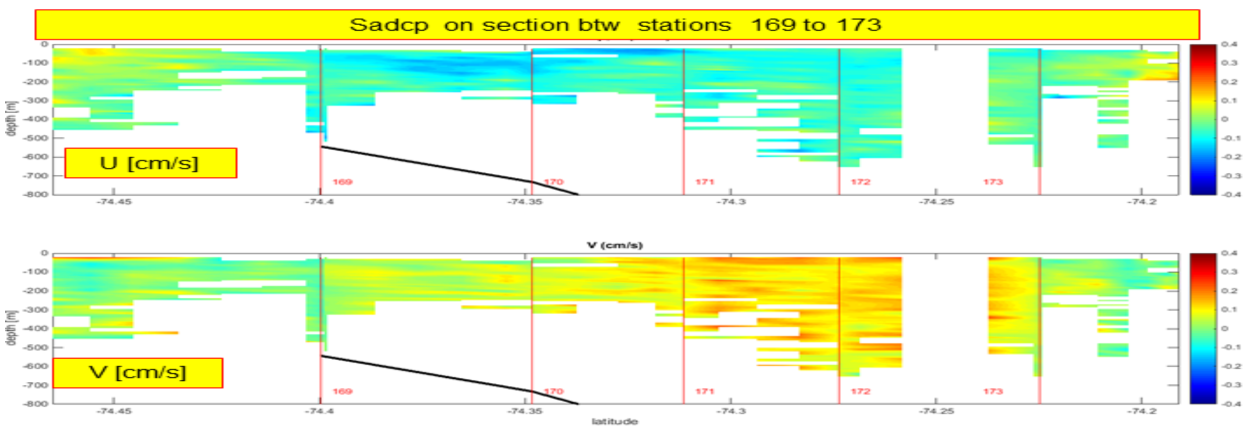

Ladcp constraint by Sadcp on stations 100 to 109
U [cm/s]
V (cm/s)
V [cm/s]
Sadcp on section btw stations 100 to 109
U [cm/s]
V (cm/s)
V [cm/s]
latitude
Poor SADCP data

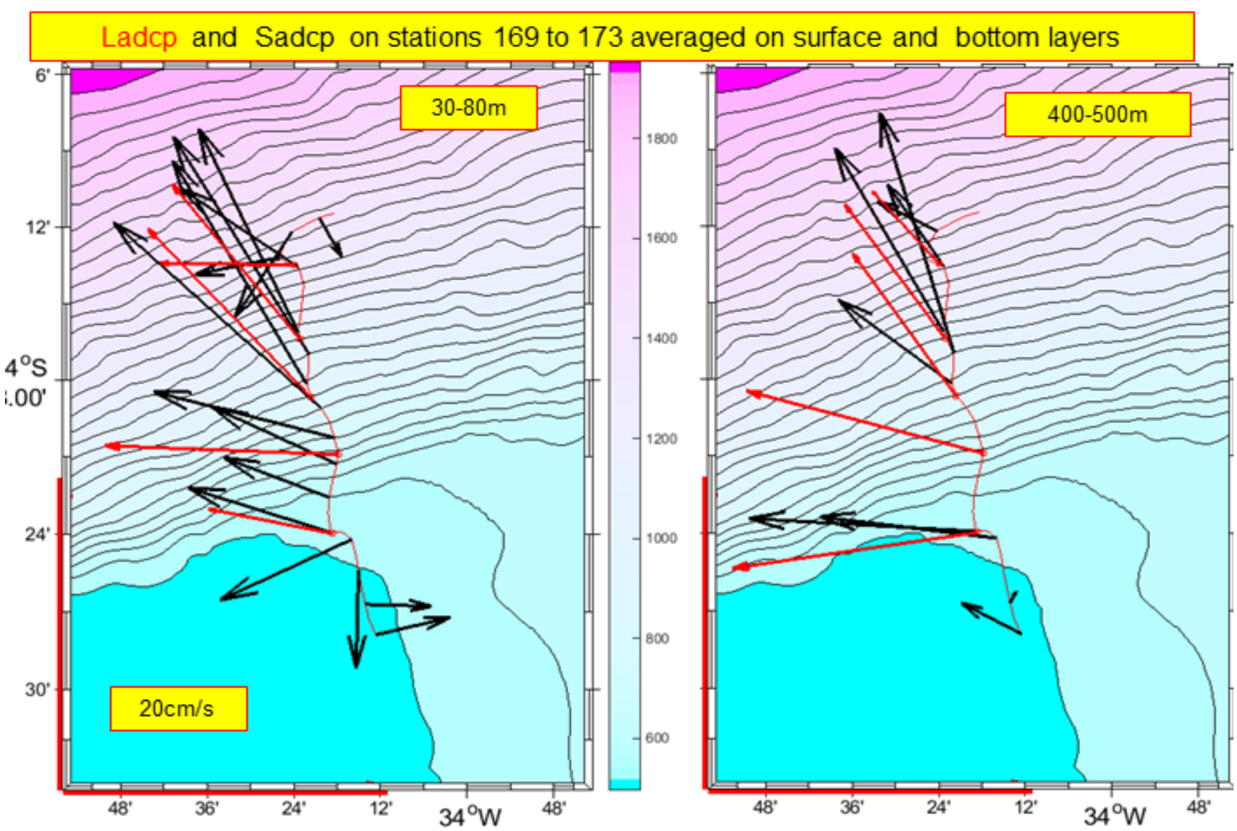

Ladcp constraint by Sadcp on stations 110 to 128
U [cm/s]
V (cm/s)
V [cm/s]
Sadcp on section btw stations 110 to 128
U [cm/s]
V (cm/s)
V [cm/s]
latitude
Poor SADCP data

Crossslope section (stations 169-170) around 74°20 S 34

Complementary of previous sections but not synoptical

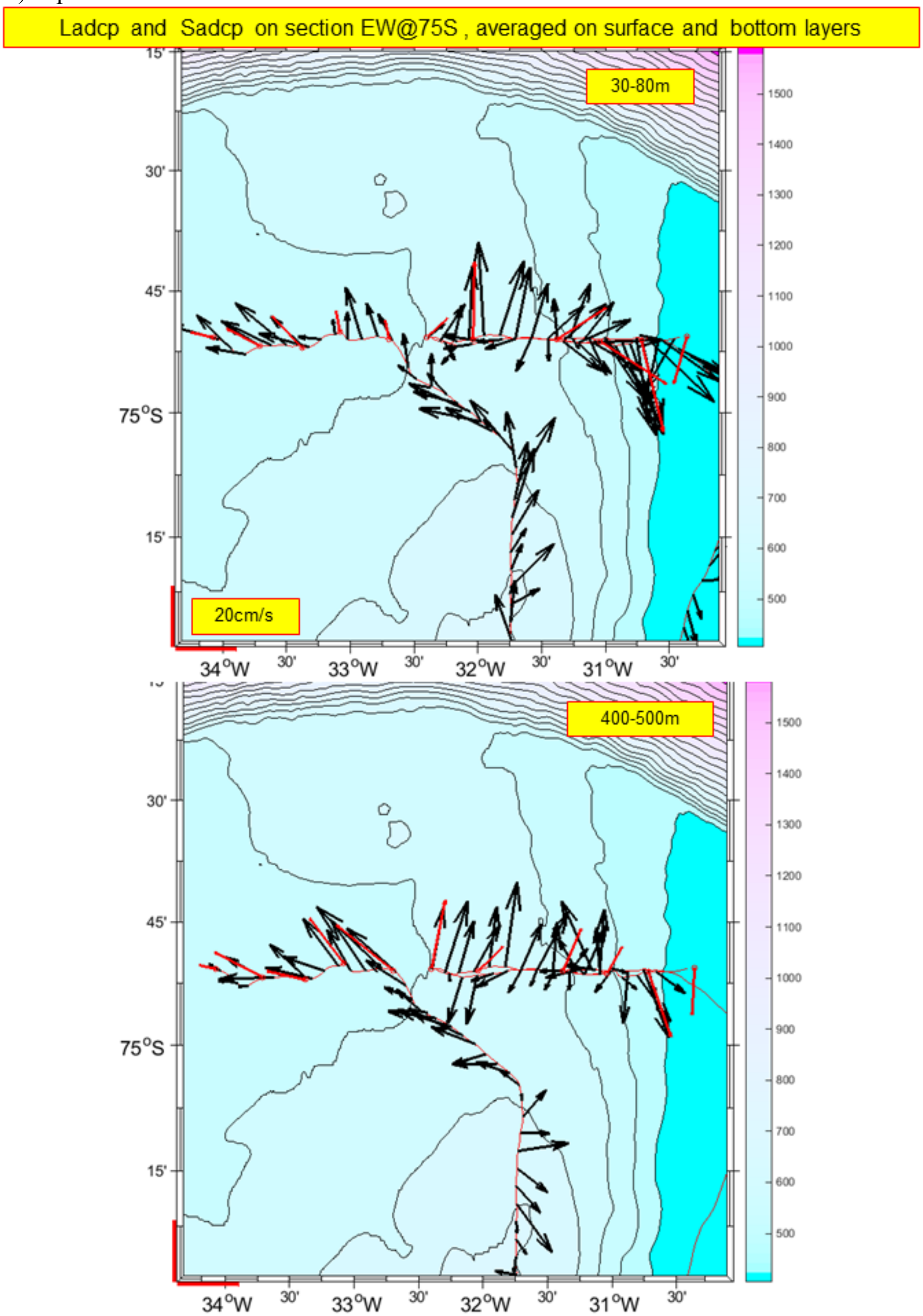


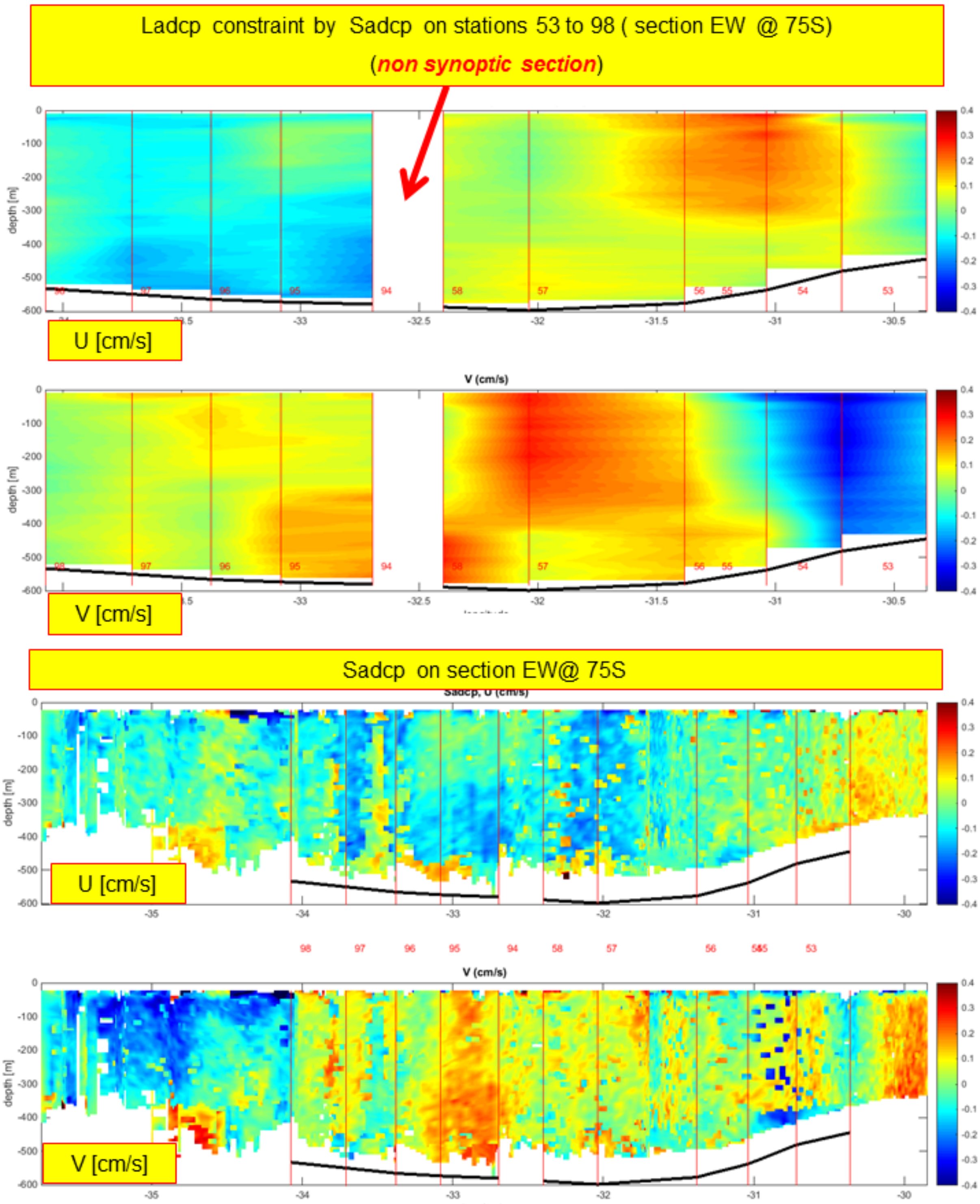




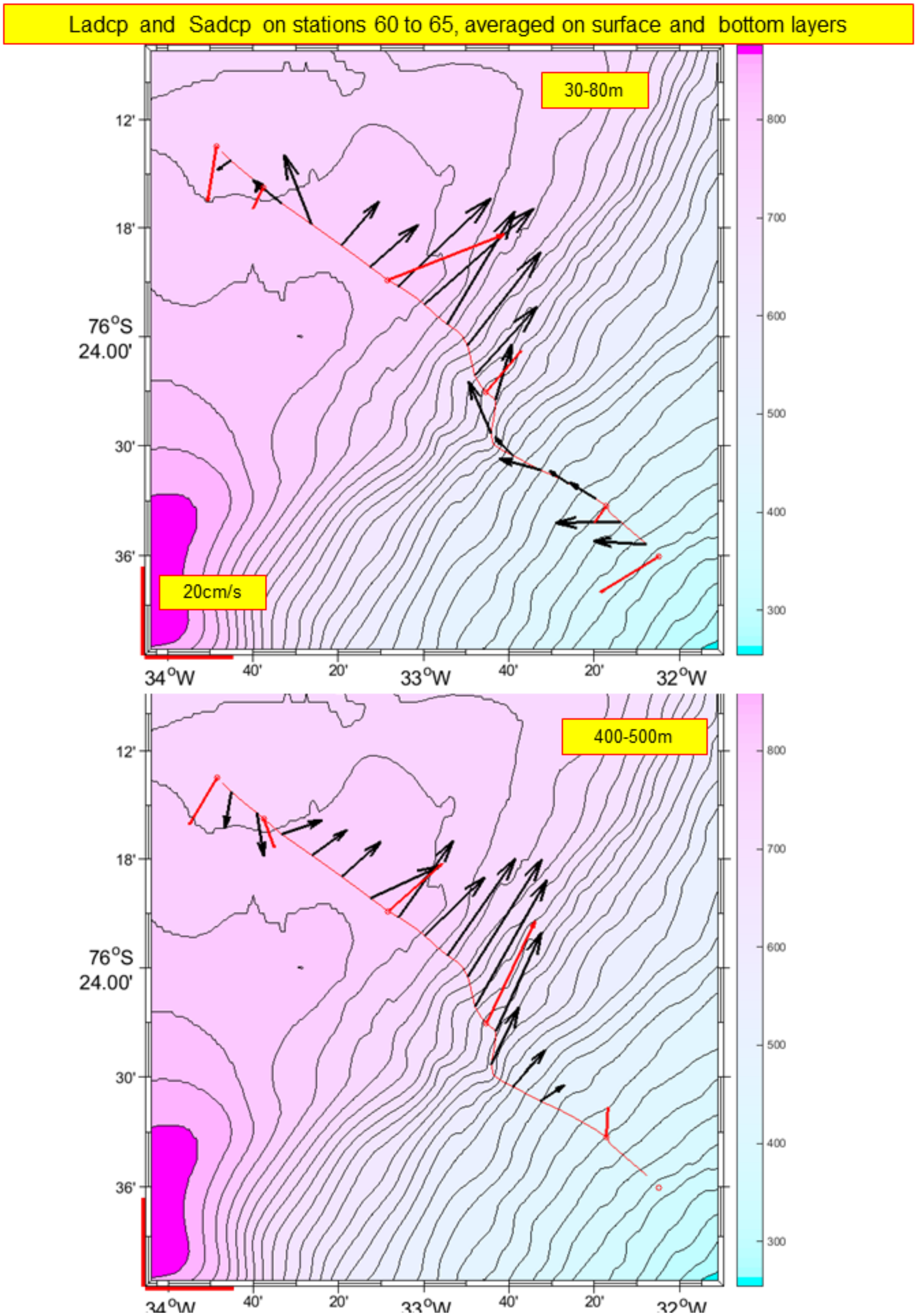
Zonal section from 30°20W to 34°W on 75°50 S (stations 53 to 128)

As this section was achieved at various time periods (asynoptical) only the 2 first parts (sta 53 to 98) is presented here .

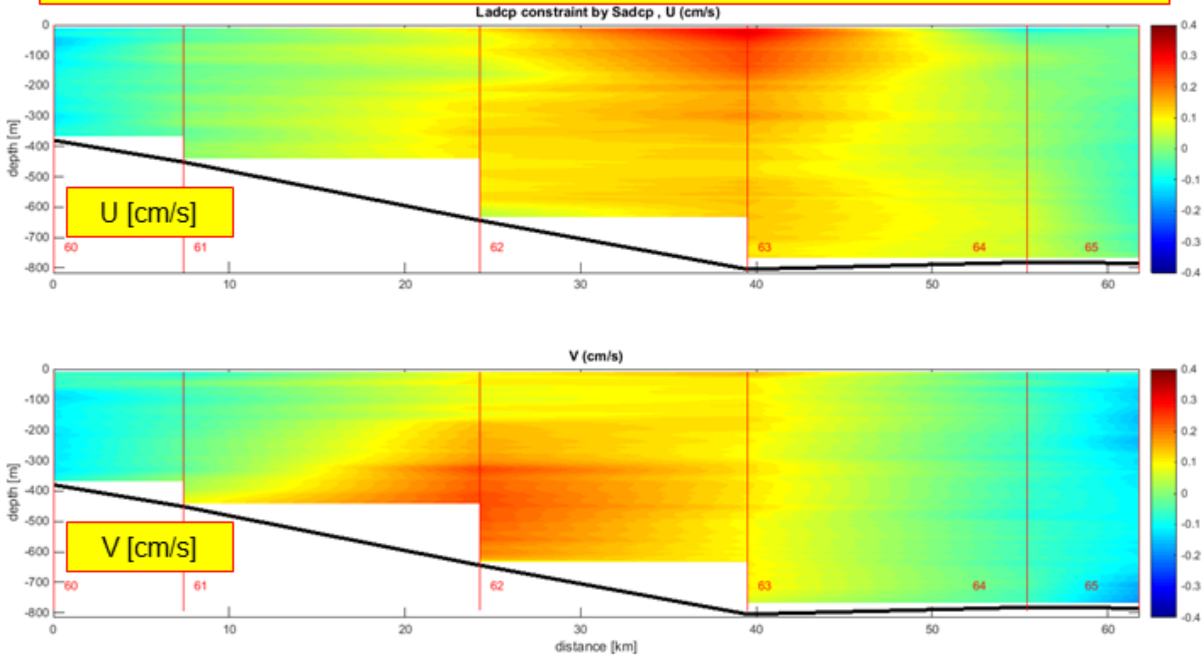



Ladcp constraint by Sadcp on stations 53 to 98 (section EW @ 75S)
(non synoptic section)
U [cm/s]
V (cm/s)
V [cm/s]
Sadcp on section EW@ 75S
U [cm/s]
V (cm/s)
V [cm/s]
depth [m]
longitude

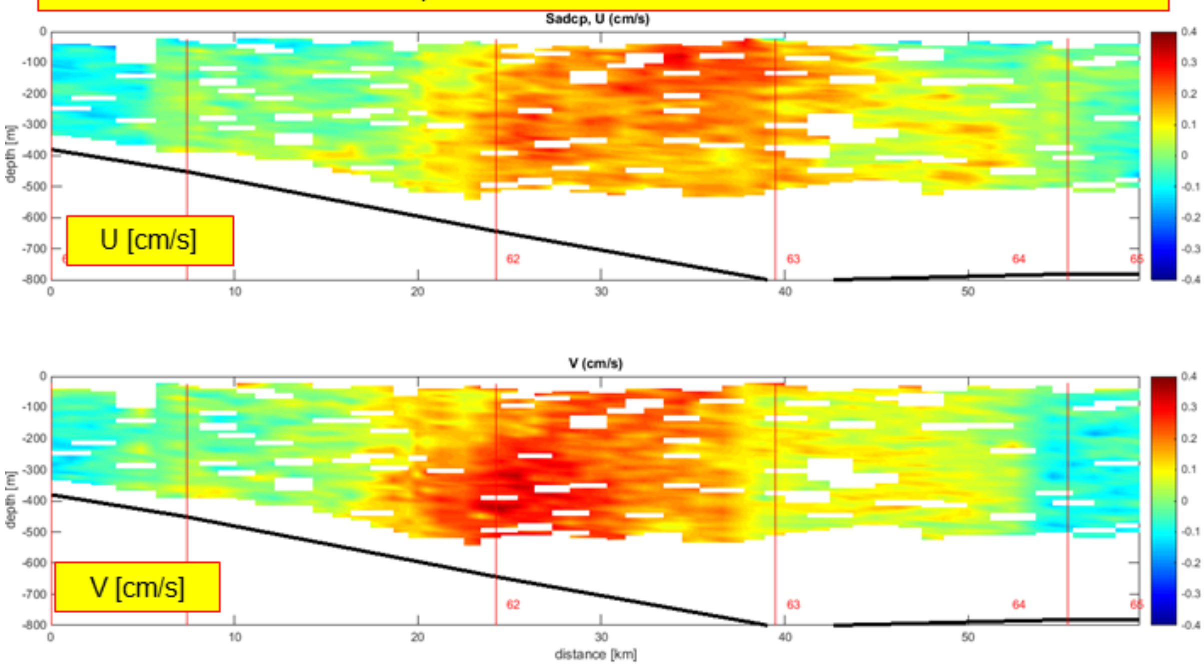
Coastal section (stations 60 to 65) around 76°25 S 33°W



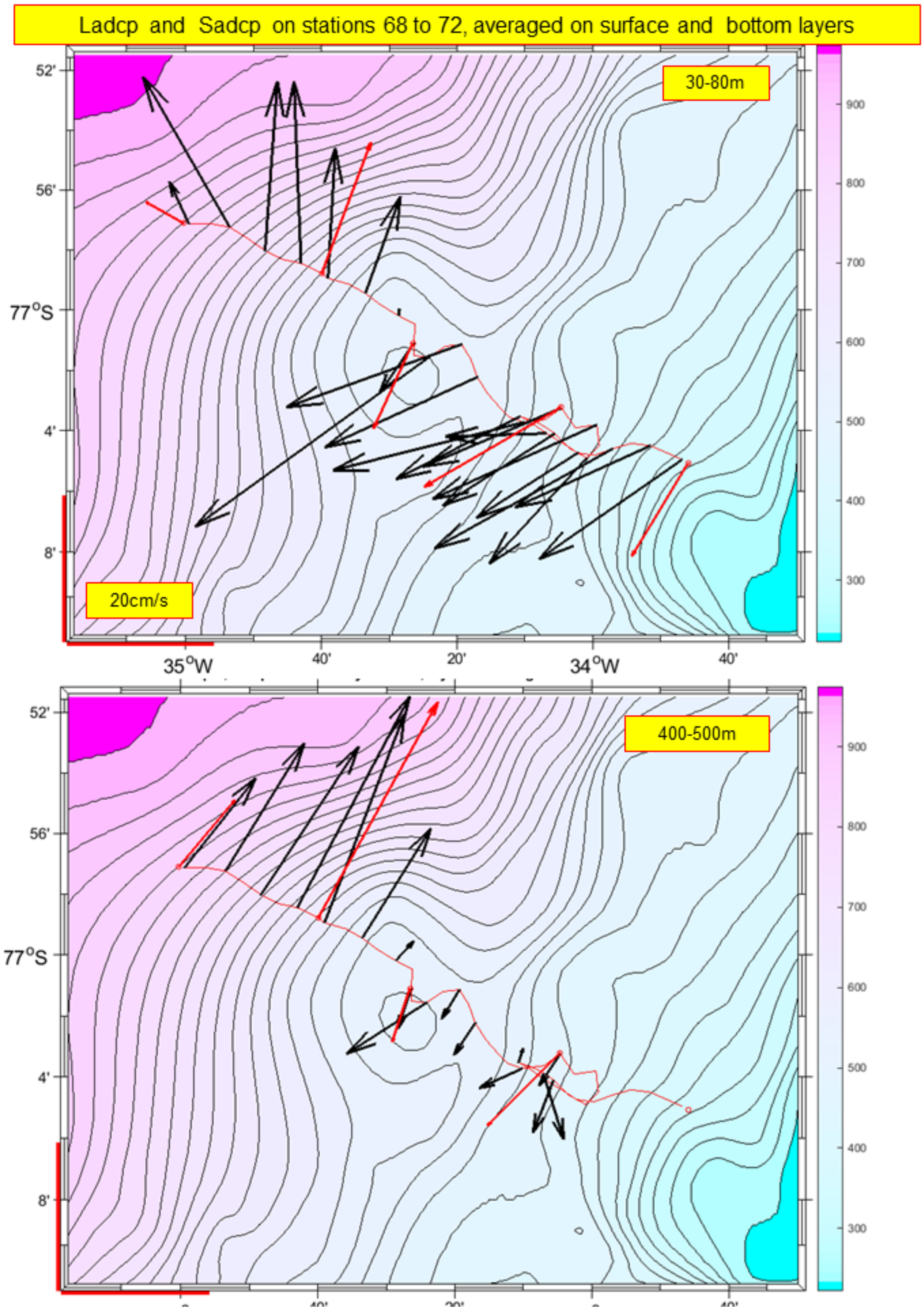
Ladcp constraint by Sadcp on stations 60 to 65



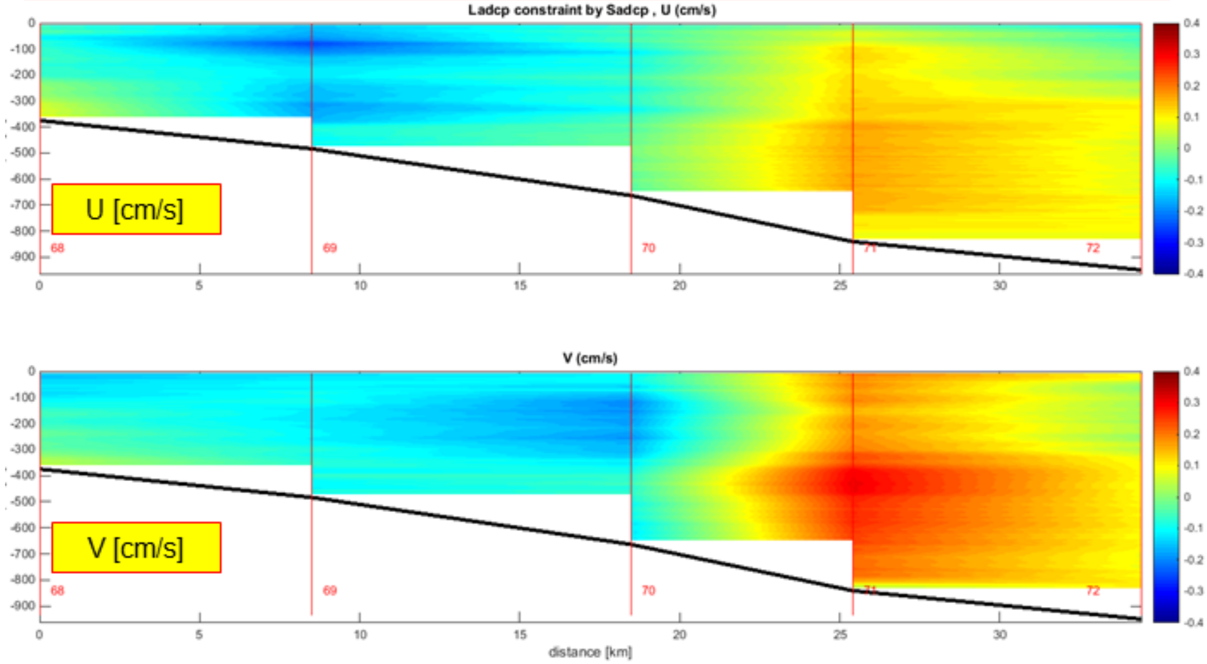
Sadcp on section btw stations 60 to 65



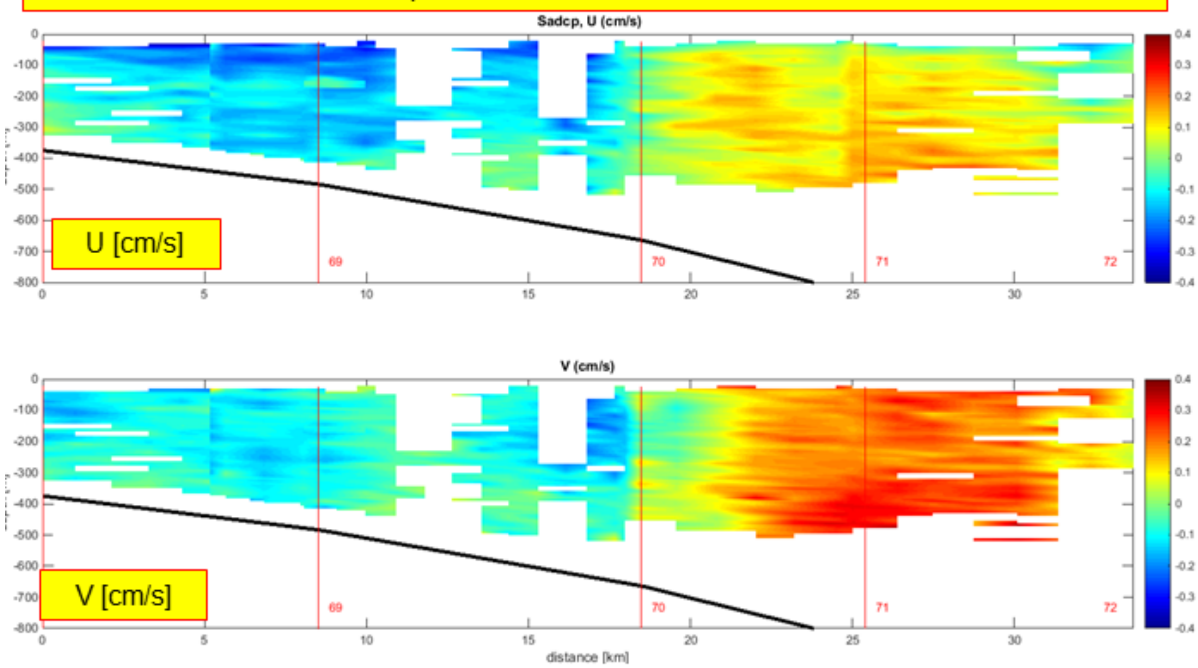
Coastal section (stations 68 to 72) around 77° S 34° 30W



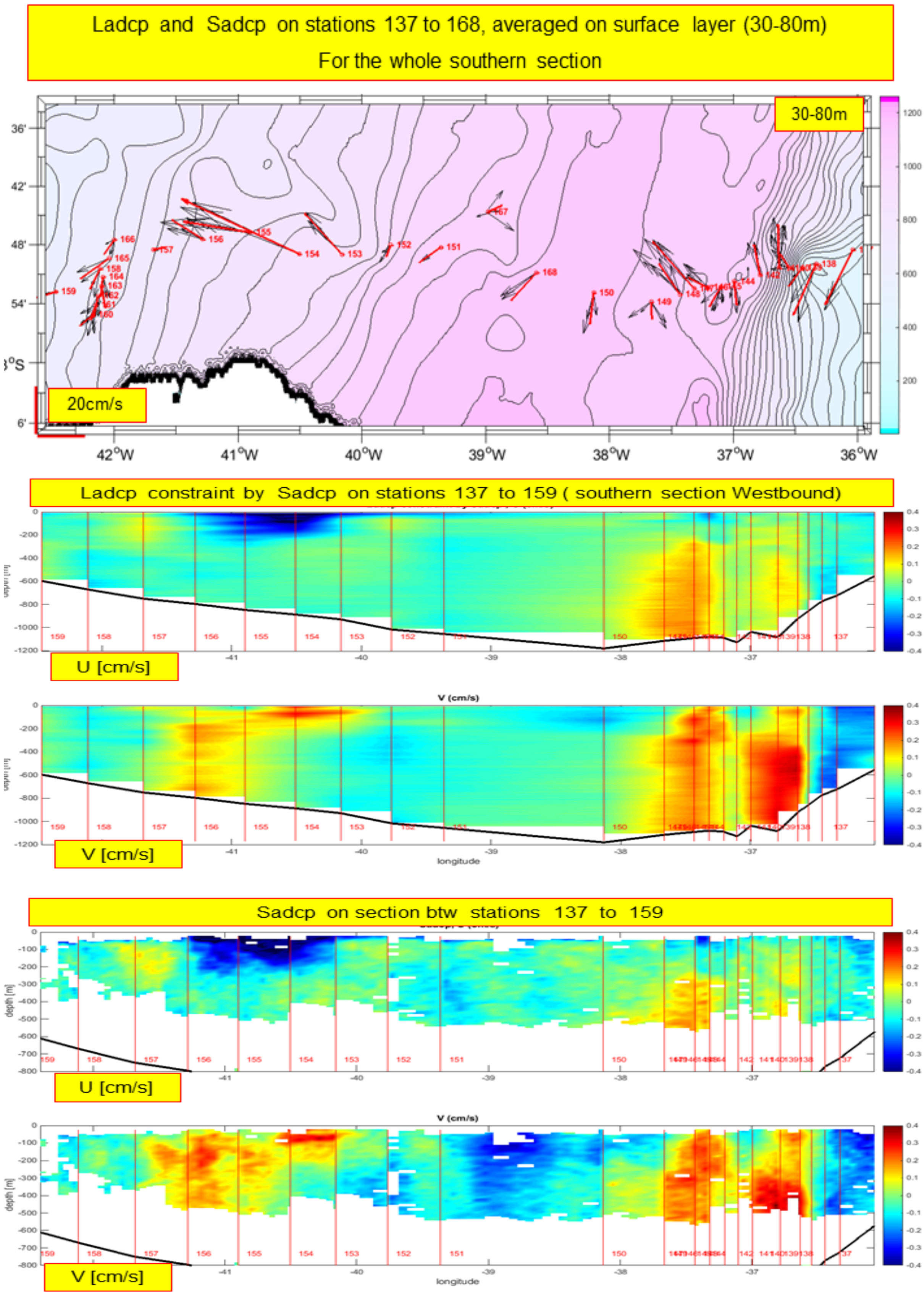
Ladcp constraint by Sadcp on stations 68 to 72



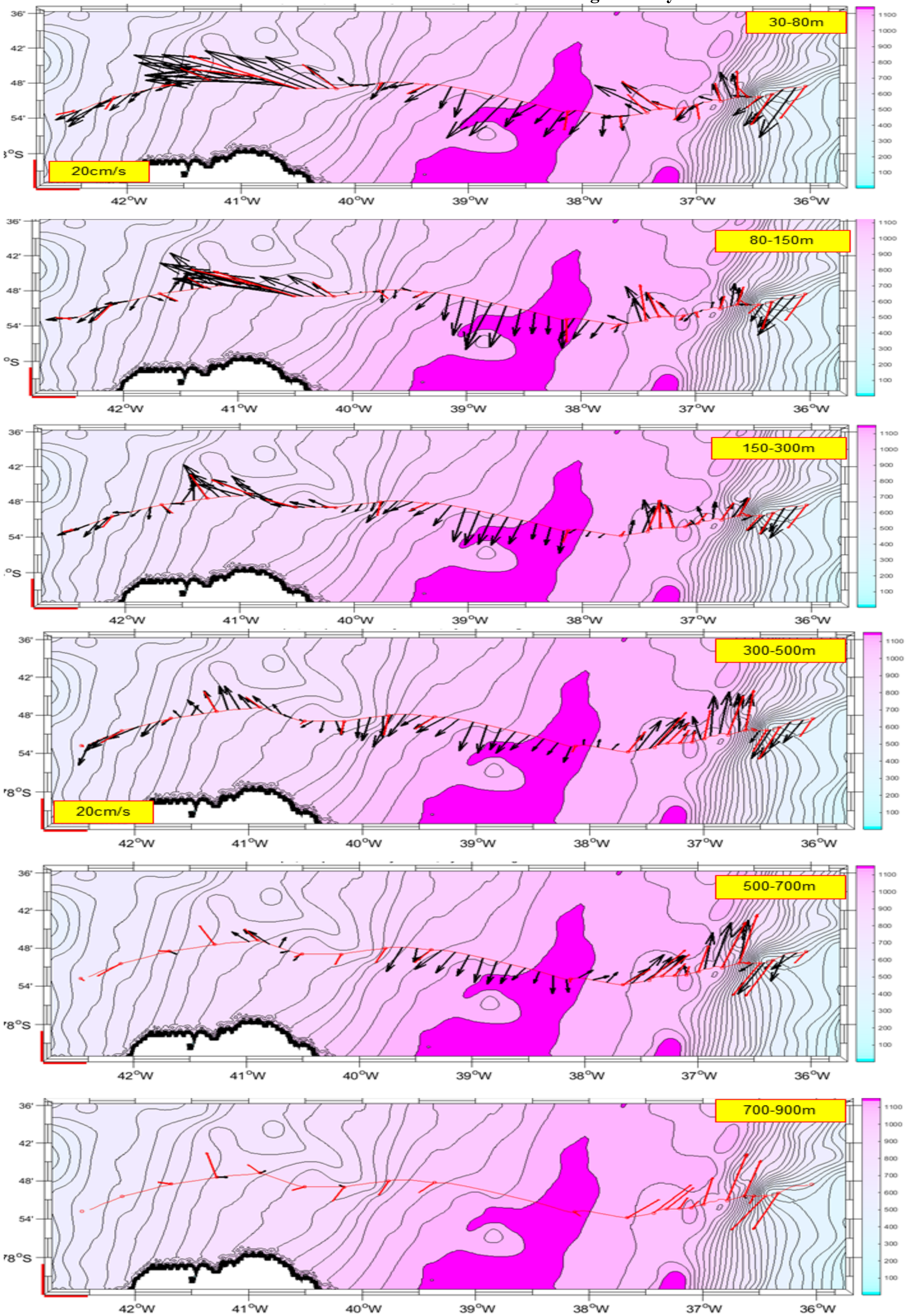
Sadcp on section btw stations 68 to 72



Zonal southern section (stations 137 to 168) around 77+45 S



SADCP and LADCP vectors for southern section westbound averaged on layers from surface to 900m



4.2.6 SADCP/LADCP profiles on the yoyo station

4.2.6.1 Yoyo station

Position: 77°S 46.627 35°W 44.159,
Bathymetry: average 445m (from bottom track /altimeter/P CTD)
Duration: ship steady on position, stuck in the pack ice from 15/02/2017 21:35 to 17/02/2017 09:30. CTD/LADCP profiles from 15/02/2017 23:19 (profile 073) to 16/02/2017 15:00 (profile 091).

4.2.6.2 CTD/LADCP/SADCP protocols

CTD/Rosette was deployed for 3 successive yoyos from surface to 10m above bottom at 0.5 m/s vertical velocity (approximate 90mn) , then hauled on deck for 30mn for LADCP file download and battery charging , then back to water for the next session of 3 yoyos .

After each Yoyo, a new CTD file was created (profiles 73 to 91) while LADCP data were only downloaded every 3 yoyos . Ladcp raw files were later splitted into individual profiles files, using *BBsplice*

LADCP configuration: WH 300khz up and downlookers, synchronized, 25 x 8m bins , pinging rate 1 Hz , WM15 mode (Ladcp/narrowband), blank size = 0.

SADCP configuration: OS 75khz, non-synchronized, 8m bins, Bottom track 800m, narrow band. SADCP was pinging continuously during the whole station (36hrs).

4.2.6.3 LADCP process and results

LADCP raw files were processed using CTD data for P and navigation (the ship was strictly stuck in the pack ice with no significant drift during the 14h of yoyos). Bottom track was obtained for every profile. Joint with the slow ascent/descent velocity, those lead to good quality on profiles: median error velocity =3.9 cm/s *(figure 4.2.4).*

U and V profiles contours appear on *figure 4.2.6*

LADCP (non constraint) profiles were then compared to simultaneous SADCP profiles, looking at offset on modules and azimuths on the vectors for each bin of the 19 profiles. Histograms appear on *figure 4.2.5*. Median values for those offset are small*, which means that SADCP and LADCP, as independent data, are in very good correlation.*

The same conclusion appears when comparing the UV contours for LADCP *(figure 3)* and SADCP *(figure 4.2.7), or* the vertical profiles for 2 examples (profiles 80 and 88, *figure 6).* The same patterns appear clearly for SADCP and LADCP data, although slightly more noisy for SADCP.

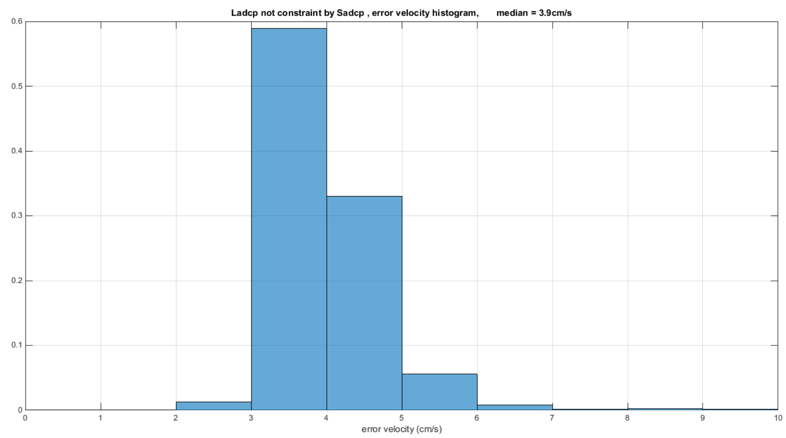


Figure 4.2.4: error velocities distribution on all bins of the 19 LADCP profiles , mean =3.9 cm/s

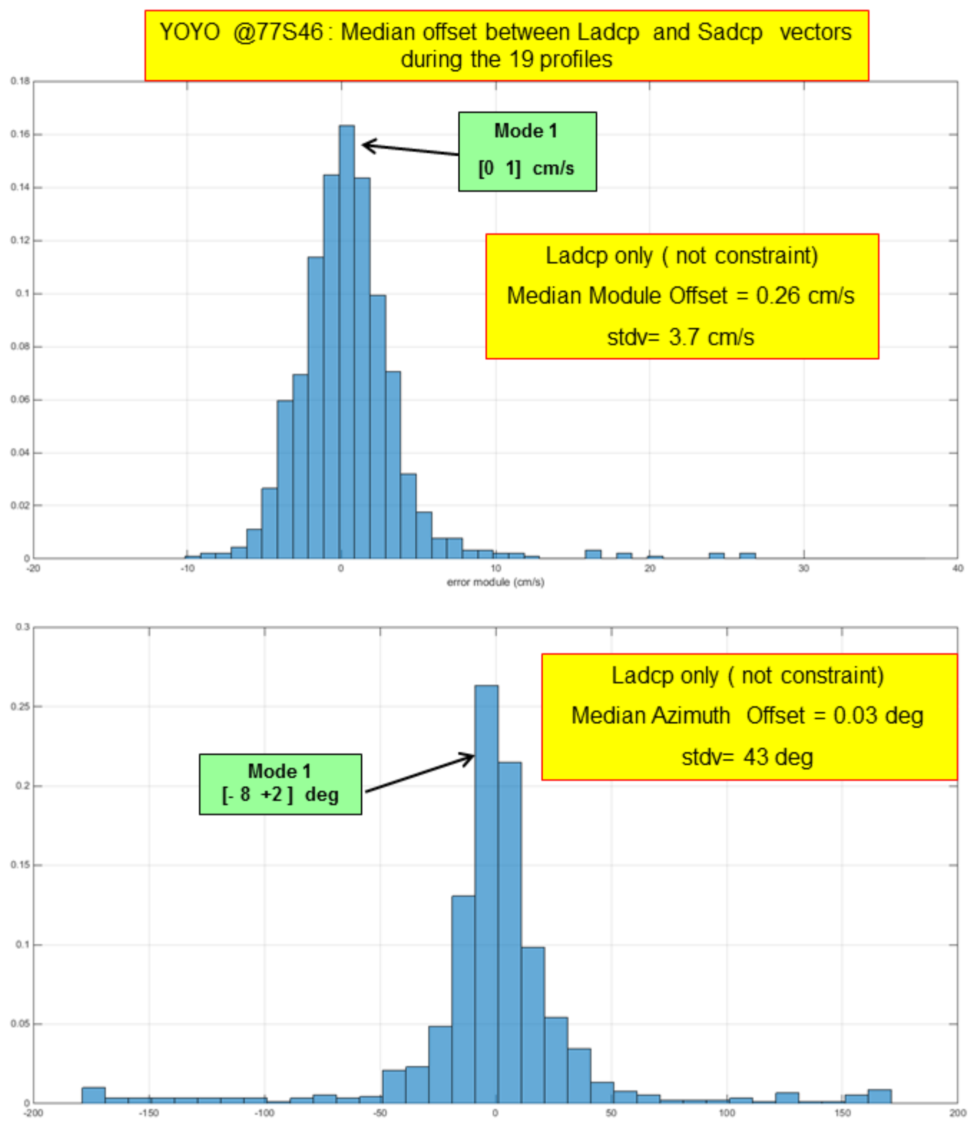


Figure 4.2.5: offset distributions on (SADCP-LADCP) vectors for all bins of the 19 LADCP profiles

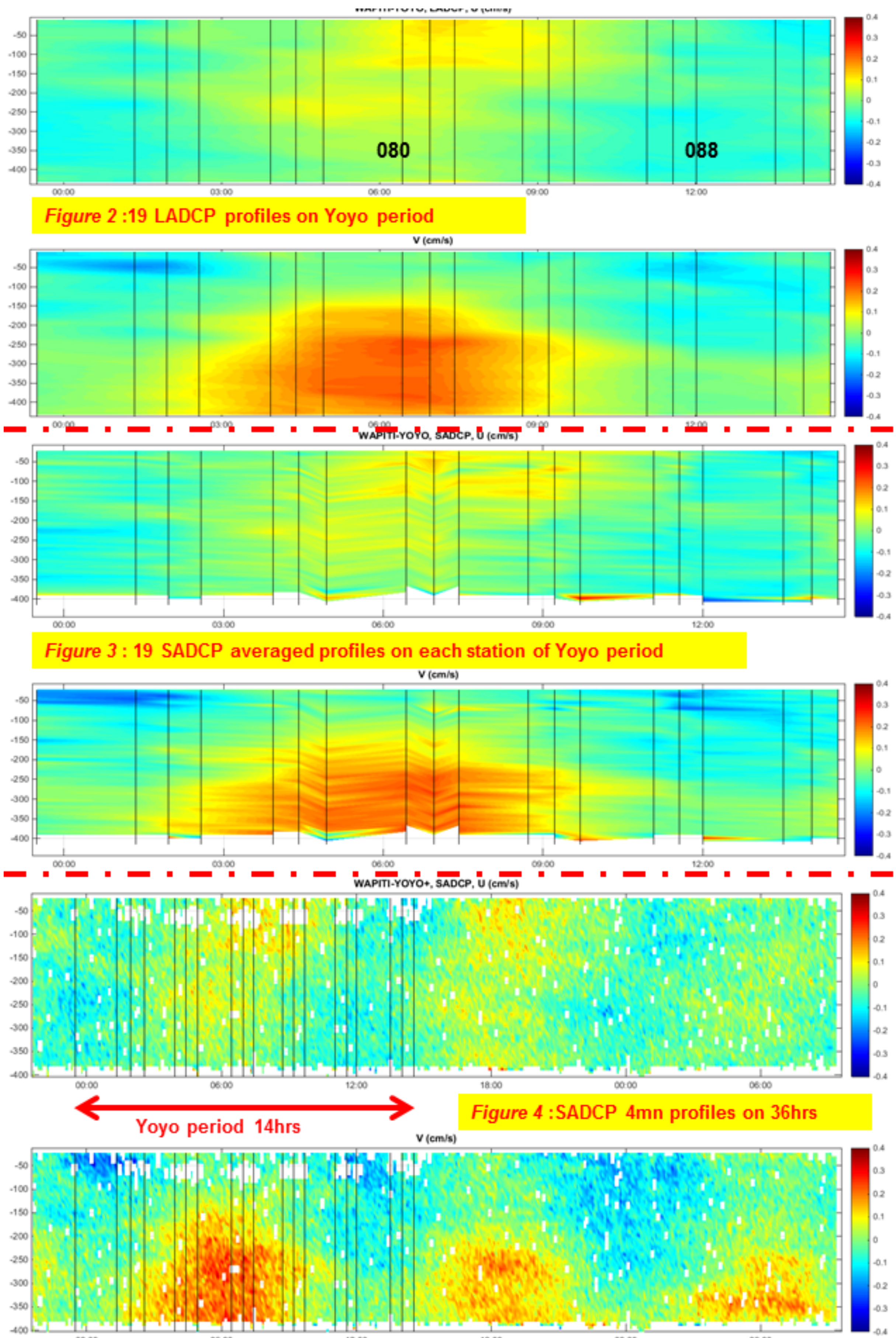


Figure 4.2.6: SADCP and LADCP non constraint UV profiles on YOYO station

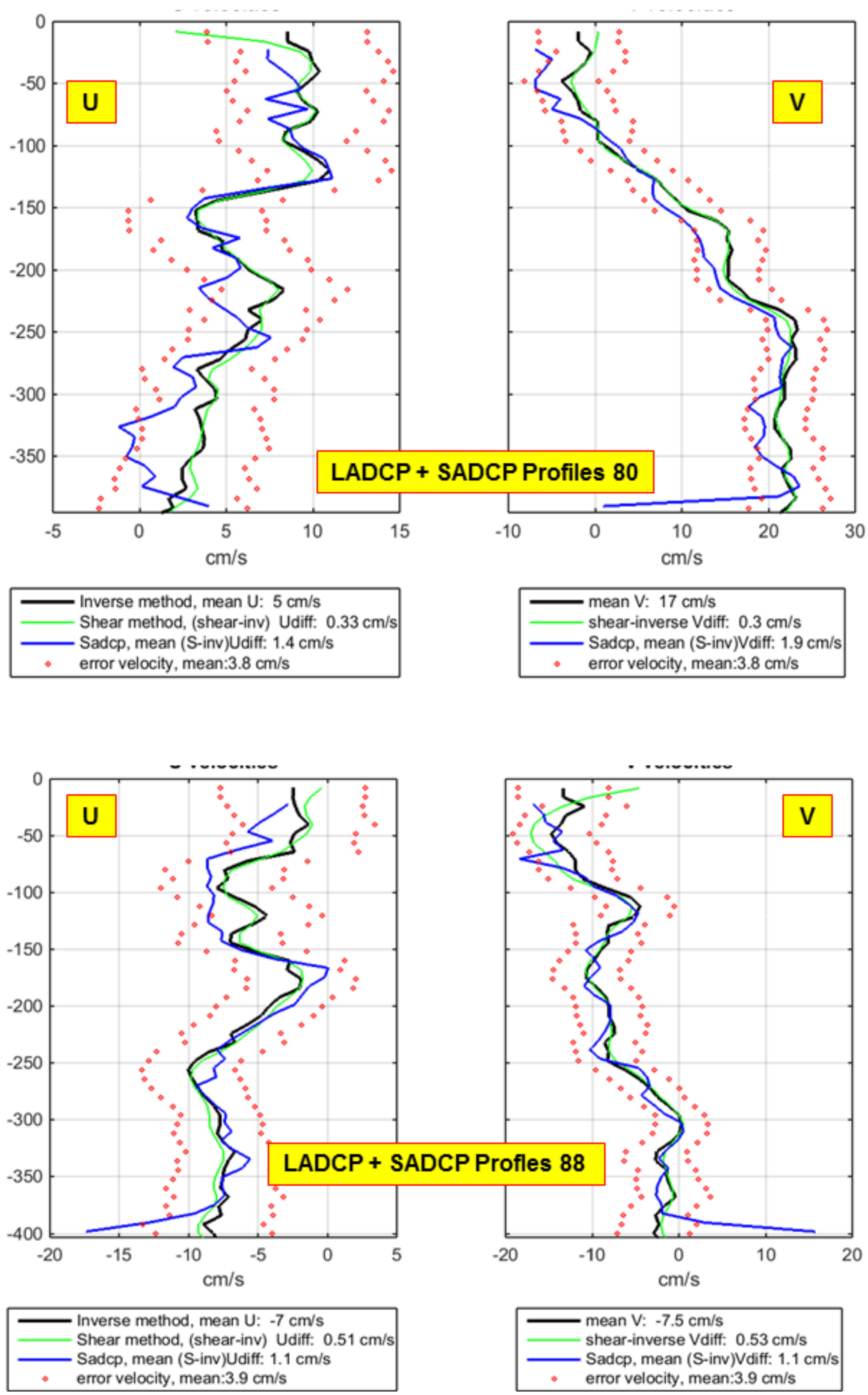


Figure 4.2.7: SADCP and LADCP non constraint UV profiles 80 and 88.

4.2.6.4 SADCP process and results

Since we have permanent bottom track and very steady attitude parameters (ship stuck in ice at constant position), SADCP data are very consistent, and well correlated with LADCP as seen in the previous chapter.

Using STA files output from *VMDAS* (short time average 2mn), *CASCADE [ref 1]* produces a station files with coherent corrections, with profiles averaged every 240 s. UV contours along the 36hrs appear on *figure 4.2.8.*

The 19 LADCP cast times appear at the beginning of session (vertical black lines): blank bins in the SADCP profiles appear in the upper layer (30-80m), time correlated with those LADCP casts, meaning that the OS75 got acoustic interferences from the WH 300k uplooker or false targets from the rosette. Those noisy bins were then rejected by the CASCADE processing. This issue will need further investigation in the final process.

We used the barotropic tidal model TPXO 7.2 to produce tidal current signal on the whole station (*figure 7 upper).* At first view the semi-diurnal harmonic (M2) seems predominant and roughly correlated with the SADCP time series.

We compare the tidal signal with SADCP vectors averaged on the upper layer *(figure 4.2.9)* and near bottom layer *(figure 4.2.10).* In both cases SADCP signal looks roughly correlated with the semi-diurnal tidal signal. But a tentative to remove tidal stream from SADCP total current is non-significant *(lower graphs on fig 8 & 9):* the "detided" signals keep a strong semi-diurnal component.

This is probably caused by the tidal model itself: TPXO 7.2 is a global model at ¼ deg resolution. It takes 10 harmonic components, issued from altimetry only. Hence the model is known to be useless in coastal areas, especially when local bathymetry is badly defined. Which was exactly the case on our Yoyo position.

Therefore a local (more accurate) tidal model must be used for this study

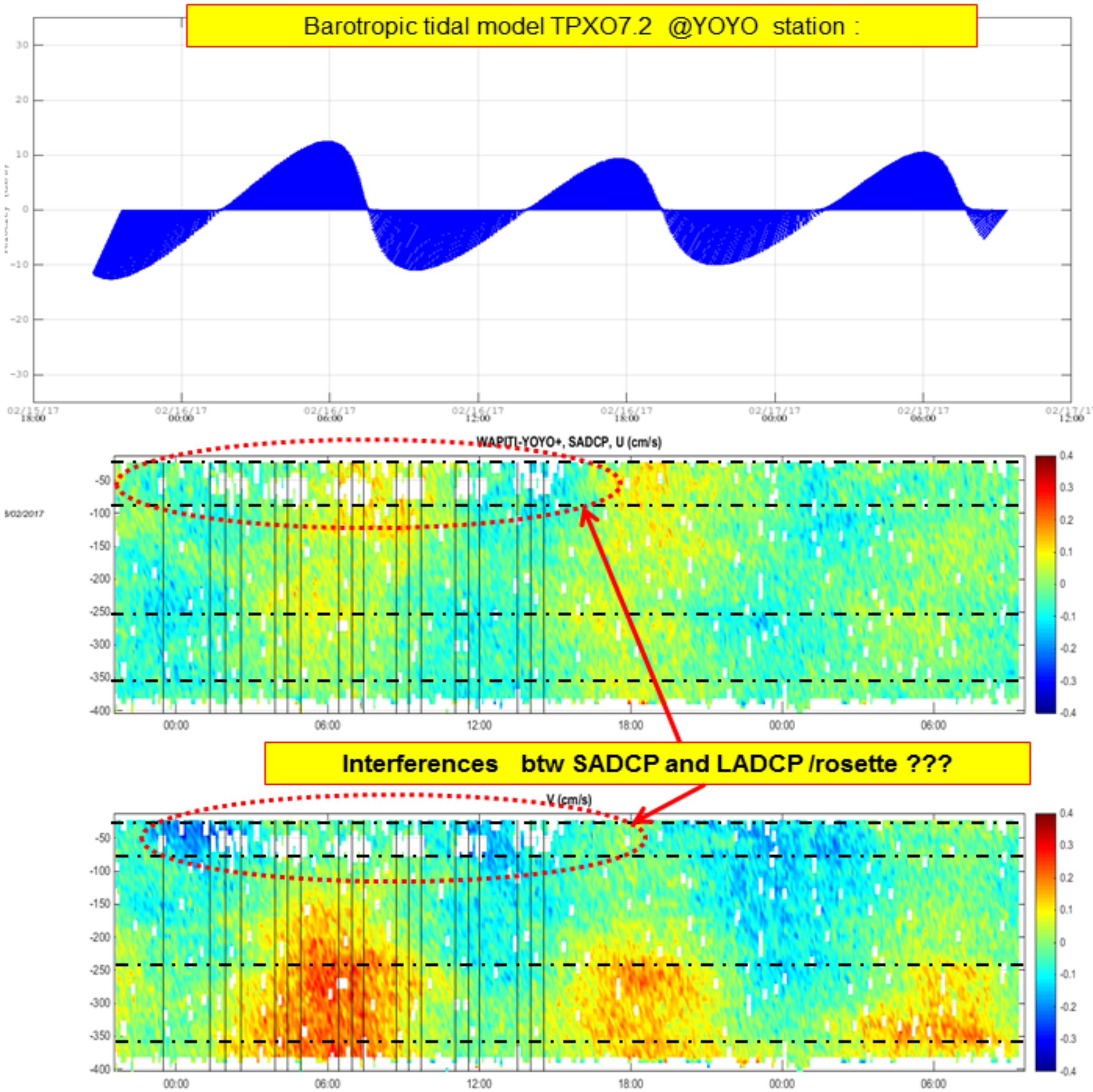


Figure 4.2.8: UV contours for SADCP profiles averaged every 240s on the whole 36h period on station (Yoyo 14h + stand-by). Tidal signal on the period from barotropic model TPXO7.2

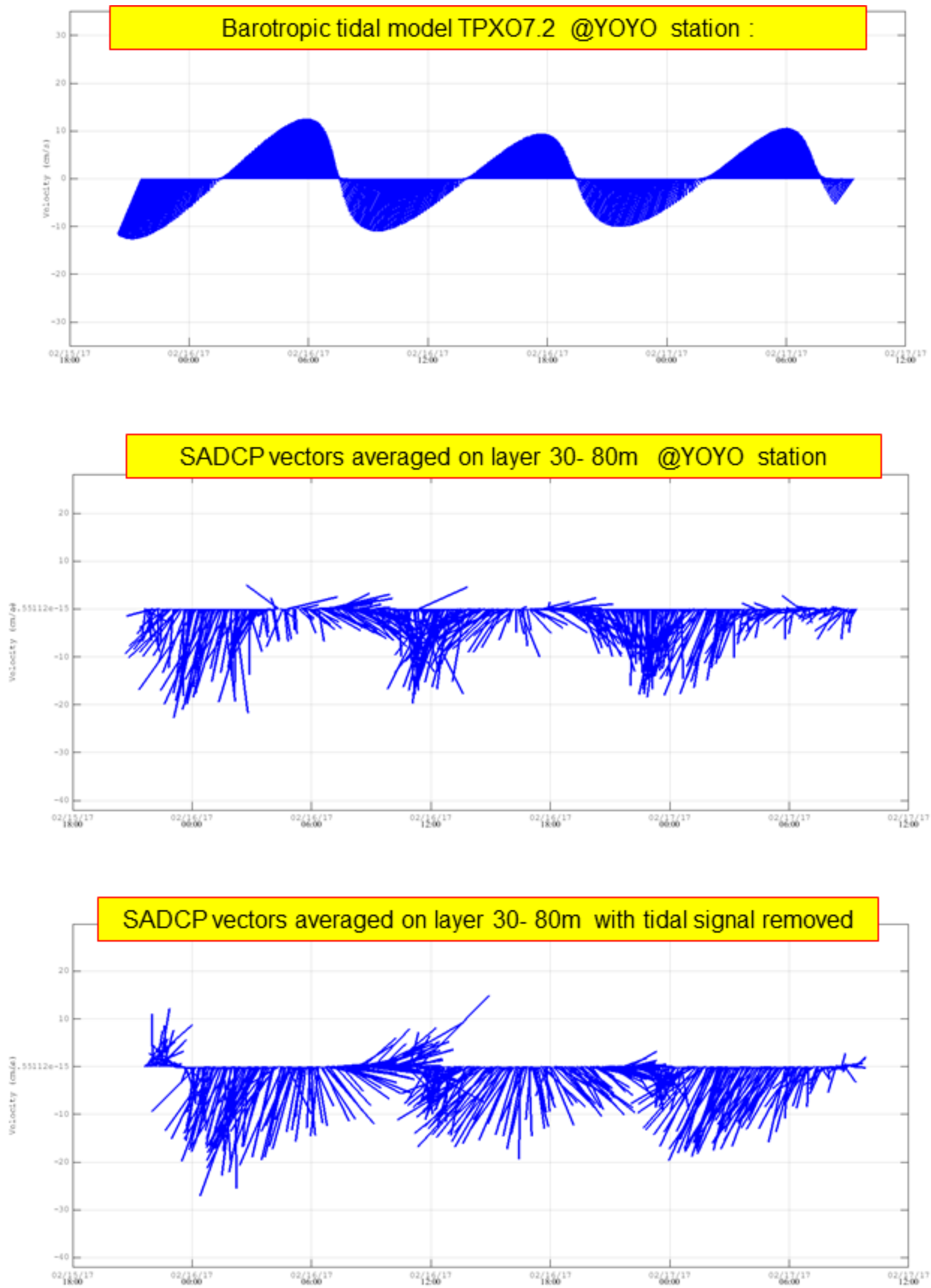


Figure 4.2.9: time series for SADCP vectors averaged on the upper layer (30-80 m). Full SADCP signal (medium graph) and detided signal (SADCP - Tide, lower graph).

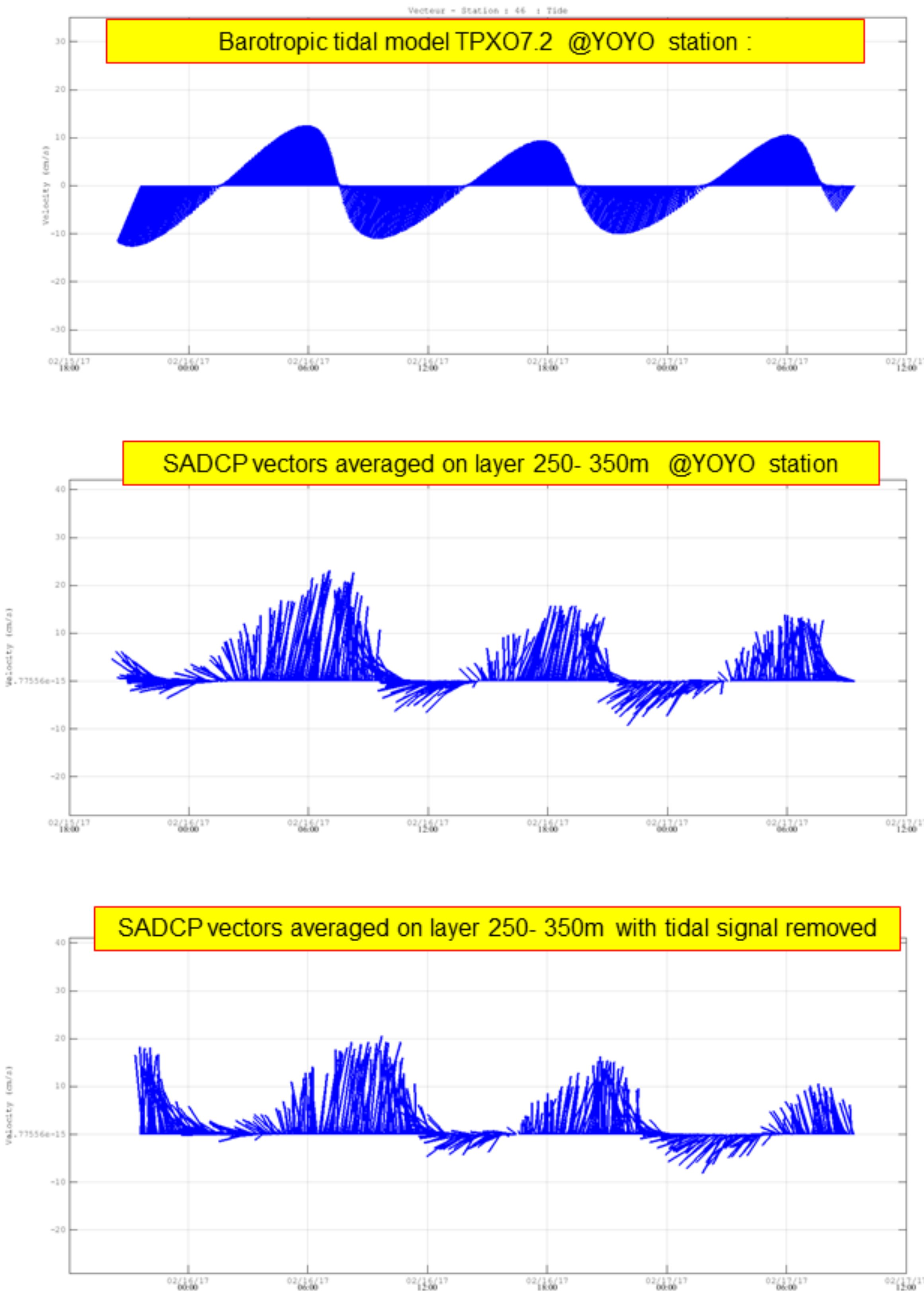


Figure 4.2.10: time series for SADCP vectors averaged on the lower layer (250-350 m). Full SADCP signal (medium graph) and detided signal (SADCP - Tide, lower graph).

4.2.7 SADCP/LADCP profiles on the Southern Orkneys section

This is a last minute add, before ending the cruise. Passing East of S. Orkneys on the way back, we deployed 2 Provor profilers equipped with DVL. Two CTD/LADCP stations (174-175) were achieved just before deployments in order to calibrate the profilers CTD sensors and assess the full depth current on site as those floats are designed to fly near sea bottom .

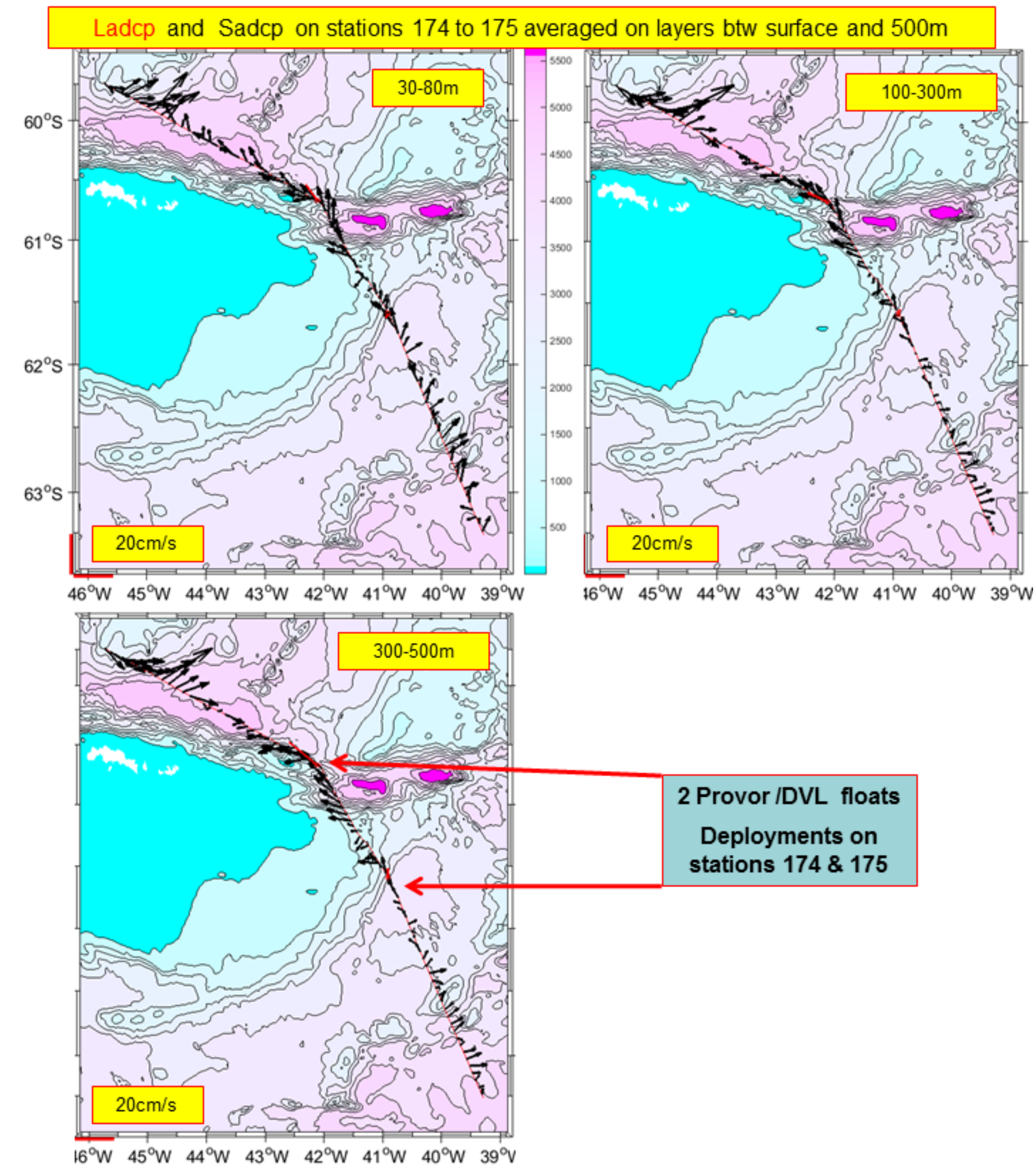


Figure 4.2.11: SADCP vectors on section averaged at 3 depths (0 to 500m) in the area where floats were deployed on 08 march 2017.

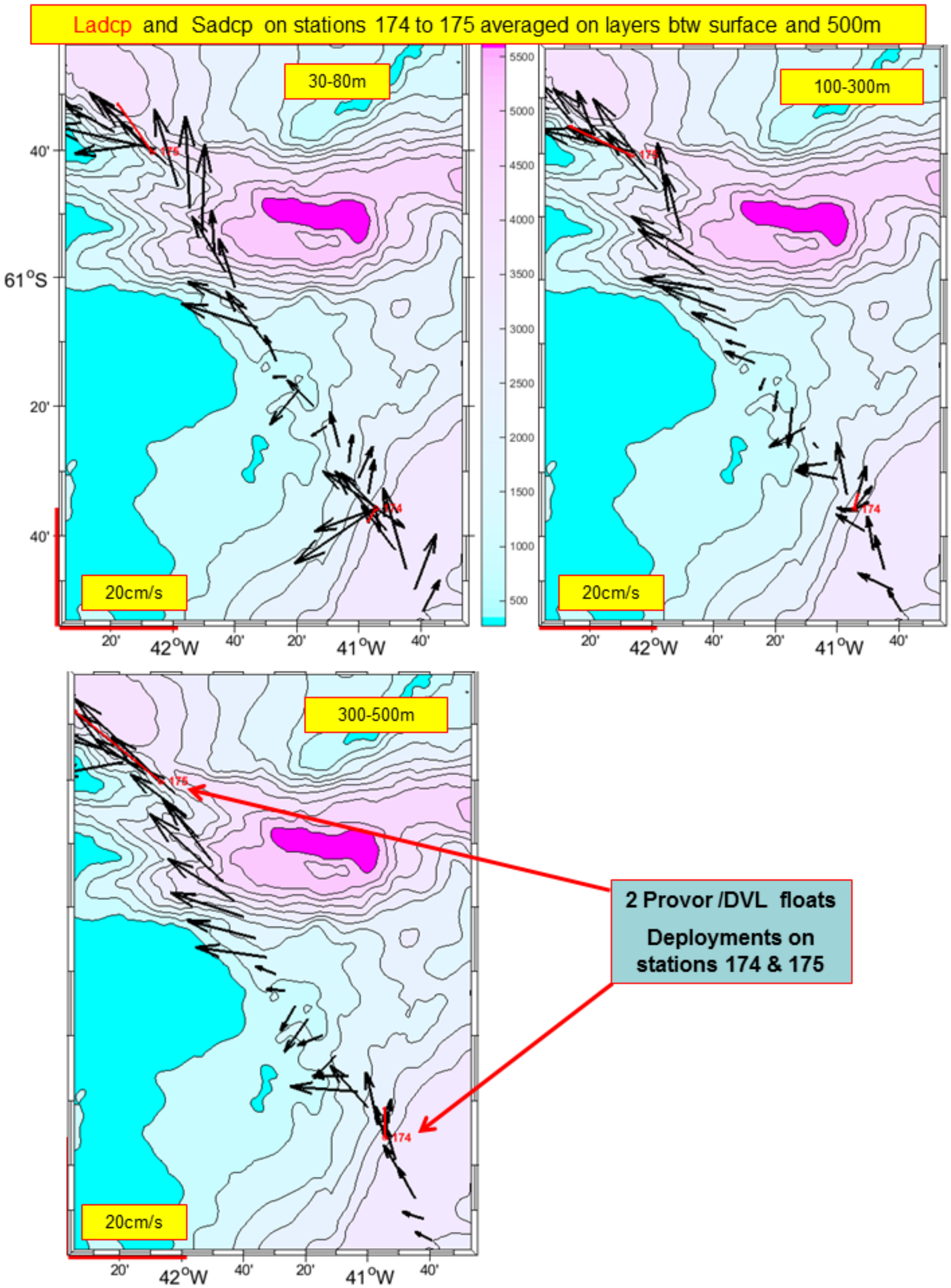


Figure 4.2.12: SADCP vectors on section and SADCP/LADCP vectors on stations 174 and 175 (zoom)

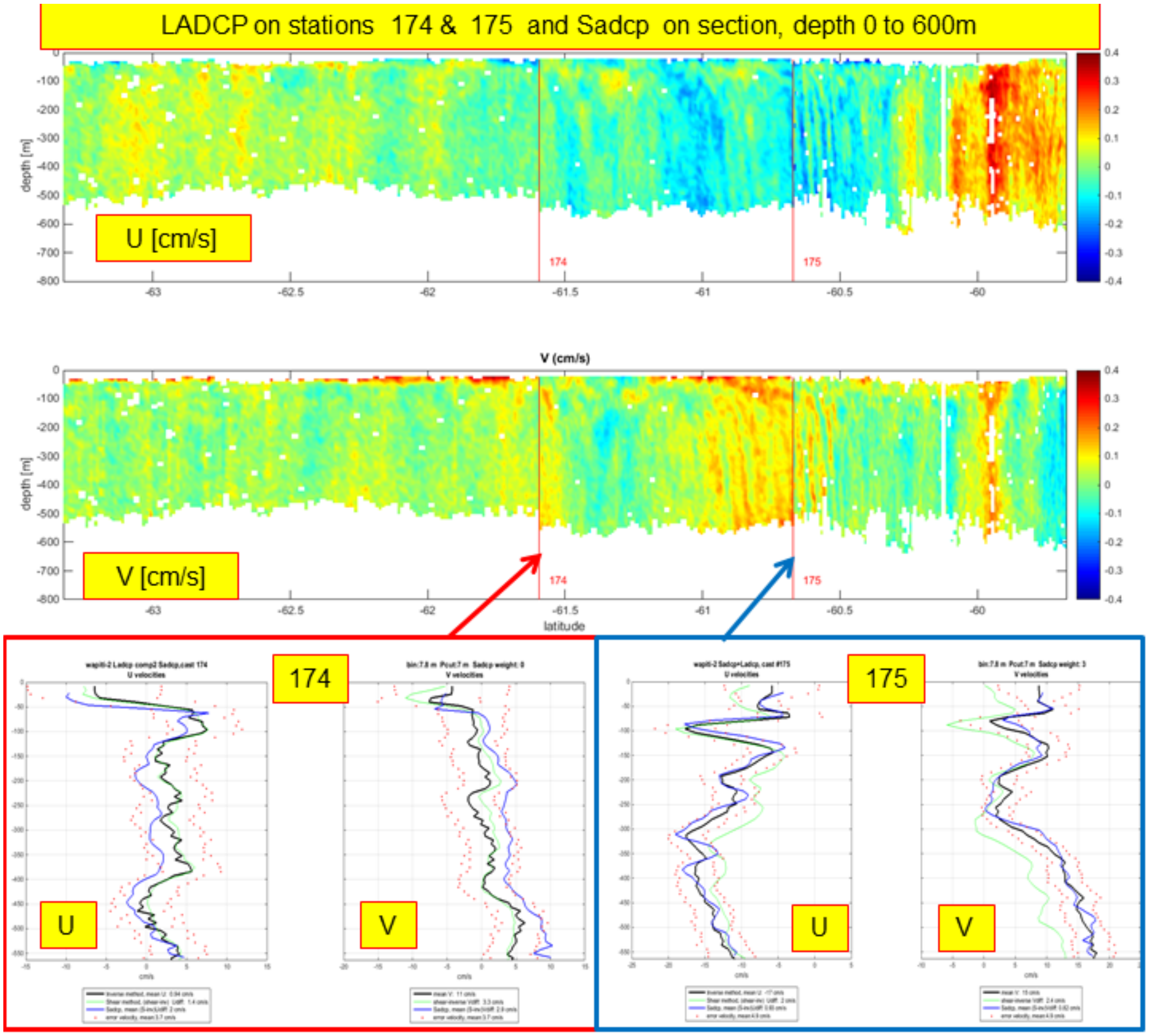


Figure 4.2.13: SADCP UV contours on section and SADCP/LADCP vertical profiles on stations 174 and 175, for SADCP max range (600m). Correlation between LADCP and LADCP profiles is not great on station 174, but good on station 175.

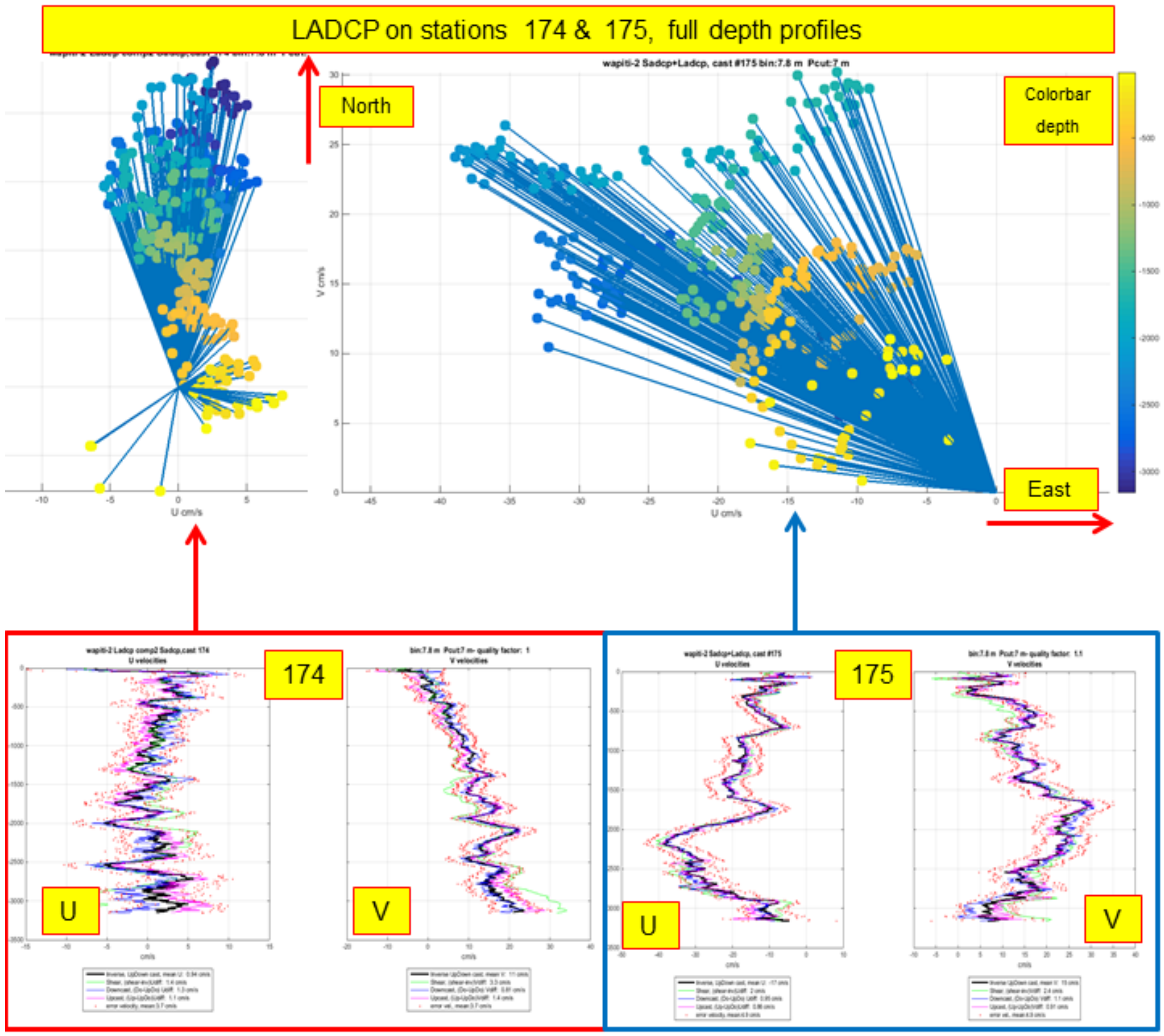


Figure 4.2.14: LADCP 2D vectors and vertical profiles on stations 174 and 175 , from surface to sea bottom

Bottom was found (bottom track and CTD altimeter @10m above bottom) at 3160 m (sta 174) and 3170 m (sta 175) which is in good accordance with the GEBCO bathymetry on each sides of the slope (*figure 4.2.12*).

Near bottom current (dark blue vectors on ***Figure 4.2.14)*** is heading NNE around 25cm/s on station 174, and NW around 40cm/s on station 175. In both cases those powerful bottom currents are approximately tangential to the isobaths.

4.2.8 Deliverable

4.2.8.1 Processed files :) : all non detided files

A23 section (Leg1)

25 LADCP-only profiles (03 to 32), file name (structure) : *LADCP_A23.mat*

WAPITI sections (Leg2): all QC validated files

135 LADCP profiles (33 to 175) constraint with SADCP , file name (structure) : *LADCP_Leg2.mat*
SADCP profiles @240s on all stations (33 to 175), file name (structure) : *SADCP_stations_Leg2.mat*

4.2.8.2 Raw files (Leg1 +Leg2)

XXX= [003 to 175]
LADCP master dowlooker : MAXXX000.000
LADCP slave uplooker : SLXXX000.000
CTD files : JR16004_XXX.cnv

YY = [07 to 36]
SADCP raw STA file from VMDAS : JR160040YY_000000.STA

References

[1] P.le Bot, C. Kermabon, P.Lherminier, F.Gaillard , "Cascade V6.1:Logiciel de validation et de visualisation des mesures ADCP de coque , document utilisateur et maintenance » *, Rapport OPS/LPO 11-01*

[2] A.M. Thurnherr, "How to process LADCP data with the LDEO Software (Versions IX.7-IX.10)» *, Internal report march 2014*

4.2.9 Appendix 1: LADCP deployment scripts

```
;======================================================================
;               M A S T E R . C M D
;               doc: Tue Jun 15 11:46:07 2004
;               dlm: Fri Jan  7 23:25:34 2011
;               (c) 2004 A.M. Thurnherr
;               uE-Info: 22 1 NIL 0 0 72 2 2 8 NIL ofnI
;======================================================================
; This is the default master/downlooker command file
; NOTES:
;   - this version requires firmware 16.30 or higher
;   - should contain only commands that change factory defaults
;   - assumes that WM15 (LADCP) mode is installed
;   - collect data in beam coordinates
;   - staggered single-ping ensembles every 1.3s/1.5s
;   - narrow bandwidth
;   - 25x 8m cells

; HISTORY:
;   Jan  7, 2011: - created for Firmware 16.30 or higher from old version
;                 - increased pinging rate
; Jan 2017 : Reset to factory Settings:
CR1
$D2
;Jan 2007 : Rename the scripts. Watch for truncating. I think it only allows for 5 charachters.
RN MA173
$D2
; Jan 2017 : Added following command to update/sync time with the PC time. Ensure that PC is updated with NTP source, otherwise the benefit is lost.
$T
WM15                    ; water mode 15 (LADCP)
TC2                     ; ensembles per burst
```

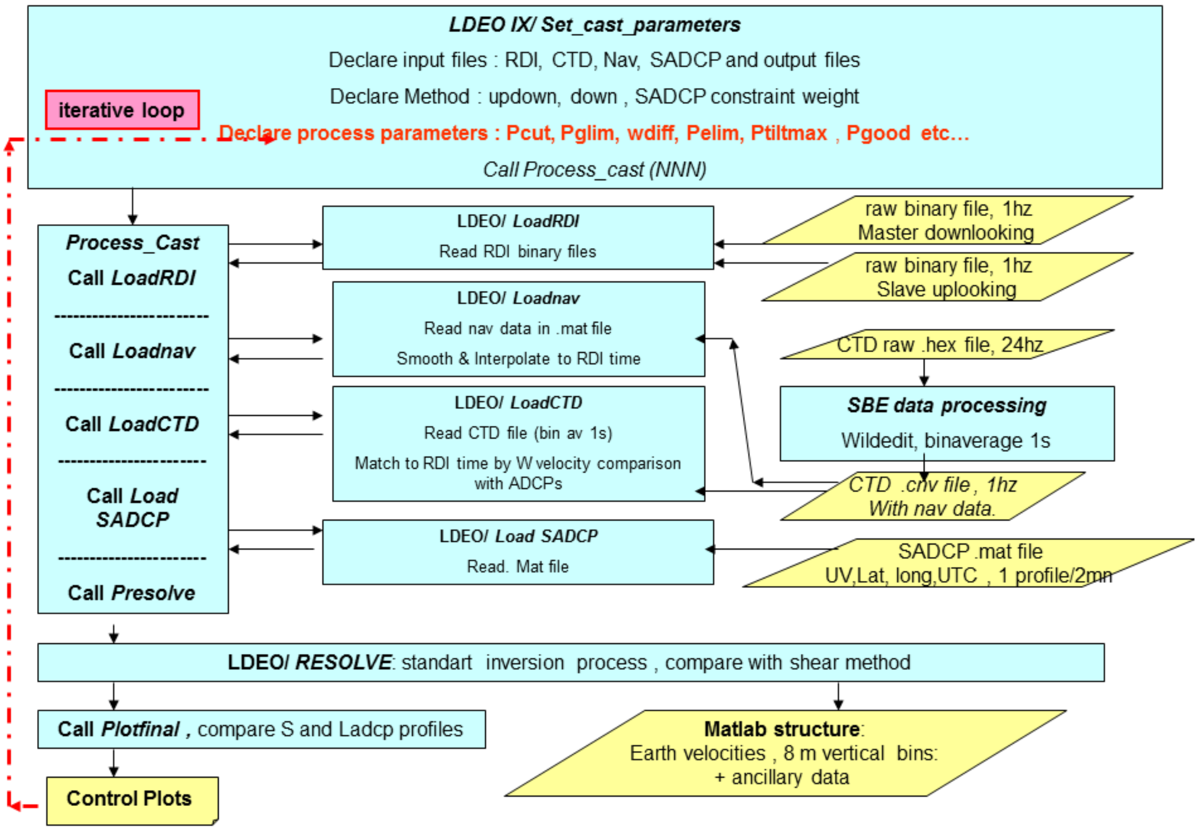
```
LP1                     ; pings per ensemble
TB 00:00:02.80          ; time per burst
TE 00:00:01.30          ; time per ensemble
TP 00:00.00             ; time between pings
LN25                    ; number of depth cells
LS0800                  ; bin size [cm]
LF0                     ; blank after transmit [cm]
LW1                     ; narrow bandwidth LADCP mode
LV400                   ; ambiguity velocity [cm/s]
SM1                     ; master
SA011                   ; send pulse before each ensemble
SB0                     ; disable hardware-break detection on Channel B (ICN118)
SW5500                  ; wait .5500 s after sending sync pulse
SI0                     ; # of ensembles to wait before sending sync pulse
EZ0011101
; Sensor source:
;       - manual speed of sound (EC)
;       - manual depth of transducer (ED = 0 [dm])
;       - measured heading (EH)
;       - measured pitch (EP)
;       - measured roll (ER)
;       - manual salinity (ES = 35 [psu])
;       - measured temperature (ET)
EX00100
; coordinate transformation:
;       - radial beam coordinates (2 bits)
;       - use pitch/roll (not used for beam coords?)
;       - no 3-beam solutions
;       - no bin mapping
CF11101
; Flow control:
;       - automatic ensemble cycling (next ens when ready)
;       - automatic ping cycling (ping when ready)
;       - binary data output
;       - disable serial output
;       - enable data recorder
CK                      ; keep params as user defaults (across power failures)
CS                      ; start pinging
; Jan 2017: Added following line. Assumed that this supresses the output from device.
$1

;======================================================================
;          S L A V E . C M D
;          doc: Tue Jun 15 11:46:07 2004
;          dlm: Fri Jan  7 23:25:28 2011
;          (c) 2004 A.M. Thurnherr
;          uE-Info: 22 1 NIL 0 0 72 2 2 8 NIL ofnI
;======================================================================
; This is the default slave/uplooker command file
; NOTES:
;   - this version requires firmware 16.30 or higher
;   - contains only commands that change factory defaults
;   - assumes that WM15 (LADCP) mode is installed
;   - collect data in beam coordinates
;   - single-ping ensembles; timing determined by [MASTER.cmd]
;   - narrow bandwidth
;   - 25x 8m cells
; HISTORY:
;   Jan  7, 2011: - created for Firmware 16.30 or higher from old version
;                 - increased pinging rate
```

```
; Jan 2017 : Reset to factory Settings:
CR1
;Jan 2007 : Rename the scripts. Watch for truncating. I think it only allows for 5 charachters.
RN SL173
; Jan 2017 : Added following command to update/sync time with the PC time. Ensure that PC is updated with
NTP source, otherwise the benefit is lost.
$T
WM15                    ; water mode 15 (LADCP)
LP1                     ; pings per ensemble
TP 00:00.00             ; time between pings
TE 00:00:00.00          ; time per ensemble
LN25                    ; number of depth cells
LS0800                  ; bin size [cm]
LF0                     ; blank after transmit [cm]
WB1                     ; narrow bandwidth mode 1 (not sure if required)
LW1                     ; narrow bandwidth LADCP mode
LV400                   ; ambiguity velocity [cm/s]
SM2                     ; slave
SA011                   ; wait for pulse before ensemble
SB0                     ; disable hardware-break detection on Channel B (ICN118)
EZ0011101
; Sensor source:
;       - manual speed of sound (EC)
;       - manual depth of transducer (ED = 0 [dm])
;       - measured heading (EH)
;       - measured pitch (EP)
;       - measured roll (ER)
;       - manual salinity (ES = 35 [psu])
;       - measured temperature (ET)
EX00100
; coordinate transformation:
;       - radial beam coordinates (2 bits)
;       - use pitch/roll (not used for beam coords?)
;       - no 3-beam solutions
;       - no bin mapping
CF11101
; Flow control:
;       - automatic ensemble cycling (next ens when ready)
;       - automatic ping cycling (ping when ready)
;       - binary data output
;       - disable serial output
;       - enable data recorder
CK                      ; keep params as user defaults (across power failures)
CS                      ; start pinging
; Jan 2017: Added following line. Assumed that this supresses the output from device.
$1
```

4.2.10 Appendix 2: LADCP data processing and quality analysis

LADCP raw files were processed with the code LDEO IX *[ref 2]* which solves LADCP profiles through both shear and inverse solutions . The inverse solution uses CTD data for P and navigation, bottom track (RDI and post-processed) and SADCP data when available . A flowheet for that process appears below:



After every cast a first run was launched without SADCP data for functional control and choice of the optimal inversion parameters for each individual LADCP-only profile : updown or downlooker only , elapsed or Julian time from CTD file, filters adjustments . Those parameters appear as comments in the list of Ladcp stations (*table 4.2.15*). They were then recorded in the *"set cast parameters"* file for further batch processing.

