environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Cruise Report
SAMBA Moorings & Monitoring Line
RS Algoa Voyage 210
15 – 29 September 2014

Compiled by Marcel van den Berg, Chief Scientist

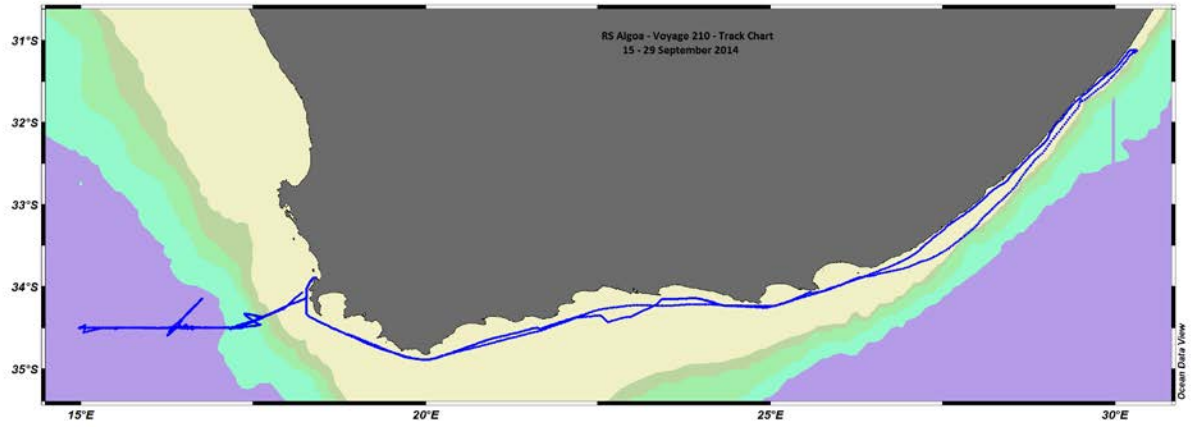


Figure 1. *Alg210- track chart*

Contents:

C1. Cruise Objectives:

1. Deploy 4 x tall moorings on the SAMBA (South Atlantic Mooring Buoy Array) mooring line incorporating ADCP's and Sea-Bird MicroCATs. (Mike Roberts and Marcel van den Berg: DEA)
2. Undertake CTD casts to 1000 m on mooring deployment sites. (Marcel van den Berg: DEA)
3. Run under-way TSG and pCO_2 (Mutshutshu Tsanwani: DEA)
4. Undertake 4 hourly underway sampling for oxygen (Mutshutshu Tsanwani – DEA)
5. Undertake DIC; nutrient; and oxygen sampling at CTD stations along SAMBA mooring line (Mutshutshu Tsanwani: DEA)

C2. Cruise participants:

#	Name	Responsibility
1	Marcel van den Berg (DEA)	Chief Scientist
2	Mbulelo Makhetha (DEA)	Moorings and CTD
3	Gavin Louw (DEA)	Moorings and CTD
4	Leon Jacobs (DEA)	Moorings and CTD
5	Bradley Blows (BCRE)	Moorings
6	Khaya Siswana (DEA)	pCO_2 and underway sampling
7	Baxolele Mdokwana (DEA)	pCO_2 and underway sampling
8	Miche Easton (DEA Intern)	Moorings and CTD
9	Mashilo Moshoabane (DEA Intern)	CTD and sampling
10	Phelokazi Ntatyana (DEA Intern)	CTD and sampling

C3. Introduction

Observations and models consistently indicate that variations in the Meridional Overturning Circulation (MOC) are strongly correlated to important climate changes such as variations in precipitation and surface air temperatures. To date, most MOC observations have been focused in the North Atlantic where the largest volume of new deep water is formed. Numerical model studies have shown, however, that the South Atlantic is not just a passive conduit for the deep water masses formed in the North Atlantic and Southern Ocean, but instead actively participates in their transformation as they are exchanged with the other ocean basins. Recognition of this led to the formation of a group dedicated to both advancing our understanding of the role of the South Atlantic Ocean in the MOC system and the establishment of an observing system to capture key components of the circulation: this initiative is known as South Atlantic Meridional Overturning Circulation, or SAMOC.

The South Atlantic Ocean is unique in its role as a nexus and melting pot for water-masses formed elsewhere and transiting between the far regions of the World Ocean. Its mean meridional circulation involves a deep, southward, flow of cold and salty North Atlantic Deep Water and, a compensating northward flow that is a mixture of warm and salty surface waters and cooler and fresher Antarctic Intermediate Waters. At a much greater depth, the lowest limb of the MOC is driven by formation of very salty and cold Antarctic Bottom Water near the Antarctic coast, and this limb of the MOC stretches throughout the complete South Atlantic, interacting with the North Atlantic Deep Water flow along the way before returning south. This complicated circulation pattern results in a significant equatorward oceanic heat flux, which is unlike any of the other ocean basins. Observations and models have shown that many of the components of the MOC in the South Atlantic are highly variable, with changes occurring on time scales ranging from a few days to many years. This variability is further complicated by the active transformation of these water masses as they pass through the South Atlantic. These changes occur across the entire basin, but are particularly intensified in regions of high mesoscale variability at the Brazil/Malvinas Confluence and at the Agulhas Retroflection. Observations show, for example, interannual variations in the sources that feed the Benguela Current, and hence in the upper ocean northward flow that eventually crosses the equator into the North Atlantic. It is this mounting evidence of the contribution of the South Atlantic to the global MOC system that has motivated broader study and international collaboration.

The main objectives of the SAMOC initiative are to measure the strength and variability of the MOC as well as the meridional heat and fresh-water transport in the South Atlantic, all of which are crucial to improving our understanding of climate system variability.

C4. Cruise Narrative

The RS Algoa departed Cape Town at 12h00 (**all times in GMT**) on the 15 September. The vessel started steaming towards the SAMBA (South Atlantic Mooring Buoy Array) transect at 34° 30 S. Due to the DEA Interns onboard not having completed their pre-safety at sea courses a muster and lifeboat drill was held before departure , in line with the conditions of the exemption that was obtained from SAMSA for the interns to be onboard.

After the vessel passed the breakwater, the scientific seawater supply was switched on. The Thermosalinograph (TSG); pCO_2 and digital SPAR systems were switched on and started recording underway data. All underway data (except for pCO_2) was captured to the SDS (Scientific Data System). *(See section C10 on underway sampling)* The vessel mounted ADCP was switched on and recorded underway current data.(*see section C10.1 on shipbased adcp*) Problems were encountered with the GPS NMEA feed to the ADCP logging computer, but this was corrected by rebooting the NMEA distribution box from the vessel's main GPS

During the evening the first 18 of 34 SBE MicroCATs earmarked for deployment, were setup to record data every 10 seconds for calibration purposes. These SBE MicroCATs were attached to the SBE CTD carousal .The next morning the vessel was positioned between station 1 and 2 in 2500m of water. The first calibration station commenced at 06h30, with a CTD dip to 1000m. The CTD was stopped at 4 selected depths for a period of 10 minutes to collect simultaneous CTD and SBE MicroCAT data. A 2nd CTD dip with 16 SBE MicroCATs was completed after the 1st dip. At both calibration dips manual oxygen and salinity samples were collected for verification of the CTD sensors. *(see section C6 on MicroCAT calibrations)*

The vessel then proceeded to the first mooring deployment position – SAMBA M7. The deployment commenced 13h00 (16 Sept) and was completed at 14h32*. (see section C7 on SAMBA mooring deployments).* After deployment a CTD cast, to 1000m, was completed and sampled for oxygen; salinity; nutrients and DIC. As the vessel was departing the station a SVP drifter buoy was deployed. *(see section C8 – SVP Drifter deployments)*

The second mooring (SAMBA M8) was deployed between 09h20 and 10h10 on the morning of 17 September, in 2124m of water depth. As for all deployments this was followed by a 1000m CTD casts and SVP drifter deployment.

The third mooring (SAMBA M9) was deployed later in the afternoon, between 13h30 and 14h50 in 2833m water depth . This was followed by a 1000m CTD casts and SVP drifter deployment.

The plan was to complete three CTD stations between mooring M9 and M10 during the night, but the weather turned against us and this was not possible. The next day (18 September 2014) all work had to be abandoned and the vessel was "hove to" for the day. Winds were gusting up to 45 knots and swell increases to 5-6 meters.

The three CTD stations and SVP drifters deployments were completed on the 19 September, after the wind speeds became more moderate (swell still 4-5 m). The swell came down during the day and decision was made to deploy the SAMBA M10 mooring that night. Deployment started at 20h00 and was completed at 21h50 in a water depth of 4474m. After the deployment a CTD cast to 1000m and deployment of SVP drifter was completed.