Once SADCP data have been processed, a second batch process was run in order to compare LADCP (non constraint) profiles with simultaneous SADCP profiles, looking at offset on modules and azimuths on the vectors for each bin of the compared profiles . Distribution histograms for those offsets recorded on the whole set of stations (33 to 173) appear in *figure 4.2.11*. Median and standart deviations are summarized in the following table:

(SADCP - LADCP) median offset for stations 33 to 173					
	Angle offset (deg)	Angle stdv (deg)	Module offset (cm/s)	Module stdv (cm/s)	Error velocity (cm/s)
Ladcp only	-0.91	36	-0.07	3.3	4.1
Ladcp constraint by SADCP	-0.09	24	0.07	1.3	4

Median values for offsets on Ladcp-only data are small*, which means that SADCP and LADCP, as independent data ,are in very good correlation .*

Constraining LADCP upper profiles with SADCP reduces significantly both medians and standart deviations on offsets, with a slight improvement on error velocities *(figure 4.2.12)*

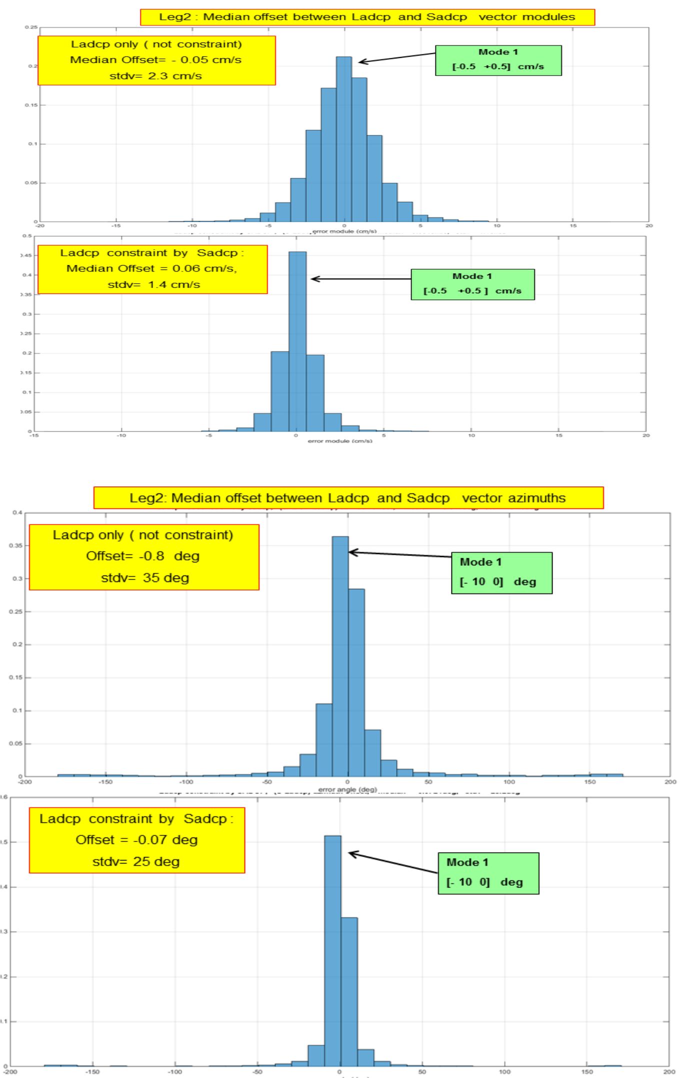


Figure 4.2.11: distributions of offsets on (SADCP-LADCP) vectors (all bins of all leg2 stations)

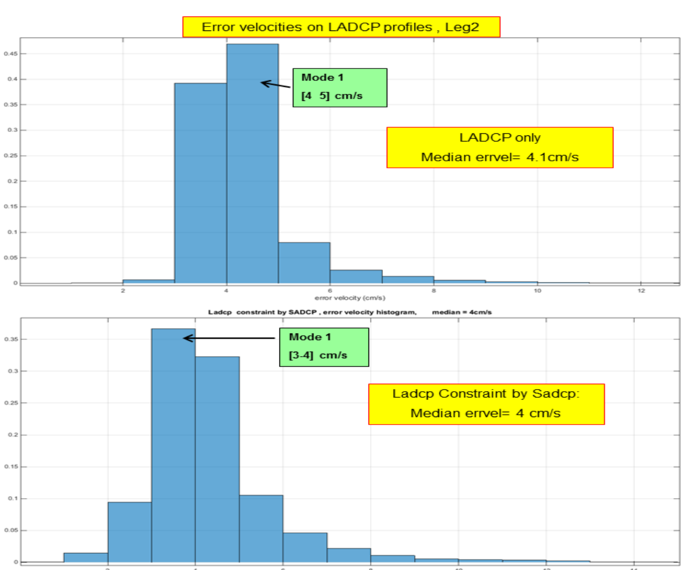


Figure 4.2.12: distributions of error velocities on LADCP vectors (all bins of all leg2 stations)

Time series for error velocities and offsets for each of the 139 Ladcp stations appear in *figure 4.2.14*. This allows analysing profiles quality and eventually discarding some of them:

- Stations 112-113-116-118 show very high values of module and angle offsets, as well as high error velocities on SADCP. During those stations of the crosslope 34°W section, SADCP was working poorly (no bttom track, probable icing on the transducer) inducing useless data. Therefore LADCP final data are NOT constrained by SADCP on those 4 stations (weight =0).

- Stations 67-109-110-159-164-169 show high values of module and angle offsets. SADCP profiles being not considered as useless, constraint is applied on LADCP with a lower weight (=1 instead of 3 , default value).

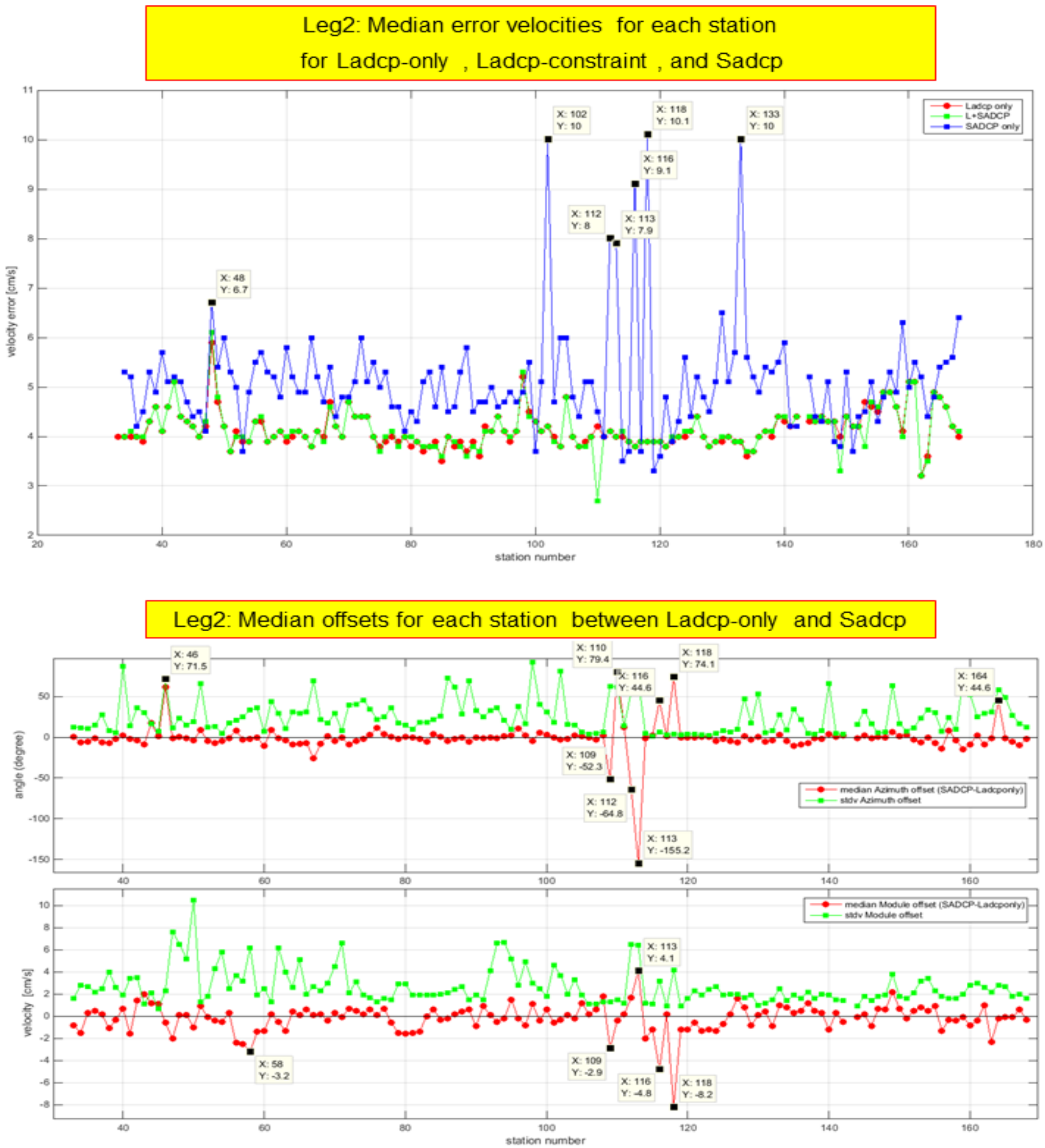


Figure 4.2.14: error velocities and offsets on (SADCP-LADCP) vectors averaged for each station of leg2

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Table 4.2.15 : Summary of all LADCP stations during Leg 2

LADCP +SADCP stations Leg2						error velocity [cm/s]			(Sadcp-Ladcp) offsets before constraint				Sadcp files	
sta	date UTC medium cast	Lati	Longi	cast depth [m]	bottom. [m]	Ladcp only	L+ Sadcp	Sadcp only	Angle offset (deg)	Module offset (cm/s)	Angle stdv (deg)	Module stdv (cm/s)	STA & mode	comments on LADCP process
33	8/2/17 21:45	-74,029	-28,09	2457	2462	4	4	3,7	-0,1	-1,2	3,4	0,8	16 WTK	
34	9/2/17 7:15	-75,202	-29,053	383	393	4	4	5,3	-6,1	-1,4	8,2	1,5	18 BTK	
35	9/2/17 8:39	-75,269	-28,905	393	404	4	4	5,2	-4,2	0,3	5,7	1,5		
36	9/2/17 10:02	-75,338	-28,738	404	414	4	4	4,2	-2	0,6	13,5	2,2		
37	9/2/17 11:20	-75,403	-28,592	423	434	3,9	4	4,5	-4,9	0,3	12,9	2,5		
38	9/2/17 16:42	-75,47	-28,461	411	422	4,3	4,3	5,2	-5,6	-1,3	7,3	1,3		CTD julian time
39	9/2/17 18:15	-75,537	-28,313	302	314	4,6	4,6	4,8	-0,9	-0,6	5,9	1,8		
40	10/2/17 2:02	-74,589	-26,014	508	521	4,1	4,1	5,7	-1,3	1,1	92,5	1,6		
41	10/2/17 3:38	-74,505	-26,115	491	503	4,6	4,6	5,1	-2,4	-1,4	6,8	1,8		
42	10/2/17 5:17	-74,462	-26,162	663	671	5,1	5,2	5,2	-3,1	1,6	12,8	1,7		
43	10/2/17 7:28	-74,424	-26,231	1471	1483	4,4	4,4	5	-7,2	2	33	0,8		
44	10/2/17 9:55	-74,327	-26,393	2184	2190	4,3	4,3	4,8	15,3	1,5	16,3	1,9		
45	10/2/17 12:24	-74,258	-26,414	2582	2593	4,2	4,2	4,4	1,3	1,1	6,8	0,7	19 WTK	CTD julian time
46	10/2/17 15:23	-74,213	-26,621	2659	2674	4	4	4,6	62,1	-0,6	71,5	2,3		Downlooker only
47	11/2/17 0:36	-74,849	-30,05	399	413	4,2	4,3	4,3	-0,4	-2	4,8	3,1	20 BTK	
48	11/2/17 2:01	-74,763	-30,008	402	414	5,9	5,9	6,7	0,8	0,4	4,9	3		
49	11/2/17 3:52	-74,677	-29,971	406	413	4,7	4,7	5,4	-1,5	0,2	3,5	1,7		
50	11/2/17 5:48	-74,591	-29,925	523	532	4,2	4,2	6	-3,3	-0,6	4,4	1,4		
51	11/2/17 7:55	-74,506	-29,869	905	915	3,7	3,7	5,3	9	1,1	60,2	1,2		CTD julian time
52	11/2/17 10:16	-74,416	-29,832	1212	1228	4,1	4	5	-2,8	-0,2	12	1,6		
53	11/2/17 17:34	-74,843	-30,361	429	445	3,9	4	3,7	-6,9	-0,2	8,8	2		
54	11/2/17 19:33	-74,852	-30,719	472	481	3,9	4	4,9	-4	-0,2	2,8	1,7		
55	11/2/17 22:24	-74,855	-31,038	528	538	4,3	4,3	5,5	-0,3	0,6	4,4	1,7		
56	12/2/17 0:27	-74,85	-31,38	571	577	4,3	4,4	5,7	8,7	-2,1	6,1	2		
57	12/2/17 2:45	-74,85	-32,038	588	598	3,9	3,9	5,5	-3	-2,2	7,1	2,4		
58	12/2/17 5:24	-74,845	-32,399	579	589	4	4	5,2	-2,1	-2,8	22,5	1,8		
59	12/2/17 8:51	-74,85	-31,71	598	608	4,1	4,1	5	2,2	-1,3	31,2	1,6		
60	13/2/17 11:24	-76,601	-32,079	371	380	3,9	4	5,8	-11,9	-1,4	6,4	2,5		
61	13/2/17 12:48	-76,555	-32,286	436	451	4	4,1	5,2	4,5	0,2	35	1,2		
62	13/2/17 14:58	-76,451	-32,755	631	644	4,1	4	5	-0,8	-0,2	7,3	2,2		
63	13/2/17 17:04	-76,348	-33,139	802	805	4	4	5	-3,3	-1,1	5	2,1	21 BTK	
64	13/2/17 19:04	-76,263	-33,626	770	782	3,8	3,8	5,7	-7,7	0,9	12,6	2		
65	13/2/17 20:47	-76,225	-33,808	771	785	4,1	4,1	5,1	-6,3	0,2	7,1	1,5		
66	13/2/17 23:14	-76,307	-33,389	788	802	4	3,9	4,7	-5,9	0,8	18	1,4		
67	14/2/17 2:25	-76,508	-32,498	489	497	4,7	4,7	5,4	-29,5	0,1	59,9	2,6		SADCP weight =1
68	14/2/17 7:35	-77,084	-33,766	365	375	4,2	4,2	4,3	-7,5	0,5	15	2,1		
69	14/2/17 10:31	-77,054	-34,078	474	484	4	4	4,8	1,7	-0,4	3,6	1,2		

70	14/2/17 13:09	-77,018	-34,443	664	663	4,7	4,7	5	-3,2	0,8	19,6	3,9		
71	14/2/17 15:27	-76,98	-34,666	831	841	4,4	4,4	5,1	0,5	0,4	4,4	1,5		
72	14/2/17 18:29	-76,952	-35,005	939	950	4,4	4,4	6	-8,9	0,7	40,4	1,9		
73	15/2/17 23:29	-77,777	-35,736	434	445	4,4	4,5	5,1	-3	0,5	37	2,7		
74	16/2/17 1:20	-77,777	-35,736	434	446	4	4	5,5	-2	0,4	46,6	1,6		
75	16/2/17 1:57	-77,777	-35,736	433	446	3,8	3,7	5	2,8	0,5	36,1	1,4		
76	16/2/17 2:34	-77,777	-35,736	434	444	3,9	4	5,3	9,3	0,1	22,5	1		
77	16/2/17 3:56	-77,777	-35,736	433	446	4	4,1	4,6	3,2	0,4	26,3	1,3		
78	16/2/17 4:24	-77,777	-35,736	434	445	3,9	3,8	4,6	-1	-0,3	37,8	1,5		
79	16/2/17 4:56	-77,777	-35,736	433	445	4	4	4,1	-1,2	-1,5	12,4	2,2		
80	16/2/17 6:26	-77,777	-35,736	433	443	3,8	4	4,6	0,7	-1,7	11,4	1,5		
81	16/2/17 6:57	-77,777	-35,736	433	443	3,9	3,9	4,3	-0,3	-1,5	10,3	1,9		
82	16/2/17 7:25	-77,777	-35,736	434	443	3,7	3,8	5,1	-1,5	-1,4	19,3	1,8	22 BTK	YOYO station CTD elapsed time problemes , hence julian time used for profiles 80 - 85 - 92
83	16/2/17 8:43	-77,777	-35,736	434	445	3,8	3,8	5,3	-5,6	0	16,9	1,6		
84	16/2/17 9:12	-77,777	-35,736	435	444	3,9	3,8	4,6	3,9	0,6	18,6	1,9		
85	16/2/17 9:41	-77,777	-35,736	435	444	3,5	3,6	5,4	1,7	-0,5	27,3	2,1		
86	16/2/17 11:04	-77,777	-35,736	434	448	4	4	4,5	-4,6	0	58,7	2,1		
87	16/2/17 11:34	-77,777	-35,736	435	447	3,8	3,8	4,6	-1,1	0	60,8	2,3		
88	16/2/17 12:00	-77,777	-35,736	435	445	3,9	3,9	5,3	0,5	0,3	8,2	1,9		
89	16/2/17 13:31	-77,777	-35,736	440	444	3,7	3,6	5,8	-5,2	0,5	49,4	1,3		
90	16/2/17 14:02	-77,777	-35,736	440	448	3,9	3,8	4,5	0,5	-0,8	30,4	2		
91	16/2/17 14:33	-77,777	-35,736	440	445	3,6	3,6	4,6	-1,4	1	26,2	1,3		
92	18/2/17 12:03	-76,444	-32,874	675	689	4,2	4,1	4,6	-0,4	0,6	28,6	2,3		
93	18/2/17 13:21	-76,465	-32,742	620	630	4,1	4,1	5,1	-1,9	-0,3	30,4	1,6		
94	19/2/17 3:13	-74,849	-32,696	569	580	4,4	4,4	4,6	1,3	0	10,5	2		
95	19/2/17 5:37	-74,834	-33,082	561	573	4,1	4,1	4,7	3,8	1,7	8	1,6		
96	19/2/17 8:21	-74,868	-33,377	549	565	3,9	4	4,8	10,2	-0,2	33,1	1,7	24 BTK	
97	19/2/17 10:57	-74,863	-33,709	537	550	4,1	4,1	4,8	2	-0,8	7,2	2,2		
98	19/2/17 13:08	-74,846	-34,073	525	533	5,2	5,3	4,5	-5,1	1,5	90,9	2,6		
99	20/2/17 3:38	-74,668	-34,046	532	545	4,5	4,4	5,5	4,2	-0,3	42,3	2,5		
100	20/2/17 8:04	-74,874	-34,348	518	529	4,3	4,3	3,7	0,5	1	15,3	1,5		CTD julian time
101	20/2/17 11:38	-74,777	-34,116	527	535	4,1	4,1	5,1	-2,1	-0,8	6,7	1,8		
102	20/2/17 15:42	-74,601	-34,039	527	540	4,2	4,2	10	-5,3	-0,3	74,1	3,8		
103	20/2/17 19:32	-74,497	-34,248	521	535	4	3,9	4,7	-3,9	0	9,4	1,5		
104	20/2/17 21:36	-74,408	-34,269	538	550	3,8	3,8	6	0,8	0,1	3	1,9		
105	21/2/17 0:26	-74,309	-34,341	939	952	4,8	4,8	6,1	2,1	1,2	5,8	1,3	25 BTK	
106	21/2/17 3:30	-74,228	-34,386	1337	1348	4	4	4,8	-1	0,3	4,2	1,2		
107	21/2/17 6:59	-74,153	-34,17	1592	1601	3,8	3,8	4,5	-4,9	0,5	5,1	1,2		
108	21/2/17 10:17	-74,063	-34,072	1849	1866	3,9	3,9	4,9	2,5	1,7	6,2	1,3		
109	21/2/17 13:35	-73,969	-34,104	2104	2112	4	4	5	-57,2	-3	65,1	1,2		SADCP weight =1
110	21/2/17 21:51	-73,892	-33,913	2213	2225	4,2	2,9	4,4	84	-0,5	63	1,6		SADCP weight =1
111	22/2/17 4:53	-74,125	-33,812	1541	1546	4	4	4	12,5	0,3	13,8	1,2		
112	22/2/17 7:21	-74,146	-33,765	1457	1474	4,1	4,1	8	-64,7	1,7	58	6,5	26 WTK	SADCP, weight=0
113	22/2/17 9:43	-74,174	-33,723	1343	1354	4	4	7,9	-155	4,2	69,5	6,3		SADCP, weight=0
114	22/2/17 13:15	-74,195	-33,75	1267	1286	4	4,1	3,5	-0,6	-2,1	5,2	1,2		

115	22/2/17 15:32	-74,215	-33,68	1176	1185	3,9	3,9	3,7	2,9	-1,3	1,8	1,1		
116	22/2/17 17:04	-74,237	-33,725	1093	1102	3,8	3,8	9,2	44,7	-4,5	4,9	1,8		SADCP, weight=0
117	22/2/17 18:27	-74,257	-33,755	1022	1032	3,9	3,9	3,7	1,5	0,1	3,2	0,9		
118	22/2/17 19:51	-74,281	-33,742	906	917	3,9	3,9	10	74,4	-9,7	7,3	3,1		SADCP, weight=0
119	22/2/17 20:54	-74,296	-33,727	837	846	3,9	3,9	3,3	0,3	-1,3	3,2	0,9		
120	22/2/17 22:01	-74,316	-33,724	730	744	3,9	3,9	3,6	0,1	-1,4	3,6	1,6		
121	22/2/17 22:58	-74,339	-33,718	613	625	3,8	3,8	4,8	-0,3	-0,7	3,6	2,3		
122	22/2/17 23:53	-74,36	-33,711	597	608	3,9	4	3,9	0,2	-1,6	3,5	1,9		
123	23/2/17 1:06	-74,377	-33,762	593	602	4	4	4,3	0,6	-1,4	2,3	2,4		CTD julian time
124	23/2/17 2:17	-74,39	-33,812	590	603	4	4,1	5,5	-4,5	-1,5	4,9	2,7		
125	23/2/17 3:17	-74,402	-33,846	588	594	4,1	4,1	4,4	-2,3	-0,6	8,1	1,9		CTD julian time
126	23/2/17 4:36	-74,419	-33,901	582	593	4,4	4,4	5,2	-4,3	0,2	6,8	2,1		
127	23/2/17 5:44	-74,43	-33,964	567	578	4	4	4,8	-7	1,5	9,8	2		
128	23/2/17 12:52	-74,656	-33,088	588	600	3,8	3,8	4,5	1,6	0,8	51,9	1,7		
129	23/2/17 20:55	-74,858	-32,066	583	596	3,9	3,9	5,1	-2,8	-0,8	17,5	1,9		CTD julian time
130	24/2/17 3:50	-74,162	-29,692	1922	1937	3,9	3,9	6,5	0,2	0,1	53,5	1	27 BTK	
131	24/2/17 6:26	-74,248	-29,738	1734	1749	4	3,9	5,1	-5,1	0,3	5,3	1,1		
132	24/2/17 8:31	-74,334	-29,785	1476	1486	3,9	3,9	5,7	-4,1	-0,9	8,3	1,5		
133	24/2/17 10:25	-74,419	-29,83	1209	1217	3,9	3,9	10	5,5	1	28	2,5		
134	24/2/17 12:47	-74,586	-29,925	542	547	3,6	3,7	5,6	-4	0,6	8,8	1,4		
135	24/2/17 16:23	-74,553	-29,901	720	731	3,7	3,7	5,2	-10,5	0,2	34,5	1,9		
136	24/2/17 20:26	-74,506	-29,866	909	915	4	4	4,9	-9	0,4	22,3	1,6		
137	25/2/17 18:38	-77,809	-36,038	540	554	4,1	4,1	5,4	-7,3	1,1	5,3	2,2		
138	25/2/17 20:24	-77,833	-36,333	714	725	4	4,1	5,2	-0,9	0,4	3,5	1,6		
139	25/2/17 22:08	-77,839	-36,446	763	773	4,4	4,4	5,5	-1,6	0,2	8,6	2		
140	25/2/17 23:27	-77,84	-36,55	851	855	4,3	4,4	5,8	4,3	-1,3	58,8	1,8		
141	26/2/17 1:27	-77,84	-36,632	911	922	4,2	4,2	4	0,2	0,3	4,7	1,5		
142	26/2/17 3:22	-77,852	-36,786	1071	1085	4,4	4,4	3,9	1,6	-0,4	4,3	1,4		
143	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan		no LADCP data
144	26/2/17 6:35	-77,863	-36,994	1031	1037	4,3	4,4	4,8	-1,7	-0,3	15,7	1		
145	26/2/17 9:11	-77,872	-37,102	1117	1129	4,3	4,3	4,2	0,3	0,2	36,6	2,1		
146	26/2/17 11:12	-77,873	-37,205	1077	1088	4,4	4,4	4	-0,9	-0,8	16,9	1,4		
147	26/2/17 12:35	-77,874	-37,319	1067	1079	4,3	4,3	4,9	0,3	0,7	5,3	1,8		
148	26/2/17 15:02	-77,885	-37,433	1080	1091	4,3	4,3	4	-0,2	0,7	6,4	1,6		
149	26/2/17 16:23	-77,897	-37,665	1104	1115	4	3,3	3,6	8,1	2,1	66,9	3,9	28 WTK	Downlooker only
150	26/2/17 18:37	-77,881	-38,128	1157	1171	4,4	4,3	5,3	1,4	0,6	17,3	1,7		CTD julian time
151	26/2/17 21:13	-77,805	-39,364	1046	1055	4,2	4,2	3,4	3,4	0,1	8,3	1,7		CTD julian time
152	26/2/17 22:50	-77,801	-39,767	1007	1016	4,2	4,2	4,3	-2,7	0,5	11,8	2,1		
153	27/2/17 0:28	-77,817	-40,161	915	929	4,7	4,1	4,1	-6,3	0,7	29,7	3,3		
154	27/2/17 2:04	-77,816	-40,506	879	888	4,6	4,7	4,7	0,2	0,5	36,1	3,1		
155	27/2/17 4:13	-77,779	-40,899	827	848	4,5	4,5	4,1	-6,7	0,8	30,2	2,3		
156	27/2/17 6:00	-77,791	-41,283	789	796	4,9	4,8	4,4	-13,7	-1	7,9	1,7		CTD julian time
157	27/2/17 8:07	-77,809	-41,683	740	751	4,9	5	4,9	7,9	-0,4	24,3	1,7		CTD julian time
158	27/2/17 10:22	-77,841	-42,112	663	670	4,6	4,6	4,9	-3,7	-0,5	9,7	1,7		

159	27/2/17 12:28	-77,88	-42,469	587	597	4,1	4.1	5,9	-12,7	0,3	78,7	2	29 BTK	SADCP weight =1
160	27/2/17 18:36	-77,919	-42,171	669	680	5,1	5,1	4,9	-9,7	-1	53,5	2,7		
161	27/2/17 20:28	-77,903	-42,148	673	691	5,1	5,1	5,6	2,3	-0,5	26,2	3		
162	27/2/17 22:09	-77,887	-42,128	675	682	3,2	3,2	5,3	-9,1	1	29,2	2,6		
163	27/2/17 23:53	-77,871	-42,101	673	685	3,6	3,5	4,4	-1,6	-2,2	30,5	2,2		
164	28/2/17 0:53	-77,855	-42,089	669	679	4,9	4,9	4,9	44,5	-0,2	59	2,8	30 BTK	SADCP weight =1
165	28/2/17 2:08	-77,823	-42,041	658	667	4,8	4,8	5,3	-1,3	-0,1	49	2,7		
166	28/2/17 3:18	-77,791	-41,997	665	674	4,6	4,6	5,5	-5,7	-0,1	26,8	1,7		CTD julian time
167	28/2/17 13:58	-77,744	-38,985	1071	1080	4,2	4,1	5,6	-9,9	0,6	17,2	2		
168	28/2/17 18:20	-77,848	-38,59	1137	1147	4	4	6,4	-2,2	-0,3	13	1,6		
169	4/3/17 0:22	-74,4	-34,31	534	544	4	4	5,6	7,7	1,4	80,5	2,5		SADCP weight =1
170	4/3/17 2:10	-74,348	-34,297	724	732	3,9	3,9	5,8	0,1	-0,7	22,4	2,1		
171	4/3/17 3:41	-74,312	-34,36	942	953	4,3	4,3	5,4	-2,7	0,4	10,2	1,9	34 BTK	
172	4/3/17 5:40	-74,274	-34,386	1129	1140	3,9	3,9	4,8	3	0,5	6,4	1,4		
173	4/3/17 8:06	-74,225	-34,399	1356	1362	4	4	4,8	-1,7	-0,3	37	1,3		

4.3 Long Term Underwater System (LoTUS)

Elin Darelius

The LoTUS system is an expendable, bottom landing sensor tailored for long-time sampling of bottom temperature in polar conditions which is under development by J. Kuttenkeuler at KTH, Stockholm, Sweden. The LoTUS buoy is rugged, small and light, with 250 mm diameter pressure hull of polystyrene rated for 2000m depth. The buoy weight is about 3 kg excluding the anchor.

Four LoTUS buoys were pre-programmed in Stockholm to sample ambient water temperature at hourly intervals for a pre-set duration after which the buoy releases from the anchor and ascends to the water surface. The release dates were set to 2nd February, with two buoys surfacing in 2018 and two buoys surfacing in 2019 (Table 4.3.1). Once surfaced the buoys connects and send the data to shore using the Iridium Short Burst Data (SBD) service. Data download will be handled by J. Kuttenkeuler.

The LoTUS buoys were attached to a 10 kg anchor using a 1.5 m long 6mm thick polypropylene rope (Figure 4.3.1). For deployment, the buoy and the anchor were lowered separately from the aft of the ship to the water surface and released using two long ropes. The location of deployment is given in Table 4.3.1 and shown in Figure 4.4.1.

Ins #	Deployment time	Longitude	Latitude	Depth (uncorrected)	Surfacing
16	20170218 05:05	33° 46.08' W	77° 05.10' S	384 m	2/2 2018
17	20170218 05:50	33° 57.44' W	77° 01.88' S	474 m	2/2 2018
18	20170218 05:29	33° 51.41' W	77° 03.49' S	427 m	2/2 2019
19	20170218 06:11	34° 03.75' W	77° 00.61' S	506 m	2/2 2019

Table 4.3.1: Deployment details of LoTUS buoys

4.4 Mooring deployment

Elin Darelius and Hervé Le Goff

Oceanic moorings carrying sensors for temperature, salinity and currents were deployed during the cruise in order to study the inflow of water towards and the outflow of water from the Filchner ice shelf cavity.

A total of nine oceanic moorings were deployed during the cruise, and three moorings were recovered. Six of the deployed moorings belongs to LOCEAN (P1-6) and three to UiB (M3, M6 and S217). The recovered moorings (S2, S2E and SA) belongs to UiB. The location of the moorings are shown in Figure 4.4.1.

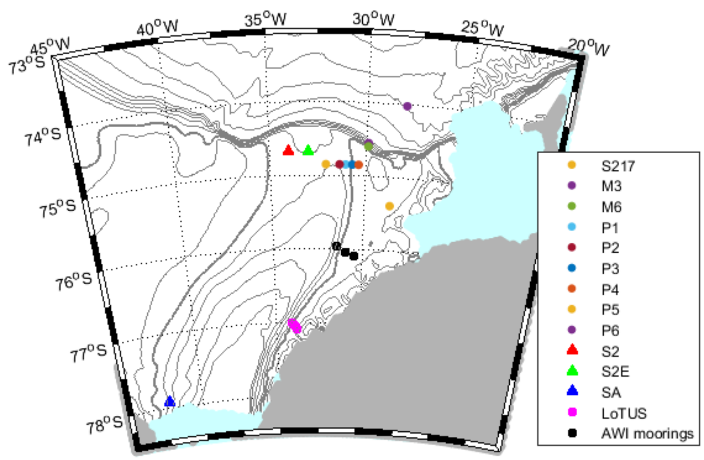

Figure 4.4.1: Map showing the location of moorings deployed (circles) and moorings recovered (triangles). The location of the LoTUS buoys (Section 4.9, magenta squares) and of AWI-moorings (black squares) deployed in 2016 are included.

Three of the moorings carried sound sources (Section 4.5) and hydrophones (Section 4.6) used to localize the movement of the APEX drifter (Section 4.7)

4.4.1 UiB Mooring deployment (M3, M6, and S217)

Elin Darelius

4.4.1.1 Mooring deployment

Mooring S217

Mooring S217 (Figure 4.4.2, Table 4.4.1) was deployed anchor first 19:50 UTC on 23 February, 2017 at 74.85057°S 32.09009°W. The acoustic release was interrogated after deployment; the acoustic release was vertical and the position was confirmed (Table 4.4.5).

Mooring M6

Mooring M6 (Figure 4.4.3, Table 4.4.1) was deployed anchor first 15:00 UTC on 24 February, 2017 at 74.59492°S 29.91619°W. When lower part of the mooring (3 x Natilus spheres, 1 x RCM7, 1 x Acoustic release) was lifted off the deck one of the Nautilus buoys swung back and touched the rotor of the RCM7 s/n 11092 so that the rotor holder cracked. The instrument was replaced and the rotor holder was later repaired using fast epoxy glue. The rotor then rotated freely and the instrument was deployed as part of mooring M3.

The acoustic release was interrogated after deployment; the acoustic release was vertical and the position was confirmed (Table 4.4.5).

Mooring M3

Mooring M3 (Figure 4.4 4, Table 4.4.1) was deployed anchor last between 17:37 and 19:00 UTC on 24 Feb. The top buoys was deployed at 74.54521^{o}S, 29.88977^{o}W. When the anchor was released, the position of the ship was 74.55066^{o}S, 29.90997^{o}W. The acoustic released was interrogated after deploymen (Table 4.4.5) and the position of the mooring was determined to be 74.5500^{o}S 29.9080 ^{o}W. The release was vertical.

Table 4.4.1: Deployment details for UiB moorings eployed during JR16004.1) Position where moorings was released – anchor first. 2) Position determined from triangulation.

Mooring	Longitude	Latitude	Depth	Time	Method
S217[1]	32.09009^{o}W	74.85057^{o}S	609 / 600 m EA600 / Swath	19:50 23/02/2017	Anchor first
M3[2]	29.9080^{o}W	74.5500^{o}S	796 / 738 m EA600 / Swath	19:00 24/02/2017	Anchor last
M6[1]	29.91619^{o}W	74.59492^{o}S	530 m Swath	15:00 24/02/2017	Anchor first

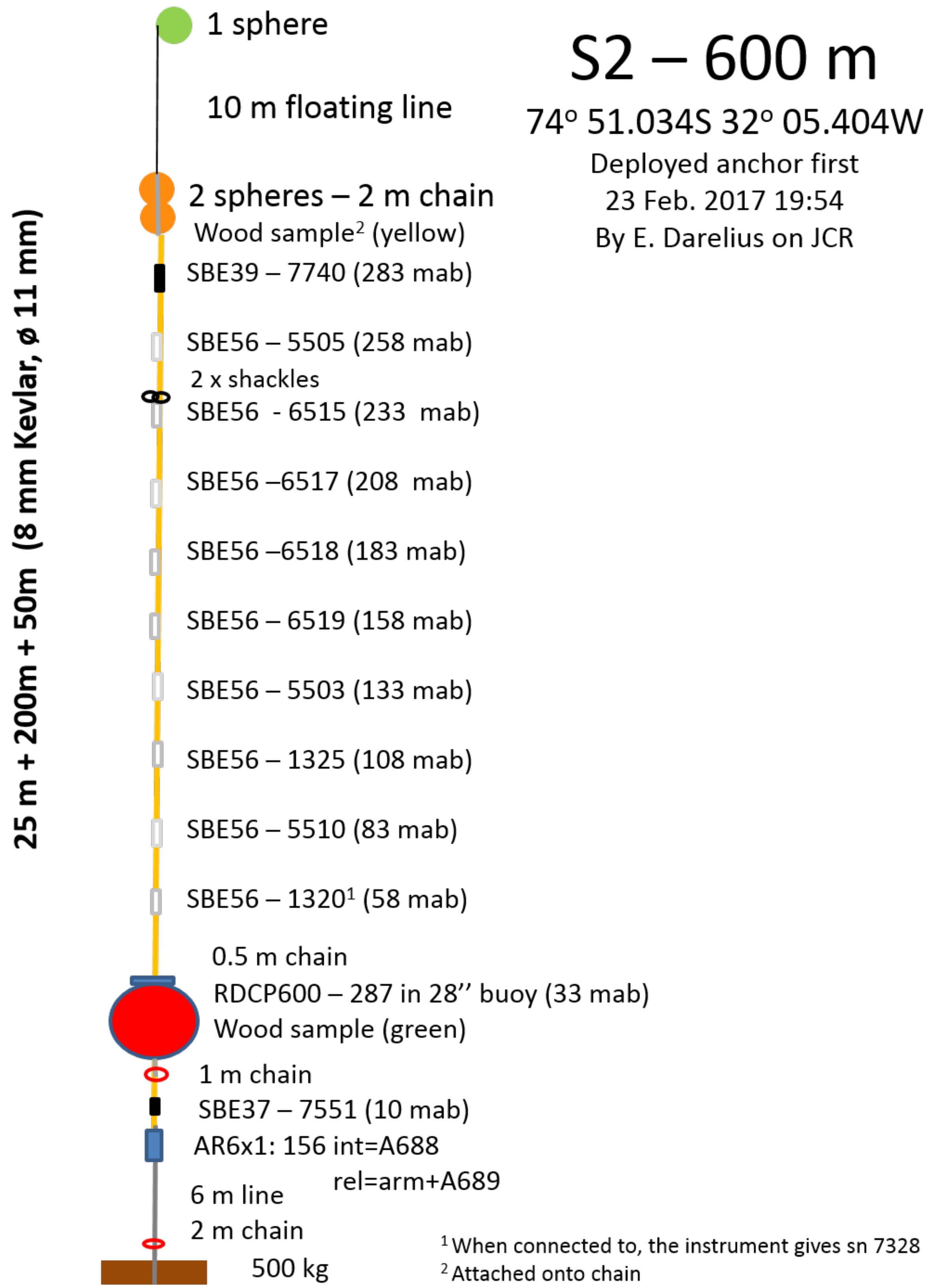

Figure 4.4.2: Sketch showing instrumentation and design of mooring S217.

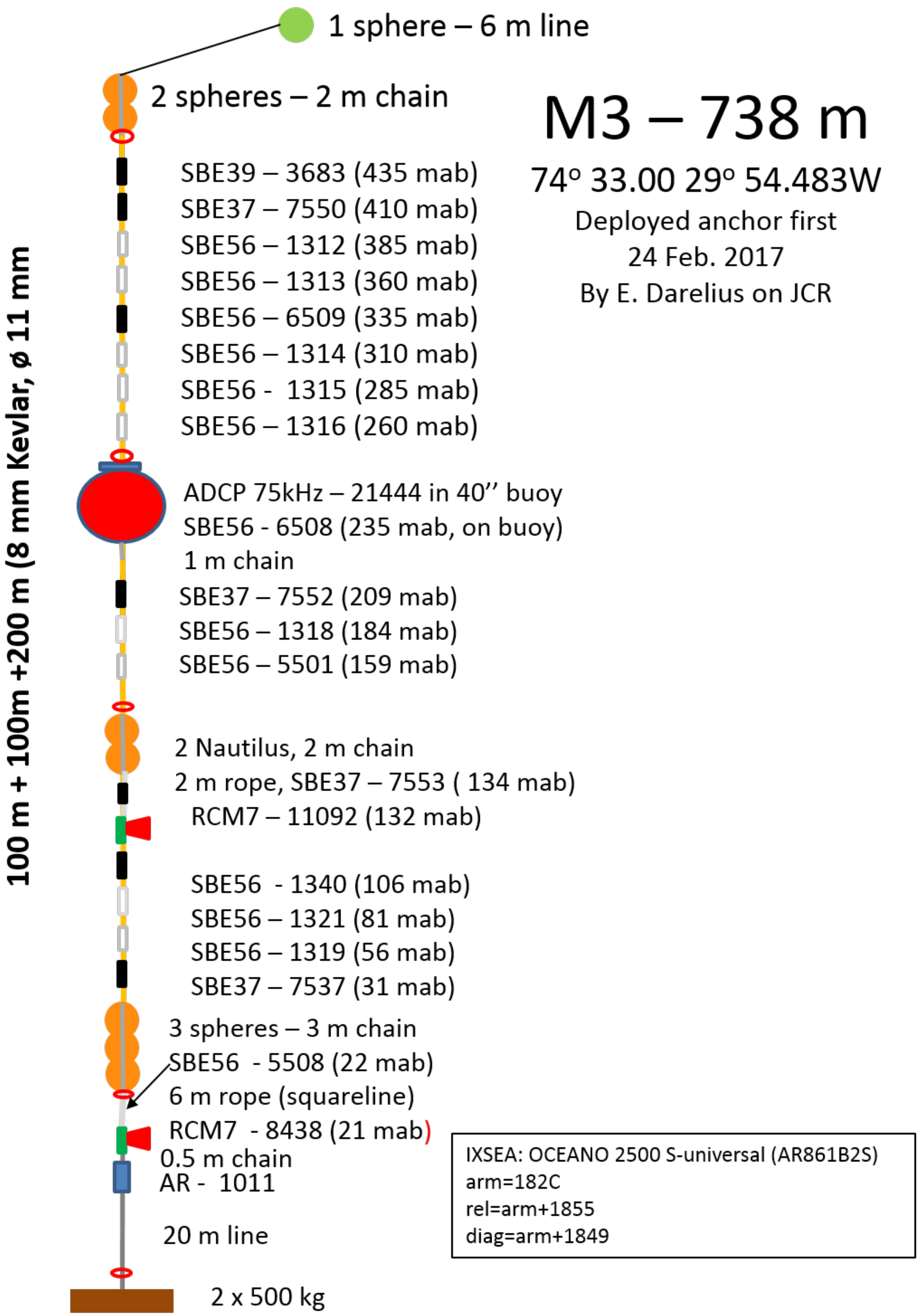

Figure 4.4.3: Sketch showing instrumentation and design of mooring M3

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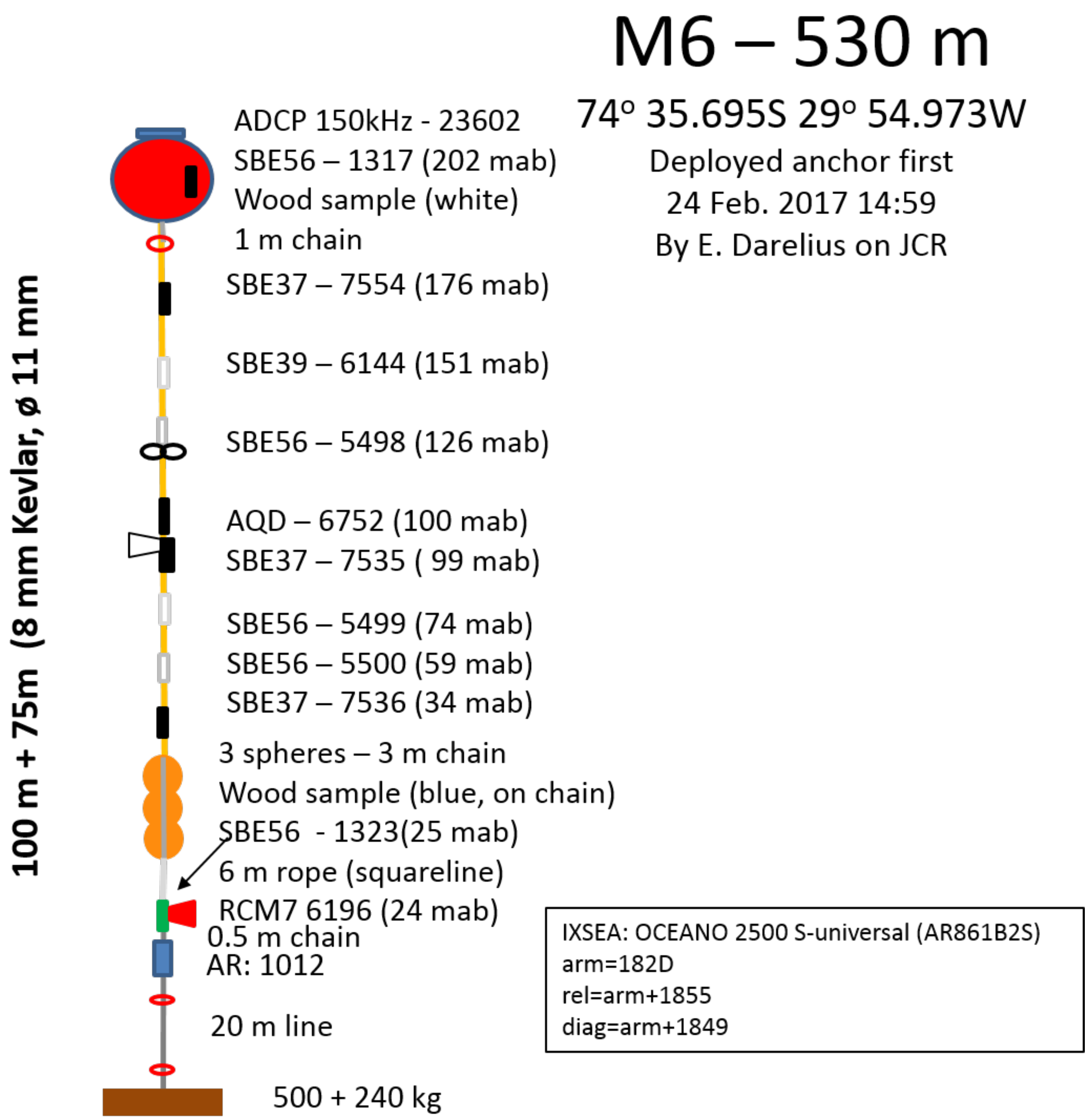


Figure 4.4 4: Sketch showing instrumentation and design of mooring M6.

4.4.1.2 Mooring instrumentation and settings

Wood samples

Marine archeologist Charlotte Björdal at Gothernburg University, Gothenburg, Sweden provided 12 strings with wood samples (4 pieces of wood per string, see Fig. 1b) that were attached to the moorings as described in Table 2 in order to study bacteria growth on wood in Antarctic waters. Three moorings were selected (one on the slope, one on the continental shelf and one in the Filchner Depression) and four strings were attached on each of these moorings: two at the lower part of the mooring and two at the upper part of the mooring (Table 4.4.2). The strings were color coded at each end using colored tape (Figure 4.4.5).

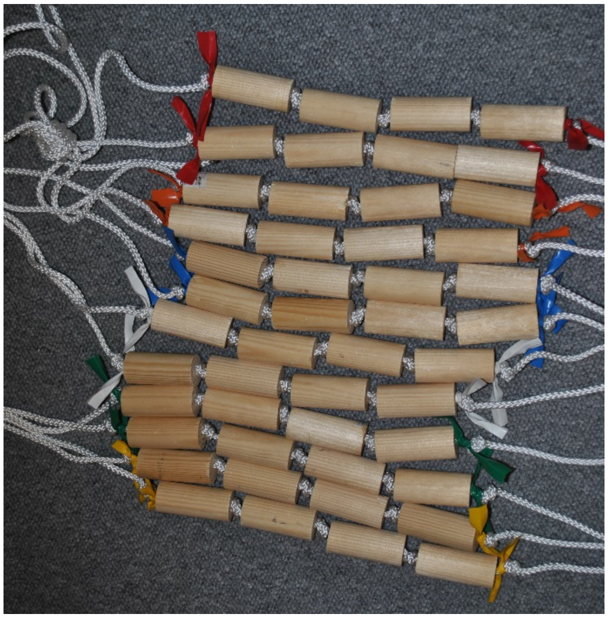


Figure 4.4.5: Wood samples for archeological invesitigations of bacterial growth.

Table 4.4.2: Details of wood sample placement on moorings.

	Mooring	Latitude	Longitude	Height above bottom	Bottom depth
Yellow	S217	74° 51.034’ S	32° 05.404’ S	285 m	600 m
Green	S217	74° 51.034’ S	32° 05.404’ S	33 m	600 m
White	M6	74° 35.695’ S	29° 54.973’W	202 m	530 m
Blue	M6	74° 35.695’ S	29° 54.973’W	29 m	530 m
Red	P5	75° 23.383’ S	28° 38.219W	115 m	420 m
Orange	P5	75° 23.383’ S	28° 38.219W	6 m	420 m

IXSEA Acoustic releases

The UiB moorings were all equipped with single IXSEA acoustic releases, see Table 4.4.5.

Table 4.4.3: Information on acoustic releases on UiB moorings.

	Model	s/n	ARM	Diagnostic	Release	Batteries
M3	OCEANO 2500 S-universal AR861B2S	1011	182C	Arm+1849	Arm+1855	Lithium
M6		1012	128D	Arm+1849	Arm+1855	Lithium
	AR6 x 1	156	A688	-	Arm+A689	Lithium

Aanderaa RDCP600

The RDCP was programmed by S. Østerhus prior to shipping. The instrument was programmed to start pinging when turned on. The instrument was turned on using the main switch at 17:00 23 February, 2017. When the internal clock became visible at 17:01 it showed 16:54. It was installed upward-looking in a 28’’ buoy. Installation of the instrument in the buoy was technically challenging and required a couple of extensions to the sockets.

Aanderaa Recording Current Meters (RCM 7)

The rotor holder on 11092 was damaged during deployment and repaired with epoxy glue (see text on mooring deployment above). Details on the RCM deployments are given in Table 4.4.4.

Table 4.4.4: Details of RCM7 deployments.

SN	DSU SN	Time started (UTC)	DSU initial / after 8h	Sampling interval	Temperature range
11092	6520	24/2 02:00	12/36	2h (setting 9)	Low
8438	-	24/2 02:00	12/36	2h (setting 9)	Low
6196	10569	24/2 02:00	12/36	2h (setting 9)	Low

SEABIRD Microcat (SBE37IM)

Eight SBE37IM, non-pumped microcats without pressuer sensors were installed on the mooring. A modem is needed to communicate with the instruments. The sampling interval was set to 600 s. Deployment details are given below

```
S>#01ds
SBE37-IM 3.0c  SERIAL NO. 7553  23 Jan 2017
19:46:59
vMain =  7.01, vLith =  3.25
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 400.0 decibars
PC baud rate = 9600

S>#02ds
SBE37-IM 3.0c  SERIAL NO. 7554  23 Jan 2017
19:21:59
vMain =  6.92, vLith =  3.23
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 325.0 decibars
PC baud rate = 9600
<Executed/>

S>#03ds
SBE37-IM 3.0c  SERIAL NO. 7537  24 Jan 2017
18:59:16
vMain =  7.00, vLith =  3.13
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 725.0 decibars
PC baud rate = 9600

S>#04t_ds
SBE37-IM 3.0c  SERIAL NO. 7552  23 Jan 2017
20:13:08
vMain =  6.96, vLith =  3.14
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 525.0 decibars
PC baud rate = 9600

S>#05ds
SBE37-IM 3.0c  SERIAL NO. 7536  24 Jan 2017
18:50:37
vMain =  6.97, vLith =  3.12
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 475.0 decibars
PC baud rate = 9600

S>#06ds
SBE37-IM 3.0c  SERIAL NO. 7550  23 Jan 2017
19:32:33
vMain =  6.92, vLith =  3.15
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 325.0 decibars
PC baud rate = 9600

S>#07ds
SBE37-IM 3.0c  SERIAL NO. 7551  23 Jan 2017
19:40:39
```

vMain = 7.00, vLith = 3.13
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 400.0 decibars
PC baud rate = 9600

S>#08ds

SBE37-IM 3.0c SERIAL NO. 7535 24 Jan 2017
19:08:27
vMain = 6.93, vLith = 3.12
samplenumber = 0, free = 838860
not logging, waiting to start at 01 Feb 2017 00:00:00
sample interval = 600 seconds
data format = converted engineering
compatible mode enabled
do not transmit sample number
pump installed = no
reference pressure = 600.0 decibars
PC baud rate = 9600

SEABIRD SBE39

One SBE39plus and two SBE39 were installed on the moorings. All instruments were equipped with Lithium-batteries. The sampling interval was set to 900 s for the SBE39 and to 300 s for SBE39plus.

S>DS
SBE 39 V 3.0b SERIAL NO. 3683 23 Jan 2017
14:26:22
battery voltage = 8.7
not logging: waiting to start at 10 Feb 2017 00:00:00
sample interval = 900 seconds
samplenumber = 0, free = 466033
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature and pressure
binary upload includes time
temperature = 18.52 deg C

S>ds
SBE 39 V 3.1b SERIAL NO. 6144 23 Jan 2017
14:18:29
battery voltage = 8.6
not logging: waiting to start at 10 Feb 2017 00:00:00
sample interval = 900 seconds
samplenumber = 0, free = 3655452
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature and pressure
binary upload includes time
temperature = 18.64 deg C

SerialNumber='03907740'>
<PressureInstalled>yes</PressureInstalled>
<SampleDataFormat>converted
engineering</SampleDataFormat>
<OutputTemperature>yes</OutputTemperature>
<TemperatureUnits>Celsius</TemperatureUnits>
<OutputPressure>yes</OutputPressure>
<PressureUnits>Decibar</PressureUnits>
<TxSampleNumber>yes</TxSampleNumber>
<TxRealTime>no</TxRealTime>
<SampleInterval>300</SampleInterval>
<SyncMode>no</SyncMode>
<RS232BaudRate>9600</RS232BaudRate>
SerialNumber='03907740'>
<DateTime>2017-01-23T20:35:36</DateTime>
<EventSummary numEvents='0'/>
<Power>
<vMain>7.19</vMain>
<vBackup>3.34</vBackup>
</Power>
<MemorySummary>
<Bytes>0</Bytes>
<Samples>0</Samples>
<SamplesFree>5592405</SamplesFree>
<SampleLength>12</SampleLength>
</MemorySummary>
<AutonomousSampling>waiting to start at 01 Feb 2017
00:00:00</AutonomousSampling>

SEABIRD SBE56 T-loggers

A total of 28 SBE56 were installed on the UiB-moorings, while 11 SBE56 sensors belonging to UiB were installed on the LOCEAN moorings. The sampling interval was set to 120 s. The metallic sensor on SBE56 s/n 1325 was slightly bent. When communicating with SBE56 s/n 1320 it states that it has s/n 7328. When last deployed (FBC 2012-2013) it functioned normally using s/n 1320. The deployment details for the SBE56 are listed in the appendix.

NORTEK Aquadopp

Two Nortek Aquadopps from UiB were installed on the moorings: one on M6 and one on a LOCEAN mooring. Extreme care had to be taken with the cables when closing up the instruments for communication to be possible. It only worked after several attempts. The instruments are made for an inductive line, but the ceramics are broken and we communicated via cable. The set-up shown belown were used for the two UiB Aquadopps.

```
=============================================================
Deployment   : 6752Fi
Current time : 25.01.2017 18:05:54
Start at     : 10.02.2017
---------------------------------------------------------
Measurement interval  (s) : 3600
Average interval      (s) : 200
Blanking distance     (m) : 0.35
Measurement load      (%) : 4
Power level               : HIGH
Diagnostics interval(min) : 360:00
Diagnostics samples       : 20
Compass upd. rate     (s) : 10
Coordinate System         : ENU
Speed of sound      (m/s) : MEASURED
Salinity            (ppt) : 35
Analog input 1            : NONE
Analog input 2            : NONE
Analog input power out    : DISABLED
Raw magnetometer out      : OFF
File wrapping             : OFF
TellTale                  : OFF
AcousticModem             : OFF
Serial output             : OFF
Baud rate                 : 9600
---------------------------------------------------------
Assumed duration   (days) : 760.0
Battery utilization   (%) : 55.0
Battery level         (V) : 14.8
Recorder size        (MB) : 9
Recorder free space  (MB) : 8.973
Memory required      (MB) : 3.3
Vertical vel. prec (cm/s) : 1.4
Horizon. vel. prec (cm/s) : 0.8
---------------------------------------------------------
Instrument ID             : AQD 6752
Head ID                   : AQD 4009
Firmware version          : 3.36
---------------------------------------------------------
Inductive modem           : DISABLED
Device ID                 : 0
Transmit power level      : HIGH
Data format               : BINARY

Coupler impedance         : N/A
---------------------------------------------------------
Aquadopp Version 1.40.14
Copyright (C) Nortek AS
=============================================================
```

RDI Acoustic Doppler Current Profiles

One RDI 75 kHz (s/n 21444) and one RDI 150 kHz (s/n 23602) were installed upward looking in their respective 40'' buoy. The instrument was started using WinADCP. The instruments both passed pre-deployment test (except for: H/W Operation........................***FAIL***). The clocks were set, the pressure zeroed but the compasses were not calibrated.
The deployment details are given below:

RDI 75 kHz, s/n 21444

```
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>CQ255
>CF11101
>EA0
>EB0
>ED5000
>ES35
>EX11111
>EZ1111101
>WA50
>WB0
>WD111100000
>WF704
>WN33
>WP11

>WS1600
>WV175
>TE02:00:00.00
>TP00:10.00
>TF17/02/24 12:00:00
>CK
[Parameters saved as USER defaults]
>The command CS is not allowed
in this command file.
It has been ignored.
>The following commands are
generated by this program:
>CF?
CF = 11101 ---------------
Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
>CF11101
>RN M3_17
```

```
>cs

RDI 150 kHz, s/n 23602
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>CF11101
>EA0
>EB0
>ED3000
>ES35
>EX11111
>EZ1111101
>WA50
>WB1
>WD111100000
>WF352
>WN36
>WP50
>WS800
>WV175
>TE01:00:00.00
>TP00:06.00
>TF17/02/24 12:00:00
>CK
[Parameters saved as USER defaults]
>The command CS is not allowed in
this command file.  It has been ignored.
>The following commands are
generated by this program:
>CF?
CF = 11101 ---------------
Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
>CF11101
>RN M6_17
>cs
```

4.4.1.3 Triangulation

Triangulation was carried out after deployment and prior to mooring recovery using the build-in transducer and the LOCEAN deck unit. The results are listed in Table 4.4.5. The calculations in Matlab were made using a sound speed of 1460 m/s.

Table 4.4.5: Results from interrogations of acoustic releases on mooring deployment and recovery.

	Latitude	Longitude	Distance
S217	74° 51.507'S	32° 03.975'W	1344 m
SA	77° 54.466'S	42° 12.922'W	2076 m
	77° 54.482'S	42° 12.390'W	1814 m
	77° 54.942'S	42° 12.466'W	1482 m
	77° 54.899'S	42° 09.842'W	782 m
M3	74° 33.048'S	29° 54.618'W	746 m
	74° 33.337'S	29° 56.367'W	1381 m
S2	74° 39.342'S	33° 05.927'W	3184 m
	74° 39.579'S	33° 02.911'W	1640 m
	74° 39.469'S	33° 00.621'W	830 m
M6	74° 35.695'S	29° 54.969'W	523 m
	74° 35.062'S	29° 55.064'W	1276 m
	74° 35.104'S	29° 54.989'W	1206 m

4.4.2 UiB Mooring recovery (S2, S2E, and SA)

4.4.2.1 UiB Mooring recovery

Mooring S2

Mooring S2-2014 (Figure 4.4 6) was deployed anchor first at 74° 40.14'S, 34° 01.54'W on 26 January, 2014 during cruise PS82 onboard RV Polarstern by S. Østerhus. The mooring consisted of a bottom buoy, 250 m of Aanderaa Seaguard Strings including sensors for C, T and O every 50 m, an RCM9 and four Nautilus spheres on the top. A Kevlar line run in parallel to the Aanderaa cable. The cable and the Kevlar were taped/cable tied together.

The site was first approached 19 February, 2017. The release was interrogated several times, confirming its presence and suggesting apposition about 30 m to the east of the given position. The site was however covered by thick ice floes and the mooring was not released. When returning to the site later in the evening, the thick ice had drifted off the site and the site was instead covered by thin, new ice. The anchor was released at 00:53 on 20 February after an ice free pool had been cleared. The release was executed, but further interrogations received no reply. It is likely that the buoy immediately turned upside down so that the acoustic head was shadowed by the buoy above it. The buoy arrived to the surface up side down.

The rising buoy missed the pool, but broke through about 10 cm of new ice. The four Nautilus buoys at the top of the mooring did not appear. There buoyance were likely to small to break through the ice.

The top buoy was lifted onboard across the side of the ship using the large crane, and the lower 175 m of the cable was hauled by hand across the railing. When hand-hauling was no longer possible - the line appeared to be stuck - the cable was separated from the Kevlar and the Kevlar was attached to the ??? over a small block in the crane. The cable hence did not pass over the block. The remaining part of the line was hauled in this way. It was very slow, since the winch continuously had to be stopped in order to remove the tape/cable ties attaching the Kevlar to the cable.

The four top-spheres and the RCM were lifted onboard using the crane.

Care had to be taken when cutting the numerable layers of tape of the cable, in order not to damage the cable. It would have been preferable to use only cable ties, which were more easily removed without risk of damaging the cable.

The Kevlar was much damaged during recovery.

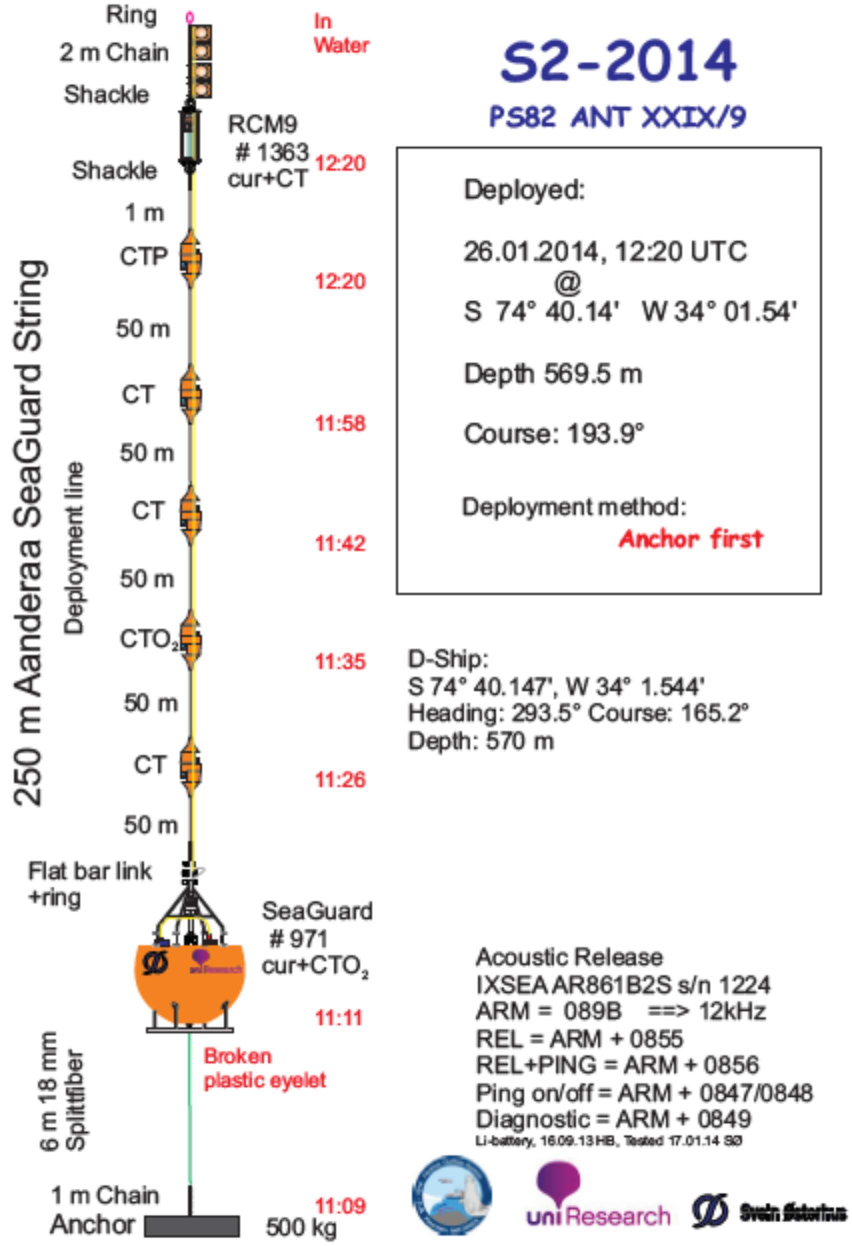


Figure 4.4 6: Sketch showing the instrumentation on mooring S2 recovered during JR16004.

Mooring S2E

Mooring S2E was deployed anchor first by S. Østerhus at 08:25 26/01/2014 from Polarstern. Triangulation confirmed its position and it was released 15:11 23/02/2017. The mooring was fully recovered by 15:55.

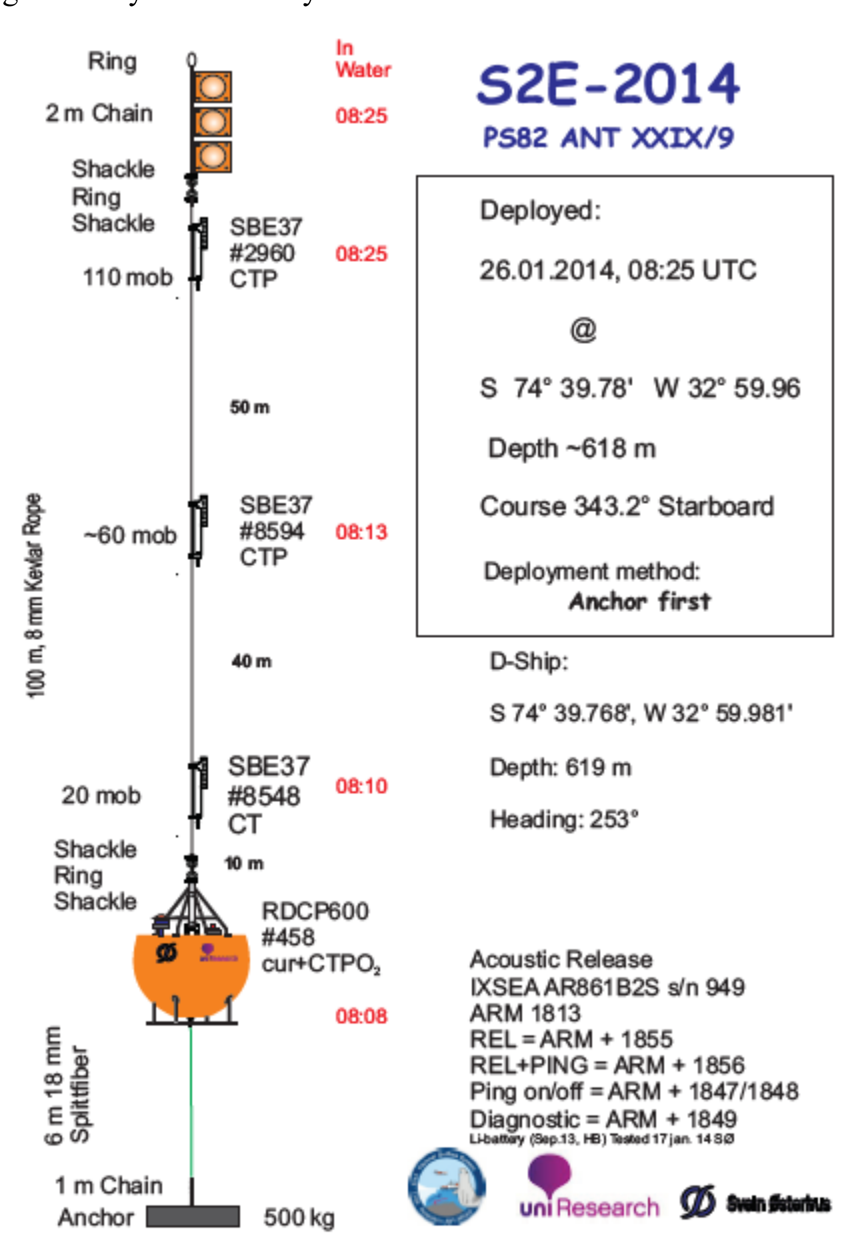
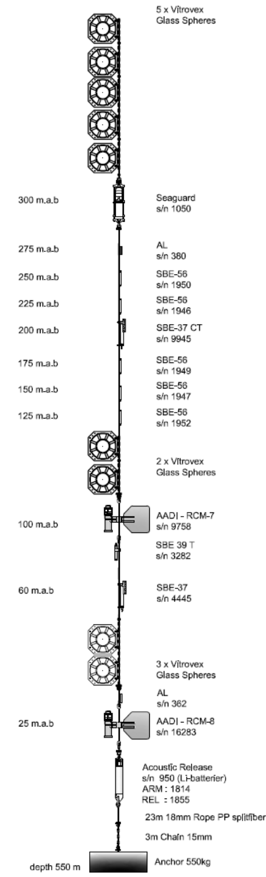


Figure 4.4. 7: Sketch showing the instrumentation on mooring S2E, recovered uring JR16004.

Mooring SA

Mooring SA (Figure 4.4.8) was deployed anchor last by E. Darelius from RRS Ernest Shackleton 4 January, 2013 at 77° 55.0612’S 42°09.4559’W. The mooring was then about 2 nm from the ice shelf front. The mooring site was approached 27 February, 2017. The acoustic release was interrogated and the position confirmed. The ice shelf front had advanced and was now about 400 m from the mooring position.

The mooring was recovered without any problems. Several instruments had moved along the mooring line (8 mm Dynema): SBE37 s/n 9945, SBE56 s/n 1946 and Aqualogger s/n 380 were all found just below the Seaguard at the top of the mooring, while the SBE37 s/n 4445 was found just above the spheres at the bottom of the mooring. Aqualogger s/n 362 and SBE56 s/n 1950 were lost.



The temperature records (

Figure 4.4. 9: SA - temperature records in May, 2014, from the SBE56 below the moved Microcat (150 and 175 mab; red and blue line),the moved microcat SBE37 s/n 9945 (purple line) and the microcat above it (yellow line).

) suggest that the formation of ice on the SBE37 s/n 9945 in May 2014, during a period when very low temperatures (-2.3C) was observed at the instrument level, caused the instrument to become sufficiently buoyant for it to be lifted up along the line – bringing SBE56 s/n 1946 and Aqualogger s/n 380 with it.

Figure 4.4.8: Sketch showing instrumentation on mooring SA when deployed. Instruments were displaced and missing when recovered.

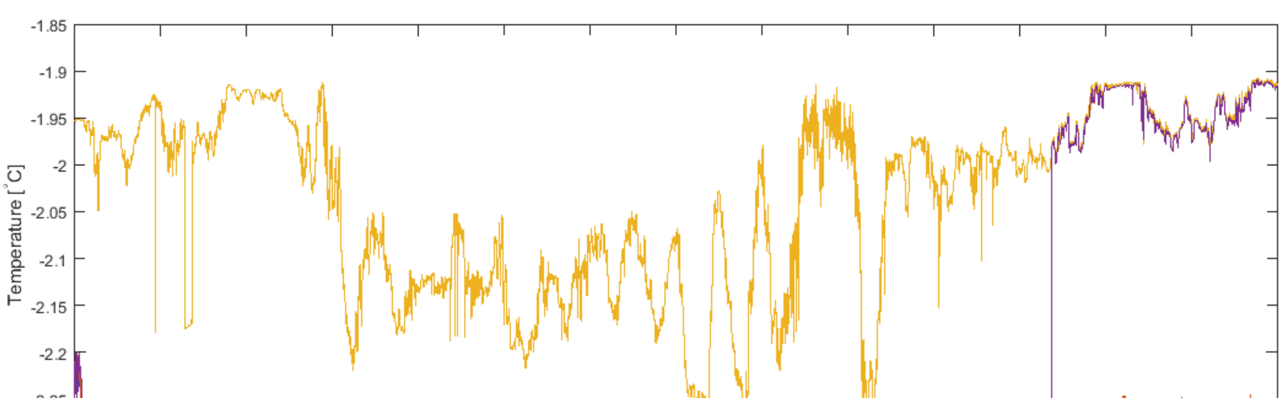


Figure 4.4. 9: SA - temperature records in May, 2014, from the SBE56 below the moved Microcat (150 and 175 mab; red and blue line),the moved microcat SBE37 s/n 9945 (purple line) and the microcat above it (yellow line).

From about 7 May, 2014 the variability of the record from the SBE37 s/n 9945 is reduced – suggesting that it is covered with ice so that the response time is increased – and from about 16 May, 2014 the record from SBE37 s/n 9945 follows that of the instrument above perfectly.

It was suggested that the instrument would have been pulled upwards by a passing ice berg, but there are no signal in the pressure or tilt records from the Seaguard at the top of the mooring to support this theory.

The anodes were completely dissolved and especially RCM8 s/n 16283 was affected by corrosion.

4.4.2.2 Recovered instrumentation

SEABIRD SBE37

The state of the recovered SBE37 are given in Table 4.4.6.

Table 4.4.6: Details on the recovered SBE37 on UiB moorings.

s/n	Logging stopped / last recording	Sample interval	Sample Num	Time UTC	Time SBE	Vmain /VLith
8548	13:53 25/02/2017	3600	27116	13:52:30	13:53:31	6.96/3.19 V
8594	12:00 25/02/2017	3600	27114	13:48:10	13:49:56	6.97/3.19 V
2960	15:58 25/02/2017	3600	27118	15:59:45	16:08:05	
9945	18:36 27/02/2017	300	436688	18:37:15	18:37:05	6.97/3.15
4445	23/03/2015	300	Out of memory	22:14:50	22:24:38	

SBE39

The SBE39 s/n 3282 had stopped logging at 07:45 14/12/2014 due to battery failure.

SBE56

The SBE56 had stopped logging due to battery failure. Details of the deployments are given in Table 4.4.7.

Table 4.4.7: Details on SBE56 deployments on recovered UiB moorings.

s/n	Sampling interval	Last recording
1946	15s	03/06/2015
1947	15s	19/06/2015
1949	15s	20/05/2015
1952	15s	12/06/2015

RDCP
The RDCP s/n 458 was disconnected from the batterypack at 17:42 25/02/2017 and switched off at 14:30 26/02/2017. The pressure container contained small quantities of a yellow, oily substance that seemed to have seeped down from the upper part of the instrument. It was suggested – but not confirmed – that the liquid originated from the pressure sensor.
The voltage of the batteries in the batterypack was 3.66V (when warmed up).

RCM7/8/9
The RCM7/8 (s/n 9758 and 18283) were opened and observed for more than an hour. The DSU reading did not increase; logging had stopped prior to recovery due to battery failure. Details of the deployments are given in Table 4.4.8.

Table 4.4.8: Details on deployments of Aanderaa RCMs on UiB moorings recovered during JR16004.

Instrument / DSU s/n	DSU reading	Temp range	Interval	Instrument stopped	Last recording
9758 / 13505	4:2536, changed to 4:2542 when removed	1/Low	8/60 min	18:31 27/02/2017	08/07/2015
12446 / 16283	65520	1/Low	8/60 min	19:10 27/02/2017	12/03/2014
1363 / 16539	5:6377	Arctic	60 min, burst mode	18:18 20/02/2017	19/04/2015

The RCM9 s/n 1363 was opened at 17:50 on 20/2 2017. The DSU reader then showed 5:6377. It pinged at 18:01. The DSU window then changed first to 5:6375, then 5: 6376 before it returned to 5:6377. The instrument was turned off at 18:18.

Attempts to download the data from the DSU were first made using a Converter 2909. They were unsuccessful. Thereafter, attempts were made using a DSU-reader 2995 that was borrowed from P. Abrahamsen. Data download were then successful.
The voltage of the RCM9 (s/n 1363) battery was 7.22V.

Seaguard

Ins s/n	Instrument turned off/disconnected
1050	19:20 27/03/2017
971	13:00 – 15:00 20/02/2017

The batteries in the Seaguard battery pack (S2) had a voltage of 3.66 when warmed up.
The voltage of the internal battery on s/n 971 was 7.37V.

Aqualogger

No equipment was brought onboard to read data from Aqualogger s/n 380.

4.4.3 Appendix: UiB SBE56 deployment

Serial number: 05601312
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:11:42
Start sampling at: 01-Feb-2017 00:00:00

Current temperature: 16,4498
Events recorded: 0
Battery changed: 22-Sep-2015 08:36:48
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]

Calculated battery life remaining: 4,84 years [82%]
Calibration:
  Date: 2012-03-26

Serial number: 05601313
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:10:11
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,5484
Events recorded: 0
Battery changed: 22-Sep-2015 08:11:25
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
  Date: 2012-03-26

Serial number: 05601313
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:10:11
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,5484
Events recorded: 0
Battery changed: 22-Sep-2015 08:11:25
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
  Date: 2012-03-26

Serial number: 05601314
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:42:15
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,7700
Events recorded: 0
Battery changed: 22-Sep-2015 08:25:07
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
  Date: 2012-04-01

Serial number: 05601315
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:26:29
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,2885
Events recorded: 0
Battery changed: 22-Sep-2015 08:18:07
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
  Date: 2012-04-01

Serial number: 05601316
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 17:59:51
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,3505
Events recorded: 0
Battery changed: 22-Sep-2015 08:48:19
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
  Date: 2012-04-01

Serial number: 05601317
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:45:44
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,6385
Events recorded: 0
Battery changed: 22-Sep-2015 09:15:15
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
  Date: 2012-04-01

Serial number: 05601318
Firmware version: SBE56 V0.96
Sample period (sec): 60,0
Date/time: 23-Jan-2017 14:51:04
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,8763
Events recorded: 0
Battery changed: 22-Sep-2015 08:14:44
Number of samples in memory: 60032
Memory Remaining: 30,74 years [99%]
Calculated battery life remaining: 3,77 years [82%]
Calibration:
  Date: 2012-04-01
Serial number: 05601319
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:33:04
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 18,3101
Events recorded: 0
Battery changed: 22-Sep-2015 08:55:10
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
  Date: 2012-04-01

Serial number: 01507328
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 15:03:04
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,3378
Events recorded: 0
Battery changed: 23-Jan-2017 15:03:04
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,87 years [100%]
Calibration:
  Date: 2012-04-01
  Coefficients:
    A0 = -1.248202E-03
    A1 = 3.488790E-04
    A2 = -6.769052E-06
    A3 = 2.048994E-07

Serial number: 05601321
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:08:23
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,4730
Events recorded: 0
Battery changed: 22-Sep-2015 08:21:56
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
Date: 2012-04-01

Serial number: 05601322
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:16:15
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,8262
Events recorded: 0
Battery changed: 22-Sep-2015 08:29:27
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
Date: 2012-04-01

Serial number: 05601323
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:29:04
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 18,0560
Events recorded: 0
Battery changed: 22-Sep-2015 08:40:23
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
Date: 2012-04-01

Serial number: 05601323
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:29:04
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 18,0560
Events recorded: 0
Battery changed: 22-Sep-2015 08:40:23
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,85 years [82%]
Calibration:
Date: 2012-04-01

Serial number: 05601324
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 14:57:53
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,4733
Events recorded: 0
Battery changed: 23-Jan-2017 14:57:53
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,87 years [100%]
Calibration:
Date: 2012-04-01

Serial number: 05601325
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:55:30
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,4962
Events recorded: 0
Battery changed: 22-Sep-2015 08:44:15
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
Date: 2012-04-01

Serial number: 05601328
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:58:48
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,5034
Events recorded: 0
Battery changed: 21-Sep-2015 13:55:43
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]
Calibration:
Date: 2012-04-01

Serial number: 05601340
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:47:15
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,3054
Events recorded: 0
Battery changed: 21-Sep-2015 13:51:14
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]
Calibration:
Date: 2012-04-04

Serial number: 05601340
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:47:15
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,3054
Events recorded: 0
Battery changed: 21-Sep-2015 13:51:14
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]
Calibration:
Date: 2012-04-04

Serial number: 05601342
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:48:46
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,4325

Events recorded: 0
Battery changed: 21-Sep-2015 13:45:18
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]
Calibration:
  Date: 2012-04-04

Serial number: 05601347
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:57:13
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,6867
Events recorded: 0
Battery changed: 21-Sep-2015 13:48:54
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]
Calibration:
  Date: 2012-04-04

Serial number: 05605498
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 17:55:56
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 15,8277
Events recorded: 0
Battery changed: 26-Aug-2015 13:48:11
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-07-30

Serial number: 05605499
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 17:51:54
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 15,1450
Events recorded: 0
Battery changed: 23-Jan-2017 17:51:54
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,87 years [100%]
Calibration:
  Date: 2015-07-30

Serial number: 05605500
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:20:46
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,1813
Events recorded: 0
Battery changed: 26-Aug-2015 13:43:55
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-07-30

Serial number: 05605501
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:39:55
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,3963
Events recorded: 0
Battery changed: 27-Aug-2015 09:28:36
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605502
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:53:21
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 18,5154
Events recorded: 0
Battery changed: 27-Aug-2015 09:33:46
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605503
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:18:13
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,0313
Events recorded: 0
Battery changed: 22-Sep-2015 10:15:50
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,84 years [82%]
Calibration:
  Date: 2015-08-01

Serial number: 05605504
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:36:52
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,6267
Events recorded: 0
Battery changed: 26-Aug-2015 13:26:22
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605505
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:23:07
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,9565
Events recorded: 0
Battery changed: 26-Aug-2015 13:28:49
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605506
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:13:06
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,3576
Events recorded: 0
Battery changed: 26-Aug-2015 13:39:52
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605507
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:01:40
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,2217
Events recorded: 0
Battery changed: 26-Aug-2015 13:33:31
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605508
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:44:08
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,6077
Events recorded: 0
Battery changed: 26-Aug-2015 13:23:05
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605509
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:06:05
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,7955
Events recorded: 0
Battery changed: 26-Aug-2015 12:51:53
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01
Serial number: 05605510
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:24:35
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,4920
Events recorded: 0
Battery changed: 26-Aug-2015 13:06:22
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605511
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:03:13
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,1967
Events recorded: 0
Battery changed: 26-Aug-2015 13:15:22
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]
Calibration:
  Date: 2015-08-01

Serial number: 05605512
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 23-Jan-2017 17:53:49
Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 15,4162
Events recorded: 0
Battery changed: 23-Jan-2017 17:53:49
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,87 years [100%]
Calibration:
  Date: 2015-08-01

Serial number: 05606508
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 19:59:03
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 6,3018
Events recorded: 0
Battery changed: 20-May-2016 10:55:59
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
  Date: 2016-05-10

Serial number: 05606509
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 20:04:40
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 7,1210
Events recorded: 0
Battery changed: 20-May-2016 10:56:23
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
  Date: 2016-05-10

Serial number: 05606515
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 20:02:20
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 6,7666
Events recorded: 0
Battery changed: 20-May-2016 10:58:28
Number of samples in memory: 0

Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
Date: 2016-04-26

Current Configuration:
Serial number: 05606517
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 20:08:42
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 7,1499
Events recorded: 0
Battery changed: 20-May-2016 10:59:06
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
Date: 2016-04-26

Current Configuration:
Serial number: 05606518
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 20:06:35
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 6,8278
Events recorded: 0
Battery changed: 20-May-2016 10:59:31
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
Date: 2016-04-21

Current Configuration:
Serial number: 05606519
Firmware version: SBE56 V0.96
Sample period (sec): 120,0
Date/time: 15-Feb-2017 19:56:16
Start sampling at: 20-Feb-2017 00:00:00
Current temperature: 7,9484
Events recorded: 0
Battery changed: 20-May-2016 11:00:00
Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,33 years [90%]
Calibration:
Date: 2016-04-26

4.4.4 LOCEAN Mooring deployment (P1 to P6)

4.4.4.1 Mooring deployment

Mooring P1

Mooring P1 was deployed anchor first 17:20 UTC on 12 February, 2017 at 74° 51.032S 031° 03.725W. The upper 100m light wire line and top buoy were eventually deployed by hand while the lower part of the line from ADCP buoy to anchor was hanging below the ship's stern . Innovative technique ®.

The acoustic release was interrogated after deployment; the acoustic release was vertical and the position was confirmed (Table 4.4.5).

Mooring P2

Mooring P2 was deployed anchor first 14:00 UTC on 12 February, 2017 at 74° 51.042S 31° 22.718W. The upper 100m light wire line and top buoy were eventually deployed by hand while the lower part of the line from ADCP buoy to anchor was hanging below the ship's stern . Innovative technique again ®.

The acoustic release was interrogated after deployment; the acoustic release was vertical and the position was confirmed (Table 4.4.5).

Mooring P3

Mooring P3 was deployed bottom lander first 21:30UTC on 12 February 2017 at 74° 50.997S 30° 42.913W.

The acoustic release was interrogated after deployment; the acoustic release was vertical and the position was confirmed (Table 4.4.5).

Mooring P4

Mooring P4 was deployed anchor last between 15:20 and 16:30 UTC on 11 Feb. The top buoy was deployed at 74° 50.854 S 30° 23.272 W. The argos beacon was broken when lifting the top buoy which turn upside down . No spare available , hence no argos on that mooring … When the anchor was released, the position of the ship was 74° 51.028 S 30° 22.852 W .The acoustic released was interrogated after deployment (Table 4.4.5) and the position of the mooring was determined to be 74° 51.022 S 30° 23.111 W. The release was vertical.

Mooring P5

Mooring P5 was deployed anchor last between 13:40 and 15.00 UTC on 09/02/17. The top buoy was deployed at 75° 23.526 S 28° 38.108 W. When the anchor was released, the position of the ship was 75° 23.350 S 28° 38.221 W. The acoustic released was interrogated after deployment (Table 4.4.5) and the position of the mooring was determined to be 75° 23.383 S 28° 38.219 W. The release was vertical.

Mooring P6

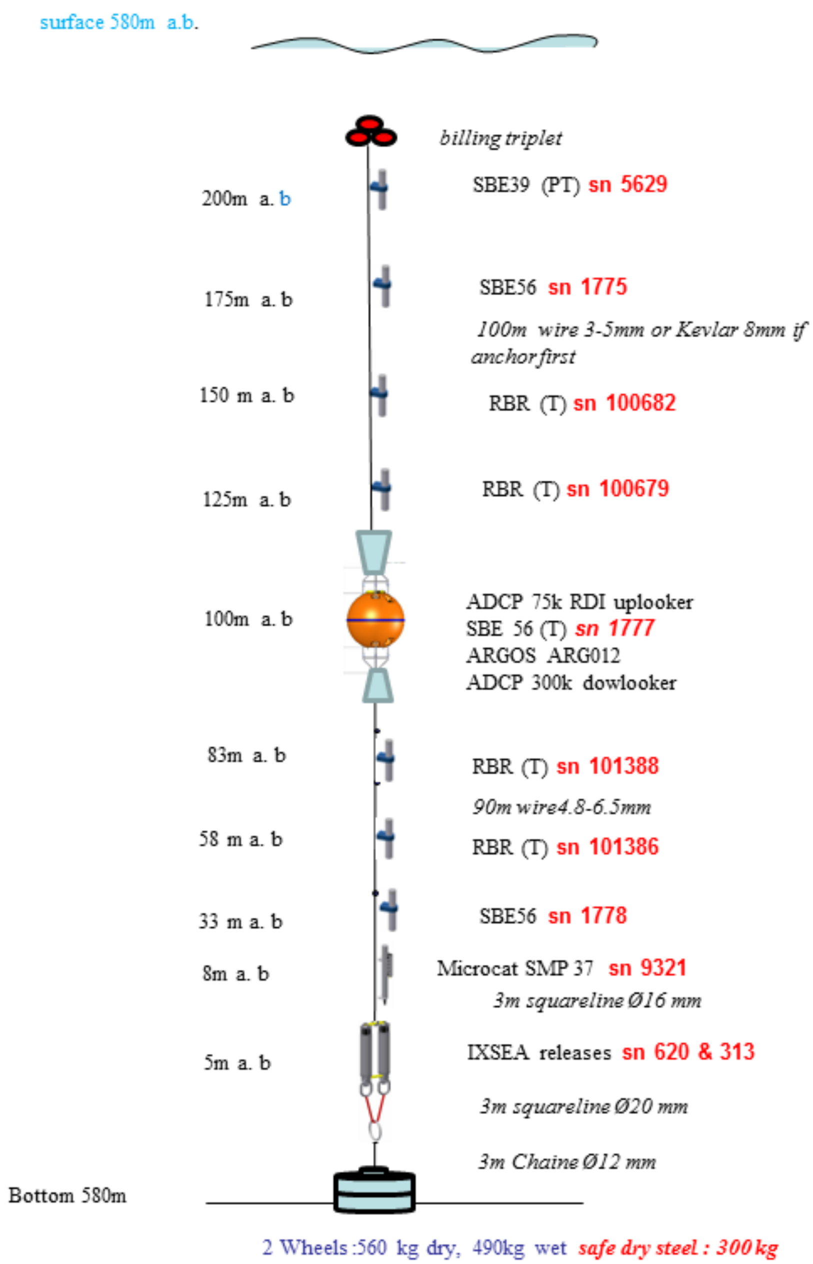
Mooring P6 was deployed anchor last between 17:00 and 19:10 UTC on 08/02/17. The top buoy was deployed at 74° 01.160 S 28° 11.290 W. When the anchor was released, the position of the ship was 74° 01.155 S 28° 04.540 W. The acoustic released was interrogated after deployment (Table 4.4.5) and the position of the mooring was determined to be 74° 01.171 S 28° 04.779 W. The release was vertical.