The vessel started steaming back along the SAMBA line (Lat 34° 30'S) to collect underway ADCP data from the offshore deployment position to the coast.

The original time allocated for the deployments of the SAMBA moorings was 15 days and we managed to complete the deployments and cruise objectives within 6 days, with only one full day lost due to bad weather. The decision was made, after receiving permission from DEA management, to use the balance of the allocated cruise time to recover a Real-time surface buoy, deployed of Port Edward (on the South African east coast). The buoy stopped transmitting data after a voltage spike and no confirmation could be obtained if the buoy was physically damaged or what caused the buoy from not transmitting data.

Before commencing up the coast towards Port Edward, the vessel docked in Cape Town harbor at 22h00 on the 20 of Sept. Seven of the scientists signed of the vessel, fresh water tanks were topped up before the vessel departed again at 11h00 on the 21st of Sept.

Vessel arrived at the Surface buoy position of Port Edward on the morning of the 25th of Sept. The surface buoy had shifted (dragged) about 750m from its deployment position and was riding very low in the water. The acoustic releases were triggered to release the mooring from the bottom and the mooring with acoustic releases were recovered. On inspection it was found that both buoyancy compartments had flooded. All the instrument connections and underwater plugs were still sound, so not yet able to determine to determine the malfunction on the buoy. We were not able to open the buoy to get to its electronics compartment, as we did not have our specialized toolkit for tamper proof bolts onboard. *(See section C11 – Recovery of Port Edward Real-time Surface Buoy)*

The vessel returned to port on the morning of the 29th of September, after 4 days of steaming down the coast from Port Edward.

C5. Station Details

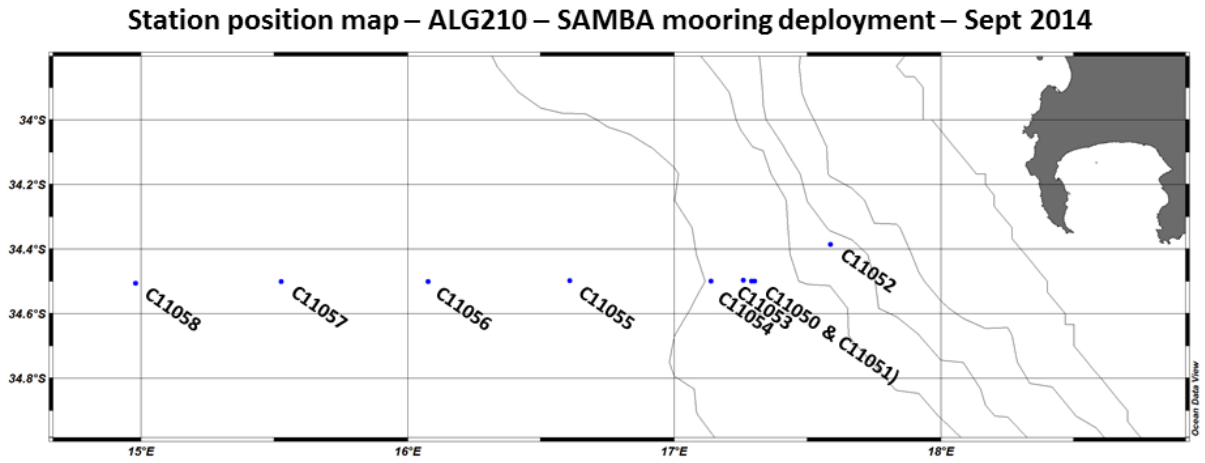
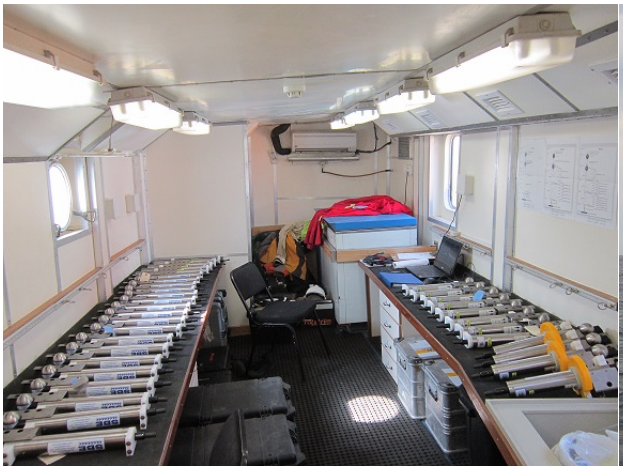


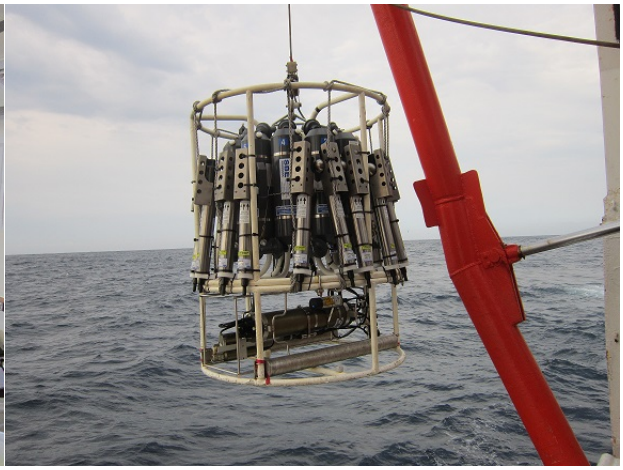
Figure 2. *Station detail map – Alg210*

Ships Station Number	Grid Number	Latitude	Longitude	Depth (m)	Operations
C11050	CTD001	34° 30.01' S	17° 17.49' E	2160	SBE MicroCAT calibration CTD
C11051	CTD002	34° 29.83' S	17° 15.61 E	2285	SBE MicroCAT calibration CTD
C11052	CTD003	34° 23.16' S	17 35.19' E	1107	SAMBA Mooring M7 CTD SVP Drifter
C11053	CTD004	34° 29.96'S	17° 18.1'E	2124	SAMBA Mooring M8 CTD SVP Drifter
C11054	CTD005	34° 30.01'S	17° 08.35'E	2832	SAMBA Mooring M9 CTD SVP Drifter
C11055	CTD006	34° 29.89'S	16° 36.55'E	3471	CTD SVP Drifter
C11056	CTD007	34° 30.07'S	16° 04.67'E	4077	CTD SVP Drifter
C11057	CTD008	34° 30.06'S	15° 31.63'E	4363	CTD SVP Drifter
C11058	CTD009	34° 30.4'S	14° 58.81'E	4473	SAMBA Mooring M10 CTD SVP Drifter

Table 1 *– Station position details*

C6. SBE MicroCAT calibrations





Two CTD casts were done before the deployments of the SAMBA moorings to calibrate the SBE MicroCAT sensors. The first casts had 18 MicoCAT sensors attached to the CTD and the second 16 MicroCAT sensors. Two types of MicroCAT's were used, namely SBE37- SMP-ODO MicroCAT, with Optical Dissolved Oxygen Sensor (SBE63), and the older SBE37-SMP – 62095 sensors. Five of the SBE37-SMP-ODO sensors had pressure sensors fitted, rated to 1000m.

All MicroCAT's were set to record data every 10 seconds, using the "Adaptive Pump Function" to regulate the pump during sampling. On both CTD casts the CTD was stopped for 10 minutes at 4 depths (1000m; 730m; 500m and 110m) to collect high density data at selected depths.

On recovery and downloading of data it was found that the "Adaptive pump function" and short sampling interval (of 10 seconds) caused the instruments to record data at irregular intervals throughout the CTD casts, especially for the instruments that did not have pressure sensors. To do the calibration comparisons with the CTD sensors, the time stamp for each instrument and related data was used to compare with the CTD data collected using the same times (All computers were synchronized to GMT before casts).

Due to the irregular sampling of the MicroCAT's at the selected depths, a comparison was attempted using the CTD down and up casts.

See Annexure I for comparison results between SBE MicroCat's and CTD

C7. SAMBA Mooring

Four SAMBA "tall" moorings were deployed during the cruise. The moorings were deployed in water depths of 1000m; 2000m; 3000m and 4500m, following the bathymetry contours, along the SAMBA transect. The moorings were deployed next to CPIES deployed, in September 2013, by IFREMER, France from the SA Agulhas II. The design and placement of instruments on moorings were agreed to at the SAMOC planning workshop, held in Maimi, Florida,USA, during January 2013.

All moorings have a sub-surface depth of 500m, with an upwards looking 75kHz RDI ADCP deployed in uppermost FT float, set to sample the top 500m of the water column. At selected depths along mooring lines, SBE 37 MicroCat's with optical oxygen sensors were attached. The planned deployment of single point RDI DVS current meters did not take place, due to battery failure of these units during testing of the units. These will be included during the first "turn around" cruise in one year's time.