Deployment details for the LOCEANmoorings 1) P1-P2-P3 Position where moorings was released – anchor first. 2) Position determined from triangulation for anchor last deployments . EA 600 depth were corrected for sound velocity =1450 m/S

LOCEAN Moorings								
name	**LAT (S)**	**LONG (W)**	**depth EA600 (m)**	**depth corrected (m)**	**distanc release bottom (m)**	**release immersion (m)**	**date**	**deployment**
P1	74° 51.032	031° 03.725	599	579	5	574	12/02/2017 17:20	anchor first
P2	74° 51.042	031° 22.718	562	543	5	538	12/02/2017 13:50	anchor first
P3	74° 50.997	030° 42.913	499	482	2	480	12/02/2017 21:30	anchor first
P4	74° 51.000	030° 23.013	456	441	5	436	11/02/2017 16:30	anchor last
P5	75° 23.383	028° 38.219	443	428	5	423	09/02/2017 15:00	anchor last
P6	74° 01.171	028° 04.779	2605	2518	415	2103	08/02/2017 19:10	anchor last

LOCEAN Mooring P1
Deployed anchor first
On 12/02/2017

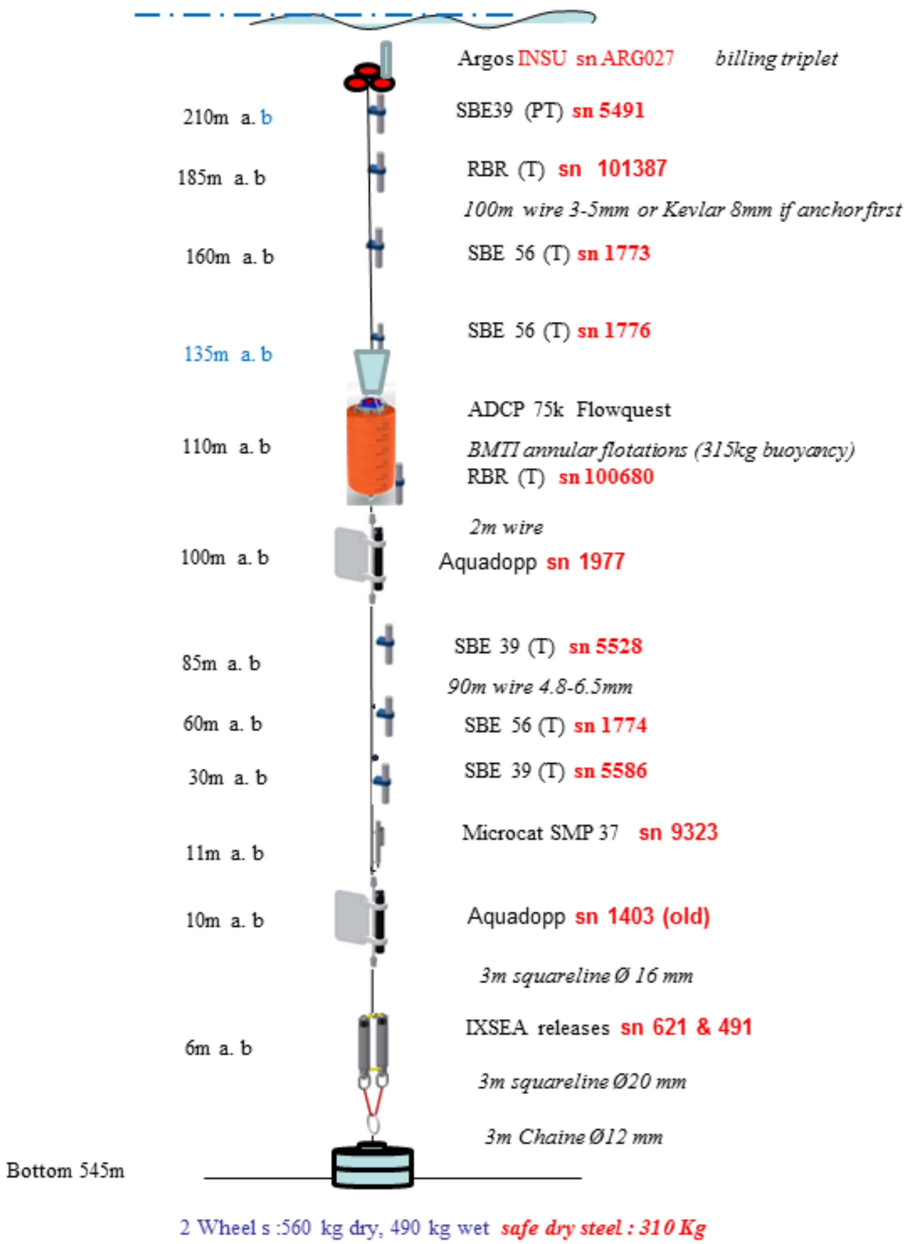
74° 51.032 S
31° 03.725 W
Bottom depth 580m



LOCEAN Mooring P2

Deployed anchor first
On 12/02/2017

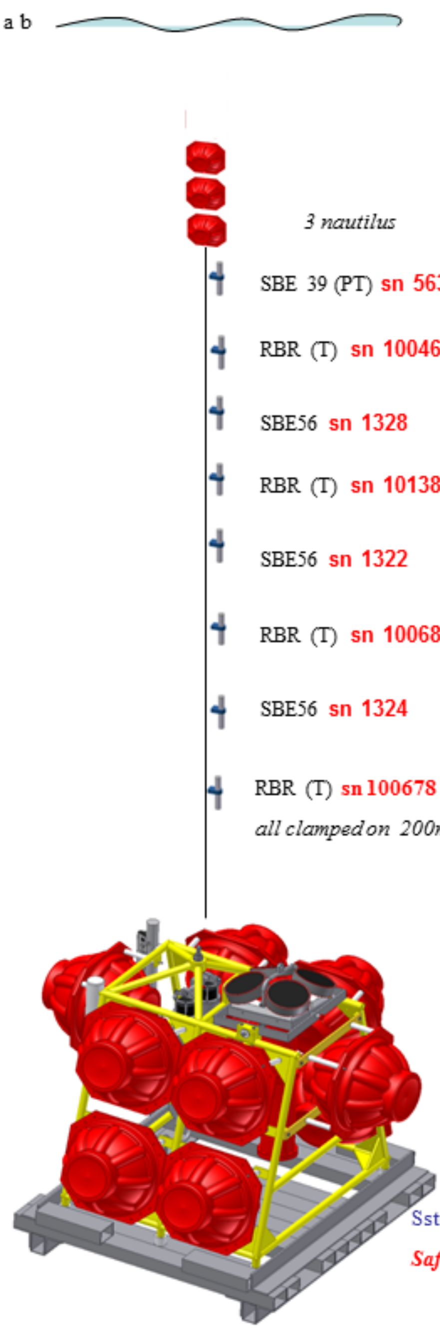
74° 51.042 S
31° 22.718 W
Bottom depth 545m

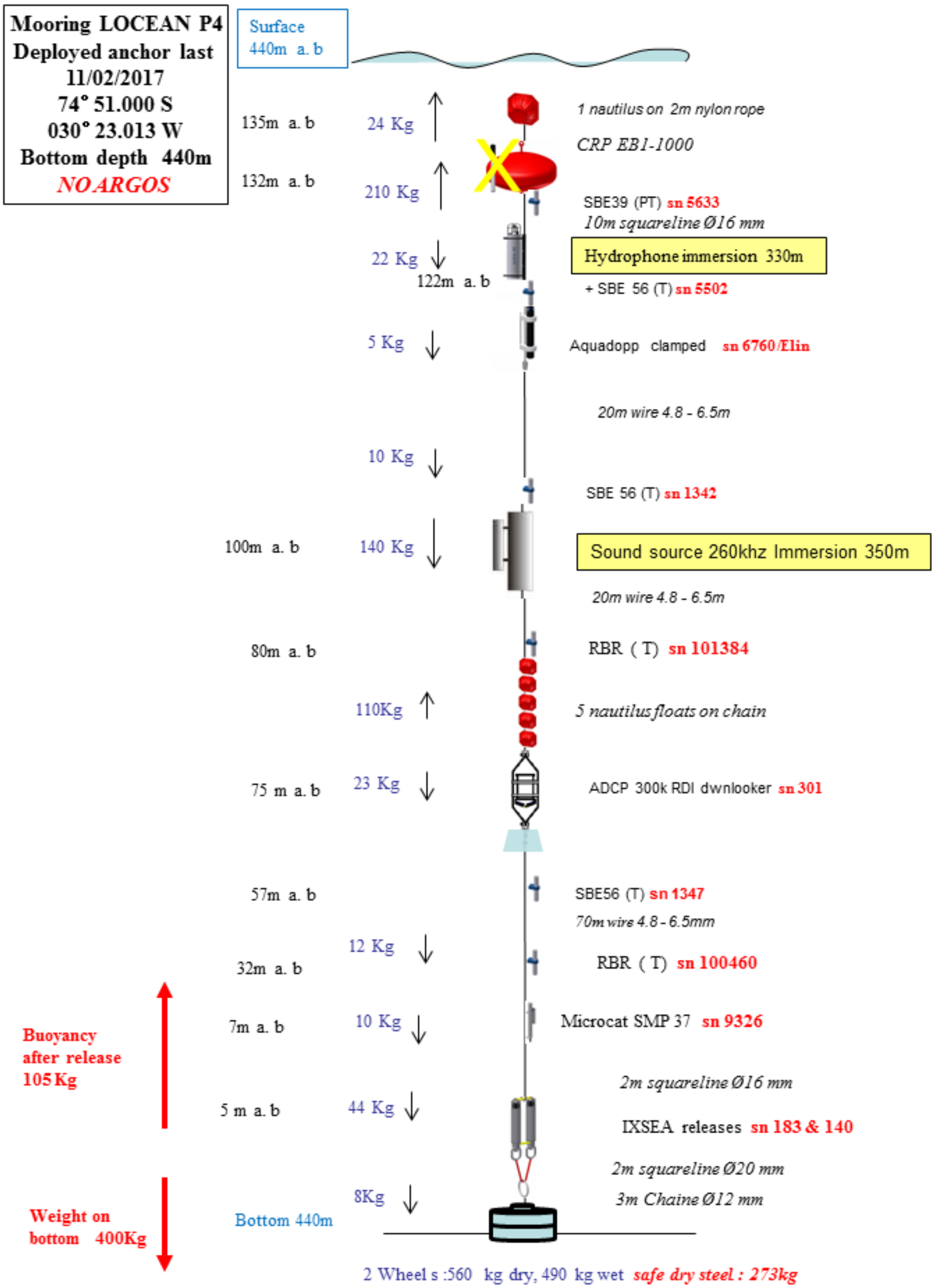


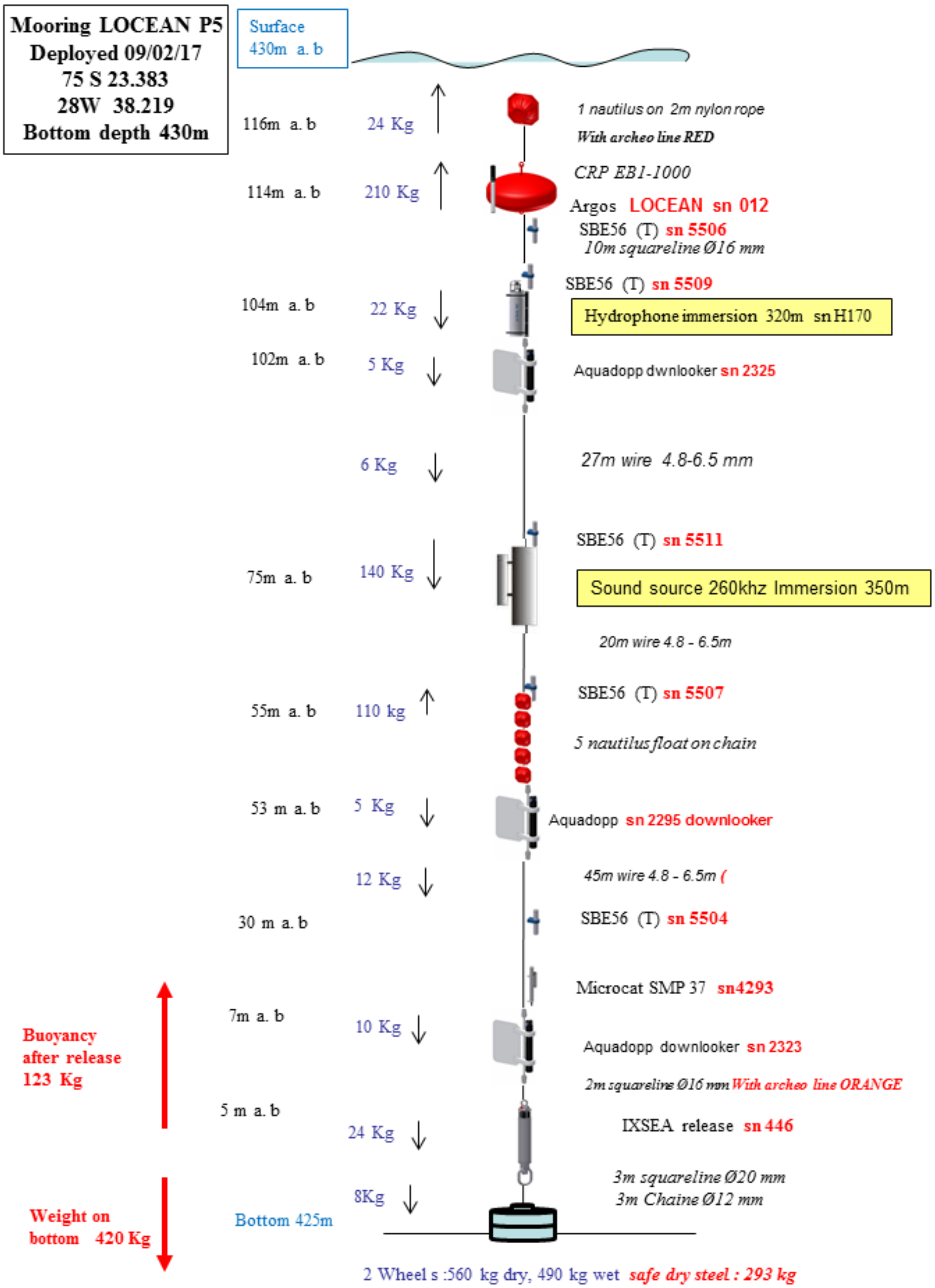
LOCEAN Mooring P3

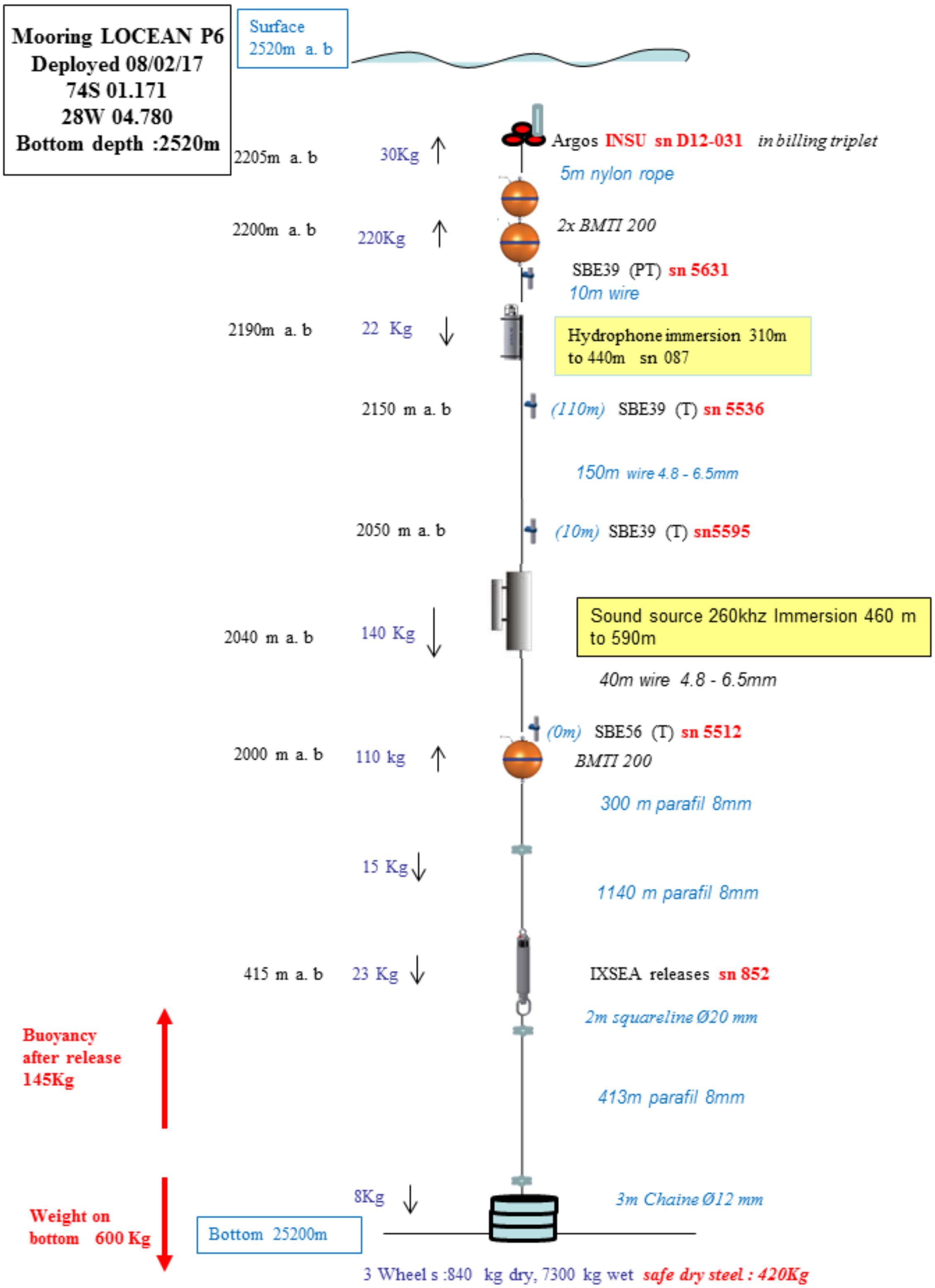
Deployed anchor first
On 12/02/2017

74° 50.997 S
30° 42.913 W
Bottom depth 480m



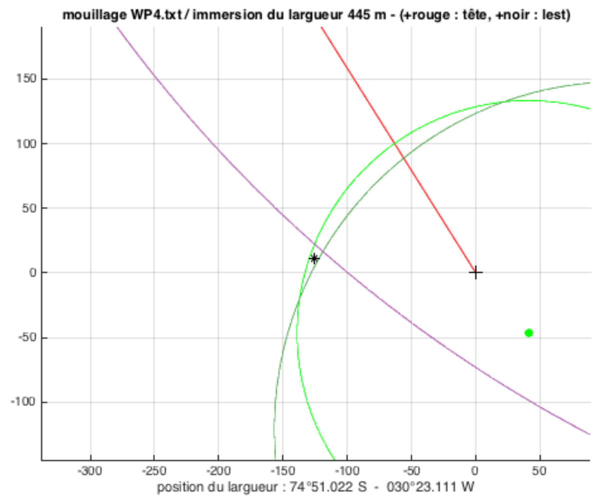

Mooring LOCEAN P4
Deployed anchor last
11/02/2017
74° 51.000 S
030° 23.013 W
Bottom depth 440m
NO ARGOS
Surface
440m a. b
135m a. b
24 Kg
1 nautilus on 2m nylon rope
CRP EB1-1000
132m a. b
210 Kg
SBE39 (PT) sn 5633
10m squareline Ø16 mm
22 Kg
Hydrophone immersion 330m
122m a. b
+ SBE 56 (T) sn 5502
5 Kg
Aquadopp clamped sn 6760/Elin
20m wire 4.8 - 6.5m
10 Kg
SBE 56 (T) sn 1342
100m a. b
140 Kg
Sound source 260khz Immersion 350m
20m wire 4.8 - 6.5m
80m a. b
RBR (T) sn 101384
110Kg
5 nautilus floats on chain
75 m a. b
23 Kg
ADCP 300k RDI dwnlooker sn 301
57m a. b
SBE56 (T) sn 1347
70m wire 4.8 - 6.5mm
12 Kg
32m a. b
RBR (T) sn 100460
Buoyancy
after release
105 Kg
7m a. b
10 Kg
Microcat SMP 37 sn 9326
2m squareline Ø16 mm
5 m a. b
44 Kg
IXSEA releases sn 183 & 140
2m squareline Ø20 mm
3m Chaine Ø12 mm
8Kg
Weight on
bottom 400Kg
Bottom 440m
2 Wheel s :560 kg dry, 490 kg wet safe dry steel : 273kg

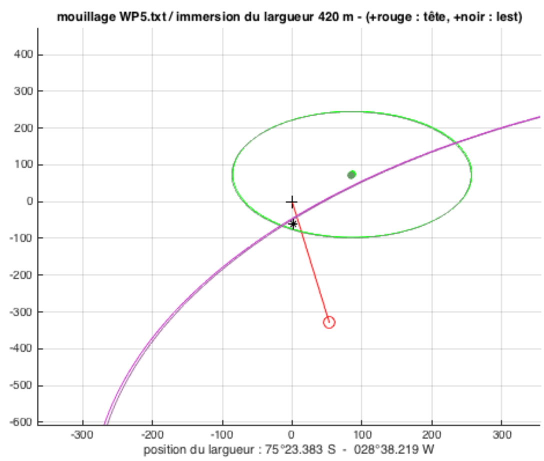

Mooring LOCEAN P5
Deployed 09/02/17
75 S 23.383
28W 38.219
Bottom depth 430m
Surface
430m a. b
116m a. b
24 Kg
1 nautilus on 2m nylon rope
With archeo line RED
114m a. b
210 Kg
CRP EB1-1000
Argos LOCEAN sn 012
SBE56 (T) sn 5506
10m squareline Ø16 mm
SBE56 (T) sn 5509
104m a. b
22 Kg
Hydrophone immersion 320m sn H170
102m a. b
5 Kg
Aquadopp dwnlooker sn 2325
6 Kg
27m wire 4.8-6.5 mm
SBE56 (T) sn 5511
75m a. b
140 Kg
Sound source 260khz Immersion 350m
20m wire 4.8 - 6.5m
SBE56 (T) sn 5507
55m a. b
110 kg
5 nautilus float on chain
53 m a. b
5 Kg
Aquadopp sn 2295 downlooker
12 Kg
45m wire 4.8 - 6.5m (
30 m a. b
SBE56 (T) sn 5504
Microcat SMP 37 sn4293
7m a. b
10 Kg
Buoyancy
after release
123 Kg
Aquadopp downlooker sn 2323
2m squareline Ø16 mm With archeo line ORANGE
5 m a. b
24 Kg
IXSEA release sn 446
3m squareline Ø20 mm
3m Chaine Ø12 mm
8Kg
Weight on
bottom 420 Kg
Bottom 425m
2 Wheel s :560 kg dry, 490 kg wet safe dry steel : 293 kg

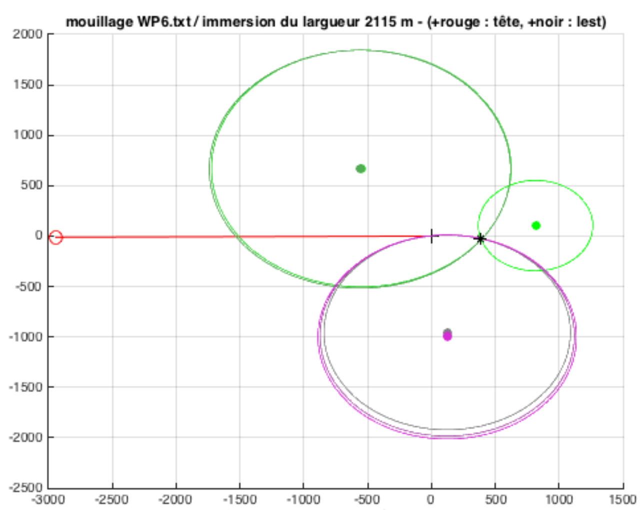

Mooring LOCEAN P6
Deployed 08/02/17
74S 01.171
28W 04.780
Bottom depth :2520m
Surface
2520m a. b
2205m a. b
30Kg
Argos INSU sn D12-031 in billing triplet
5m nylon rope
2200m a. b
220Kg
2x BMTI 200
SBE39 (PT) sn 5631
10m wire
2190m a. b
22 Kg
Hydrophone immersion 310m to 440m sn 087
2150 m a. b
(110m) SBE39 (T) sn 5536
150m wire 4.8 - 6.5mm
2050 m a. b
(10m) SBE39 (T) sn5595
2040 m a. b
140 Kg
Sound source 260khz Immersion 460 m to 590m
40m wire 4.8 - 6.5mm
(0m) SBE56 (T) sn 5512
2000 m a. b
110 kg
BMTI 200
300 m parafil 8mm
15 Kg
1140 m parafil 8mm
415 m a. b
23 Kg
IXSEA releases sn 852
2m squareline Ø20 mm
Buoyancy after release 145Kg
413m parafil 8mm
8Kg
3m Chaine Ø12 mm
Weight on bottom 600 Kg
Bottom 25200m
3 Wheel s :840 kg dry, 7300 kg wet safe dry steel : 420Kg

4.4.4.2 Triangulations

Acoustic triangulations were achieved only after anchor last deployment. After anchor first deployments a single interrogation close to the anchor splash position was carried out to check functionality of the releases. Using a sound speed of 1460 m/s, triangulation results appear below







4.4.4.3 Mooring instrumentation and settings

IXSEA Acoustic releases

Used with TT801 deck release and transducer integrated in hull. Double releases on each line, except on P5 & P6. 2 releases equipped with alkaline batteries, purposely coupled with lithium-equipped units.

SN	owner	type	battery	mooring	ARM	diagnos	release
140	INSU	AR601	Li	P4	6197	NAN	6198
183	INSU	AR 861	Li	P4	0402	0449	0455
313	INSU	RT 661	alcaline	P1	C432	C435	C434
620	INSU	Oceano Universal AR8X	Li	P1	1561	1549	1555
621	INSU	Oceano Universal AR8X	Li	P2	1562	1549	1555
491	INSU	RT 661	alcaline	P2	2867	2870	2869
447	LOCEAN		Li	P3	0229	0249	0255
1088	LOCEAN	Oceano Universal AR8X	Li	P3	1802	1849	1855
446	LOCEAN	RT 861 B2S	Li	P5	0220	0249	0255
852	INSU	Oceano Universal AR8X	Li	P6	1678	1649	1655

ARGOS beacons

The new Novatech beacons from DT INSU are not decoded by our old ARGOS directional finder, but though received OK for azimuth /ranging**.** All beacons were monitored during deployment until they dived below surface. Argos beacon from Locean was broken during P4 deployment.

Mooring	ID	deployed	owner
P1	357	12 feb 17	INSU
P2	D12-032	12 feb 17	INSU
P3	18780	12 feb 17	LOCEAN
P4	***broken***		LOCEAN
P5	11429	09 feb 17	LOCEAN
P6	D12-031	08 feb 17	INSU

Pressure/temperature/conductivity sensors : SEABIRD Microcat SBE37 SMP

All instruments from DT INSU . Pmax 2000m, 2 versions inducing slower sampling rate for the old ones.

mooring	µcat depth (m)	µcat sn	start time	sampling (s)	endurance (days)
P1	570	9321	12 feb 00:00	180	878
P2	535	9323	12 feb 00:00	180	878
P3	480	4027	13 feb 00:00	1200	955
P4	430	9326	11 feb 00:00	180	878
P5	415	4293	10 feb 00:00	1200	955

SBE37-SM V 2.6b SERIAL NO. 4027 12 Feb 2017 18:01:26	**SBE37-SM V 2.6b SERIAL NO. 4293 07 Feb 2017 19:53:47**
not logging: waiting to start at 13 Feb 2017 00:00:00	not logging: waiting to start at 10 Feb 2017 00:00:00
sample interval = 1200 seconds	sample interval = 1200 seconds
samplenumber = 0, free = 190650	samplenumber = 0, free = 190650
do not transmit real-time data	do not transmit real-time data
do not output salinity with each sample	do not output salinity with each sample
do not output sound velocity with each sample	do not output sound velocity with each sample
store time with each sample	store time with each sample
number of samples to average = 3	number of samples to average = 3
serial sync mode disabled	serial sync mode disabled
wait time after serial sync sampling = 30 seconds	wait time after serial sync sampling = 30 seconds
internal pump is installed	internal pump is installed
temperature = 2.98 deg C	temperature = 14.28 deg C

SBE37SM-RS232 v4.1 SERIAL NO. 9321 11 Feb 2017 13:26:07	**SBE37SM-RS232 v4.1 SERIAL NO. 9323 11 Feb 2017 13:12:32**
vMain = 13.13, vLith = 2.94	vMain = 13.12, vLith = 2.94
samplenumber = 0, free = 559240	samplenumber = 0, free = 559240
not logging, waiting to start at 12 Feb 2017 00:00:00	not logging, waiting to start at 12 Feb 2017 00:00:00
sample interval = 180 seconds	sample interval = 180 seconds
data format = converted engineering	data format = converted engineering
transmit real-time = no	transmit real-time = no
sync mode = no	sync mode = no
pump installed = yes, minimum conductivity frequency = 3092.9	pump installed = yes, minimum conductivity frequency = 3097.7

SBE37SM-RS232 v4.1 SERIAL NO. 9326 09 Feb 2017 20:05:22
vMain = 13.13, vLith = 2.88
samplenumber = 0, free = 559240
not logging, waiting to start at 11 Feb 2017 00:00:00
sample interval = 180 seconds
data format = converted engineering
transmit real-time = no
sync mode = no
pump installed = yes, minimum conductivity frequency = 3104.9

Temperature/pressure sensors: SEABIRD SBE39

All instruments from DT INSU. Unfortunately they were not checked before departure and we misunderstood the battery type. As those old models use 9V battery (instead of LSH14500 for the new model) we had eventually to mount alkaline 9v batteries borrowed from the ship , which lead to reduce the sampling rate to 3600s.

mooring	SBE39 depth (m)	SBE39 sn & Type	start time	sampling (s)	endurance (days)
P1	380	5629 / PT	12 feb 00:00	3600	763
P2	335	5491 /PT	12 feb 00:00	3600	763
	460	5528 / T	12 feb 00:00	3600	833
	515	5586 / T	12 feb 00:00	3600	833
P3	280	5630 / PT	13 feb 00:00	3600	763
P4	305	5633 /PT	11 feb 00:00	3600	833
P6	330	5631 / PT	08 feb 00:00	3600	763
	370	5536 / T	08 feb 00:00	3600	833
	480	5595 / T	08 feb 00:00	3600	833

SBE 39 V 3.1b SERIAL NO. 5491 11 Feb 2017 13:39:20	**SBE 39 V 3.1b SERIAL NO. 5536 07 Feb 2017 17:26:48**
battery voltage = 8.9	battery voltage = 8.9
not logging: waiting to start at 12 Feb 2017 00:00:00	not logging: waiting to start at 08 Feb 2017 00:00:00
sample interval = 3600 seconds	sample interval = 3600 seconds
samplenumber = 0, free = 3655452	samplenumber = 0, free = 4699867
serial sync mode disabled	serial sync mode disabled
real-time output disabled	real-time output disabled
SBE 39 configuration = temperature and pressure	SBE 39 configuration = temperature only
binary upload includes time	binary upload includes time
temperature = 12.88 deg C	temperature = 16.74 deg C
SBE 39 V 3.1b SERIAL NO. 5586 11 Feb 2017 20:06:59	**SBE 39 V 3.1b SERIAL NO. 5595 07 Feb 2017 17:23:17**
battery voltage = 8.9	battery voltage = 8.9
not logging: waiting to start at 12 Feb 2017 00:00:00	not logging: waiting to start at 08 Feb 2017 00:00:00
sample interval = 3600 seconds	sample interval = 3600 seconds
samplenumber = 0, free = 4699867	samplenumber = 0, free = 4699867
serial sync mode disabled	serial sync mode disabled
real-time output disabled	real-time output disabled
SBE 39 configuration = temperature only	SBE 39 configuration = temperature only
binary upload includes time	binary upload includes time
temperature = 8.48 deg C	temperature = 16.27 deg C
SBE 39 V 3.1b SERIAL NO. 5629 11 Feb 2017 13:43:58	**SBE 39 V 3.1b SERIAL NO. 5630 12 Feb 2017 18:13:27**
battery voltage = 8.8	battery voltage = 8.8
not logging: waiting to start at 12 Feb 2017 00:00:00	not logging: waiting to start at 12 Feb 2017 19:00:00
sample interval = 3600 seconds	sample interval = 3600 seconds
samplenumber = 0, free = 3655452	samplenumber = 0, free = 3655452
serial sync mode disabled	serial sync mode disabled
real-time output disabled	real-time output disabled

SBE 39 configuration = temperature and pressure	SBE 39 configuration = temperature and pressure
binary upload includes time	binary upload includes time
temperature = 12.74 deg C	temperature = 8.53 deg C
SBE 39 V 3.1b SERIAL NO. 5631 07 Feb 2017 17:17:50	**SBE 39 V 3.1b SERIAL NO. 5633 09 Feb 2017 20:17:26**
battery voltage = 8.9	battery voltage = 8.9
not logging: waiting to start at 08 Feb 2017 00:00:00	not logging: waiting to start at 11 Feb 2017 00:00:00
sample interval = 3600 seconds	sample interval = 3600 seconds
samplenumber = 0, free = 3655452	samplenumber = 0, free = 3655452
serial sync mode disabled	serial sync mode disabled
real-time output disabled	real-time output disabled
SBE 39 configuration = temperature and pressure	SBE 39 configuration = temperature and pressure
binary upload includes time	binary upload includes time
temperature = 16.41 deg C	temperature = 8.94 deg C

Temperature sensors: SEABIRD SBE56

11 instruments were kindly borrowed from Elin /UIB.

mooring	SBE56 depth (m)	SBE56 sn	start time	sampling (s)	endurance (days)	owner
P1	400	1775	01 feb 00:00	30	1670	INSU
	547	1778	01 feb 00:00	30	1670	INSU
P2	385	1773	01 feb 00:00	30	1670	INSU
	360	1776	01 feb 00:00	30	1670	INSU
	485	1774	01 feb 00:00	30	1670	INSU
P3	330	1328	01 feb 00:00	120	2500	UIB/Elin
	380	1322	01 feb 00:00	120	2500	UIB/Elin
	430	1324	01 feb 00:00	120	2500	UIB/Elin
P4	317	5502	01 feb 00:00	120	2500	UIB/Elin
	340	1342	01 feb 00:00	120	2500	UIB/Elin
	380	1347	01 feb 00:00	120	2500	UIB/Elin
P5	315	5506	01 feb 00:00	120	2500	UIB/Elin
	325	5509	01 feb 00:00	120	2500	UIB/Elin
	350	5511	01 feb 00:00	120	2500	UIB/Elin
	370	5507	01 feb 00:00	120	2500	UIB/Elin
	395	5504	01 feb 00:00	120	2500	UIB/Elin
P6	520	5512	01 feb 00:00	120	2500	UIB/Elin

Serial number: 05601328	**Serial number: 05601322**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:58:48	Date/time: 23-Jan-2017 18:16:15
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,5034	Current temperature: 16,8262
Events recorded: 0	Events recorded: 0
Battery changed: 21-Sep-2015 13:55:43	Battery changed: 22-Sep-2015 08:29:27
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]	Calculated battery life remaining: 4,84 years [82%]
Calibration:	Calibration:
Date: 2012-04-01	Date: 2012-04-01
Coefficients:	Coefficients:
A0 = -1.311919E-03	A0 = -1.295906E-03
A1 = 3.542975E-04	A1 = 3.552619E-04

A2 = -6.957628E-06	A2 = -7.128663E-06
A3 = 2.093387E-07	A3 = 2.118497E-07
Serial number: 05601324	**Serial number: 05605502**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0
Date/time: 23-Jan-2017 14:57:53	Date/time: 23-Jan-2017 18:53:21
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,4733	Current temperature: 18,5154
Events recorded: 0	Events recorded: 0
Battery changed: 23-Jan-2017 14:57:53	Battery changed: 27-Aug-2015 09:33:46
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 5,87 years [100%]	Calculated battery life remaining: 4,79 years [81%]
Calibration:	Calibration:
Date: 2012-04-01	Date: 2015-08-01
Coefficients:	Coefficients:
A0 = -1.291163E-03	A0 = -1.271822E-03
A1 = 3.526308E-04	A1 = 3.528486E-04
A2 = -6.904021E-06	A2 = -7.073100E-06
A3 = 2.078202E-07	A3 = 2.121088E-07
Serial number: 05601342	**Serial number: 05601347**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:48:46	Date/time: 23-Jan-2017 18:57:13
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,4325	Current temperature: 17,6867
Events recorded: 0	Events recorded: 0
Battery changed: 21-Sep-2015 13:45:18	Battery changed: 21-Sep-2015 13:48:54
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,60 years [78%]	Calculated battery life remaining: 4,60 years [78%]
Calibration:	Calibration:
Date: 2012-04-04	Date: 2012-04-04
Coefficients:	Coefficients:
A0 = -1.281839E-03	A0 = -1.292991E-03
A1 = 3.483616E-04	A1 = 3.513719E-04
A2 = -6.558504E-06	A2 = -6.754992E-06
A3 = 2.009798E-07	A3 = 2.054680E-07
Serial number: 05605506	**Serial number: 05605509**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:13:06	Date/time: 23-Jan-2017 18:06:05
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,3576	Current temperature: 16,7955
Events recorded: 0	Events recorded: 0
Battery changed: 26-Aug-2015 13:39:52	Battery changed: 26-Aug-2015 12:51:53
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]	Calculated battery life remaining: 4,79 years [81%]
Calibration:	Calibration:
Date: 2015-08-01	Date: 2015-08-01
Coefficients:	Coefficients:
A0 = -1.228896E-03	A0 = -1.266540E-03
A1 = 3.497635E-04	A1 = 3.478165E-04
A2 = -6.942421E-06	A2 = -6.580253E-06
A3 = 2.066777E-07	A3 = 2.004059E-07
Serial number: 05605511	**Serial number: 05605507**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0

Date/time: 23-Jan-2017 18:03:13	Date/time: 23-Jan-2017 18:01:40
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 16,1967	Current temperature: 16,2217
Events recorded: 0	Events recorded: 0
Battery changed: 26-Aug-2015 13:15:22	Battery changed: 26-Aug-2015 13:33:31
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]	Calculated battery life remaining: 4,79 years [81%]
Calibration:	Calibration:
Date: 2015-08-01	Date: 2015-08-01
Coefficients:	Coefficients:
A0 = -1.279283E-03	A0 = -1.298742E-03
A1 = 3.558026E-04	A1 = 3.519919E-04
A2 = -7.250016E-06	A2 = -6.775567E-06
A3 = 2.142020E-	A3 = 2.052069E-07
Serial number: 05605504	**Serial number: 05605512**
Firmware version: SBE56 V0.96	Firmware version: SBE56 V0.96
Sample period (sec): 120,0	Sample period (sec): 120,0
Date/time: 23-Jan-2017 18:36:52	Date/time: 23-Jan-2017 17:53:49
Start sampling at: 01-Feb-2017 00:00:00	Start sampling at: 01-Feb-2017 00:00:00
Current temperature: 17,6267	Current temperature: 15,4162
Events recorded: 0	Events recorded: 0
Battery changed: 26-Aug-2015 13:26:22	Battery changed: 23-Jan-2017 17:53:49
Number of samples in memory: 0	Number of samples in memory: 0
Memory Remaining: 61,71 years [100%]	Memory Remaining: 61,71 years [100%]
Calculated battery life remaining: 4,79 years [81%]	Calculated battery life remaining: 5,87 years [100%]
Calibration:	Calibration:
Date: 2015-08-01	Date: 2015-08-01
Coefficients:	Coefficients:
A0 = -1.357458E-03	A0 = -1.338592E-03
A1 = 3.651556E-04	A1 = 3.568513E-04
A2 = -7.646402E-06	A2 = -7.010524E-06
A3 = 2.227287E-07	A3 = 2.100925E-07

Temperature sensor RBR solo

mooring	RBR depth (m)	RBR sn	start time	sampling (s)	endurance (days)	Pmax (dbar)	owner
P1	350	100682	01 feb 00h00	5	1412	1600	LOCEAN
	325	100679					
	417	101388					
	442	101386					
P2	360	101387					
	435	100680					
P3	295	100461					
	355	101385					
	405	100681					
	455	100678					
P4	360	101384					
	408	100460					

Acoustic Current profilers: RDI and Flowquest ADCPs

The 4 RDI ADCPs were equipped with Lithium battery packs, which allows 2.5 times the autonomy compared to alkaline packs. The 2x WH300 used packs stored since 2012, hence we discount 20% self-discharge for the energy balance. All battery packs and stainless steel frames around the ADCPs heads were degaussed prior deployment at LOCEAN, in order to minimized ferromagnetic bias on the Fluxgate compasses.

The Flowquest 75k can use only alkaline packs, and the endurance calculator provided with the instrument shows strange optimistic result compared to RDI calculator. It might well happen that the instrument will stop before the previsted 800 days …

All RDI instruments were controlled acoustically (stethoscope) after pinging started. This was impossible with the Flowquest, which is NOT allowed to ping in the air on high power. Therefore it was deployed in start later mode without control….

When installing the WH 150khz in its gimballed bottom frame (P3) it appeared that the gimball was unbalanced because WH 150khz having external battery case, the instrument body has a very high gravity center. We had to block the gimball (with ropes). Tilt angles will need to be carefully controlled in the final data.

ADCP type (all belonging to INSU)	**WH 300k**	**WH 300k**	**WH 150k**	**Long ranger 75k**	**Flowquest 75k**
location on mooring	P1, 100 mab downlooker	P4, 75 mab downlooker	P3, 2 mab uplooker	P1, 100 mab uplooker	P2, 110 mab uplooker
start time	12 feb 00:00	11 feb 00:00	12 feb 18:00	12 feb 00:00	13 feb 00:00
battery type	1 lithium pack 80% (2012)	1 lithium pack 80% (2012)	4 lithium packs external case	4 lithium packs	4 alcaline packs
battery capacity (Wh)	1050	1050	5200	5200	2800
confg bins	25 bins 4m	20 bins 4m	20 bins 16m	28 bins 16m	29 bins 16m
config power /banwidth	NB	NB	NB	NB	high
Tensemble (mn)	30 mn	30 mn	30 mn	60 mn	120 mn
nb ping/ensemble	50	50	80	32	45
std deviation (cm/s)	0.50 cm/s	0.50 cm/s	0.40 cm/s	1,34 cm/s	0.60 cm/s
last cell range	100 m	80 m	320 m	455 m	450 m
energy for 800 days(Wh)	848	848	4355	5130	2800
% of battery pack for 800 days	81%	81%	84%	99%	100%

ADCP WH300k P4 75mab downlooker	ADCP WH300k P1 100mab downlooker	ADCP Long ranger75k P1 100mab uplooker	ADCP WH150k ,P3 2mab, uplooker
CR1	CR1	CR1	CR1
CF11101	CF11101	CQ255	CF11101
EA0	EA0	CF11101	EA0
EB0	EB0	EA0	EB0
ED0	ED4000	EB0	ED0
ES34	ES34	ED4000	ES35
EX11111	EX11111	ES34	EX11111
EZ1111101	EZ1111101	EX11111	EZ1111101
WA50	WA50	EZ1111101	WA50
WB0	WB0	WA50	WB1
WD111100000	WD111100000	WB1	WD111100000
WF176	WF176	WD111100000	WF352
WN20	WN25	WF704	WN20
WP50	WP50	WN28	WP80
WS400	WS400	WP32	WS1600
WV175	WV175	WS1600	WV175
TE00:30:00.00	TE00:30:00.00	WV175	TE00:30:00.00
TP00:36.00	TP00:36.00	TE01:00:00.00	TP00:01.16
TF17/02/11 00:00:00	TF17/02/12 00:00:00	TP01:52.50	CK
CK	CK	TF17/02/12 00:00:00	CS
CS	CS	CK	;
;	;	CS	; Workhorse Sentinel
;Workhorse Sentinel	;Workhorse Sentinel	;	;Frequency = 153600
;Frequency = 307200	;Frequency = 307200	;Workhorse Long Ranger	;Water Profile = YES
;Water Profile = YES	;Water Profile = YES	;Frequency = 76800	;Bottom Track = NO
;Bottom Track = NO	;Bottom Track = NO	;Water Profile = YES	;High Res. Modes = NO
;High Res. Modes = NO	;High Res. Modes = NO	;Bottom Track = NO	;High Rate Pinging = NO
;High Rate Pinging = NO	;High Rate Pinging = NO	;High Res. Modes = NO	;Shallow Bottom Mode= NO
;Shallow Bottom Mode= NO	;Shallow Bottom Mode= NO	;High Rate Pinging = NO	;Wave Gauge = NO
;Wave Gauge = NO	;Wave Gauge = NO	;Shallow Bottom Mode= NO	;Lowered ADCP = NO
;Lowered ADCP = NO	;Lowered ADCP = NO	;Wave Gauge = NO	;Ice Track = NO
;Ice Track = NO	;Ice Track = NO	;Lowered ADCP = NO	;Surface Track = NO
;Surface Track = NO	;Surface Track = NO	;Ice Track = NO	;Beam angle = 20
;Beam angle = 20	;Beam angle = 20	;Surface Track = NO	;Temperature = 5.00
;Temperature = 0.00	;Temperature = 0.00	;Beam angle = 20	;Deployment hours = 19200.00
;Deployment hours = 9600.00	;Deployment hours = 9600.00	;Temperature = 0.00	;Battery packs = 4
;Battery packs = 1	;Battery packs = 1	;Deployment hours = 9600.00	;Automatic TP = NO
;Automatic TP = YES	;Automatic TP = YES	;Battery packs = 4	;Memory size [MB] = 256
;Memory size [MB] = 256	;Memory size [MB] = 256	;Automatic TP = YES	;Saved Screen = 1
;Saved Screen = 2	;Saved Screen = 2	;Memory size [MB] = 256	;
;	;	;Saved Screen = 2	;Consequences
;Consequences	;Consequences	;	;First cell range = 20.02 m
;First cell range = 6.17 m	;First cell range = 6.17 m	;Consequences	;Last cell range = 324.02 m
;Last cell range = 82.17 m	;Last cell range = 102.17 m	;First cell range = 24.45 m	;Max range = 323.66 m
;Max range = 104.25 m	;Max range = 106.23 m	;Last cell range = 456.45 m	;Standard deviation = 0.40 cm/s
;Standard deviation = 0.50 cm/s	;Standard deviation = 0.50 cm/s	;Max range = 725.80 m	;Ensemble size = 554 bytes
;Ensemble size = 554 bytes	;Ensemble size = 654 bytes	;Standard deviation = 1.34 cm/s	;Storage required = 20.29 MB (21273600 bytes)
;Storage required = 10.14 MB (10636800 bytes)	;Storage required = 11.98 MB (12556800 bytes)	;Ensemble size = 714 bytes	;Power usage = 4354.87 Wh
;Power usage = 423.61 Wh	;Power usage = 445.66 Wh	;Storage required = 6.54 MB (6854400 bytes)	;Battery usage = 9.7
;Battery usage = 0.9	;Battery usage = 1.0	;Power usage = 2564.90 Wh	;
		;Battery usage = 5.7	

Acoustic current meters / Nortek Aquadopp

All instruments with Lithium battery pack 160wh. 1 AQD was kindly borrowed from UIB/Elin

mooring	AQD depth (m)	Aquadopp sn	start time	sampling (s)	endurance (days)	owner
P2	535	1403	13 feb 00:00	1800	875	LOCEAN
	445	1977	13 feb 00:00	1800	900	LOCEAN
P4	320	6760	10 feb 00:00	1800	900	UIB/Elin
P5	370	2295	09 feb 00:00	1800	900	INSU
	300	2325	09 feb 00:00	1800	900	INSU
	417	2323	09 feb 00:00	1800	900	INSU

Deployment : P5_bottom	**Deployment : P5_mid**
Current time : 07/02/2017 20:35:19	Current time : 07/02/2017 20:26:07
Start at : 09/02/2017	Start at : 09/02/2017
mooriingP5 7 mab	mooriingP5 53 mab
--	--
Measurement interval (s) : 1800	Measurement interval (s) : 1800
Average interval (s) : 75	Average interval (s) : 75
Blanking distance (m) : 0.37	Blanking distance (m) : 0.37
Diagnostics interval(min) : 1440	Diagnostics interval(min) : 1440
Diagnostics samples : 20	Diagnostics samples : 20
Measurement load (%) : 4	Measurement load (%) : 4
Power level : HIGH	Power level : HIGH
Compass upd. rate (s) : 2	Compass upd. rate (s) : 2
Coordinate System : ENU	Coordinate System : ENU
Speed of sound (m/s) : MEASURED	Speed of sound (m/s) : MEASURED
Salinity (ppt) : 35	Salinity (ppt) : 35
File wrapping : OFF	File wrapping : OFF
--	--
Assumed duration (days) : 730.0	Assumed duration (days) : 730.0
Battery utilization (%) : 267.0	Battery utilization (%) : 267.0
Battery level (V) : 14.8	Battery level (V) : 14.8
Recorder size (MB) : 9	Recorder size (MB) : 9
Recorder free space (MB) : 9.000	Recorder free space (MB) : 9.000
Memory required (MB) : 2.0	Memory required (MB) : 2.0
Vertical vel. prec (cm/s) : 1.9	Vertical vel. prec (cm/s) : 1.9
Horizon. vel. prec (cm/s) : 1.3	Horizon. vel. prec (cm/s) : 1.3
Deployment : P5_sup	**Deployment : P4**
Current time : 07/02/2017 20:31:48	Current time : 25.01.2017 17:26:05
Start at : 09/02/2017	Start at : 10.02.2017
mooriingP5 120 mab	Measurement interval (s) : 3600
Measurement interval (s) : 1800	Average interval (s) : 200
Average interval (s) : 75	Blanking distance (m) : 0.35

Blanking distance (m) : 0.37	Measurement load (%) : 4
Diagnostics interval(min) : 1440	Power level : HIGH
Diagnostics samples : 20	Diagnostics interval(min) : 360:00
Measurement load (%) : 4	Diagnostics samples : 20
Power level : HIGH	Compass upd. rate (s) : 10
Compass upd. rate (s) : 2	Coordinate System : ENU
Coordinate System : ENU	Speed of sound (m/s) : MEASURED
Speed of sound (m/s) : MEASURED	Salinity (ppt) : 35
Salinity (ppt) : 35	File wrapping : OFF
File wrapping : OFF	Assumed duration (days) : 760.0
--	Battery utilization (%) : 55.0
Assumed duration (days) : 730.0	Battery level (V) : 14.8
Battery utilization (%) : 267.0	Recorder size (MB) : 9
Battery level (V) : 14.8	Recorder free space (MB) : 8.971
Recorder size (MB) : 9	Memory required (MB) : 3.3
Recorder free space (MB) : 9.000	Vertical vel. prec (cm/s) : 1.4
Memory required (MB) : 2.0	Horizon. vel. prec (cm/s) : 0.8
Vertical vel. prec (cm/s) : 1.9	Instrument ID : AQD 6760
Horizon. vel. prec (cm/s) : 1.3	Head ID : AQD 4029
Deployment :P2 10mab	**Deployment :P2 100mab**
Current time : 12/02/2017 02:30:35	Current time : 12/02/2017 02:25:17
Start at : 13/02/2017	Start at : 13/02/2017
Comment:	Measurement interval (s) : 1800
Measurement interval (s) : 1800	Average interval (s) : 75
Average interval (s) : 75	Blanking distance (m) : 0.50
Blanking distance (m) : 0.37	Measurement load (%) : 4
Measurement load (%) : 4	Power level : HIGH
Power level : HIGH	Diagnostics interval(min) : 1440:00
Diagnostics interval(min) : 150:00	Diagnostics samples : 20
Diagnostics samples : 20	Compass upd. rate (s) : 2
Compass upd. rate (s) : 2	Coordinate System : ENU
Coordinate System : ENU	Speed of sound (m/s) : MEASURED
Speed of sound (m/s) : MEASURED	Salinity (ppt) : 35
Salinity (ppt) : 35	Analog input 1 : NONE
Analog input 1 : NONE	Analog input 2 : NONE
Analog input 2 : NONE	Analog input power out : DISABLED
Analog input power out : DISABLED	Raw magnetometer out : OFF
File wrapping : OFF	File wrapping : OFF
TellTale : OFF	TellTale : OFF
AcousticModem : OFF	AcousticModem : OFF
Serial output : OFF	Serial output : OFF
Baud rate : 9600	Baud rate : 9600
Assumed duration (days) : 970.0	Assumed duration (days) : 970.0
Battery utilization (%) : 148.0	Battery utilization (%) : 100.0
Battery level (V) : 14.8	Battery level (V) : 14.8

Recorder size (MB) : 9	Recorder size (MB) : 9
Recorder free space (MB) : 8.973	Recorder free space (MB) : 8.973
Memory required (MB) : 9.6	Memory required (MB) : 2.7
Vertical vel. prec (cm/s) : 2.2	Vertical vel. prec (cm/s) : 1.3
Horizon. vel. prec (cm/s) : 1.3	Horizon. vel. prec (cm/s) : 0.8
Instrument ID : AQD 1403	Instrument ID : AQD 1977
Head ID : A2K 1131	Head ID : 2KL 1672
Firmware version : 1.17	Firmware version : 1.21

Hydrophones

mooring	Hydrophone depth (m)	SN	open tension	tension under load	start time
P6	310-440	087	12,8	11,6	09/02/17 00h
P4	320	119	12,79	11,7	12/02/17 00h
P5	330	170	12,77	11,7	10/02/17 00h

Sound sources

Mooring	Depth SS	SoSo	lat	lon	Pong	
P4	350	FSU1	74° 51.022S	30° 23.111W	02:00 - 08:00 - 14:00 - 20:00	
P5	350	FSU2	75° 23.383S	28° 38.219W	02:20 - 08:20 - 14:20 - 20:20	
P6	490	FSU3	74° 01.171S	28° 04.779W	02:40 - 08:40 - 14:40 - 20:40	

4.5 Sound Sources

Peter Lazeravitch

RAFOS sound sources were installed on three of the WAPITI moorings: P4, P5, and P6 (see section 4.4). These instruments emit an acoustic signal for the purpose of underwater tracking of various drifters, which in our experiment are the APEX floats (see section 4.7). A sound source consists of an electronic/battery pack and a ceramic-driven pipe-resonator (see Photo 4.5.1). It emits an 80-second long, 260Hz, swept-frequency signal, referred to as a "pong". The APEX float listens for these pongs, and from an analysis of the arrival-times from different sources, the float's location can be estimated. The three sound sources used in the WAPITI experiment were manufactured by Webb Research Corporation (Falmouth, MA. U.S.A.).

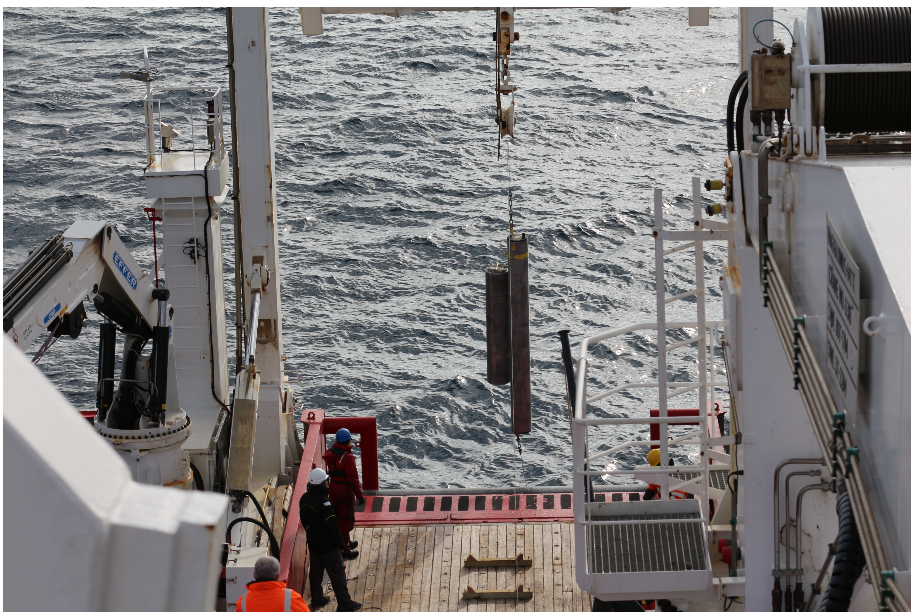


Photo 4.5.1. A RAFOS sound source deployed as part of mooring P6. Photo by Yves David.

Each sound source was programmed to pong four times a day, at six-hour intervals. They are expected to have an operational lifetime of approximately 1.5 to 2 years, spanning most of the duration of our field program. The pongs from the three sound sources were clustered together to fall within a single one-hour listening-window of the APEX float, with pongs separated from another by 20 minutes. Thus, four (of the six-per-day) listening-windows of the APEX float were dedicated to these sources. Table 4.5.1 shows details for the sound sources deployed on the WAPITI moorings.

Mooring			Sound Source		
Name	Position (°S and °W)	Water Depth (m)	Serial Number	Source Depth (m)	Pong schedule (HH:MM:SS, GMT)
P4 (LO1)	74° 51.02' 30° 23.11'	450	54	350	02:00:00 08:00:00 14:00:00 20:00:00
P5 (LO2)	75° 23.38' 28° 38.22'	425	57	350	02:20:00 08:20:00 14:20:00 20:20:00
P6 (LO3)	74° 01.17' 28° 04.78'	2530	56	490	02:40:00 08:40:00 14:40:00 20:40:00

Table 4.5.1. Details for the WAPITI moorings containing the RAFOS sound sources, including mooring position and water depth at the mooring site. Also given are details for the sound sources, including serial number, depth of the sound source, and the pong schedule.

The timing of the sound-source pongs was also chosen to minimize interference (overlapping pongs) with an existing network of sound sources in the interior of the Weddell Sea. These had been deployed in previous years by AWI: The Alfred Wegener Institute for Polar and Marine Research (Bremerhaven, Germany). Two listening-windows of the APEX float were dedicated for these AWI sources.

4.6 Hydrophones

Antonio Lourenco

3 hydrophones are added on moorings M4, M5 and M6.

These hydrophones are for listening sea mammals but we also plan to use them for monitor the acoustic signal transmit by the 3 sound sources. They were setup to listen frequencies up to 2048Hz. The sound sources transmit every 6 hours a 80s signal swapped from 259.75 to 262.25Hz at 181 dB ref µPa@1m.

We choose to have 2 listening windows of 3 hours a day. During the first listening window from 0am to 3am the 3 sound sources deployed during Wapiti cruise will be listened. During the second one all sources from the area are supposed to transmit (cf. figure 4.6.1).

With this configuration the hydrophones have an autonomy of more than 564 days.

Information on deployment is listed in table 4.6.1.

564days –

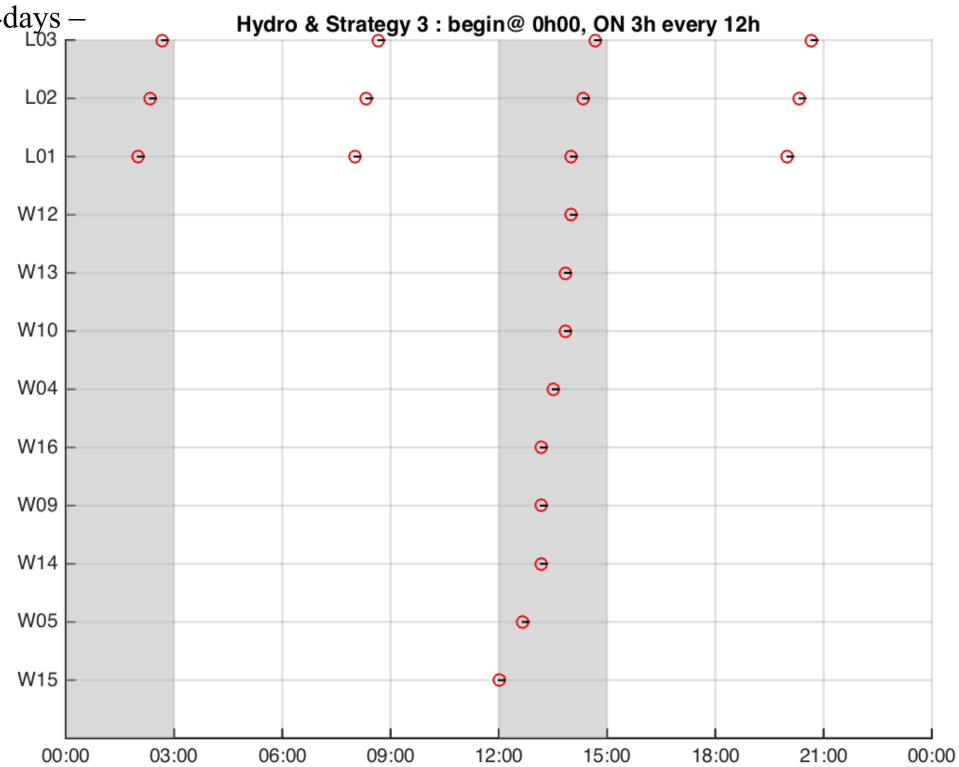


Figure 4.6.2 : In grey, hydrophone listing activation. Sound sources on the left axis

SN	Vdc Off [V]	Vdc On [V]	Mooring	Start listening	Remarks
087	12,80	11,6	M6	09/02/17 00h	Different frame, stainless shackles
119	12,79	11,7	M4	12/02/17 00h	
170	12,77	11,7	M5	10/02/17 00h	Bottom screw broken

Table 4.6.1 : Aural hydrophone deployment informations

Note: we found a broken screw at the Aural #170 bottom. Some screws are corroded but with no effect expected during deployment, no load is applied on this tape (cf. figure 4.6.2).

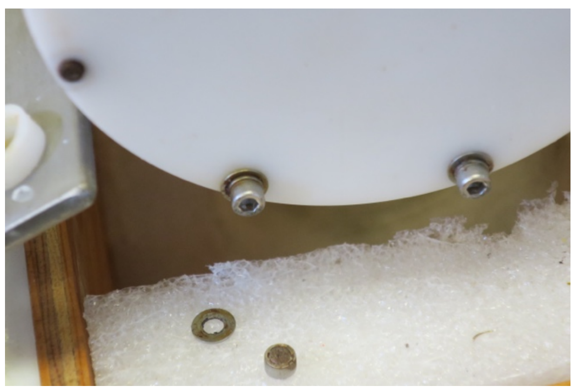


Figure 4.6. 3 : broken screew on Aural#170

Deployment log sheet for the 3 Aural hydrophones are below.

Fiche de suivi de déploiement
AURAL M2_V3
N/O
James Clark ROSS

Site de mouillage : M6 Zone : ***Mer de Weddell***
Identité hydrophone : *MTEAU 00087LF* **HTI N/S:**
Chef scientifique : JB Sallée **Technique :**

Hydrophone testé au labo : oui□□ non
Horloge pc synchronisée le *07/02/2017* **à** *21h09min29 s GMT*

RTC Initialization

JP1 = M2 oui ð non **Gain 22 dB (JP3) oui ð non**
Date et heure: le *07/02 /2017* **à** *21h11min37s GMT*

Sync RTC/PC : oui□□ non

Formatage disque dur : oui□□ non
N/S PCI: *0000013551D1* **AURAL V 04.0.0**

System Operation

Réveil : *09/02/2017* **à** *00h00min 00s GMT*
Taux d'échantillonnage : 4096*Hz*
Durée d'un cycle : *720 minutes* **Temps d'enregistrement :** *180 minutes*
Taille de fichier : *100 MB* **Résultat « Compute » :**

Parameters

Capacité carte flash : *1024 MB* **Capacité disque dur :** *2x298 GB*
Nombre de piles : *128* **Voltage:** *1.5* **Capacité par pile :** *15000*

Result

Fin de vie des piles : *14/08/2018*
Limite de capacité du disque dur : *01/01/2027*
Date de limite opérationnelle : *14/08/2018*
Enregistrement par fichier : *1* **Nombre de fichier :** *7231*
Taille totale des fichiers : *88 474 104*

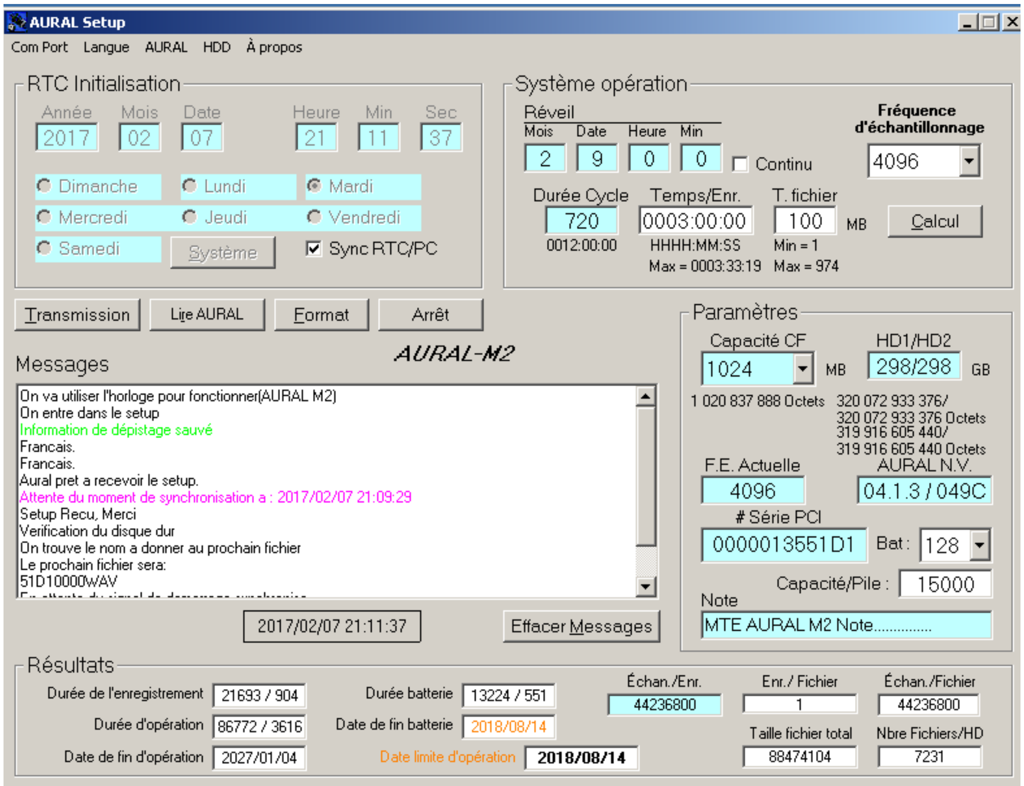
Largueur

Numéro de série : **Testé à bord : ouið non**
Armement/distance : **Largage :** **Larg.+pinger :**
Pinger ON : **Pinger OFF : Diagnostique:**

Mouillage

Composition de haut en bas: *08/02/2017 19:07:00*
Date et heure du largage du lest :

Course du navire :
Position du navire au largage du lest :
Lat **Long.**
Position du mouillage:
Lat *74° 01.171S* **Long.** *28° 04.779W*
Log on board JCR



On va utiliser l'horloge pour fonctionner(AURAL M2)
On entre dans le setup
Information de dépistage sauvé
Francais.
Francais.
Aural pret a recevoir le setup.
Attente du moment de synchronisation a : 2017/02/07 21:09:29
Setup Recu, Merci
Verification du disque dur
On trouve le nom a donner au prochain fichier
Le prochain fichier sera:
51D10000WAV
En attente du signal de demarrage synchronise
Passage en mode power-down ...Jusqu au prochain (MM/JJ hh/mm/ss) : 02/08 23:59:55

Fiche de suivi de déploiement

AURAL M2_V3

N/O

James Clark ROSS

Site de mouillage : M4 **Zone :** *Mer de Weddell*

Identité hydrophone : *MTEAU 000119LF* **HTI N/S:**

Chef scientifique : JB Sallée **Technique :**

Hydrophone testé au labo : oui□□ non

Horloge pc synchronisée le *11/02 /2017* **à** *01h16min16s GMT*

RTC Initialization

JP1 = M2 oui ð non **Gain 22 dB (JP3) oui ð non**

Date et heure: le *11/02/2017* **à** *01h16 min31 s GMT*

Sync RTC/PC : oui□□ non

Formatage disque dur : oui ð non

N/S PCI: *000001B8082A* **AURAL V 04.0.0**

System Operation

Réveil : *12/02/2017* **à** *00h00min00s GMT*

Taux d'échantillonnage : 4096*Hz*

Durée d'un cycle : *720 minutes* **Temps d'enregistrement :** *180minutes*

Taille de fichier : *100MB* **Résultat « Compute » :**

Parameters

Capacité carte flash : *1024 MB* **Capacité disque dur :** *2x298 GB*

Nombre de piles : *128* **Voltage :** *1.5* **Capacité par pile :** *15000*

Result

Fin de vie des piles : *17/08/2018*

Limite de capacité du disque dur : *07/01/2027*

Date de limite opérationnelle : *17/08/2018*

Enregistrement par fichier : *1* **Nombre de fichier :** *7231*

Taille totale des fichiers : *88 474 104*

Largueur

Numéro de série : **Testé à bord : ouið non**

Armement/distance : **Largage :** **Larg.+pinger :**

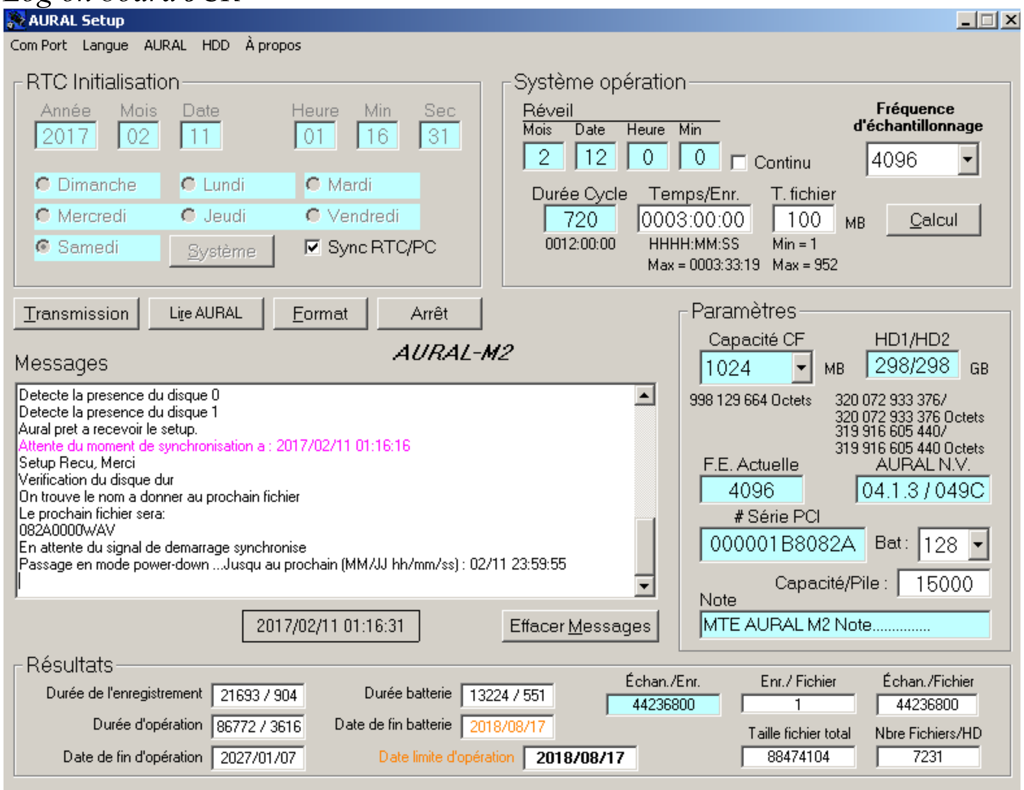
Pinger ON : **Pinger OFF : Diagnostique:**

Mouillage

Composition de haut en bas :

Date et heure du largage du lest : *11/02/2017 16:30:00*
Course du navire :
Position du navire au largage du lest :
Lat **Long.**
Position du mouillage :
Lat *74° 51.022S* **Long.** *30° 23.111W*

Log on board JCR



On va utiliser l'horloge pour fonctionner(AURAL M2)
On entre dans le setup
Information de dépistage sauvé
Francais.
Detecte la presence du disque 0
Detecte la presence du disque 1
Aural pret a recevoir le setup.
Attente du moment de synchronisation a : 2017/02/11 01:16:16
Setup Recu, Merci
Verification du disque dur
On trouve le nom a donner au prochain fichier
Le prochain fichier sera:
082A0000WAV
En attente du signal de demarrage synchronise
Passage en mode power-down ...Jusqu au prochain (MM/JJ hh/mm/ss) : 02/11 23:59:55

Fiche de suivi de déploiement

AURAL M2_V3

N/O

James Clark ROSS

Site de mouillage : **M5** **Zone :** *Mer de Weddell*

Identité hydrophone : *MTEAU 000170LF* **HTI N/S:**

Chef scientifique : **JB Sallée** **Technique :**

Hydrophone testé au labo : oui□□ non

Horloge pc synchronisée le *09/02/2017* **à** *11h47min04s GMT*

RTC Initialization

JP1 = M2 ouið non **Gain 22 dB (JP3) ouið non**

Date et heure: le *09/02/2017* **à** *11h48min09s GMT*

Sync RTC/PC : oui□□ non

Formatage disque dur : oui ð non

N/S PCI: *0000028F73C1* **AURAL V 04.0.0**

System Operation

Réveil : *10/02/2017* **à** *00h00min00s GMT*

Taux d'échantillonnage : **4096***Hz*

Durée d'un cycle : *720 minutes* **Temps d'enregistrement :** *180minutes*

Taille de fichier : *100 MB* **Résultat « Compute » :**

Parameters

Capacité carte flash : *1024 MB* **Capacité disque dur :** *2x298 GB*

Nombre de piles : *128* **Voltage:** *1.5* **Capacité par pile :** *15000*

Result

Fin de vie des piles : *15/08/2018*

Limite de capacité du disque dur : *05/01/2027*

Date de limite opérationnelle : *15/08/2018*

Enregistrement par fichier : *1* **Nombre de fichier :** *7231*

Taille totale des fichiers : *88 474 104*

Largueur

Numéro de série : **Testé à bord : ouið non**

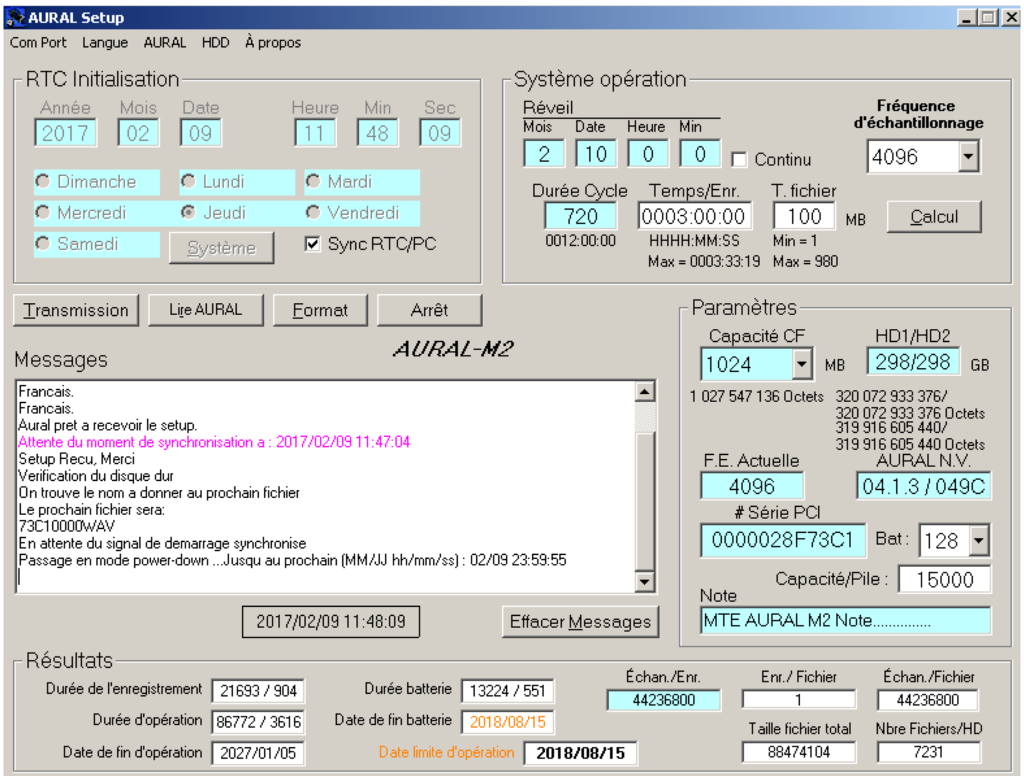
Armement/distance : **Largage :** **Larg.+pinger :**

Pinger ON : **Pinger OFF :** **Diagnostique:**

Mouillage

Composition de haut en bas:
Date et heure du largage du lest : *09/02/2017 14:59:00*
Course du navire :
Position du navire au largage du lest :
Lat Long.
Position du mouillage:
Lat *75° 23.383S* **Long.** *28° 38.219W*

LOG JCR



On va utiliser l'horloge pour fonctionner(AURAL M2)
On entre dans le setup
Information de dépistage sauvé
Francais.
Francais.
Aural pret a recevoir le setup.
Attente du moment de synchronisation a : 2017/02/09 11:47:04
Setup Recu, Merci
Verification du disque dur
On trouve le nom a donner au prochain fichier
Le prochain fichier sera:
73C10000WAV
En attente du signal de demarrage synchronise
Passage en mode power-down ...Jusqu au prochain (MM/JJ hh/mm/ss) : 02/09 23:59:55

4.7. APEX Floats

Antonio Lourenco

Seven Apex profiling floats equipped with Rafos hydrophones were deployed in 3 spots in the south of the Weddell sea. To estimate underwater or "underice" Rafos floats drift 14 AWI sound sources were already deployed in the past years. Figure 4.7.1 shows the actual acoustic network available in Weddell sea.

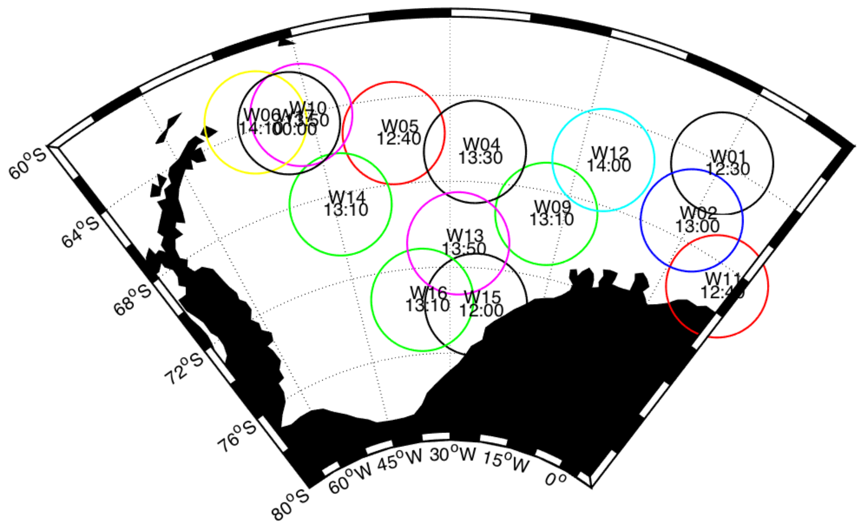


Figure 4.7.4 : rafos network in Weddell sea

Details on AWI sound sources are listed in table 4.7.1.

N	MOORING	FSU SITE	PONG	LAT	LON	RMQ
1	D0032 - AWI255	W15	12:00	-73.7167	-25.7418	HS ?
2	D0048 - AWI229	W01	12:30	-64	0	HS ?
3	D0029 - AWI208	W05	12:40	-65.6205	-36.422	
4	D0047 - AWI244	W11	12:40	-69.006	-06.982	
5	D0024 - AWI231	W02	13:00	-67	0	HS ?
6	W0023 - AWI250	W14	13:10	-68,483	-44.111	
7	R0030 : AWI245	W09	13:10	-69.058	-17.3887	
8	D0027 - AWI256	W16	13:10	-73.48	-34.62	HS ?
9	D0025 - AWI209	W04	13:30	-66.608	-27.121	
10	R0034 - AWI217	W10	13:50	-64	-46	
11	D0030 - AWI249	W13	13:50	-70.893	-28.891	
12	D0028 - AWI248	W12	14:00	-65.968	-12.252	
13	R0027 - AWI207	W06	14:10	-63.656	-50.8103	
14	AWI257	W17	0:00	-64.216	-47.49	to be deployed

Table 4.7.2 : details for the AWI sound sources (grey for Soso that sould be out of order)

We choose to deploy the 3 sound sources for a 'high' frequency positioning, with 4 pong a day. Remember that each sound source can transmit 4000 pongs, 4 pongs a days let us more more than 30 month autonomy.

Apex Rafos will have six rafos windows of 59min each : 4 for this 3 sound sources and 2 for the AWI sound sources. Sound sources pong are listed on table 4.7.2 and a resume of listening windows are show on figure 4.7.2.

SoSo	Mooring	Lat	Lon	Soso[m]	Deployment time	Pong Time (GMT)			
LO3	P6	-74,0195	-28,0796	490	08/02/2017 19:07	02:40	08:40	14:40	20:40
LO2	P5	-75,3897	-28,6369	350	09/02/2017 14:59	02:20	08:20	14:20	20:20
LO1	P4	-74,8503	-30,3851	350	11/02/2017 16:30	02:00	08:00	14:00	20:00

Table 4.7.3 : Sound sources positions and pong times

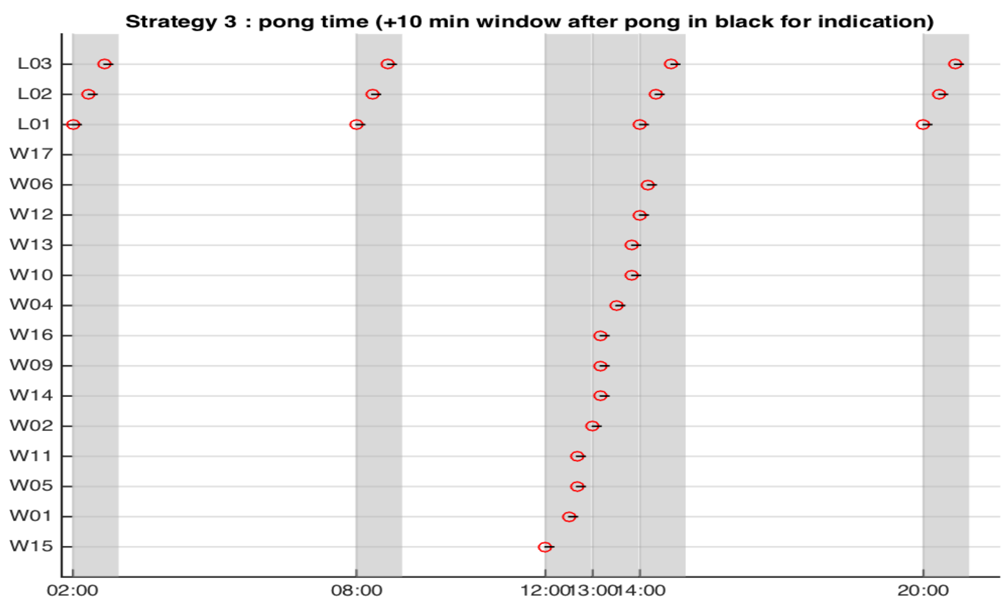


Figure 4.7.5 : Rafos listening windows (grey) 59 min each.

Figure 4.7.3 shows maps with red circles of 200km radius (minimum range expected for acoustic propagation) for the different listening windows listed bellow:

window	start	end
1	01:59	02:58
2	07:59	08:58
3	11:59	12:58
4	12:59	13:58
5	13:59	14:58
6	19:59	20:58

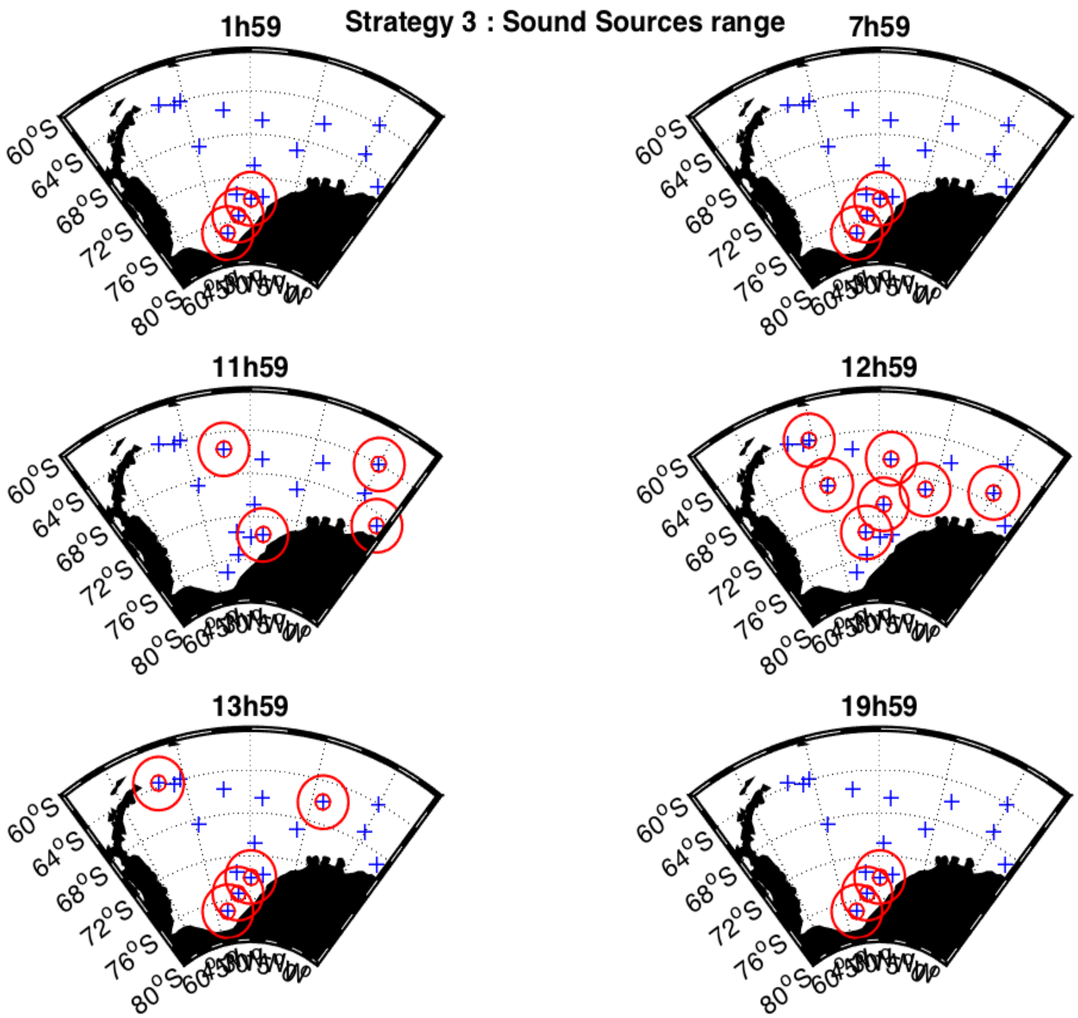


Figure 4.7.6 : minimum acoustic propagation for 6 listening windows

Table 4.7.3 resume all Apex deployment location, time and park depth. Parameters configuration at the deployment for all floats are listed just after.

APEX Nb	Iridium Nb	Lat	Lon	Deployment [utc]	Park [m]
7829	12681	-74,46104	-26,16269	10/02/17 05:44	400
7830	12682	-74,45266	-26,18320	10/02/17 06:06	400
7831	12677	-74,44278	-26,18822	10/02/17 06:29	400
7832	12686	-74,84898	-30,71351	12/02/17 22:26	400
7833	12703	-74,85276	-30,64634	12/02/17 22:48	400
7834	12679	-76,46532	-32,74232	18/02/17 14:16	400
7835	12684	-76,47313	-32,71802	18/02/17 14:47	400

Table 4.7.4 : Apex Rafos deployment positions

Picture of one deployment are in figure 4.7.4, and deployment log sheet are shown below.

Figure 4.7.7 : Apex deployment near ice floes

APEX version 070216 sn 12681

```
User: f12681
Pwd:  0xd658
Pri:  AT+CBST=71,0,1;DT00881600005155           Mhp
Alt:  ATDT0033561393749                        Mha
Rafos: 59;119,479,719,779,839,1199      (Minutes) Mtw
 1290 ToD for down-time expiration. (Minutes)     Mtc
 01190 Down time. (Minutes)                      Mtd
 00250 Up time. (Minutes)                        Mtu
 00120 Ascent time-out. (Minutes)                Mta
 00030 Deep-profile descent time. (Minutes)       Mtj
 00100 Park descent time. (Minutes)              Mtk
 00060 Mission prelude. (Minutes)                Mtp
 00005 Telemetry retry interval. (Minutes)        Mhr
 00060 Host-connect time-out. (Seconds)          Mht
   200 Continuous profile activation. (Decibars)   Mc
   400 Park pressure. (Decibars)                 Mk
   500 Deep-profile pressure. (Decibars)          Mj
   111 Park piston position. (Counts)            Mbp
   102 Deep-profile piston position. (Counts)      Mbj
   010 Ascent buoyancy nudge. (Counts)            Mbn
   022 Initial buoyancy nudge. (Counts)           Mbi
   001 Park-n-profile cycle length.              Mn
  45.0 Ice detection: Mixed-layer Pmax (Decibars)  Mix
  15.0 Ice detection: Mixed-layer Pmin (Decibars)  Min
 -1.65 Ice detection: Mixed-layer Tcritical (C)    Mit
 0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
   124 Maximum air bladder pressure. (Counts)      Mfb
   096 OK vacuum threshold. (Counts)              Mfv
   227 Piston full extension. (Counts)            Mff
   016 P-Activation piston position. (Counts)      Mfs
     2 Logging verbosity. [0-5]                  D
  0002 DebugBits.                                D
  d519 Mission signature (hex).
> e Executing mission activation sequence.
```

(Feb 10 2017 05:14:13, 106911 sec)
SelfTest()
Executing self-test for ApfId 12681.

APEX version 070216 sn 12682

User: f12682
Pwd: 0xe63b
Pri: AT+CBST=71,0,1;DT00881600005155 Mhp
Alt: ATDT0033561393749 Mha
Rafos: 59;119,479,719,779,839,1199 (Minutes) Mtw
1290 ToD for down-time expiration. (Minutes) Mtc
01190 Down time. (Minutes) Mtd
00250 Up time. (Minutes) Mtu
00120 Ascent time-out. (Minutes) Mta
00030 Deep-profile descent time. (Minutes) Mtj
00100 Park descent time. (Minutes) Mtk
00060 Mission prelude. (Minutes) Mtp
00005 Telemetry retry interval. (Minutes) Mhr
00060 Host-connect time-out. (Seconds) Mht
200 Continuous profile activation. (Decibars) Mc
400 Park pressure. (Decibars) Mk
500 Deep-profile pressure. (Decibars) Mj
111 Park piston position. (Counts) Mbp
102 Deep-profile piston position. (Counts) Mbj
010 Ascent buoyancy nudge. (Counts) Mbn
022 Initial buoyancy nudge. (Counts) Mbi
001 Park-n-profile cycle length. Mn
45.0 Ice detection: Mixed-layer Pmax (Decibars) Mix
15.0 Ice detection: Mixed-layer Pmin (Decibars) Min
-1.65 Ice detection: Mixed-layer Tcritical (C) Mit
0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
124 Maximum air bladder pressure. (Counts) Mfb
096 OK vacuum threshold. (Counts) Mfv
226 Piston full extension. (Counts) Mff
016 P-Activation piston position. (Counts) Mfs
2 Logging verbosity. [0-5] D
0002 DebugBits. D
b4ab Mission signature (hex).
> E Executing mission activation sequence.
(Feb 10 2017 05:40:31, 110802 sec)
SelfTest()
Executing self-test for ApfId 12682.

APEX version 070216 sn 12677
User: f12677
Pwd: 0xa6a0
Pri: AT+CBST=71,0,1;DT00881600005155 Mhp
Alt: ATDT0033561393749 Mha
Rafos: 59;119,479,719,779,839,1199 (Minutes) Mtw
1290 ToD for down-time expiration. (Minutes) Mtc
01190 Down time. (Minutes) Mtd
00250 Up time. (Minutes) Mtu
00120 Ascent time-out. (Minutes) Mta
00030 Deep-profile descent time. (Minutes) Mtj
00100 Park descent time. (Minutes) Mtk
00060 Mission prelude. (Minutes) Mtp
00005 Telemetry retry interval. (Minutes) Mhr
00060 Host-connect time-out. (Seconds) Mht
200 Continuous profile activation. (Decibars) Mc
400 Park pressure. (Decibars) Mk
500 Deep-profile pressure. (Decibars) Mj
111 Park piston position. (Counts) Mbp
102 Deep-profile piston position. (Counts) Mbj
010 Ascent buoyancy nudge. (Counts) Mbn
022 Initial buoyancy nudge. (Counts) Mbi
001 Park-n-profile cycle length. Mn
45.0 Ice detection: Mixed-layer Pmax (Decibars) Mix
15.0 Ice detection: Mixed-layer Pmin (Decibars) Min
-1.65 Ice detection: Mixed-layer Tcritical (C) Mit
0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
124 Maximum air bladder pressure. (Counts) Mfb
096 OK vacuum threshold. (Counts) Mfv
227 Piston full extension. (Counts) Mff
016 P-Activation piston position. (Counts) Mfs
2 Logging verbosity. [0-5] D
0002 DebugBits. D
39eb Mission signature (hex).
> E Executing mission activation sequence.
(Feb 10 2017 06:04:30, 106083 sec)
SelfTest()
Executing self-test for ApfId 12677.

APEX version 070216 sn 12686

```
User: f12686
Pwd:  0xa6bf
Pri:  AT+CBST=71,0,1;DT00881600005155          Mhp
Alt:  ATDT0033561393749                        Mha
Rafos: 59;119,479,719,779,839,1199      (Minutes) Mtw
 1290 ToD for down-time expiration. (Minutes)     Mtc
 01190 Down time. (Minutes)                     Mtd
 00250 Up time. (Minutes)                       Mtu
 00120 Ascent time-out. (Minutes)               Mta
 00030 Deep-profile descent time. (Minutes)       Mtj
 00100 Park descent time. (Minutes)             Mtk
 00060 Mission prelude. (Minutes)               Mtp
 00005 Telemetry retry interval. (Minutes)        Mhr
 00060 Host-connect time-out. (Seconds)           Mht
   200 Continuous profile activation. (Decibars)   Mc
   400 Park pressure. (Decibars)                 Mk
   500 Deep-profile pressure. (Decibars)          Mj
   111 Park piston position. (Counts)            Mbp
   102 Deep-profile piston position. (Counts)      Mbj
   010 Ascent buoyancy nudge. (Counts)            Mbn
   022 Initial buoyancy nudge. (Counts)           Mbi
   001 Park-n-profile cycle length.              Mn
  45.0 Ice detection: Mixed-layer Pmax (Decibars)  Mix
  15.0 Ice detection: Mixed-layer Pmin (Decibars)  Min
 -1.65 Ice detection: Mixed-layer Tcritical (C)    Mit
 0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
   124 Maximum air bladder pressure. (Counts)      Mfb
   096 OK vacuum threshold. (Counts)              Mfv
   226 Piston full extension. (Counts)            Mff
   016 P-Activation piston position. (Counts)      Mfs
     2 Logging verbosity. [0-5]                  D
  0002 DebugBits.                                D
  455b Mission signature (hex).
> e Executing mission activation sequence.
```

(Feb 12 2017 21:43:50, 288381 sec)
SelfTest()
Executing self-test for ApfId 12686.

APEX version 070216 sn 12703
User: f12703
Pwd: 0x4883
Pri: AT+CBST=71,0,1;DT00881600005155   Mhp
Alt: ATDT0033561393749   Mha
Rafos: 59;119,479,719,779,839,1199   (Minutes) Mtw
 1290 ToD for down-time expiration. (Minutes)   Mtc
 01190 Down time. (Minutes)   Mtd
 00250 Up time. (Minutes)   Mtu
 00120 Ascent time-out. (Minutes)   Mta
 00030 Deep-profile descent time. (Minutes)   Mtj
 00100 Park descent time. (Minutes)   Mtk
 00060 Mission prelude. (Minutes)   Mtp
 00005 Telemetry retry interval. (Minutes)   Mhr
 00060 Host-connect time-out. (Seconds)   Mht
 200 Continuous profile activation. (Decibars)   Mc
 400 Park pressure. (Decibars)   Mk
 500 Deep-profile pressure. (Decibars)   Mj
 111 Park piston position. (Counts)   Mbp
 102 Deep-profile piston position. (Counts)   Mbj
 010 Ascent buoyancy nudge. (Counts)   Mbn
 022 Initial buoyancy nudge. (Counts)   Mbi
 001 Park-n-profile cycle length.   Mn
 45.0 Ice detection: Mixed-layer Pmax (Decibars) Mix
 15.0 Ice detection: Mixed-layer Pmin (Decibars) Min
 -1.65 Ice detection: Mixed-layer Tcritical (C)   Mit
 0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
 124 Maximum air bladder pressure. (Counts)   Mfb
 096 OK vacuum threshold. (Counts)   Mfv
 226 Piston full extension. (Counts)   Mff
 016 P-Activation piston position. (Counts)   Mfs
 2 Logging verbosity. [0-5]   D
 0002 DebugBits.   D
 8dc3 Mission signature (hex).
> e Executing mission activation sequence.
(Feb 12 2017 22:20:37, 274666 sec)
SelfTest()
Executing self-test for ApfId 12703.

APEX version 070216 sn 12679

```
User: f12679
Pwd:  0x476e
Pri:  AT+CBST=71,0,1;DT00881600005155           Mhp
Alt:  ATDT0033561393749                         Mha
Rafos: 59;119,479,719,779,839,1199      (Minutes) Mtw
 1290 ToD for down-time expiration. (Minutes)     Mtc
 01190 Down time. (Minutes)                       Mtd
 00250 Up time. (Minutes)                         Mtu
 00120 Ascent time-out. (Minutes)                 Mta
 00030 Deep-profile descent time. (Minutes)       Mtj
 00100 Park descent time. (Minutes)               Mtk
 00010 Mission prelude. (Minutes)                 Mtp
 00005 Telemetry retry interval. (Minutes)        Mhr
 00060 Host-connect time-out. (Seconds)           Mht
   200 Continuous profile activation. (Decibars)  Mc
   400 Park pressure. (Decibars)                  Mk
   500 Deep-profile pressure. (Decibars)          Mj
   111 Park piston position. (Counts)             Mbp
   102 Deep-profile piston position. (Counts)     Mbj
   010 Ascent buoyancy nudge. (Counts)            Mbn
   022 Initial buoyancy nudge. (Counts)           Mbi
   001 Park-n-profile cycle length.               Mn
  45.0 Ice detection: Mixed-layer Pmax (Decibars)  Mix
  15.0 Ice detection: Mixed-layer Pmin (Decibars)  Min
 -1.65 Ice detection: Mixed-layer Tcritical (C)    Mit
 0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
   124 Maximum air bladder pressure. (Counts)     Mfb
   096 OK vacuum threshold. (Counts)              Mfv
   227 Piston full extension. (Counts)            Mff
   016 P-Activation piston position. (Counts)     Mfs
     2 Logging verbosity. [0-5]                   D
  0002 DebugBits.                                 D
  8bc4 Mission signature (hex).
> E Executing mission activation sequence.
```

(Feb 18 2017 13:47:58,   -1 sec)
SelfTest()
Executing self-test for ApfId 12679.

APEX version 070216 sn 12684
User: f12684
Pwd: 0x86fd
Pri: AT+CBST=71,0,1;DT00881600005155 Mhp
Alt: ATDT0033561393749 Mha
Rafos: 59;119,479,719,779,839,1199 (Minutes) Mtw
1290 ToD for down-time expiration. (Minutes) Mtc
01190 Down time. (Minutes) Mtd
00250 Up time. (Minutes) Mtu
00120 Ascent time-out. (Minutes) Mta
00030 Deep-profile descent time. (Minutes) Mtj
00100 Park descent time. (Minutes) Mtk
00010 Mission prelude. (Minutes) Mtp
00005 Telemetry retry interval. (Minutes) Mhr
00060 Host-connect time-out. (Seconds) Mht
200 Continuous profile activation. (Decibars) Mc
400 Park pressure. (Decibars) Mk
500 Deep-profile pressure. (Decibars) Mj
111 Park piston position. (Counts) Mbp
102 Deep-profile piston position. (Counts) Mbj
010 Ascent buoyancy nudge. (Counts) Mbn
022 Initial buoyancy nudge. (Counts) Mbi
001 Park-n-profile cycle length. Mn
45.0 Ice detection: Mixed-layer Pmax (Decibars) Mix
15.0 Ice detection: Mixed-layer Pmin (Decibars) Min
-1.65 Ice detection: Mixed-layer Tcritical (C) Mit
0xffd Ice detection: Winter months [DNOSAJJMAMFJ] Mib
124 Maximum air bladder pressure. (Counts) Mfb
096 OK vacuum threshold. (Counts) Mfv
226 Piston full extension. (Counts) Mff
016 P-Activation piston position. (Counts) Mfs
2 Logging verbosity. [0-5] D
0002 DebugBits. D
988b Mission signature (hex).
> E Executing mission activation sequence.
(Feb 18 2017 14:12:08, 913819 sec)
SelfTest()
Executing self-test for ApfId 12684.

4.8. Deep DVL

Antonio Lourenco

2 Deep-Arvor equipped with Nortek Signature 500 AD2CP to follow the bottom and measure bottom layer velocity until 4000m depth were deployed in the north of Weddell Sea.

We first update all firmware and software, cf table 4.8.1.

Boards	Firmware updated
AD2CP, version 20/7/2016	NortekAD2CP_SECV3607_BBPV3042_0.ad2
Alees carte	Alees_flash_V00_01_06_cksum5EB2.bin
I535 eprom	deepArvor_carteI535_eeprom_v5608A15.hex
I535 flash	deepArvor_carteI535_flash_v5608A14_cksumFA73.hex
Prog file	G601022e

Table 4.8.5 : Deep Arvor firmware versions updated on board

The Deep Arvor, will follow the bottom at 70m +/40m during 4 days cycles, permitting an autonomy of more than 2 years.

Table 4.8.2 reports deployment information and instruments serial numbers.

DEEP ARVOR	D01	D03
Serial Number	AD17-22-16FR-001	AD17-22-16FR-003
IMEI	300234063641500	300234063648510
Bluetooth	2015-09-019	2015-09-014
WMO	6902821	6902823
AD2CP SN	10354	10301
Magnet removed (utc)	08/03/2017 13:57	08/03/2017 02:34
5 valve clicking (utc)	08/03/2017 13:57	08/03/2017 02:34
Pump humming (utc)	08/03/2017 14:00	08/03/2017 02:35
Valve clicking & engine humming (utc)	-	08/03/2017 02:37
Parking Deep	3000	3100
Deployment time (utc)	08/03/2017 14:08	08/03/2017 02:49
Deployment position (lat,lon)	-60.67078° , -42.11161°	-61.59725° , -40.90726°

Table 4.8.6 : deployment information and instruments serial numbers :

Photo 4.8.1 shows deployment of the 2 Deep Arvor. Log sheet of the Deep Arvor configuration are shown below.

Numéro de série du flotteur *Float Serial Number* :	AD1722-16FR 001 – IMEI : 300234063648510

MISSION PARAMETERS

Abbr.	NAME	DEFAULT VALUE	UNIT	REQUEST VALUE
PM0	PM0 – Number of cycles	255	-	255
PM1	PM1 – Cycle Period	10	Days	4
PM2	PM2 – Reference Day [1]	2	Mission day	2
PM3	PM3 - Estimated hour on surface [1]	6	Hour in the day	9
PM4	PM4 – Delay Before Mission	0	Minutes	15
PM5	PM5 – Descent Sampling Period	0	Seconds	0
PM6	PM6 – Drift Sampling Period	12	Hours	1
PM7	PM7 – Ascent Sampling Period	10	Seconds	10
PM8	PM8 – Drift Depth	1000	dBars	3000
PM9	PM9 – Profile Depth	2000	dBars	3000
PM10	PM10 - Threshold Middle/Surface Pressure	10	dBars	10
PM11	PM11 - Threshold Middle/Bottom Pressure	200	dBars	200
PM12	PM12 - Thickness of the surface layers	1	dBars	1
PM13	PM13 - Thickness of the middle layers	10	dBars	10
PM14	PM14 - Thickness of the bottom layers	25	dBars	25
PM15	PM15 - End of life Iridium period	60	Minutes	60
PM16	PM16 – Iridium 2d serssion waiting time	0	Minutes	0
PM17	PM17 – Iridium wait inter-cycle	0	Minutes	0

Alternate Profiles
Alternate Profile : ☐ Yes ☒ No
Alternate Profile Depth : _ _ _ _ dBars

Grounding
Grounding mode : ☒ Stay Grounded ☐ Minus pressure profile
Grounding pressure correction : _ _ _ dBars (100 recommended)

Armed mode ON : ☒ Yes ☐ No

Shipping Adress : Punta Arenas (Chile)

WAPITI Deep-Arvor-AD2CP Deployment :
08/03/2017 @ 13:57:03 UTC : Magnet removed
08/03/2017 @ 13:57:13 UTC : 5 valve clicking
08/03/2017 @ 14:00:06 UTC : Valve clicking & engine humming
08/03/2017 @ 14:08:00 UTC : Deployment @ Lat -60.67078° , Lon -42.11161°

]?pm
<PM0 255> Total cycle nb
<PM1 4> Cycle period (Days)
<PM2 2> Reference day
<PM3 9> Hour at surface

```
<PM4       15> Delay before mission (Minutes)
<PM5        0> Descent CTD sampling period (Seconds)
<PM6        1> Drift CTD sampling period (Hours)
<PM7       10> Ascent CTD sampling period (Seconds)
<PM8     3000> Drift pressure (dBars)
<PM9     3000> Profile pressure (dBars)
<PM10      10> Threshold Zone 1/2 (dBars)
<PM11     200> Threshold Zone 2/3 (dBars)
<PM12       1> Slice thickness in zone 1-Surface (dBars)
<PM13      10> Slice thickness in zone 2-Intermediate (dBars)
<PM14      25> Slice thickness in zone 3-Deep (dBars)
<PM15      60> Iridium End of Life Period (Minutes)
<PM16       0> Time between 1st&2nd Iridium session(min)
<PM17       0> Wait at surface if grounding (Minutes)


]?pt
<PT0     1800> (csec)
<PT1       17> (cm3)
<PT2      450> (csec)
<PT3     1120> (csec)
<PT4    28000> (csec)
<PT5       50> (dbars)
<PT6     4000> (dbars)
<PT7        1> (dbars)
<PT8       12> (dbars)
<PT9        2>
<PT10       0>
<PT11      47>
<PT12     200> (dbars)
<PT13     100> (dbars)
<PT14      40> (dbars)
<PT15       1>
<PT16       1>
<PT17    4000> (dbars)
<PT18      27> (mm/sec)
<PT19       0> (dbars)
<PT20       5> (dbars)
<PT21       0>
<PT22      10> (dbars)
<PT23      90> (mm/sec)
<PT24       2> (min)
<PT25      10> (dbars)
<PT26       5> (min)
<PT27       6> (dbars)
<PT28      24>
<PT29       1>
<PT30      30> (sec)
<PT31       5> (min)
<PT32   30000> (csec)
<PT33       0>
<PT34      60> (min)
<PT35   1.288>
<PT36   -52.580>


]?pg
<PG0       20> ICE DETECTION : Number of days without emergence
<PG1        2> ICE DETECTION : Number of days before force emergence
<PG2       45> ISA : Start pressure (dbars)
```

```
<PG3      15> ISA : Stop pressure (dbars)
<PG4   -1650> ISA : Temperature median (m∞C)
<PG5     200> ISA : Deceleration treshold (dbars)
<PG6       2> ISA : Scrutation pressure delay on ascent (minutes)
<PG7       4> ISA : Stabilization pressure on ascent (dbars)
<PG8     500> ISA : Pumping activation delay on ascent (csec)
<PG9       8> SATELLITE MASK : Session timeout (minutes)
<PG10     30> ASCENT HANGING : Confirmation delay (minutes)
<PG11     20> BUOYANCY INVERSION : Offset pressure (dbars)
<PG12     17> BUOYANCY INVERSION : EV volume per action (cm3)
<PG13    300> BUOYANCY INVERSION : EV volume max (cm3)


]?pw
<PW0       0> SHOCK : Detection mode (0=NotUsed, 1=Used)
<PW1     300> SHOCK : Detection threshold (dbars)
<PW2       1> DVL : Acquisition mode (0=NotUsed, 1=Used)
<PW3       1> DVL : Sampling period (hours)
<PW4    3000> DIVING : Bathymetry of first cycle (dbars)
<PW5     200> DVG : Offset from bathy of last cycle to DVL (dbars)
<PW6       5> DVG : Sampling period of altimetry measure (minutes)
<PW7      80> BOTTOM TRACKING : Drift offset from bathy (dbars)
<PW8       1> BT : Number max of repositioning gap
<PW9       5> BT : Delay between actions of repositioning (minutes)
<PW10     10> BT : Period to update the setpoint (minutes)
<PW11    100> BT : Number of hydraulic actions to abort tracking


]?fr
<FR 0 0>
<FR 1 200>
<FR 2 5>
<FR 3 15000>
<FR 4 10>
<FR 5 50>
<FR 6 70>
<FR OUT>


]?re
02/03/17, 20h 29m 15s
04/03/17, 13h 11m 31s
04/03/17, 17h 36m 16s
04/03/17, 18h 02m 40s
00/00/00, 00h 00m 00s


]!sp
<SP OF>
]!sp
<SP ON>
]!sh
<SH ON>
]!sh
<SH OF>
]!ar
<AR ON>
```

Numéro de série du flotteur *Float Serial Number* :	AD1722-16FR 003 – IMEI : 300234406641500

MISSION PARAMETERS

Abbr.	NAME	DEFAULT VALUE	UNIT	REQUEST VALUE
PM0	PM0 – Number of cycles	255	-	255
PM1	PM1 – Cycle Period	10	Days	4
PM2	PM2 – Reference Day (1)	2	Mission day	2
PM3	PM3 - Estimated hour on surface (1)	6	Hour in the day	9
PM4	PM4 – Delay Before Mission	0	Minutes	15
PM5	PM5 – Descent Sampling Period	0	Seconds	0
PM6	PM6 – Drift Sampling Period	12	Hours	1
PM7	PM7 – Ascent Sampling Period	10	Seconds	10
PM8	PM8 – Drift Depth	1000	dBars	3100
PM9	PM9 – Profile Depth	2000	dBars	3100
PM10	PM10 - Threshold Middle/Surface Pressure	10	dBars	10
PM11	PM11 - Threshold Middle/Bottom Pressure	200	dBars	200
PM12	PM12 - Thickness of the surface layers	1	dBars	1
PM13	PM13 - Thickness of the middle layers	10	dBars	10
PM14	PM14 - Thickness of the bottom layers	25	dBars	25
PM15	PM15 - End of life Iridium period	60	Minutes	60
PM16	PM16 – Iridium 2d serssion waiting time	0	Minutes	0
PM17	PM17 – Iridium wait inter-cycle	0	Minutes	0

Alternate Profiles
Alternate Profile : ☐ Yes ☒ No
Alternate Profile Depth : _ _ _ _ dBars

Grounding
Grounding mode : ☒ Stay Grounded ☐ Minus pressure profile
Grounding pressure correction : _ _ _ dBars (100 recommended)

Armed mode ON : ☒ Yes ☐ No

Shipping Adress : Punta Arenas (Chile)
WAPITI Deep-Arvor-AD2CP Deployment :

08/03/2017 @ 02:34:00 UTC : Magnet removed
08/03/2017 @ 02:34:12 UTC : 5 valve clicking
08/03/2017 @ 02:35:20 UTC : Pump humming
08/03/2017 @ 02:37:12 UTC : Valve clicking & engine humming
08/03/2017 @ 02:49:00 UTC : Deployment @ Lat -61.59725° , Lon -40.90726°

```
]?pm
<PM0     255> Total cycle nb
<PM1       4> Cycle period (Days)
<PM2       2> Reference day
<PM3       9> Hour at surface
<PM4      15> Delay before mission (Minutes)
<PM5       0> Descent CTD sampling period (Seconds)
<PM6       1> Drift CTD sampling period (Hours)
<PM7      10> Ascent CTD sampling period (Seconds)
<PM8    3100> Drift pressure (dBars)
<PM9    3100> Profile pressure (dBars)
<PM10     10> Threshold Zone 1/2 (dBars)
<PM11    200> Threshold Zone 2/3 (dBars)
<PM12      1> Slice thickness in zone 1-Surface (dBars)
<PM13     10> Slice thickness in zone 2-Intermediate (dBars)
<PM14     25> Slice thickness in zone 3-Deep (dBars)
<PM15     60> Iridium End of Life Period (Minutes)
<PM16      0> Time between 1st&2nd Iridium session(min)
<PM17      0> Wait at surface if grounding (Minutes)

]?pt
<PT0    1800> (csec)
<PT1      17> (cm3)
<PT2     450> (csec)
<PT3    1120> (csec)
<PT4   28000> (csec)
<PT5      50> (dbars)
<PT6    4000> (dbars)
<PT7       1> (dbars)
<PT8      12> (dbars)
<PT9       2>
<PT10      0>
<PT11     47>
<PT12    200> (dbars)
<PT13    100> (dbars)
<PT14     40> (dbars)
<PT15      1>
<PT16      1>
<PT17   4000> (dbars)
<PT18     27> (mm/sec)
<PT19      0> (dbars)
<PT20      5> (dbars)
<PT21      0>
<PT22     10> (dbars)
<PT23     90> (mm/sec)
<PT24      2> (min)
<PT25     10> (dbars)
<PT26      5> (min)
<PT27      6> (dbars)
<PT28     24>
<PT29      1>
<PT30     30> (sec)
<PT31      5> (min)
<PT32  30000> (csec)
<PT33      0>
<PT34     60> (min)
<PT35  1.276>
<PT36  -33.500>
```

```
]?pg
<PG0      20> ICE DETECTION : Number of days without emergence
<PG1       2> ICE DETECTION : Number of days before force emergence
<PG2      45> ISA : Start pressure (dbars)
<PG3      15> ISA : Stop pressure (dbars)
<PG4   -1650> ISA : Temperature median (m∞C)
<PG5     200> ISA : Deceleration treshold (dbars)
<PG6       2> ISA : Scrutation pressure delay on ascent (minutes)
<PG7       4> ISA : Stabilization pressure on ascent (dbars)
<PG8     500> ISA : Pumping activation delay on ascent (csec)
<PG9       8> SATELLITE MASK : Session timeout (minutes)
<PG10     30> ASCENT HANGING : Confirmation delay (minutes)
<PG11     20> BUOYANCY INVERSION : Offset pressure (dbars)
<PG12     17> BUOYANCY INVERSION : EV volume per action (cm3)
<PG13    300> BUOYANCY INVERSION : EV volume max (cm3)


]?pw
<PW0       0> SHOCK : Detection mode (0=NotUsed, 1=Used)
<PW1     300> SHOCK : Detection threshold (dbars)
<PW2       1> DVL : Acquisition mode (0=NotUsed, 1=Used)
<PW3       1> DVL : Sampling period (hours)
<PW4    3100> DIVING : Bathymetry of first cycle (dbars)
<PW5     200> DVG : Offset from bathymetry of last DVL (dbars)
<PW6       5> DVG : Sampling period of altimetry measure (minutes)
<PW7      80> BOTTOM TRACKING : Drift offset bathymetry (dbars)
<PW8       1> BT : Number max of repositioning gap
<PW9       5> BT : Delay between actions of repositioning (minutes)
<PW10     10> BT : Period to update the setpoint (minutes)
<PW11    100> BT : Number of hydraulic actions to abort tracking


]?fr
<FR 0 0>
<FR 1 200>
<FR 2 5>
<FR 3 15000>
<FR 4 10>
<FR 5 50>
<FR 6 70>
<FR OUT>


]?re
07/03/17, 09h 55m 17s
08/03/17, 01h 10m 03s
04/03/17, 14h 22m 54s
04/03/17, 14h 24m 40s
04/03/17, 17h 22m 00s

]!sp
<SP OF>
]!sp
<SP ON>
]!sh
<SH ON>
]!sh
<SH OF>
]!ar
```

PART V: Ecology

5.1 Marine mammal and seabird sightings

Sara Labrousse and Yves David

The Weddell Sea harbors rich ecosystems associated with the seasonal sea ice dynamics (krill, copepods, fish, seabirds and marine mammals). However, this sector remains under-sampled and little is known about the seabirds and marine mammals distribution in this region due to compact and extended sea ice making the access difficult even in summer. In the context of the further development of a MPA proposal for the Weddell Sea under CCAMLR, the cruise represents a unique opportunity to opportunistically study seabird and marine mammal distribution along the ship track.

5.1.1 Method for marine mammal sightings

During JR16004 expedition on board RRS James Clark Ross in the Weddell Sea (24 Jan 2017 – 12 Mar 2017), marine mammals were recorded by two persons opportunistically along the ship track half an hour per hour from 11 am to 7 pm GMT time. Observers searched for animals with the naked eye or with binoculars, within 300 m around the boat in a sector of 90 degrees from the bow, port and starboard sides. Marine mammals seen outside the surveyed bandwidth and outside the sighting hours were recorded as well as “out” sightings.

Date, time, species, number, behaviour, identification quality and characteristics, age, distance and angle from the boat, ship speed and heading were recorded. Additional information on environmental conditions was also collected: air temperature, air pressure, sea temperature, sea salinity, bottom depth, wind speed, wind direction, ship activity, sea state, sea ice, visibility. If possible pictures were taken to document observations of scarce species and to contribute to a photo-identification catalogue.

Observation effort from the officers (outside the sighting hours) is impossible to quantify since officers are primarily tasked with other duties and collect sighting data in addition to other tasks.

5.1.2 Initial results for marine mammal sightings

Species	Weddell sea		Sub-antarctic	
	Count of observations	**Count of animals**	**Count of observations**	**Count of animals**
Hourglass dolphin	0	0	3	38
Long finned pilot whale	0	0	1	6
Killer whale	3	10	0	0
Minke whale	31	84	0	0
Fin whale	0	0	24	67
Humpback whale	8	27	10	25
Southern right whale	0	0	2	2
Sei whale	0	0	2	5
Whale not identified	*3*	*4*	*17*	*29*
	45	**125**	**59**	**172**
Crabeater seal	62	120	0	0
Leopard seal	1	1	0	0
Ross's seal	1	1	0	0
Weddell seal	23	65	0	0
	87	**187**	**0**	**0**

Figure 5.2. 1: Number of observations and sightings of marine mammals during the JR16004 WAPITI cruise.

5.1.3 Method for seabird sightings

During JR16004 expedition on board RRS James Clark Ross in the Weddell Sea (24 Jan 2017 – 12 Mar 2017), seabirds were recorded by one person along the ship track 15 minutes per hour from 11 am to 7 pm GMT time. Observer searched for birds with the naked eye or with binoculars (8*42), within 300 m around the boat in a sector of 90 degrees from the bow, port or starboard sides depending on the sun conditions for 10 minutes. Then for the remaining 5 minutes, the observer reported the birds at the back of the boat. Seabirds seen outside the surveyed bandwidth and outside the sighting hours were recorded as “out” sightings.

Date, time, species, number, behaviour, distance and angle from the boat, ship speed and heading were recorded. Additional information on environmental conditions was also collected: air temperature, air pressure, sea temperature, sea salinity, bottom depth, wind speed, wind direction, ship activity, sea state, sea ice, visibility. If possible pictures were taken to document observations of scarce species.

No observation was reported from the officers (outside the sighting hours), the priority was given to marine mammal sightings.

5.1.4 Initial results for seabird sightings

Figure 5.2. 2: Number of observations and sightings of seabirds during the JR16004 WAPITI cruise.

Species	Code	Weddell sea		Sub-antarctic	
		Count of observations	**Count of individuals**	**Count of observations**	**Count of individuals**
Emperor Penguin	EMPE	42	193	0	0
Chinstrap Penguin	CHPE	2	4	7	27
Adélie Penguin	ADPE	16	45	0	0
Penguin sp.	PESP	0	0	2	3
Wandering Albatros	WAAL	3	3	53	78
Black-browed Albatros	BBAL	16	16	50	73
Grey-headed Albatros	GHAL	0	0	6	6
Light-manted sooty Albatros	LMSA	7	16	1	1
Nothern giant Petrel	NGPE	1	1	13	21
Southern giant Petrel	SGPE	41	492	28	33
Giant Petrel sp.	GPSP	1	1	20	55
Antarctic Petrel	ANPE	46	320	0	0
Snow Petrel	SNPE	109	346	6	6
Blue Petrel	BLPE	23	289	5	8
Cape Petrel	CAPE	27	179	17	111
Southern Fulmar	SOFU	5	6	16	55
Kerguelen Petrel	KEPE	8	15	1	1
Soft-plumaged Petrel	SPPE	2	3	5	20
Snowy Sheathbill	SNCH	0	0	2	2
Prion sp.	PRSP	41	508	80	4231
White-chinned Petrel	WCPE	32	95	109	360
Sooty Shearwater	SOSH	0	0	4	7
Great Shearwater	GRSH	0	0	3	3
Wilson's Storm-Petrel	WISP	25	32	39	507
White-bellied Storm-Petrel	WBSP	0	0	5	5
Black-bellied Storm-Petrel	BBSP	0	0	11	21
Diving Petrel sp.	DPSP	0	0	2	2
Antarctic Tern	ANTE	18	247	0	0
South Polar Skua	SPSK	4	4	0	0
Subantarctic Skua	SUSK	0	0	1	1
		469	**2815**	**486**	**5637**

5.2 Sighting effort

Sara Labrousse and Yves David

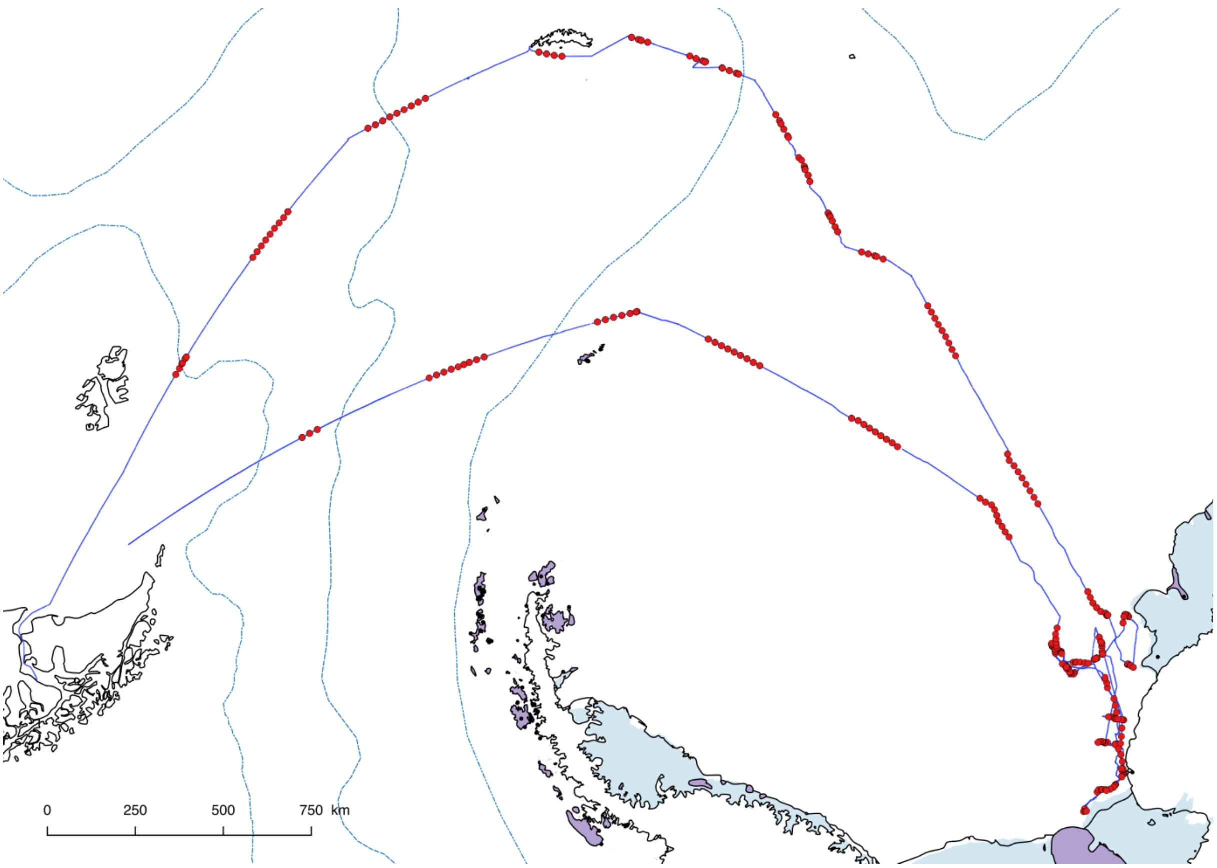


Figure 5.2. 3: Sighting effort during the JR16004 cruise.

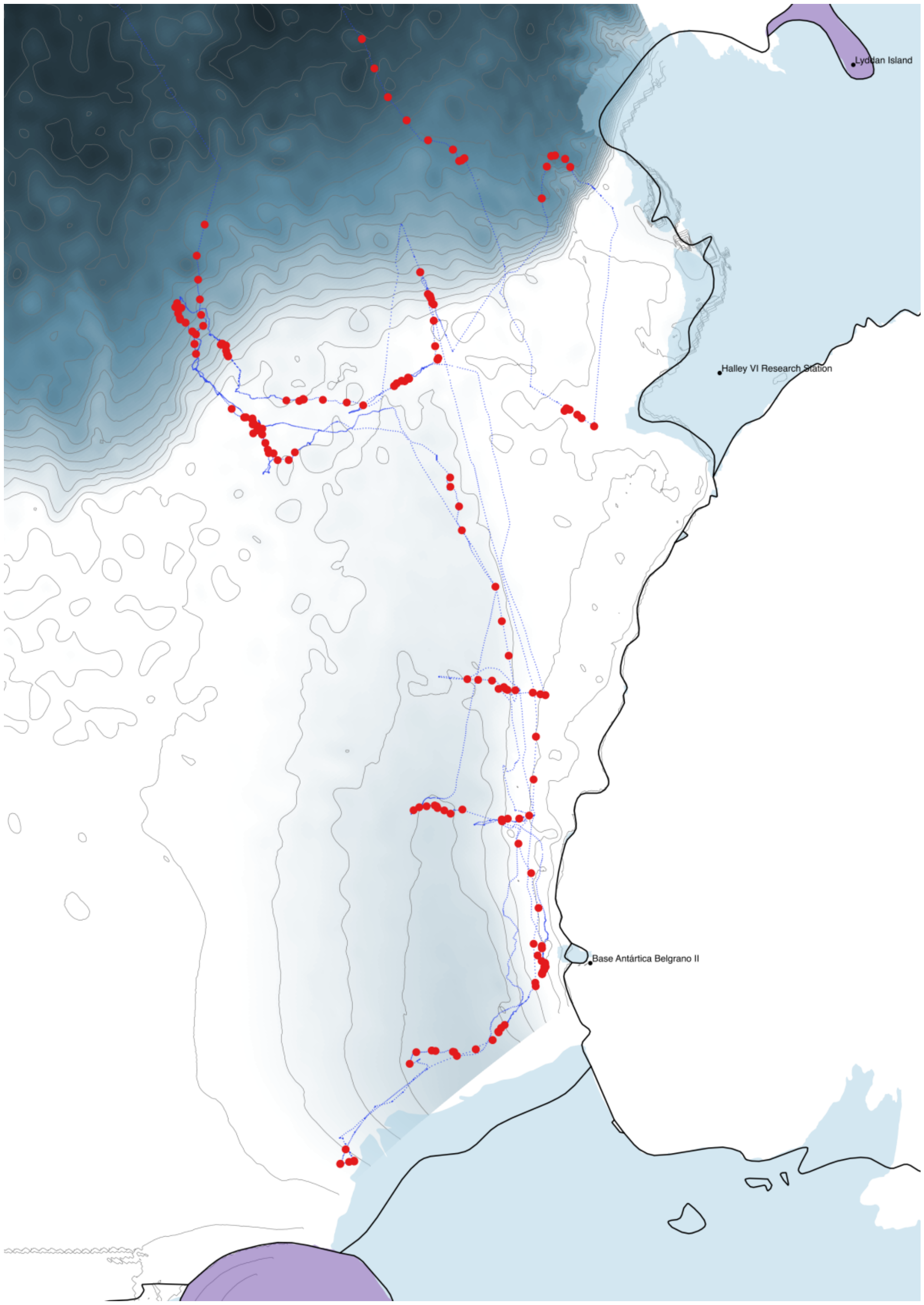


Figure 5.2. 4: Sighting effort during the JR16004 in the Weddell sea continental shelf.

5.3 Seals tagging

Sara Labrousse and Yves David

5.3.1 Introduction

The Weddell Sea harbors rich ecosystems associated with the seasonal sea ice dynamics (krill, copepods, fish, birds and marine mammals). However, this sector remains under-sampled and little is known about the oceanographic and biological processes taking place in this region due to compact and extended sea ice making the access difficult even in summer. The cruise represented a unique opportunity to study the ecology of marine top predators by equipping them with satellite-relayed data loggers, in a region where little is known on their movements, foraging activity and their preferences in terms of oceanographic conditions.

The project consisted in opportunistic deployment from the R/V James Clark Ross of Argos tags coupled with diving recorder and a CTD miniaturized sensor on one emblematic species of pinnipeds, major consumer of the ecosystem of the Antarctic sea ice, the Weddell seal (*Leptonychotes weddellii*). Such deployment co-ordinated within the framework of the physics-based WAPTITI will allow unique interdisciplinary research: (i) acquiring essential information on the feeding ecology of Weddell seals, where only few studies are available (Plötz et al., 2001; Boehme et al., 2016), and (ii) acquiring valuable hydrological data under sea ice in late summer, autumn and winter from the CTD profiles recorded during dives of the Weddell seals (Nicholls et al., 2008). The study of the seal diving behavior under sea ice combined with simultaneously recorded hydrographic profiles will first highlight preferred feeding habitat in terms of oceanographic conditions. Secondly, this telemetry monitoring will help to quantify the role of hydrological and sea ice conditions on the abundance and availability of resources in the Antarctic shelf, improving our still very patchy knowledge on ecosystem functioning under winter sea ice (Flores et al., 2012).

References:

Boehme, L., Baker, A., Fedak, M., Årthun, M., Nicholls, K., Robinson, P., Costa, D., Biuw, M., Photopoulou, T., 2016. Bimodal Winter Haul-Out Patterns of Adult Weddell Seals (Leptonychotes weddellii) in the Southern Weddell Sea. PLOS ONE 11, e0155817. doi:10.1371/journal.pone.0155817

Flores, H., van Franeker, J.A., Siegel, V., Haraldsson, M., Strass, V., Meesters, E.H., Bathmann, U., Wolff, W.J., 2012. The Association of Antarctic Krill *Euphausia superba* with the Under-Ice Habitat. PLoS ONE 7, e31775.doi:10.1371/journal.pone.0031775

Nicholls, K.W., Boehme, L., Biuw, M., Fedak, M.A., 2008. Wintertime ocean conditions over the southern Weddell Sea continental shelf, Antarctica. Geophysical Research Letters 35.

Plötz, J., Bornemann, H., Knust, R., Schröder A., Bester, M., 2001. Foraging behaviour of Weddell seals, and its ecological implications. Polar Biology 24, 901–909.

5.3.2 Method

5.3.2.1 Calibration of the seal loggers: a comparison of CTD–SRDLs with a ship-based CTD system

To improve the quality of hydrographic data from CTD–Satellite Relay Data Loggers (CTD–SRDL) deployed on Weddell seals, comparisons of CTD-SRDLs with a ship based CTD system were done. These comparisons will be used to correct pressure-induced linear biases on both temperature and salinity measurements. A salinity offset correction will be then carried out using delayed-mode methods.

Several calibrations were done, a map of the position of the different calibrations, a summary of the loggers used for the different calibrations and the problem encountered are presented in Figure 5.3. 1 and Figure 5.3. 2.

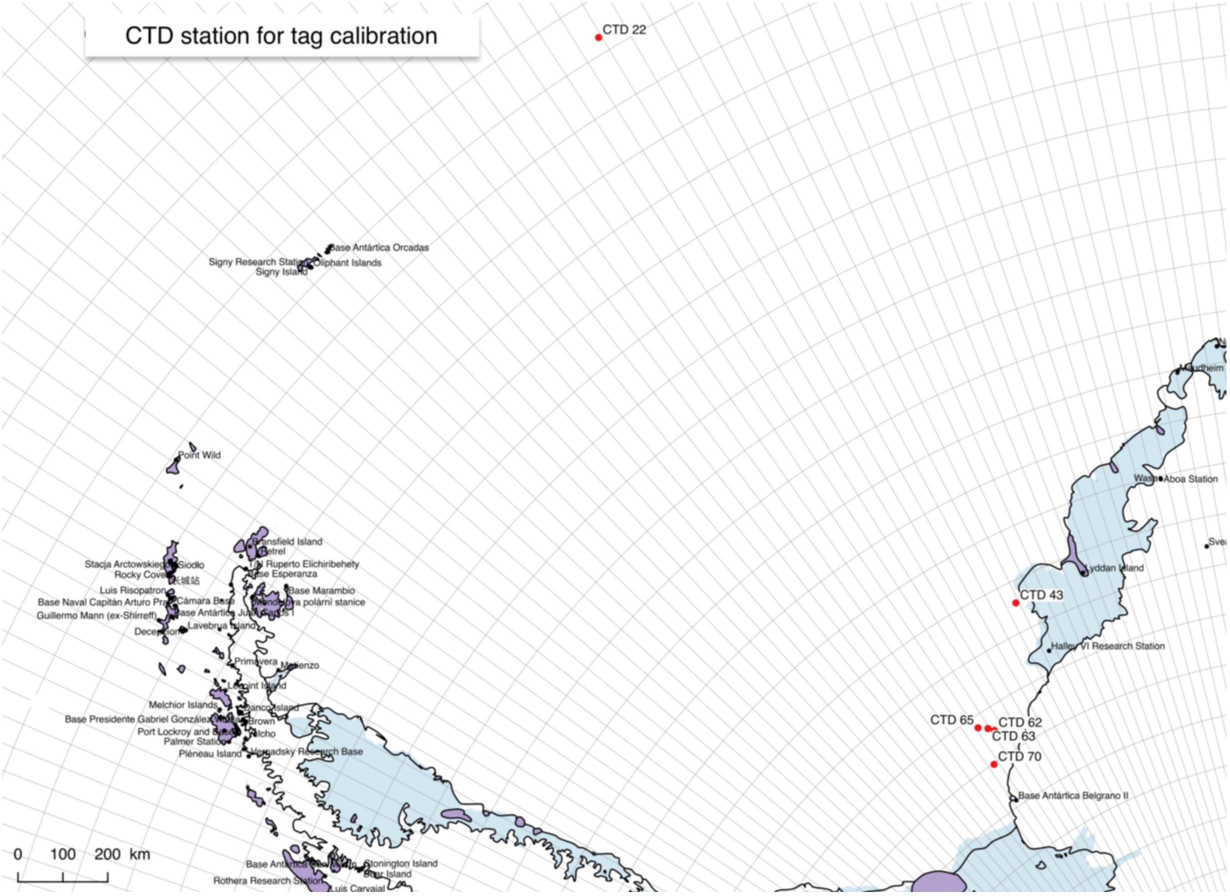


Figure 5.3. 1: CTD station for calibration

Figure 5.3. 2: Summary of the different calibrations done on the seal loggers.

	Calibration 1	Calibration 2	Calibration 3	Calibration 4	Calibration 5	Calibration 6
Tag body no	12261, 11700, 12246, 14408, 14411, 14412, 14413, 14414	12261, 11700, 12246, 14408, 14411, 14412, 14413, 14414	14413	14412	14414, 12261	14411,14408
Problems encountered	4 tags (i.e. 14408, 14411, 14412, 14414) were in the "deployment mode" (seal mode) instead of "calibration mode".	3 tags (i.e. 14412, 14413 and 14414) had wrong conversion coefficients. P, T and C retrieved with coefficients found in the "debug file". Conversion coefficients were then changed in the TagConfig interface. The tag 12261 had non-real values in conductivity.	The tag 14413 had wrong conversion coefficients . P, T and C retrieved with coefficients found in the "debug file". Conversion coefficients were then changed in the TagConfig interface.	The tag 14412 had wrong conversion coefficients. P, T and C retrieved with coefficients found in the "debug file". Conversion coefficients were then changed in the TagConfig interface.	The tag 14414 had wrong conversion coefficients. P, T and C retrieved with coefficients found in the "debug file". Conversion coefficients were then changed in the TagConfig interface. The tag 12261 had ireal values in conductivity (like in the second calibration).	The tags 14411 and 14408 had wrong conversion coefficients. P, T and C retrieved with coefficients found in the "debug file". Conversion coefficients were then changed in the TagConfig interface.
Station CTD no	22	43	62	63	65	70
Date	03/02/2017	10/02/2017	13/02/2017	13/02/2017	13/02/2017	14/02/2017

First calibration

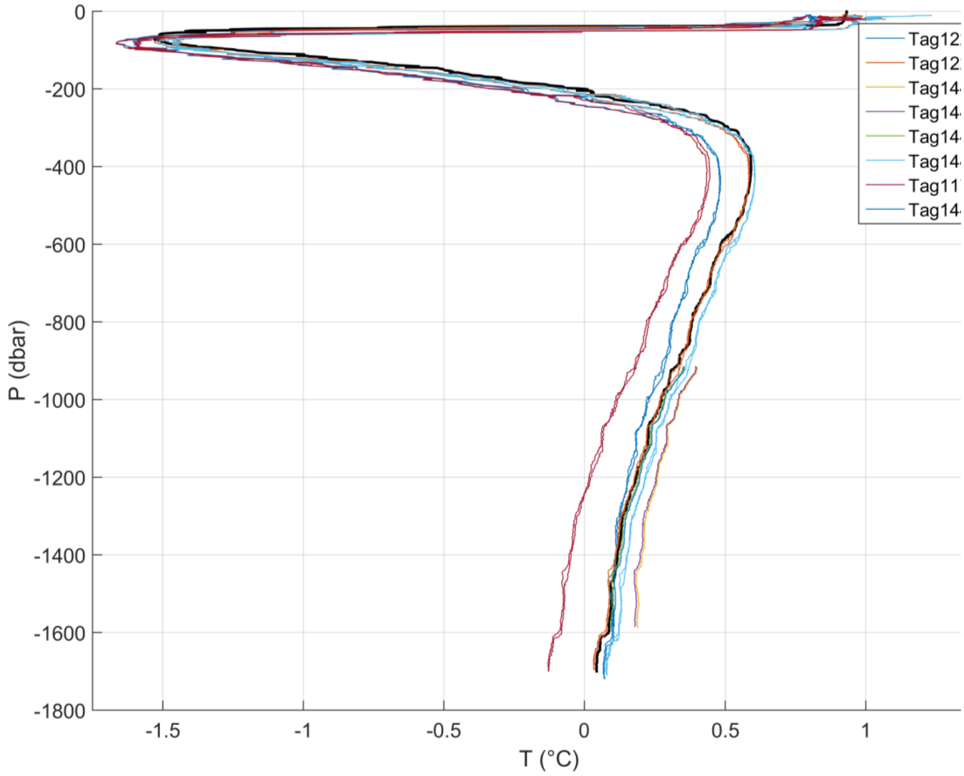


Figure 5.3. 3: Vertical profiles of temperature sampled by the 8 CTD–SRDLs (colours) and the shi (black) during the same cast for the first calibration.

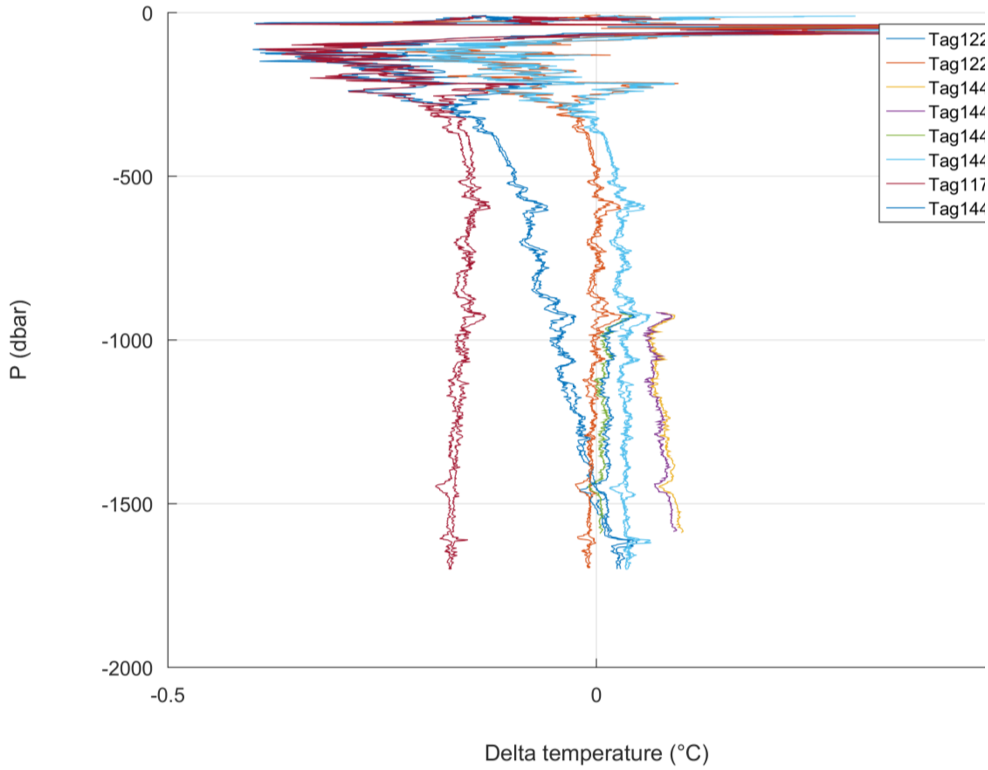


Figure 5.3. 4: Temperature differences between the CTD–SRDLs and the ship-based CTD for the fi

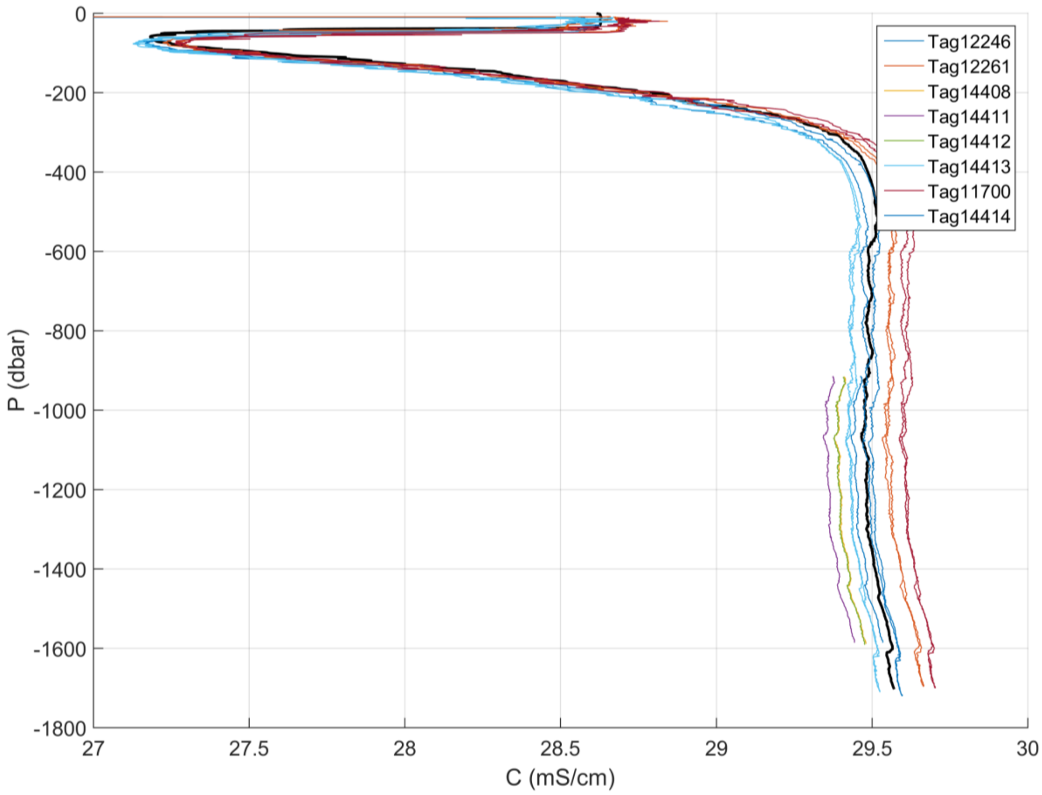


Figure 5.3. 5: Vertical profiles of conductivity, sampled by the 8 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the first calibration.

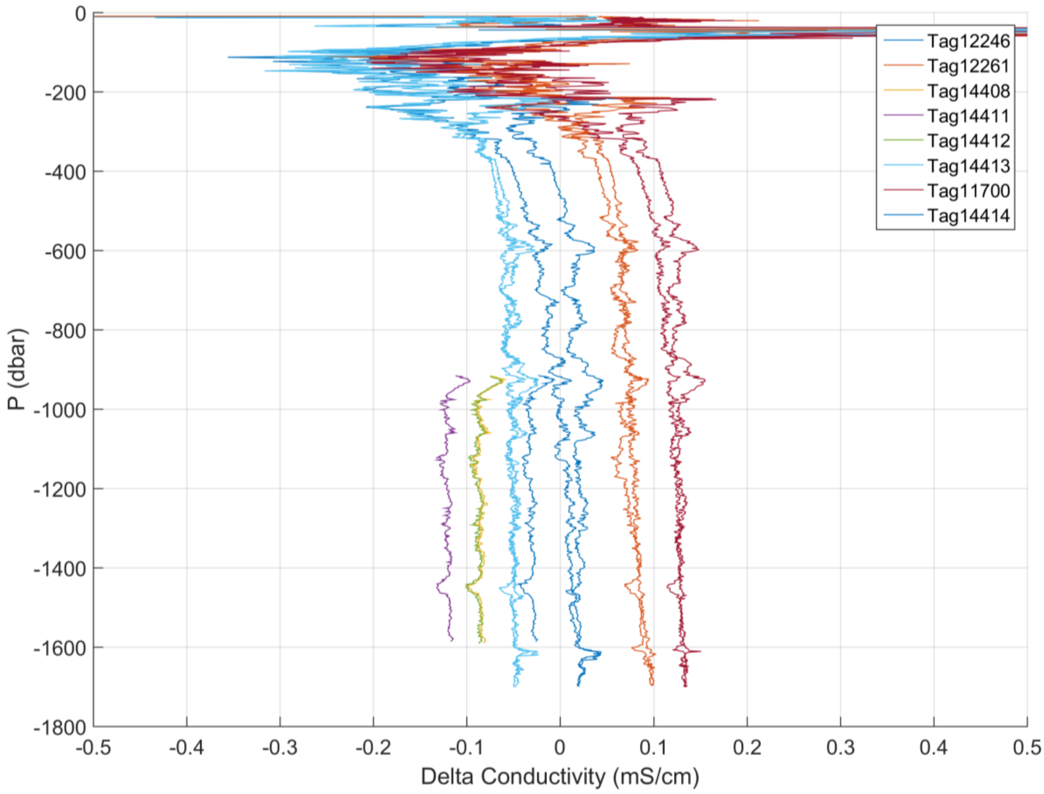


Figure 5.3. 6: Conductivity differences between the CTD–SRDLs and the ship-based CTD for the first calibration.

Second calibration

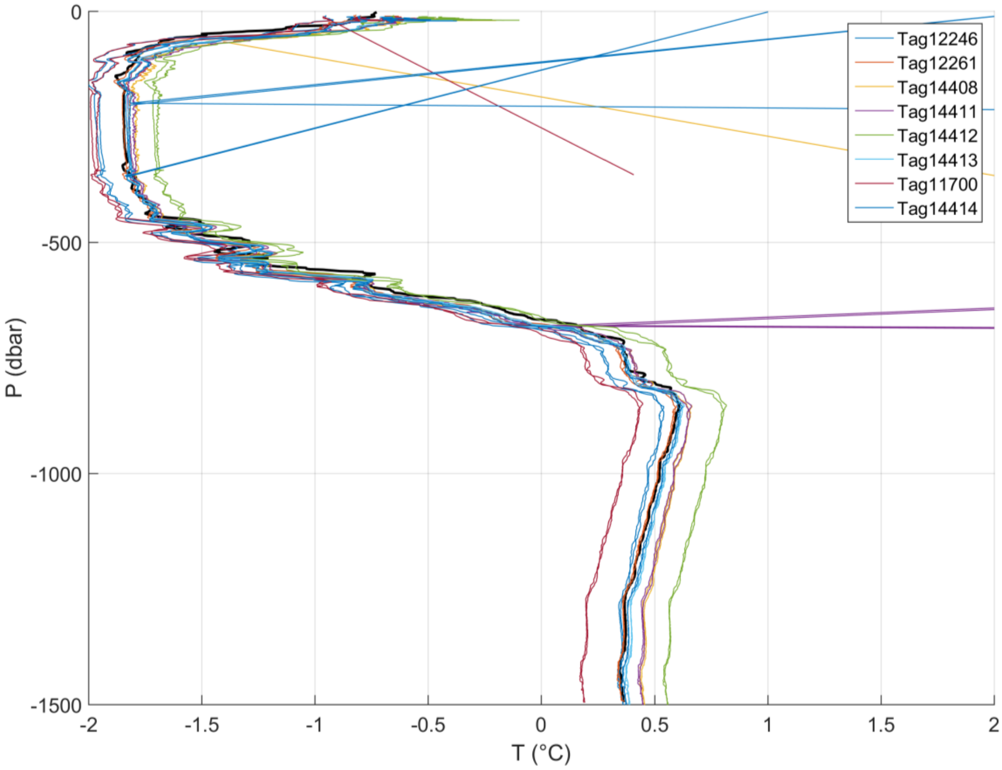


Figure 5.3. 7: Vertical profiles of temperature sampled by the 8 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the second calibration.

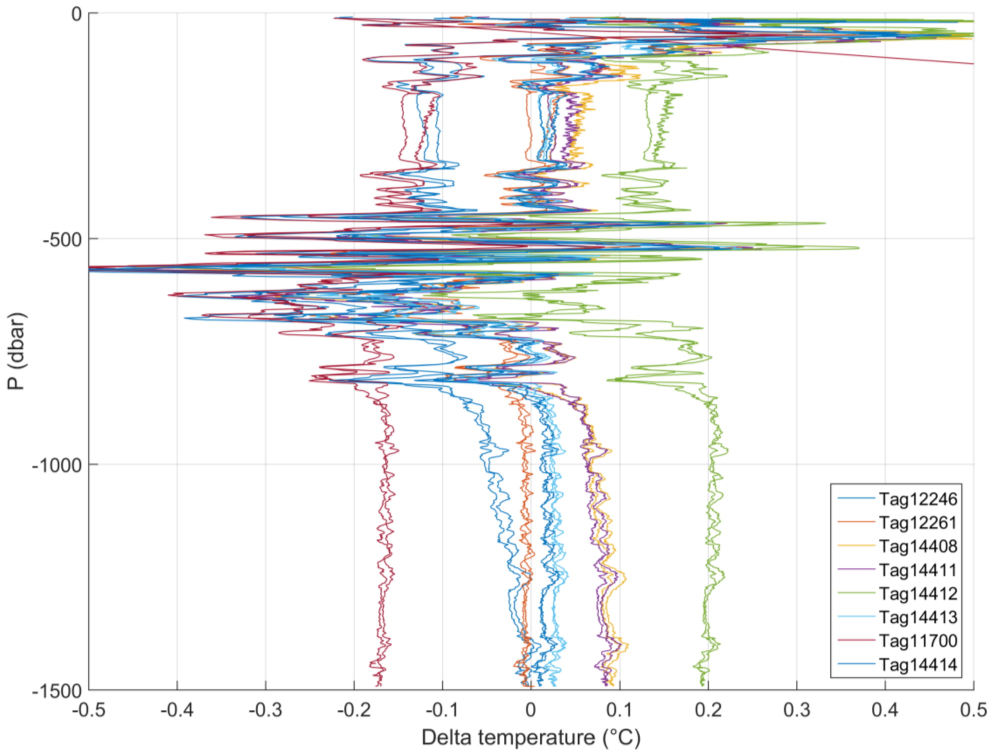


Figure 5.3. 8: Temperature differences between the CTD–SRDLs and the ship-based CTD for the second calibration.

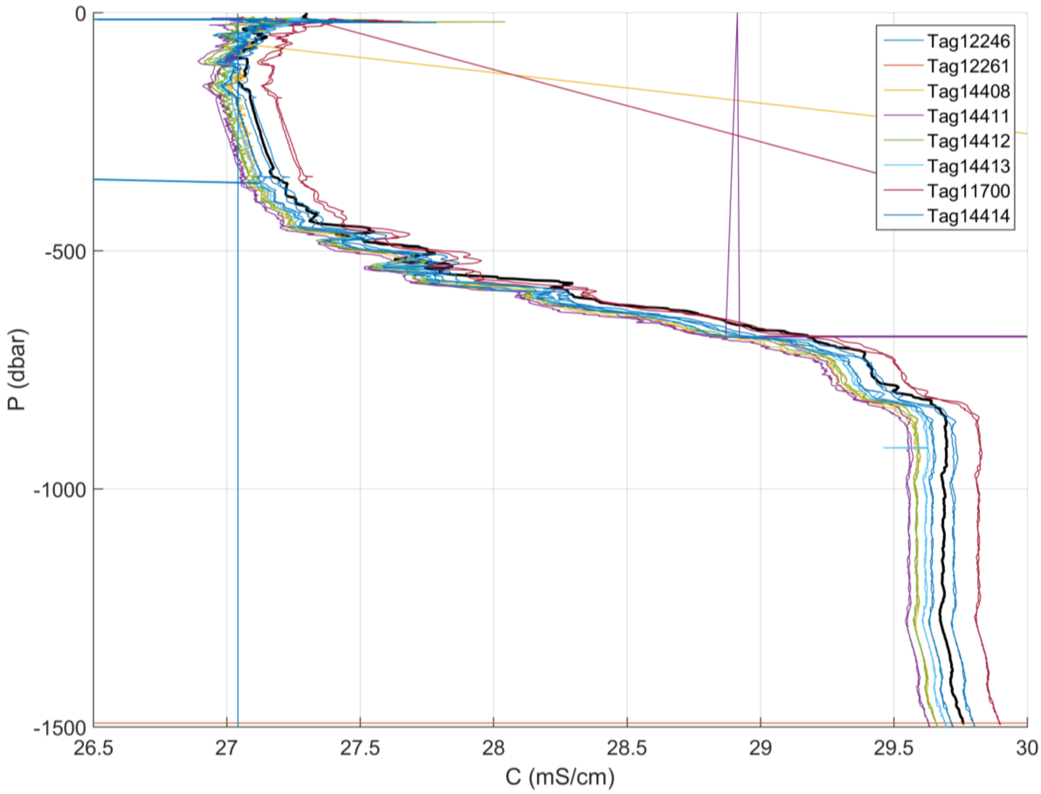


Figure 5.3. 9: Vertical profiles of conductivity, sampled by the 8 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the second calibration.

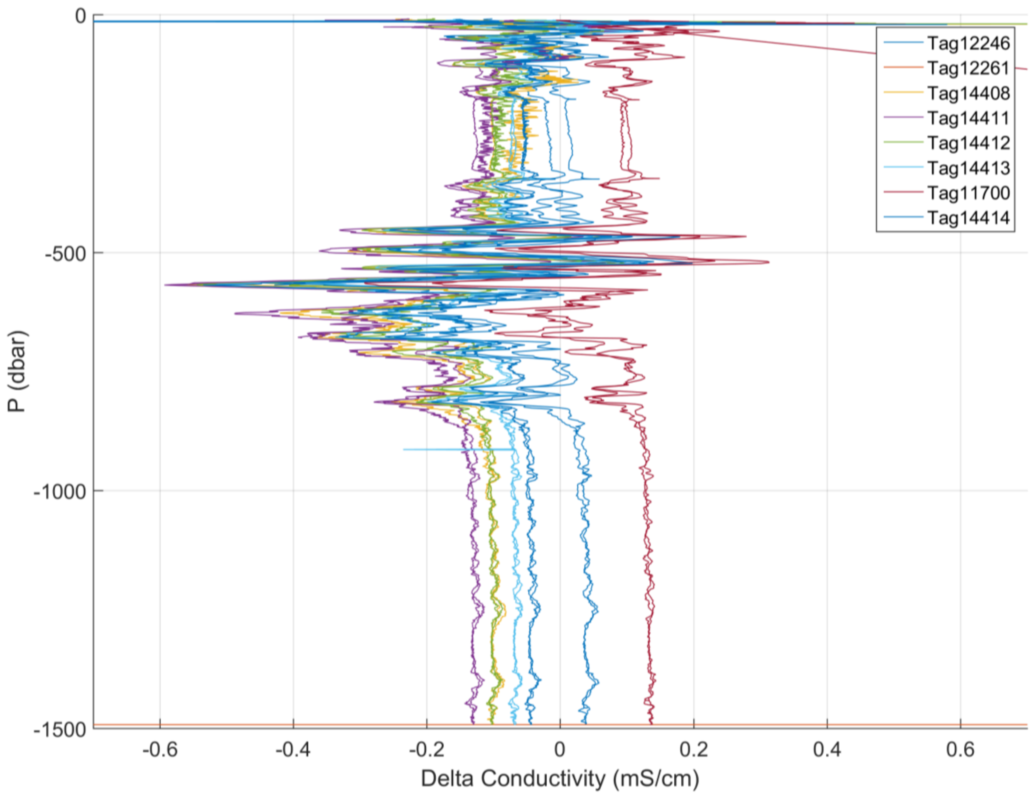


Figure 5.3. 10: Conductivity differences between the CTD–SRDLs and the ship-based CTD for the second calibration.

Third calibration

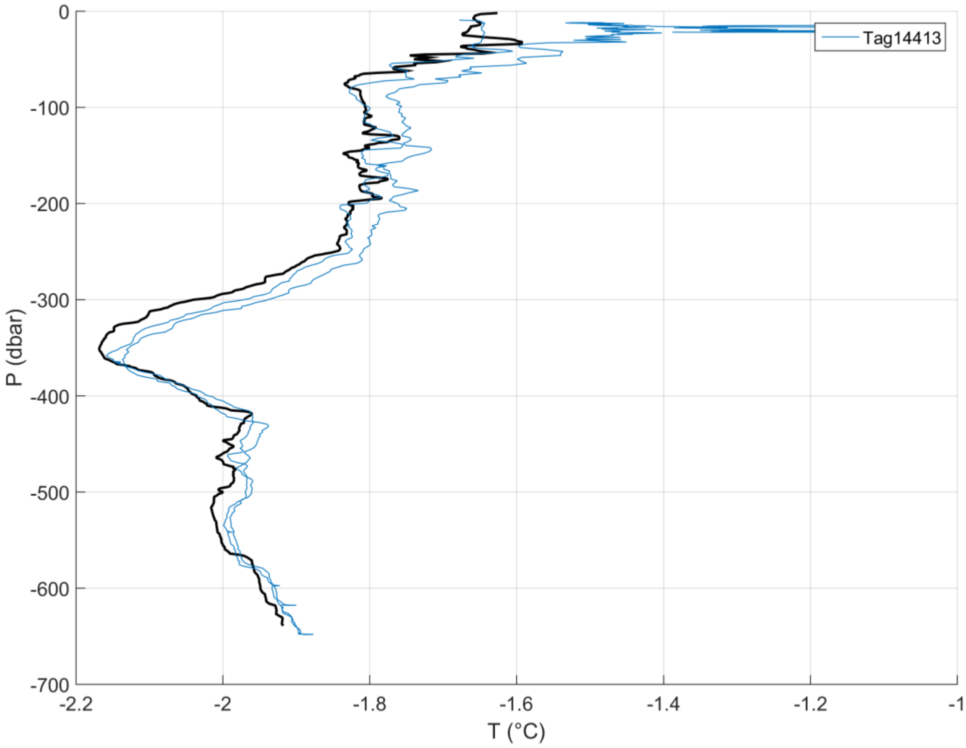


Figure 5.3. 11: Vertical profiles of temperature sampled by the CTD–SRDL no 14413 (blue colour) and the ship-based CTD (black) during the same cast for the third calibration.

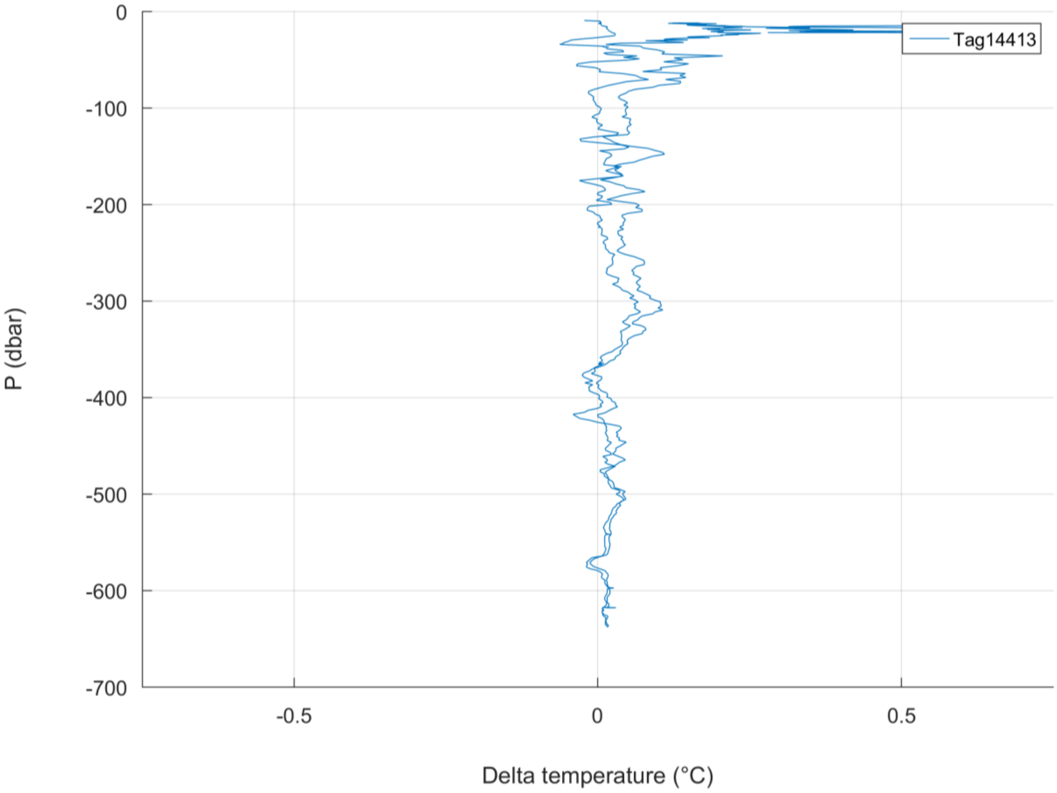


Figure 5.3. 12: Temperature differences between the CTD–SRDL and the ship-based CTD for the third calibration.

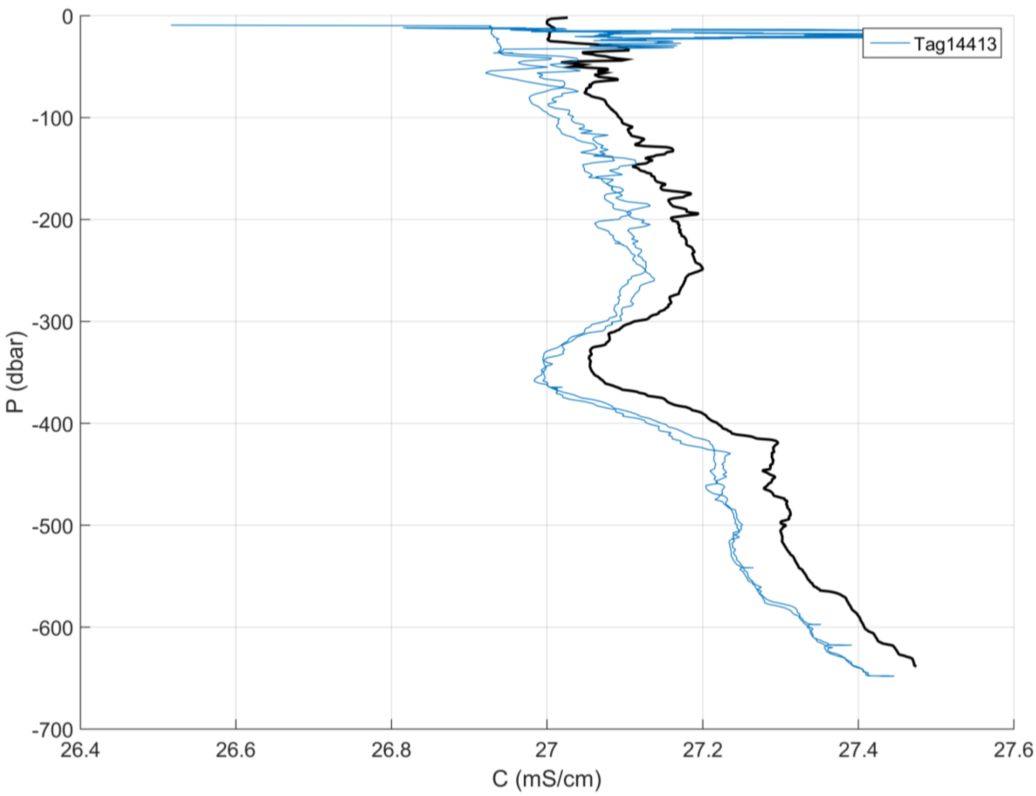


Figure 5.3. 13: Vertical profiles of conductivity sampled by the CTD–SRDL no 14413 (blue colour) and the ship-based CTD (black) during the same cast for the third calibration.

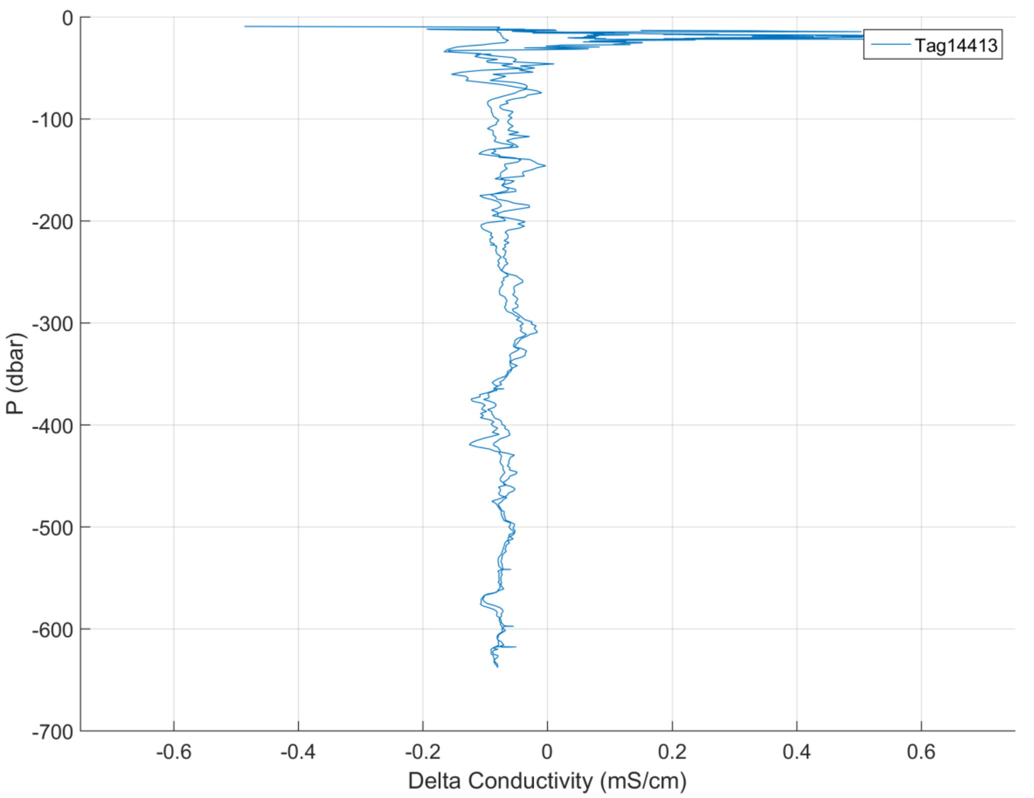


Figure 5.3. 14: Conductivity differences between the CTD–SRDL and the ship-based CTD for the third calibration.

Fourth calibration

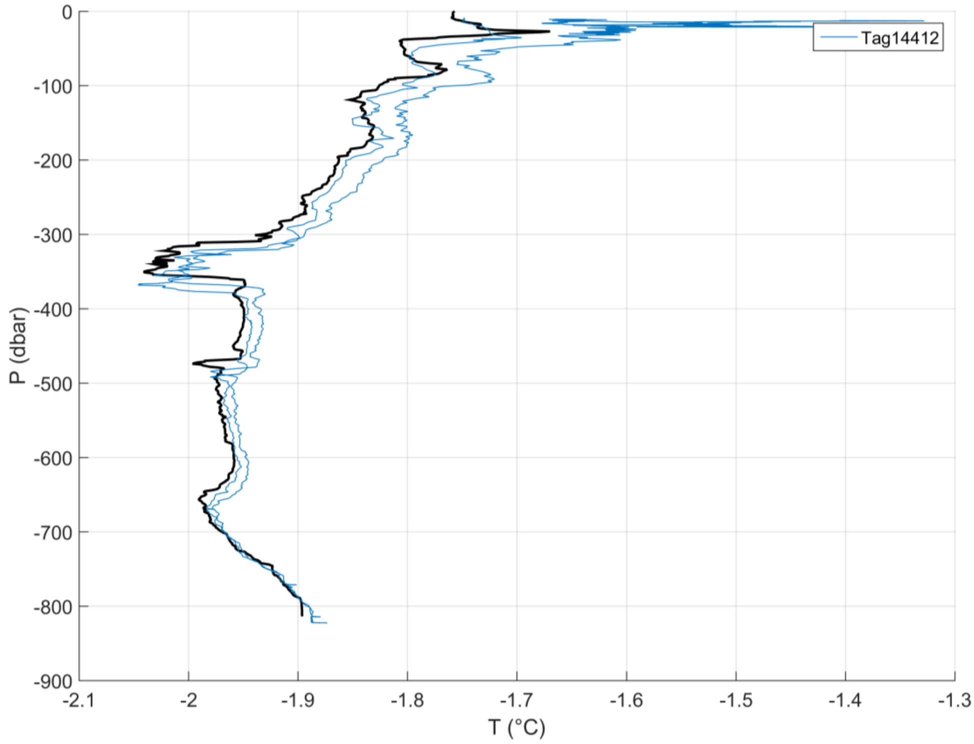


Figure 5.3. 15: Vertical profiles of temperature sampled by the CTD–SRDL no 14412 (blue colour) and the ship-based CTD (black) during the same cast for the fourth calibration

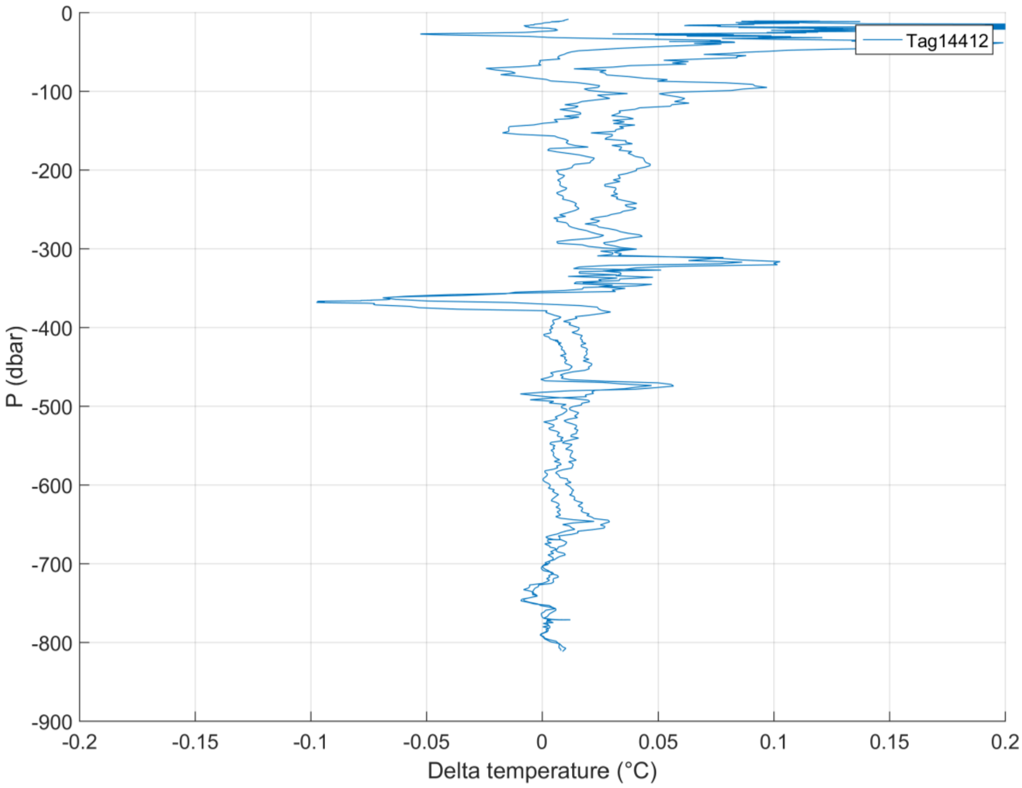


Figure 5.3. 16: Temperature differences between the CTD–SRDL and the ship-based CTD for the fourth calibration.

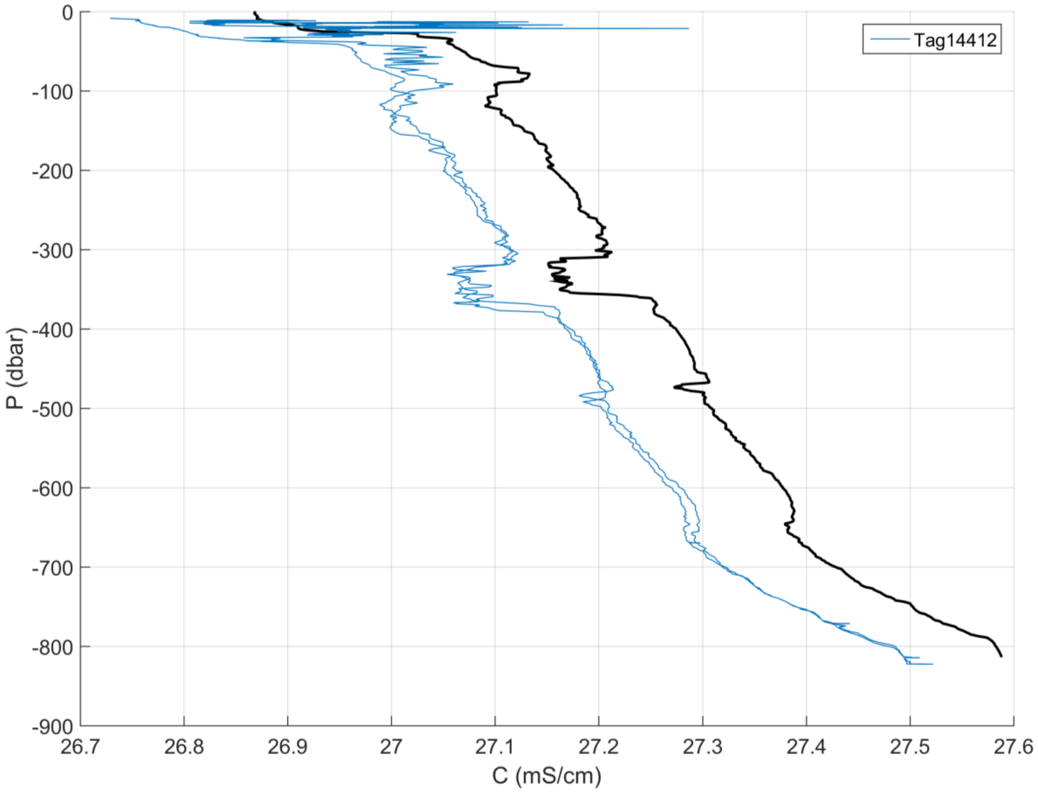


Figure 5.3. 17: Vertical profiles of conductivity sampled by the CTD–SRDL no 14412 (blue colour) and the ship-based CTD (black) during the same cast for the fourth calibration.

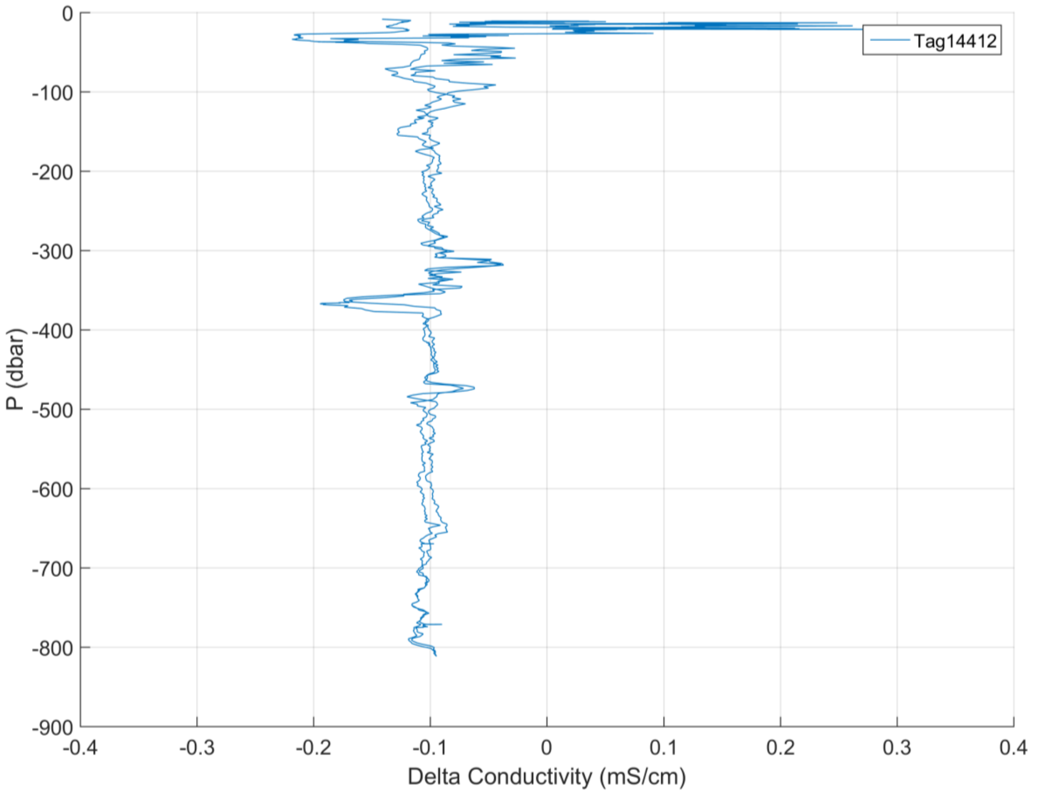


Figure 5.3. 18: Conductivity differences between the CTD–SRDL and the ship-based CTD for the fourth calibration.

Fifth calibration

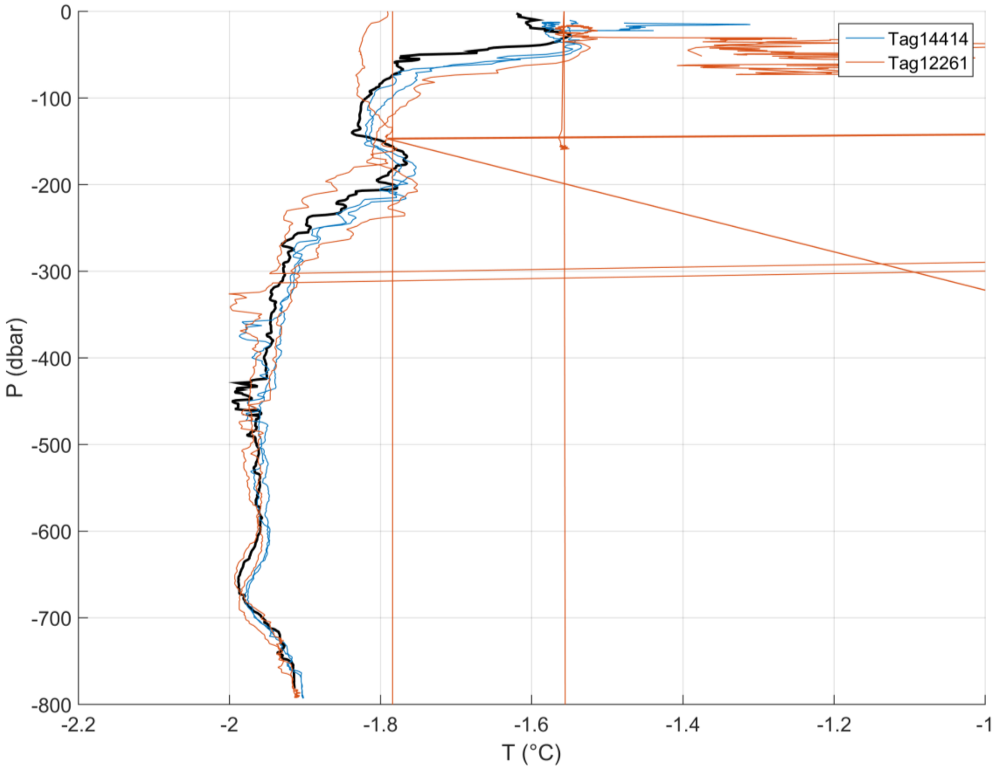


Figure 5.3. 19: Vertical profiles of temperature sampled by the 2 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the fifth calibration.

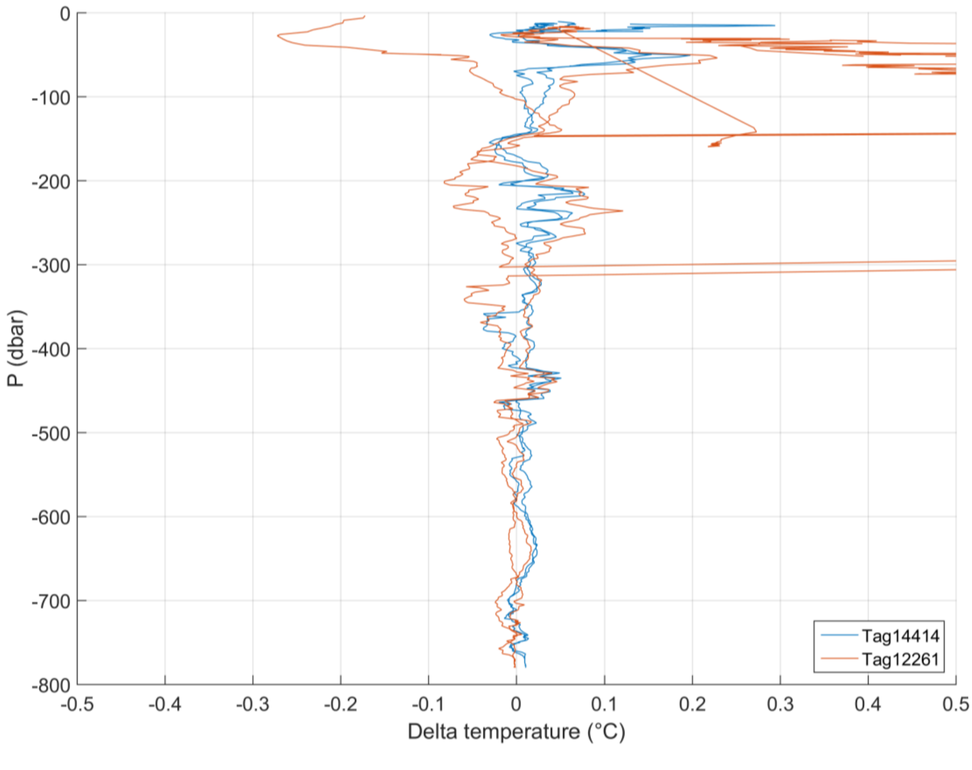


Figure 5.3. 20: Temperature differences between the 2 CTD–SRDLs and the ship-based CTD for the fifth calibration.