Due to vessel noise, no attempts were made at tri-angulating mooring positions after deployment

See Annexure II and III for final deployment diagrams and deployment sheets

The following settings were used for the 75kHz ADCP's and SBE 37 MicroCATs for all 4 moorings deployed.

75kHZ RDI ADCP – Long Ranger	
No of depth bins	37
Bin depth size (m)	16
Pings per ensemble	25
Blanking distance	7.04m
Sampling interval	1 hour
Magnetic variation	0 °

SBE 37 SMP- ODO Microcats	
Sampling Interval	3600s (1 Hour)
Sampling Type	Autonomous
Pump setting	Adaptive Pump Control = 1

SAMBA mooring deployments
September 2014

C8. SVP Drifter Deployments

7 SVP drifters were deployed after each CTD cast. See Table 3,below for deployment details.

SVP Drifter Serial no	WMO #	Deployment Date	Deployment Time (GMT)	Latitude	Longitude	Water Depth
116048	15659	16/09/2014	15h40	34° 23.2851'S	17° 35.2207'E	1111m
115992	15654	17/09/2014	12h00	34° 29.961'S	17° 18.117'E	2124m
116122	15663	17/09/2014	15h40	34° 30.1492'S	17° 08.2856'E	2833m
116120	15662	19/09/2014	08h31	34° 30.0015'S	16° 36.3297'E	3471m
115995	15656	19/09/2014	11h58	34° 30.033'S	16° 04.646'E	4079m
115996	15657	19/09/2014	16h03	34° 29.9988'S	15° 31.6598'E	4363m
115983	15653	19/09/2014	22h34	34° 30.446'S	14° 58.825'E	4474m

Table 3 - *SVP Drifter deployment details*

The deployment was done on behalf of the South African Weather Services (SAWS). All the data collected by the satellite drifting buoys are available in near real time. All that is required is the WMO number for that buoy. This number can be obtained without any restrictions from the deployment log on the website of the Global Drifter Program (http://www.aoml.noaa.gov/phod/dac/gdp_track.php). See *Figure 3* for drifter track.

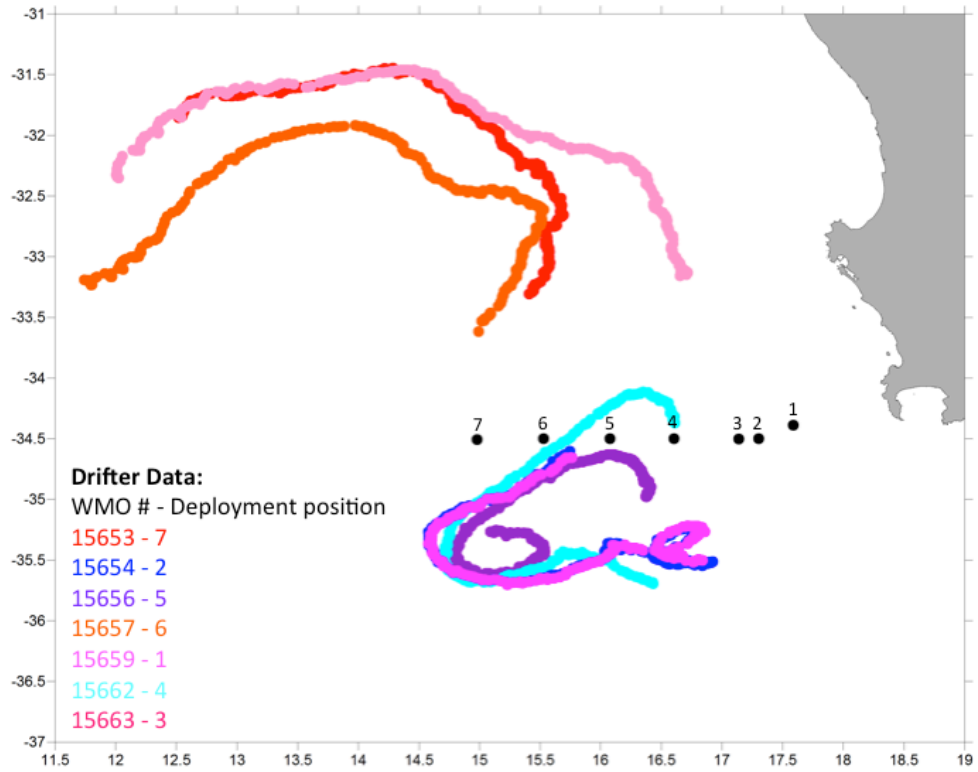


Figure 3 *– Drifter tracks after deployment*

C9. CTD Stations and Hydrography

A total of 9 CTD/Carousel stations were completed during the cruise. Two casts were done for the MicroCAT calibrations and then a cast at each mooring deployment position with 3 additional casts between mooring M9 and M10. See *Table 4* for list of station details.

All CTD casts were profiled to a maximum of 1000m wire. CTD profiles were collected with a Sea-Bird SBE-911+ CTD/SBE 32 carousel water sampler equipped with 12 x 5 liter Niskin sampling bottles.

Channel	**Sensor**	**Serial number**
Frequency 1	Temperature – SBE 3+	2867
Frequency 2	Conductivity – SBE4C	2919
Frequency 3	Pressure (Digiquartz with TC)	89112
Voltage 0	Oxygen – SBE43	1991
Voltage 1	Wetlabs Fluorometer	FLRTD-2051
Voltage 2	Free	
Voltage 3	Free	
Voltage 4	Cambell Scientific OBS 3+ - Turbidity sensor	T8684
Voltage 5	Cambell Scientific OBS 3+ - Turbidity sensor	T8684
Voltage 6	Benthos Altimeter	42437
Voltage 7	Biospherical PAR	70322
SPAR Voltage	Biospherical SPAR	16502

Table 4 - *Sensors mounted on SBE 911 CTD*

Plots of the down and up traces were generated and stored with the CTD cast log sheets. Data from casts were averaged over 1m bins and saved separately as up and down traces during post processing. The data was logged and bottles triggered using Seabird Seasave Win32 Version 7.21d and the data processed using SBE Data Processing Version 7.21g. Downcast profile data was re-formatted then imported into **O**cean **D**ata **V**iew (ODV) for further analysis. See *Figure 4* for preliminary results obtained from CTD casts

Water samples were collected at discrete depths on all casts. Nutrient; **D**issolved **I**norganic **C**arbon (DIC); Oxygen and salinity samples were collected for analysis. Oxygen and salinity samples were collected for calibration of CTD sensors. Salinity Analyses will be completed once vessel returns to port.