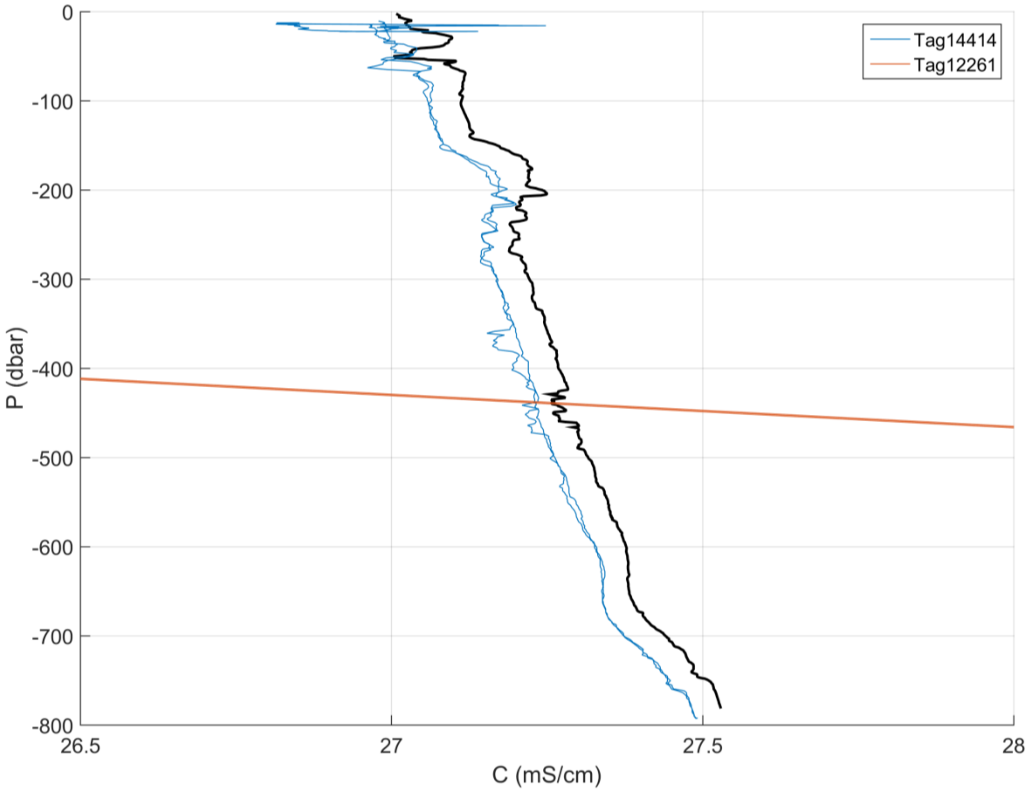


Figure 5.3. 21: Vertical profiles of conductivity sampled by the 2 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the fifth calibration. The tag with the body number 12261 had non-real values.

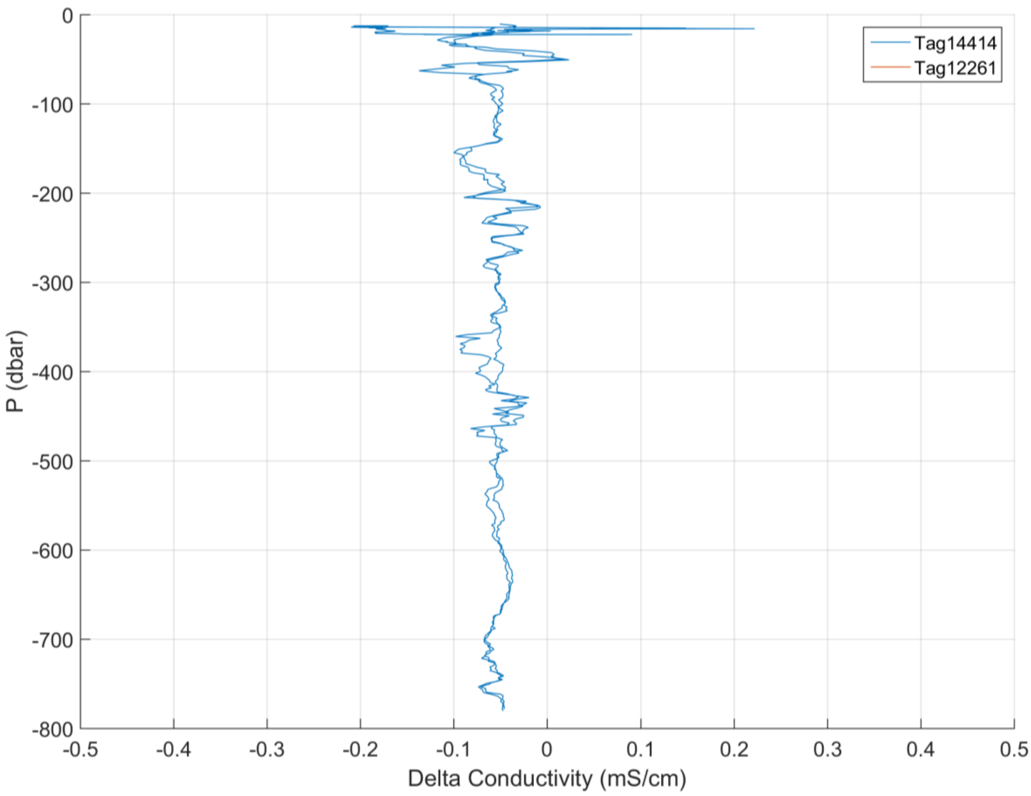


Figure 5.3. 22: Conductivity differences between the 2 CTD–SRDLs and the ship-based CTD for the fifth calibration. The tag with the body number 12261 had non-real values.

Sixth calibration

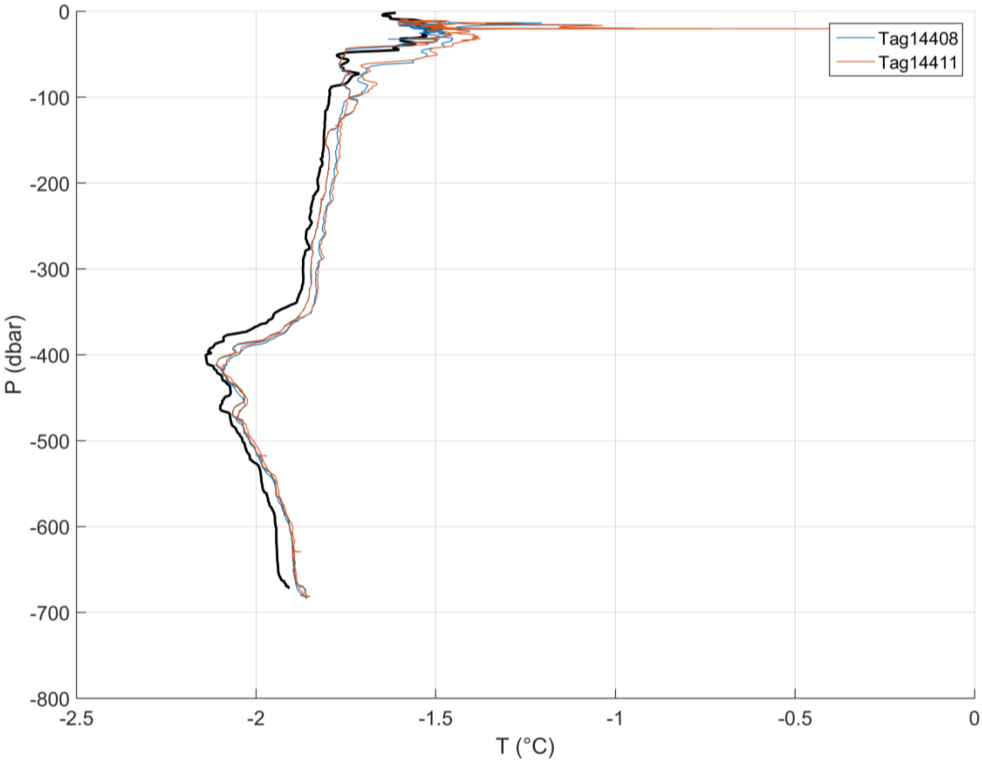


Figure 5.3. 23: Vertical profiles of temperature sampled by the 2 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the sixth calibration.

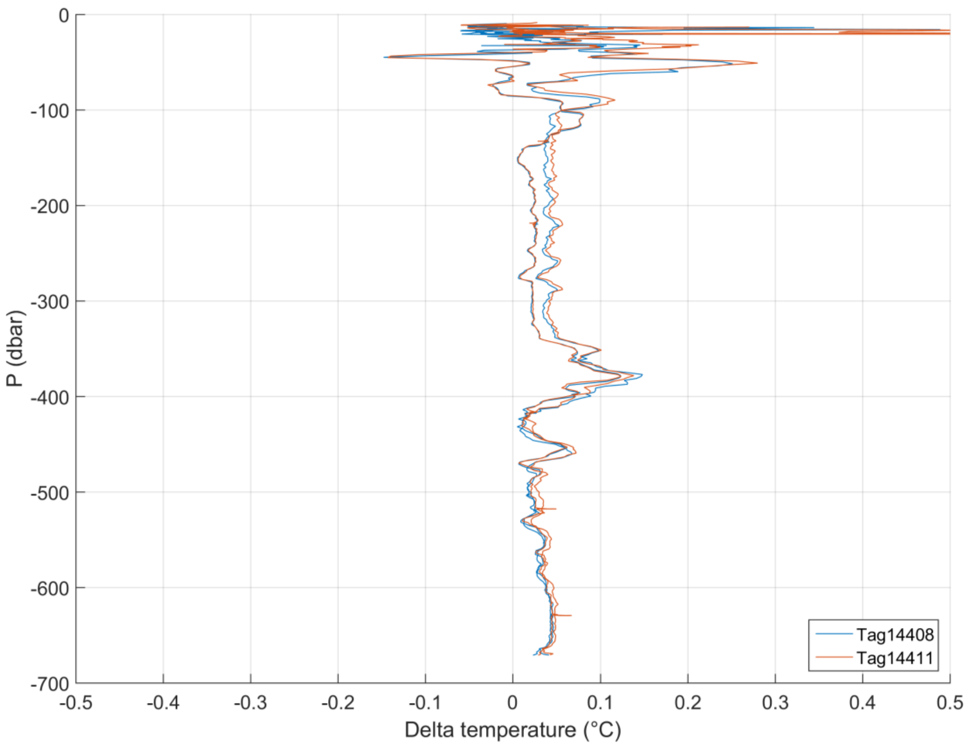


Figure 5.3. 24: Temperature differences between the 2 CTD–SRDLs and the ship-based CTD for the sixth calibration.

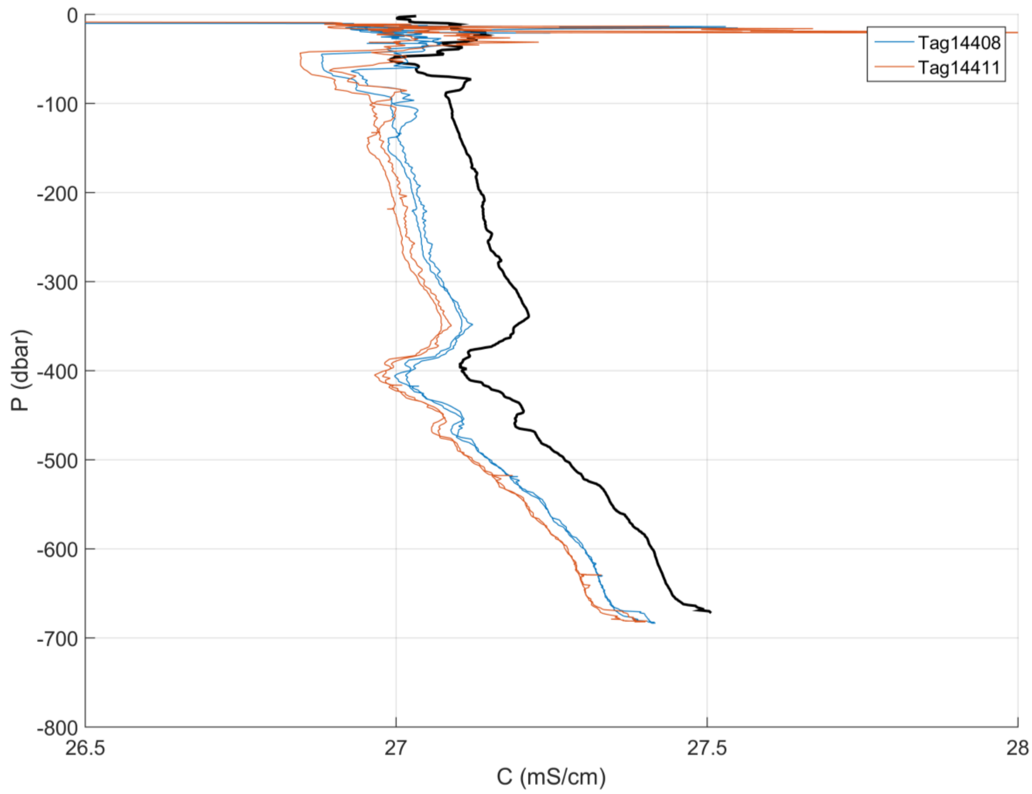


Figure 5.3. 25: Vertical profiles of conductivity sampled by the 2 CTD–SRDLs (colours) and the ship-based CTD (black) during the same cast for the sixth calibration.

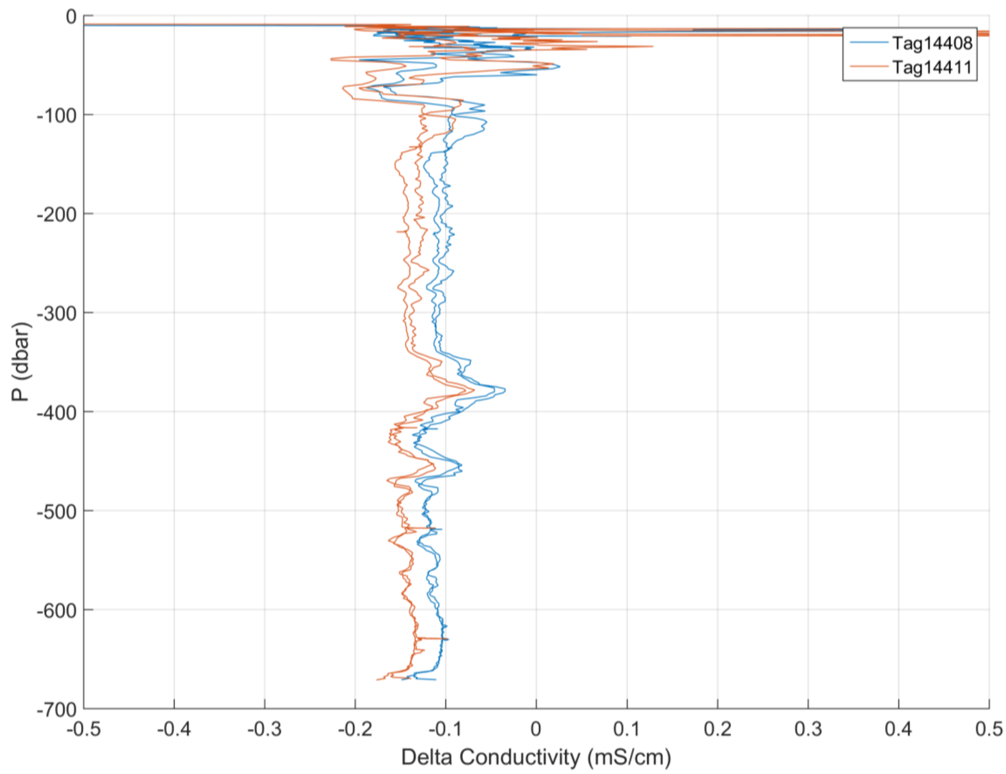


Figure 5.3. 26: Conductivity differences between the 2 CTD–SRDLs and the ship-based CTD for the sixth calibration.

Summary

Figure 5.3. 27: Summary of the different offsets observed over the six calibrations.

Tag body no	Offset in Temperature	Offset in Conductivity
12261	0,01	Only worked for the first calibration
11700	-0,18	0,15
12246	-0,1 to 0,01 ; deviation with pressure	0,04
14408	0,05 to 0,08 ; deviation with pressure for calibration 1 and 2	-0,08 to -0,1
14411	0,05 to 0,08 ; deviation with pressure for calibration 1 and 2	-0,15
14412	0,01; except for calibration 2 (0,2)	-0,1
14413	0,02	-0,05 to -0,08
14414	0,01	-0,05

5.3.2.2 Animal handling and deployment

We caught Weddell seals (*Leptonychotes weddellii*) opportunistically on sea ice floes within the Antarctic shelf in the Weddell Sea. Seals were captured at the end of their annual moult haul-out. The animals to be tagged were a combination of male and female adults (average weight of 300-500 kg) and juveniles, the precise mix of which was determined by on-ground availability of animals. The tags were deployed on the most suitable animals available at those times (i.e. those that have finished moulting and are in good condition). We equipped 5 individual seals during the cruise. All of these deployments were post-moult, so that there was no risk of pup desertion or disturbance to breeding groups. The CTD-SRDLs do not need to be recovered given all the data is received via satellite. Thus, the tag will stay in place about 6 months and at the latest until the annual moult when the tag will fall off.

Once the candidate seal had been sighted, the ship manoeuvred up to the floe and the team were deposited on the ice using a Wor Geordie (Figure 5.3. 28).

The team walked towards the seal (Figure 5.3. 29) and four personnel worked their way around to prevent the seal to leave at-sea (Figure 5.3. 30).


Figure 5.3. 28: Wor Geordie


Figure 5.3. 29


Figure 5.3. 30

At the forefront of pinniped anaesthesia methods, we applied the gas sedation method reducing the side effects of anaesthesia and accelerating the wakening of the animal.

Once located and in a safe position, the seal had a canvas bag placed over its head and was then restrained to allow the intravenous administration of the Midazolam (pre-medication). Restraint is achieved by one person to 4 persons (depending of the seal weight) climbing atop the seal and holding both fore flippers (Figure 5.3. 31), this prevents the seal gaining purchase on the ground.

Before capturing a seal its mass was estimated (based on length and body condition i.e. thin or fat) to calculate the correct dose of drugs. The pre-medication used are Midazolam and were administered at a rate of **0.1 to 0.2 mg/kg (IV);** those rates were lower than the recommended dose of 0.2 to 0.5 mg/kg. These lower doses were sufficient to put the mask on the seal despite it was still moving the head.

Figure 5.3. 31: Seal immobilization.

The procedures for injecting the drug are as follows:

1. The dosage was prepared in a new sterile syringe (10 mL, depending on seal size) and needle (150 mm; 18 gauge) prior to head-bagging the seal. Then the syringe and needles were kept in an icebox close to warm bottles before use.
2. The tail section of the seal was straddled and the pelvis located by feel. Once the pelvis had been identified the hand was moved to the spine on the dorsal surface and then forward one hand's breadth.
3. The thumb was pushed firmly on the spine to locate an inter-vertebra cavity.
4. The needle was inserted into the middle of an identified cavity penetrating the wall of the extra-dural vein that runs dorsally along the spine.
5. The drug was injected slowly into the extra-dural vein.
6. As the seal became sedated, the reflex responses were monitored. For intraveinous procedures the induction time was between 30 and 90 seconds.
7. Once muscle tone was relaxed, physical restraint was removed.

The procedures for the gas sedation are as follows:

8. The canvas bag was removed and if the seal was still able to lift head but not able to bite the mask, one person held the neck of the seal while a second person put the mask on;
9. If the seal was able to lift head and bite the mask, the canvas bag was placed over its head again, and the mask was applied on the hood hole; once the seal was not able to lift head or bite, the canvas bag was removed and the mask placed on the seal.
10. If a seal regained a level of consciousness that did not allow the procedures to be completed with the canvas bag on, then a top-up dose of Midazolam may have been given.
11. Then the seal was given sevoflurane (3-5%) plus oxygen at a flow rate 10-15 L/min by mask (Fig. 31-33).
12. Then, the animal was maintained on 1.5 to 3% isoflurane (or sevoflurane) plus oxygen (~6-7 L/min). The seal's body was covered with blanket and the animal placed on an insulated mat to reduce heat loss.
13. Respiratory rate, capillary refill, gum colour and level of immobilisation were monitored.

Figure 5.3. 32: Gas machine for anaesthesia

Figure 5.3. 33: Gas anaesthesia

Figure 5.3. 34: Gas anaesthesia

The procedures for tagging the seal are as follows:

14. The CTD-SRDL tag was glued directly onto the fur and the prime position is on the seal's head, this maximises communication between the tags and the ARGOS satellites and data transmission.
15. The tag was placed on the animal's head with the antenna pointing forward, to give the best satellite reception and transmission while the seal is at sea.
16. We used two part epoxy such as Araldite AW 2101 and Hardener HW 2951. The combined mass of the tags and glue was 580 g (dimensions: 105 x 70 x 40 mm).
17. The seal was then measured.
18. Finally, the seal was monitored during recovery to ensure animals were fit before release.

Figure 5.3. 35: The seal with the glued tag on its head.

Figure 5.3. 36: Wakening phase.

Five Weddell seals were tagged from February 17th to March 3rd, two adult males, two subadult males and one adult female (Figure 5.3. 37).

A total of 65 Weddell seals were spotted opportunistically during the cruise from January 24th to March 13th. However, we were not able to go down on sea ice when the boat was doing CTD station or mooring deployment/recovery. Moreover, when the floes were too small but suitable to go down, we attempted to go down but most of the time the seal went at-sea.

One male Weddell seal caught was not tagged. The pre-medication of 6 ml of Midazolam (IV) was not sufficient to remove the hood and put the mask on. The seal was still able to move head and bite the mask. We tried to put the mask on the hole at the top of the hood, but after few minutes of gas sedation induction, when we attempted to remove the hood a second time, the seal was still awake and biting the mask while approaching it to his face. We put back the hood on and we added a second dose of 1.5 ml of Midazolam (IV). Again, after removing the hood, it was impossible to put the mask on the animal still fully awake. At the very end, we attempted to inject a third dose of Midazolam but with air temperature of -11°C and 20 knots wind, the needle and syringe were full of ice, despite being kept in warm bottles until the last minute. We thus decided to not tag the animal and released it. From this experience we determined that seal tagging using Midazolam pre-medication and gas sedation was not feasible for:

- Winds < 15 knots and temperatures < -15°C;
- Winds > 15 knots and temperatures < -10°C.

The seal capture data can be found in Figure 5.3. 38. One male was captured on the South-East of the Filchner depression, two males on the North-East of the Filchner depression and one female on the North-West of the Filchner depression (Figure 5.3. 39).

Figure 5.3. 37: The five seals tagged during the JR16004 cruise.

Figure 5.3. 38: Seal capture data

Date tagging	SMRU Tag Body #	Location	Latitude (°S)	Longitude (°W)	Sex	Temperature (°C)	Wind (knots)	Length (cm)	Girth (cm)	Estimated Mass (kg)	Midazolam dose IV (ml)	Midazolam dose IV (mg)	Dose rate with estimated weight (mg/kg)	GMT Time	Sevoflurane (%)	Flow of Oxygen (L/min)	GMT start time	Phase
17/02/2017	14408	Weddell Sea	77,65662	35,40584	Adult male	-15	10	231	178	300	9	45	0,15	21:47	3	9	21:52	pre-medication & gas induction phase
															2,5	9	-	gas induction phase
															3,5	7	22:08	gas induction phase
															2,5	11		attempt to reach maintenance of the anaesthesia, short apneas
															2	10		gas reduction phase, short apneas
															2	11		gas reduction phase, short apneas
															1,1	10		gas reduction phase, short apneas
															0	10		wakening phase, short apneas
															0	0	22:36	first signs of wakening
																		signs of wakening
																	23:30	seal awake, we left
																	23:50	seal went at-sea
19/02/2017	14414	Weddell Sea	74,65967	33,99648	Adult male	-10	16	240	168	350	6	30	0,09	18:35	3	10	18:45	pre-medication & gas induction phase
															2,5	9		attempt to reach maintenance of the anaesthesia
															2	7 to 8		attempt to reach maintenance of the anaesthesia
															1,5	7		level ok, maintenance of anaesthesia, very good dose rate
															0	10 to 12	19:07	wakening phase
															0	0	19:17	first head movements
																	19:25	animal awake
																	19:40	seal went at-sea
															3	10	16:00	pre-medication & gas induction phase

Date tagging	SMRU Tag Body #	Location	Latitude (°S)	Longitude (°W)	Sex	Temperature (°C)	Wind (knots)	Length (cm)	Girth (cm)	Estimated Mass (kg)	Midazolam dose IV (ml)	Midazolam dose IV (mg)	Dose rate with estimated weight (mg/kg)	GMT Time	Sevoflurane (%)	Flow of Oxygen (L/min)	GMT start time	Phase
															0	0	16:26	wakening phase
																	16:27	first signs of wakening
																	16:40	seal went at-sea
02/03/2017	14413	Weddell Sea	75,27745	31,40377	Subadult male	-9	10	205	150	250	8,5	42,5	0,17	16:51	3	10	16:56	pre-medication & gas induction phase
															4	10		gas induction phase
															3,5	10		attempt to reach maintenance of the anaesthesia
															1,5	7		maintenance of anaesthesia, 2-3 short apneas at the end
															0	10	17:13	wakening phase
															0	0	17:23	first signs of wakening
																	17:44	seal went at-sea
03/03/2017	12246	Weddell Sea	74,58992	34,05281	Adult female	-3	10 to 17	250	178	380	10	50	0,13	18:13	4	10	18:18	pre-medication & gas induction phase with the canvas bag on
															4	10	18:25	gas induction phase without the hooded bag
															2,5	8	18:30	attempt to reach maintenance of the anaesthesia
															1,5	7		maintenance of anaesthesia, 1-2 short apneas at the end
															0	10	18:44	wakening phase
															0	0	18:51	first signs of wakening
																	19:13	attempt to reach water
																	19:25	back to the boat, seal still on ice floe resting

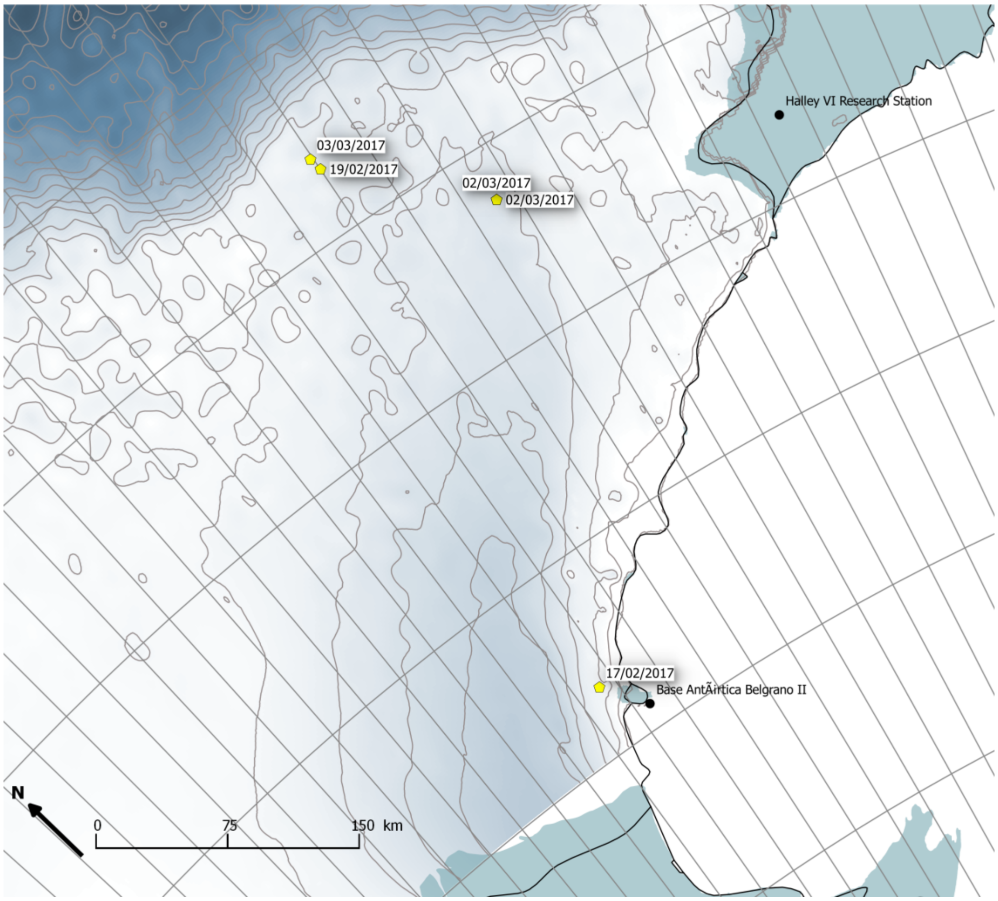


Figure 5.3. 39: Seal deployment locations.

5.3.3 Initial results

A summary of the different parameters recorded by each tag is presented in Figure 5.3. 40. Preliminary seal track positions from deployment to March 9th are presented in Figure 5.3. 41 & Figure 5.3. 42.

Figure 5.3. 40: Summary of parameters recorded by the five tags deployed.

SMRU Tag Body #	Environmental parameters recorded	Behavioural parameters recorded	Argos position	Comments
14408	Temperature, salinity, pression	Dive behaviour	yes	Light not working
14414	Temperature, salinity, pression	Dive behaviour	yes	Light not working
14412	Temperature, salinity, pression, light	Dive behaviour, prey capture attempts	yes	-
14413	-	-	yes	T,S,P,L and dive behaviour not working
12246	Temperature, salinity, pression	Dive behaviour	yes	-

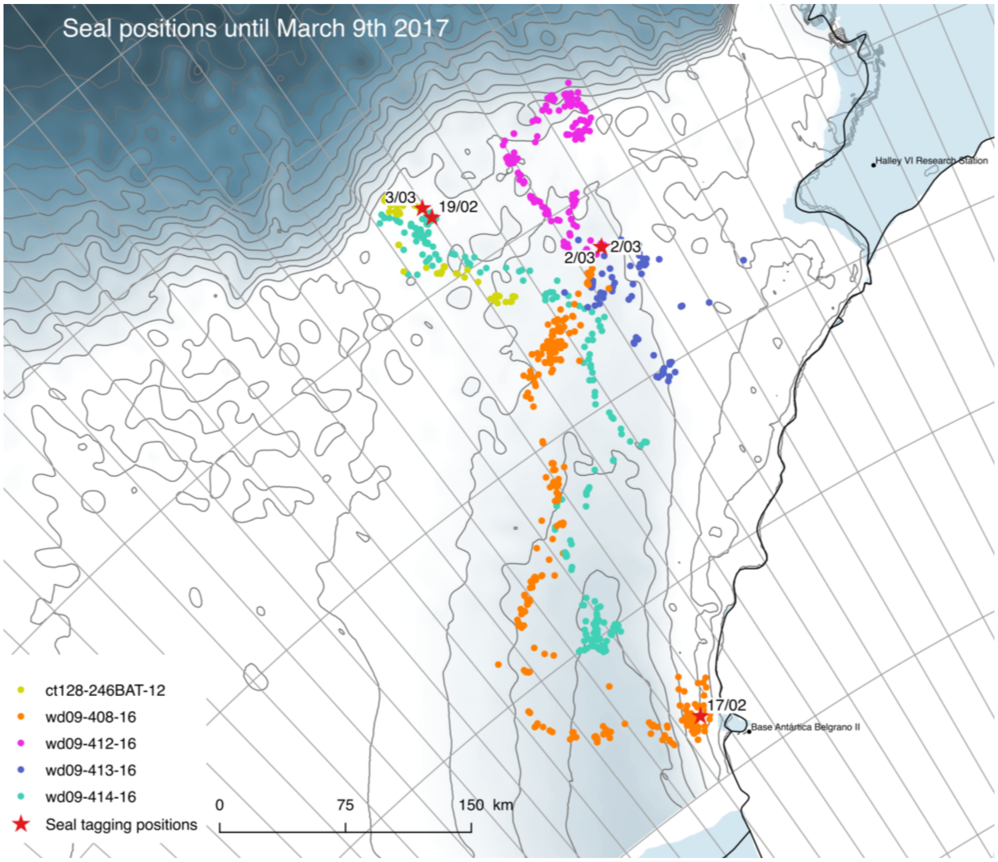


Figure 5.3. 41: Seal track positions. The colour represents each individual.

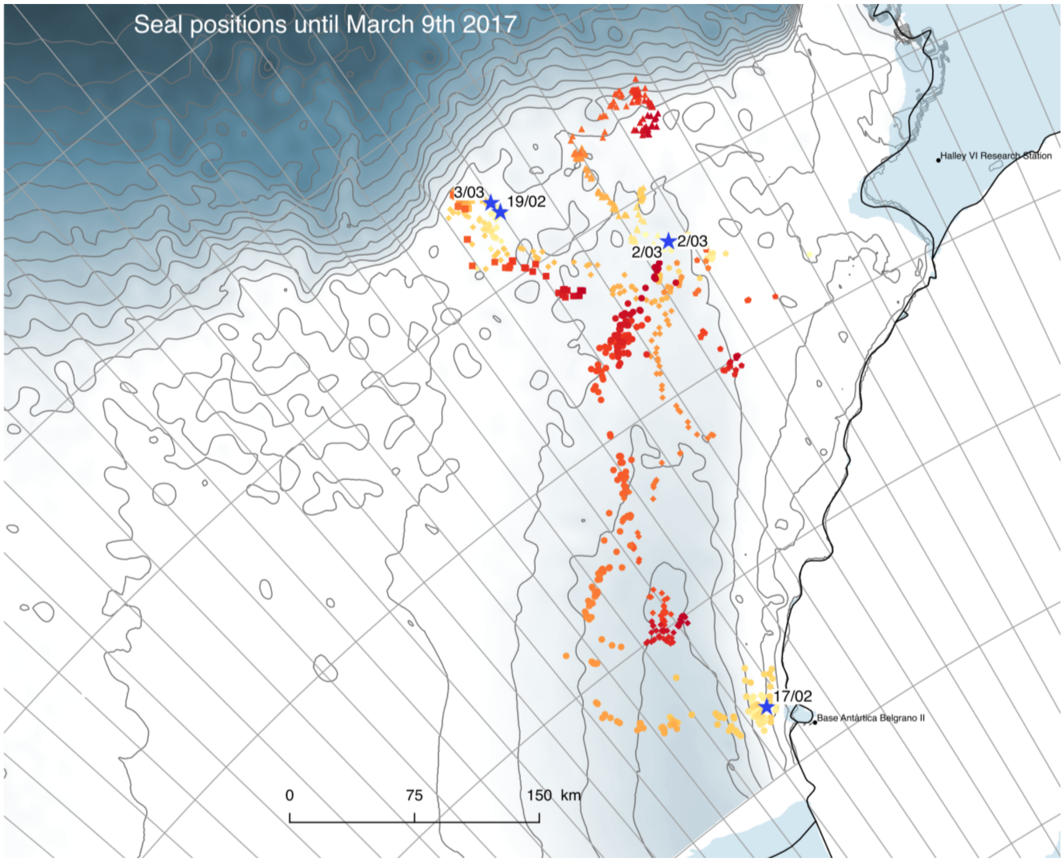


Figure 5.3. 42: Seal track positions. The colour represents the time since deployment from yellow to red.

Initial CTD profiles recorded by the four tags until March 11th 2017 are presented in Figure 5.3. 43 to Figure 5.3. 50.

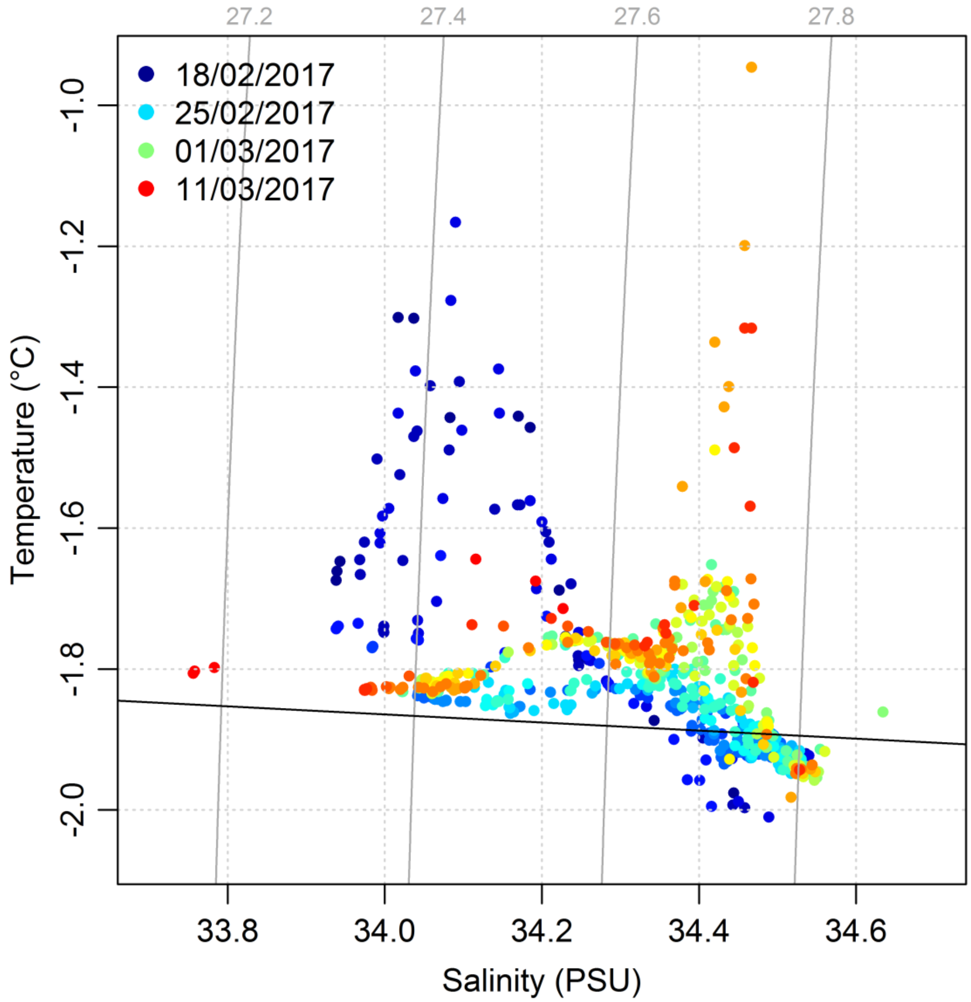
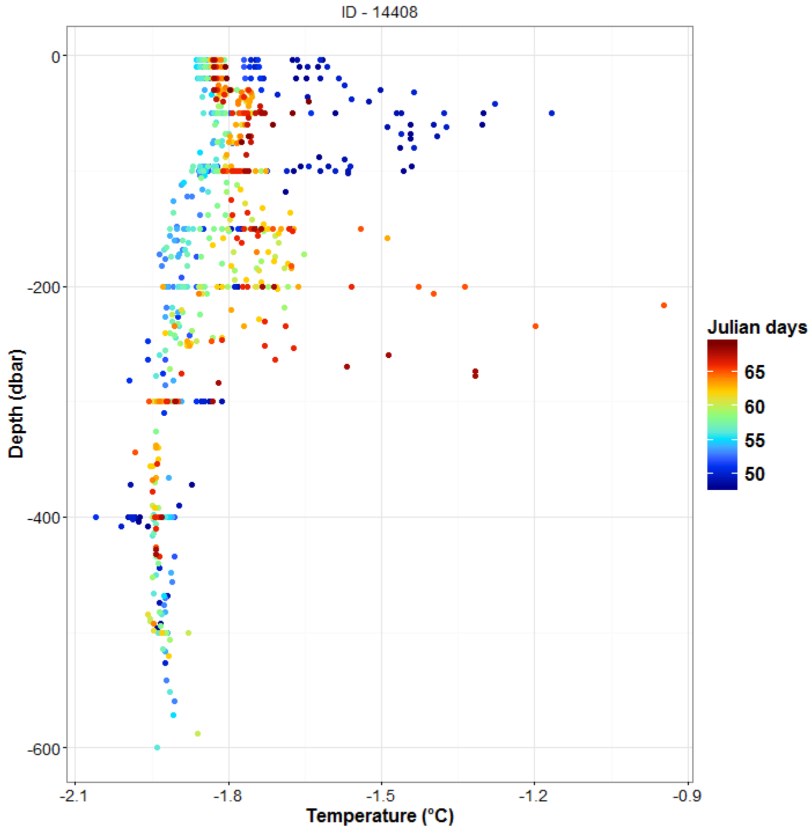


Figure 5.3. 43: TS diagram for tag body 14408.



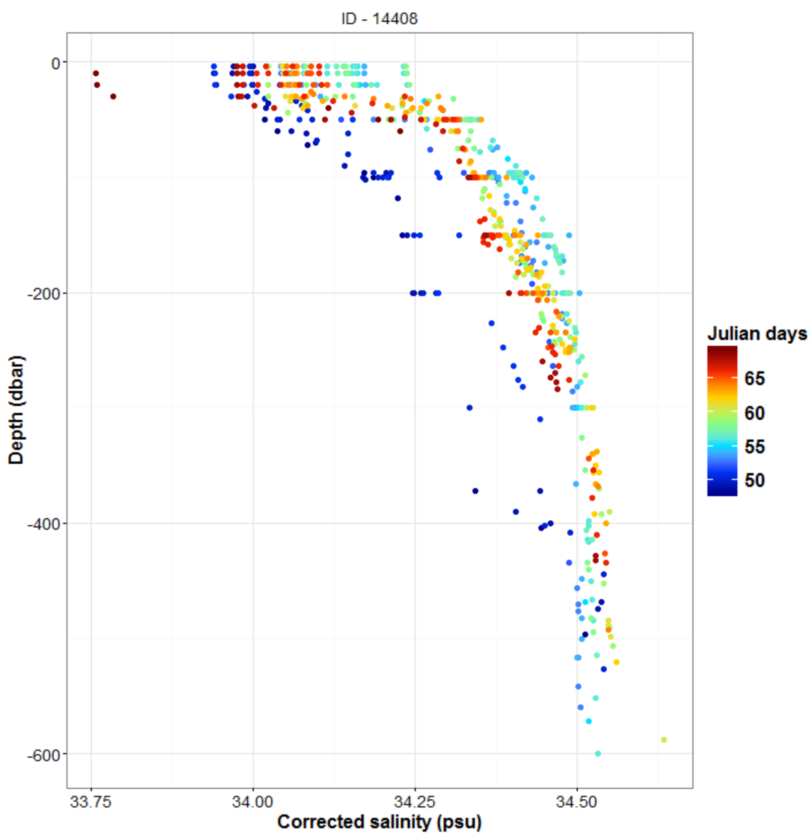


Figure 5.3. 44: Temperature and salinity profiles for tag body 14408.

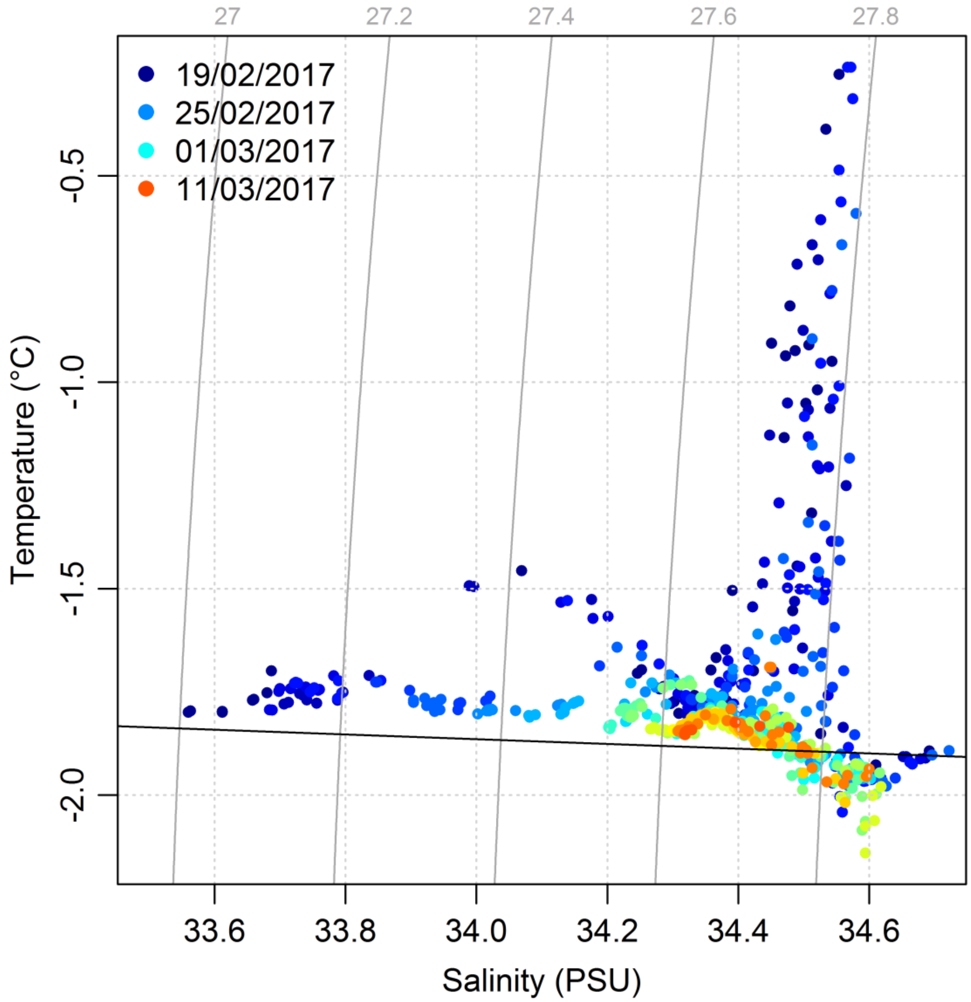


Figure 5.3. 45: TS diagram for tag body 14414.

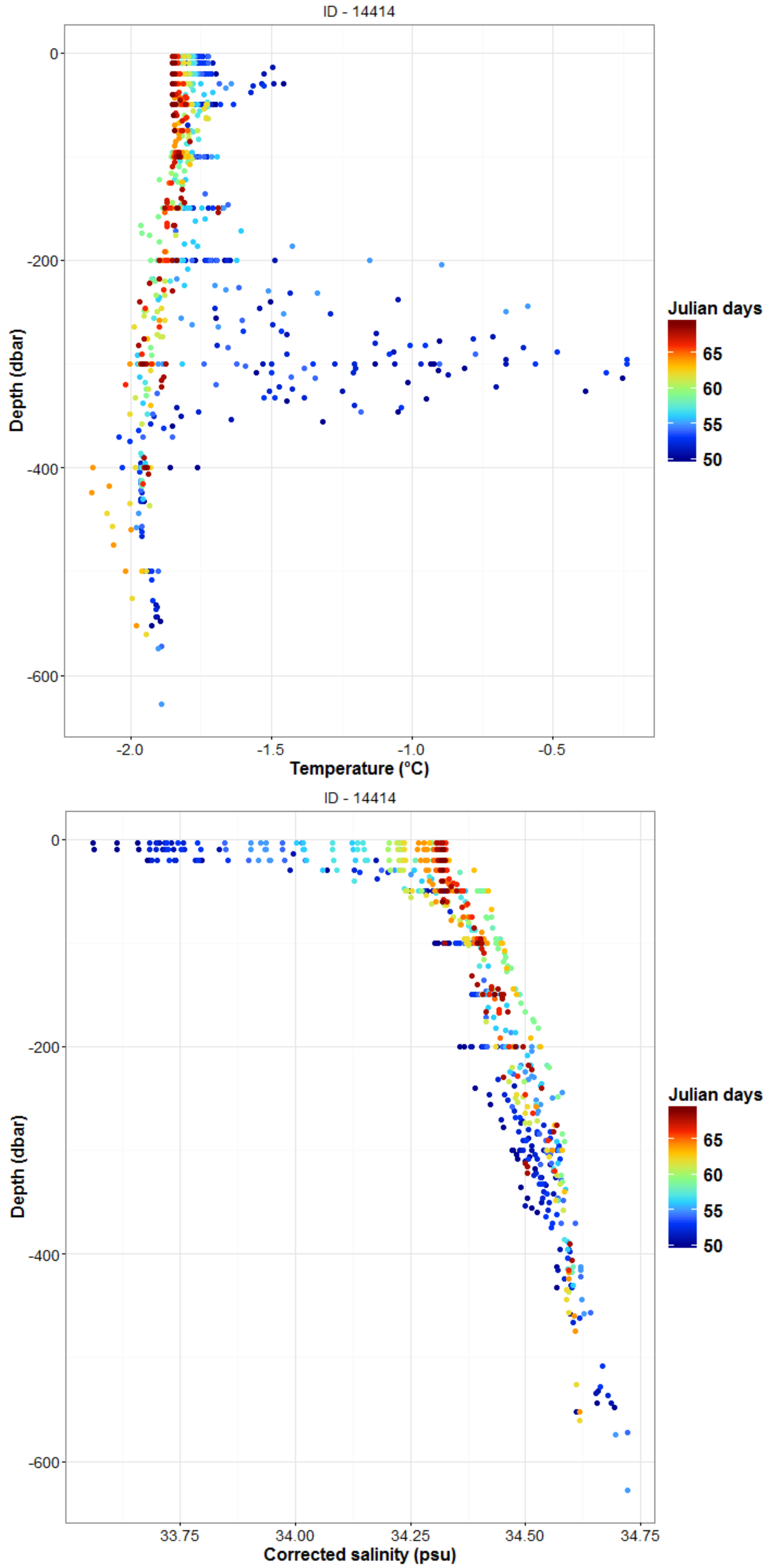


Figure 5.3. 46: Temperature and salinity profiles for tag body 14414.

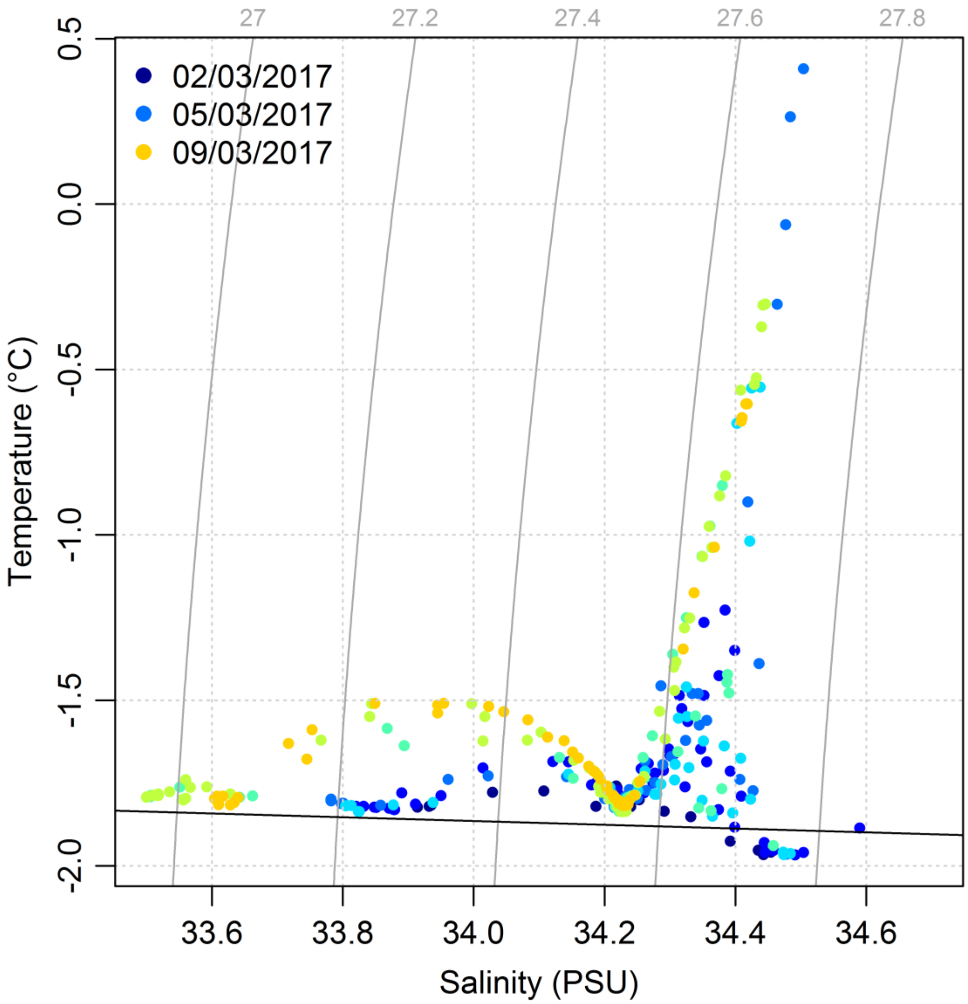


Figure 5.3. 47: TS diagram for tag body 14412.

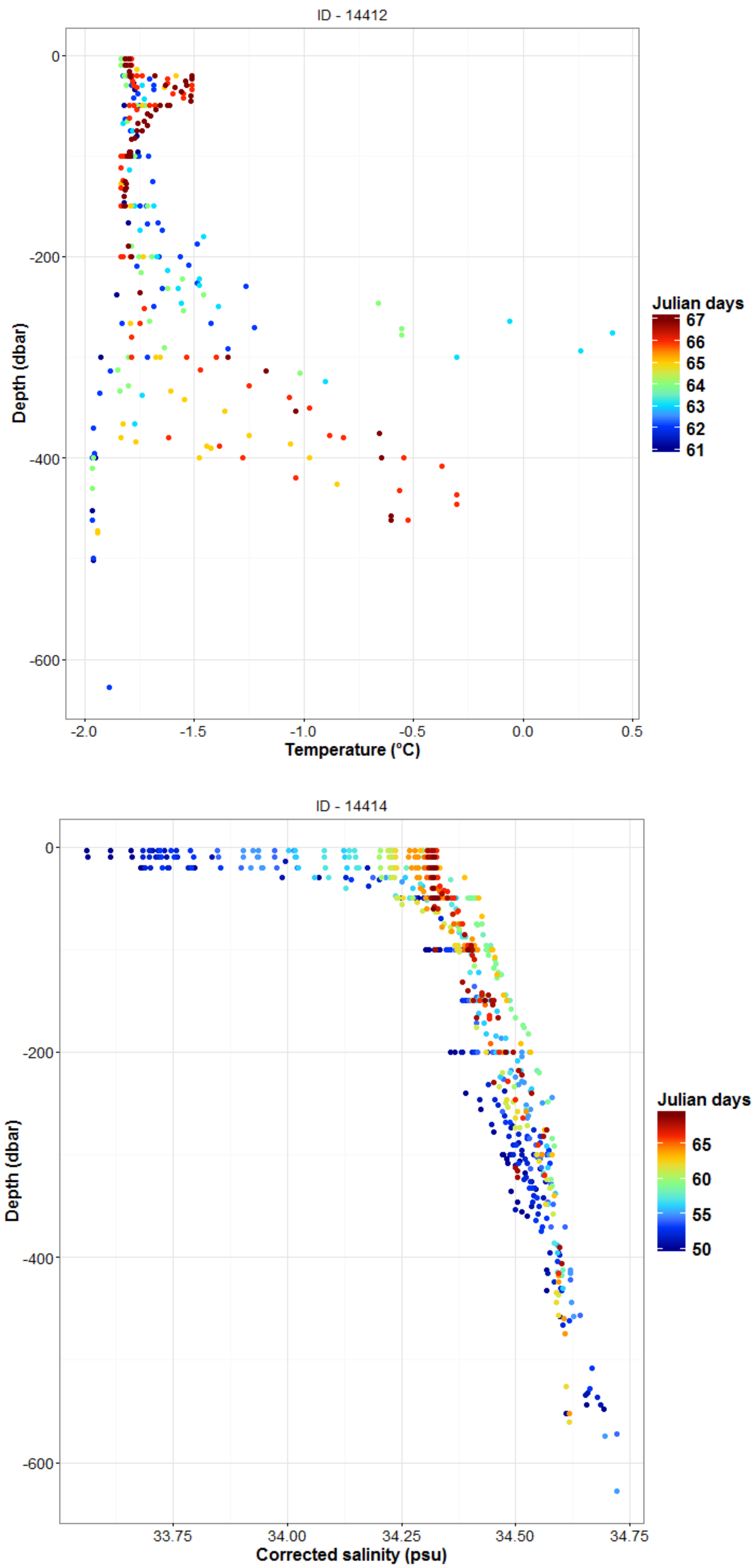


Figure 5.3. 48: Temperature and salinity profiles for tag body 14412.

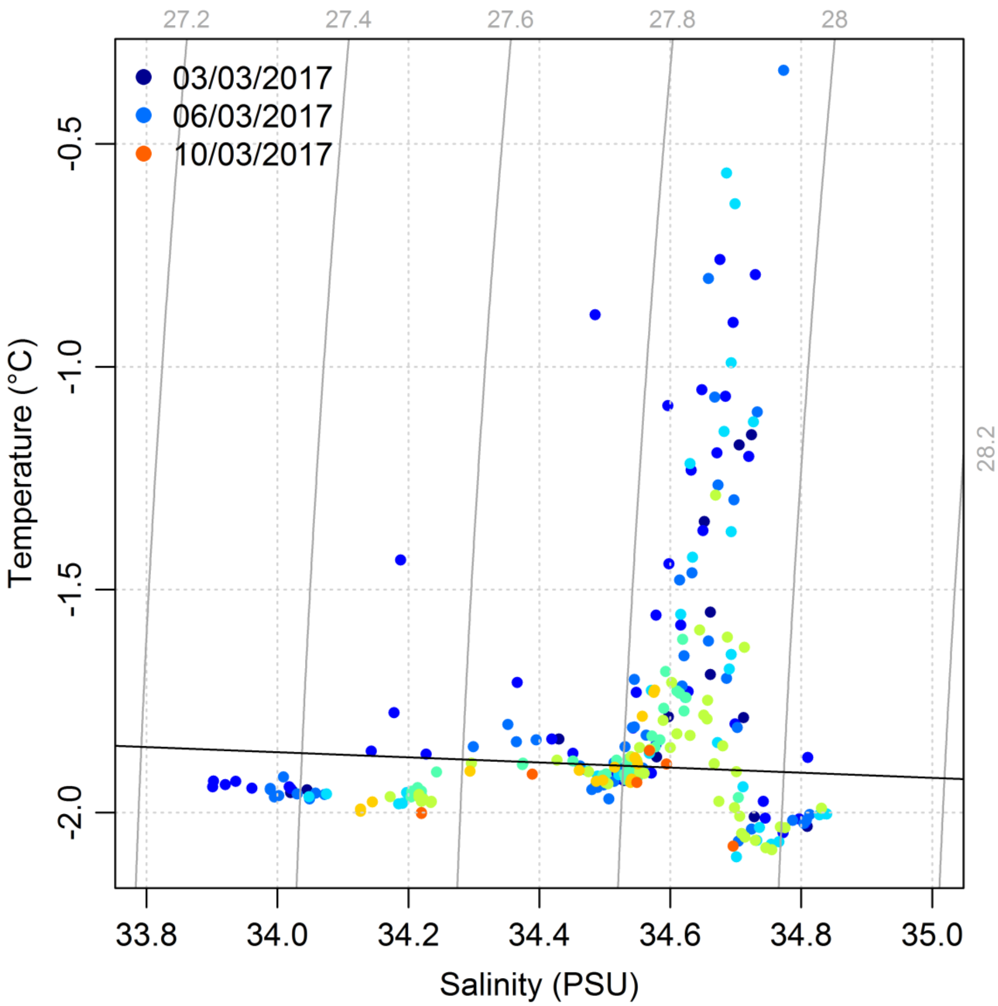


Figure 5.3. 49: TS diagram for tag body 12246.

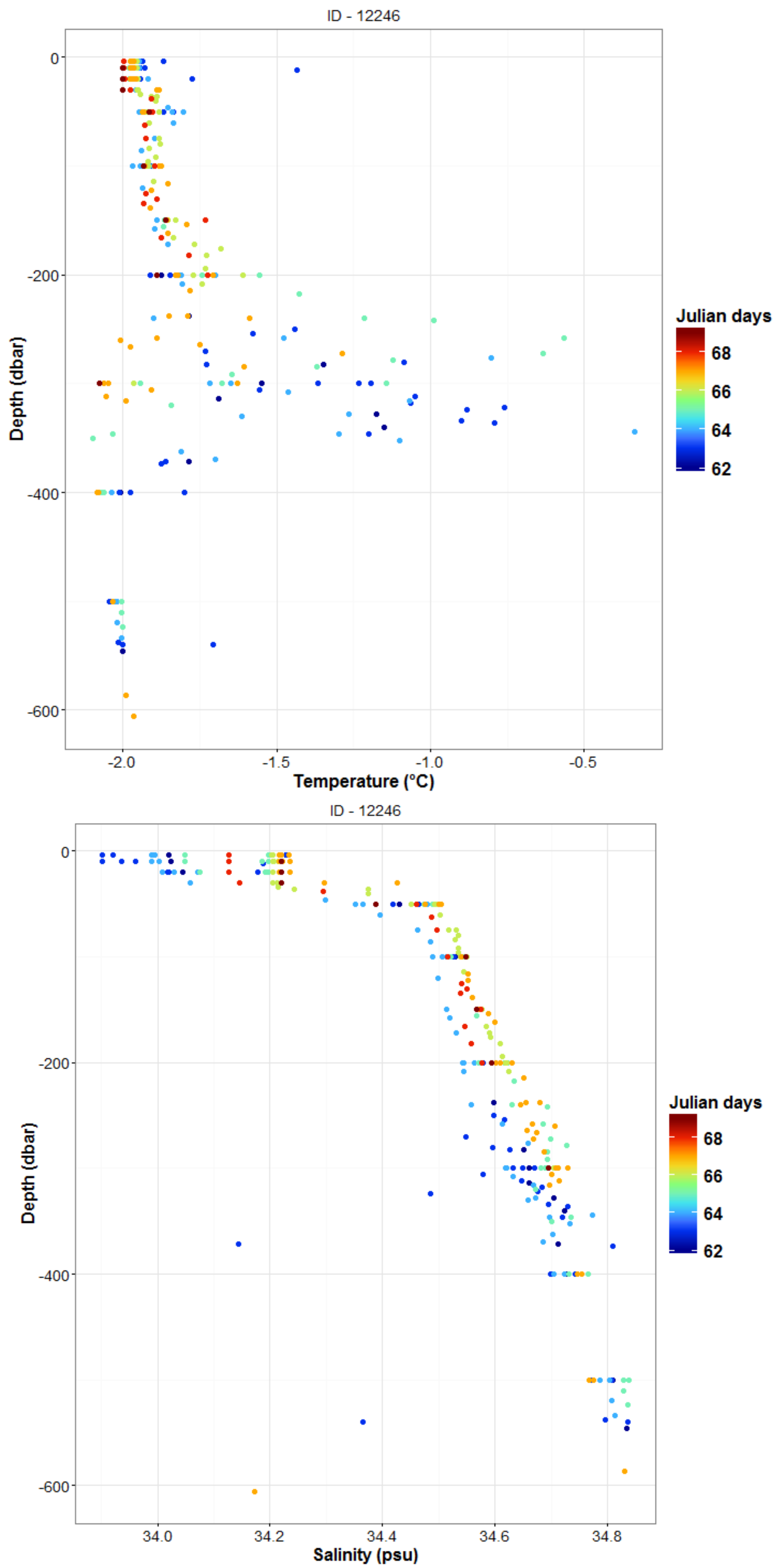


Figure 5.3. 50: Temperature and salinity profiles for tag body 12246.

Part VI: Cruise Services

6.1. Technicians Report

Name of AME engineer: Carson McAffee

LAB Instruments

Instrument	**S/N Used**	**Comments**
AutoSal	68533	Minor Issues. Needs Spares.
Scintillation counter	N	
Magnetometer STCM1	N	
XBT	N	

ACOUSTIC

Instrument	**S/N Used**	**Comments**
ADCP	Y	
PES	N	
EM120	Y	EM122
TOPAS	N	
EK60	N	
EK80	N	
Ksync	Y	
USBL	N	
10kHz IOS pinger	N	
Benthos 12kHz pinger S/N 1316 + bracket	N	
Benthos 12kHz pinger S/N 1317 + bracket	N	
MORS 10kHz transponder	N	

OCEANLOGGER

Instrument	S/N Used	Comments
Barometer1(UIC)	Y	
Barometer1(UIC)	Y	
Foremast Sensors		
Air humidity & temp1	6138 / 6609	
Air humidity & temp2	6137 / 6752	
TIR1 sensor (pyranometer)	161952	Not Working
TIR2 sensor (pyranometer)	161953	
PAR1 sensor	150813	Different values to PAR2
PAR2 sensor	150814	Different values to PAR1
prep lab		
Thermosalinograph SBE45	4524698-0018	
Transmissometer	527DR	
Fluorometer	6456RTX	
Flow meter	811950	
Seawater temp 1 SBE38	0767	
Seawater temp 2 SBE38	0771	

CTD (all kept in cage/ sci hold when not in use)

Instrument	S/N Used	Comments
Deck unit 1 SBE11plus	0458	
Underwater unit SBE9plus	0771	
Temp1 sensor SBE3plus	5623	
Temp2 sensor SBE3plus	4874	
Cond1 sensor SBE 4C	4090	Replaced During Trip. Damaged Unit: 3491
Cond2 sensor SBE 4C	1912	
Pump1 SBE5T	7966	Replaced During Trip. Damaged Unit: 2395
Pump2 SBE5T	1807	
Standards Thermometer SBE35	0051	
Transmissometer C-Star	CST-1505DR	
Oxygen sensor SBE43	0242	Alternated with 0620. See CTD Section.
PAR sensor	70636	
Fluorometer CTG	12-8513-003	

Altimeter PA200	26993	
LADCP	Master: 14443 Slave: 14897	
CTD swivel linkage	1961018	
Pylon SBE32	1106	
Notes on any other part of CTD e.g. faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc		No major incidents. Standard issues with instruments. Occasional cases of freezing. Strange bottle firing issue, which has not happened again.

AME UNSUPPORTED INSTRUMENTS BUT LOGGED

Instrument	**Working ?**	**Comments**
EA600	Y	
Anemometer	Y	
Gyro	Unsure	
DopplerLog	Unsure	
EMLog	Unsure	

End of Cruise Procedure

At the end of the cruise, please ensure that:

- the XBT is left in a suitable state (store in cage if not to be used for a while – do not leave on deck or in UIC as it will get kicked around). Remove all deck cables at end of cruise prior to refit.
- the salinity sample bottles have been washed out and left with deionised water in – please check this otherwise the bottles will build up crud and have to be replaced.
- the CTD is left in a suitable state (washed (including all peripherals), triton + deionised water washed through TC duct, empty syringes put on T duct inlets to keep dust out and stored appropriately). Be careful about freezing before next use – this will damage the C sensors (run through with used standard seawater to reduce the chance of freezing before the next use). Remove all the connector locking sleeves and wash with fresh water. Blank off all unconnected connectors. See the CTD wisdom file for more information. If the CTD is not going to be used for a few weeks, at the end of your cruise please clean all connectors and attach dummy plugs or fit the connectors back after cleaning if they are not corroded.
- the CTD winch slip rings are cleaned if the CTD has been used – this prevents failure through accumulated dirt.
- all manuals have been returned to the designated drawers and cupboards.

- you clean all the fans listed below every cruise or every month, whichever is the longer.

Please clean the intake fans on the following machines:

Instrument	Cleaned?
Oceanlogger	Y
EM120, TOPAS, NEPTUNE UPSs	Y
Seatex Seapath	Y
EM120 Tween Deck	Y
TOPAS Tween Deck	Y

Additional notes and recommendations for change / future work

CTD

There were 175 casts during the cruise. Most casts were a success, however there were a number of incidents and problems during the cruise. There were no major incidents that would impact on the success of this cruise (or the next), but these incidents will still be discussed for the benefit of future cruise support.

Overall Summary:
The following list summarizes the mechanical and technical issues experienced during the casts. These will aid in the sections to follow.

- **001**: Issues with the CTD wire drum/spooling Mechanism.
- **002**: Maintenance Cast to check CTD wire spooling (correct poor spooling from last cast.). Intermittent speeds on downcast. 15 m/min at 350 m. 60 m/min at 390 m. Multiple periods of long stops on downcast.
- **005**: Upcast was slow at 1100 m, 735 m, 340-300 m. Still having issues with the spooling mechanism.
- **006**: Downcast slowed at 300 m to 15 m/min. On upcast winch was stopped at 2051 m in order to inspect the wire drum. Upcast then slowed at 1880 m (5 m/min), 1140 m (10 m/min) and 350 m (10 m/min). Still issues with spooling.
- **007**: During upcast CTD was stopped at 1906 m, and then ran slowly at 5 m/min from 16:00-16:07, then returned to normal speed. At 1129 the CTD was stopped again to check the wire and spooling, then ran slow at 5 m/min from 16:22-16:27.
- **008**: Still having issues with the CTD spooling mechanism. CTD was slowed during the upcast during multiple periods. 3330-3300 m, 2673-2580 m, 1918-1835 m and 1190-1000m.

- **009**: CTD had to slow during the downcast: 190-300 m at 10 m/min, and 1100-1200 m at 10 m/min. Still drum and spooling issues.
- **010**: Another slow downcast due to nest of cable on the drum. 0-120 m at 20-30 m/min, 280-340 m at 40 m/min, 340-460 m at 30 m/min, 460-500 m at 45 m/min, 500-1030 m at 60 m/min, 1030-1200 m at 45-30 m/min, 1200-1240 m at 45 m/min, 1240-2580 m at 60 m/min, 2580-2670 m at 45 m/min and from 2670 m at 60 m/min. On the upcast the CTD stopped at 2664 m from 15:40-15:50.
- **011**: CTD slowed to 30 m/min at 2620 m during the downcast.
- **012**: CTD slowed to 5 m/min from 3350-3250 m during the upcast.
- **013**: No problems with wire/drum/spooling. Once surfaced Niskin 2 came loose from the CTD frame. Niskin spring arm head came loose. No titanium skrew. Replaced with an A2 SS bold from AME stock. Sample is uncompromised.
- **014**: The time on the CTD PC was wrong during this cast. Approximately 5 minutes off. This was traced to the K9 time server client being closed on the PC before cast (accidentally by scientists). Not a major issue, and was corrected after cast. During the cast the CTD was stopped at 3330 m to check winch downstairs.
- **016**: CTD started slow from surface to 110 m. Then on the upcast the CTD was stopped at 48 m (16:54) to check the winch.
- **017**: The seal tags/CTDs are placed on this cast, and the CTD stopped at 300m. Niskin was fired at this depth too, so it should not appear different in the data files.
- **027**: CTD slowed during the upcast between 4658-4400 m, and 4000-3970 m. These are regions where the CTD wire approaches the edge of the drum (downstairs).
- **028**: CTD was slow during the upcast from 4746-4600 m, and 4010-3960 m.
- **030**: CTD had a long wait at the bottom (10 m off bottom) while crew checked winch. Standard checks, no problem. CTD was slow on the upcast at 4760 m at 15 m/min, and between 4010-3950 m.
- **049**: CTD slowed to 5 m/min at 50 m before bottom, and then sped up agaon before reaching bottom.
- **066**: T+C inlet ducts froze before entering water, and had to be recovered and defrosted. CTD then proceeded as normal, except for a long LADCP stop (50 m off bottom), which became a long stop due to winch checks. After retrieval the CTD inlet tubes had frozen again during the short period in the air (-11°c outside).
- **072**: There were two attempts at this cast. The first failed due to a bad freezing incident. Suspect that the sensors were not drained before the cast, and therefore froze before entering the water. Possible damage on the Conductivity and Dissolved Oxygen sensors. After recovery the instruments were defrosted slowly with cool water, and then drained. After redeployment the difference between conductivity sensors was higher, and the dissolved oxygen values looked bad.

- **073**: After reviewing data. The scientists suspect an issue with Pump 1. Therefore pump 1 was removed and tuned to 3000 RPM. The pumps were then swapped (Pump 1 on line 2, and Pump 2 on line 1) for cast 073.
- **074**: The previous cast showed a possible problem with Pump 1. Therefore Pump 2 was reinstalled on line 2, and a new pump was installed on line 1.
- **096**: CTD slowed during downcast from 390-430 m. During upcast the CTD stopped at 280 m for 5 min due ice near cable. For the remainder of the upcast the speed was 30 m/min.
- **104**: During upcast the CTD had to stop at 250 m and 150 m due to ice near the cable.
- **110**: New Conductivity sensor (C1) installed for this cast. Interestingly, freezing occurred after entering the water. Both sensor sets were dry before entering water, but pumps did not start and suspected reason is icing. CTD was recovered, thawed, and redeployed.
- **112**: Icing occurred after entering the water again, but this time the ice was thawed by lowering CTD to 17.5 m, and waiting for ice to melt.
- **114**: This cast took two attempts. The first was cancelled due to no accurate depth reading.
- **118**: No EA600 depth reading, and SADCP is noisy. Suspect ice is covering hull transducers. May have effect on CTD after entering?
- **124**: Reinstalled the original DO sensor used in casts 001-093 (SN:0242).
- **137**: Niskin 1 is newly installed for this cast. The original one is missing its nozzle pin.
- **140**: Values from T2 and C2 are not good. Suspect that the pumps did not run, however found after wards that pump tube was bent and frozen. This tube was replaced for the next cast.
- **145**: Freezing issue again on line 2. CTD was recovered, thawed, drained/dryed and redeployed.
- **146**: It was noted that the Pressure Sensor took a while to respond to depth changes. I suspect freezing as the issue.
- **153**: Noted that pin on bottle 2 is bent. It was straightened after cast.
- **158**: There was an issue sending the firing command to the SBE32. It did not respond initially, and took multiple clicks for the system to respond to the fire command.
- **159**: Definite issue with the bottle fire element of the CTD. Seasoft would not respond to fire commands, and worked intermittently. No confidence in the niskin fired during this cast. The problem was traced to the sea cable termination (insulation resistance was 600 kOhm). The cable was reterminated on the pigtail, therefore no cable needed to be chopped, and the mechanical fixings were left alone.
- **161**: C1 took a long time to respond, and suspect freezing in the pump/instruments. Problem rectified itself during the 10 m soak.
- **162**: Freezing issue after entering water. CTD had to be recovered, thawed, dryed and redeployed.
- **166**: Problems with the niskin firing again. 10 firing commands were sent, and received on the Plus9/SBE35, however only 3,8 and 10 fired. After cast the termination was chacked as well as

the Plus9->SBE32+SBE35 cable. No problems found. No communication issues found. Therefore no action was taken. Possible that this is a mechanical issue with the firing mechanism, however this is very unlikely.

- **167**: All bottles fired on cast. No issues.
- **168**: C1 did not settle at soak depth. Suspect freezing in pipes. CTD was recovered, thawed, dryed and redeployed. The aborted cast was saved in its own directory. All bottles fired on cast. No issues.
- **169**: All bottles fired on cast. No issues.
- **173**: CTD slow from surface to 100m due to ice near wire.
- **174**: Bottle 14 was fired during recovery. Possibly in air. No apparent damage.

Winch and Spooling Issue:
At the beginning of the cruise there was an issue with the winch/spooling mechanism. This occurred when the CTD wire was spooled back on to the drum, and the wire would skip a turn and cause a mess in higher layers. This problem could only be rectified by lowering the CTD to a deeper depth than before and manually monitoring/managing the spooling at the drum. This is why there were a number of casts with a slow upcast speed. Once re-spooled the problem would not occur again until the CTD went to a deeper depth. After going to the deepest depth on this cruise the CTD spooling stopped causing issues, and casts resumed a normal operation.

Every effort was made to maintain a constant downcast speed during the cruise (due to seasoft/seabird standard operational requirements), however certain casts, as listed above, did have a variable speed due to mechanical constraints on the winch/drum, as well ice on the surface.

Ice in instruments:
This cruise spent a large portion of time far south in the ice, with extremely cold external temperatures. These temperatures were low enough to cause water to freeze within minutes of being outside. To counter these freezing effects on the CTD instruments (primarily on the Temperature, Conductivity and Oxygen sensors) a number of methods were attempted.

The first method was to keep the T+C lines filled with milliQ between casts, and then drain before deployment. However it has been brought to my attention that milliQ is not good for the DO membrane (as it is deionised). Therefore it was recommended to either use standard tap water (for long periods), or sea water (short periods). Unfortunately during these freezing events there was no sea water source available, so tap water was used. The problem with this method is that when removing the T+C duct caps before a cast the fresh water would not drain fully, and could potentially freeze in the outside air before entering the water. This is a realistic assumption due to the fact that fresh water will freeze faster than sea water. Therefore a different approach was taken. The CTD operator teams were instructed to flush and fully drain the T+C lines after each cast. The theory here being that there would be no liquid available in the lines to freeze while the CTD was exposed to the outside air.

To aid this the deck crews had been briefed to minimise the time where the CTD would be exposed to the outside air. Therefore the CTD doors were only opened when everything else was ready, and the CTD was not kept on deck for extended periods. The same is true for the recovery.

This method worked fine for most of the casts, however icing still occurred on a few. The current working theory is that the instruments themselves (especially the conductivity cells with their cell thermal mass) would hold their temperature after entering the water. At times the CTD bottle annex, even with the doors closed and heaters running, would sit at below 10°c. After leaving the bottle annex before deployment, even for a short period, it is possible for the instruments themselves to drop to a temperature below 0°c. After entering the water (-2°c) and dropping to 10 m, the thermal mass of the cell would maintain a below freezing value, and would freeze the sea water after it floods the cells. At this point the lines would be frozen, and pumps would either not start, or would start and be unable to create a flow. This would explain the effects seen during the failed casts: Pumps not starting, or Pumps starting, but T and C values would not stabilise.

One possible solution would be to keep this above method but keep the Bottle Annex at a higher temperature (21°c). This would keep the cell thermal mass at a high enough value that would not drop far enough once exposed to the outside temperatures. By doing this freezing should not occur after entering the water. During this cruise the CTD bottle annex had two free standing heaters brought in to help warm the room (and the scientists). The 2nd Engineer also investigated the heating system in the room and found that the annex has a 4 kw heater available, however the supply vent to the room is too small. He has proposed expanding the vent in the room to improve the flow of warm air from the heater. The 2nd Engineer has detailed these plans in his notes and refit recommendations.

Icing summary:

- **066 13/02/2017 22:57**: T+C inlet ducts froze before entering water, and had to be recovered and defrosted. No problems during cast. After retrieval the CTD inlet tubes had frozen again during the short period in the air (-11°c outside). Subsequent casts show no problems with the instruments. After this cast the plan was made to dry instrument lines after casts.
- **072 14/02/2017 17:29**: The first cast failed due to freezing. CTD operators had not been briefed to dry instruments. Suspect that the sensors were not drained before the cast, and therefore froze before entering the water. Possible damage on the Conductivity and Dissolved Oxygen sensors. After recovery the instruments were defrosted slowly with cool water, and then drained. After redeployment the difference between conductivity sensors was higher, and the dissolved oxygen values looked bad. These sensors were cleaned with triton and their performance improved.
- **110 21/02/2017 21:07**: Freezing occurred after entering the water. Both sensor sets were dry before entering water, but pumps did not start and suspected reason is icing. CTD was recovered, thawed, and redeployed.
- **112 22/02/2017 06:53**: Icing occurred after entering the water again, but this time the ice was thawed by lowering CTD to 17.5 m, and waiting for ice to melt.
- **140 25/02/2017 23:11**: Values from T2 and C2 are not good. Suspect that the pumps did not run, however found after wards that pump tube was bent and frozen. This tube was replaced for the next cast.

- **145 26/02/2017 08:44**: Freezing issue again on line 2. CTD was recovered, thawed, drained/dryed and redeployed.
- **161 27/02/2017 20:05**: C1 took a long time to respond, and suspect freezing in the pump/instruments. Problem rectified itself during the 10 m soak.
- **162 27/02/2017 21:54**: Freezing issue after entering water. CTD had to be recovered, thawed, dryed and redeployed.

Instrument Changes:
The CTD instruments and their serial numbers are recorded at the beginning of this document. This section details the changes made during the cruise:

Conductivity Cell 1:
SN: 3491. Casts 001 – 109. 25/01/2017 – 21/02/2017.
SN: 4090. Casts 110 – 175. 21/02/2017 – End of cruise.

SBE43 Oxygen Sensor:
SN: 0242. Casts 001 – 093. 25/01/2017 – 18/02/2017.
SN: 0620. Casts 094 – 123. 18/02/2017 – 23/02/2017.
SN: 0242. Casts 124 – 175. 23/02/2017 – End of cruise.
SBE43 Oxygen Sensor (unpumped experimental setup on frame):
SN: 0242. Casts 094 – 123. 18/02/2017 – 23/02/2017.

SBE5T Pump 1:
SN: 2395. Casts 001 – 072. 25/01/2017 – 15/02/2017.
SN: 1807. Cast 073. 15/02/2017.
SN: 7966. Casts 074 – 175. 16/02/2017 – End of cruise.

SBE5T Pump 2:
SN: 1807. Casts 001 – 072. 25/01/2017 – 15/02/2017.
SN: 2395. Cast 073. 15/02/2017.
SN: 1807: Casts 074 – 175. 16/02/2017 – End of cruise

Replaced Lanyards:
After cast 172 all the bottle lanyards were replaced. The old ones were starting to wear on the CTD frame, and some lanyards were too tight. The overly tight lanyards may be causing extra stress on the bottle seals during the cocking stage, and is suspected of causing damage.

As a note, here are the dimensions used:

- Top and bottom loops on the lids are 20 cm lengths, with negligible excess after feeding in to the copper sleeves.
- The top attachment length is measured to 55 cm length. Afterwards two loops are made in either end. The loop attaching to the SBE32 pin has a folded length of 10 cm, and the attachment loop has a folded length of 6 cm. I also placed a ball/float on this line.

- The middle lanyard is cut to 120 cm length. The one loop is attached to the 6 cm loop mentioned above (minimal fold length). The bottom loop is adjusted on a cocked bottle to suit.

Bottle attachment:
After cast 72 a scientist noted that bottle 10 had come loose from the frame. After inspection I found that the white plastic spring mechanism that holds the bottle on to the frame had worked its way loose. This white plastic mechanism is attached to a metal bracket by titanium screws. This bracket is then attached to the bottle by jubilee clips.

I later checked all the bottles and found that most of them either had damaged screws, or that the screws had come loose. This is shown in Figures 1 and 2

Figure 1 Damaged Screw

Figure 2 Loose Screw

I have tightened all the loose screws and replaced damaged/missing screws where possible. I need to order spares for these.

This problem is not obvious during use, but has the potential to be quite bad. The rope used to attach the bottles to the frame is tied around the white spring mechanism, and therefore had this problem not been pointed out the bottle could have fallen off during a cast. I would recommend checking this at least every 3 months.

A recommendation has also been made to use a ratchet strap around the front of the bottles (through the handles), rather than a rope through the back as described above. This would provide additional safety from the above mentioned issue, and would also be more convenient (untying the knot behind the bottles can be tedious). A possible downside is that the ratchet could rust, and cause problems.

Bottle Fire Issue:
On cast 158 the operators reported an issue with firing the bottles. They had to click multiple times before the software acknowledged the fire command. The SBE35 file had additional entries, but the data files (seasoft hex files) all appeared fine. This was not reported to me until after the next cast.

On cast 159 the bottle firing issue was worse. The software would not acknowledge the fire command, and trying different bottles showed intermittent success. The problem had definitely got worse after the previous cast. It is important to note that at the beginning of the cast there was a short period where the recorded data was impossibly wrong. This could potentially mean that there was an issue with the sea cable termination, however the rest of the cast data was fine, and there was no error reported by the deck unit.

After the cast I ran tests on the SBE35 and found that there was a poor data connection to the instrument (poor data transmission resulting in incorrect characters). My initial assumption was that this could either be caused by a sea cable termination issue, or the cable connecting the Plus9 and the SBE35. The cable connecting the Plus9 and the SBE35 also has a branch that connects to the SBE32. The SBE35 line has full RS232 (RX and TX) to plus 9, and the line to the SBE32 only has the RX line attached. If this cable harness had damage then it could explain the poor communication with the SBE35 and the failed bottle fire commands.

I started by running an insulation test (mega ohm test) on the cable harness, but all lines showed an resistance greater than 4000 MΩ at 1000 V (except one line pair with 600 MΩ). I therefore ruled out the cable harness as an issue. However I found that there is no spare for this cable harness in our stores and have request a spare for future cruises.

This left the sea cable termination. Three days before this issue, while testing the drum slip rings with the Deck Engineer, I found that the insulation resistance of the termination was 600 kΩ. This is far lower than the recommended 1000 MΩ (250 V) recommended for the termination, however there had been no issues with the data or communications, or even errors on the deck unit. Therefore no action was taken. However after the above issue the termination seemed the most likely cause of the problem.

A re-termination was done on the excess pigtail, rather than chopping a length of the CTD cable (as it showed no damage). This would also avoid repeating a load test on the cable. With the old termination removed the cable showed open circuit insulation values, and the inner core of the remaining pigtail showed no oxidization damage. A new pigtail was used as the old one, even with the end trimmed off, showed a poor insulation value.

The re-termination was completed using a different coating technique. The standard technique is to use multiple layers of heat shrink, with Scotchkote in between the layers. This time the solder points were covered with a heat shrink section, and then the whole surrounding area was painted with Scotchkote. After drying, the whole area was wrapped tight with self-amalgamating tape, after which a layer of heatshrink was used. The theory, as suggested by a French scientist onboard, is that the self-amalgamating tape will compress with sea water pressure, and maintain a seal, whereas heat shrink will not.

Before the next cast the insulation resistance was measured at 4.8 MΩ, and after the cast it was measured at 5.8 MΩ. Neither of these values is near the suggested 1000 MΩ value, however it seems to be working.

The casts that followed had no issues until cast 166. On this cast the software aspect showed no problems, and received and logged 10 bottle fire commands. These were logged in the SBE35, showing that there were no issues with communication to the Plus9 or the SBE35. However after recovery only 3 (3,8,10) of the 10 bottles had fired correctly on the SBE32. There were no communications problems with the Plus9 or the SBE35, and therefore I ruled out the sea cable termination as a cause. I have limited the problem down to either being a mechanical issue with the SBE32 (highly unlikely to have 7 failures), or the branch feeding the SBE32 on the cable harness having a fault. I checked the SBE32 firing head and cleaned it. I then ran an insulation test on the cable harness and the sea cable termination. Neither had issue. I could not find any clear cause for this issue, and decided to watch it on the following casts until the problem became clearer.

Unfortunately the 9 cast that followed had no issues with the bottles. Without a clear cause for the problem on cast 166 I have decided not to change anything. This unfortunately means that there is a potential that the problem may occur on the next cruise.

Optical Instrument mountings:
The Transmissometer and Flourometer were reinstalled on the CDT frame so that the sea water flow could move directly past the lenses with minimal interference from the frame. The flourometer was placed below its standard location as seen in Figure 3.

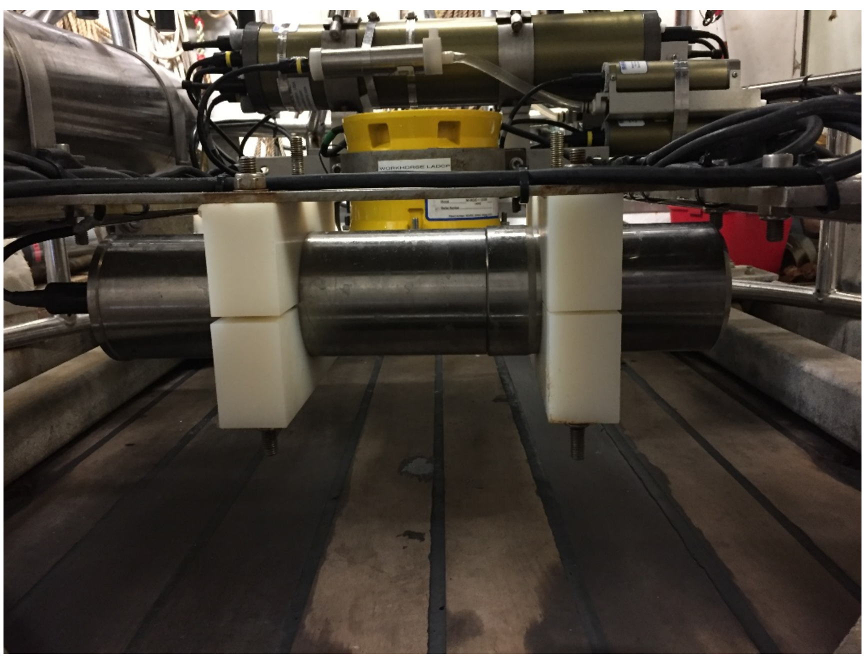


Figure 3 Lowered Flourometer

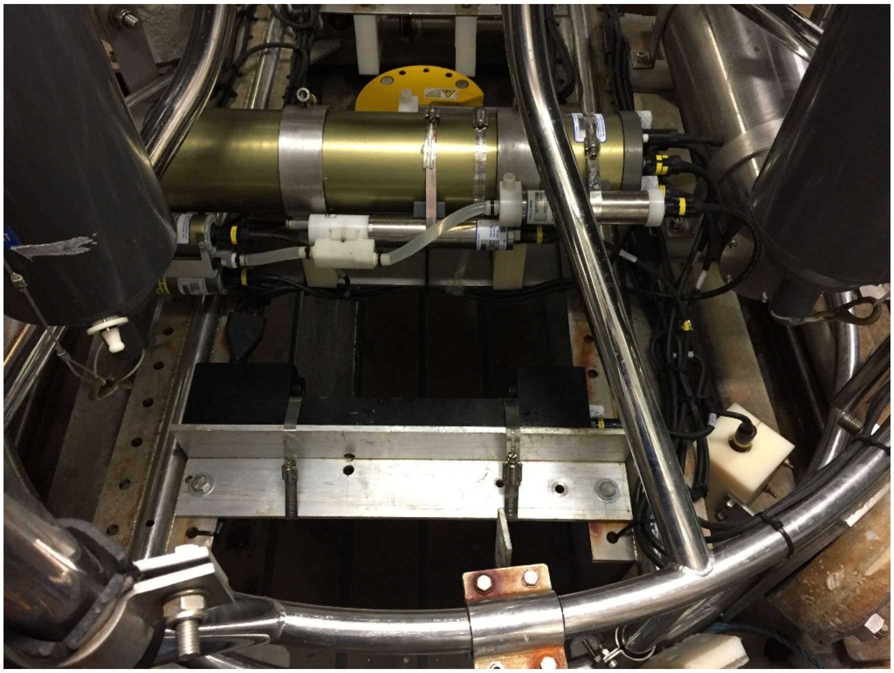


Figure 4 Transmissometer Mounting

The Transmissometer was mounted on a new bracket near the Plus9 unit. This is shown in Figure 4.

In the ideal situation the lenses on these instruments should be cleaned with milliQ and whipped dry before each cast. This was done at the start of the cruise, but was quickly abandoned by the CTD operator teams.

Recommendations:
After discussing the data with the scientists a recommendation has been made to replace Conductivity Sensor 1 (SN: 4090), as well as the SBE43 Oxygen Sensor (SN:0242) for the next cruise.

The PSO has requested whether it would be possible to get the seabird calibration values for C1 and C2 before and after their next calibration. They would like to use these to offset the values recorded during this cruise.

The scientists have also made a request for the bottle annex to be kept warmer, which has already been discussed.

Uncontaminated Sea Water Systems

It was noted by a scientist at the end of this cruise that the transmissometer in the sea water system (prep lab) was not giving good results. I suspect that the lense may be dirty, and will be clean before the next cruise.

UWIA

The UWIA system is not normally maintained by AME, but I have experience and an interest with the instrument. Additionally this cruise is part of a collaborative effort between BAS and an Isotope team from the scientific party. This section details the work done on the system, and the problems encountered.

Temperature Sensitivity:

This system is highly sensitive to temperature changes. The fridge at the bottom of the cabinet is kept at a constant 19°, which is important for the air moisture exchange in the membrane. If the fridge is opened, even briefly, the temperature will change and immediately affect the recorded data. This is the first point of temperature dependence.

The next aspect to consider is the ambient temperature of the room surrounding the sample pipes. The fridge takes in a dry air source, and a sea water feed. These are mixed, and the output is a waste sea water feed, and a sample feed of vaporised sea water used for measurements. The temperature of this air/vapour is 19° after leaving the fridge. If the outside temperature is lower than 19°, then the temperature difference causes the vapour to condense on the inner tube walls. This condensation initially lowers the humidity of the sample source, and later increases the humidity. The condensed droplets also affect the measured properties. Essentially if the outside temperature is lower than 19° then the system will not operate correctly. Unfortunately this is not always practical to achieve. During this cruise the ship was far south and struggling to maintain a constant inside temperature. Additionally the UWIA system is located in a passage work area which is used to access the CTD. Therefore there is a high traffic of scientists opening/closing the door, and lowering the room temperature. To help with this the scientists were asked to keep the door closed. I also reattached the door of the cabinet to help hold its heat inside.

I have also found that the inverse temperature problem may be happening. I found that after I achieved a higher room temperature, I started getting moisture/condensation forming on the air outlet pipe of the membrane. I suspect that this is caused by warm air (ambient temperature) passing through the membrane at 19° and then condensing on the output. This is just a theory. I have tried to compensate for this by cooling the air (through a coil in the fridge) before the input of the drierite canister. However this coil does not seem to have worked, as the moisture still continues to form on the membrane air output. This is a problem that still needs to be corrected. Although the moisture does not appear to affect the humidity of the sample, there is a possibility that the moisture is affecting the sample variables.

Water Samples:
Water samples were taken during the cruise for later lab testing, and system calibration. Figure 5 shows the locations of the samples. A log sheet containing the information of each sample is available on request.

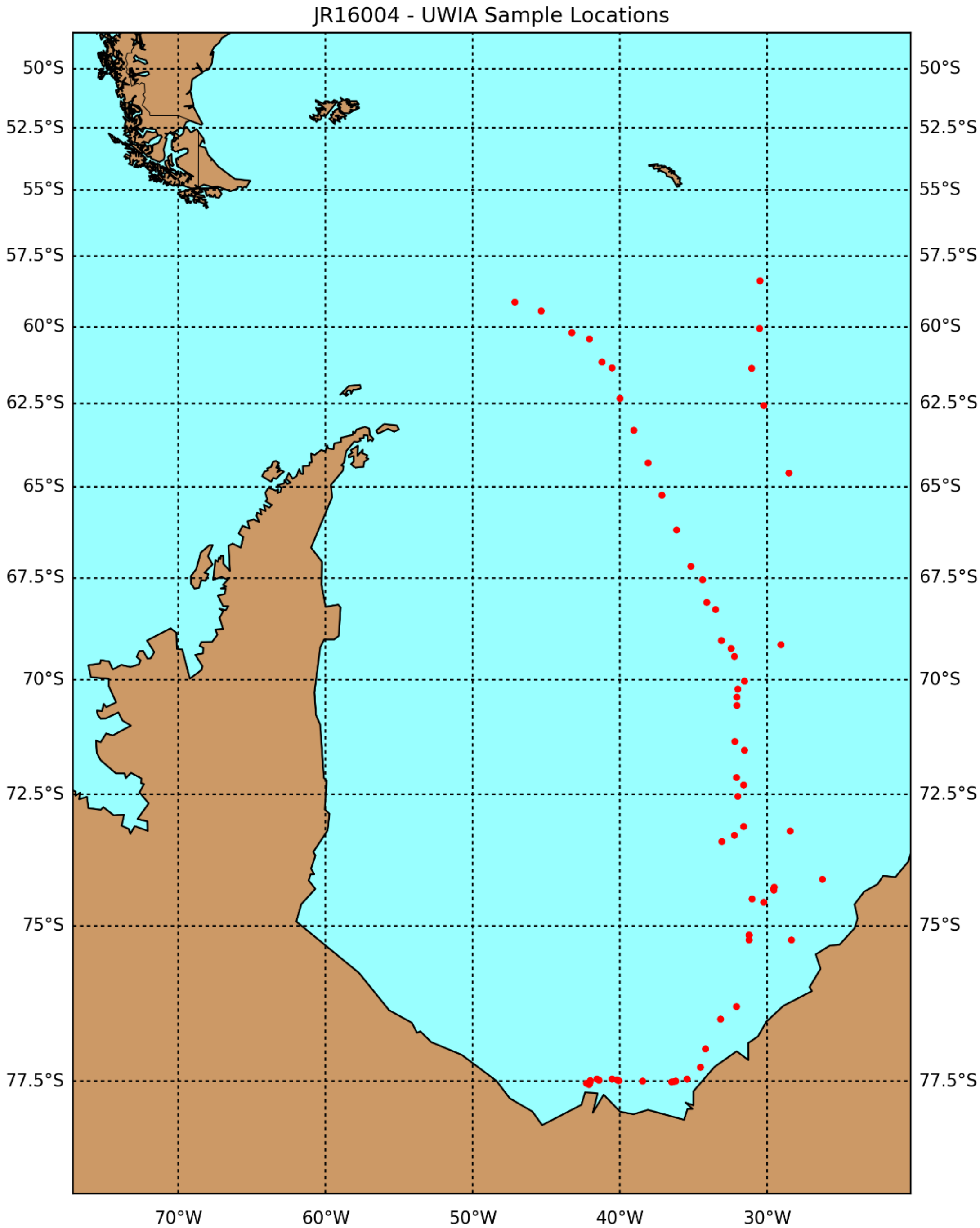


Figure 5 UWIA Water Sample Locations

System Work Log:

What follows is a daily log of work completed on the system. These logs also discuss problems found, as well as the conclusions and solutions arrived at during the cruise. This may be useful for future cruises. Note that all times are in UTC.

26/01/2017
12:26 – Started the UWIA, and changed the water filter.
20:00 – Opened fridge to inspect.

27/01/2017
At some time between 03:30 and 06:30 the pumps for the sea water stopped. Still water in the pipes, but would not have been a fresh stream. The H2O values start to fall at 06:30. There is also a weird blip in H2O at 07:33.
07:50 – Sea water started again.
17:53 I notice that the PC time is wrong. PC time is 18:58, Real time (ship time) is 14:55. I manually reset the time and created new files. (Note: I must have done something wrong here. Maybe a time zone issue. As noted later there was a problem with the recorded time.)

28/01/2017
System seems fine.

01/02/2017
At approximately 18:20 the system started acting up. This is seen in the H2O values. Strange.
20:24 – Switched to ambient air source (Direct ambient air input to sampler through a filter).
20:33 – I checked the membrane. There is moisture in the outlet air pipe. Just light droplets.
20:33 – Changed the Filter and the Peristaltic Pump Tube.
21:45 – Attached the drierite air source (This is the standard configuration except the membrane air flow section is bypassed). This should dry up the Moisture.
22:37 – Opened fridge to check membrane is fine. Still waiting on the delta18 values to settle with current drierite source.
22:52 – I have noticed that the drierite H2O value is higher than the Ambient air value. It is possible that the drierite is wet from the last equator crossing. I will change the drierite.
22:53 – Remove drierite canister.
23:10 – Refit the new drierite canister. I expect the H2O value to drop low.
23:30 – Values are looking better.

02/02/2017
12:04 – Something looks strange in plots. Will check soon.
18:13 – Values seem strange. I have changed to the drierite source.
19:19 – System does not seem to be stabilizing with drierite source. Switching to ambient air source.
21:09 – Still not stable on ambient source. Reconnecting the drierite source.
22:03 – H2O value not dropping. There is a problem. Will give it another hour.
23:10 – H2O still not down. Changing to ambient.

03/02/2017
00:45 – H2O value has finally dropped. Down to 7568 ppm on ambient air. Changing to drierite source.
02:19 – System seems to be behaving again. H2O value has settled on a drierite value of 2785 ppm. (Note: At the time this was the normal level, however I later found that this was still too high).
02:19 – Reconnected the membrane. System running normally again.
12:04 – Data looks weird again.

06/02/2017
System does not look rite. Data is bad. Cannot see the calibration periods.

08/02/2017
12:03 – System seems stable, but I still don't believe it. Also cannot see standard test.
15:00 – After reviewing the data files, I realise that the time is 1 hour off. Looking at the UWIA settings I see that the time zone is set to GMT-1. This explains the issue. I change the time zone to GMT+0.
14:59 – Changed the time zone.
15:02 – Reset the time to correct value. This creates a new set of data files in PC. This has shifted the PC time 1 hour back.
15:03 – I still don't trust the data. I am going to run tests on the ambient and drierite sources again.
15:04 – Attach the ambient air.
15:37 – H2O value is stable at 5324 ppm.
15:39 – Attach drierite source.
16:28 – H2O stable at 2103 ppm (Note: Again I assumed at the time that this was a good H2O value for drierite. I was wrong.)
16:30 – Reconnected the membrane. System running normally again.

11/02/2017
16:25 – Don't trust data values.
16:26 – Connect ambient air source.
16:52 – Ambient H2O value stable at 5551 ppm.
16:53 – Connect drierite source.
17:19 – Remove the drierite canister.
17:20 – Install drierite canister directly to sample input (through filter). There are no other pipes or systems in the air path.
17:33 – Drierite H2O value is at 362 ppm. This is more correct (as confirmed by the other isotope team on the scientific party). I therefore believe that there is moisture in my pipes. There is definitely a problem with the current plumbing.
18:07 – H2O value has dropped further to 269 ppm, and appears to be stabilizing.
18:14 – Connect drierite canister to input side of MFC, and output of MFC to input of sampler. This still has a minimal pipe configuration, with only the MFC in the sample system. End this step at 18:18. System now running on Drierite -> MFC -> Sample in.
I have got a lab air pump and am flowing air through the remaining air pipes in the fridge, and feeding system. I am trying to dry them out while I test the MFC.
I decide to replace the air inlet filter on the drierite. It may be damp from the equator crossing.
18:32 – H2O is at 550 ppm. Value is still dropping. I am fairly happy that the MFC and pipes are dry. However the value is still not as low as previous test, so I will wait a bit more.
18:50 – H2O value is at 488 ppm. Dropping slowly. Will connect the drierite directly to sample inlet again while I reconfigure the pipes.
18:52 – I have shortened the tube from the MFC to the sample input.
19:03 – H2O is at 295 ppm, as expected.
19:04 – Switching to ambient air while I move the drierite canister to new location. Originally the canister was installed behind the PC monitor, and fed the dry air down a long pipe to the fridge at the bottom. I have decided to move it down to the bottom of the cabinet close to the fridge, and reduce the length of the hoses.
19:09 – Drierite canister is now installed at the bottom. There is a higher risk of dust, but there is less pipe, and hopefully less issues.
19:11 – Reconnect the system in a standard drierite configuration (membrane bypassed). Drierite -> short pipes -> filter -> fridge -> bypass membrane -> short pipe -> MFC -> short pipe -> sample inlet.
19:23 – Taking a long time to drop. Will give it 30 min.
19:25 – System going in to a standard test. Will come back later.

20:04 – H_2O value is at 665 ppm. Still dropping. Good sign. Will leave for another hour.

12/02/2017
00:31 – System has been running on drierite configuration for a few hours now. Current H_2O value is 490 ppm. This is not quite the 260 ppm achieved from the direct drierite canister test. However these values are similar to the short MFC test I did at 18:50, which included the MFC and short pipes. Therefore I am assuming that the MFC has an effect on the humidity. Therefore I have decided that this is a good H_2O value for a drierite test in the future. Values higher than this will indicate moisture in the pipes.
00:33 – Fridge is back to 19°. I now reconnect the system as normal (reattach the membrane).
00:40 – The water outlet flow by the sink seems a bit low. I have increased the pump speed.
12:01 – Values/data is bad again. There is condensation on the Air outlet pipe leaving the fridge. This is strange. Fridge is 19° and ambient air is 20°. If anything condensation should form on the outside of the pipe. Due to the fact that condensation is in the inside of the pipe suggests that the air is warmer on the inside and cooler on the outside. I suspect that the MFC has a role to play here. (Note: A few days later I figured out why this is happening. During the night the scientists would open the prep lab door, and flood the room with cold air, therefore meeting the requirements for condensation to form inside the pipes. This can happen quite quickly. Unfortunately it takes a much longer time for this condensation to dry up. And by the time I reach the system in the morning the temperature in the room has improved, and there is no clear reason for the problem. Keep this in mind for the next few reports).

13/02/2017
System seems stable. I want to test Ambient and Drierite values again.
18:54 – Attach the ambient air source.
19:20 – Ambient H_2O is stable at 3741 ppm.
19:21 – Connect drierite source.
20:04 – Drierite H_2O is at 772 ppm. This is fairly close to 500 ppm. Therefore I am happy with this value.
20:06 – Membrane reconnected. System running normally again.
23:27 – Values very definitely wrong again.
23:57 – There is condensation on the walls of the membrane outlet air pipe before and after leaving the fridge wall (the pipe running to the MFC, at the fridge boundary). This explains why the H_2O values are so unstable, and below 20000 mark. Vapor condensing, and therefore less humidity. Later this condensation will mess with the system (as seen in the past few days). During the last period there were a number of CTDs and therefore the scientists have been leaving the door open again, and making the room cold. Under these circumstances the condensation now makes sense. To help retain heat, I have reinstalled the cabinet door (removed at beginning of cruise due to space requirements in the lab). Additionally I have spoken to all the scientist and asked them to keep to door closed, and minimise time spent open. I have also spoken to the 2nd Engineer and requested that the heat be increased in the lab. At this point though the pipes are sill wet, and I need to dry the pipes.

14/02/2017
00:04 – Connect drierite source.
03:26 – Drierite H_2O is now stable at 473 ppm. Pipes are now dry.
03:27 – Membrane reconnected and system is running normally again.
15:50 – Sea water has been off for over an hour now. Still not on. This explains the drop in H_2O values.
17:35 – The sea water feed is frozen at the base of the ship.
17:36 – UWIA system is shut down. (Note: I probably should have kept the system running on milliQ, which is what I do later in the cruise. This will obviously keep the UWIA warm.)
23:51 – Sea water feed started again.
23:52 – UWIA system restarted.

15/02/2017
00:41 – Changed the peristaltic pump tube, and the water filter. Ended at 00:46.

00:50 – Opened fridge to check pump flow.
11:11 – Sea water turned off in the night. System has been running dry. H_2O values are still humid, so membrane was not dry.
11:11 – Turned the system off again.

16/02/2017
19:45 – Turned system back on. Sea water has been restored.

17/02/2017
12:04 – Sea water stopped again. Turned system off.
13:00 – Sea water still off. I have realised that it is better to keep system running (keeps heaters warm, and shows system functioning). Therefore I have turned the UWIA system back on, and am using milliQ as the water source.

18/02/2017
15:52 – Sea water back on. Sea water feed reattached.
16:39 – Sea water was briefly off for 5 min.
16:50 – Sea water feed is off in the lab. We are changing the plumbing for the Picarro system.
17:03 – Sea water back on in lab.
18:55 – Just checked outlet water flow. Approximately 110 ml/hour.
21:03 – Opened fridge and slowed the flow rate on the peristaltic pump.

19/02/2017
00:02 – Sea water has stopped. No idea when. Guessing it was recently.
00:05 – Switched to milliQ water source.
00:51 – Sea water back on. Sea water feed reconnected. System running normally.
11:20 – Sea water has stopped again at some time in the night. No clue when. MilliQ was not installed correctly, and therefore the system has been running dry.
11:21 – MilliQ is attached as the water supply and system is left running.

21/02/2017
00:24 – System looks good. Nice and stable. I adjust the flow rate down to see effect.
12:06 – System still on milliQ. No sea water available.
For the past 3 days I have noticed condensation on the air outlet of the membrane (directly at the membrane, inside the fridge). It is strange, but this has not been affecting the humidity. As a test I will adjust the peristaltic pump flow rate lower. My theory is that this condensation on the membrane output is caused either by damage to the membrane (leaking excess liquid), or that the have a standard condensation issue (hot air inside, and cold on the outside). The problem here is that the other isotope team have suggested that condensation on the outlet side of the membrane (directly at the membrane) will interfere with the sample air passing the droplets. Therefore, although the H_2O values are stable, there is still the change that the measured values are wrong.
12:08 – Reduced flow rate.
16:59 – H_2O values are all over the place. No clue why this is acting up now. I don't think this is related to my flow test.
The outlet pipe of the membrane still has condensation. Is it possible that this is causing the problem? Will leave for another 2 hours.
18:57 – H_2O is stable again. Still condensation on air outlet pipe of membrane. I do note that the room temperature has risen from 19.5° to 20.5°. Also note that the flow rate is now 69 ml/hour.
23:29 – H_2O is unstable again. Still condensation on air outlet of the membrane. I have increased the pump speed again to see the effect.

22/01/2017
01:08 – Pipes are all still wet. Connected drierite source to help drying.

02:15 – Pipes are all dry.
02:16 – Membrane reconnected, and system running normally.

24/02/2017
01:25 – Sea water on again. Sea water source reconnected.
12:03 – Just did a system check and sample. Looks good. Still condensation on outlet side of the membrane air pipe. Does not seem to be causing a problem.
Currently the ambient air is warm (20.7°), and the fridge is cool (19°). It is possibly this temperature change that is causing the membrane condensation. However I would have expected the condensation to form on the air inlet pipe that feeds the membrane (at the point where the pipe enters the fridge).

25/02/2017
System looks good. H2O is stable.
20:41 – Open fridge to inspect. The air outlet pipe of the membrane still has condensation forming. Apparently this is bad even though the humidity is stable. I wil try dry the pipes now.
20:43 – Connected drierite.
The membrane condensation issue is possibly due to:

1. Damaged membrane.

2. 22° Room temp air going in to the membrane at 19°.

Options:

1. Increase chamber temp to match ambient (however this will make it even more susceptible to drops in room temp).

2. Lower the air temp entering the membrane.

I will try option 2. I have made a 1 meter coil of pipe which I will stick in to the fridge before the air input to the membrane. Therefore the warm air entering the fridge from the drierite will cool in the coil before entering the membrane. That is the theory…
21:37 – H2O value has dropped nicely, and quick to 513 ppm. I am happy with this. Pipes are dry.
21:38 – I have now connected my coiled pipe.
21:43 – Connect membrane. Everything is now dry again.
21:45 – I have shifted the peristaltic pump tube (not replaced, just shifted to a less worn patch of pipe), and also changed the water filter.
System is now back to normal. Lets see if it works.

26/02/2017
11:50 – Sea water was stopped at some time in the night. System running dry for a few hours.
11:50 – MilliQ water source attached.
Room temp is 16°! Seriously not good!
16:26 – Sea water back on. Sea water feed attached.
Room temperature is at 16.8°. The condensation issue has started again. It is simply too cold at the moment to warm the room.
20:03 – Room temp is 18°. Still causing condensation on the air outlet pipe leaving the fridge.

27/02/2017
00:01 – Room temp is up to 19.4°. Still condensation on external air outlet pipes (leaving fridge). Will rush drying by bypassing the membrane.
00:02 – Membrane bypassed. Drierite source attached.

28/02/2017
00:10 – A scientist left the door open again. Temp dropped to 18°. Condensation formed on pipe leaving fridge. H2O values are bad again.
00:12 – Dreirite connected to speed drying.
01:14 – Drierite H2O is at 1089 ppm. Not quite 500.
02:02 – The H2O is now 1062 ppm. Not dropping !? Maybe drierite is wet again?
02:03 – Membrane reconnected, and system running normally again.
11:05 – Sea water went off approximately 30 min ago.
18.5° ambient temperature. I suspect that someone left door open again. Condensation in pipes.
11:09 – MilliQ water source attached.
11:10 – Membrane bypassed and drierite source attached. Wil help dry tubes out (mainly the one leaving the fridge).
15:54 – Sea water still off. No rush to attach membrane again. Will continue with drierite source until system is completely dry.

02/03/2017
13:46 – Still no sea water. The air flow is still bypassing membrane, but I have milliQ pumping through the membrane. The H2O value is still high. There is definitely a problem. System has been running drierite for a few days and should have dropped by now.
13:49 – I have attached a shorter pipe to the drierite output feed. Hopefully the H2O will drop. If it does not then the drierite is probably wet.
14:00 – Sea water has started again, so I took a bottle sample. However there is definitely a problem with the system. The H2O values should be in the 500 ppm region, and they are in the 1000 ppm region. At approximately 14:00 the system did a standard test. Before this test I had the drierite feed going through the pipes in the fridge (my new coil included), bypassing the membrane, out the fridge, through the MFC, and in to the sample inlet. After the standard test I had just the drierite connected directly (with a filter) to the sample inlet. H2O value before is approximately 1000 ppm, and after it is 336 ppm.
I also note that the delta18 values are different before and after the pipe change (keeping in mind that both are supposed to be a drierite source). Therefore there is something wrong with the pipes. I know the MFC does something to the humidity, but it should not be this bad.
14:14 – I have reconnected the pipe setup from before the standard test.
14:27 – I have removed the coil that I installed on the 25th. In hindsight the warm (and dry) ambient air leaving the drierite canister enters the cool fridge, and then the cool coil. This temperature will cause condensation to form inside the coil as it cools the sample air. A consequence of this is that the air is now no longer dry (which explains the 1000 ppm values), and therefore explains the difference seen in the above tests. At this point I am still running a drierite source (membrane bypassed).
14:53 – Drierite H2O is at 489 ppm. This is what I was expecting. Therefore my coil was definitely causing a problem. I need to add a fridge coil before the inlet to the drierite canister. This will manage the temperature change, and remove humidity/condensation. System is now ready for me to attempt sea water again.
15:02 – Changed the water filter and pump tube.
15:03 – Attached membrane, and sea water feed. System is running normally again.
16:00 – System running well again. Small drop on membrane air outlet arm again. Worrying how fast condensation forms there. But as stated before it does not seem to affect the humidity values.
18:03 – Small droplets forming on membrane air outlet arm again.
18:08 – Sea water feed was stopped briefly for 3 min while I helped with Picarro plumbing.
19:58 – Sea water off (ice again). MilliQ source attached.
21:41 – Sea water back on. Sea water feed attached.
22:06 – Sea water off again. Back to milliQ.

03/03/2017
17:30 – Briefly removed the MilliQ bottle to fill. Some air in the supply pipe.

04/03/2017
16:40 – Sea water back on. Sea water attached. System running normally.
16:43 – I note a lot of condensation on the air output arm of the membrane. I believe that this is caused by warm drierite air (22°) passing through the membrane at 19°, and then condensing on the pipe. I want to put a coil of pipe in the fridge to cool the air before entering the drierite canister.
17:07 – Sea water has been on for 20 min already but there is still no change. I have decided to try my new coil idea.
17:08 – Start new pipe install.
17:41 – Done installing my new pipe/coil.
I basically drilled an additional hole in the fridge for my new pipe. I place a long length (made up of a few turns) of pipe in the fridge. The inlet hangs outside the fridge. Air then moved in and around the coil where it will cool to the fridge temperature. It then leaves and enters the drierite canister (removing any additional humidity caused by the cooling process). The drierite outlet runs through an air filter and then through a short pipe entering the fridge and then the membrane. Hopefully this will solve the condensation issue on the air outlet arm of the membrane.
I have also dried the pipes after doing this installation.
17:44 – System is running normally again, with everything reconnected.

06/03/2017
Unfortunately there is still condensation forming on the air output arm of the membrane. This means that my coil idea has not worked. But it also does not seem to have had a negative effect on the system, and will therefore be left in.

10/03/2017
16:36 – Sea water has been stopped. Entering Argentinian waters. End of science.

Acoustic Cabinet UPS

The acoustic cabinet in the UIC houses a number of the scientific systems, including the Seapath GPS, Ocean Logger, ADCP, KSync ect.

At approximately 14:20 UTC on the 8/03/2017 the Seatex GPS feed failed, and caused problems with the Ship DP system that uses that location. After investigating this I found that the Seatex PC had restarted. Additionally the SCS, Ksync PC, NMEA PC had all been restarted. All of these systems are powered by UPS1 in the cabinet.

Pete Lens (ICT) noted that the battery percentage was increasing from 15%, which indicated that there had been an issue with the UPS. Later during a UPS test the UPS1 failed again. Pete has suggested that there may be a problem with the UPS hardware.

This same issue has happened once before on this trip, but had only been reported an hour after the fact. Discussions with the ETO led us to believe that there were no issues with the power supply, and therefore definitely an issue with the UPS.

All the critical systems have been moved to UPS2. I would like to run further tests when we get back to port, by changing the batteries in UPS1 to see if the problem persists.

LADCP

There were two primary issues with the LADCP's on the cruise. The first was with the battery, and the second was with the communications:

Battery Issue:
At the beginning of the cruise, before Cast 005, a sequence of events led to a failure in the LADCP battery pack. Essentially there were issues communicating with the LADCP units. When this happened the units were power cycled (by unplugging the battery connector) to re-establish communications. During one of these cases the battery connector was cleaned, and o-ring lube was used (instead of silicone grease) to seal around the connector. During cast 005 the connector leaked and formed a salt bridge that drained the LADCP battery (causing the initial damage). After the cast the battery connector was cleaned again, and silicone grease was used. The battery was then put on charge for the next cast. Unfortunately the cable feeding the battery charge lines (master cable connecting inside RS232 to CTD frame) had been damaged by people pulling the cable neck, rather than the connector. A dissection of the cable showed that only the positive battery supply line had been damaged, and all other lines were fine. Therefore the battery did not charge before the next cast. Before the cast the LADCP's were started using the little remaining charge in the battery, and then sent down. This then drained the batteries to an unrecoverable point, and even after the charge cable was replaced, it was found that the battery would not hold a charge.

The LADCP battery case was then removed from the frame, and opened up for inspection. The battery is made up of 8 * 6 V lead acid batteries. Powersonic PS-682, 6 V, 9 Ah, AGM. Two of these batteries were found to be damaged, and unable to hold a charge. However the rest seemed fine. There were 7 batteries spare in the cage, however they had not been charged for a while, and only 3 were found to be acceptable. Plans have been made to get additional spare batteries at the next port.

Using 2 of the spare batteries the battery bank was charged, and reinstalled in the battery housing. This new installation has performed well during the remainder of the cruise, and appears to be perfectly fine for the next cruise.

This problem resulted in LADCP data being lost on casts 005, 006, 008 and 009.

Communications Issue:
We encountered an issue when loading the deployment scripts to the LADCP's. We are able to load the predeployment scripts to both master and slave with no problems. We can then load the slave deployment script with no problems, however when loading the master script the communications would hang, and BBTalk would become unresponsive. Initially the solution to this was to power cycle the units at the battery (which led to the above mentioned problems). Later it was found that by sending break commands to both the slave and master would wake the master up after a minute (which saves interfering with the battery connector). A similar problem occurred occasionally before starting the data download from the slave, and it would also hang.

It is important to note that there has never been a single failure during a data download, which operates at a higher baud rate. This is why I believe that the problem is caused by software, rather than the cable run or the USB-Serial converters. I have tried a number of different script configurations, hardware configurations, and software setups, and have been unable to find the cause of the problem.

I have found that this error may be caused by operators sending commands too fast to the devices, and not waiting for the previous command to execute fully (wait for cursor to reappear and start blinking).

At the moment no data has been lost, and the problem is intermittent. I have therefore not classed it as critical.

pCO2

Pete Lens (ICT) and myself assisted the Deck Engineer with this system at the start of the cruise. Initially we found that the system was not fully connected (pipes, tubes and fittings), so we started by making sure that everything was mechanically sound.

Secondly we noted that there was an issue with the Licor communication. It would fail, and not provide the active GUI with data. The solution was to restart the software and/or the Licor unit. We spent a lot of time testing drivers, and software configurations. In the end we traced the problem down to a faulty USB-Serial converter. We installed a new one (external to the PC), and reconfigured the com ports to operate off it. This solved the problem with communications to the Licor (as noted in previous cruises in ICT handover notes).

The third problem came from the electronic flow control valve. The flow controller appears to have been damaged by a surge. I attempted to repair it, but did not come rite. I have made PML aware of the issue, and they will arrange a spare. In the interim, I offered to manually adjust the flow rate (and change a new inline filter) periodically throughout the cruise. Details of the dates and times of the flow adjustment, and filter change, are shown in the following table. I also took pictures of the filters, which are available on request.

Date	Start Time	End Time	Note
12/02/2017	12:08	12:21	Carson
13/02/2017	03:58	04:17	Chris
13/02/2017	12:00	12:14	Carson. Small Equilibrator incorrectly set by Chris to 1.6 l/m.
14/02/2017	03:51	04:09	Chris
14/02/2017	12:04	12:30	Carson. Small Equilibrator incorrectly set by Chris to 1.6 l/m.
16/02/2017	19:45	19:51	Carson. Sea water has been off for a while. Restored and flow set correctly.
18/02/2017	15:16	15:20	Carson. Filter not cleaned. Flow rate set.
25/02/2017	12:06	12:15	Carson
25/02/2017	20:02	20:06	Carson
26/02/2017	03:58	04:04	Chris
26/02/2017	20:03	20:08	Carson
27/02/2017	03:49	03:57	Chris
27/02/2017	12:01	12:06	Carson
27/02/2017	20:04	20:11	Carson
28/02/2017	04:42	04:49	Chris

01/03/2017	05:58	06:00	Chris. No flow but changed filter.
02/03/2017	03:45	04:00	Chris. Flow rate restored. No filter Change.
04/03/2017	17:30	17:46	Carson. Flow rates adjusted.
05/03/2017	12:16	12:24	Carson
06/03/2017	00:03	00:08	Carson
06/03/2017	12:03	12:08	Carson
06/03/2017	23:50	23:54	Carson
07/03/2017	12:08	12:15	Carson
07/03/2017	23:50	23:54	Chris
08/03/2017	12:04	12:13	Carson
09/03/2017	00:00	00:05	Carson
09/03/2017	11:56	12:01	Carson
09/03/2017	23:55	00:00	Carson
10/03/2017	12:07	12:14	Carson

Clam

The VGA to composite converter, used for distributing the display, failed at the start of the cruise. I have replaced it with the spare in the cage. I will need to order a new one.

Ship ADCP and EM122

At the beginning of the cruise we ran the Ship ADCP (SADCP) in parallel with the EM122. However we found that the EM122 was adding noise to the SADCP data. Therefore we stopped running the EM122.

In the past the ADCP has been found to only work while on station (not moving). However on this cruise the SADCP has been found to work quite well, provided that there is a bottom track available (Sea floor within 800 m), and the sea state is not too rough.

6.2. IT Report

Peter Lens

- Data is logged under the concept of a "*leg*" which is defined as a port-to-port voyage of the JCR. JR16004 data will be available on the BAS Storage Area Network (SAN) as **leg 20170120**.
- *legs* start or end at ports with customs, for example; Punta, Stanley and UK ports.
- A leg number is the date at which the leg was started in the format YYYYMMDD.

Data Collection Process

- Most instruments are connected via serial links to the central collection point; the SCS server (JCR-SCS-S1). The data is recorded in raw format (.RAW) and also sub-sampled to give a time delimited data file (.ACO). An indication of the variables and their units can be found in the (.TPL) files. This data is found under the /scs directory.
- Data from instruments which do not log directly to the SCS are also gathered in the legdata area such as CTD, ADCP, XBT, etc.
- A copy of all data collected under legdata is transferred to Cambridge and will be available forever. Please make requests via the Polar Data Centre or helpdesk@bas.ac.uk.

Daily Issue Log (reads from bottom)

Pcdl 20:23, 8 March 2017 (UTC)
Periodic failures of seatex, labview and SCS computers led to discovery that the top UPS in the acoustic cabinet (labelled UPS1) will shutdown, dropping power to outputs during a self test. The display reads 0% load despite being connected to 6 live machines. High importance devices like seatex were moved to the working UPS (labelled UPS2). Failed UPS will be replaced after return to UK in June.

Pcdl 14:15, 8 March 2017 (UTC)
Added “Firewall” Group Policy Object to the JCR Active Directory domain. Includes Sophos rule and ICMP v4 ping rule for all desktops.

Pcdl 10:52, 6 March 2017 (UTC)
No Seatex data from 10:13 to 10:47
Fix : power cycle the Seapath 320 unit

Pcdl 13:55, 4 March 2017 (UTC)
Samba certificates expired, users lost access to K: and L: drives.
Samba/ACQ restarted.
Gap in underway data from 13:21:58 to 13:22:45 (UTC)

Pcdl 13:04, 4 March 2017 (UTC)
EA600 stopped logging to SCS (although continues to ping and give depth for Bridge).
Message on screen;

> SIMRAD EchoSounder
> File write error
> The path is set to default storage:
> C:\EA600\Data2\filename.raw
> Please go to File - Store... to set your own storage location.

Under File - Store... the location is set to the network U:\data which was not mapped.

Pcdl 11:00, 4 March 2017 (UTC)
Jrlamanda replication jobs failing.
Traced to a sync network problem between jrw-veeam-s1 (192.168.100.11) and jrw-veeam-s2 (192.168.100.12). The proxy for the jrlamanda job was fixed between these two addresses, but the proxy for all the other VM's is set to automatic. This means that the main LAN was used for the replication of VM's which manifested as network slow downs. Fix was to reboot jrw-veeam-s1.
Changed Veeam job settings for "Replication ESX0 to ESX1"; proxies were set to automatic and now set to;

source 192.168.100.11
destination 192.168.100.12

Future fails of the sync network will result in all replication jobs failing which will be a better indicator of a sync network problem.

Pcdl 22:31, 3 March 2017 (UTC)
Routine check showed JRLB CA certificate was about to expire. Jeremy Robst remotely replaced CA cert for JRLB and JRLC, keeping the same key.

Pcdl 18:06, 3 March 2017 (UTC)
JR-ESX0 iDrac lock up for both http and ssh. Forums suggest reset fix of holding UID button for 20+ seconds, but that did not work. Intend to reboot when science complete.

Pcdl 11:28, 22 February 2017 (UTC)
PCO2 Licor data has not frozen for 12 days. Ian Brown *iaian2@pml.ac.uk* will remove system whilst in Southampton in June. Will be sent to Dartcom for refurb. Recommended replacement of all USB to serial converters with FTDI devices.

Pcdl 18:00, 20 February 2017 (UTC)
Jupyter Notebook created which reads underway seatex/anemometer data to pandas dataframe and produces ACO file of true wind speed and direction. Copy can be found under /work/truewind

Pcdl 16:04, 19 February 2017 (UTC)
Resolved issue with Veeam backups to tape. Jobs were reporting success, but 0 files written. Cause was loss of iSCSI target connection. Indicator was drive icon was superimposed with a red warning sign here: *JRW-VEEAM-S1, Veeam Backup and Replication, Backup Infrastructure, Tape, IBM 3573-TL C.00, Drives*. Fix was to run iSCSI Initiator on JRW-VEEAM-S1 and connect the inactive targets.

Pcdl 18:12, 15 February 2017 (UTC)
Fulfilled role as ground person for quadcopter flight (SkyRanger). Short flight for recon of ice conditions. Optical camera failed, infra red images captured.

Pcdl 15:36, 14 February 2017 (UTC)
Licor remains working since fix applied
Truewind Python code developed - anemometer wiki notes updated

Pcdl 18:14, 10 February 2017 (UTC)
PCO2 : The ATEN usb-to-serial adapter was bypassed to see the effect.
It was confirmed that the Licor is connected to the PC via COM6 (an ATEN adapter is used housed inside the PC case).
An US232-R USB-to-serial adapter (FTDI chip from RS components) was inserted into one of the front facing USB ports.
The ATEN adapter that was assigned to COM6 was changed to COM30.
The new US232-R device was assigned to COM6 and the system restarted.
The Licor unit was attached to the new adapter and data is flowing.

All data streams appear to be functioning.
Com ports can be changed in Windows using;
Device Manager -> Select port -> Properties -> Port Settings -> Advanced

Pcdl 14:44, 9 February 2017 (UTC)
Licor frozen; detached serial comms and connected LI-840 unit to a laptop. Sent

<LI840><DATA>?</DATA></LI840>

which returned good data so the problem is NOT with the licor unit. The problem lies at the PC end. Further investigation on the PC revealed a USB to Serial Bridge is being used. This is an ATEN UC232A device with a driver v1.0.075 from March 2011 (7 years old). The latest driver is v1.0.082 from Jan 2016. Requested that we be allowed to update the driver in an email to PML; *vak@pml.ac.uk* and *iaian2@pml.ac.uk*. Driver updated but the problem got worse. Rolled back to previous restore point.

Pcdl 17:33, 8 February 2017 (UTC)
JRW-LVDISP-V1 LabVIEW crash with Access Violation 0xC0000005. Restarted Graphical Displays
Removed Sophos from JRW-LVDISP-V1 to determine effect - if it stops the crashing then will configure for exclusions

Pcdl 14:18, 5 February 2017 (UTC)
JRW-LVDISP-V1 LabVIEW crash with Access Violation 0xC0000005. Restarted Graphical Displays

Pcdl 14:05, 5 February 2017 (UTC)
Licor frozen.
Remove top mesh panel from PCO2 rack. The Licor device is a box at the rear. Model LI-840
It has 4 connections; 24v, serial DB9, air in and air out.
24v supply tested as clean and in spec by Carson (AME).
Connect serial DB9 cable with null modem to a laptop.
Use 9600,N,8,1 no flow control. Use RealTerm to send the following

<LI840><DATA>?</DATA></LI840> (plus CRLF) returns data
<LI840><CFG>?</CFG></LI840> (plus CRLF) returns licor configuration
<LI840>?</LI840> (plus CRLF) returns all information
<LI840><VER>?</VER></LI840> returns firmware version

Pcdl 20:17, 3 February 2017 (UTC)
LADCP: The Master unit freezes regularly while being sent startup configuration. Consistently after issuing the command "CR1" which is a factory reset. Not a baud rate or serial comms setting problem. Not a serial comms connection problem (large data files can be transferred at much higher baud). Not helped by placing small delay commands "$D2" after the "CR1" and other commands. LADCP can usually be woken up by sending break then wait 2 minutes. Returns with a "Wakeup B" so send a further break which gives "Wakeup A". Unresolved.

Pcdl 11:08, 31 January 2017 (UTC)
LabView Displays on Main LAN die every 12 hours. Nothing to indicate why other than "access violation" message from LabView. No issues with CPU, memory, hard drive space etc.

Pcdl 17:13, 24 January 2017 (UTC)
Sailed from Punta Arenas at 10:00 (UTC)

jpro 02:32, 20 January 2017 (UTC)
Restarted Samba (to clear old maps to L: drive) - restarted ACQ

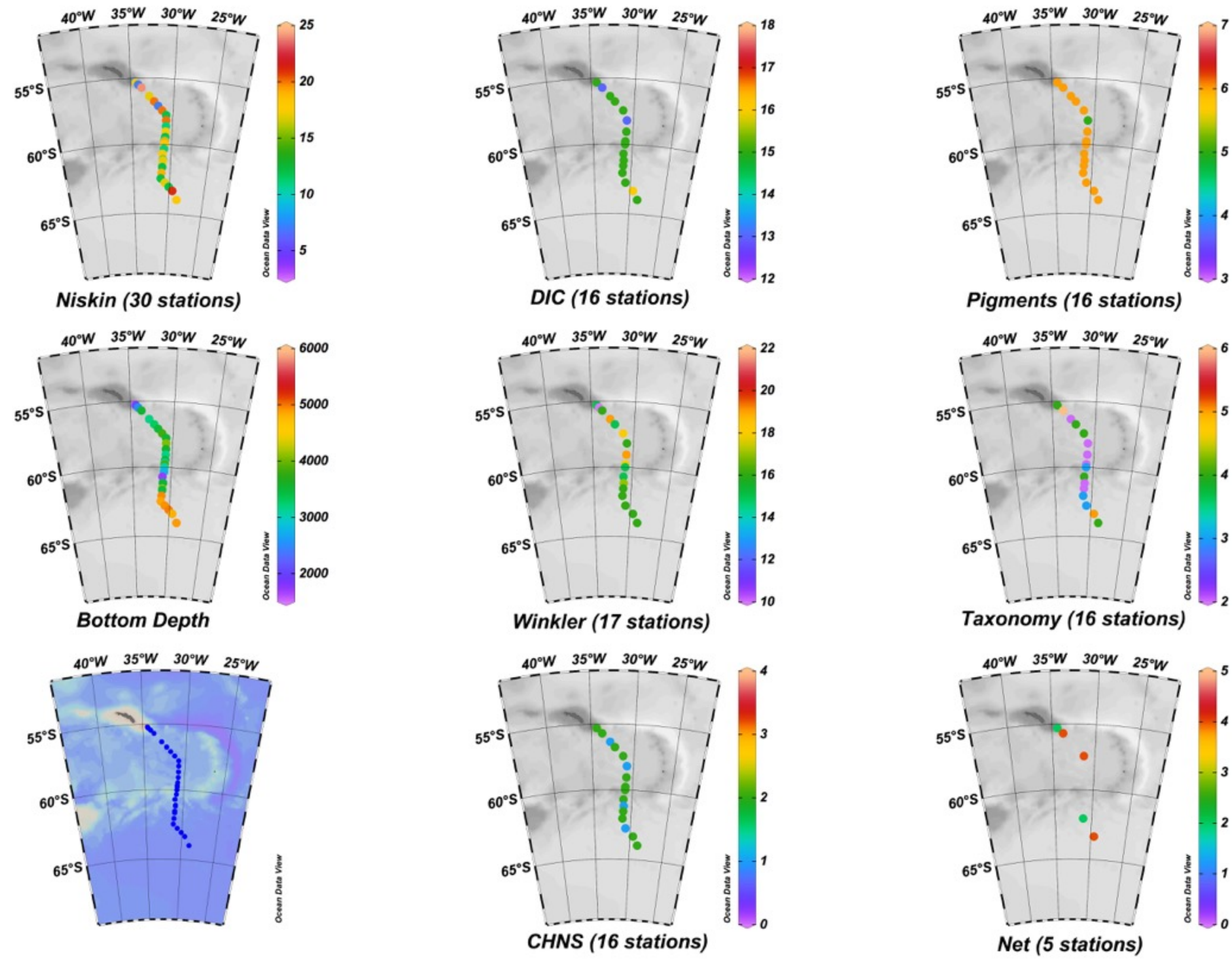
jpro 02:23, 20 January 2017 (UTC)
Underway data collection (ACQ) Started

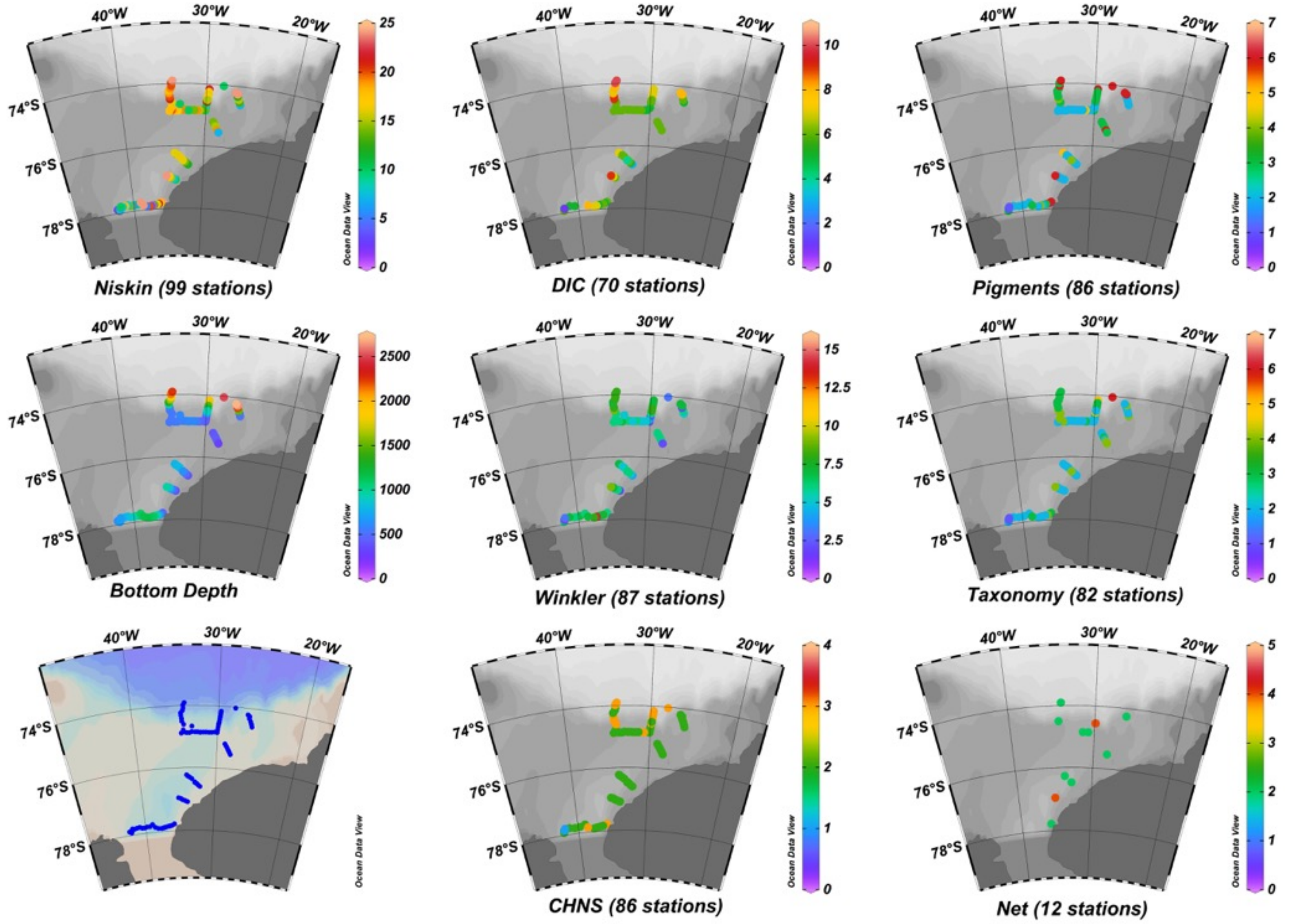
Part VII: Appendix

Appendix 1: Biogeochemistry sampling and measured parameter

The following figures shows for each biogeochemestry parameter, DIC/Alk, Oxygen, Pigments, Taxonomy, CHNS and Biodiversity, the distribution and location (depth and latitude) of the number of samples collected during the cruise.

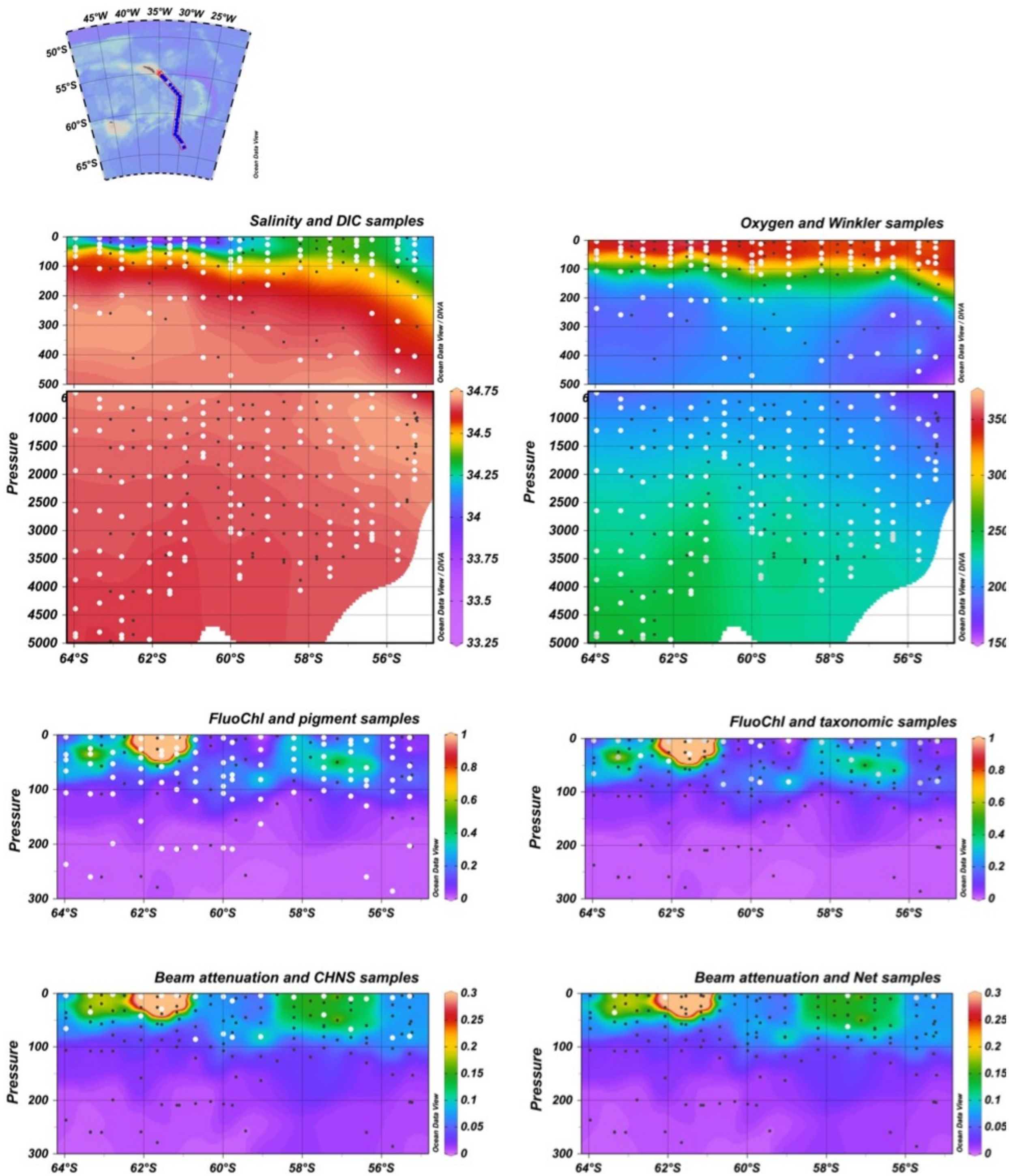
Figure A.1.1. Number and position of the station sampled with Niskin bottles, the corresponding depth of each station and the numer of stations where were take samples for each biogeochemical parameter a) for the transect at the North Weddell sea 55°S-65°S (A23) b) for the transect at south Weddell sea 74°S-78°S.

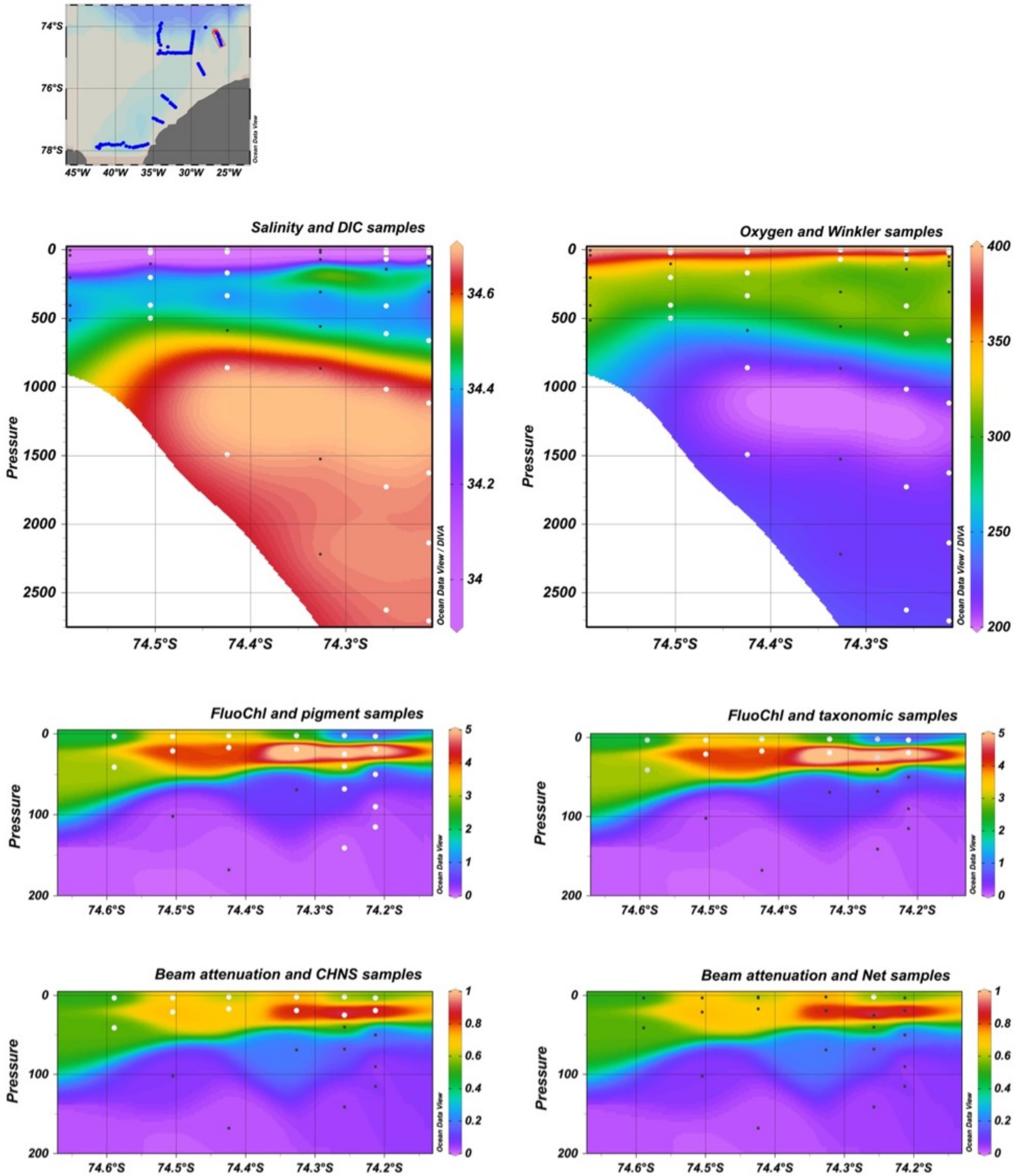


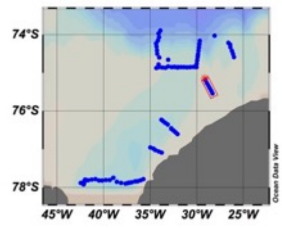


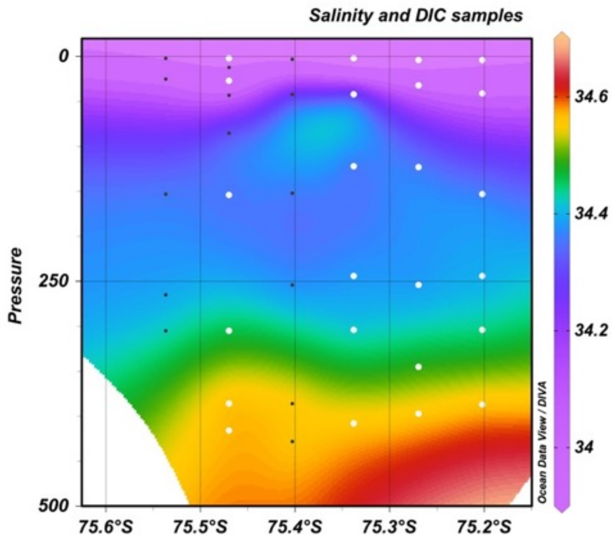
In general the structure of strong gradient, maxima and minima obtained by Niskin bottles sampling (black dot) were catch by deployed sampling strategy for biogeochemistry parameter (white dot).

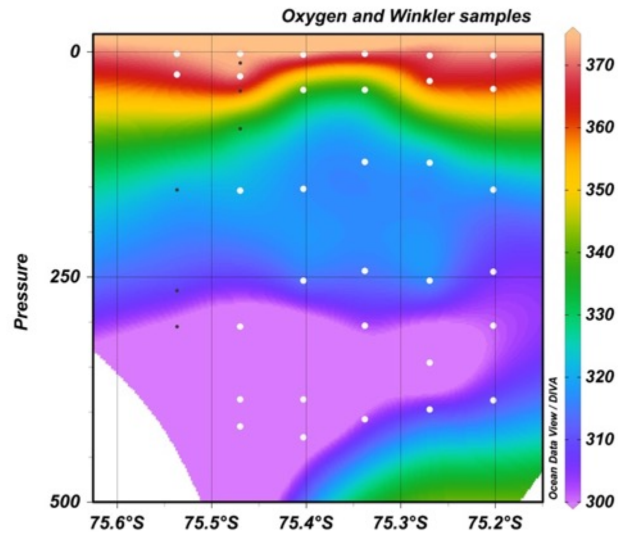
Figures A.1.2. Variability across each transect showed on figure A.1.1 of the corresponding interpolated salinity, oxygen, fluorescence and beam attenuation coming from Rosette sensor using only measured values at the corresponding depth of Niskin bottles. The black dots correspond to the total Niskin bottles depth and the whith to those wehre were sampled the biogeochemical parameter.

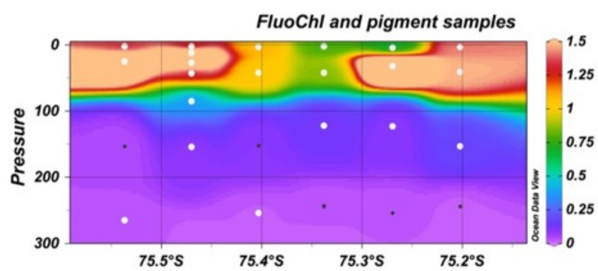


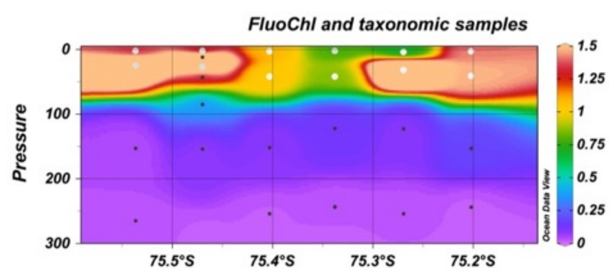

74°S
76°S
78°S
45°W
40°W
35°W
30°W
25°W
Ocean Data View
Salinity and DIC samples
Oxygen and Winkler samples
FluoChl and pigment samples
FluoChl and taxonomic samples
Beam attenuation and CHNS samples
Beam attenuation and Net samples
Pressure
74.6°S
74.5°S
74.4°S
74.3°S
74.2°S
Ocean Data View / DIVA

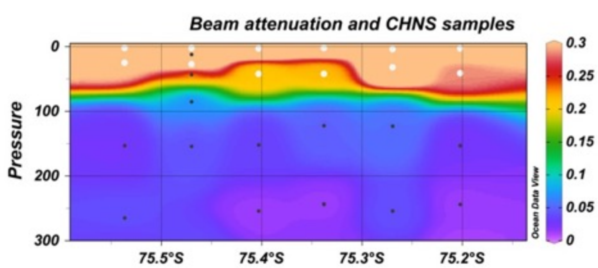

74°S
76°S
78°S
45°W
40°W
35°W
30°W
25°W
Ocean Data View

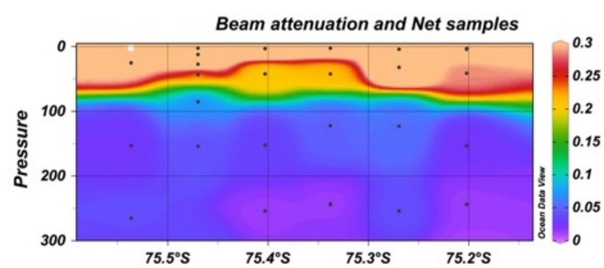

Salinity and DIC samples
Pressure
0
250
500
75.6°S
75.5°S
75.4°S
75.3°S
75.2°S
34.6
34.4
34.2
34
Ocean Data View / DIVA

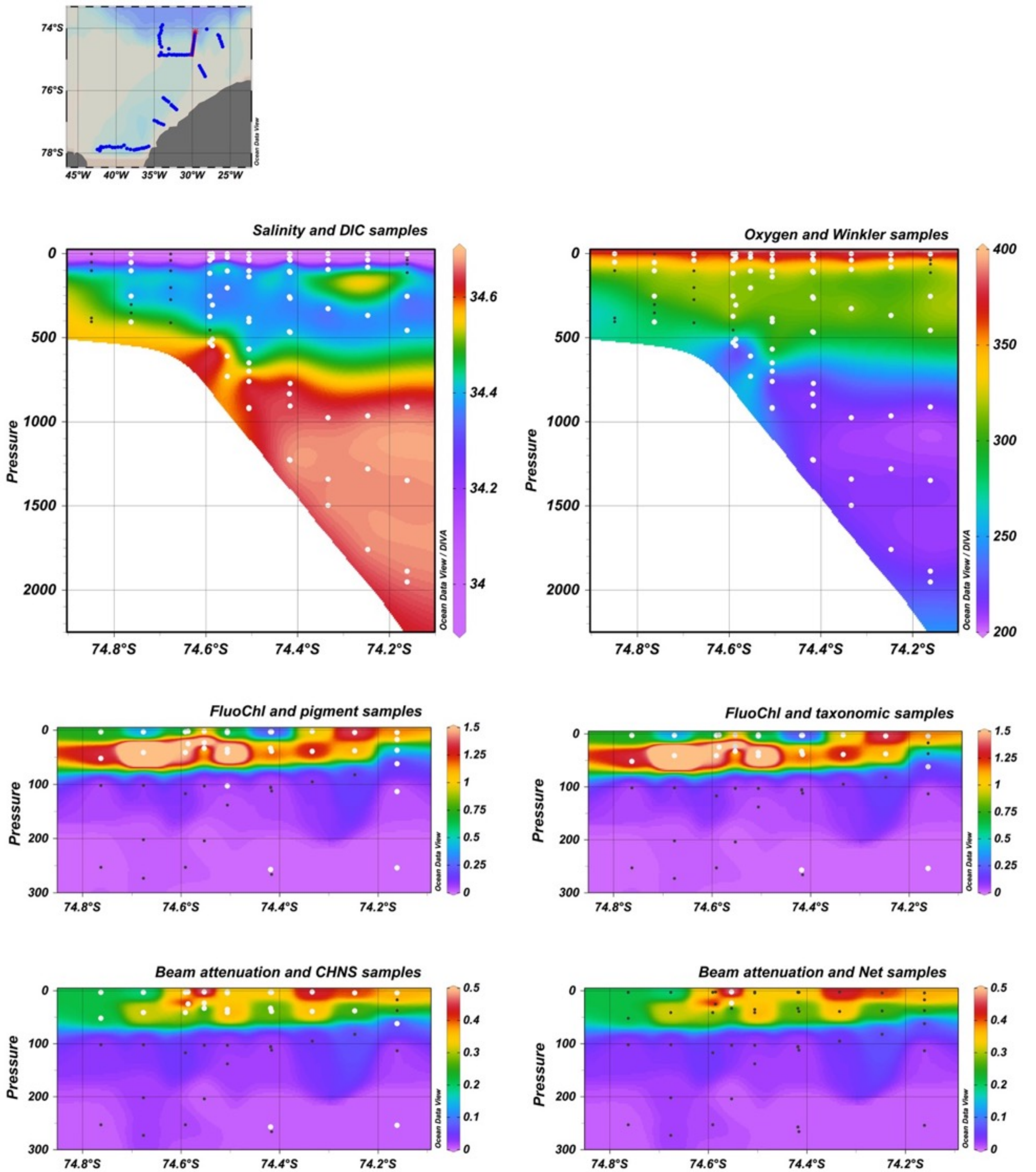

Oxygen and Winkler samples
Pressure
0
250
500
75.6°S
75.5°S
75.4°S
75.3°S
75.2°S
370
360
350
340
330
320
310
300
Ocean Data View / DIVA

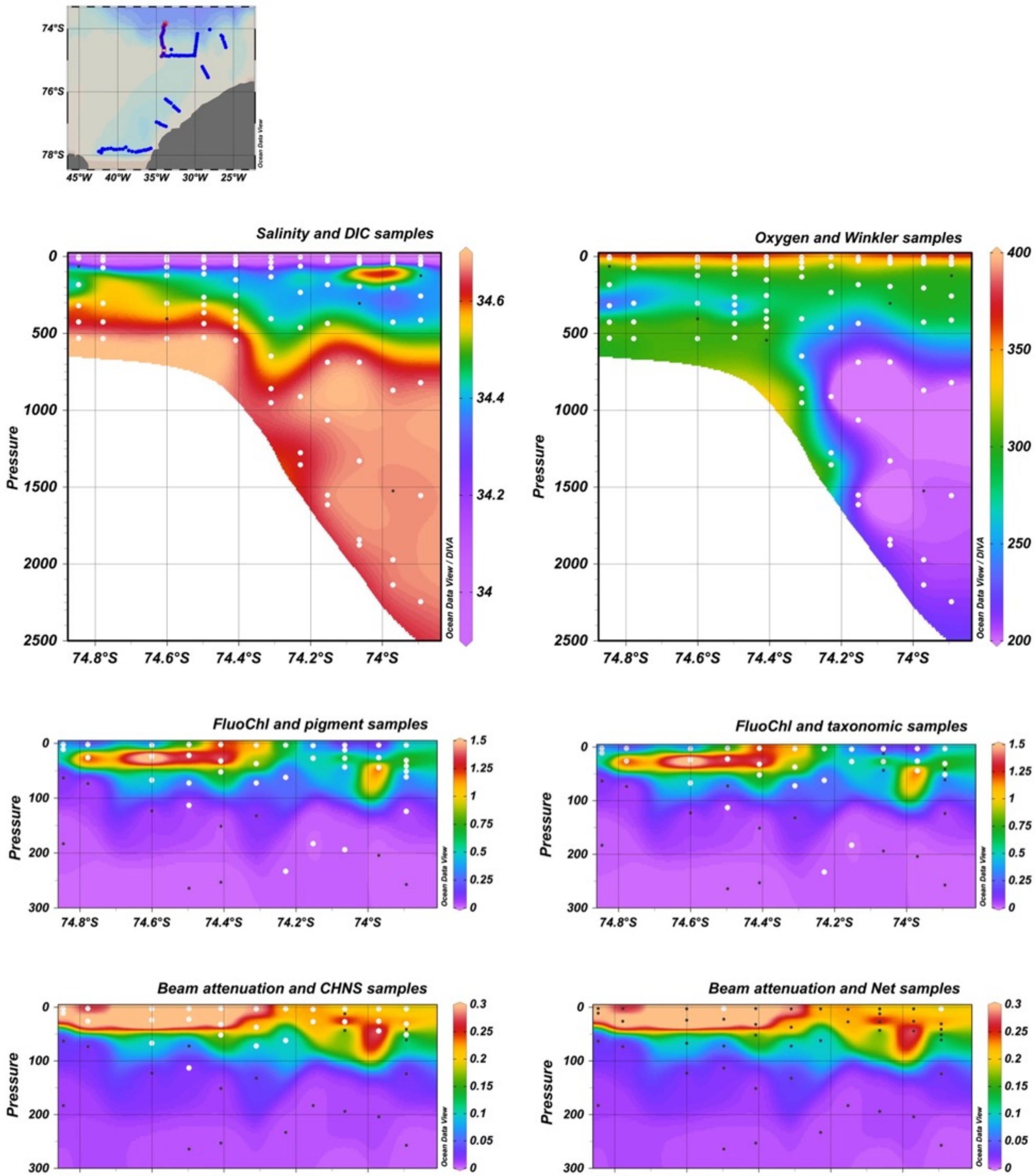

FluoChl and pigment samples
Pressure
0
100
200
300
75.5°S
75.4°S
75.3°S
75.2°S
1.5
1.25
1
0.75
0.5
0.25
0
Ocean Data View

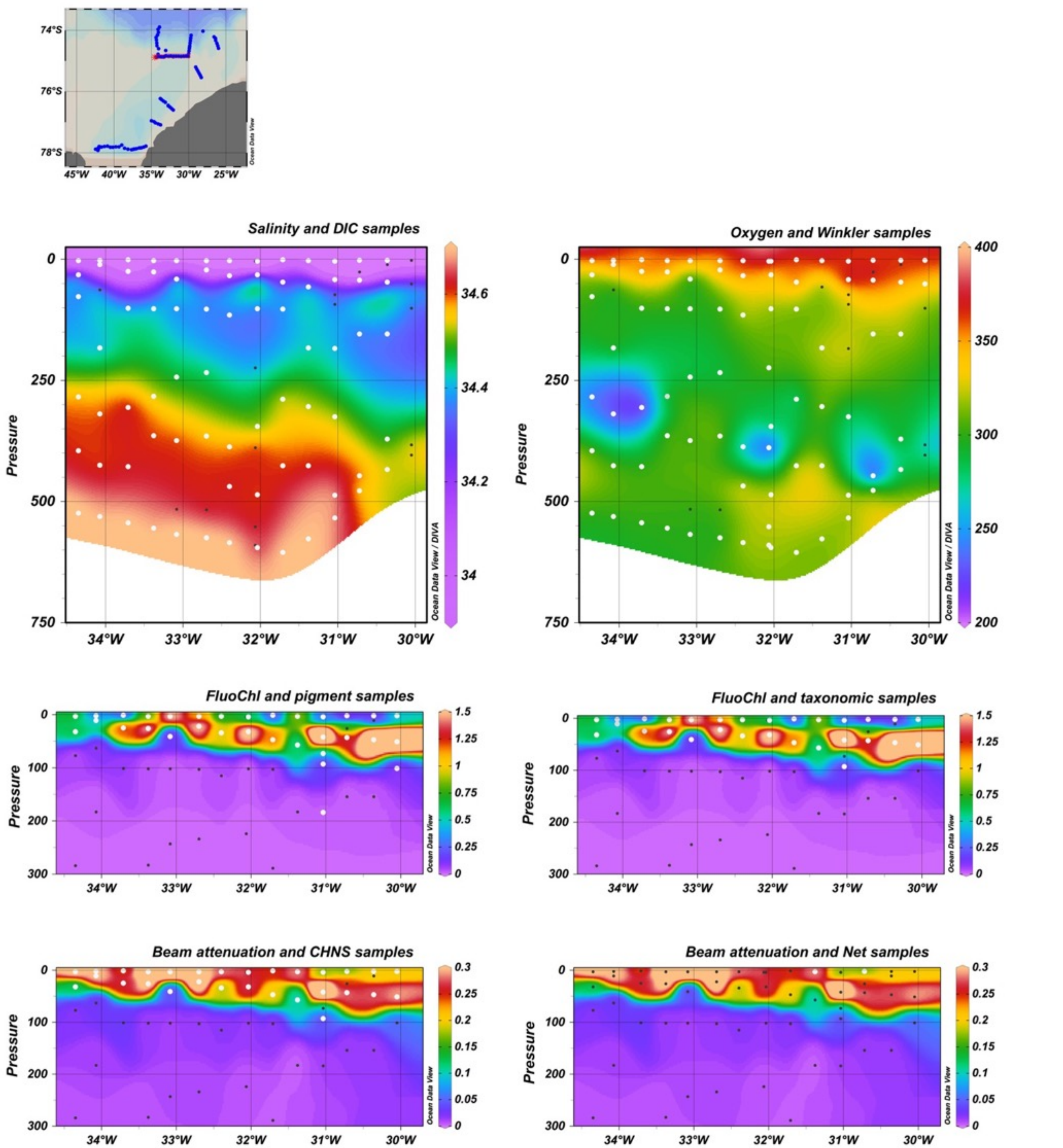

FluoChl and taxonomic samples
Pressure
0
100
200
300
75.5°S
75.4°S
75.3°S
75.2°S
1.5
1.25
1
0.75
0.5
0.25
0
Ocean Data View

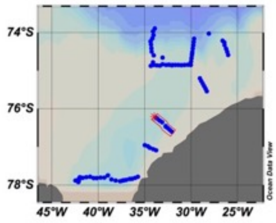

Beam attenuation and CHNS samples
Pressure
0
100
200
300
75.5°S
75.4°S
75.3°S
75.2°S
0.3
0.25
0.2
0.15
0.1
0.05
0
Ocean Data View


Beam attenuation and Net samples
Pressure
0
100
200
300
75.5°S
75.4°S
75.3°S
75.2°S
0.3
0.25
0.2
0.15
0.1
0.05
0
Ocean Data View


74°S
76°S
78°S
45°W
40°W
35°W
30°W
25°W
Ocean Data View
Salinity and DIC samples
Oxygen and Winkler samples
Pressure
74.8°S
74.6°S
74.4°S
74.2°S
34.6
34.4
34.2
34
400
350
300
250
200
Ocean Data View / DIVA
FluoChl and pigment samples
FluoChl and taxonomic samples
Beam attenuation and CHNS samples
Beam attenuation and Net samples
Ocean Data View


74°S
76°S
78°S
45°W 40°W 35°W 30°W 25°W
Ocean Data View
Salinity and DIC samples
Oxygen and Winkler samples
Pressure
74.8°S 74.6°S 74.4°S 74.2°S 74°S
Ocean Data View / DIVA
FluoChl and pigment samples
FluoChl and taxonomic samples
Beam attenuation and CHNS samples
Beam attenuation and Net samples
Ocean Data View


Salinity and DIC samples
Oxygen and Winkler samples
FluoChl and pigment samples
FluoChl and taxonomic samples
Beam attenuation and CHNS samples
Beam attenuation and Net samples
Pressure
Ocean Data View / DIVA
Ocean Data View


74°S
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78°S
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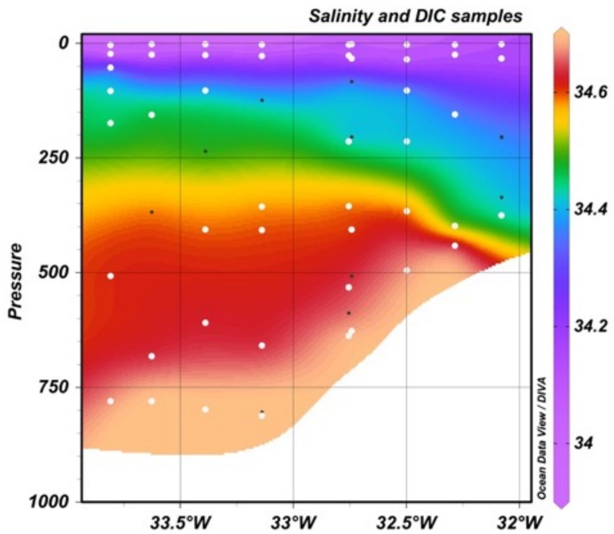
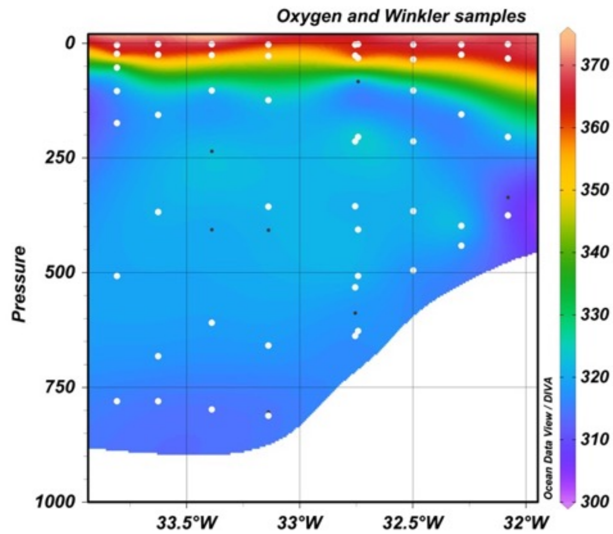
40°W
35°W
30°W
25°W
Ocean Data View


Salinity and DIC samples
Pressure
0
250
500
750
1000
33.5°W
33°W
32.5°W
32°W
34.6
34.4
34.2
34
Ocean Data View / DIVA


Oxygen and Winkler samples
Pressure
0
250
500
750
1000
33.5°W
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32.5°W
32°W
370
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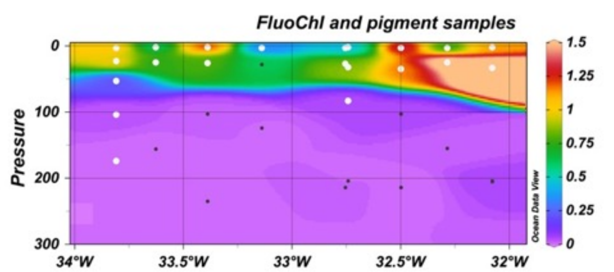
350
340
330
320
310
300
Ocean Data View / DIVA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Pressure
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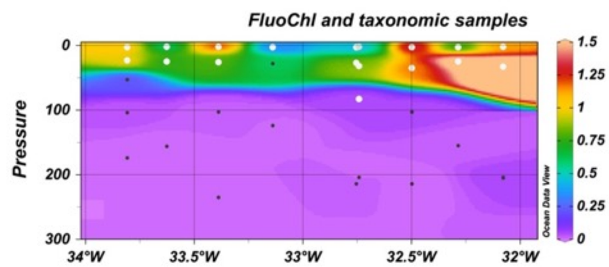
200
300
34°W
33.5°W
33°W
32.5°W
32°W
1.5
1.25
1
0.75
0.5
0.25
0
Ocean Data View


FluoChl and taxonomic samples
Pressure
0
100
200
300
34°W
33.5°W
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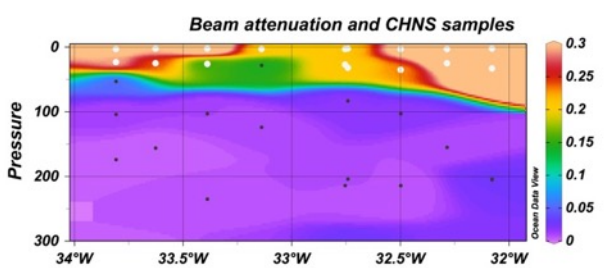
32.5°W
32°W
1.5
1.25
1
0.75
0.5
0.25
0
Ocean Data View


Beam attenuation and CHNS samples
Pressure
0
100
200
300
34°W
33.5°W
33°W
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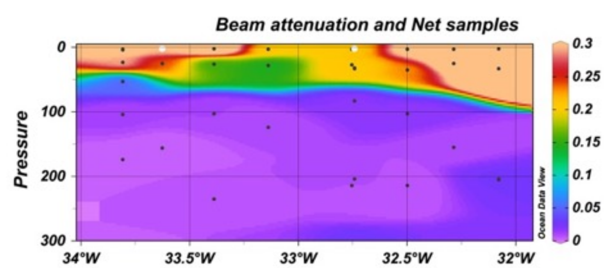
32°W
0.3
0.25
0.2
0.15
0.1
0.05
0
Ocean Data View


Beam attenuation and Net samples
Pressure
0
100
200
300
34°W
33.5°W
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0.3
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0.2
0.15
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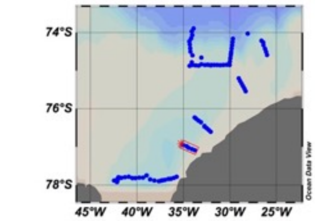
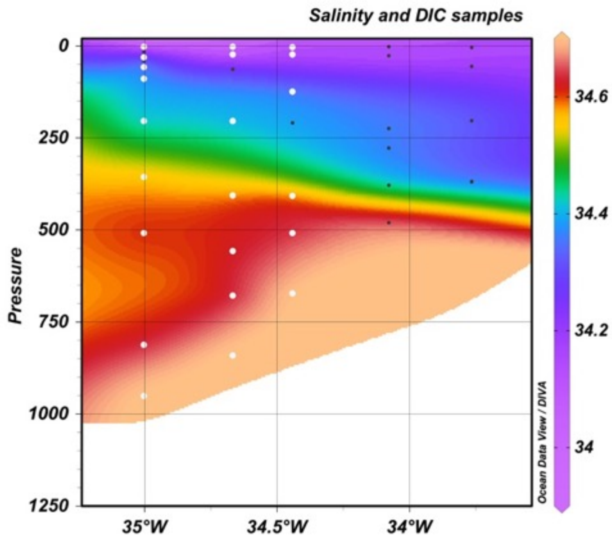
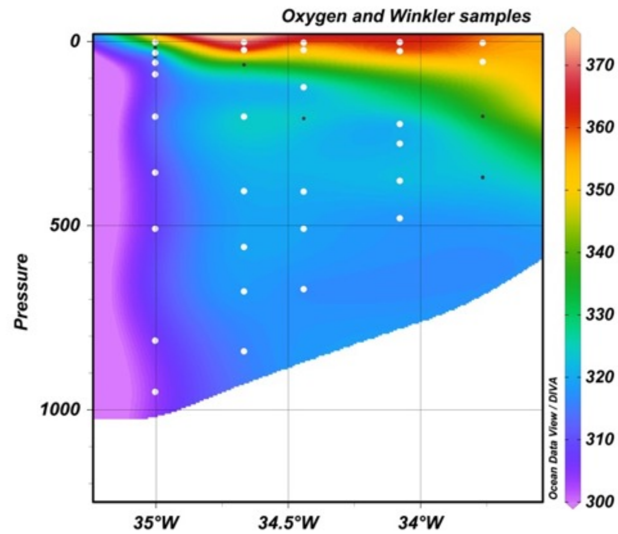
0.05
0
Ocean Data View


74°S
76°S
78°S
45°W 40°W 35°W 30°W 25°W
Ocean Data View


Salinity and DIC samples
Pressure
0
250
500
750
1000
1250
35°W 34.5°W 34°W
34.6
34.4
34.2
34
Ocean Data View / DIVA


Oxygen and Winkler samples
Pressure
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1000
35°W 34.5°W 34°W
370
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320
310
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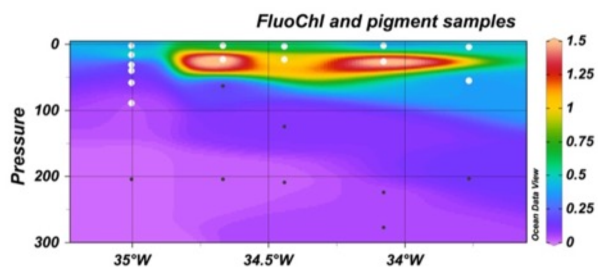
Ocean Data View / DIVA


FluoChl and pigment samples
Pressure
0
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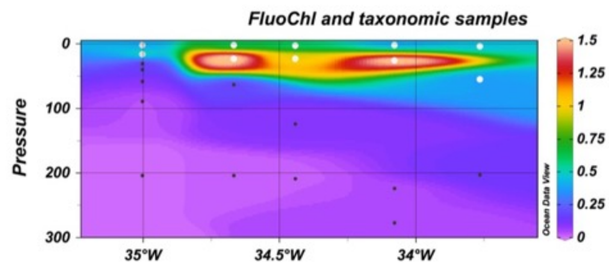
200
300
35°W 34.5°W 34°W
1.5
1.25
1
0.75
0.5
0.25
0
Ocean Data View


FluoChl and taxonomic samples
Pressure
0
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200
300
35°W 34.5°W 34°W
1.5
1.25
1
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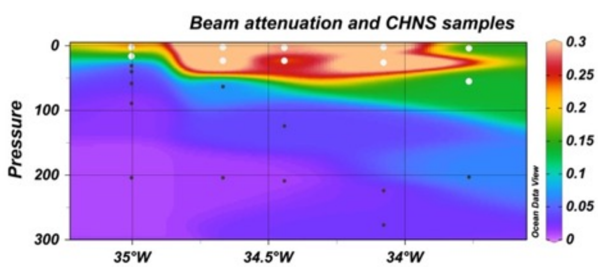
0.25
0
Ocean Data View


Beam attenuation and CHNS samples
Pressure
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0.05
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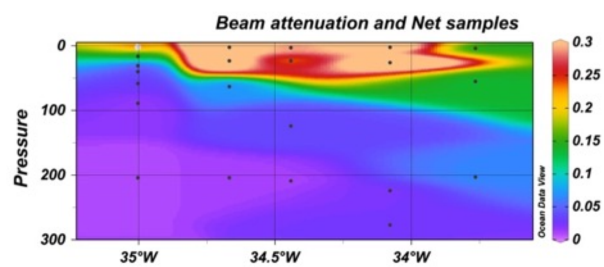
Ocean Data View


Beam attenuation and Net samples
Pressure
0
100
200
300
35°W 34.5°W 34°W
0.3
0.25
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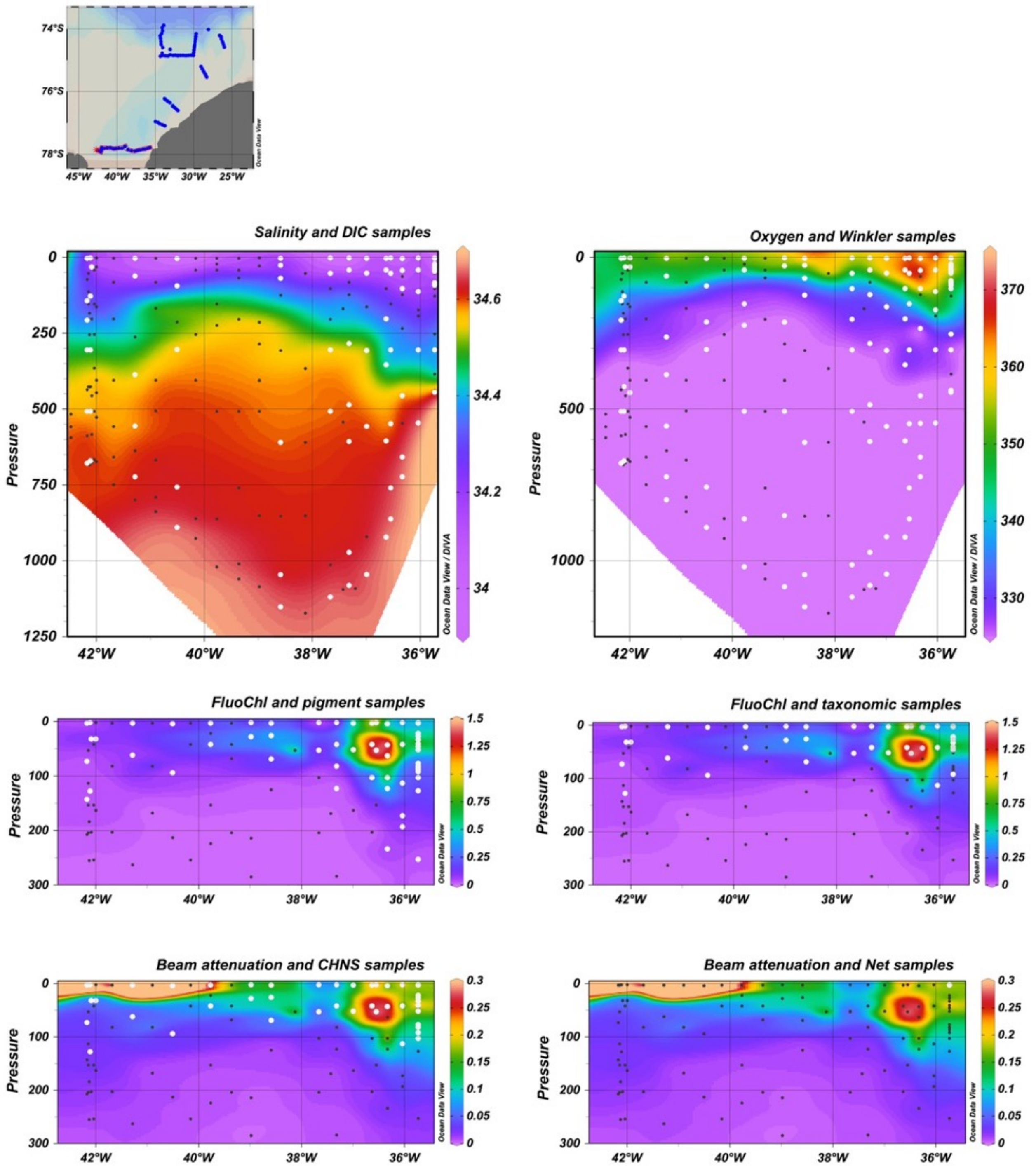
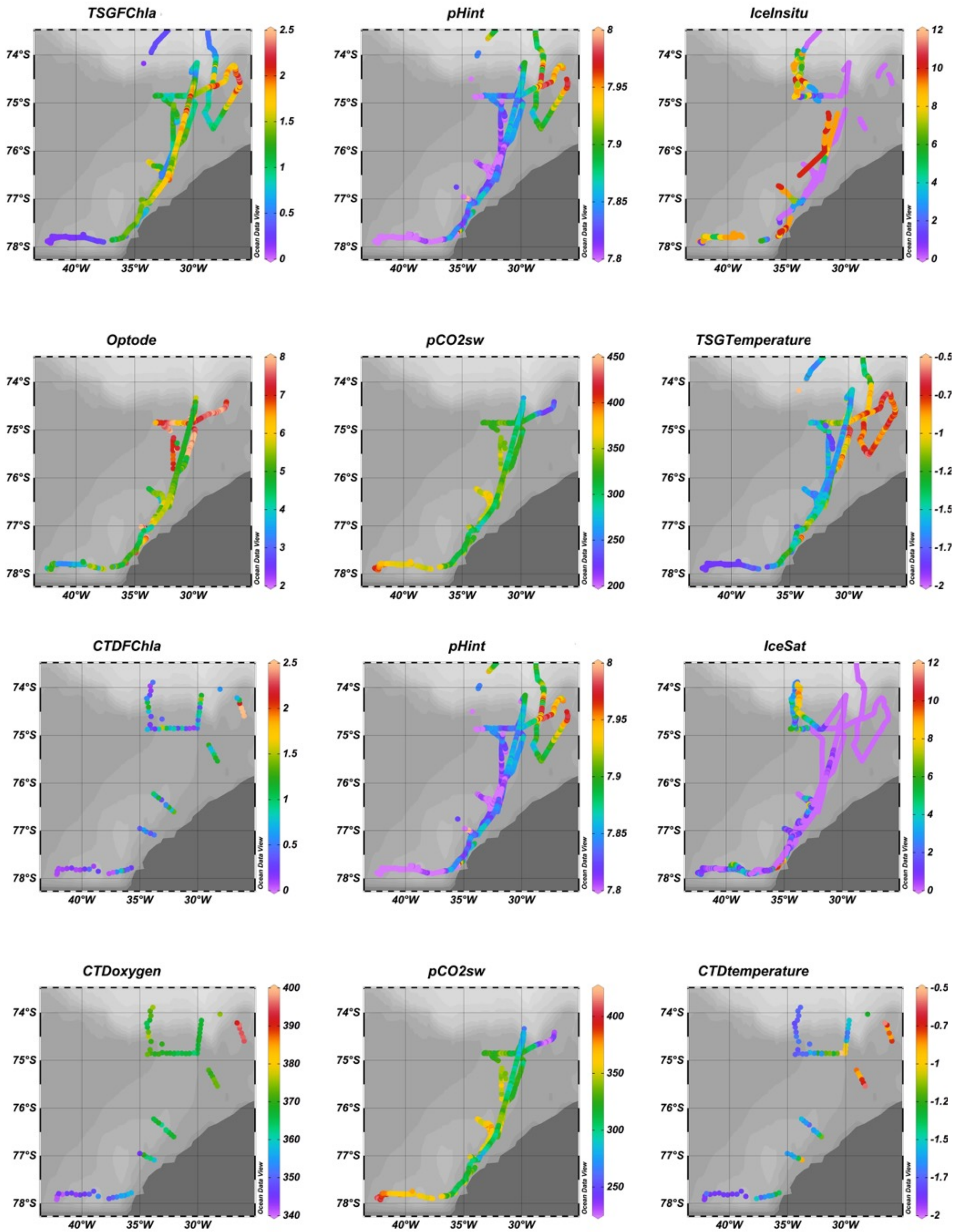
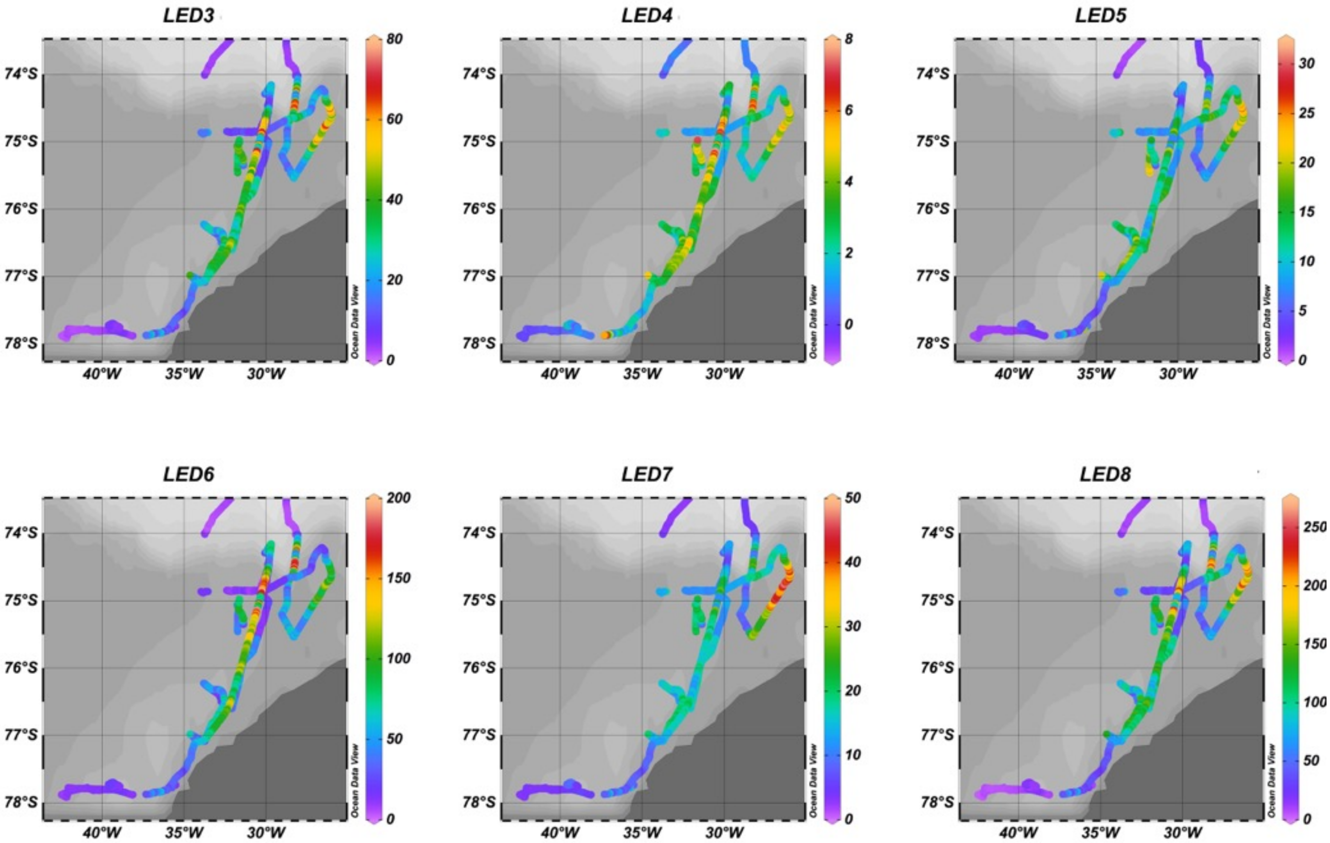
0.15
0.1
0.05
0
Ocean Data View


74°S
76°S
78°S
45°W 40°W 35°W 30°W 25°W
Ocean Data View
Salinity and DIC samples
Oxygen and Winkler samples
FluoChl and pigment samples
FluoChl and taxonomic samples
Beam attenuation and CHNS samples
Beam attenuation and Net samples
Pressure
42°W 40°W 38°W 36°W
Ocean Data View / DIVA
34.6
34.4
34.2
34
370
360
350
340
330
1.5
1.25
1
0.75
0.5
0.25
0
0.3
0.25
0.2
0.15
0.1
0.05

Appendix 2: Underway measured parameters in the Weddell Sea





LED3
LED4
LED5
LED6
LED7
LED8
74°S
75°S
76°S
77°S
78°S
40°W
35°W
30°W
Ocean Data View

Appendix 3: Sampling, storage and Analytical protocols to be used after the cruise

- **A.3. DIC/ALk by Potentiometry (LOCEAN-UPMC-Paris France)**

A.3.1.Theory

Total Alkalinity (TA) in seawater is defined as the ability to neutralize an acid. TA in natural waters is mainly controlled by carbonates, bicarbonates and hydroxides. Borates, silicates, phosphate and certain forms of organic matter contribute slightly to TA.

$$\mathbf{AT= [HCO_3^-]+2*[CO_3^{2-}]+[B(OH)_4^-]+[OH^-]-[H^+]+......}$$

Total Carbon (or Dissolved Inorganic Carbon, DIC) is the sum of carbonic acid, carbonates and bicarbonates in seawater. Carbonic acid originates from the dissolution of carbon dioxide (CO2) from the atmosphere, combined with H2O, while the carbonates and bicarbonates originates from the carbonate rocks in contact with the water masses.

$$\mathbf{CT= [CO_2]+[H_2CO_3]+[HCO_3^-]+[CO_2^{2-}]}$$

TA and DIC are determined by titration of seawater with a strong acid (HCl).

$$\mathbf{H_2CO_3 \leftrightarrow H^+ + HCO_3^- \leftrightarrow 2\ H^+ + CO_3^{2-}}$$

Due to the addition of HCl, , the pH of seawater decreases slightly during the titration. If the sample contains carbonate ions, a first equivalence point is be observed. This point corresponds to the conversion of carbonate ions to bicarbonates. TA is determined at the second equivalence point, corresponding to the conversion of bicarbonate to carbonic acid. DIC is derived from the difference between the second and first equivalence points.