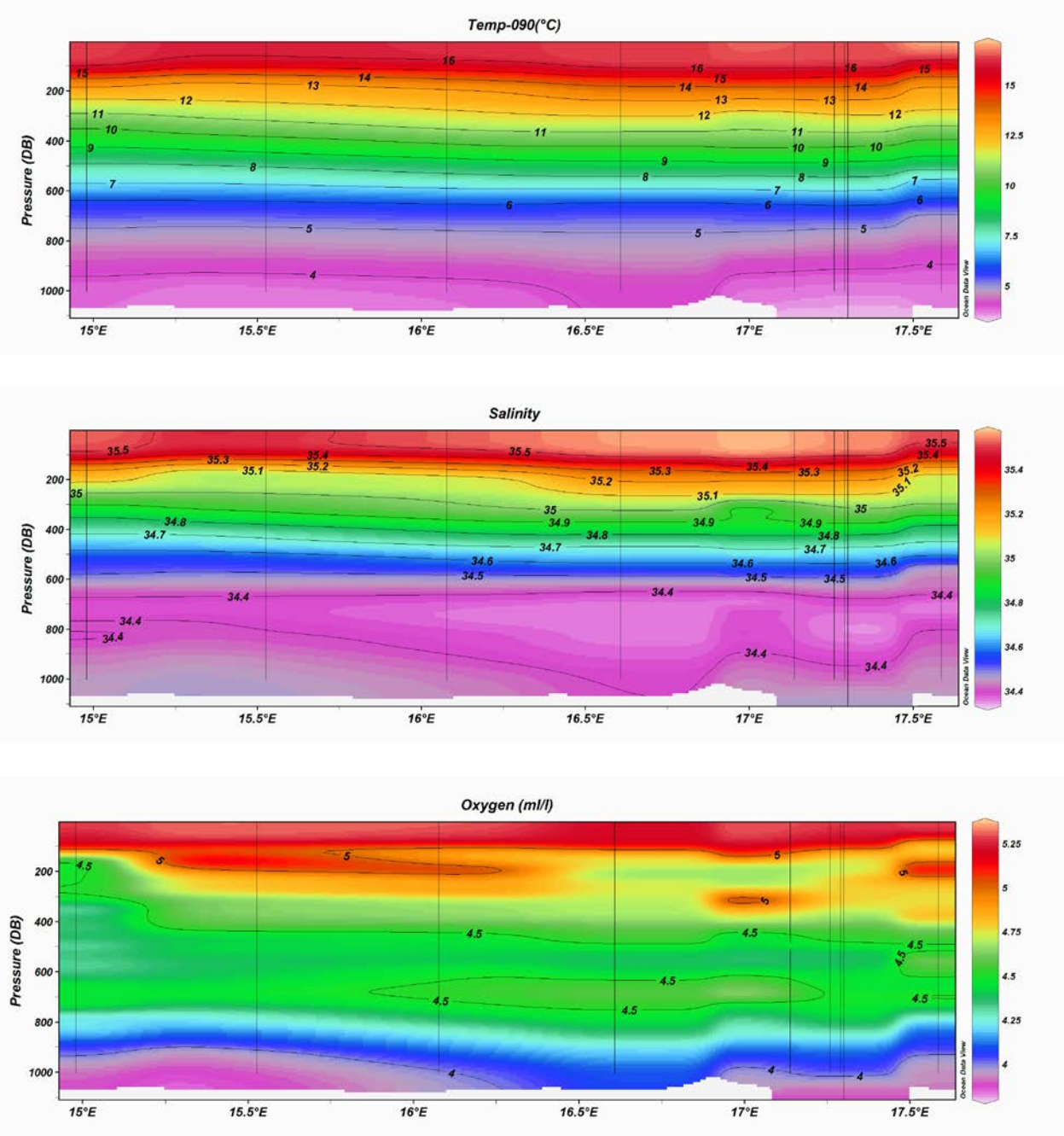


Fig 4 *- Preliminary results obtained from CTD casts along SAMBA transect (Lat 34° 30' S)*

C10. Scientific Underway Equipment:

C10.1 Shipbased ADCP Data:

The vessel's keel mounted 75kHz Teledyne RD Instruments ADCP was set to collect data for selected transects during the voyage. Data was recorded using the Teledyne RDI VMDAS (version1.46) software.

The instrument was setup to collect data for 70 bins, with a bin size of 8m to a total depth of 560m. The instruments alignment correction, in relation to the vessel, was set to -46°. This value was determined after installation trials in July 2012.The blanking distance was set at 8m.

Short **T**erm **A**veraged (STA) data, using a 3 minute average, from the ADCP was processed up to maximum depth of 501 m and data discarded with an error velocity of greater than +.03 and less than -0.3. All data was converted into spread sheets using an extraction function from the *Aqua Vision* ViSea DAS and ViSea DPS software. The data was then reformatted for importing into ODV to create plots. All velocity data is in m/s.

See *Table 5* below for information on filenames and related transects. *Figure 5* shows the surface currents for uninterrupted ADCP transect from offshore mooring (M10) to the coast (ALG210 003 & ALG210 004 combined). *Figure 6* shows Altimetry data (obtained from CCAR) for 20 September 2014 for the area covered during the SAMBA deployments (white line shows S-ADCP transect). *Figure 7* shows the vertical profile (Direction and Velocity) for the same transects as Figure 5.

Transect description	**ADCP File name**
Transect from M7 to M10 (including station stops/ drifts)	ALG210 002
Transect from M10 to M7 (uninterrupted along Lat 34° 30'S)	ALG210 003
Transect from M7 to coast (across Benguela Jet current)	ALG210 004

Table 5 *– ADCP transect details*

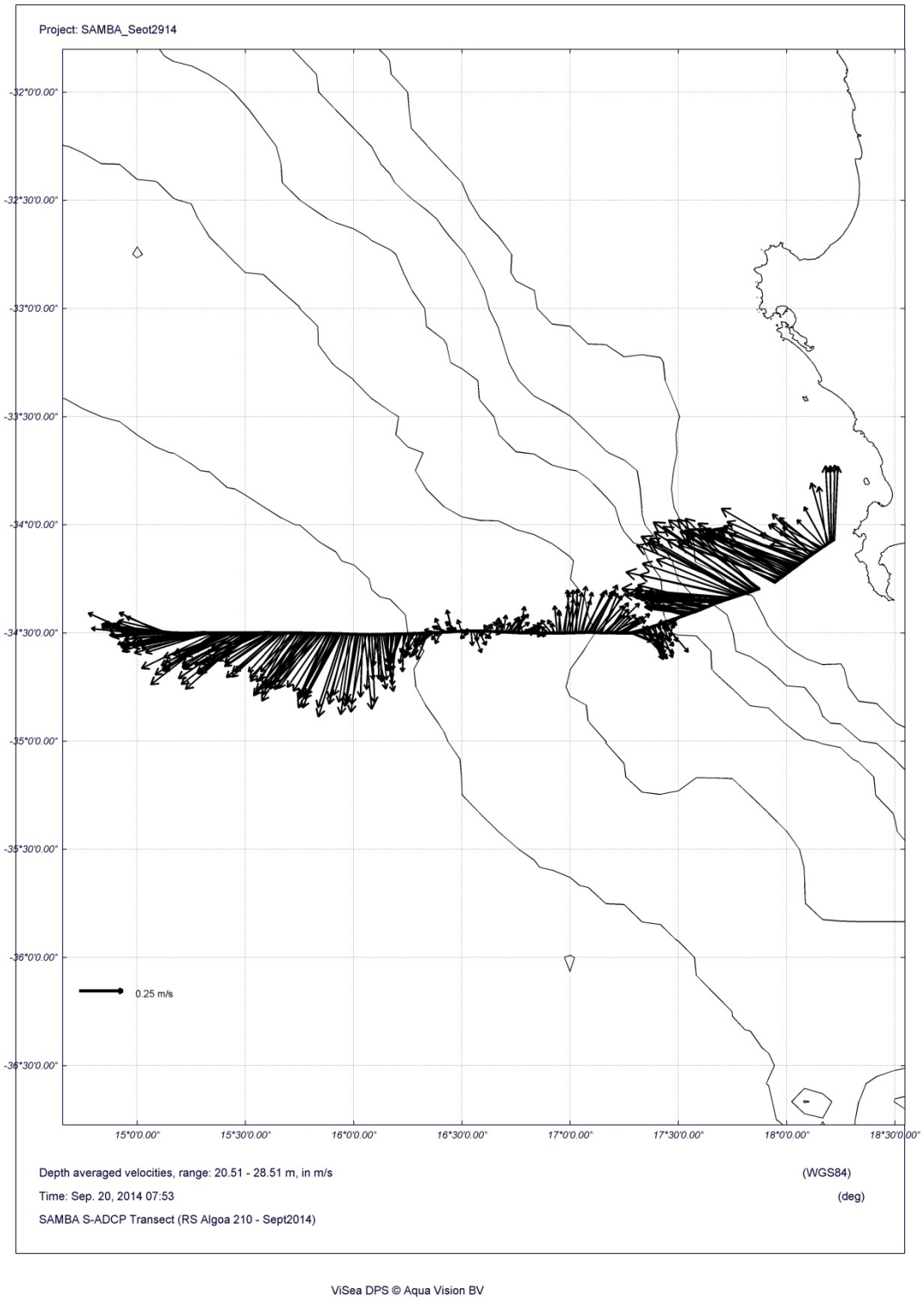


Figure 5 *- Surface current along SAMBA Transect*

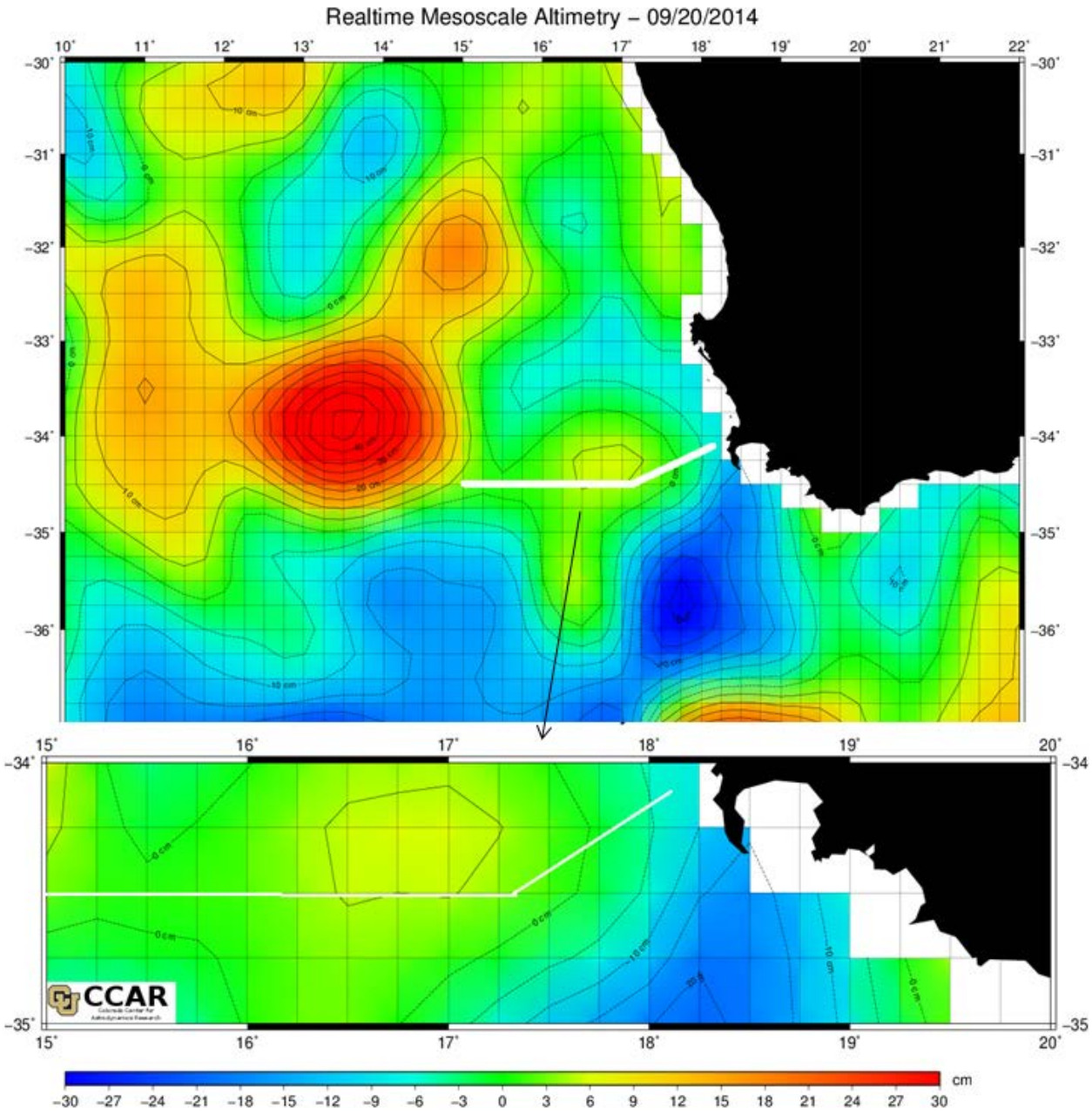


Figure 6 - *Altimetry data (obtained from CCAR) for 20 September 2014 – white line shows S-ADCP transect*

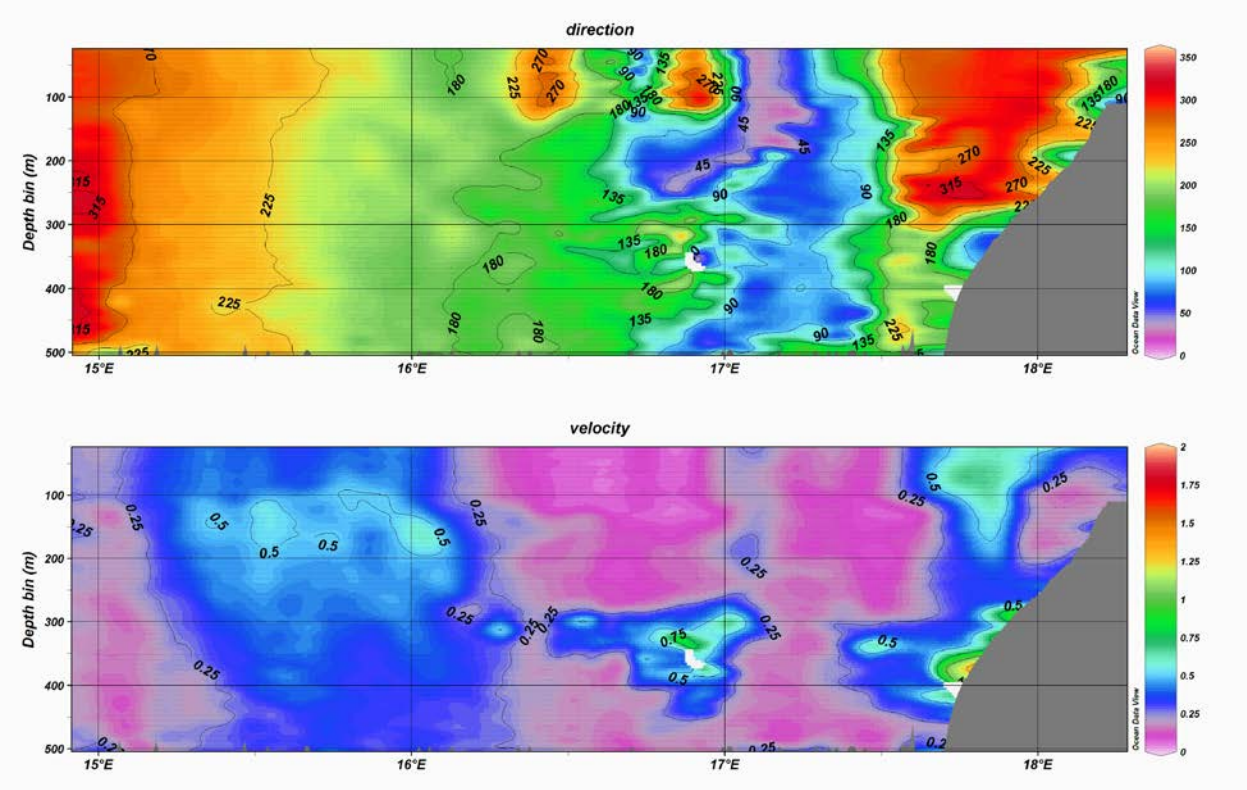


Figure 7 *- Vertical profile of S-ADCP data along SAMBA Transect (Velocity in m/s)*

C10.2 Thermosalinograph (TSG) & pCO_2 Systems

The SeaBird **T**hermo**s**alino**g**raph (TSG) system was run for the duration of the voyage for the collection of underway temperature and salinity data. The instrument obtains sea water from the on-board seawater supply manifold, with seawater being pumped from the sea-chest located in the engine room to the laboratory. The data is recorded in raw format (*.hex) and relayed to the **S**cientific **D**ata **S**ystem (SDS). See *Figure 8* for TSG data plot along SAMBA Transect.

For the duration of the voyage continuous surface pCO_2 data was collected. Surface water was obtained from the seawater intake. The PCO_2 analysis was done by a LiCor Li-7000 CO_2 / H_2O analyser.The pCO_2 system samples the sea surface water that flows through the system every minute and collects additional data from the TSG system and atmospheric air intakes connected to the system. Underway Oxygen calibration samples were collected, every 4 hours, from the scientific seawater outlet to attempt calibration of pCO_2 oxygen sensor.

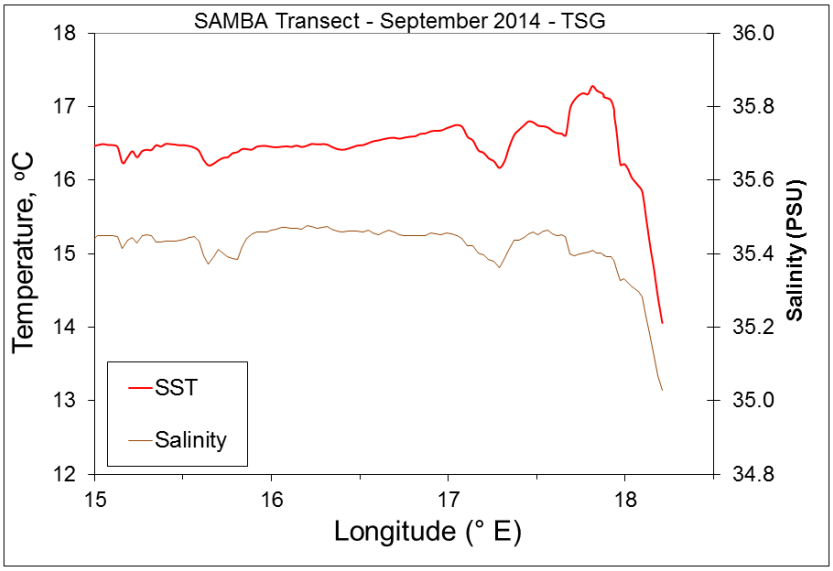


Figure 8 *– Temperature and Salinity plot, from TSG data, along SAMBA transect (Lat 34° 30' S)*