A.3.2.Sampling and conservation

500 ml of seawater are collected in a pyrex glass bottle with ground stoppers, by taking care to prevent the introduction of air bubbles in the sample, and to limit contact with the air. To this aim, allow the sample to overflow for about 10 seconds in order to get rid of both bubbles and the water which was in contact with the air when the bottle was being filled.. The samples are kept at low temperature (around 4°C) after being poisonned with $HgCl_2$ to prevent changes in concentrations through biological (bacterial) activity. Without addition of $HgCl_2$, the sample must be analyzed within a few hours.

A.3. 3. Instrumentation

The automated system used for the simultaneous determination of TA and DIC in seawater is based on the potentiometric method introduced by Edmond in1970 (dosage of sea water by a strong acid in a variable volume air-tight cell during dosing). It consists essentially of a burette, a pH meter, an automated 'home-made' titration cell and a computer for conducting the analysis (figures 1 and 2). A continuous flow of thermostated water maintains the ensemble (cell, burette, acid reservoir) at constant temperature. The analysis is controlled using a program developed with LabView, that commands the burette delivering HCl (Hydrochloric acid, Hcl at 0,1N (CAS n°7647-01-0) To which are added 35of NaCl) to the cell, as well as the opening and closing of the cell, and a set of valves allowing filling of the cell. The computer is also used during the titration to store outputs from the pHmeter (potential) and burette (volume of HCl).

The LabVIEW program enables to check each step of the analysis (real-time visualisation, figure 3), and to process the data at the end of the analysis, so that preliminary results are immediately available.

A non-linear method is used to detemine the equivalent points (following recommendation at the international level, D.O.E., 1994). TA, DIC and pH ('free H + scale') are obtained at the measurement temperature.

The measurement system is calibrated with Certified Reference Materials (CRMs) provided by Pr. A. Dickson (SIO, Univ. California,, USA). The precision of the system, evaluated from the analysis of CRMs, is usually around ±3 µmol/kg for both TA and DIC. The reproducibility of measurements, based on the analysis of replicate samples, is better than 5 µmol/kg for both TA and DIC.

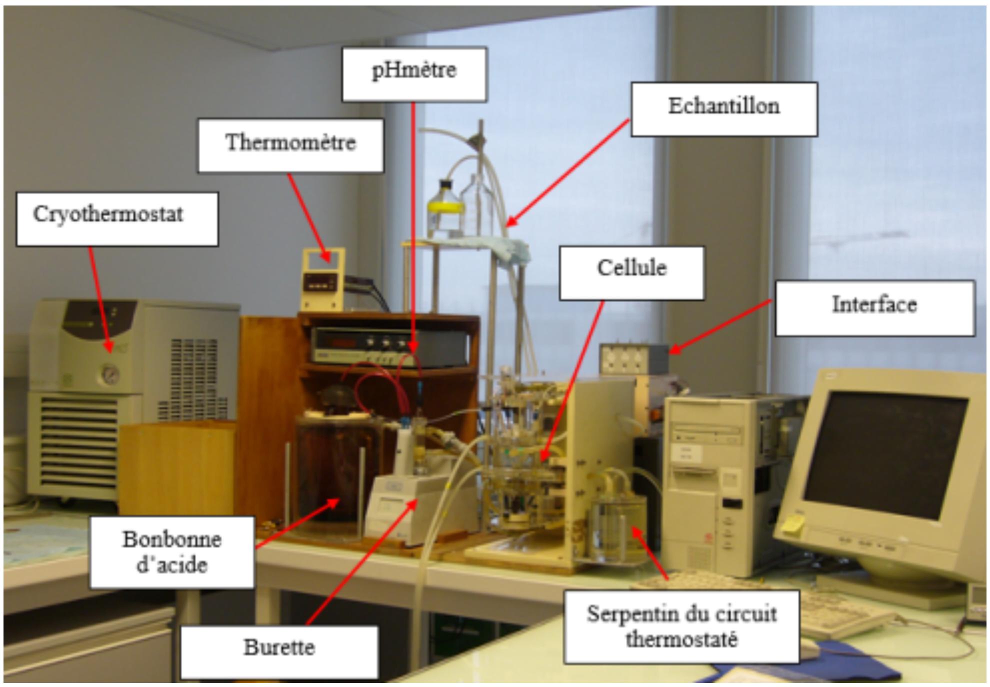


Figure A.3.1: Picture of the TA / DIC measurement system used at the SNAPOCO2

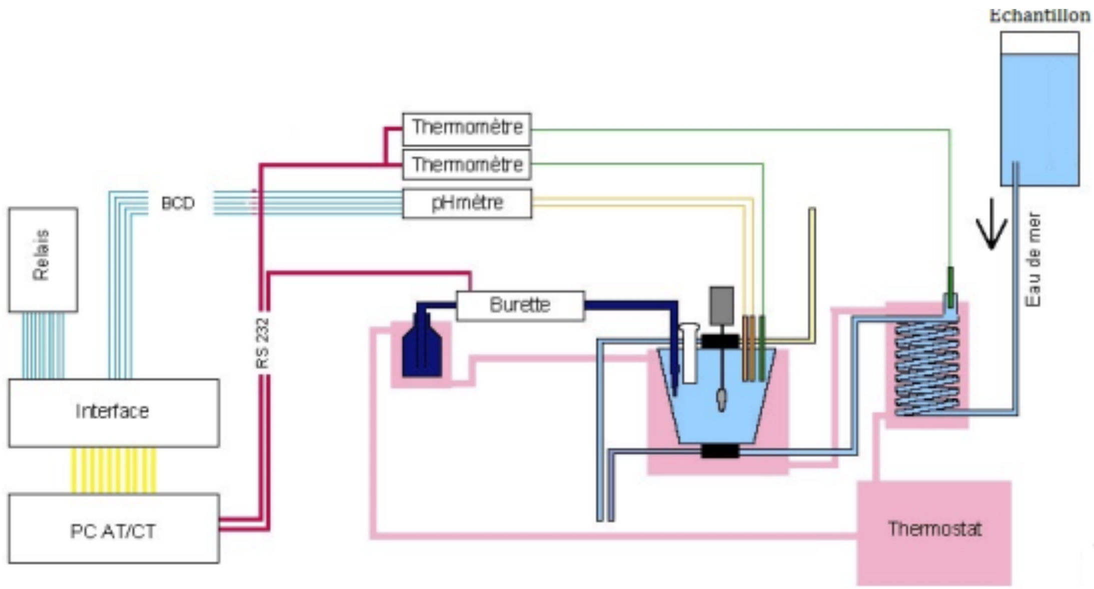
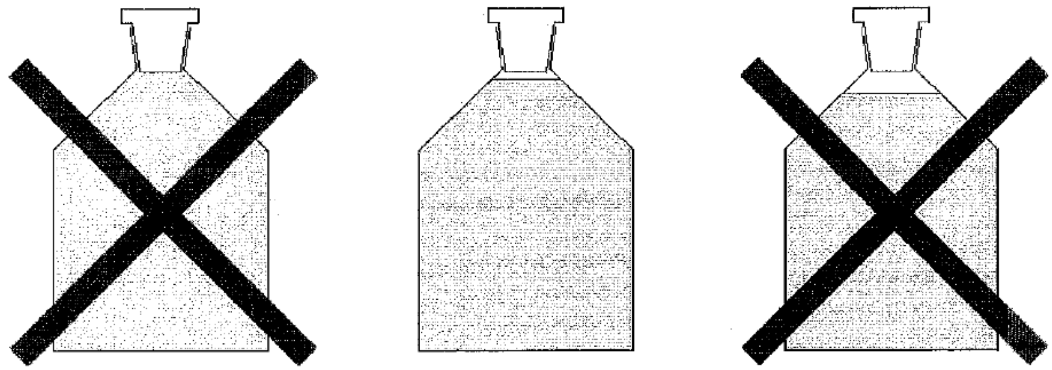


Figure A.3. 2: Schematics of the instrumentation used at the SNAPO-CO_2

Sampling procedure for Alkalinity and Total CO2 (CT or DIC)
Sampling is easy but needs a specific procedure. Thanks for your help and wish you a nice cruise and discoveries.

Filling PROCEDURE On Rosette-CTD - Sample for AT/CT (likely after oxygen).

1 Rinse the sample bottle: If the bottle is not already clean, rinse it twice with 30–50 cm3 of sample to remove any traces of a previous sample.
2 Fill the sample bottle: Fill the bottle smoothly from the bottom using a drawing tube which extends from the Niskin drain to the bottom of the glass sample bottle. It is critical to remove any bubbles from the draw tube before filling. Overflow the water by at least a half, and preferably by a full, bottle volume.
3 Adjust the headspace: A headspace of 1% of the bottle volume is left to allow for water expansion (see figure below). This can be achieved by pinching off the draw tube before removing it from the sample bottle or removing excess water using a plastic pipette with a bulb.
4 Add mercuric chloride. Mercuric chloride (HgCl2) is added to poison the sample (use the micro-pipette, fixed at 300 ul).
5 Close the bottle: Seal the bottle carefully to ensure that it remains gas-tight: Add a very thin layer of grease (Apiezon) on the stopper and twist the stopper to squeeze the air out of the grease to make a good seal.
6 Finally, secure the lid: Use a rubber band to block the stopper, then invert the bottle several times to disperse the mercuric chloride solution thoroughly.
7 Sample storage: The samples in boxes should be stored in a cool, dark, location (preferably refrigerated but not frozen) until use.



Information needed for AT/CT analysis, best would be to fill a simple table that include: Sample number, Station-number, Rosette-Bottle-number, Depth, Salinity, temperature, (any other informations : e.g. Niskin leakage, air bubbles during sampling, bottle not closed at correct depth, etc…).

HPLC / PIGMENTS *(Vincent Taillandier)*

Preparation

- 1- Tag cryotubes with sample ID choosing colour for pen and top 1 sample from underway system: WPT-MONTH-DAY-HOUR (UTC time) 6 samples at stations WPT-CTD-BTL (BTL=1:6)
- 2- Place one GF/F filter on each unit of filtration PUMP SWITCHED ON using the tap of the filtration unit

Sampling

3- FULLY fill sampling bottle (VOLUMIC METHOD)

4- IMMENDATELY store the bottle away from light (INSIDE GREY BOX)

Filtration

- 5- Switch off the light and close the store during filtration
- 6- Put the bottle upon the filtration unit, fixed with velcro and elastic
- 7- Switch on the pump and turn the tap of the filtration unit
- 8- Stop the filtration unit as soon as the seawater volume is filtered. INITIATE STORAGE ASAP FOR EACH SAMPLE
- 9- Fullfill the appropriate logsheet (station or underway) reporting eventually any loss of seawater from the 2.7L initial volume

Storage

-10 Remove the tulipe and fold the filter with the two pliers

- 11- Put the filter inside the associated cryotube (with BTL ID)

-12- In case of stations, put the 6 cryotubes in a ziloc plastic bag

- 13- Put the samples inside the FRIDGE -80°C AS SOON AS POSSIBLE

CHNS Sampling protocol : The Quartz filters *(Hassiba Lazar)*

1 ° - Sampling and filtration of samples on Quartz filters

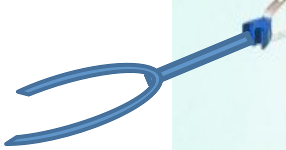
Hardware:

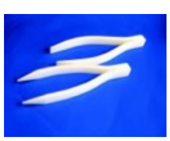
- 2L PET bottles,
- Filter unit 1L,
- Quartz filters prewashed in the lab with 200mL of milliq water, calcined at 500 ° C for 5h and weighed with the bottom of the box with the balance of the Water Geochemistry Team,
- Petri dishes,
- Electric vacuum pump,
- plastic clamp,
- Stand and clamp to hook the filtration unit,
- oven.

-







Protocol:

1. Take 2L or more of sea water by depth. Do not forget to wash the bottle when you move from one site to another. The washing is done with the sample of the site that you are going to take,

2. Unscrew the white ring from the funnel of the filter unit and place the quartz filter on the back plate of the PES filter unit,

3. Connect the hose located at the inlet of the pump to the outlet of the filter unit, turn on the pump and filter. The flow rate should not be> 10 mm Hg,

4. If after filtering 2L of sample the filter is very clear then filter in addition and until the filter is well loaded,

5. If the amount of filtered sample is sufficient, disconnect the hose that connects the pump to the bottom of the filter unit, unscrew the white ring between the top and bottom of the unit,

6. With the small plastic clamp recover the filter, taking care not to leave anything on the back pressure plate of the filter. The filters are weighed to µg and nothing should be lost. Any torn part will be recovered and placed in the petri dish corresponding to the sample. This is to avoid any weighing error,

7. Place the filter in the box with which it was weighed,

8. Write the reference of the site on the box. Important! Use the boxes in numerical order!

9. Mark the final filtered volume on your handbook,

10. Place the canister with its filter and sample in an oven and allow to dry overnight at 60 ° C. No more because the petri dish can melt.

The sample is ready to be stored in its bag.

Materials to be used:

(2) filtrates after filtration through Quartz filters

Hardware:

- Tubes FALCON 50mL,
- Tubes FALCON 14mL

Protocol:

After filtration through a quartz filter, take the filtrate and fill:

- 1 tube FALCON 50m. This will be the backup tube in case you want to do some analysis that you will not have planned,
- 2 tubes FALCON 14mL 1st tube for ICP, ... Add 2 drops of HNO_3. Close the tube and surround the parafilm cap

2nd tube for the chromato, ... Keep as. Close the tube and surround the paraffin plug

PHYTOPLANKTON TAXONOMY and BIODIVERSITY *(Fernando Gomez, LOV Boulogne-France, and Angela Oviedo, LOV)*

Sampling Protocol

1. Have ready an alkaline Lugol's solution: (20g potassium iodide (KI) dissolved in 200 ml of distilled water + 10g Crystalline iodine (I_2) + (50g sodium acetate (CH_3COONa) dissolved in a small part of the previous solution or in max. 20ml of distilled water). Keep in dark glass cover with aluminium foil.
2. Bring water from the niskin bottles using pre-rinsed (distilled water or filtered seawater) and dry baskets. You could use pumped water from the boat but this disintegrates colonies.
3. Fix samples with Lugol's solution; use ~ 0.5 -1 ml per 100 ml sample. Close.
4. Store in a **dark** place at 4 °C.

*Volum to filter:
1 litre filtered could be a maxima taken into account that the density of cell in the Antarctic ocean could reach 1 million of cells, such as suggested by the following values proposed by Kang, SH. & Fryxell, G.A. Marine Biology (1993) 116: 335. doi:10.1007/BF00350024 : 0.2×10^6 cells l-1 (all phyto); 0.14×10^6 cells l-1 (diatoms) and about 0.2×10^6 to 1million cells per L (Cefarelli, A.O., et al., Phytoplankton composition and abundance in relation to free-floating Antarctic icebergs. Deep-Sea Research II, 2011), doi:10.1016/j.dsr2.2010.11.023).

BIODIVERSITY Sampling Protocol

Method phytoplankton collection, preservation and storage

www.planktonlab.comfernando.gomez@fitoplancton.com

Preparation of lugol solution Lugol´s solution

IMPORTANT: For purchase, do not confuse with Lugol (stain for Gram + bacteria). Prepare by yourself.

neuter Lugol's solution (0.5 L)

50 gr potassium iodide (KI) 500 ml distilled water 25 gr iodine (I_2) (not the pure and expensive one!) .Dissolve 50 gr KI in 0.3 L of distilled water. Dissolve 25 gr iodine in 0.2 L of distilled water. The two solutions were mixed and any precipitates removed. Please the stock in a sink and take care because the iodine is highly oxidant. To be stored in dark conditions and glass (usually Amber =brown) bottles. Please divide the stock into two different bottles (in case of accident and lose of one bottle).

Procedure to preserve samples with Lugol's solution

Preservation of phytoplankton samples should be carried out immediately after the sample is transferred to the sample bottle. This is important because a loss of species can quickly develop (cell lysis, grazing), and prevent morphological changes (ecdysis or exuviation, encystment, retraction of body extensions).

For bottle samples: By using a Pasteur plastic pipette, 1 ml Lugol's solution should be added per ~130 ml of the water sample and store in the dark. Please take Lugol from the surface, not from the bottom because they are precipitates. This approximates to 3-5 drops using a Pasteur pipette, do so´drop by drop´ until the sample turns a darker tea colour. Please cover the tap with Parafilm©.

For using with plankton net samples: Because the concentration of organisms in plankton net samples generally is considerably higher than in bottle samples, a greater quantity of Lugol’s solution must be added (4 ml). Please cover the tap with Parafilm©.

Preparation of Lugol´s solution

IMPORTANT: For purchase, do not confuse with Lugol (stain for Gram + bacteria). Prepare by yourself.

neuter Lugol’s solution (0.5 L)
50 gr potassium iodide (KI) 500 ml distilled water 25 gr iodine (I_2) (not the pure and expensive one!)

Dissolve 50 gr KI in 0.3 L of distilled water. Dissolve 25 gr iodine in 0.2 L of distilled water. The two solutions were mixed and any precipitates removed. Please the stock in a sink and take care because the iodine is highly oxidant.
To be stored in dark conditions and glass (usually Amber =brown) bottles. Please divide the stock into two different bottles (in case of accident and lose of one bottle).

Procedure to preserve samples with Lugol’s solution

Preservation of phytoplankton samples should be carried out immediately after the sample is transferred to the sample bottle. This is important because a loss of species can quickly develop (cell lysis, grazing), and prevent morphological changes (ecdysis or exuviation, encystment, retraction of body extensions).
For bottle samples: By using a Pasteur plastic pipette, 1 ml Lugol’s solution should be added per ~130 ml of the water sample and store in the dark. Please take Lugol from the surface, not from the bottom because they are precipitates. This approximates to 3-5 drops using a Pasteur pipette, do so´drop by drop´ until the sample turns a darker tea colour. Please cover the tap with Parafilm©.
For using with plankton net samples: Because the concentration of organisms in plankton net samples generally is considerably higher than in bottle samples, a greater quantity of Lugol’s solution must be added (4 ml). Please cover the tap with Parafilm©. The lugol preservation is used for both Niskin samples and Net samples.

Sample collection (bottle sample)

1 ml Lugol Polyestyrene plastic bottle (~130 ml seawater)
station, depth , Storage: dark, cool and quiet place, preservation in both lugol and ethanol

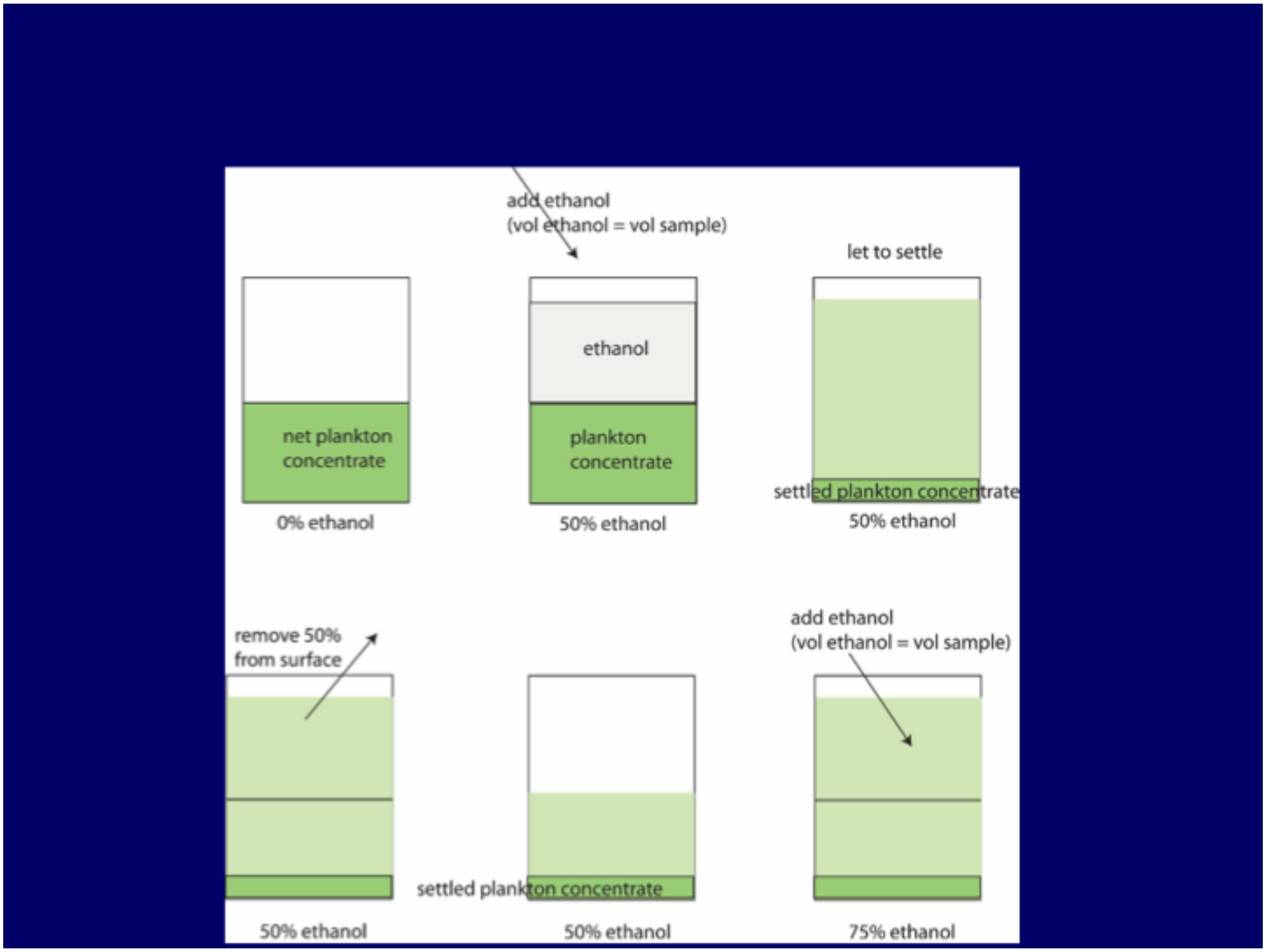
Using the plankton net

The plankton net shall be raised slowly to the surface. Hauling speed shall not exceed 0.3 m per second (~1 Km h^{-1}). If the net is hauled too quickly, it will act like a bucket and not sample phytoplankton.

Any material adhering to the plankton net shall be rinsed with seawater down into the collection cup at its end piece. The phytoplankton sample shall contain little seawater. The amount of material collected shall be inspected. Please remove big organisms (medusa, ctenophores) before fixation. If there is insufficient material, the plankton net shall be deployed several times, making sure that any material adhering to the net is washed down into the collection cup between each deployment, otherwise this material may be lost during the new haul. The collection cup shall be removed and the sample shall be decanted into the universal container. The sample shall be fixed immediately.

Sample collection (net sample)

~130 ml plankton concentrate
station, depth
Storage: dark, cool and quiet place , 4 ml Lugol or ethanol



Protocol to preserve the samples in ethanol (to analyze genetic) .

The final concentration of ethanol in the net sample should be, at least, higher than 70% (better 90%) Sample bottles can be labelled with broad white tape or sufficiently large label. The following information should be written on the bottle in the field using waterproof marker pen or pencil (additional information may be noted on a separate form or in the sample logsheet):
• **Name of site or locality (sampling station number)** • **Sample depth (single depth or integrated sample, e.g. 0 m-10 m).** It should be clear: • Geographical coordinates. • Date, hour of sampling. • Sample type and preservative used. • Project name. • Initials of personnel who collected the sample. • Code of the CTD cast.
Sample storage

Phytoplankton samples should be stored in a cool, dark place (~3 °C-10 °C). For long-term storage (>1 year), the samples need to be checked periodically and if necessary topped up with preservative.

Maintenance of the plankton net

The plankton net shall be thoroughly rinsed before deployment at the next station. There shall not be any remaining phytoplankton in the net when the next sample is taken. The equipment shall preferably be washed in freshwater. The net shall then be hung up to dry (avoid direct sunlight or exposed to sharp or pointed objects). Before the net is stored for future use, it shall be checked to ensure there are no tears or holes. Plankton nets must be stored in a dark place because the netting material tends to become damaged by sunlight. After the cruise, plankton nets need to be washed sometimes in soapy water. They are soaked for one day and then abundantly rinsed in freshwater. After rinsing, they are soaked in freshwater for one day to make sure all traces of soap are removed from the mesh.

Appendix 4: Count of number of samples collected, measurement performed, by station, by transect and for the total cruise

Table A4.1. Sampling strategy for the transect and station where was collected discrete samples to measure all biogeochemical parameter. Locations of Weddell transects sampled for biogeochemistry parameter and approximate water depth (meters, taken from altimeter during CTD casts), date sampled and corresponding CTD number. The table starts with surface sampling sorted backward in time, then sampling on stations are shown sorted forward in time.

Station	Niskin	Day	Month	Year	Time	Latitude	Longitude	BotDepth	Winkler	DIC	Pigments	CHNS	Taxonomy	Net
surface	0	9	3	2017	68,791664	-58,0583	-51,311001	1	0	0	1	1	0	0
surface	0	9	3	2017	68,621529	-58,446499	-50,028	1	3	0	1	1	1	0
surface	0	9	3	2017	68,465279	-58,7481	-48,954899	1	3	0	1	1	1	0
surface	0	9	3	2017	68,291664	-59,149899	-47,557098	1	3	0	1	1	1	0
surface	0	9	3	2017	68,114586	-59,483501	-46,361698	1	3	0	1	1	1	0
surface	0	8	3	2017	67,965279	-59,782001	-45,345402	1	3	0	1	1	1	0
surface	0	8	3	2017	67,791664	-60,2006	-43,8591	1	3	0	1	1	1	0
surface	0	8	3	2017	67,466667	-60,658501	-42,0676	1	0	0	1	1	1	0
surface	0	8	3	2017	67,292358	-61,149899	-41,519299	1	3	0	1	1	1	0
surface	0	7	3	2017	66,947914	-61,753399	-40,741501	1	3	0	1	1	1	0
surface	0	7	3	2017	66,791664	-62,375599	-40,190399	1	3	0	1	1	1	0
surface	0	7	3	2017	66,621529	-63,057201	-39,5448	1	3	0	1	1	1	0
surface	0	7	3	2017	66,462502	-63,698299	-38,944599	1	3	0	1	1	1	0
surface	0	7	3	2017	66,289581	-64,365402	-38,282101	1	3	0	1	1	1	0
surface	0	7	3	2017	66,117363	-64,9776	-37,664299	1	3	0	1	1	1	0
surface	0	6	3	2017	65,952782	-65,565201	-37,065701	1	3	0	1	1	1	0
surface	0	6	3	2017	65,815277	-66,106201	-36,622299	1	3	0	1	1	1	0
surface	0	6	3	2017	65,628471	-66,815102	-35,816898	1	3	0	1	1	1	0
surface	0	6	3	2017	65,458336	-67,4664	-35,1791	1	3	0	1	1	1	0

surface	0	5	3	2017	64,961113	-69,246696	-32,994301	1	3	0	1	1	1	0
surface	0	5	3	2017	64,795135	-69,891899	-32,201199	1	3	0	1	1	1	0
surface	0	5	3	2017	64,631248	-70,473	-32,125198	1	3	0	1	1	1	0
surface	0	5	3	2017	64,461113	-71,136803	-32,1745	1	3	0	1	1	1	0
surface	0	5	3	2017	64,291664	-71,800301	-32,069199	1	3	0	1	1	1	0
surface	0	5	3	2017	64,18264	-72,200104	-32,063801	1	3	0	1	1	1	0
surface	0	4	3	2017	63,972221	-73,001099	-32,033501	1	3	0	1	1	1	0
surface	0	25	2	2017	56,711807	-77,631798	-35,502701	1	2	1	1	1	1	0
surface	0	25	2	2017	56,463196	-76,767502	-32,7901	1	2	1	1	1	1	0
surface	0	25	2	2017	56,083332	-75,290901	-30,737101	1	2	0	1	1	2	0
surface	0	18	2	2017	49,958332	-75,287804	-31,7416	706	0	0	1	1	1	0
surface	0	13	2	2017	44,083332	-75,213501	-30,0646	421	2	0	1	1	1	0
surface	0	12	2	2017	43,954166	-74,852501	-30,6215	483	0	0	0	1	1	0
surface	0	12	2	2017	43,717361	-74,850502	-31,3783	598	2	0	1	1	1	0
surface	0	12	2	2017	43,458332	-74,856201	-31,1653	581	2	0	1	1	1	0
surface	0	9	2	2017	40,962502	-74,915199	-26,734699	302	0	0	1	1	1	0
surface	0	9	2	2017	40,208332	-74,926598	-28,7159	444	2	1	1	1	1	0
surface	0	8	2	2017	39,724998	-74,020699	-28,169701	2511	2	1	1	1	2	0
surface	0	8	2	2017	39,458332	-73,2314	-28,684401	3489	2	1	1	1	1	0
surface	0	8	2	2017	39,208332	-72,247902	-28,776199	4058	2	1	1	1	1	0
surface	0	7	2	2017	38,956249	-71,262001	-28,7829	4174	2	1	1	1	2	0
surface	0	7	2	2017	38,708332	-70,220703	-28,8617	4551	3	1	1	1	1	0
surface	0	7	2	2017	38,299305	-68,440598	-28,8515	4705	2	1	1	1	1	0
surface	0	7	2	2017	38,206249	-68,024002	-28,85	4686	3	1	1	1	1	0
surface	0	6	2	2017	37,967361	-67,045403	-28,882401	4760	1	1	1	1	2	0
surface	0	6	2	2017	37,727081	-65,987503	-28,854401	4873	3	1	1	1	2	0
surface	0	30	1	2017	30,206944	-55,198799	-34,750801	161	3	0	1	1	1	0
surface	0	29	1	2017	29,960417	-55,048801	-36,371899	268	2	0	1	1	1	0
surface	0	29	1	2017	29,725695	-54,454102	-37,614101	324	2	0	1	1	1	0

surface	0	29	1	2017	29,455557	-54,0695	-38,188499	129	2	0	1	1	1	0
surface	0	29	1	2017	29,246529	-53,838402	-39,647598	1417	2	0	1	1	1	0
surface	0	28	1	2017	28,96875	-53,569	-41,2565	173	2	0	1	1	1	0
surface	0	28	1	2017	28,722221	-53,2542	-43,1679	1258	2	0	1	1	1	0
surface	0	28	1	2017	28,4625	-52,903198	-45,093399	2875	2	0	1	1	1	0
surface	0	28	1	2017	28,206249	-52,776798	-46,777302	3354	2	0	1	1	1	0
surface	0	27	1	2017	27,952084	-52,811001	-48,570499	3451	2	0	1	1	1	0
surface	0	27	1	2017	27,713888	-52,852299	-50,225101	2662	2	0	1	1	1	0
surface	0	27	1	2017	27,479168	-52,879398	-51,834099	3111	2	0	1	1	1	0
surface	0	26	1	2017	26,984028	-52,948399	-55,329601	2150	2	0	1	1	0	0
surface	0	26	1	2017	26,743055	-52,974998	-56,780399	1595	2	0	1	1	0	0
1	24	26	1	2017	26,605051	-52,978001	-57,019001	1587	10	0	5	2	0	0
3	3	30	1	2017	30,268742	-55,215	-34,507999	405	0	0	0	0	0	0
4	7	30	1	2017	30,31962	-55,230999	-34,488998	1049	0	0	0	0	0	0
5	8	30	1	2017	30,390215	-55,258999	-34,444	1509	0	0	0	0	0	0
6	18	30	1	2017	30,487734	-55,290001	-34,401001	2088	15	15	6	2	4	2
7	7	30	1	2017	30,659163	-55,485001	-34,132999	2487	5	0	0	0	0	0
8	24	30	1	2017	30,852465	-55,723	-33,783001	3521	16	13	6	2	6	4
9	17	31	1	2017	31,352274	-56,379002	-32,870998	3168	19	15	6	1	2	0
10	20	31	1	2017	31,634331	-56,775002	-32,299	3282	15	15	6	2	4	0
11	7	1	2	2017	32,47271	-57,119999	-31,813999	3465	0	0	0	0	0	0
12	20	1	2	2017	32,698608	-57,458	-31,327	3817	18	15	6	2	4	4
13	12	1	2	2017	32,922577	-57,798	-30,832001	3509	0	0	0	0	0	0
14	20	2	2	2017	33,191681	-58,213001	-30,820999	4062	16	13	5	1	2	0
15	11	2	2	2017	33,442287	-58,634998	-30,823	3566	0	0	0	0	0	0
16	18	2	2	2017	33,65757	-59,049999	-30,829	3161	19	15	6	2	2	0
17	12	2	2	2017	33,855659	-59,436001	-30,858	3468	0	0	0	0	0	0
18	11	3	2	2017	34,050571	-59,674999	-30,896	2980	0	0	0	0	0	0
19	19	3	2	2017	34,197819	-59,765999	-30,905001	3851	18	15	6	2	2	0

20	18	3	2	2017	34,411903	-59,992001	-30,93	3035	15	15	6	2	3	0
21	11	3	2	2017	34,612175	-60,313	-30,954	2776	0	0	0	0	0	0
22	18	3	2	2017	34,801876	-60,696999	-31,120001	1698	15	15	6	2	4	0
23	11	4	2	2017	35,029694	-61,109001	-31,039	2547	0	0	0	0	0	0
24	17	4	2	2017	35,158497	-61,169998	-31,045	3535	17	15	6	1	2	0
25	17	4	2	2017	35,40411	-61,550999	-31,103001	4127	16	15	6	2	2	0
26	12	4	2	2017	35,5681	-61,660999	-31,110001	3441	0	0	0	0	0	0
27	19	4	2	2017	35,817287	-62,075001	-31,181999	4936	16	15	6	2	3	2
28	12	5	2	2017	36,11005	-62,491001	-31,261	4847	0	0	0	0	0	0
29	17	5	2	2017	36,363716	-62,783001	-30,698	4917	16	15	6	1	3	0
30	12	5	2	2017	36,613628	-63,071999	-30,112	4966	0	0	0	0	0	0
31	21	5	2	2017	36,851536	-63,348	-29,570999	4804	16	16	6	2	5	4
32	18	6	2	2017	37,175041	-63,965	-28,877001	4889	16	15	6	2	4	0
33	10	8	2	2017	39,906265	-74,028999	-28,09	2497	3	0	6	3	6	0
34	14	9	2	2017	40,302563	-75,202003	-29,052999	387	6	6	3	2	2	0
35	14	9	2	2017	40,360249	-75,268997	-28,905001	397	6	6	3	2	2	0
36	15	9	2	2017	40,41893	-75,337997	-28,738001	408	6	6	3	2	3	0
37	15	9	2	2017	40,471767	-75,403	-28,591999	428	6	0	3	2	2	0
38	19	9	2	2017	40,694695	-75,470001	-28,461	416	6	6	6	2	4	0
39	7	9	2	2017	40,760582	-75,537003	-28,311001	305	2	0	3	2	4	2
40	7	10	2	2017	41,085712	-74,588997	-26,014	514	0	0	2	2	4	0
41	13	10	2	2017	41,152348	-74,504997	-26,115	497	5	5	2	2	2	0
43	15	10	2	2017	41,311306	-74,424004	-26,231001	1492	6	6	2	2	2	0
44	12	10	2	2017	41,413235	-74,327003	-26,393	2218	2	0	2	2	2	0
45	24	10	2	2017	41,516479	-74,258003	-26,414	2625	7	8	6	2	4	2
46	24	10	2	2017	41,64003	-74,212997	-26,621	2704	7	8	6	2	2	0
47	10	11	2	2017	42,024563	-74,848999	-30,049999	404	2	0	3	2	2	0
48	14	11	2	2017	42,08363	-74,763	-30,007999	407	5	5	2	2	2	0
49	8	11	2	2017	42,162197	-74,677002	-29,971001	411	2	0	2	2	2	0

50	12	11	2	2017	42,241993	-74,591003	-29,924999	529	6	6	2	2	2	0
51	17	11	2	2017	42,329712	-74,505997	-29,868999	916	8	8	2	2	2	0
52	17	11	2	2017	42,42696	-74,416	-29,833	1228	8	9	2	2	2	0
53	13	11	2	2017	42,731831	-74,843002	-30,361	434	5	5	2	2	2	0
54	15	11	2	2017	42,813606	-74,851997	-30,719	478	5	5	2	3	2	2
55	19	11	2	2017	42,932884	-74,855003	-31,038	534	5	6	5	3	3	0
56	14	12	2	2017	43,020012	-74,849998	-31,379999	577	5	6	2	2	2	2
57	14	12	2	2017	43,113777	-74,849998	-32,037998	595	6	6	2	2	2	0
58	14	12	2	2017	43,22562	-74,845001	-32,398998	585	6	6	2	2	2	0
59	14	12	2	2017	43,368977	-74,849998	-31,709	605	6	6	2	2	2	0
60	12	13	2	2017	44,475449	-76,600998	-32,078999	375	4	3	2	2	2	0
61	12	13	2	2017	44,533257	-76,555	-32,285999	441	5	5	2	2	2	0
62	16	13	2	2017	44,623249	-76,450996	-32,755001	638	6	6	2	2	2	0
63	16	13	2	2017	44,710205	-76,348	-33,139	812	6	6	2	2	2	0
64	14	13	2	2017	44,794544	-76,263	-33,625999	780	6	5	2	2	2	2
65	16	13	2	2017	44,864822	-76,224998	-33,807999	780	7	7	5	2	2	0
66	16	13	2	2017	44,96735	-76,306999	-33,389	798	5	6	2	2	2	0
67	14	14	2	2017	45,099697	-76,508003	-32,498001	495	6	6	2	2	2	0
68	10	14	2	2017	45,316265	-77,084	-33,765999	369	2	0	2	2	2	0
69	8	14	2	2017	45,439056	-77,053001	-34,078999	480	6	0	2	2	2	0
70	15	14	2	2017	45,552067	-77,017998	-34,442001	672	6	6	2	2	2	0
71	17	14	2	2017	45,644604	-76,980003	-34,667	841	7	7	2	2	2	0
72	24	14	2	2017	45,769493	-76,953003	-35,002998	951	9	9	6	2	4	4
73	10	15	2	2017	46,978436	-77,777	-35,736	439	5	3	6	3	5	2
76	2	16	2	2017	47,118607	-77,777	-35,736	77	2	0	2	2	0	0
79	21	16	2	2017	47,213829	-77,777	-35,736	103	2	0	2	2	0	0
82	17	16	2	2017	47,318604	-77,777	-35,736	82	2	0	2	2	0	0
85	17	16	2	2017	47,413452	-77,777	-35,736	52	2	0	2	2	0	0
88	19	16	2	2017	47,510288	-77,777	-35,736	83	4	4	4	2	6	2

91	24	16	2	2017	47,6073	-77,777	-35,736	445	6	6	6	3	3	0
93	16	18	2	2017	49,556	-76,464996	-32,742001	627	6	4	4	2	4	2
94	19	19	2	2017	50,134869	-74,848999	-32,695999	575	6	6	2	2	2	0
95	19	19	2	2017	50,234432	-74,834	-33,082001	568	6	6	2	2	2	0
96	17	19	2	2017	50,347221	-74,869003	-33,376999	555	7	6	2	2	2	0
97	18	19	2	2017	50,456707	-74,862999	-33,709	544	6	6	2	2	4	0
98	20	19	2	2017	50,546967	-74,847	-34,073002	531	6	6	2	2	4	0
100	18	20	2	2017	51,33699	-74,874001	-34,349998	524	6	6	2	2	2	0
101	18	20	2	2017	51,485596	-74,778999	-34,113998	533	6	6	2	2	4	0
102	16	20	2	2017	51,654072	-74,600998	-34,037998	533	6	6	3	3	4	0
103	21	20	2	2017	51,81398	-74,498001	-34,25	528	9	9	4	3	4	2
104	20	20	2	2017	51,898628	-74,408997	-34,269001	544	8	9	3	3	3	0
105	19	21	2	2017	52,018238	-74,309998	-34,34	951	8	8	3	3	3	0
106	18	21	2	2017	52,14513	-74,228996	-34,386002	1355	7	7	3	2	3	0
107	19	21	2	2017	52,291248	-74,153	-34,175999	1615	8	8	3	2	3	0
108	20	21	2	2017	52,428635	-74,065002	-34,074001	1876	8	8	6	2	3	0
109	20	21	2	2017	52,565716	-73,971001	-34,103001	2136	8	10	3	3	3	0
110	24	21	2	2017	52,91074	-73,893997	-33,917999	2246	8	10	6	3	3	2
128	10	23	2	2017	54,536545	-74,656998	-33,085999	595	5	0	0	0	0	0
129	10	23	2	2017	54,871796	-74,858002	-32,066002	590	5	0	0	0	0	0
130	22	24	2	2017	55,159225	-74,162003	-29,691999	1951	7	7	6	3	5	0
131	17	24	2	2017	55,267258	-74,248001	-29,738001	1759	7	7	3	3	3	0
132	16	24	2	2017	55,355171	-74,334	-29,785	1497	7	7	3	3	3	0
133	17	24	2	2017	55,433933	-74,417999	-29,830999	1225	8	7	3	3	3	0
134	12	24	2	2017	55,532669	-74,585999	-29,927999	548	5	5	2	2	3	0
135	21	24	2	2017	55,681881	-74,553001	-29,900999	729	6	6	3	3	5	4
136	15	24	2	2017	55,851299	-74,505997	-29,865999	921	8	6	3	2	2	0
137	18	25	2	2017	56,776302	-77,808998	-36,037998	546	6	5	6	3	3	0
138	21	25	2	2017	56,850109	-77,833	-36,333	723	8	6	6	2	4	0

140	15	25	2	2017	56,977547	-77,839996	-36,549999	862	7	6	2	2	4	0
141	16	26	2	2017	57,060467	-77,839996	-36,632	922	7	6	3	2	2	0
144	14	26	2	2017	57,273247	-77,862999	-36,993999	1045	7	5	2	2	2	0
146	2	26	2	2017	57,466877	-77,873001	-37,205002	1091	0	0	0	0	0	0
147	24	26	2	2017	57,523216	-77,874001	-37,319	1081	14	7	4	2	2	0
148	3	26	2	2017	57,627411	-77,885002	-37,432999	1094	0	0	0	0	0	0
149	20	26	2	2017	57,689632	-77,897003	-37,665001	1119	8	7	2	2	2	0
150	5	26	2	2017	57,776299	-77,880997	-38,127998	1172	0	0	0	0	0	0
151	8	26	2	2017	57,883831	-77,805	-39,363998	1060	0	0	0	0	0	0
152	10	26	2	2017	57,951115	-77,801003	-39,766998	1020	7	0	2	2	2	0
153	6	27	2	2017	58,01997	-77,817001	-40,16	926	0	0	0	0	0	0
154	14	27	2	2017	58,086769	-77,816002	-40,507	890	6	5	2	2	2	0
155	8	27	2	2017	58,166283	-77,778999	-40,902	838	0	0	0	0	0	0
156	18	27	2	2017	58,249474	-77,791	-41,285999	799	7	5	2	2	2	0
157	8	27	2	2017	58,338814	-77,808998	-41,681999	749	0	0	0	0	0	0
158	15	27	2	2017	58,43261	-77,841003	-42,111	671	6	5	2	2	2	0
159	3	27	2	2017	58,519405	-77,879997	-42,471001	594	0	0	0	0	0	0
160	21	27	2	2017	58,774849	-77,918999	-42,171001	678	6	6	3	2	2	0
161	8	27	2	2017	58,853035	-77,903	-42,147999	682	0	0	0	0	0	0
162	7	27	2	2017	58,925346	-77,887001	-42,127998	683	0	0	0	0	0	0
164	8	28	2	2017	59,036602	-77,855003	-42,089001	677	1	1	1	1	1	0
165	6	28	2	2017	59,089645	-77,822998	-42,041	666	0	0	0	0	0	0
166	10	28	2	2017	59,136791	-77,791	-41,997002	673	3	0	1	1	1	0
167	24	28	2	2017	59,583656	-77,746002	-38,983002	1085	6	0	2	2	2	0
168	24	28	2	2017	59,763645	-77,847	-38,59	1152	7	8	3	3	3	0
169	24	4	3	2017	63,017616	-74,400002	-34,310001	522	0	0	0	0	0	0
170	3	4	3	2017	63,09306	-74,348	-34,297001	685	0	0	0	0	0	0
171	24	4	3	2017	63,153553	-74,310997	-34,359001	954	0	0	0	0	0	0
172	3	4	3	2017	63,239437	-74,273003	-34,386002	1055	0	0	0	0	0	0

173	8	4	3	2017	63,337097	-74,224998	-34,396	1375	10	0	0	0	0	0
174	13	8	3	2017	67,048485	-61,596001	-40,908001	3209	8	0	2	2	2	0
175	24	8	3	2017	67,524994	-60,672001	-42,111	3210	10	6	3	2	2	0
198	**1998**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**959**	**691**	**417**	**283**	**340**	**44**

Appendix 5: Cruise Event Log

Time	Event	Lat	Lon	Comment
08/03/17 14:18		-60.67291	-42.11907	Vsl on passage
08/03/17 14:12		-60.67178	-42.11082	Vsl off DP
08/03/17 14:08	210	-60.67078	-42.11161	PROVOR float deployed
08/03/17 13:50	209	-60.67007	-42.11213	CTD recovered
08/03/17 12:34	209	-60.67191	-42.11081	CTD stopped at 3183m
08/03/17 11:41	209	-60.67188	-42.11086	CTD veering to 3100m
08/03/17 11:39	209	-60.67192	-42.11081	CTD 175 deployed
08/03/17 11:30		-60.67082	-42.10888	Vsl on DP
08/03/17 11:24		-60.66351	-42.09574	Contour found
08/03/17 11:12		-60.65841	-42.0676	Vsl searching for 3200m depth contour
08/03/17 03:00		-61.60069	-40.89229	Vsl on passage
08/03/17 02:54		-61.5986	-40.90606	Vsl off DP
08/03/17 02:49	208	-61.59725	-40.90726	PROVOR float deployed
08/03/17 02:42	208	-61.59619	-40.90802	Commenced PROVOR Float deployed
08/03/17 02:21	207	-61.59602	-40.90826	CTD recovered
08/03/17 01:09	207	-61.59604	-40.90818	CTD stopped at 3153m
08/03/17 00:16	207	-61.59604	-40.90826	CTD veering to 3100m
08/03/17 00:10	207	-61.596	-40.90822	CTD 174 deployed
08/03/17 00:00		-61.59388	-40.9072	Vsl on DP
07/03/17 23:54		-61.59503	-40.9017	Vsl slowing down for station
04/03/17 09:00		-74.22518	-34.42393	VSL on passage departing Weddell Sea area towards South Orkney Passage.
04/03/17 08:54		-74.22326	-34.41873	VSL off DP
04/03/17 08:49	206	-74.22354	-34.41602	CTD recovered
04/03/17 08:08	206	-74.22528	-34.39672	CTD at depth 1359m (EA600 1400) comme
04/03/17 07:36	206	-74.22624	-34.38412	CTD 173 deployed
04/03/17 07:34	206	-74.22631	-34.38384	CTD off deck
04/03/17 07:30		-74.22638	-34.38353	VSL on DP
04/03/17 07:24		-74.22652	-34.38254	commence slow down
04/03/17 06:18		-74.27167	-34.39192	On Passage
04/03/17 06:12		-74.27218	-34.3943	VSL off DP
04/03/17 06:09	205	-74.27233	-34.3934	CTD Recovered to Deck
04/03/17 05:40	205	-74.27379	-34.385	CTD Stopped at 1128m
04/03/17 05:16	205	-74.27487	-34.37861	CTD Veering to approx 1000m
04/03/17 05:14	205	-74.27502	-34.37803	CTD in the Water
04/03/17 05:11	205	-74.27526	-34.3772	Commence Deploying CTD 172
04/03/17 05:06		-74.27541	-34.37642	VSL on DP
04/03/17 04:54		-74.28091	-34.36615	Commence Slowing Down
04/03/17 04:18		-74.30761	-34.36833	On Passage
04/03/17 04:12		-74.3106	-34.36994	VSL off DP
04/03/17 04:09	204	-74.31051	-34.36838	CTD Recovered to Deck
04/03/17 03:40	204	-74.3114	-34.35821	CTD Stopped 942m
04/03/17 03:22	204	-74.31252	-34.35246	CTD Veering to Approx 900m
04/03/17 03:19	204	-74.31278	-34.35187	CTD in the Water
04/03/17 03:17	204	-74.31284	-34.35163	Commence Deploying CTD 171
04/03/17 03:12		-74.31294	-34.35122	VSL on DP
04/03/17 03:00		-74.31419	-34.34638	Commence Slowing Down
04/03/17 02:42		-74.33956	-34.30433	Vsl on passage
04/03/17 02:36		-74.34793	-34.30069	Vsl off DP
04/03/17 02:30	203	-74.3481	-34.30034	CTD recovered
04/03/17 02:11	203	-74.34843	-34.29657	CTD stopped at 723m
04/03/17 01:57	203	-74.34863	-34.29393	CTD veering to 700m
04/03/17 01:53	203	-74.34863	-34.29394	CTD 170 deployed
04/03/17 01:48		-74.3488	-34.29455	Vsl on DP
04/03/17 01:42		-74.35006	-34.29631	Vsl slowing down
04/03/17 00:54		-74.39848	-34.32227	Vsl on passage
04/03/17 00:48		-74.3989	-34.31872	Vsl off DP

04/03/17 00:40	202	-74.39924	-34.31527	CTD recovered
04/03/17 00:22	202	-74.39998	-34.30954	CTD stopped at 534m
04/03/17 00:11	202	-74.40002	-34.30533	CTD veering to 500m
04/03/17 00:08	202	-74.40002	-34.30414	CTD 169 deployed
03/03/17 23:36		-74.3997	-34.29495	Vsl on DP
03/03/17 23:24		-74.39262	-34.2793	Vsl slowing down
03/03/17 19:30		-74.58777	-34.05494	VSL off DP
03/03/17 19:26	201	-74.58794	-34.05419	Wor geordie on deck - persons aboard
03/03/17 19:22	201	-74.58808	-34.05411	Wor geordie lifted - 5 persons
03/03/17 19:20	201	-74.58815	-34.05405	seal away - team returning to vessel
03/03/17 19:00	201	-74.58882	-34.05344	Seal Waking Up
03/03/17 18:06	201	-74.59002	-34.05298	Hood On Seal
03/03/17 17:56	201	-74.59012	-34.0533	Seal Team (5 Persons) on the Ice
03/03/17 17:51	201	-74.59019	-34.0536	VSL Alongside Floe
03/03/17 17:40	201	-74.59025	-34.05584	Approaching the Floe
03/03/17 17:00		-74.59103	-34.06356	VSL on DP
03/03/17 16:52	201	-74.5922	-34.06184	Stopped to Assess
03/03/17 16:42	201	-74.5977	-34.0699	Seal Sighted
03/03/17 15:54		-74.62815	-34.07519	On Passage
03/03/17 15:48	200	-74.62795	-34.07286	Seal Too Small Turning Around
03/03/17 15:20	200	-74.62666	-34.05972	VSL Approaching Floe
03/03/17 15:05	200	-74.62386	-34.05932	VSL Stopped to Assess
03/03/17 14:58	200	-74.62354	-34.05565	Seal sighted
03/03/17 14:24	200	-74.64069	-34.05337	Crab Eater
03/03/17 13:30	200	-74.65159	-33.9883	Seal sighted
03/03/17 12:30	200	-74.66885	-34.02631	Seal identified 'Crab Eater' vsl proceeding
03/03/17 12:20	200	-74.66398	-34.04116	Seal sighted
03/03/17 11:48	200	-74.66456	-34.08335	Seal identified 'Crab Eater' vsl proceeding
03/03/17 11:20	200	-74.66943	-34.13813	Seal sighted
02/03/17 18:06		-75.25812	-31.386	On Passage
02/03/17 18:00		-75.26462	-31.37596	VSL off DP
02/03/17 17:48	199	-75.26601	-31.37317	Seal Team Recovered to Deck
02/03/17 17:45	199	-75.26627	-31.37381	Seal Team Clear of Floe
02/03/17 17:44	199	-75.26637	-31.37402	2nd Seal in the Water
02/03/17 17:27	199	-75.26805	-31.37836	2nd Seal Waking Up
02/03/17 16:46	199	-75.27196	-31.39172	Hood on Second Seal
02/03/17 16:44	199	-75.27214	-31.39244	1st Seal in the Water
02/03/17 16:40	199	-75.27258	-31.3936	1st Seal Awake Approaching Second Seal
02/03/17 16:33	199	-75.27329	-31.39537	First Seal Waking Up
02/03/17 15:52	199	-75.2778	-31.40442	Hood on First Seal
02/03/17 15:44	199	-75.27873	-31.4064	Commence Lifting Seal Team (5 Persons)
02/03/17 15:42	199	-75.27899	-31.40697	VSL Alongside Floe
02/03/17 15:26	199	-75.28185	-31.41322	VSL Approaching Seals
02/03/17 14:48	199	-75.28627	-31.42508	Vsl on DP
02/03/17 14:42	199	-75.29742	-31.41841	Seal identified as Weddel seal
02/03/17 14:30	199	-75.32974	-31.39848	Seal sighted
02/03/17 13:30	198	-75.43411	-31.52474	Seal identified as Crab eater
02/03/17 12:48	198	-75.45109	-31.43032	Seal sighted
01/03/17 16:36		-76.7396	-35.57248	Seals (x2) Identified as Crabeaters
01/03/17 16:18		-76.75057	-35.5366	Seal Sighted Approaching
01/03/17 15:48		-76.75623	-35.458	VSL off DP
01/03/17 15:36	197	-76.75833	-35.45995	Seal Team Recovered to Deck
01/03/17 15:35	197	-76.75849	-35.46004	Seal Tagging Team off the Ice (5 Persons)
01/03/17 15:34	197	-76.75867	-35.4601	Seal in the Water
01/03/17 15:30	197	-76.75929	-35.46042	Seal Team on the Floe (5 Persons)
01/03/17 15:29	197	-76.75945	-35.46053	Commence Deploying Seal Tagging Team
01/03/17 14:42	197	-76.7668	-35.46547	Vsl on DP
01/03/17 13:56	197	-76.77621	-35.46355	Seal identified as Weddel
01/03/17 13:50	197	-76.7801	-35.4545	Seal sighted
01/03/17 13:19	197	-76.80071	-35.41126	Seal identified as Crab Eater
01/03/17 13:02	197	-76.80335	-35.37639	Seal identified as Crab Eater
01/03/17 12:45	197	-76.81088	-35.34276	Seal spotted
01/03/17 12:32	197	-76.81816	-35.32952	Seal abandoned floe

01/03/17 12:22	197	-76.82086	-35.3281	Seal identified as Weddel
01/03/17 12:10	197	-76.82956	-35.3145	Seal sighted
28/02/17 19:12		-77.84966	-38.58195	VSL on passage
28/02/17 19:06		-77.84743	-38.58993	VSL off DP
28/02/17 19:03	196	-77.84744	-38.58994	CTD recovered
28/02/17 18:18	196	-77.84749	-38.58999	CTD Stopped at 1135m
28/02/17 17:58	196	-77.84749	-38.58993	CTD Veering to Approx 1100m
28/02/17 17:54	196	-77.84749	-38.58997	CTD in the Water
28/02/17 17:51	196	-77.84747	-38.58995	Re Commence Deploying CTD 168
28/02/17 17:38	196	-77.84749	-38.58996	CTD Recovered to Deck
28/02/17 17:35	196	-77.84749	-38.58991	Recovering CTD as Frozen
28/02/17 17:27	196	-77.84749	-38.58993	CTD in the Water
28/02/17 17:23	196	-77.84749	-38.58992	Commence Deploying CTD 168
28/02/17 17:18		-77.84745	-38.58984	VSL on DP
28/02/17 17:12		-77.83899	-38.58809	Commence Slowing Down
28/02/17 16:42		-77.81616	-38.61425	VSL off DP
28/02/17 16:40		-77.81598	-38.61486	Floe to Small Given Prevailing Conditions
28/02/17 16:24		-77.81787	-38.60397	VSL on DP
28/02/17 16:21		-77.8182	-38.60182	VSL Alongside Floe Assessing Conditions
28/02/17 16:06		-77.8192	-38.60263	Seal Sighted
28/02/17 14:48		-77.74333	-38.98797	Vsl on passage
28/02/17 14:42		-77.74197	-38.99038	Vsl off DP
28/02/17 14:38	195	-77.74202	-38.99026	CTD recovered
28/02/17 13:59	195	-77.74554	-38.9826	CTD stopped at 1071m
28/02/17 13:39	195	-77.74596	-38.979	CTD veering to 1050m
28/02/17 13:32	195	-77.74598	-38.97892	CTD 167 deployed
28/02/17 13:00		-77.74397	-38.99648	Vsl on DP
28/02/17 12:54		-77.73992	-39.02565	Vsl slowing down
28/02/17 03:54		-77.78876	-42.01998	On Passage
28/02/17 03:48		-77.79017	-42.00074	VSL off DP
28/02/17 03:43	194	-77.79127	-41.99671	CTD Recovered to Deck
28/02/17 03:13	194	-77.7914	-41.99737	CTD Stopped at 695m
28/02/17 03:00	194	-77.79143	-41.99755	CTD Veering to 620m
28/02/17 02:56	194	-77.79143	-41.99769	CTD 166 deployed
28/02/17 02:54		-77.79147	-41.99859	Vsl on DP
28/02/17 02:36		-77.82102	-42.05206	Vsl off DP
28/02/17 02:28	193	-77.82328	-42.04022	CTD recovered
28/02/17 02:08	193	-77.8233	-42.04057	CTD stopped at 657m
28/02/17 01:56	193	-77.82327	-42.04054	CTD veering to 636m
28/02/17 01:52	193	-77.82341	-42.04186	CTD 165 deployed
28/02/17 01:36		-77.82369	-42.04482	Vsl on DP
28/02/17 01:18		-77.85465	-42.09047	Vsl off DP
28/02/17 01:15	192	-77.85487	-42.08871	CTD recovered
28/02/17 00:51	192	-77.85489	-42.08867	CTD stopped at 669m
28/02/17 00:39	192	-77.85477	-42.08906	CTD veering to 650m
28/02/17 00:36	192	-77.85476	-42.08903	CTD 164 deployed
28/02/17 00:30		-77.85476	-42.08885	Vsl on DP
28/02/17 00:18		-77.8679	-42.10174	Vsl off DP
28/02/17 00:12	191	-77.87024	-42.09833	CTD recovered
27/02/17 23:54	191	-77.87046	-42.10107	CTD stopped at 673m
27/02/17 23:41	191	-77.87048	-42.10093	CTD veering to 650m (EA600 704m)
27/02/17 23:38	191	-77.8705	-42.10156	CTD redeployed
27/02/17 23:24	191	-77.87049	-42.10371	CTD recovered due to freezing
27/02/17 23:17	191	-77.87064	-42.1067	CTD 164 deployed
27/02/17 22:54		-77.87078	-42.10332	Vsl on DP
27/02/17 22:42		-77.88626	-42.13552	VSL off DP
27/02/17 22:36	190	-77.88709	-42.12813	CTD recovered
27/02/17 22:11	190	-77.88708	-42.12759	CTD at depth 674m (EA600 707m) commence recovery
27/02/17 21:56	190	-77.88701	-42.12745	CTD redeployed
27/02/17 21:42	190	-77.88702	-42.12588	CTD recovered - sensor problem
27/02/17 21:37	190	-77.88701	-42.12579	CTD 163 deployed
27/02/17 21:35	190	-77.88703	-42.12582	CTD off deck
27/02/17 21:12		-77.887	-42.12573	VSL on DP

27/02/17 21:00		-77.90211	-42.14387	VSL off DP
27/02/17 20:54	189	-77.90264	-42.14781	CTD recovered
27/02/17 20:27	189	-77.90265	-42.14783	CTD at depth 672m (EA600 707m) commence recovery
27/02/17 20:07	189	-77.90264	-42.14784	CTD 162 deployed
27/02/17 20:05	189	-77.90262	-42.14782	CTD off deck
27/02/17 19:30		-77.90251	-42.14874	VSL on DP - awaiting sampling completion
27/02/17 19:15		-77.91854	-42.17084	VSL off DP
27/02/17 19:08	188	-77.91891	-42.17127	CTD recovered
27/02/17 18:33	188	-77.91891	-42.17132	CTD Stopped at 669m
27/02/17 18:21	188	-77.9189	-42.17133	CTD Veering to 650m
27/02/17 18:18	188	-77.91891	-42.17129	CTD in the Water
27/02/17 18:16	188	-77.9189	-42.17132	Commence Deploying CTD 160
27/02/17 16:31	186	-77.91747	-42.17491	Stern Bulwark Door Closed
27/02/17 16:30	186	-77.91746	-42.17488	Bottom Set of Floats
27/02/17 16:19	186	-77.91748	-42.17487	Middle Set of Floats and RCM7 Recovered to Deck
27/02/17 15:58	186	-77.91747	-42.17491	Top Floats Recovered to Deck
27/02/17 15:49	186	-77.91671	-42.17509	Stern Bulwark Door Opened
27/02/17 15:39	186	-77.91607	-42.1814	Top Floats Grappled
27/02/17 15:19	186	-77.91493	-42.16376	VSL Approaching Top Floats on DP
27/02/17 15:08	186	-77.91492	-42.16373	Top Floats on the Surface and Sighted
27/02/17 15:02	186	-77.915	-42.16387	Mooring Released from Seabed
27/02/17 14:48	186	-77.91666	-42.15704	Vsl on DP in mooring position
27/02/17 14:35	186	-77.91721	-42.2061	Vsl on DP ranging at 1250m
27/02/17 14:16	186	-77.90776	-42.20677	Vsl ranging from 1500m to NW on DP
27/02/17 14:00	186	-77.90242	-42.27535	Vsl procceding to 1000m from mooring position off DP
27/02/17 13:54	186	-77.90247	-42.27543	Vsl on DP ranging mooring 3000m to NW of position
27/02/17 13:48	186	-77.9026	-42.29054	Vsl slowing down to range mooring
27/02/17 13:12		-77.88399	-42.44087	Vsl on passage
27/02/17 13:06		-77.88129	-42.46547	Vsl off DP
27/02/17 12:58	187	-77.87986	-42.46978	CTD recovered
27/02/17 12:26	187	-77.8802	-42.47069	CTD stopped at 586m
27/02/17 12:16	187	-77.88004	-42.46852	CTD veering to 550m - EA600 618m
27/02/17 12:12	187	-77.88004	-42.46867	CTD 159 deployed
27/02/17 12:06		-77.87989	-42.46835	Vsl on DP
27/02/17 12:00		-77.87829	-42.45317	vsl slowing down
27/02/17 11:30	186	-77.85831	-42.27414	Distnace to mooring to great
27/02/17 11:24	186	-77.85853	-42.26077	Vsl stopped to range mooring
27/02/17 11:06		-77.84596	-42.15077	Vsl on passage
27/02/17 11:00		-77.84169	-42.11621	Vsl off DP
27/02/17 10:51	185	-77.84089	-42.11211	CTD recovered
27/02/17 10:21	185	-77.84091	-42.11104	CTD at depth 662m (EA600 694m) commence recovery
27/02/17 10:05	185	-77.8409	-42.11279	CTD 158 deployed
27/02/17 10:03	185	-77.84093	-42.11261	CTD off deck
27/02/17 10:00		-77.84091	-42.11257	VSL on DP
27/02/17 09:54		-77.84016	-42.10739	commence slow down
27/02/17 08:48		-77.81118	-41.69199	VSL on passage
27/02/17 08:42		-77.80909	-41.68658	VSL off DP
27/02/17 08:40	184	-77.80905	-41.6855	CTD on deck
27/02/17 08:04	184	-77.80857	-41.68265	CTD at depth 740m (EA600 773m) commence recovery
27/02/17 07:47	184	-77.80847	-41.68637	CTD 157 deployed
27/02/17 07:45	184	-77.80852	-41.68667	CTD off deck
27/02/17 07:42		-77.80859	-41.68722	VSL on DP
27/02/17 07:36		-77.80907	-41.68273	commence slow down
27/02/17 06:42		-77.79172	-41.29289	VSL on passage
27/02/17 06:36		-77.79081	-41.27705	VSL off DP
27/02/17 06:34	183	-77.79081	-41.27717	CTD Recovered to Deck
27/02/17 05:55	183	-77.79071	-41.28719	CTD Stopped at 790m
27/02/17 05:40	183	-77.79076	-41.28766	CTD Veering to 780m
27/02/17 05:36	183	-77.79084	-41.28882	CTD in the Water
27/02/17 05:32	183	-77.79091	-41.28976	Commence Deploying CTD 156
27/02/17 05:24		-77.79066	-41.28795	VSL on DP
27/02/17 05:12		-77.78968	-41.22743	Commence Slowing Down
27/02/17 04:42		-77.78057	-40.93586	On Passage

27/02/17 04:36		-77.77775	-40.90657	VSL off DP
27/02/17 04:31	182	-77.7788	-40.89861	CTD Recovered to Deck
27/02/17 03:54	182	-77.77947	-40.90325	CTD stopped at 828m
27/02/17 03:40	182	-77.77982	-40.90568	CTD Veering to Approx 800m
27/02/17 03:37	182	-77.78002	-40.90686	CTD in the Water
27/02/17 03:33	182	-77.78017	-40.90787	Commence Deploying CTD 155
27/02/17 03:24		-77.77991	-40.91006	VSL on DP
27/02/17 03:12		-77.7835	-40.84743	Commence Slowing Down
27/02/17 02:48		-77.8115	-40.58037	Vsl on passage
27/02/17 02:42		-77.81651	-40.52149	Vsl off DP
27/02/17 02:35	181	-77.8155	-40.51115	CTD recovered
27/02/17 02:02	181	-77.81572	-40.50661	CTD stopped at 879m
27/02/17 01:47	181	-77.816	-40.5053	CTD veering to 850m (EA600 924m)
27/02/17 01:43	181	-77.81606	-40.50558	CTD 154 deployed
27/02/17 01:36		-77.81612	-40.50365	Vsl on DP
27/02/17 01:30		-77.81582	-40.4663	Vsl off passage
27/02/17 01:06		-77.8153	-40.20753	Vsl on passage
27/02/17 01:00		-77.81509	-40.17286	Vsl off DP
27/02/17 00:55	180	-77.81643	-40.162	CTD recovered
27/02/17 00:28	180	-77.81653	-40.16049	CTD stopped at 914m
27/02/17 00:10	180	-77.81653	-40.16068	CTD veering to 900m
27/02/17 00:06	180	-77.81653	-40.16085	CTD 153 deployed
27/02/17 00:00		-77.81652	-40.1587	Vsl on DP
26/02/17 23:54		-77.81359	-40.11843	Vsl slowing down
26/02/17 23:30		-77.80202	-39.80206	Vsl on passage
26/02/17 23:24		-77.80027	-39.77222	Vsl off DP
26/02/17 23:20	179	-77.80065	-39.76727	CTD recovered
26/02/17 22:48	179	-77.80067	-39.76658	CTD at depth 1007 (EA600 1053m) commence recovery
26/02/17 22:28	179	-77.80067	-39.76657	CTD 152 deployed
26/02/17 22:26	179	-77.80067	-39.76662	CTD off deck
26/02/17 22:24		-77.80068	-39.76676	VSL on DP
26/02/17 22:18		-77.80018	-39.76042	commence slow down
26/02/17 21:54		-77.80288	-39.43559	Vessel on passage
26/02/17 21:48		-77.80479	-39.36627	VSL off DP
26/02/17 21:42	178	-77.80454	-39.36369	CTD on deck
26/02/17 21:12	178	-77.80453	-39.36359	CTD at depth 1046m (EA600 1093m) commence recovery
26/02/17 20:50	178	-77.80454	-39.36361	CTD 151 deployed
26/02/17 20:49	178	-77.80454	-39.36359	CTD off deck
26/02/17 20:42		-77.80488	-39.36105	VSL on DP
26/02/17 20:36		-77.80529	-39.32973	commence slow down
26/02/17 19:18		-77.88313	-38.14768	VSL on passage
26/02/17 19:12		-77.8814	-38.12832	VSL off DP
26/02/17 19:08	177	-77.88141	-38.12837	CTD recovered
26/02/17 18:37	177	-77.88141	-38.12832	CTD Stopped at 1156m
26/02/17 18:16	177	-77.88137	-38.12839	CTD Veering to Approx 1150m
26/02/17 18:12	177	-77.88138	-38.12835	CTD in the Water
26/02/17 18:09	177	-77.88139	-38.1283	Commence Deploying CTD 150
26/02/17 17:54		-77.88138	-38.1285	VSL on DP
26/02/17 17:42		-77.87809	-38.06831	Commence Slowing Down
26/02/17 17:18		-77.89643	-37.69752	On Passage
26/02/17 17:12		-77.89726	-37.66296	VSL off DP
26/02/17 17:09	176	-77.89732	-37.66243	CTD Recovered to Deck
26/02/17 16:32	176	-77.89699	-37.66523	CTD Stopped at 1106m
26/02/17 16:13	176	-77.89702	-37.66517	CTD Veering to Approx 1100m
26/02/17 16:10	176	-77.897	-37.66519	CTD in the Water
26/02/17 16:02	176	-77.89703	-37.66515	Commence Deploying CTD149
26/02/17 16:00		-77.897	-37.66528	VSL on DP
26/02/17 15:48		-77.89317	-37.59529	Commence Slowing Down
26/02/17 15:36		-77.88582	-37.43898	On Passage
26/02/17 15:30		-77.88461	-37.43257	VSL off DP
26/02/17 15:29	175	-77.88461	-37.43261	CTD Recovered to Deck
26/02/17 15:02	175	-77.88461	-37.43261	CTD Stopped at 1084m
26/02/17 14:42	175	-77.8846	-37.43263	CTD veering to 1050m

26/02/17 14:39	175	-77.88459	-37.43261	CTD 148 deployed
26/02/17 13:42		-77.88023	-37.42429	Vsl on DP
26/02/17 13:36		-77.87927	-37.41025	Vsl slowing down
26/02/17 13:24		-77.87458	-37.34802	Vsl on passage
26/02/17 13:18		-77.8744	-37.32171	Vsl off DP
26/02/17 13:14	174	-77.87434	-37.31957	CTD recovered
26/02/17 12:33	174	-77.87424	-37.31932	CTD stopped at 1068m
26/02/17 12:13	174	-77.87422	-37.31931	CTD veering to 1050m
26/02/17 12:06	174	-77.87423	-37.31924	CTD 147 deployed
26/02/17 12:00		-77.87423	-37.31939	Vsl on DP
26/02/17 11:54		-77.87483	-37.3138	Vsl slowing down
26/02/17 11:42		-77.87354	-37.22232	Vsl on passage
26/02/17 11:36		-77.87293	-37.20499	Vsl off DP
26/02/17 11:34	173	-77.8729	-37.20503	CTD recovered
26/02/17 11:12	173	-77.87291	-37.20503	CTD stopped at 1076m
26/02/17 10:52	173	-77.87291	-37.20502	CTD veering to 1070m
26/02/17 10:46	173	-77.8729	-37.20507	CTD redeployed
26/02/17 10:44	173	-77.8729	-37.20511	CTD off deck
26/02/17 10:32	173	-77.87291	-37.20499	CTD recovered - technical issue
26/02/17 10:27	173	-77.8729	-37.20507	CTD 146 redeployed
26/02/17 10:16	173	-77.87289	-37.20504	CTD recovered - frozen pumps
26/02/17 10:11	173	-77.87289	-37.20506	CTD 146 deployed
26/02/17 10:09	173	-77.87286	-37.20506	CTD off deck
26/02/17 10:00		-77.87292	-37.20073	VSL on DP
26/02/17 09:54		-77.87244	-37.17679	commence slow down
26/02/17 09:42		-77.87229	-37.11359	VSL on passage
26/02/17 09:36		-77.87201	-37.10507	VSL off DP
26/02/17 09:33	172	-77.87207	-37.10425	CTD recovered
26/02/17 09:10	172	-77.87159	-37.10141	CTD at depth 1118m (EA600 1163m) commence recovery
26/02/17 08:44	172	-77.87092	-37.09946	CTD redeployed
26/02/17 08:32	172	-77.86991	-37.09617	CTD recovered - flush the pumps
26/02/17 08:26	172	-77.86961	-37.09479	CTD 145 deployed
26/02/17 08:24	172	-77.86952	-37.09463	CTD off deck
26/02/17 07:54		-77.8695	-37.09481	VSL on DP
26/02/17 07:48		-77.8687	-37.08564	commence slow down
26/02/17 07:24		-77.86214	-36.99911	VSL on passage
26/02/17 07:18		-77.86252	-36.9951	VSL off DP
26/02/17 07:09	171	-77.86256	-36.99425	CTD on deck
26/02/17 06:30	171	-77.86256	-36.99432	CTD Stopped at 1032m
26/02/17 06:11	171	-77.86254	-36.9944	CTD Veering to 1000m
26/02/17 06:07	171	-77.86252	-36.99436	CTD in the Water
26/02/17 06:03	171	-77.86252	-36.99445	Commence Deploying CTD 144
26/02/17 06:00		-77.86253	-36.99427	VSL on DP
26/02/17 05:54		-77.85972	-36.97702	Commence Slowing Down
26/02/17 05:30		-77.85366	-36.89576	On Passage
26/02/17 05:24		-77.85381	-36.88179	VSL off DP
26/02/17 05:20	170	-77.8539	-36.88175	CTD Recovered to Deck
26/02/17 04:56	170	-77.8542	-36.88184	CTD Stopped at 1065m
26/02/17 04:37	170	-77.85435	-36.88179	CTD Veering to Approx 1050m
26/02/17 04:34	170	-77.85434	-36.88178	CTD in the Water
26/02/17 04:30		-77.85436	-36.8818	VSL on DP
26/02/17 04:30	170	-77.85436	-36.8818	Commence Deploying CTD 143
26/02/17 03:54		-77.85195	-36.78918	On Passage
26/02/17 03:48		-77.85188	-36.78603	VSL off DP
26/02/17 03:46	169	-77.85188	-36.78608	CTD Recovered to Deck
26/02/17 03:22	169	-77.85186	-36.78601	CTD Stopped at 1077m
26/02/17 03:03	169	-77.85188	-36.78603	CTD Veering to approx 1050m
26/02/17 02:58	169	-77.8519	-36.78609	CTD deployed 142
26/02/17 02:36		-77.85149	-36.78389	Vsl on DP
26/02/17 02:30		-77.85042	-36.76927	Vsl slowing down
26/02/17 02:12		-77.84094	-36.64743	Vsl on passage
26/02/17 02:06		-77.83969	-36.63234	Vsl off DP
26/02/17 01:58	168	-77.8397	-36.63228	CTD recovered

26/02/17 01:24	168	-77.8397	-36.63225	CTD stopped at 914m
26/02/17 01:09	168	-77.8397	-36.63229	CTD veering to 900m
26/02/17 01:05	168	-77.8397	-36.63224	CTD deployed 141
26/02/17 00:36		-77.83985	-36.62963	Vsl on DP
26/02/17 00:30		-77.84	-36.62421	Vsl slowing down
26/02/17 00:12		-77.83996	-36.56672	Vsl on passage
26/02/17 00:06		-77.83988	-36.55556	Vsl off DP
25/02/17 23:59	167	-77.83981	-36.54949	CTD recovered
25/02/17 23:26	167	-77.83981	-36.54952	CTD stopped at 851m
25/02/17 23:10	167	-77.83981	-36.54952	CTD veering to 850m
25/02/17 23:02	167	-77.83983	-36.54924	CTD deployed 140
25/02/17 23:00		-77.83986	-36.54934	VSL on DP
25/02/17 22:54		-77.83941	-36.44625	commence slow down
25/02/17 22:36		-77.84036	-36.46142	VSL on passage
25/02/17 22:30		-77.83941	-36.44624	VSL off DP
25/02/17 22:28	166	-77.83942	-36.44621	CTD on deck
25/02/17 22:08	166	-77.83941	-36.44622	CTD at depth 764m (EA600 798m) commence recovery
25/02/17 21:52	166	-77.83942	-36.44623	CTD 139 deployed
25/02/17 21:49	166	-77.83942	-36.44625	commence deploying CTD
25/02/17 21:18		-77.8395	-36.44458	VSL on DP - awaiting completion of sampling
25/02/17 21:12		-77.83885	-36.41696	commence slow down
25/02/17 20:52	165	-77.83268	-36.33293	CTD recovered
25/02/17 20:23	165	-77.83266	-36.33291	CTD at depth 715m (EA600 747m) commence recovery
25/02/17 20:07	165	-77.83267	-36.33296	CTD 138 deployed
25/02/17 20:05	165	-77.83268	-36.33294	CTD off deck
25/02/17 20:00		-77.83182	-36.33286	VSL on dp
25/02/17 19:54		-77.83041	-36.33299	commence slow down
25/02/17 19:24		-77.81307	-36.12505	VSL on Passage
25/02/17 19:12		-77.80879	-36.03783	VSL off DP
25/02/17 19:08	164	-77.8088	-36.03785	CTD recovered
25/02/17 18:37	164	-77.8088	-36.03792	CTD Stopped at 539m
25/02/17 18:27	164	-77.8088	-36.03791	CTD Veering to Approx 500m
25/02/17 18:24	164	-77.8088	-36.03792	CTD in the Water
25/02/17 18:21	164	-77.80879	-36.038	Commence Deploying CTD 137
25/02/17 18:18		-77.8088	-36.03801	VSL on DP
25/02/17 18:06		-77.79867	-36.01025	Commence Slowing Down
24/02/17 21:12		-74.51388	-29.88589	VSL on passage
24/02/17 21:06		-74.50632	-29.86694	VSL off DP
24/02/17 20:58	163	-74.50613	-29.86599	CTD recovered
24/02/17 20:26	163	-74.50614	-29.86596	CTD at depth 909m (EA600 941m) commence recovery
24/02/17 20:05	163	-74.50616	-29.86595	CTD 136 deployed
24/02/17 20:04	163	-74.50615	-29.86596	CTD off deck
24/02/17 20:00		-74.50616	-29.86595	VSL on DP
24/02/17 19:54		-74.50852	-29.8813	commence slow down
24/02/17 19:36		-74.55562	-29.9542	VSL on passage
24/02/17 19:30	162	-74.55561	-29.93947	Mooring ranged - vsl off DP
24/02/17 19:24	162	-74.55412	-29.92936	On DP 1000m for ranging mooring
24/02/17 19:06	162	-74.55081	-29.91021	Mooring pinged moving 1000m
24/02/17 19:04	162	-74.55066	-29.90997	Weight released - mooring deloyed to the sea bed
24/02/17 18:56	162	-74.54999	-29.90904	Second RCM7 and Acoustic Release in the Water
24/02/17 18:50	162	-74.54964	-29.90857	Three Floats in the Water
24/02/17 18:21	162	-74.54791	-29.89831	Two Floats and RMC7 in the Water
24/02/17 18:03	162	-74.54707	-29.89317	ADCP Float in the water
24/02/17 17:37	162	-74.54521	-29.88977	Top Floats in the Water
24/02/17 17:35	162	-74.54513	-29.8897	Stern Bulwark Door Opened Commence Deploying M3
24/02/17 17:30		-74.54514	-29.8897	VSL on DP
24/02/17 17:24		-74.54428	-29.90714	VSL off DP
24/02/17 17:18		-74.54384	-29.91468	VSL on DP
24/02/17 17:00		-74.55321	-29.90082	VSL off DP
24/02/17 16:55	161	-74.55322	-29.90082	CTD Recovered to Deck
24/02/17 16:20	161	-74.55323	-29.90083	CTD Stopped at 719m
24/02/17 16:07	161	-74.55321	-29.90083	CTD Veering to Approx 700m
24/02/17 16:04	161	-74.55322	-29.90081	CTD in the Water

24/02/17 16:01	161	-74.55321	-29.90081	Commence Deploying CTD 135
24/02/17 15:54		-74.55318	-29.90083	VSL on DP
24/02/17 15:48		-74.5508	-29.90694	Commence Slowing Down
24/02/17 15:36		-74.58193	-29.92589	On Passage
24/02/17 15:30	160	-74.58508	-29.91648	Mooring Range Checked at 1000m
24/02/17 15:18		-74.59516	-29.91626	VSL off DP
24/02/17 15:15	160	-74.59492	-29.91615	Mooring on the Seabed and Ranged
24/02/17 15:00	160	-74.59491	-29.91624	Stern Bulwark Door Closed
24/02/17 14:58	160	-74.59492	-29.91619	Top Float Released
24/02/17 14:34	160	-74.59492	-29.91616	SBE37 deployed
24/02/17 14:26	160	-74.59492	-29.91612	SBE56 deployed
24/02/17 14:22	160	-74.59493	-29.91616	SBE56 deployed
24/02/17 14:15	160	-74.59492	-29.91617	Acoustic release / SBE37 / 3x floats / RCM7 deployed
24/02/17 13:47	160	-74.59491	-29.91613	Weight deployed
24/02/17 13:42	160	-74.5949	-29.9161	Bulwark door lowered
24/02/17 13:40	160	-74.59491	-29.91616	Commneced mooring deployment
24/02/17 13:12		-74.58447	-29.92688	Vsl proceeding to mooring deployment
24/02/17 13:08	159	-74.5847	-29.92712	CTD recovered
24/02/17 12:46	159	-74.58566	-29.92793	CTD stopped at 530m
24/02/17 12:31	159	-74.58608	-29.92301	CTD deployed 134
24/02/17 12:31	159	-74.58608	-29.92301	CTD deployed veering to 500m
24/02/17 12:18		-74.58609	-29.92125	Vsl on DP
24/02/17 12:12		-74.58592	-29.9207	Vsl slowing down
24/02/17 11:12		-74.42308	-29.83526	Vsl on passage
24/02/17 11:06		-74.41952	-29.83541	Vsl off DP
24/02/17 11:02	158	-74.41895	-29.83532	CTD recovered
24/02/17 10:24	158	-74.41818	-29.83098	CTD at depth 1211m (EA600 1248m) commence recovery
24/02/17 09:59	158	-74.41858	-29.82365	CTD 133 deployed
24/02/17 09:57	158	-74.41858	-29.82369	CTD off deck
24/02/17 09:54		-74.41861	-29.82355	VSL on DP
24/02/17 09:48		-74.41154	-29.82138	commence slow down
24/02/17 09:24		-74.34191	-29.78462	VSL on passage
24/02/17 09:18		-74.33386	-29.78456	VSL off DP
24/02/17 09:14	157	-74.33386	-29.78468	CTD on deck
24/02/17 08:30	157	-74.33386	-29.78464	CTD at depth 1473m (EA600 1524m) commence recovery
24/02/17 08:01	157	-74.33386	-29.78463	CTD 132
24/02/17 07:59	157	-74.33387	-29.78462	CTD off deck
24/02/17 07:54		-74.33385	-29.78476	VSL on DP
24/02/17 07:48		-74.32738	-29.7787	commence slow down
24/02/17 07:24		-74.26173	-29.739	VSL on passage
24/02/17 07:18		-74.24803	-29.73744	VSL off DP
24/02/17 07:11	156	-74.24755	-29.73789	CTD on deck
24/02/17 06:23	156	-74.24756	-29.73784	CTD Stopped at 1731m
24/02/17 05:53	156	-74.24755	-29.73785	CTD Veering to Approx 1720m
24/02/17 05:50	156	-74.24756	-29.73776	CTD in the Water
24/02/17 05:45	156	-74.24755	-29.73771	Commence Deploying CTD 131
24/02/17 05:36		-74.24753	-29.73758	VSL on DP
24/02/17 05:30		-74.24254	-29.73624	Commence Slowing Down
24/02/17 05:00		-74.16278	-29.69101	On Passage
24/02/17 04:54		-74.1616	-29.692	VSL off DP
24/02/17 04:49	155	-74.16161	-29.69201	CTD Recovered to Deck
24/02/17 03:42	155	-74.16159	-29.69202	CTD Stopped at 1922m
24/02/17 03:09	155	-74.1616	-29.69204	CTD Veering to Approx 1900m
24/02/17 03:05	155	-74.16161	-29.69204	CTD in the Water
24/02/17 03:01	155	-74.16162	-29.69204	Commence Deploying CTD 130
24/02/17 02:54		-74.1615	-29.6919	Vsl on DP
24/02/17 02:48		-74.15734	-29.69678	Vsl slowing down
23/02/17 21:30		-74.86094	-32.0621	Vsl on passage
23/02/17 21:24		-74.85844	-32.06623	VSL off DP
23/02/17 21:19	154	-74.85842	-32.06624	CTD recovered
23/02/17 20:55	154	-74.85844	-32.06619	CTD at depth 583m (611m) commence recovery
23/02/17 20:41	154	-74.85844	-32.06615	CTD 129 deployed
23/02/17 20:40	154	-74.85844	-32.06616	CTD off deck

23/02/17 20:18	153	-74.85846	-32.06635	Mooring ranged. Standing by on station for CTD
23/02/17 20:04	153	-74.85056	-32.09014	Mooring ranged - vsl moving 1000m to second ranging
23/02/17 19:50	153	-74.85057	-32.09009	Mooring released and deployed
23/02/17 19:02	153	-74.85056	-32.09003	Commence S2 mooring deployment
23/02/17 18:48		-74.84986	-32.09228	VSL on DP
23/02/17 18:36		-74.84097	-32.11536	Commence Slowing Down
23/02/17 16:12		-74.66733	-32.97453	On Passage
23/02/17 16:06		-74.6623	-33.00658	VSL off DP
23/02/17 15:56	152	-74.66194	-33.00807	Stern Bulwark Door Closed
23/02/17 15:55	152	-74.66197	-33.00782	Third SBE and Floats Recovered to Deck
23/02/17 15:51	152	-74.66235	-33.00688	Second SBE Recovered to Deck
23/02/17 15:37	152	-74.66311	-33.00262	Bottom Float Recovered to Deck
23/02/17 15:32	152	-74.66316	-33.00266	Stern Bulwark Door Lowered
23/02/17 15:27	152	-74.66191	-33.00252	Bottom Float Hooked
23/02/17 15:24		-74.66164	-33.00048	VSL on DP
23/02/17 15:15	152	-74.66906	-32.99539	Mooring at the Surface and Sighted
23/02/17 15:12		-74.66389	-32.99688	VSL off DP
23/02/17 15:11	152	-74.66323	-32.99682	Mooring Released from Seabed
23/02/17 15:06		-74.663	-32.99853	VSL on DP
23/02/17 14:54		-74.66181	-32.99627	Vsl off DP
23/02/17 14:45		-74.66299	-32.99984	Vsl on DP
23/02/17 14:24	152	-74.66288	-33.00165	Vsl off DP breaking ice for mooring recovery
23/02/17 14:12		-74.66283	-33.00145	Vsl on DP
23/02/17 14:09	152	-74.66235	-33.00212	Vsl interrogating mooring 50m to the West of Mooring position
23/02/17 13:52	152	-74.65834	-33.01241	Vsl interrogating mooring 500m to the North of mooring position
23/02/17 13:36	152	-74.6596	-33.04961	Vsl interrogating mooring at 1500m from mooring position
23/02/17 13:24		-74.65618	-33.09721	Vsl on passage
23/02/17 13:18		-74.65571	-33.09846	Vsl off DP
23/02/17 13:14	153	-74.65589	-33.09637	CTD recovered
23/02/17 12:51	153	-74.65657	-33.08575	CTD stopped at 587m
23/02/17 12:40	153	-74.65683	-33.08202	CTD veering to 559m
23/02/17 12:36	153	-74.65693	-33.08063	CTD deployed 128
23/02/17 12:24		-74.65685	-33.07821	Vsl on station
23/02/17 12:18		-74.65484	-33.06589	Vsl slowing down
23/02/17 11:52	152	-74.64896	-33.0702	Comunication established with mooring (S2E - 2014)
23/02/17 06:12		-74.43145	-33.97357	On Passage
23/02/17 06:06		-74.42908	-33.96709	VSL off DP
23/02/17 06:01	151	-74.42907	-33.96708	CTD Recovered to Deck
23/02/17 05:44	151	-74.42978	-33.96345	CTD Stopped at 569m
23/02/17 05:34	151	-74.43049	-33.96048	CTD Veering to approx 500m
23/02/17 05:31	151	-74.43064	-33.9602	CTD in the Water
23/02/17 05:27	151	-74.43071	-33.96003	Commence Deploying CTD 127
23/02/17 05:24		-74.43078	-33.95983	VSL on DP
23/02/17 05:18		-74.43027	-33.94622	Commence Slowing Down
23/02/17 05:00		-74.42016	-33.89925	On Passage
23/02/17 04:54		-74.41783	-33.90228	VSL off DP
23/02/17 04:53	150	-74.41796	-33.90232	CTD Recovered to Deck
23/02/17 04:35	150	-74.41988	-33.90008	CTD Stopped at 581m
23/02/17 04:24	150	-74.42026	-33.89972	CTD Veering to Approx 500m
23/02/17 04:21	150	-74.42026	-33.89963	CTD in the Water
23/02/17 04:18	150	-74.42037	-33.89944	Commence Deploying CTD 126
23/02/17 04:12		-74.42031	-33.90009	VSL on DP
23/02/17 04:06		-74.41773	-33.905	Commence Slowing Down
23/02/17 03:42		-74.40213	-33.8376	On Passage
23/02/17 03:36		-74.39992	-33.84037	VSL off DP
23/02/17 03:35	149	-74.40002	-33.84056	CTD Recovered to Deck
23/02/17 03:17	149	-74.40226	-33.84489	CTD Stopped at 588m
23/02/17 03:06	149	-74.40365	-33.84962	CTD Veering to 500m
23/02/17 03:03	149	-74.40382	-33.85022	CTD in the Water
23/02/17 03:00	149	-74.40403	-33.85073	Commence Deploying CTD 125
23/02/17 02:54		-74.40417	-33.85218	Vsl on DP