C10.3 Scientific Data System (SDS)

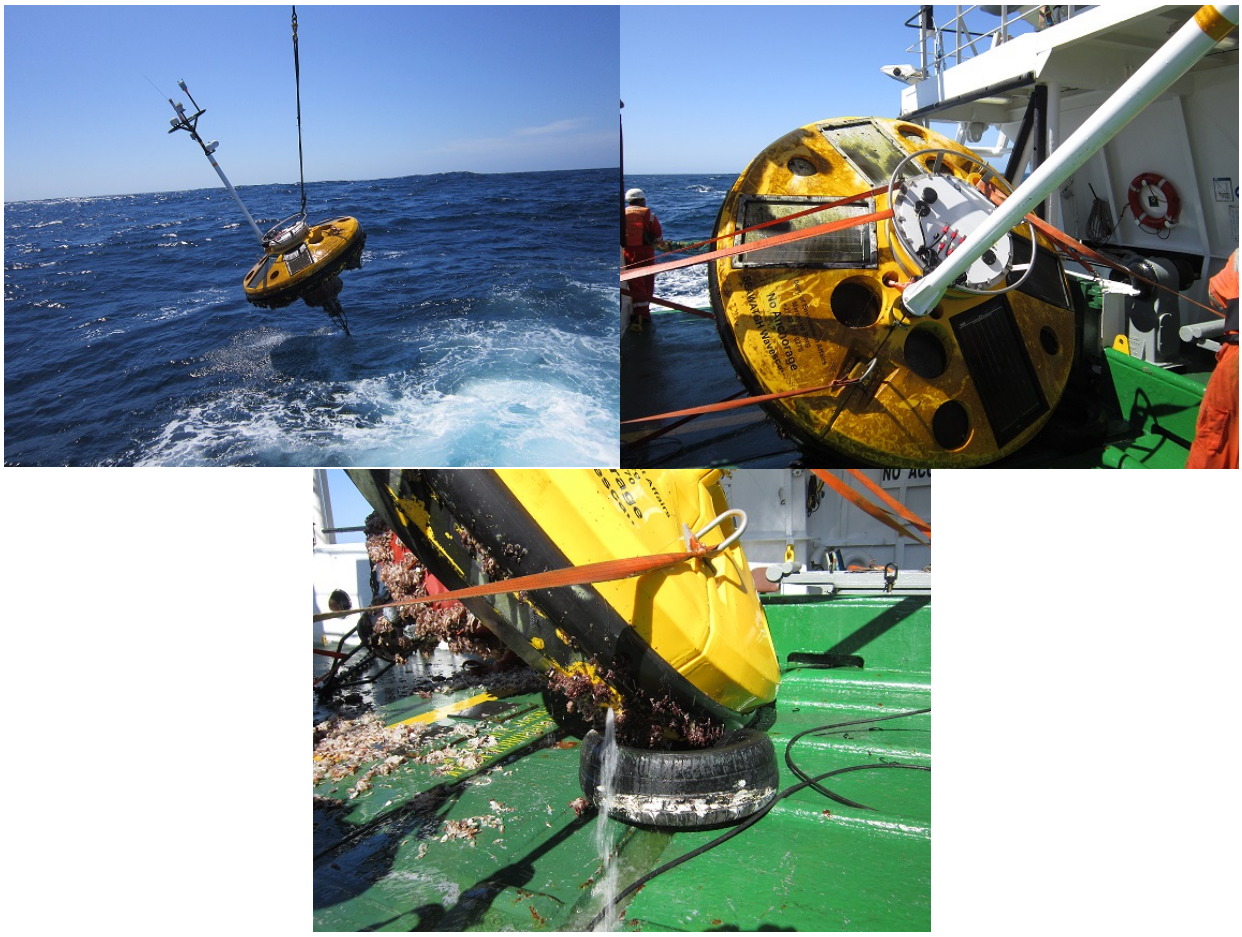
The **S**cientific **D**ata **S**ystem (SDS) records underway data on the vessel from various instruments (ie TSG; Surface light meter (SPAR); navigational; scientific winches and weather stations), installed on the vessel, continuously during the voyage. From the database the "live" data is streamed, via the vessels network, to relevant scientific laboratories for use by the scientists.

C11. Recovery of Port Edward Real-time Surface Buoy

The Real-Time Surface Buoy of Port Edward was deployed two months previously (during July 2014 mooring voyage - Alg208) with the separate sub-surface current meter mooring (ALEX) in close proximity. The Surface Buoy stopped transmitting data (deep currents from ALEX and on-board weather data) about two week previously, after a voltage spike was observed in the data being transmitted back to land.

On arrival at the location of the Real-Time Surface Buoy it was found that the buoy was 750m of position, and had shifted (dragged) from the original deployment position. No physical damage to the buoy could be observed. The buoy was also riding very low in the water, with all 4 solar panels under water. Some growth on the topside of the buoy and solar panels was observed, indicating that the buoy had been partially submerged for a while.

After releasing the acoustic releases holding to buoy to the bottom, the free drifting buoy sat much higher in the water, showing that the mooring lines were also under tension. The buoy was successfully recovered and both flotation compartments were found to be flooded. No damage to instruments, cables and underwater connection could be observed. The electronics compartment of the buoy could not be opened at sea, but will be inspected once the vessel returns to port to try and establish what caused the break in data transmission.



Once the vessel returned to port it was found that the electronics compartment had been flooded, as well as the flotation compartments. Looking at the data downloaded from the *Nortek AS* Aquadopp current meter mounted on the surface buoy, it clearly showed that the surface buoy was been dragged underwater during strong currents (>2m/s). *Figure 9* shows the pressure increase on the current meter, from 0.8m to 3m, when strong currents were experiences on the surface. With the surface buoy constantly being underwater allowed the flotation chambers to become flooded over time and not returning to its normal position (with current meter around 0.8m) when the currents dissipates.
With this information a re-design in the mooring configuration will have to be investigated before re-deployment of the surface buoy.

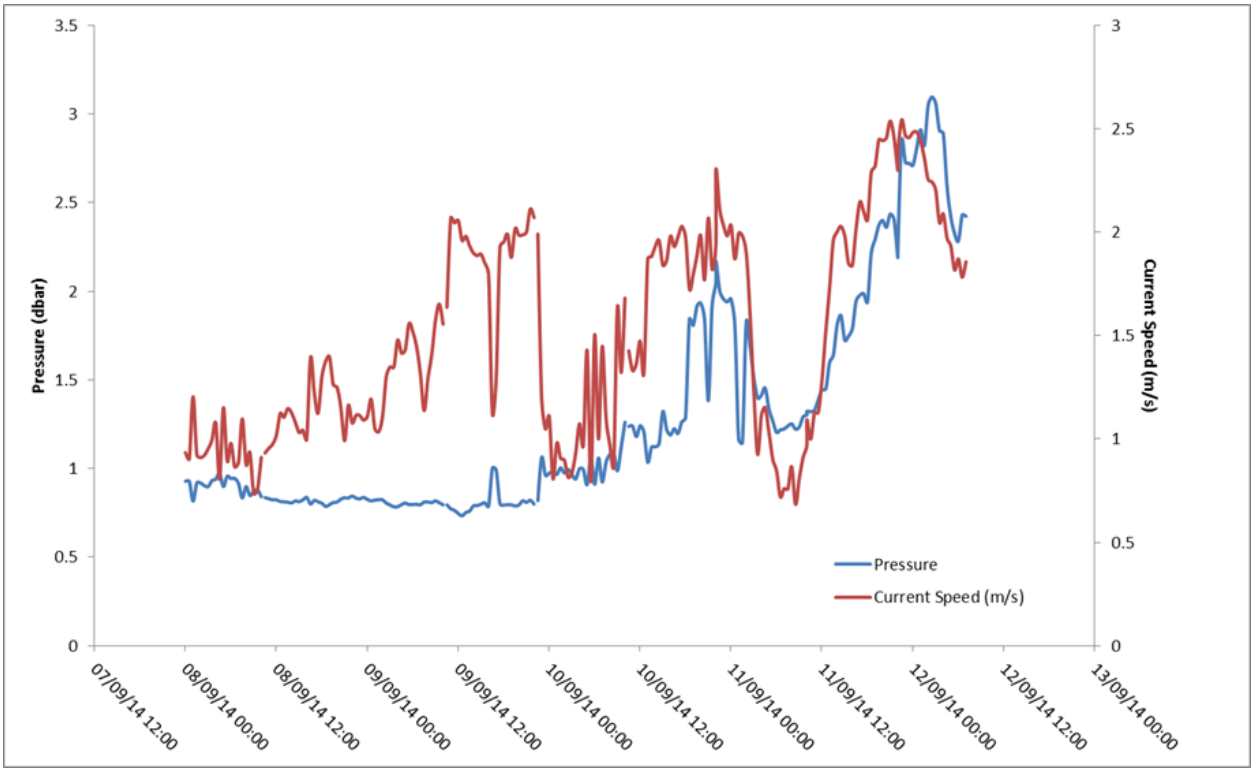


Figure 9 **–** Plot of pressure vs Current speed, obtained from surface buoy's *Nortek AS* Aquadopp current meter

C13 References:

http://www.aoml.noaa.gov/phod/SAMOC_international/index.php

Schlitzer, R., Ocean Data View, http://www.awi.bremerhaven.de/GEO/ODV, 2001.

VISEA DPS, Aquavision – ADCP data

Near real-time Altimetry provided by Colorado Center for Astrodynamics Research (CCAR)at the University of Colorado, Boulder. (http://ccar.colorado.edu)

C13. Scientific Log

15 September 2014, Monday

13h15 Complete muster and abandon vessel drill before departure

14h05 Depart Cape Town and start steaming towards SAMBA transect (Latitude 34° 30')

14h30 – switch on scientific water supply and get TSG running

14h30-15h40 – Calibration of PCO2 gasses

15h40 – Start PCO2 sample collection.

17h30 – 21h00 – set up 18 Microcats to sample at 10 second intervals for calibration CTD cast. Mounted units onto CTD frame.

16 September 2014, Tuesday

07h00 – collect LNSW (Oceanic) seawater for Trevor Probyn on position: Long 34° 29.84S; Lat 17° 15.0 E. Water depth: 2309m

07h00 – reboot NMEA distribution box and restart ADCP data collection. Filename ALG210-002.

08h30 – First Microcat calibration CTD station (CTD001), with 18 Microcats attached. CTD down to 1000m and then 10 minutes " soaks" at 1000m; 700m; 500m and 200m.

09h00 – 10h00 – Set up 16 Microcats with 10 second sampling interval for calibrations

10h00 – Second Microcat calibration CTD station (CTD002) with 16 Microcats attached. CTD down to 1000m and then 10 minutes " soaks" at 1000m; 700m; 500m and 200m.

At both calibration CTD stations calibration samples were collected for oxygen and salinities

13h00 – 15h00 Preparing Mooring 1 (SAMBA7) for deployment.

15h00 – 16h32 – Deployment of mooring 1 (Anchors released 200m past position at Lat: 34° 23.6357 S; Long: 17° 35.6644 E in 1111m water depth.)

16h57 – 17h37 – CTD station (CTD003), at deployment position. Sampled for DIC; Nutrients and salinity.

17h40 – SAWS Drifter 116048 deployed at Lat: 34° 23.2851 S and Long: 17° 35.2207 E. Depth – 1111m

17 September 2014, Wednesday

08h00-11h00 – Prepare mooring 2 (SAMBA 8) for deployment.

11h18 – 12h09 Deployment of Mooring 2 (Start position – Lat 34° 30.2081 S; Long 17° 19.6637 E. End position – Lat 34° 29.9611 S; Long 17° 17.7505 E)

13h09 – 14h00 CTD station (CTD004) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

14h00 – SAWS Drifter 115992 deployed at Lat: 34° 29.961 S and Long: 17° 18.117 E. Depth – 2124m

13h00 – 15h20 Prepare mooring 3 (SAMBA 9) for deployment

15h34 – 16h50 Deployment of Mooring 3 (Start position – Lat 34° 31.0 S; Long 17° 10.6 E. End position – Lat 34° 29.8146 S; Long 17° 07.9886 E)

17h06-17h40 CTD station (CTD005) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

17h40 – SAWS Drifter 116122 deployed at Lat: 34° 30.1492 S and Long: 17° 08.2856 E. Depth-2833m

21h00 – cancel planned CTD stations due to increases winds (+35knots) and swell

18 September 2014, Thursday

07h00 - Strong winds (+35knots) and big swell (4-5m). Vessel is hove to and no work can be done.

19 September 2014, Friday

09h44 – 10h31 CTD station (CTD006) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

10h31 – SAWS Drifter 116120 deployed at Lat: 34° 30.0015 S and Long: 16° 36.3297 E. Depth-3471m

13h16 – 13h58 CTD station (CTD007) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

13h58 – SAWS Drifter 115995 deployed at Lat: 34° 30.033 S and Long: 16° 04.646 E. Depth-4079m

17h28 – 18h03 CTD station (CTD008) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

18h03 – SAWS Drifter 115996 deployed at Lat: 34° 29.9988 S and Long: 15° 31.6598 E. Depth-4363m

18h30 – 21h00 – prepare Mooring 4 (SAMBA 10) for deployment

21h59 – 23h50 – Deployment of mooring 4 (Anchors deployed at Lat 34° 30.36; Long 14° 59.05E – mooring position will be 360m to the west of proposed position)

20 September 2014, Saturday

23h57 – 00h33 CTD station (CTD009) at deployment position. Sampled for oxygen; DIC; nutrients and salinity.

00h34 – SAWS Drifter 115983 deployed at Lat: 34° 30.446 S and Long: 14° 58.825 E. Depth-4474m

00h40 – 18h00 ADCP transect (ALG210-003) – SAMBA transect from offshore – inshore (Lat 34° 30)

18h00 – 19h30 Transducer testing on two moorings deployed on shelf during ast mooring voyage. Not able to communicate with acoustic releases

19h30 – ADCP transect (ALG210 004) – from Slangkop moorings to Cape Town.

20h00 – Contacted Ashley Johnson, to obtain permission to deviate the vessel to Port Edward. This is to recover ALEX surface buoy that stop working after a power surge 2 weeks ago. Permission was given by Ashley and it was decided to take all the scientists onboard, except myself' Bradley and Gavin off the vessel for the trip to Port Edward.

2354 – docked at Q500, Cape Town

21 September 2014, Sunday

13h00 – Depart Cape Town for Port Edward, to recover ALEX surface buoy.

13h15 – switch on scientific pump and TSG system

22 September 2014. Monday

Enroute to Port Edward

23 September 2014, Tueasday

Enroute to Port Edward

12h00 – Weatherpack malfunction – giving air temperature of -39.5 ° C. Rebooted system, but still incorrect air temperature readings.

24 September 2014, Wednesday

Enroute to Port Edward

Lunch time braai – National Heritage day !!!!!

25 September 2014, Thursday

10h30 – arrived at surface buoy location of Port Edward. The buoy had shifted (dragged) 750m from original deployment position. The buoy was also riding very low in the water with all 4 solar panels underwater.

11h10 – release acoustic releases holding buoy to bottom.

11h15 – 12:45 recovery of surface buoy; mooring lines and acoustic releases

13h00 – start steaming for Port St Johns – to try and recover mooring that did not surface last trip (alg208).

13h00 – 16h00 – Clean surface buoy and remove attached instrumentation

17h40 – Arrive at Port St Johns and ping for mooring

18h00 – mooring releases and on surface. Used older DS8000 deck unit with new battery.

18h09 – mooring on deck and secured

26 September 2014, Friday

08h00 – 10h00 – Service and clean the ADCP mooring recovered from Port St Johns and down load data

18h30 – Arrive at Cape Receife Mooring position. Released the unit but did not surface, suspect that releases overgrown after being deployed for over a year.

19h30 – steaming for Cape Town.

27 September 2014, Saturday

Steaming for Cape Town

Vessel only doing 3 knots in heavy seas and strong westerly winds (+40 knots). Managed to travel 35 nmiles in last 8 hours.

28 September 2014, Sunday

Steaming for Cape Town

11h00 – “Man over board” drill, with the launch of the rescue boat

18h00 – Switch off scientific pump and TSG system. Flush de-bubbler and SBE 45 with fresh water.

29 September 2014, Monday

01h28 vessel docks in Cape Town

08h00 Scientists sign off vessel.

C14. Problems and Suggestions

1. GPS NMEA feed to TSG

   This had to be monitored throughout the cruise as the GPS feed was "lost" and not recorded to the TSG Seasave 5 software at times. The distribution box and TSG octo-box were still functioning when the signal was lost. To re-establish GPS feed the TSG software had to be re-started, after "re-booting" GPS distribution box and TSG Octo-box.

2. ADCP GPS feed – not able to collect data as GPS feed is giving incorrect data – data not coming through cleanly (see data string below) - send email to Mfundo Lombi to see what modifications he has made to the system after experiencing the same problems during the previous voyage. Problem solved after rebooting the 2 GPS systems on bridge and distribution boards.