23/02/17 02:48		-74.39948	-33.8389	Vsl slowing down
23/02/17 02:42		-74.39418	-33.81287	Vsl on passage
23/02/17 02:36		-74.38888	-33.81015	Vsl off DP
23/02/17 02:31	148	-74.38932	-33.81069	CTD recovered
23/02/17 02:17	148	-74.39062	-33.81249	CTD stopped at 591m
23/02/17 02:06	148	-74.39138	-33.81346	CTD veering to 580m
23/02/17 02:02	148	-74.39152	-33.81373	CTD deployed 124
23/02/17 01:54		-74.39174	-33.81338	Vsl on DP
23/02/17 01:48		-74.38815	-33.79188	Vsl slowing down
23/02/17 01:30		-74.37763	-33.76571	Vsl on Passage
23/02/17 01:24		-74.37671	-33.76204	Vsl off DP
23/02/17 01:22	147	-74.37672	-33.76203	CTD recovered
23/02/17 01:06	147	-74.3769	-33.76203	CTD stopped at 596m
23/02/17 00:54	147	-74.37692	-33.76206	CTD veering to 580m
23/02/17 00:51	147	-74.3769	-33.76212	CTD deployed 123
23/02/17 00:42		-74.37596	-33.76032	Vessel on DP
23/02/17 00:36		-74.37146	-33.73556	Vessel slowing down
23/02/17 00:24		-74.36029	-33.70855	On passage
23/02/17 00:18		-74.35896	-33.71012	Vsl off DP
23/02/17 00:08	146	-74.3591	-33.71033	CTD recovered
22/02/17 23:53	146	-74.35993	-33.71055	CTD stopped at 599m
22/02/17 23:42	146	-74.36004	-33.71115	CTD veering to 580m
22/02/17 23:36	146	-74.36005	-33.71114	CTD deployed 122
22/02/17 23:30		-74.3569	-33.71187	Vessel on DP
22/02/17 23:24		-74.34495	-33.71004	Vessel on passage
22/02/17 23:18		-74.33865	-33.71827	Vsl off DP
22/02/17 23:15	145	-74.33866	-33.71827	CTD recovered
22/02/17 22:58	145	-74.33868	-33.71827	CTD at depth 615m (EA600 637m)
22/02/17 22:45	145	-74.33866	-33.71825	CTD 121 deployed
22/02/17 22:43	145	-74.33867	-33.71821	CTD off deck
22/02/17 22:36		-74.33799	-33.72248	VSL on DP
22/02/17 22:30		-74.32756	-33.72038	commence slow down
22/02/17 22:24		-74.32756	-33.72038	VSL on Passage
22/02/17 22:18	144	-74.31564	-33.72434	CTD on deck
22/02/17 22:18		-74.31611	-33.72454	VSL off DP
22/02/17 22:01	144	-74.31566	-33.7243	CTD at depth 733m (EA600 762m) commence recovery
22/02/17 21:45	144	-74.31709	-33.72355	CTD 120 deployed
22/02/17 21:43	144	-74.31706	-33.72355	CTD off deck
22/02/17 21:36		-74.31799	-33.72305	VSL on DP
22/02/17 21:30		-74.31513	-33.72386	Commence slow down
22/02/17 21:24		-74.3051	-33.73169	VSL on passage
22/02/17 21:18		-74.29682	-33.73087	VSL off DP
22/02/17 21:14	143	-74.29661	-33.72994	CTD on deck
22/02/17 20:53	143	-74.29533	-33.72634	CTD at depth 838m (EA600 871m) commence recovery
22/02/17 20:35	143	-74.29466	-33.72382	CTD 119 deployed
22/02/17 20:33	143	-74.29459	-33.72346	CTD off deck
22/02/17 20:30		-74.29428	-33.7227	VSL on DP
22/02/17 20:24		-74.29324	-33.73017	VSL on passage
22/02/17 20:17		-74.28393	-33.74833	VSL off DP
22/02/17 20:14	142	-74.28254	-33.7496	CTD on deck
22/02/17 19:51	142	-74.2811	-33.74258	CTD at depth 909m (EA600 920m) commence recovery
22/02/17 19:32	142	-74.28002	-33.73424	CTD 118 deployed
22/02/17 19:24		-74.27973	-33.73118	VSL on DP
22/02/17 19:18		-74.27851	-33.73023	commence slow down
22/02/17 18:54		-74.25963	-33.76342	On Passage
22/02/17 18:48	141	-74.25864	-33.76083	CTD Recovered to Deck and VSL off DP
22/02/17 18:27	141	-74.25756	-33.75538	CTD Stopped at 1022m
22/02/17 18:09	141	-74.25577	-33.74974	CTD Veering to Approx 1000m
22/02/17 18:06	141	-74.25539	-33.74864	CTD in the Water
22/02/17 18:02	141	-74.25505	-33.74735	Commence Deploying CTD 117
22/02/17 17:48		-74.25419	-33.74269	VSL on DP
22/02/17 17:42		-74.24935	-33.74385	Commence Slowing Down
22/02/17 17:36		-74.24152	-33.74048	On Passage

22/02/17 17:30		-74.23913	-33.73555	VSL off DP
22/02/17 17:27	140	-74.23894	-33.73421	CTD Recovered to Deck
22/02/17 17:04	140	-74.23755	-33.72522	CTD Stopped at 1095m
22/02/17 16:45	140	-74.23559	-33.71553	CTD Veering to Approx 1000m
22/02/17 16:42	140	-74.23537	-33.71425	CTD in the Water
22/02/17 16:38	140	-74.23523	-33.71315	Commence Deploying CTD 116
22/02/17 16:30		-74.23455	-33.70871	VSL on DP
22/02/17 16:24		-74.23396	-33.70711	Commence Slowing Down
22/02/17 16:12		-74.22581	-33.68296	On Passage
22/02/17 16:06		-74.2183	-33.68425	VSL off DP
22/02/17 15:57	139	-74.21549	-33.68809	CTD Recovered to Deck
22/02/17 15:11	139	-74.21495	-33.67177	CTD Veering to Approx 1150m
22/02/17 15:08	139	-74.21503	-33.67128	CTD in the Water
22/02/17 15:05	139	-74.21503	-33.67131	Commence Deploying CTD 115
22/02/17 15:00		-74.215	-33.671	Vsl on DP
22/02/17 14:54		-74.21412	-33.66644	Vsl slowing down
22/02/17 13:54		-74.19583	-33.7563	Vsl on passage
22/02/17 13:48		-74.19287	-33.76156	Vsl off DP
22/02/17 13:43	138	-74.19315	-33.75988	CTD recovered
22/02/17 13:16	138	-74.19553	-33.74953	CTD stopped at 1282m
22/02/17 12:53	138	-74.19742	-33.74119	CTD veering to 1200m
22/02/17 12:44	138	-74.19818	-33.73989	Technical issue resolved
22/02/17 12:36	138	-74.19755	-33.72792	Vsl on DP
22/02/17 12:18	138	-74.19691	-33.70929	Vsl off DP
22/02/17 12:04	138	-74.19773	-33.70724	CTD recovered due to technical issue
22/02/17 11:42	138	-74.19935	-33.70842	CTD deployed 114
22/02/17 11:36		-74.19972	-33.70912	Vessel on DP
22/02/17 11:30		-74.19999	-33.71093	Vsl slowing down
22/02/17 10:24		-74.17109	-33.71134	VSL on passage
22/02/17 10:18		-74.17051	-33.71443	VSL off station
22/02/17 10:14	137	-74.17121	-33.7156	CTD on deck
22/02/17 09:43	137	-74.17468	-33.72282	CTD at depth 1354m (EA600 1393m) commence recovery
22/02/17 09:16	137	-74.17684	-33.73022	CTD 113 deployed
22/02/17 09:14	137	-74.177	-33.73071	CTD off deck
22/02/17 09:12		-74.17716	-33.73108	VSL on station
22/02/17 09:06		-74.1775	-33.73242	commence slow down
22/02/17 08:12		-74.14926	-33.76498	VSL on passage
22/02/17 08:06		-74.14518	-33.76291	VSL off DP
22/02/17 07:57	136	-74.14509	-33.76262	CTD on deck
22/02/17 07:21	136	-74.14661	-33.76643	CTD stopped at 1459m (EA600 1467m)
22/02/17 06:56	136	-74.14768	-33.76557	CTD Veering to Approx 1450m
22/02/17 06:53	136	-74.1478	-33.76544	CTD in the Water
22/02/17 06:49	136	-74.14788	-33.76546	Commence Deploying CTD 112
22/02/17 06:18		-74.15033	-33.76284	VSL on DP
22/02/17 06:06		-74.14789	-33.76314	Commence Slowing Down
22/02/17 05:36		-74.12084	-33.81349	On Passage
22/02/17 05:30		-74.12052	-33.81987	VSL off DP
22/02/17 05:26	135	-74.12082	-33.81863	CTD Recovered to Deck
22/02/17 04:54	135	-74.12479	-33.8117	CTD Stopped at 1544m
22/02/17 04:26	135	-74.12881	-33.80541	CTD Veering to Approx 1530m
22/02/17 04:22	135	-74.12935	-33.80349	CTD in the Water
22/02/17 04:18	135	-74.1296	-33.80183	Commence Deploying CTD 111
22/02/17 04:12		-74.1298	-33.80104	VSL on DP
22/02/17 04:00		-74.12076	-33.79702	Commence Slowing Down
21/02/17 23:12		-73.87973	-33.87443	Vsl on passage
21/02/17 23:06		-73.88102	-33.87631	VSL off station
21/02/17 23:00	134	-73.88207	-33.87556	CTD on deck
21/02/17 22:33	134	-73.88773	-33.89276	Net recovered
21/02/17 22:24	134	-73.88916	-33.89818	Net deployed
21/02/17 21:50	133	-73.89396	-33.91904	CTD at depth 2270m (EA600 2278m) commence recovery
21/02/17 21:05	133	-73.89935	-33.94669	CTD 110 redeployed
21/02/17 20:55	133	-73.90034	-33.95251	CTD recovered
21/02/17 20:45	133	-73.90145	-33.95866	CTD 110 deployed

21/02/17 20:43	133	-73.90167	-33.95991	CTD off deck
21/02/17 18:54		-73.89664	-33.98934	VSL on DP
21/02/17 18:42		-73.89473	-33.97761	Commence Slowing Down
21/02/17 18:06		-73.92798	-33.98096	VSL off DP and On Passage
21/02/17 17:00		-73.92871	-33.97079	VSL on DP
21/02/17 16:36		-73.92444	-33.9739	VSL Turning to Make Pool
21/02/17 16:06		-73.92806	-33.97524	On Passage
21/02/17 16:00		-73.90915	-34.0561	VSL off DP
21/02/17 15:42		-73.91075	-34.05427	VSL on DP
21/02/17 15:30		-73.9149	-34.04438	Commence Slowing Down
21/02/17 14:48		-73.95766	-34.09724	Vsl on passage
21/02/17 14:42		-73.96128	-34.09895	Vsl off DP
21/02/17 14:36	132	-73.96238	-34.09905	CTD recovered
21/02/17 13:34	132	-73.97066	-34.10275	CTD stopped at 2120m
21/02/17 12:56	132	-73.97527	-34.10969	CTD Veering to 2100m
21/02/17 12:54	132	-73.97547	-34.11017	CTD deployed 109
21/02/17 12:48		-73.97597	-34.11159	Vsl on DP
21/02/17 12:42		-73.97667	-34.11196	Vsl slowing down
21/02/17 11:18		-74.05847	-34.05699	Vsl on passage
21/02/17 11:12		-74.05838	-34.044	Vessel off DP
21/02/17 11:06	131	-74.05913	-34.04579	CTD recovered
21/02/17 10:16	131	-74.06484	-34.07435	CTD at depth 1870m (EA600 1901m) commence recovery
21/02/17 09:40	131	-74.06706	-34.09796	CTD 108 deployed
21/02/17 09:37	131	-74.06748	-34.09913	CTD off deck
21/02/17 09:36		-74.06764	-34.09943	VSL on DP
21/02/17 09:30		-74.06792	-34.10065	commence slow down
21/02/17 07:54		-74.15033	-34.13315	VSL on Passage
21/02/17 07:48		-74.15348	-34.14439	VSL off DP
21/02/17 07:44	130	-74.15346	-34.14795	CTD on deck
21/02/17 06:57	130	-74.15294	-34.17744	CTD Stopped at 1593m
21/02/17 06:29	130	-74.15316	-34.19053	CTD Veering to Approx 1630m
21/02/17 06:25	130	-74.15341	-34.1921	CTD in the Water
21/02/17 06:21	130	-74.15345	-34.19227	Commence Dploying CTD 107
21/02/17 06:06		-74.15066	-34.19609	VSL on DP
21/02/17 06:00		-74.15177	-34.19501	Commence Slowing Down
21/02/17 04:18		-74.22668	-34.37541	On Passage
21/02/17 04:12		-74.22487	-34.37843	VSL off DP
21/02/17 04:07	129	-74.22514	-34.3799	CTD Recovered to Deck
21/02/17 03:25	129	-74.22909	-34.38649	CTD Stopped at 1338m
21/02/17 03:02	129	-74.23158	-34.3906	CTD Veering to approx 1350m
21/02/17 02:58	129	-74.23207	-34.3912	CTD in the Water
21/02/17 02:55	129	-74.23234	-34.39183	CTD deployed 106
21/02/17 02:36		-74.23486	-34.3948	Vsl on DP
21/02/17 02:30		-74.23515	-34.39358	Vsl slowing down
21/02/17 01:18		-74.3006	-34.35089	Vessel on passage
21/02/17 01:12		-74.30333	-34.34502	Off DP
21/02/17 01:04	128	-74.30481	-34.34489	CTD recovered
21/02/17 00:24	128	-74.31074	-34.33971	CTD stopped at 942m
21/02/17 00:07	128	-74.31337	-34.33776	CTD veering to 900m
21/02/17 00:04	128	-74.3137	-34.33743	CTD deployed 105
20/02/17 23:54		-74.31467	-34.33723	Vsl on DP
20/02/17 23:48		-74.31582	-34.33486	Vsl slowing down
20/02/17 22:12		-74.40353	-34.26803	VSL on Passage
20/02/17 22:06		-74.40454	-34.26811	VSL off Station
20/02/17 22:05	127	-74.40454	-34.26811	CTD on deck
20/02/17 21:32	127	-74.40897	-34.26923	CTD at depth 538m (EA600 565m) commence recovery
20/02/17 21:19	127	-74.41046	-34.26993	CTD 104 deployed
20/02/17 21:18	127	-74.41057	-34.26997	CTD off deck
20/02/17 21:06		-74.41152	-34.26907	VSL on DP
20/02/17 20:54		-74.4154	-34.27679	commence slow down
20/02/17 20:06		-74.49353	-34.24524	VSL on passage
20/02/17 20:01	125	-74.49484	-34.2444	CTD on deck
20/02/17 19:38	126	-74.49696	-34.24855	Net recovered

20/02/17 19:31	125	-74.49757	-34.24986	CTD at depth 521m (EA600 548m) commence recovery
20/02/17 19:28	126	-74.49781	-34.2502	Net deployed
20/02/17 19:20	125	-74.49831	-34.25141	CTD 103 deployed
20/02/17 19:16	125	-74.49827	-34.25135	CTD off deck
20/02/17 19:00		-74.49889	-34.25222	VSL on DP
20/02/17 18:54		-74.50624	-34.25224	Commence Slowing Down
20/02/17 17:54		-74.57344	-34.12923	Continuing on Passage
20/02/17 17:06		-74.57326	-34.12132	Seal Sighted
20/02/17 16:18		-74.59756	-34.04951	On Passage
20/02/17 16:12		-74.59949	-34.04236	VSL off DP
20/02/17 16:06	124	-74.59982	-34.04194	CTD Recovered to Deck
20/02/17 15:41	124	-74.60075	-34.03738	CTD Stopped at 526m
20/02/17 15:31	124	-74.60096	-34.03528	CTD Veering to Approx 500m
20/02/17 15:27	124	-74.60127	-34.03441	CTD in the Water
20/02/17 15:18	124	-74.60054	-34.03223	VSL on DP
20/02/17 15:12		-74.59808	-34.02814	VSL off DP
20/02/17 15:06		-74.59816	-34.0261	VSL on DP
20/02/17 14:48		-74.59947	-34.02122	vessel slowing down
20/02/17 12:18		-74.76281	-34.11874	On passage
20/02/17 12:12		-74.76975	-34.1206	Off DP
20/02/17 12:08	123	-74.77376	-34.11773	CTD recovered
20/02/17 11:37	123	-74.77887	-34.11466	CTD stopped at 527m
20/02/17 11:28	123	-74.77986	-34.11602	CTD veering to 500m
20/02/17 11:22	123	-74.77983	-34.11606	CTD deployed 101
20/02/17 11:18		-74.77995	-34.1154	Vessel on DP
20/02/17 11:12		-74.78102	-34.11638	Vessel slowing down
20/02/17 08:42		-74.86946	-34.36522	VSL on passage
20/02/17 08:36		-74.87157	-34.34223	VSL off DP
20/02/17 08:29	122	-74.8724	-34.34221	CTD on deck
20/02/17 08:03	122	-74.8743	-34.35084	CTD at depth 519m (EA600 546m) commence recovery
20/02/17 07:49	122	-74.87522	-34.35245	CTD 100 deployed
20/02/17 07:47	122	-74.87519	-34.35242	CTD off deck
20/02/17 07:36		-74.87523	-34.35248	VSL on DP
20/02/17 07:30		-74.87333	-34.35381	commence slow down
20/02/17 04:12		-74.66773	-34.05238	On Passage
20/02/17 04:06		-74.66583	-34.04925	VSL off DP
20/02/17 03:55	121	-74.66637	-34.04879	CTD Recovered to Deck
20/02/17 03:39	121	-74.66781	-34.04622	CTD Stopped at 532m
20/02/17 03:28	121	-74.66859	-34.04323	CTD Veering to 540m
20/02/17 03:23	121	-74.66912	-34.04247	CTD in the Water
20/02/17 03:19	121	-74.6694	-34.04212	Commence Deploying CTD 099
20/02/17 03:12		-74.66971	-34.04202	VSL on DP
20/02/17 03:06		-74.67045	-34.04089	Commence Slowing Down
20/02/17 02:30	120	-74.65889	-34.03528	Mooring recovery complete
20/02/17 02:24	120	-74.65971	-34.03463	CTP / RMC9 (1363) + CT / Floats recovered
20/02/17 02:00	120	-74.6624	-34.03219	CT recovered
20/02/17 01:51	120	-74.66075	-34.03435	CT recovered
20/02/17 01:39	120	-74.66409	-34.03008	CTO2 recovered
20/02/17 01:36	120	-74.66435	-34.02977	CT recovered
20/02/17 01:35	120	-74.66441	-34.02974	Seagaurd (971) recovered to deck
20/02/17 01:27	120	-74.66485	-34.03004	Mooring grappled
20/02/17 00:57	120	-74.67113	-34.02124	Mooring sighted
20/02/17 00:53	120	-74.67197	-34.02536	S2 - 2014 mooring released
20/02/17 00:24	120	-74.66958	-34.02524	Vessel breaking ice to aid mooring recovery
20/02/17 00:18	120	-74.66764	-34.02422	vessel on mooring site assessing conditions
19/02/17 23:24		-74.62379	-33.95394	Vessel off floe
19/02/17 23:16	119	-74.62399	-33.95057	Seal team on deck
19/02/17 23:14	119	-74.62427	-33.95052	Seal team off ice
19/02/17 23:13	119	-74.62441	-33.95049	Seal team at worgeordie
19/02/17 23:00	119	-74.62629	-33.95035	Packing equipment and commencing return to vessel
19/02/17 21:23	119	-74.63926	-33.95587	Working with seal
19/02/17 21:19	119	-74.6398	-33.95658	Approaching seal
19/02/17 21:12	119	-74.64074	-33.95786	Seal team landed on ice - 5 persons

19/02/17 21:10	119	-74.641	-33.95821	Seal team on WOR Geordie
19/02/17 21:06	119	-74.64154	-33.95889	Seal team preparing on deck
19/02/17 20:22	119	-74.64386	-33.96784	confirm Weddell seal
19/02/17 19:49		-74.65172	-33.98093	VSL off DP - man. to identify another seal
19/02/17 19:48	118	-74.65183	-33.98113	Seal team onboard
19/02/17 19:46	118	-74.65205	-33.98147	Seal team on WOR Geordie
19/02/17 19:42	118	-74.65249	-33.98225	Seal away to water
19/02/17 19:12	118	-74.65249	-33.98225	Seal awake
19/02/17 18:33	118	-74.65988	-33.99696	Seal in Bag
19/02/17 18:20	118	-74.66122	-34.00008	Seal Team with Seal on Floe
19/02/17 18:13	118	-74.66192	-34.00148	Wor Georgdie Landed on Floe
19/02/17 18:11	118	-74.66215	-34.00165	Commence Lifting Seal Team (5 Persons) on to Floe with Wor Geordie
19/02/17 18:06		-74.66251	-34.00214	VSL on DP
19/02/17 18:00		-74.66272	-34.00283	VSL off DP
19/02/17 17:36		-74.66438	-34.00875	VSL on DP Alongside Floe
19/02/17 17:06		-74.66895	-34.02346	Seal Sighted Moving Off to Approach
19/02/17 17:00		-74.66932	-34.02398	VSL Stopped Over Mooring Position to Assess Ice
19/02/17 16:48		-74.66637	-34.02233	VSL Moving off to Sit over Mooring Position
19/02/17 16:36		-74.66869	-34.02078	VSL Stopped in Proximity of Mooring to Asses Ice
19/02/17 13:42		-74.84445	-34.07528	Vsl Off DP
19/02/17 13:42		-74.84445	-34.07528	Vsl on passage
19/02/17 13:35	117	-74.84536	-34.07266	CTD recovered
19/02/17 13:06	117	-74.84653	-34.07316	CTD stopped at 524m
19/02/17 12:57	117	-74.84653	-34.07322	CTD veering to 500m
19/02/17 12:52	117	-74.84651	-34.07316	CTD deployed 098
19/02/17 12:42		-74.84652	-34.07316	Vsl on DP
19/02/17 12:36		-74.84679	-34.07102	Vsl slowing down
19/02/17 11:30		-74.86526	-33.72363	Vsl on passage
19/02/17 11:24		-74.86249	-33.70888	Vsl off DP
19/02/17 11:22	116	-74.8625	-33.70889	CTD recovered
19/02/17 10:56	116	-74.8625	-33.70891	CTD at depth 535m (EA600 565m) commence recovery
19/02/17 10:42	116	-74.86249	-33.70891	CTD 097 deployed
19/02/17 10:40	116	-74.86245	-33.70887	CTD off deck
19/02/17 10:36		-74.86248	-33.70887	VSL on DP
19/02/17 10:30		-74.86292	-33.7074	commence slow down
19/02/17 09:06		-74.85677	-33.39307	VSL on passage
19/02/17 09:00		-74.8615	-33.37894	VSL off DP
19/02/17 08:57	115	-74.86267	-33.37778	CTD on deck
19/02/17 08:18	115	-74.86962	-33.37726	CTD at depth 551m (EA600 577m) commence recovery
19/02/17 08:03	115	-74.87164	-33.3747	CTD 096 deployed
19/02/17 08:01	115	-74.87164	-33.37469	CTD off deck
19/02/17 07:54		-74.87166	-33.3744	VSL on DP
19/02/17 07:48		-74.87217	-33.37348	commence slow down
19/02/17 06:18		-74.83936	-33.09961	On Passage
19/02/17 06:12		-74.83413	-33.08289	VSL off DP
19/02/17 06:03	114	-74.83401	-33.0822	CTD Recovered to Deck
19/02/17 05:36	114	-74.83396	-33.0817	CTD Stopped at 562m
19/02/17 05:25	114	-74.83396	-33.08166	CTD Veering to 580m
19/02/17 05:18	114	-74.834	-33.08164	CTD 095 in the Water
19/02/17 05:14	114	-74.83396	-33.08179	Commence Deploying CTD
19/02/17 05:12		-74.83406	-33.08165	VSL on DP
19/02/17 05:06		-74.83589	-33.07775	Commence Slowing Down
19/02/17 03:54		-74.85043	-32.70365	On Passage
19/02/17 03:48		-74.84899	-32.69603	VSL off DP
19/02/17 03:42	113	-74.84899	-32.69604	CTD Recovered to Deck
19/02/17 03:12	113	-74.84898	-32.69602	CTD Stopped at 568m
19/02/17 03:00	113	-74.849	-32.696	CTD Veering to 581m
19/02/17 02:57	113	-74.84901	-32.69601	CTD deployed 094
19/02/17 02:42		-74.84901	-32.69584	Vessel on DP
19/02/17 02:36		-74.85001	-32.68341	Vessel slowing down
18/02/17 15:18		-76.47999	-32.70797	On Passage
18/02/17 15:06		-76.47356	-32.72122	VSL off DP

18/02/17 15:02	112	-76.47355	-32.72116	Net recovered
18/02/17 14:55	112	-76.47354	-32.72115	Net deployed
18/02/17 14:47	111	-76.47313	-32.71802	APEX float 7835 deployed
18/02/17 14:30		-76.47284	-32.71807	Vsl On DP
18/02/17 14:18		-76.46513	-32.74474	Vsl off DP
18/02/17 14:16	110	-76.46532	-32.74232	APEX float 7834 deployed
18/02/17 13:49	109	-76.46535	-32.74212	CTD recovered
18/02/17 13:20	109	-76.46524	-32.74197	CTD stopped at 626m
18/02/17 13:07	109	-76.46509	-32.74184	CTD veering to 600m
18/02/17 13:04	109	-76.46498	-32.74176	CTD deployed 093
18/02/17 13:00		-76.46488	-32.7417	Vsl on DP
18/02/17 12:54		-76.46497	-32.74094	Vsl slowing down
18/02/17 12:36		-76.44972	-32.86244	Vsl on passage
18/02/17 12:30		-76.44433	-32.87356	Vsl off DP
18/02/17 12:22	108	-76.44424	-32.87351	CTD recovered
18/02/17 12:03	108	-76.44419	-32.87341	CTD stopped at 674m
18/02/17 11:49	108	-76.44418	-32.87345	CTD veering to 600m
18/02/17 11:44	108	-76.44423	-32.87324	CTD deployed 092
18/02/17 11:30		-76.44356	-32.87397	Vessel on DP
18/02/17 11:24		-76.44321	-32.87849	Vessel slowing down
18/02/17 06:18		-77.00957	-34.06021	On Passage
18/02/17 06:12		-77.0099	-34.0615	VSL off DP
18/02/17 06:11	107	-77.01021	-34.06255	LOTUS Float 19 in the Water
18/02/17 06:06		-77.01149	-34.0562	VSL on DP
18/02/17 05:54		-77.02856	-33.96716	VSL off DP
18/02/17 05:50	106	-77.03141	-33.95741	LOTUS Float 17 in the Water
18/02/17 05:48		-77.03173	-33.95525	VSL on DP
18/02/17 05:30		-77.05822	-33.85864	VSL off DP
18/02/17 05:29	105	-77.0582	-33.85676	LOTUS Float 18 in the Water
18/02/17 05:24		-77.05977	-33.84758	VSL on DP
18/02/17 05:05	104	-77.08505	-33.76797	LOTUS Float 16 in the Water
18/02/17 04:54		-77.08705	-33.77738	Commence Slowing Down
18/02/17 00:00	103	-77.65614	-35.44007	Vessel off floe
17/02/17 23:50	103	-77.65595	-35.43492	Seal left ice
17/02/17 23:42	103	-77.65586	-35.4311	Worgeordie on deck
17/02/17 23:40	103	-77.65582	-35.43017	Seal team on worgeordie
17/02/17 23:38	103	-77.65579	-35.42925	Seal team at worgeordie
17/02/17 23:30	103	-77.65566	-35.42563	Seal team left seal site
17/02/17 23:00	103	-77.65526	-35.4127	Seal awake
17/02/17 22:45	103	-77.65503	-35.40647	Seal tagged
17/02/17 21:00	103	-77.65398	-35.3655	Seal approach
17/02/17 20:55	103	-77.65396	-35.36379	Team landed on ice
17/02/17 20:51	103	-77.65394	-35.36243	commence deployment of seal team on wor geordie - 5 persons dispatched
17/02/17 20:12	103	-77.65515	-35.35277	VSL stopped in flow for seal tagging
17/02/17 20:06	103	-77.65534	-35.35442	Seal sited
17/02/17 13:00		-77.77584	-35.73709	On Passage
17/02/17 11:30		-77.77708	-35.73638	Turning in Pool
16/02/17 15:06	102	-77.77711	-35.73603	CTD Recovered to Deck
16/02/17 15:03	102	-77.77711	-35.73603	CTD recovered
16/02/17 14:32	102	-77.77711	-35.73602	CTD stopped at 439m
16/02/17 14:19	102	-77.77711	-35.73602	CTD at surface
16/02/17 14:04	102	-77.77711	-35.73601	CTD stopped at 439m
16/02/17 13:49	102	-77.77711	-35.73599	CTD at surface
16/02/17 13:32	102	-77.77712	-35.73601	CTD stopped at 440m
16/02/17 13:16	102	-77.77712	-35.736	CTD veering to 400m
16/02/17 13:12	102	-77.77712	-35.736	CTD in water
16/02/17 13:10	102	-77.77712	-35.73601	CTD deployed 089
16/02/17 12:32	101	-77.77712	-35.736	Net recovered
16/02/17 12:28	101	-77.77712	-35.736	Net deployed
16/02/17 12:25	100	-77.77712	-35.736	CTD recovered
16/02/17 12:22	100	-77.77712	-35.73599	CTD at surface
16/02/17 12:01	100	-77.77712	-35.73599	CTD stopped at 434m

16/02/17 11:49	100	-77.77712	-35.73598	CTD at surface
16/02/17 11:32	100	-77.77712	-35.73597	CTD stopped at 434m
16/02/17 11:20	100	-77.77712	-35.73597	CTD at surface
16/02/17 11:03	100	-77.77712	-35.73598	CTD stopped at 434m
16/02/17 10:47	100	-77.77712	-35.73598	CTD 086 deployed
16/02/17 10:45	100	-77.77712	-35.73598	CTD off deck
16/02/17 10:00	99	-77.77713	-35.73599	CTD on deck
16/02/17 09:41	99	-77.77713	-35.73597	CTD at depth 434m (EA600 458m) commence recovery
16/02/17 09:29	99	-77.77713	-35.73596	CTD at surface
16/02/17 09:13	99	-77.77712	-35.73595	CTD at depth 434m (EA600 458m) commence heauling
16/02/17 09:00	99	-77.77712	-35.73597	CTD surface
16/02/17 08:44	99	-77.77712	-35.73597	CTD at depth 434m (EA600 458m) commence hauling
16/02/17 08:29	99	-77.77712	-35.73598	CTD 083 deployed
16/02/17 08:27	99	-77.77712	-35.73598	CTD off deck
16/02/17 07:47	98	-77.77713	-35.7359	CTD on deck
16/02/17 06:56	98	-77.77713	-35.7359	CTD Stopped at 433m
16/02/17 06:42	98	-77.77713	-35.73591	CTD at Surface
16/02/17 06:22	98	-77.77713	-35.73591	CTD Stopped at 433m
16/02/17 06:15	98	-77.77713	-35.73591	CTD Veering to approx 440m
16/02/17 06:13	98	-77.77713	-35.73591	CTD in the Water
16/02/17 06:07	98	-77.77713	-35.73591	Commence Deploying CTD 080
16/02/17 05:17	97	-77.77712	-35.736	CTD Recovered to Deck
16/02/17 04:54	97	-77.77712	-35.73598	CTD Stopped at 433m
16/02/17 04:42	97	-77.77712	-35.73598	CTD at Surface
16/02/17 04:26	97	-77.77712	-35.73597	CTD Stopped at 433m
16/02/17 04:13	97	-77.77712	-35.73596	CTD at Surface
16/02/17 03:57	97	-77.77713	-35.73595	CTD Stopped at 433m
16/02/17 03:45	97	-77.77713	-35.73595	CTD Veering to approx 440m
16/02/17 03:41	97	-77.77713	-35.73596	CTD in the Water
16/02/17 03:38	97	-77.77713	-35.73596	Commence Deploying CTD 077
16/02/17 02:56	96	-77.77712	-35.73596	CTD recovered to deck
16/02/17 02:54	96	-77.77712	-35.73596	CTD at surface
16/02/17 02:34	96	-77.77713	-35.73591	CTD stopped at 433m
16/02/17 02:19	96	-77.77713	-35.73591	CTD veering to 400m
16/02/17 02:15	96	-77.77713	-35.73591	CTD at surface
16/02/17 01:57	96	-77.77714	-35.7359	CTD stopped at 433m
16/02/17 01:42	96	-77.77714	-35.73589	CTD veering to 400m
16/02/17 01:37	96	-77.77714	-35.73588	CTD at surface
16/02/17 01:18	96	-77.77714	-35.73588	CTD stopped at 434m
16/02/17 01:09	96	-77.77714	-35.73589	CTD Veering to 400m
16/02/17 01:06	96	-77.77714	-35.7359	CTD in water
16/02/17 01:04	96	-77.77714	-35.7359	CTD deployed 074
16/02/17 00:00	95	-77.77714	-35.7359	Net recovered
15/02/17 23:54	95	-77.77714	-35.7359	Net deployed
15/02/17 23:49	94	-77.77714	-35.73591	CTD recovered to deck
15/02/17 23:47	94	-77.77714	-35.73591	CTD on surface
15/02/17 23:28	94	-77.77714	-35.7359	CTD stopped at 434m
15/02/17 23:19	94	-77.77714	-35.73591	CTD Veering to 400m
15/02/17 23:15	94	-77.77714	-35.7359	CTD in water
15/02/17 23:12	94	-77.77714	-35.7359	CTD deployed 073
15/02/17 19:40		-77.77302	-35.72326	VSL moving off
15/02/17 18:50		-77.773	-35.72343	Seal Enters Water
15/02/17 18:06		-77.77153	-35.71014	Seal identified as a crabeater not a weddell moving towards a second seal
15/02/17 17:18		-77.76584	-35.64774	Moving off towards a seal for tagging
15/02/17 16:52		-77.76555	-35.64773	UAV Recovered to deck
15/02/17 16:36		-77.76543	-35.64706	UAV Launched to Assess Ice
14/02/17 19:18		-76.95134	-35.00906	VSL off DP
14/02/17 19:09	91	-76.95055	-35.00884	CTD on deck
14/02/17 18:27	91	-76.95278	-35.00321	CTD Stopped at 938m
14/02/17 18:22	93	-76.95303	-35.00308	Net Recovered to Deck
14/02/17 18:16	93	-76.95324	-35.00222	Net Deployed
14/02/17 18:13	92	-76.95323	-35.00167	Net Recovered to Deck

14/02/17 18:09	92	-76.95325	-35.00103	Net Deployed
14/02/17 18:09	91	-76.95325	-35.00103	CTD Veering to approx 900m
14/02/17 18:02	91	-76.95328	-34.99978	CTD in the Water
14/02/17 17:59	91	-76.9534	-34.99926	Commence Redeploying CTD 072
14/02/17 17:29	90	-76.9527	-34.99318	CTD Recovered to Deck as Instruments Frozen
14/02/17 17:27	90	-76.95255	-34.99351	CTD in the Water
14/02/17 17:22	90	-76.95226	-34.99396	Commence Deploying CTD 072
14/02/17 17:06		-76.95228	-34.99422	VSL on DP
14/02/17 17:00		-76.95129	-34.97737	Commence Slowing Down
14/02/17 16:12		-76.97679	-34.6689	On Passage
14/02/17 16:06		-76.97861	-34.66239	VSL off DP
14/02/17 16:03	89	-76.97883	-34.66308	CTD Recovered to Deck
14/02/17 15:27	89	-76.98039	-34.66748	CTD Stopped at 833m
14/02/17 15:11	89	-76.98039	-34.66736	CTD Veering to Approx 800m
14/02/17 15:07	89	-76.9804	-34.66736	CTD in the Water
14/02/17 15:03	89	-76.98039	-34.66735	Commence Deploying CTD 071
14/02/17 15:00		-76.98039	-34.66727	VSL on DP
14/02/17 14:54		-76.98132	-34.66513	Vsl slowing down
14/02/17 13:54		-77.01887	-34.43134	Vsl on passage
14/02/17 13:48		-77.01981	-34.43595	Vsl off DP
14/02/17 13:42	88	-77.0193	-34.43793	CTD recovered
14/02/17 13:14	88	-77.0184	-34.44248	CTD stopped at 662m
14/02/17 13:02	88	-77.01827	-34.44405	CTD veering to 650m
14/02/17 12:56	88	-77.01827	-34.4441	CTD deployed 070
14/02/17 12:48		-77.01826	-34.44383	vessel on DP
14/02/17 12:42		-77.0202	-34.44508	Vessel slowing down
14/02/17 11:00		-77.05501	-34.07355	On passage
14/02/17 10:58		-77.05471	-34.0737	Off DP
14/02/17 10:53	87	-77.05402	-34.07577	CTD on deck
14/02/17 10:30	87	-77.05323	-34.07888	CTD at depth 471m (EA600 499m) commence recovery
14/02/17 10:17	87	-77.05331	-34.0794	CTD 069 deployed
14/02/17 10:16	87	-77.05331	-34.07948	CTD off deck
14/02/17 10:12		-77.05334	-34.0795	vessel on DP
14/02/17 10:06		-77.05395	-34.0772	commence slow down
14/02/17 08:24		-77.0789	-33.81948	Vessel on passage
14/02/17 08:18		-77.08342	-33.77483	VSL off DP
14/02/17 07:50	88	-77.08436	-33.76585	CTD on deck
14/02/17 07:34	88	-77.08437	-33.76583	CTD at depth 365m (EA600 385m) commence recovery
14/02/17 07:23	88	-77.08437	-33.76583	CTD 068 deployed
14/02/17 07:21	88	-77.08436	-33.76592	CTD off deck
14/02/17 07:18		-77.08436	-33.76591	VSL on DP
14/02/17 07:12		-77.08683	-33.76235	commence slow down
14/02/17 03:24		-76.52503	-32.53588	On Passage
14/02/17 03:18		-76.51331	-32.51233	VSL off DP
14/02/17 02:47	87	-76.50778	-32.49819	CTD recovered
14/02/17 02:23	87	-76.50776	-32.49822	CTD stopped at 488m
14/02/17 02:14	87	-76.50777	-32.49819	CTD veering to 450m
14/02/17 02:08	87	-76.50784	-32.49856	CTD deployed 067
14/02/17 02:06		-76.50789	-32.49896	Vsl on DP
14/02/17 02:00		-76.5079	-32.49898	Vsl slowing down
13/02/17 23:54		-76.30979	-33.37667	Vsl on passage
13/02/17 23:48		-76.30709	-33.38914	Vsl off DP
13/02/17 23:40	86	-76.30705	-33.38893	CTD recovered
13/02/17 23:12	86	-76.30703	-33.38888	CTD stopped at 787m
13/02/17 22:58	86	-76.30702	-33.38889	CTD veering to 800m - EA600 824m
13/02/17 22:56	86	-76.30703	-33.38891	CTD deployed
13/02/17 22:54	86	-76.30702	-33.38891	CTD off deck
13/02/17 22:32	86	-76.30703	-33.38894	CTD recovered for technical issue diagnosis
13/02/17 22:23	86	-76.30703	-33.38892	CTD deployed
13/02/17 22:21	86	-76.30705	-33.38891	CTD off Deck 066
13/02/17 22:18		-76.30707	-33.38893	VSL on DP
13/02/17 22:12		-76.30528	-33.38922	commence slow down
13/02/17 21:24		-76.22472	-33.78882	VSL on passage

13/02/17 21:18		-76.22448	-33.80738	VSL off DP
13/02/17 21:13	85	-76.22447	-33.80742	CTD on deck
13/02/17 20:44	85	-76.22485	-33.80841	CTD at depth 770m (EA600 806m) commence recovery
13/02/17 20:24	85	-76.22521	-33.80941	CTD 065 deployed
13/02/17 20:22	85	-76.22521	-33.80941	CTD off deck
13/02/17 20:06		-76.22526	-33.8092	VSL on DP
13/02/17 20:00		-76.23048	-33.78471	commence slow down
13/02/17 19:35	84	-76.26255	-33.62613	CTD on deck
13/02/17 19:03	84	-76.26254	-33.62608	CTD Stopped at 767m
13/02/17 18:59	85	-76.26252	-33.62612	Net Recovered to Deck
13/02/17 18:52	85	-76.26253	-33.62613	Net Deployed
13/02/17 18:49	84	-76.26254	-33.62612	CTD Veering to Approx 700m
13/02/17 18:45	84	-76.26255	-33.62613	CTD in the Water
13/02/17 18:41	84	-76.26253	-33.62622	Commence Deploying CTD 064
13/02/17 18:36		-76.26262	-33.62465	VSL on DP
13/02/17 18:30		-76.26938	-33.59373	Commence Slowing Down
13/02/17 17:48		-76.33917	-33.19127	On Passage
13/02/17 17:42		-76.34692	-33.14517	VSL off DP
13/02/17 17:33	83	-76.34829	-33.13879	CTD Recovered to Deck
13/02/17 17:02	83	-76.34833	-33.1388	CTD Stopped at 801m
13/02/17 16:48	83	-76.34832	-33.13873	CTD Veering to 800m
13/02/17 16:45	83	-76.34831	-33.13876	CTD in the Water
13/02/17 16:41	83	-76.34829	-33.13874	Commence Deploying CTD 063
13/02/17 16:36		-76.3485	-33.13864	VSL on DP
13/02/17 16:30		-76.35246	-33.10746	Commence Slowing Down
13/02/17 15:36		-76.44367	-32.78352	On Passage
13/02/17 15:30		-76.45094	-32.75524	VSL off DP
13/02/17 15:24	82	-76.45117	-32.75466	CTD Recovered to Deck
13/02/17 14:57	82	-76.45118	-32.75465	CTD stopped at 630m
13/02/17 14:46	82	-76.45116	-32.75457	CTD Veering to 600m
13/02/17 14:40	82	-76.45116	-32.75456	CTD deployed 062
13/02/17 14:36		-76.45116	-32.75447	Vsl on DP
13/02/17 14:30		-76.4527	-32.7405	Vsl slowing down
13/02/17 13:12		-76.5549	-32.28554	Vsl off DP
13/02/17 13:10	80	-76.5549	-32.28549	CTD recovered
13/02/17 12:52	81	-76.55491	-32.2855	Net recovered
13/02/17 12:46	80	-76.5549	-32.28552	CTD stopped at 433m
13/02/17 12:37	80	-76.55491	-32.28561	CTD veering to 400m
13/02/17 12:36	81	-76.55491	-32.28563	Net Deployed
13/02/17 12:32	80	-76.55491	-32.28548	CTD deployed 061
13/02/17 12:30		-76.55489	-32.28547	Vsl on DP
13/02/17 12:24		-76.55541	-32.2853	Vsl slowing down
13/02/17 11:54		-76.59603	-32.09872	Vsl on passage
13/02/17 11:48		-76.60058	-32.07905	Vsl off DP
13/02/17 11:44	79	-76.6006	-32.07904	CTD recovered
13/02/17 11:23	79	-76.6006	-32.07903	CTD stopped at 369m
13/02/17 11:14	79	-76.6006	-32.07906	CTD veering to 350m EA600 - 392m
13/02/17 11:09	79	-76.60059	-32.07902	CTD deployed 060
13/02/17 11:06		-76.60041	-32.07949	Vsl on DP
13/02/17 11:00		-76.59985	-32.07833	Vsl slowing down
12/02/17 22:54		-74.8525	-30.62138	Vsl on passage
12/02/17 22:48	78	-74.85276	-30.64634	ARGO float deployed
12/02/17 22:26	77	-74.84898	-30.71351	ARGO float deployed
12/02/17 22:20		-74.84999	-30.71516	VSL off DP
12/02/17 21:32	76	-74.84996	-30.71515	Mooring P3 released
12/02/17 20:51	76	-74.84996	-30.71516	Commence deployment of P3 mooring (depth 499m)
12/02/17 19:24		-74.84821	-30.71119	VSL on DP at P3 mooring site. Awaiting mooring preparations
12/02/17 19:18		-74.84501	-30.71612	commence slow down
12/02/17 17:48		-74.84837	-31.35037	On Passage
12/02/17 17:42		-74.84995	-31.38113	VSL off DP
12/02/17 17:17	75	-74.85069	-31.37863	ADCP Let Go and Sinking Clear
12/02/17 17:14	75	-74.85061	-31.37842	All of Wire Top Secton in the Water

12/02/17 17:09	75	-74.85006	-31.3774	Top Float in the Water
12/02/17 17:07	75	-74.85003	-31.37737	ADCP in the Water
12/02/17 16:50	75	-74.85002	-31.37734	Second SBE39 in the Water
12/02/17 16:47	75	-74.85002	-31.37735	First SBE39 in the Water
12/02/17 16:45	75	-74.85002	-31.37737	Microcat in the Water
12/02/17 16:42	75	-74.85003	-31.3773	Acoustic Release and Aquadrop in the Water
12/02/17 16:41	75	-74.85001	-31.37728	Anchor Weight in the Water
12/02/17 16:36	75	-74.85001	-31.3773	Commence Deploying P1 Mooring
12/02/17 15:24		-74.84944	-31.38512	VSL on DP
12/02/17 15:18		-74.85099	-31.37746	Commence Slowing Down
12/02/17 14:24		-74.84922	-31.08734	Vessel on passage
12/02/17 14:18		-74.85049	-31.06289	Vsl off DP
12/02/17 13:52	74	-74.85055	-31.06211	ADCP buoy deployed
12/02/17 13:42	74	-74.85062	-31.06033	Top float in water
12/02/17 13:04	74	-74.85061	-31.06026	Weight suspended on scientific wire
12/02/17 13:02	74	-74.85063	-31.06025	Bulwark lowered
12/02/17 13:00		-74.85063	-31.06032	Vsl on DP
12/02/17 12:42		-74.85761	-31.05521	Vsl off DP
12/02/17 11:36		-74.85706	-31.05974	Vsl on DP
12/02/17 11:30		-74.85666	-31.06424	Vsl slowing down
12/02/17 09:30		-74.8461	-31.6964	Vsl on passage
12/02/17 09:24		-74.84968	-31.70872	Vsl off dp
12/02/17 09:18	73	-74.84978	-31.70945	CTD recovered
12/02/17 08:50	73	-74.84979	-31.70948	CTD at depth 597m (EA600 628m) commence recovery
12/02/17 08:36	73	-74.84978	-31.70946	CTD 059 deployed
12/02/17 08:34	73	-74.84979	-31.70948	CTD off deck
12/02/17 08:30		-74.84979	-31.70947	VSL on DP
12/02/17 08:24		-74.84926	-31.7122	commence slow down
12/02/17 06:06		-74.84649	-32.38704	On Passage
12/02/17 06:00		-74.84577	-32.39877	VSL off DP
12/02/17 05:51	72	-74.84525	-32.39883	CTD Recovered to Deck
12/02/17 05:23	72	-74.84526	-32.39884	CTD Stopped at 576m
12/02/17 05:12	72	-74.84525	-32.39884	CTD Veering to Approx 590m
12/02/17 05:07	72	-74.84524	-32.39879	CTD in the Water
12/02/17 05:03	72	-74.84524	-32.39887	Commence Deploying CTD 058
12/02/17 05:00		-74.84524	-32.39891	VSL on DP
12/02/17 04:54		-74.84497	-32.39605	Commence Slowing Down
12/02/17 03:24		-74.85088	-32.06318	On Passage
12/02/17 03:18		-74.85021	-32.03834	VSL off DP
12/02/17 03:12	71	-74.85004	-32.03767	CTD Recovered to Deck
12/02/17 02:41	71	-74.85005	-32.03764	CTD stopped at 588m
12/02/17 02:31	71	-74.85005	-32.03765	CTD veering to 600m
12/02/17 02:26	71	-74.85005	-32.03763	CTD deployed 057
12/02/17 02:12		-74.85006	-32.03767	Vsl on DP
12/02/17 02:06		-74.84599	-32.01414	Vsl slowing down
12/02/17 01:06		-74.84965	-31.39896	Vessel on passage
12/02/17 01:00		-74.84985	-31.37999	Vessel off DP
12/02/17 00:53	69	-74.84981	-31.37985	CTD recovered
12/02/17 00:26	70	-74.84982	-31.37986	Net recovered
12/02/17 00:25	69	-74.84982	-31.37985	CTD Stopped at 570m
12/02/17 00:14	69	-74.8498	-31.37985	CTD veering to 567m
12/02/17 00:12	70	-74.8498	-31.37986	Net Deployed on Starboard quarter
12/02/17 00:08	69	-74.8498	-31.37982	CTD Deployed 056
12/02/17 00:00		-74.84993	-31.37972	Vsl on DP
11/02/17 23:54		-74.84953	-31.3641	Vsl slowing down
11/02/17 23:00		-74.855	-31.04411	VSL on passage
11/02/17 22:56		-74.8547	-31.03749	VSL off DP
11/02/17 22:48	68	-74.85472	-31.03739	CTD on deck
11/02/17 22:22	68	-74.85478	-31.03796	CTD at depth 527m (EA600 554m) commence recovery
11/02/17 22:09	68	-74.85475	-31.03815	CTD deployed 055
11/02/17 22:05		-74.85476	-31.03804	CTD off deck
11/02/17 22:00		-74.85469	-31.03815	VSL on DP
11/02/17 21:54		-74.85212	-31.03728	commence slow down

11/02/17 20:06		-74.85249	-30.71214	VSL on passage
11/02/17 20:00		-74.85194	-30.71908	VSL off DP
11/02/17 19:54	66	-74.85193	-30.71905	CTD recovered
11/02/17 19:42	67	-74.85191	-30.71897	Net recovered
11/02/17 19:30	66	-74.85191	-30.71897	CTD at depth 471m (EA600 496m) commence recovery
11/02/17 19:25	67	-74.85191	-30.71898	Net deployed
11/02/17 19:17	66	-74.85189	-30.71895	CTD 054 deployed
11/02/17 19:15	66	-74.85192	-30.71904	CTD off deck
11/02/17 19:12		-74.8519	-30.71894	VSL on DP
11/02/17 19:06		-74.85183	-30.71274	commence slow down
11/02/17 18:12		-74.84496	-30.3858	On Passage
11/02/17 18:06		-74.84378	-30.35877	VSL off DP
11/02/17 17:56	65	-74.84304	-30.36081	CTD Recovered to Deck
11/02/17 17:32	65	-74.84307	-30.36079	CTD Stopped at 428m
11/02/17 17:24	65	-74.84307	-30.36078	CTD Veering toApprox 400m
11/02/17 17:22	65	-74.84307	-30.36078	CTD in the Water
11/02/17 17:17	65	-74.84306	-30.3608	Ranging Completed
11/02/17 17:00		-74.8439	-30.36291	VSL on DP to Range Mooring
11/02/17 16:48		-74.8519	-30.37586	VSL off DP
11/02/17 16:32	64	-74.85063	-30.38047	Stern Bulwark Door Closed
11/02/17 16:30	64	-74.85046	-30.38087	Anchor Weight Dropped EA600 Depth 462m
11/02/17 16:27	64	-74.8499	-30.38206	Acoustic Release in the Water
11/02/17 15:52	64	-74.84806	-30.38722	Final Section of Floats and ADCP in the Water
11/02/17 15:43	64	-74.84784	-30.38754	Sound Source in the Water
11/02/17 15:32	64	-74.84776	-30.38759	Hydrophone and Aquadrop in the Water
11/02/17 15:19	64	-74.84757	-30.38786	Top Float in the Water
11/02/17 15:16	64	-74.84751	-30.388	Problem with Top Float Deployment Stopped until Fixed
11/02/17 15:10	64	-74.84744	-30.38814	Commence Deploying P4 Mooring Stern Bulwark Lowered
11/02/17 14:42		-74.84779	-30.38856	Vessel on DP
11/02/17 14:36		-74.84689	-30.3904	Vessel slowing down
11/02/17 11:06		-74.42298	-29.83623	Vessel on passage
11/02/17 11:00	63	-74.41629	-29.83163	VSL off DP
11/02/17 10:56	63	-74.41622	-29.83137	CTD on deck
11/02/17 10:13	63	-74.41647	-29.833	CTD at depth 1210m (EA600 1255m) commence recovery
11/02/17 09:49	63	-74.41649	-29.83302	CTD 052 deployed
11/02/17 09:46	63	-74.41649	-29.83299	CTD off deck
11/02/17 09:42		-74.41648	-29.83302	VSL on DP
11/02/17 09:36		-74.41653	-29.82603	commence slow down
11/02/17 08:42		-74.50313	-29.86697	VSL on passage
11/02/17 08:36		-74.50588	-29.87106	VSL off DP
11/02/17 08:29	62	-74.50598	-29.86945	CTD on deck
11/02/17 07:52	62	-74.50596	-29.86947	CTD at depth 904m (EA600 942m) commence recovery
11/02/17 07:27	62	-74.50604	-29.86916	CTD 051 deployed
11/02/17 07:24		-74.50635	-29.86749	VSL on DP
11/02/17 07:18		-74.50674	-29.86494	Commence slow down
11/02/17 06:18		-74.59134	-29.92518	VSL off DP
11/02/17 06:17	61	-74.59134	-29.92517	CD Recovered to Deck
11/02/17 05:46	61	-74.59136	-29.92513	CTD Stopped at 525m
11/02/17 05:36	61	-74.59135	-29.92511	CTD Veering to Approx 530m
11/02/17 05:33	61	-74.59135	-29.92511	CTD in the Water
11/02/17 05:29	61	-74.59135	-29.92521	Commence Deploying CTD 050
11/02/17 05:24		-74.59126	-29.92398	VSL on DP
11/02/17 05:18		-74.59161	-29.90504	Commence Turning on to Station
11/02/17 04:24		-74.67528	-29.97392	On Passage
11/02/17 04:18		-74.67671	-29.97081	VSL off DP
11/02/17 04:16	60	-74.67672	-29.97068	CTD Recovered to Deck
11/02/17 03:51	60	-74.67671	-29.97072	CTD Stopped at 407m
11/02/17 03:42	60	-74.67672	-29.97073	CTD Veering to Approx 400m
11/02/17 03:39	60	-74.67671	-29.97073	CTD in the Water
11/02/17 03:36		-74.6767	-29.97083	VSL on DP
11/02/17 03:36	60	-74.6767	-29.97083	Commence Deploying CTD 049
11/02/17 03:24		-74.67735	-29.96555	Commence Comming on Station
11/02/17 02:30		-74.76079	-30.00842	On passage

11/02/17 02:26		-74.76299	-30.00818	Off DP
11/02/17 02:20	59	-74.76306	-30.00823	CTD recovered
11/02/17 02:00	59	-74.76306	-30.00819	CTD stopped at 403m
11/02/17 01:52	59	-74.76307	-30.0082	CTD Veering to 400m
11/02/17 01:48	59	-74.76306	-30.00825	CTD Deployed 048
11/02/17 01:42		-74.76356	-30.00763	On DP
11/02/17 01:36		-74.76895	-30.01035	Slowing down
11/02/17 01:06		-74.84465	-30.05123	On passage
11/02/17 01:00		-74.84938	-30.05032	Vsl off DP
11/02/17 00:54	58	-74.84944	-30.05015	CTD recovered
11/02/17 00:34	58	-74.84944	-30.0499	CTD stopped at 401m
11/02/17 00:26	58	-74.84944	-30.04986	CTD veering to 400m
11/02/17 00:18	58	-74.84939	-30.04982	CTD deployed 047
11/02/17 00:12		-74.84949	-30.04983	Vsl on DP
11/02/17 00:06		-74.84752	-30.03343	Vsl slowing down
10/02/17 16:42		-74.21198	-26.63079	On Passage
10/02/17 16:36		-74.21304	-26.62109	VSL off DP
10/02/17 16:30	57	-74.21305	-26.62108	CTD Recovered to Deck
10/02/17 15:20	57	-74.21305	-26.6211	CTD Stopped at 2657m
10/02/17 14:35	57	-74.21303	-26.62109	CTD Veering to 2680m
10/02/17 14:26	57	-74.21303	-26.6211	CTD deployed 046
10/02/17 14:18		-74.2128	-26.62096	Vessel on DP
10/02/17 14:12		-74.213	-26.60585	Vessel slowing down
10/02/17 13:42		-74.25582	-26.42118	Vessel on passage
10/02/17 13:36		-74.25763	-26.41388	Vessel off DP
10/02/17 13:34	55	-74.25763	-26.41392	CTD Recovered
10/02/17 13:18	56	-74.25762	-26.41387	Net recovered
10/02/17 13:08	56	-74.2576	-26.41392	Net deployed
10/02/17 12:21	55	-74.25762	-26.41389	CTD stopped at 2579m
10/02/17 11:37	55	-74.25764	-26.4139	CTD Veering to 2600m
10/02/17 11:32	55	-74.25763	-26.41383	CTD Deployed 045
10/02/17 11:24		-74.2587	-26.41556	Vessel on DP
10/02/17 11:18		-74.26636	-26.42099	Vessel slowing down
10/02/17 10:54		-74.32372	-26.38737	VSL on passage
10/02/17 10:48		-74.32679	-26.39257	VSL off DP
10/02/17 10:47	54	-74.3268	-26.39258	CTD on deck
10/02/17 09:54	54	-74.32681	-26.39254	CTD at depth 2182m (EA600 2191m) commence recovery
10/02/17 09:12	54	-74.32681	-26.3925	CTD 044 deployed
10/02/17 09:10	54	-74.32681	-26.39249	CTD off deck
10/02/17 09:06		-74.32689	-26.39326	VSL on DP
10/02/17 09:00		-74.33253	-26.39886	commence slow down
10/02/17 08:18		-74.42247	-26.2379	VSL on passage
10/02/17 08:12		-74.42439	-26.23076	VSL off DP
10/02/17 08:07	53	-74.42439	-26.23074	CTD on deck
10/02/17 07:26	53	-74.4244	-26.23071	CTD at depth 1473m (EA600 1467m) commence recovery
10/02/17 07:01	53	-74.42442	-26.23073	CTD Veering to 1460m
10/02/17 06:58	53	-74.42441	-26.23072	CTD in the Water
10/02/17 06:54	53	-74.4244	-26.23077	Commence Deploying CTD 043
10/02/17 06:48		-74.42447	-26.23058	VSl on DP
10/02/17 06:29	52	-74.44278	-26.18822	Argo Float 7831 Deployed
10/02/17 06:06	51	-74.45266	-26.1832	Agro Float 7830 Deployed
10/02/17 05:48		-74.46024	-26.16335	VSL off DP
10/02/17 05:44	50	-74.46104	-26.16269	Agro Float 7829 Deployed
10/02/17 05:35	49	-74.46184	-26.16241	CTD Recovered to Deck
10/02/17 05:17	49	-74.46183	-26.16242	CTD Stopped at 659m
10/02/17 05:05	49	-74.46185	-26.16247	CTD Veering to Approx 650m
10/02/17 05:02	49	-74.46187	-26.16242	CTD in the Water
10/02/17 04:58	49	-74.46186	-26.16241	Commence Deploying CTD 042
10/02/17 04:54		-74.46174	-26.16245	VSL on DP
10/02/17 04:36		-74.45869	-26.17522	Commence Slowing Down
10/02/17 04:18		-74.50193	-26.11994	On Passage
10/02/17 04:12		-74.50503	-26.11455	VSL off DP
10/02/17 04:02	48	-74.50502	-26.11452	CTD Recovered to Deck

10/02/17 03:38	48	-74.50501	-26.11452	CTD Stopped at 492m
10/02/17 03:29	48	-74.50501	-26.11455	CTD Veeriing to 500m
10/02/17 03:26	48	-74.50503	-26.11451	CTD in the Water
10/02/17 03:20	48	-74.50503	-26.11454	Commence Deploying CTD 041
10/02/17 03:12		-74.50498	-26.11689	VSL on DP
10/02/17 03:06		-74.51331	-26.11041	Commence Slowing Down
10/02/17 02:42		-74.57788	-26.03204	Vessel on passage
10/02/17 02:36		-74.58841	-26.01433	Vessel off DP
10/02/17 02:25	47	-74.58935	-26.01394	CTD Recovered
10/02/17 02:00	47	-74.58937	-26.01393	CTD stopped at 508m
10/02/17 01:51	47	-74.58937	-26.01395	CTD Veering to 500m
10/02/17 01:46	47	-74.58935	-26.01391	CTD deployed 040
10/02/17 01:36		-74.59067	-26.01842	Vessel on DP
10/02/17 01:30		-74.60123	-26.03227	Vessel slowing down for station
09/02/17 18:48		-75.52763	-28.29125	On Passage
09/02/17 18:42		-75.53649	-28.31002	VSL off DP
09/02/17 18:38	46	-75.53672	-28.31117	Net Recovered to Deck
09/02/17 18:32	46	-75.53672	-28.31117	Net Deployed
09/02/17 18:31	44	-75.53672	-28.31118	CTD Recovered to Deck
09/02/17 18:28	45	-75.53671	-28.3112	Net Recovered to Deck
09/02/17 18:18	45	-75.53672	-28.31116	Net Deployed
09/02/17 18:15	44	-75.53672	-28.31112	CTD Stopped at 300m
09/02/17 18:08	44	-75.53698	-28.31383	CTD Veeering to Approx 280m
09/02/17 18:05	44	-75.53699	-28.31385	CTD in the Water
09/02/17 18:01	44	-75.53699	-28.31384	Commence Deploying CTD 039
09/02/17 17:54		-75.53699	-28.3138	VSL on DP
09/02/17 17:42		-75.52768	-28.33544	Commence Slowing Down
09/02/17 17:18		-75.47126	-28.45606	On Passage
09/02/17 17:12		-75.47002	-28.46109	VSL off DP
09/02/17 17:08	43	-75.47002	-28.46109	CTD Recovered to Deck
09/02/17 16:38	43	-75.47001	-28.46104	CTD Stopped at 410m
09/02/17 16:29	43	-75.47002	-28.46111	CTD Veering to Approx 400m
09/02/17 16:26	43	-75.47001	-28.46104	CTD in the Water
09/02/17 16:24	43	-75.47002	-28.46108	Commence Deploying CTD 038
09/02/17 16:24		-75.47002	-28.46108	VSL on DP
09/02/17 15:42		-75.39766	-28.6037	On Passage
09/02/17 15:39	42	-75.39723	-28.60677	Mooring Range Double Checked
09/02/17 15:18		-75.38836	-28.6335	VSL off DP
09/02/17 14:59	42	-75.38916	-28.63702	IXSEA and anchor deployed
09/02/17 14:48	42	-75.39029	-28.64235	Microcat SMP37 and Aquadopp deployed
09/02/17 14:33	42	-75.39084	-28.64489	Aquadopp deployed
09/02/17 14:27	42	-75.39125	-28.64681	Nautilis float deployed
09/02/17 14:16	42	-75.39141	-28.6476	SBE56 and Sound Source deployed
09/02/17 14:00	42	-75.39167	-28.64875	SBE56 Deployed
09/02/17 13:56	42	-75.39178	-28.6493	Aquadopp deployed
09/02/17 13:55	42	-75.39182	-28.64954	Hydrophone deployed
09/02/17 13:40	42	-75.39215	-28.6511	Argos float deployed
09/02/17 13:38	42	-75.39221	-28.65139	Commence P5 mooring deployment
09/02/17 11:48		-75.4031	-28.59209	Vessel changing position for mooring deployment
09/02/17 11:42	41	-75.4031	-28.59209	CTD recovered
09/02/17 11:18	41	-75.40308	-28.59207	CTD stopped at 422m
09/02/17 11:10	41	-75.40308	-28.59205	CTD veering to 400m - EA600 depth 443m
09/02/17 11:08	41	-75.40307	-28.59205	CTD deployed 037
09/02/17 11:00	41	-75.33801	-28.73799	VSL on DP
09/02/17 10:54	41	-75.39928	-28.61233	commence slow down
09/02/17 10:30		-75.34178	-28.72927	VSL on passage
09/02/17 10:24		-75.33802	-28.73801	VSL off DP
09/02/17 10:22	40	-75.33802	-28.73802	CTD on deck
09/02/17 10:02	40	-75.33802	-28.738	CTD at depth 403m (EA600 425m) commence recovery
09/02/17 09:49	40	-75.33802	-28.73799	CTD deployed 036
09/02/17 09:47	40	-75.33803	-28.73791	CTD off deck
09/02/17 09:42		-75.33803	-28.73792	VSL on DP
09/02/17 09:36		-75.33801	-28.73871	commence slow down

09/02/17 09:12		-75.27664	-28.88306	VSL on passage
09/02/17 09:06		-75.26931	-28.90289	VSL off DP
09/02/17 08:56	39	-75.26942	-28.90513	CTD on deck
09/02/17 08:37	39	-75.26942	-28.90511	CTD at depth 392m (EA600 412m) commence recovery
09/02/17 08:26	39	-75.26941	-28.90519	CTD 035 deployed
09/02/17 08:24	39	-75.26941	-28.90519	CTD off deck
09/02/17 08:12		-75.26932	-28.9091	VSL on DP
09/02/17 08:06		-75.25743	-28.93901	commence slow down
09/02/17 07:48		-75.2119	-29.02819	VSL on passage
09/02/17 07:42		-75.2021	-29.05158	VSL off DP
09/02/17 07:38	38	-75.20208	-29.05315	CTD on deck
09/02/17 07:14	38	-75.20207	-29.05315	CTD at depth 382m (EA600 405m) commence recovery
09/02/17 07:00	38	-75.20209	-29.05317	CTD 034 deployed
09/02/17 06:58	38	-75.20208	-29.05314	Commence Deploying CTD
09/02/17 06:54		-75.20207	-29.0531	VSL on DP
09/02/17 06:48		-75.20189	-29.05819	Commence Slowing Down
09/02/17 02:48		-74.60448	-28.37455	Vessel on passage
09/02/17 02:44		-74.60261	-28.37147	Vessel off DP
09/02/17 02:43	36	-74.60253	-28.3714	Hydrophone recovered
09/02/17 02:32	36	-74.60204	-28.37042	Hydrophone deployed
09/02/17 02:30		-74.60204	-28.37043	vessel on DP
09/02/17 02:24		-74.60064	-28.36897	Vessel slowing down for hydrophone deployment
08/02/17 22:54		-74.0289	-28.08777	VSL on passage
08/02/17 22:48		-74.02875	-28.08958	VSL off DP
08/02/17 22:43	37	-74.02874	-28.08959	CTD on deck
08/02/17 21:44	37	-74.02875	-28.08957	CTD at depth 2457m (EA600 2516m) commence recovery
08/02/17 20:58	37	-74.02873	-28.08955	CTD 033 deployed
08/02/17 20:55	37	-74.02876	-28.08957	Commence Deploying CTD 033
08/02/17 20:45	36	-74.02877	-28.08968	Hydrophone recovered
08/02/17 20:30	36	-74.0282	-28.08809	Hydrophone deployed for mooring
08/02/17 20:11	36	-74.02823	-28.08828	P6 mooring acquired in position 74 01.170S 028 04.780W
08/02/17 19:07	36	-74.01921	-28.07569	P6 Mooring deployed
08/02/17 18:39	36	-74.02036	-28.08878	Acoustic Release in the Water
08/02/17 17:46	36	-74.02155	-28.15777	SBE56 and Final Float in the Water Paying out 1540m
08/02/17 17:36	36	-74.02111	-28.16435	Sound Source in the water
08/02/17 17:11	36	-74.01994	-28.17987	Hydrophone in the Water
08/02/17 17:05	36	-74.01963	-28.18343	ARGOS INSU and Top Section of Floats in the Water
08/02/17 16:59	36	-74.01934	-28.18816	Commence P6 Mooring Deployment Stern Bulwark Door Lowered
08/02/17 16:36		-74.01915	-28.19783	VSL on DP Assessing Ice Movement
06/02/17 06:18		-64.01319	-28.87659	On Passage
06/02/17 06:06		-63.96539	-28.87686	VSL off DP
06/02/17 06:00	35	-63.96537	-28.87687	CTD Recovered to Deck (A23 Transect Completed)
06/02/17 04:11	35	-63.96537	-28.87688	CTD Stopped at 4783m
06/02/17 02:52	35	-63.96539	-28.87686	CTD veering to 4700m
06/02/17 02:45	35	-63.96538	-28.87687	CTD Deployed 032
06/02/17 02:36		-63.96503	-28.87631	Vessel on DP
06/02/17 02:30		-63.95815	-28.87328	Vessel slowing down for station
05/02/17 22:24		-63.35043	-29.57312	VSL on Passage
05/02/17 22:18		-63.34818	-29.57109	VSL off DP
05/02/17 22:14	34	-63.34816	-29.57111	CTD on deck
05/02/17 20:25	34	-63.34816	-29.5711	CTD at depth 4700m (EA600 4724m) commence recovery
05/02/17 19:01	34	-63.34815	-29.57115	CTD 031 deployed
05/02/17 18:59	34	-63.34815	-29.57111	CTD off deck
05/02/17 18:54		-63.3477	-29.57013	VSL on DP
05/02/17 18:48		-63.33876	-29.58317	Commence Slowing Down
05/02/17 16:48		-63.08127	-30.09775	On Passage
05/02/17 16:42		-63.07303	-30.11298	VSL off DP
05/02/17 16:28	33	-63.07243	-30.11213	CTD Recovered to Deck
05/02/17 14:40	33	-63.07244	-30.11207	CTD stopped at 4856m
05/02/17 13:18	33	-63.07243	-30.11205	CTD veering to 4900m
05/02/17 13:14	33	-63.07245	-30.11204	CTD Deployed 030
05/02/17 13:06		-63.0723	-30.11317	Vessel on DP

05/02/17 13:00		-63.0624	-30.11051	Vessel slowing down for station
05/02/17 10:48		-62.78994	-30.69963	VSL on passage
05/02/17 10:42		-62.78321	-30.69871	VSL off DP
05/02/17 10:35	32	-62.78312	-30.69791	CTD on deck
05/02/17 08:42	32	-62.78313	-30.69788	CTD at depth 4810m (EA600 4859m) commence recovery
05/02/17 07:18	32	-62.78313	-30.69783	CTD deployed 029
05/02/17 07:15	32	-62.78313	-30.6978	CTD off deck
05/02/17 07:12		-62.78313	-30.69773	VSL on DP
05/02/17 07:06		-62.78296	-30.69728	Commence slow down
05/02/17 04:48		-62.49428	-31.26224	On Passage
05/02/17 04:42		-62.49096	-31.26145	VSL off DP
05/02/17 04:24	31	-62.49086	-31.26074	CTD Recovered to Deck
05/02/17 02:37	31	-62.49089	-31.26072	CTD all stopped at 4741m
05/02/17 01:20	31	-62.49092	-31.26074	CTD Veering to 4700m
05/02/17 01:12	31	-62.49091	-31.26075	CTD Deployed 028
05/02/17 00:30		-62.49085	-31.26071	Vessel on DP
05/02/17 00:24		-62.48393	-31.24379	Vessel slowing down for station
04/02/17 21:48		-62.07663	-31.18733	VSL on passage
04/02/17 21:42		-62.07545	-31.18274	VSL off DP
04/02/17 21:33	30	-62.07503	-31.18185	CTD on deck
04/02/17 19:36	30	-62.07516	-31.18198	CTD at depth 4829m (EA600 4883m) commence recovery
04/02/17 18:14	30	-62.07517	-31.18206	CTD Veering to Approx 4800m
04/02/17 18:11	30	-62.07518	-31.18201	CTD in the Water
04/02/17 18:04	30	-62.07518	-31.18204	Commence Deploying CTD 027
04/02/17 18:00		-62.07515	-31.18203	VSL on DP
04/02/17 17:54		-62.07249	-31.17854	Commence Turning onto Station
04/02/17 15:06		-61.66722	-31.11303	On Passage
04/02/17 15:00		-61.6605	-31.11121	VSL off DP
04/02/17 14:52	29	-61.66066	-31.10957	CTD Recovered
04/02/17 13:37	29	-61.66067	-31.10975	CTD all stopped at 3376m
04/02/17 12:39	29	-61.66072	-31.1097	CTD Veering to 3400m
04/02/17 12:33	29	-61.66071	-31.10969	CTD Deployed 026
04/02/17 12:24		-61.66066	-31.10742	Vessel on DP
04/02/17 12:18		-61.65528	-31.10207	Vessel slowing down for station
04/02/17 11:30		-61.55166	-31.10843	Vessel on passage
04/02/17 11:24		-61.55078	-31.1028	Vessel Off DP
04/02/17 11:16	28	-61.55084	-31.10299	CTD recovered
04/02/17 09:41	28	-61.55088	-31.10301	CTD at depth 4044m (EA600 4076m) commence recovery
04/02/17 08:24	28	-61.55093	-31.10311	CTD 025 deployed
04/02/17 08:20	28	-61.55094	-31.10308	CTD off deck
04/02/17 08:12		-61.55098	-31.10311	VSL on DP
04/02/17 08:06		-61.54384	-31.1003	Commence slow down
04/02/17 05:36		-61.17749	-31.04714	On Passage
04/02/17 05:24		-61.16988	-31.04496	VSL off DP
04/02/17 05:15	27	-61.16988	-31.04495	CTD Recovered to Deck
04/02/17 03:47	27	-61.16995	-31.04494	CTD Stopped at 3466m
04/02/17 02:46	27	-61.17002	-31.04491	CTD Veering to 3400m
04/02/17 02:37	27	-61.16996	-31.04502	CTD Deployed 024
04/02/17 02:24		-61.1704	-31.04256	Vessel on DP
04/02/17 02:18		-61.16297	-31.0356	Vessel slowing down
04/02/17 02:00		-61.11711	-31.03849	On passage
04/02/17 01:54		-61.11024	-31.04002	Vessel off DP
04/02/17 01:40	26	-61.1087	-31.03875	CTD recovered
04/02/17 00:42	26	-61.1087	-31.03877	CTD stopped at 2502m
03/02/17 23:58	26	-61.10868	-31.03864	CTD veering to 2300m - EA600 depth: 2484m
03/02/17 23:50	26	-61.10873	-31.03866	CTD Deployed 023
03/02/17 23:42		-61.10858	-31.03751	Vessel on DP
03/02/17 23:36		-61.10582	-31.03324	Vessel slowing down
03/02/17 20:54		-60.70405	-31.14166	Vessel on Passage
03/02/17 20:48		-60.6983	-31.12554	Vessel Off DP
03/02/17 20:05	25	-60.69704	-31.12047	CTD on deck - securing the deck and science cargo
03/02/17 19:14	25	-60.69699	-31.12044	CTD at depth 1671m (EA600 1710m) commence recovery
03/02/17 18:44	25	-60.69707	-31.12036	CTD Veering to Approx 1700m

03/02/17 18:40	25	-60.69702	-31.12039	CTD in the Water
03/02/17 18:34	25	-60.69708	-31.12075	Commence Deploying CTD 022
03/02/17 18:30		-60.69669	-31.1199	VSL on DP
03/02/17 18:24		-60.69113	-31.11052	Commence Turning on to Station
03/02/17 16:00		-60.32168	-30.9663	On Passage
03/02/17 15:48		-60.31313	-30.95365	VSL off DP
03/02/17 15:44	24	-60.31312	-30.95366	CTD Recovered to Deck
03/02/17 14:40	24	-60.31317	-30.95353	CTD stopped at 2728m
03/02/17 13:53	24	-60.3131	-30.95375	CTD Veering to 2600m
03/02/17 13:47	24	-60.31308	-30.95368	CTD Deployed 021
03/02/17 13:36		-60.31311	-30.95369	Vessel on DP
03/02/17 13:30		-60.31321	-30.95072	Vessel slowing for station
03/02/17 11:18		-59.99145	-30.93077	Vessel on passage
03/02/17 11:12		-59.99164	-30.92981	Vessel off DP
03/02/17 11:04	23	-59.99162	-30.92983	CTD Recovered
03/02/17 09:52	23	-59.99164	-30.92992	CTD at depth 2980m (EA600 3042m) commence recovery
03/02/17 08:55	23	-59.99163	-30.92997	CTD deployed 020
03/02/17 08:51	23	-59.99165	-30.93001	CTD off deck
03/02/17 08:30		-59.99016	-30.93221	VSL on DP - waiting for CTD reboot
03/02/17 08:24		-59.97979	-30.93708	Commence slow down
03/02/17 06:42		-59.77091	-30.90604	On Passage
03/02/17 06:36		-59.76622	-30.90516	VSL off DP
03/02/17 06:19	22	-59.76618	-30.90513	CTD Recovered to Deck
03/02/17 04:44	22	-59.76623	-30.90527	CTD Stopped at 3774m
03/02/17 03:39	22	-59.76625	-30.9052	CTD Veering to Approx 3700
03/02/17 03:36	22	-59.76625	-30.90521	CTD in the Water
03/02/17 03:27	22	-59.76627	-30.90517	Commence Deploying CTD 019
03/02/17 03:24		-59.76628	-30.90521	VSL on DP
03/02/17 03:18		-59.76578	-30.90168	Commence Turning onto Station
03/02/17 02:36		-59.67361	-30.89666	Vessel on passage
03/02/17 02:30		-59.67456	-30.89589	Vessel Off DP
03/02/17 02:18	21	-59.67453	-30.89599	CTD recovered
03/02/17 01:12	21	-59.67456	-30.89597	CTD stopped at 2928m
03/02/17 00:14	21	-59.67456	-30.89593	CTD Veering to 2800m
03/02/17 00:12	21	-59.67455	-30.89593	CTD Deployed 018
03/02/17 00:00		-59.67482	-30.89085	Vessel on DP
02/02/17 23:54		-59.6681	-30.88526	Vessel slowing down
02/02/17 22:24		-59.43454	-30.87462	On Passage
02/02/17 22:18		-59.4359	-30.85906	Off DP
02/02/17 22:04	20	-59.43595	-30.85839	CTD on deck
02/02/17 20:31	20	-59.43595	-30.85841	CTD at depth 3403m (EA600 3459m) commence recovery
02/02/17 19:29	20	-59.43594	-30.85842	CTD deployed 017
02/02/17 19:26	20	-59.43592	-30.85835	CTD off deck
02/02/17 19:24		-59.43593	-30.85837	VSL on DP
02/02/17 19:18		-59.43235	-30.85501	Commence slow down
02/02/17 17:12		-59.05296	-30.82922	On Passage
02/02/17 17:06		-59.0501	-30.82929	VSL off DP
02/02/17 17:01	19	-59.05011	-30.82927	CTD Recoverd to Deck
02/02/17 15:45	19	-59.0501	-30.82933	CTD Stopped at 3102m
02/02/17 14:52	19	-59.05013	-30.8293	CTD veering to 3100m
02/02/17 14:48	19	-59.05011	-30.82926	CTD Deployed 016
02/02/17 14:42		-59.05001	-30.82945	Vessel on DP
02/02/17 14:36		-59.0496	-30.82504	Vessel slowing down
02/02/17 12:06		-58.6359	-30.8303	Vessel on passage
02/02/17 12:00		-58.63532	-30.8232	Vessel Off DP
02/02/17 11:51	18	-58.63532	-30.82317	CTD Recovered to deck
02/02/17 10:36	18	-58.63532	-30.82324	CTD at depth 3500m (EA600 3599m) commence recovery
02/02/17 09:33	18	-58.63533	-30.82323	CTD deployed 015
02/02/17 09:31	18	-58.63533	-30.82329	CTD off deck
02/02/17 09:24		-58.63541	-30.82258	VSL on DP
02/02/17 09:18		-58.62609	-30.82318	Commence slow down
02/02/17 06:54		-58.22184	-30.8214	On Passage
02/02/17 06:48		-58.21323	-30.8212	VSL off DP

02/02/17 06:32	17	-58.2132	-30.82056	CTD Recovered to Deck
02/02/17 04:34	17	-58.21316	-30.82057	CTD Stopped at 3973m (EA 600 depth 4083m)
02/02/17 02:57	17	-58.21322	-30.82052	CTD veering to 3700m
02/02/17 02:50	17	-58.21318	-30.82046	CTD Deployed 014
02/02/17 02:48		-58.21319	-30.8205	Vessel on DP
02/02/17 02:42		-58.21309	-30.81861	vessel slowing down
02/02/17 00:00		-57.79799	-30.83631	Vessel on Passage
01/02/17 23:54		-57.79786	-30.83207	Vessel Off DP
01/02/17 23:42	16	-57.79786	-30.83206	CTD recovered
01/02/17 22:08	16	-57.79783	-30.83211	CTD at depth 3441m (EA600 3474m) commence recovery
01/02/17 21:07	16	-57.79783	-30.83217	CTD deployed 013
01/02/17 21:02	16	-57.79784	-30.83215	CTD off deck
01/02/17 20:54		-57.79788	-30.83215	On DP
01/02/17 20:48		-57.7916	-30.83631	Commence slow down
01/02/17 18:30		-57.4598	-31.32312	On Passage
01/02/17 18:18		-57.45743	-31.32706	VSL off DP
01/02/17 18:12	15	-57.45743	-31.32706	CTD Recovered to Deck
01/02/17 16:45	15	-57.4575	-31.32701	CTD Stopped at 3744m
01/02/17 15:41	15	-57.45749	-31.32698	CTD Veering to approx 3700m
01/02/17 15:38	15	-57.45747	-31.32706	CTD in the Water
01/02/17 15:35	15	-57.45748	-31.32703	Commence Deploying CTD 012
01/02/17 15:30		-57.4577	-31.32672	VSL on DP
01/02/17 15:24		-57.45943	-31.32408	Commence Slowing Down
01/02/17 12:54		-57.11737	-31.81699	Vessel on Passage
01/02/17 12:48		-57.11996	-31.81352	Vessel off DP
01/02/17 12:40	14	-57.11999	-31.81362	CTD Recovered
01/02/17 12:36	14	-57.12	-31.81356	CTD at surface
01/02/17 11:20	14	-57.12005	-31.81351	CTD Stopped at 3402m
01/02/17 10:17	14	-57.12008	-31.81357	CTD deployed 011
01/02/17 10:14	14	-57.12006	-31.81351	Commence CTD deployment
01/02/17 08:42		-57.11986	-31.81352	V/L on DP
31/01/17 17:00		-56.77481	-32.29776	VSL off DP and Hove to for Weather Conditions
31/01/17 16:54	13	-56.77484	-32.29832	CTD Recovered to Deck
31/01/17 15:12	13	-56.77465	-32.29905	CTD stopped at 3221m
31/01/17 14:07	13	-56.77464	-32.29917	CTD Veering to 3200m
31/01/17 14:02	13	-56.77465	-32.29915	CTD Deployed 010
31/01/17 13:30		-56.77434	-32.29908	Vessel on DP
31/01/17 13:24		-56.76736	-32.30451	Vessel commencing slow down
31/01/17 10:24		-56.37058	-32.86879	Vessel on Passage
31/01/17 10:18		-56.37756	-32.87199	Vessel Off DP
31/01/17 10:09	12	-56.37908	-32.87106	CTD on deck
31/01/17 08:26	12	-56.37909	-32.87125	CTD at depth 3107m (EA600 3176m) commence recovery
31/01/17 06:46	12	-56.37909	-32.87129	CTD Veering to Approx 3100m
31/01/17 06:43	12	-56.37907	-32.87133	CTD in the Water
31/01/17 06:36	12	-56.37908	-32.87131	Commence Deploying CTD 009
31/01/17 06:00		-56.37903	-32.87123	VSL on DP
31/01/17 05:48		-56.3798	-32.87265	Commence Turning onto Station
31/01/17 02:18		-55.98869	-33.41943	Vessel on Passage
31/01/17 02:12		-55.99059	-33.41879	Vessel Off DP
31/01/17 01:30		-55.9908	-33.41879	Vessel on DP assessing conditions
31/01/17 01:18		-55.98887	-33.41787	Commence slow down
30/01/17 23:18		-55.72301	-33.77945	Vessl on Passage
30/01/17 23:12		-55.72145	-33.78385	V/L off DP
30/01/17 23:11	xxx002	-55.72179	-33.78356	ARGO Float deployed
30/01/17 22:56	10	-55.72251	-33.78296	CTD 008 recovered to deck
30/01/17 20:27	10	-55.72251	-33.78311	CTD 008 at depth 3461m (EA600 3493m) commence recovery
30/01/17 19:36	11	-55.72252	-33.7831	Net recovered due to wind
30/01/17 19:26	11	-55.72251	-33.78308	Net deployed
30/01/17 19:16	10	-55.72251	-33.78309	CTD 008 deployed
30/01/17 19:14	10	-55.72251	-33.78308	CTD off deck
30/01/17 19:06		-55.72341	-33.78335	V/L on DP
30/01/17 18:54		-55.70299	-33.80858	Commence Slowing Down

30/01/17 17:06		-55.48421	-34.12983	On Passage
30/01/17 17:00		-55.48453	-34.1331	VSL off DP
30/01/17 16:53	9	-55.48454	-34.1331	CTD Recovered to Deck
30/01/17 15:48	9	-55.48454	-34.13312	CTD Stopped at 2449m
30/01/17 15:05	9	-55.48453	-34.13311	CTD Veering to Approx 2450m
30/01/17 15:01	9	-55.48453	-34.13311	CTD in the Water
30/01/17 14:58	9	-55.48453	-34.1331	CTD 007 Deployed
30/01/17 14:36		-55.48453	-34.1332	Vessel On DP
30/01/17 14:30		-55.48532	-34.13706	Vessel slowing down for station
30/01/17 13:06		-55.29871	-34.39234	Vessel on passage
30/01/17 13:00		-55.29036	-34.40358	Vessel Off DP
30/01/17 12:50	6	-55.28966	-34.40135	CTD recovered
30/01/17 12:47	6	-55.28967	-34.40134	CTD at surface
30/01/17 11:49	8	-55.28967	-34.40134	Net recovered
30/01/17 11:46	8	-55.28966	-34.40134	Net deployed
30/01/17 11:42	7	-55.28966	-34.40133	Net recovered
30/01/17 11:41	7	-55.28966	-34.40132	Net deployed
30/01/17 11:40	6	-55.28965	-34.40131	CTD stopped at 2057m
30/01/17 11:00	6	-55.28964	-34.40132	CTD Veering to 2065m
30/01/17 10:58	6	-55.28964	-34.40134	CTD deployed
30/01/17 10:57	6	-55.28964	-34.40134	CTD off deck
30/01/17 10:31	6	-55.28966	-34.40134	V/L on DP
30/01/17 10:25		-55.2843	-34.40927	Commence slow down
30/01/17 10:10		-55.2594	-34.45846	V/L on passage
30/01/17 10:03	5	-55.25891	-34.44408	V/L off DP
30/01/17 09:59	5	-55.25893	-34.44389	CTD on deck
30/01/17 09:21	5	-55.25893	-34.44388	CTD at depth 1490m (EA600 1515m) commence recovery
30/01/17 08:52	5	-55.25891	-34.44389	CTD deployed
30/01/17 08:50	5	-55.2589	-34.44388	CTD off deck
30/01/17 08:41		-55.25891	-34.44387	V/L on DP for CTD
30/01/17 08:36		-55.25709	-34.44547	Commence slow down
30/01/17 08:21	4	-55.23517	-34.49999	V/L on passage
30/01/17 08:12	4	-55.231	-34.48885	V/L off DP
30/01/17 08:08	4	-55.23096	-34.48888	CTD 004 on deck
30/01/17 07:39	4	-55.23099	-34.48888	CTD 004 at depth 1036m (EA600 1050m) commence recovery
30/01/17 07:17	4	-55.23099	-34.48888	CTD deployed
30/01/17 07:14	4	-55.23104	-34.48887	CTD off deck
30/01/17 07:06	4	-55.23104	-34.48884	VSL on DP
30/01/17 07:00	4	-55.22911	-34.48762	Commence Slowing Down
30/01/17 06:54		-55.2198	-34.50224	On Passage
30/01/17 06:48		-55.21556	-34.50771	VSL off DP
30/01/17 06:41	3	-55.21544	-34.50779	CTD Recovered to Deck
30/01/17 06:23	3	-55.21541	-34.50776	CTD Stopped at 539m
30/01/17 06:11	3	-55.2155	-34.5076	CTD Veering to Approx 550m
30/01/17 06:06	3	-55.2155	-34.5076	CTD in the Water
30/01/17 06:02	3	-55.21582	-34.5077	Commence Deploying CTD
30/01/17 06:00		-55.21607	-34.50779	VSL on DP
30/01/17 05:54		-55.21562	-34.50754	Commence Slowing Down
29/01/17 01:36	ADCP Calib	-53.67124	-40.67223	Vessel at speed on passage. End of ADCP calibration
29/01/17 01:30	ADCP Calib	-53.67081	-40.67513	A/C 106
29/01/17 01:19	ADCP Calib	-53.67047	-40.83383	A/C 016
29/01/17 01:06	ADCP Calib	-53.67737	-40.79785	A/C 286
29/01/17 00:45	ADCP Calib	-53.65062	-40.79429	A/C 196
29/01/17 00:36	ADCP Calib	-53.64537	-40.82666	Commence calibration
28/01/17 08:00	xxx007	-52.73495	-45.96372	VSL on passage
28/01/17 07:49	xxx007	-52.74693	-45.97403	Reissmann Argo Float deployed Water depth 3363m
28/01/17 07:40	xxx007	-52.75649	-45.97402	V/L reduces speed and alters course for ARGO float deployment
26/01/17 18:48		-52.97463	-56.77129	On Passage
26/01/17 18:42		-52.97502	-56.78037	VSL off DP
26/01/17 18:33	002 Test	-52.97502	-56.78038	CTD Recovered to Deck
26/01/17 17:36	002 Test	-52.97499	-56.78038	CTD Stopped at 1319m

26/01/17 17:01	002 Test	-52.97504	-56.78035	CD veering to approx 1500m
26/01/17 16:58	002 Test	-52.97502	-56.78036	CTD in the Water
26/01/17 16:55	002 Test	-52.97502	-56.78038	Commence Deploying CTD
26/01/17 16:54		-52.97502	-56.78038	VSL on DP
26/01/17 16:48		-52.97615	-56.78015	Commence Slowing Down
26/01/17 15:54		-52.97593	-57.0174	On Passage
26/01/17 15:48		-52.97756	-57.01866	VSL off DP
26/01/17 15:43	001 Test	-52.97757	-57.01864	CTD Recovered to Deck
26/01/17 14:26	001 Test	-52.9776	-57.0186	CTD Stopped at 1567m - Commenced hauling
26/01/17 13:58	001 Test	-52.97761	-57.01864	CTD Veering to 1590m
26/01/17 13:54	001 Test	-52.9776	-57.01862	CTD in Water
26/01/17 13:50	001 Test	-52.9776	-57.01861	CTD Deployed
26/01/17 13:00		-52.97758	-57.01857	Vessel On DP
26/01/17 12:54		-52.97848	-57.01832	Vessel slowing down for station