*$GPZDA,142035,15,29,2014,-02,00*6C*

*$GPGGA,142034,3t02.6475,S,01816.5872,E,1,08,00.9,20.1,M,31.7,M,,*5B*

*$GPGLL,³402.649-S,01816.587,E,146035,A*3C*

*$GPWPL,3306.00,S,027=2.30<E,0014*5´*

*$GPVTG,175,t.200,M,06.8,N,12.6,K*44*

*J$GPRMC,1424·6¬A¬3402.651,Sœ01816.587-E,06.8,175.5,150914,024n7¬W*49*

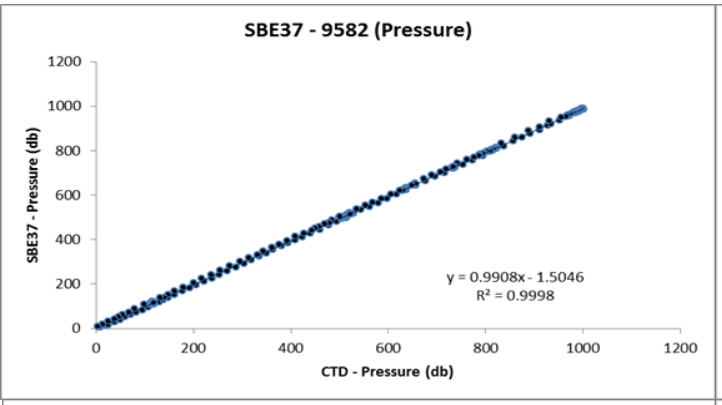
*$GPVXW,,T,,M<00,N,00,K*42*

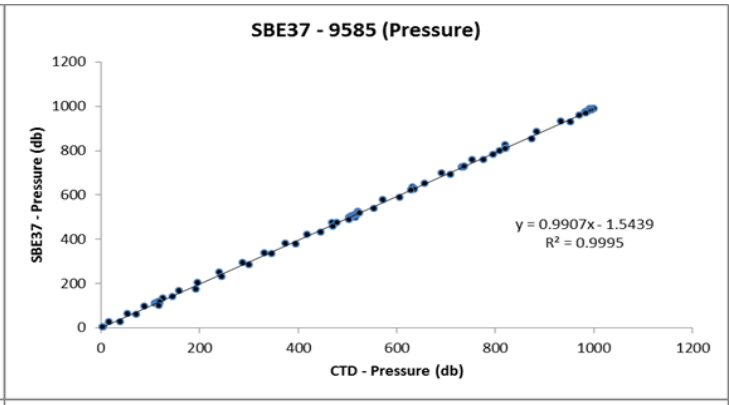
3. The *Coastal Environmental Systems* ,Weatherpak, meteorology station malfunctioned on the 23rd of September, with air temperatures of -39 °C and incorrect wind readings being observed. Unit was re-booted, but this did not solve incorrect readings. Unit to be removed after voyage and replaced with calibrated unit.

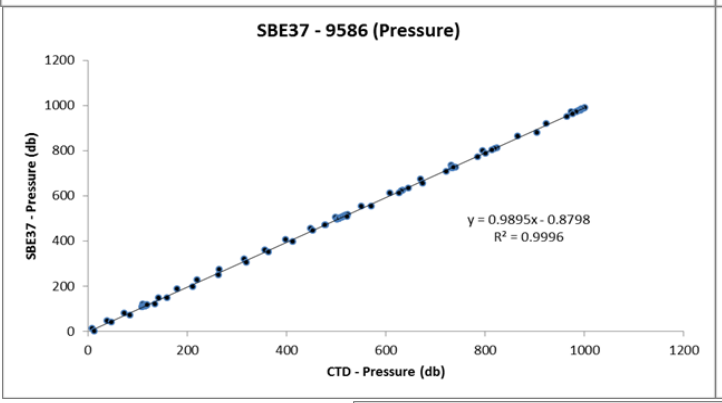
ANNEXURE I
SBE37 Microcat calibrations

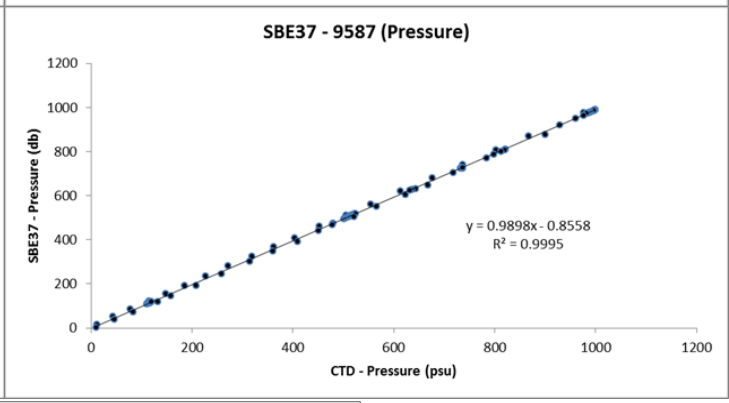
SBE37 Serial #	Cast #	Pressure Regression	Temperature Regression	Salinity Regression	Oxygen Regression	Oxygen Regression
					Down Cast	Up Cast
8331	2		y=1.0027x-0.0041	y=0.697x+10.761		
8332	2		y=1.0017x+0.0071	y=0.6897x+11.017		
8333	2		y=1.0033x-0.0054	y=0.6872x+11.096		
8334	2		y=1.0023x+0.0007	y=0.6894x+11.026		
9561	1		y=1.0006x+0.0076	y=0.7268x+9.7339	y=1.199x-0.8996	y=1.0209x-0.3226
9570	2		y=1.0014x+0.0078	y=0.7102x+10.313	y=1.947x-4.0587	y=1.1703x-1.0012
9571	2		y=0.9896x+0.0562	y=0.6989x+10.704	y=1.1001x-0.5832	y=1.0515x-0.4744
9572	1		y=1.0016x+0.0111	y=0.7322x+9.5358	y=1.1384x-0.6517	y=1.0348x-0.3975
9573	2		y=1.0021x-0.0002	y=0.7144x+10.166	y=1.1619x-0.8234	y=1.0382x-0.426
9574	1		y=1.0017x+0.0034	y=0.7237x+9.8405	y=1.1059x-0.5356	y=1.0599x-0.4926
9575	2		y=0.9996x+0.0204	y=0.7089x+10.356	y=1.108x-0.4629	y=1.0011x-0.2113
9576	1		y=1.0006x+0.0122	y=0.7257x+9.7682	y=1.8132x-3.3721	y=1.0764x-0.5672
9577	2		y=1.0025x+0.002	y=0.7178x+10.048	y=1.3742x-1.7095	y=1.0372x-0.4053
9578	1		y=1.0006x+0.01	y=0.7297x+9.6275	y=1.2034x-0.9547	y=1.0496x-0.4514
9579	1		y=1.0023x+0.0017	y=0.7272x+9.7165	y=1.3705x-1.6737	y=1.0621x-0.5165
9580	1		y=1.0014x+0.0109	y=0.7215x+9.9152	y=1.3171x-1.4943	y=1.0877x-0.6501
9582	2	y=0.9908x-1.5046	y=1.0029x-0.0034	y=1.0076x-0.2592	y=1.3747x-1.4577	y=0.7929x+0.7782
9585	2	y=0.9907x-1.5439	y=1.0028x+0.001	y=1.0038x-0.1222	y=1.1399x-0.579	y=0.9421x+0.1222
9586	2	y=0.9895x-0.8798	y=0.9999x+0.0168	y=1.0036x-0.1142	y=1.1809x-0.7651	y=0.8893x+0.3555
9587	2	y=0.9898x-0.8558	y=1.0007x+0.0064	y=1.0018x-0.0563	y=1.1872x-0.7829	y=0.8902x+0.365
9588	1		y=1.001x+0.0111	y=0.7251x+9.7885	y=1.4309x-1.8925	y=1.0386x-0.4007
9589	1		y=1.0078x+0.0694	y=0.7203x+9.9718	y=1.0411x-0.1254	y=1.0684x-0.5232
9593	1	y=0.9839x+15.779	y=0.9894x-0.0323	y=0.9917x+0.2766	y=1.9357x-3.5854	y=0.7314x+1.0377
9598	2		y=1.0015x+0.0005	y=0.7113x+10.276	y=1.2228x-1.0448	y=1.0475x-0.4579
9599	1		y=1.0007x+0.0097	y=0.7278x+9.6934	y=1.5247x-2.2667	y=1.0422x-0.4349
9600	1		y=1.0013x+0.0045	y=0.7291x+9.6489	y=1.3019x-1.3544	y=1.0717x-0.5419
9601	1		y=1.0003x+0.014	y=0.7251x+9.7961	y=1.672x-2.7045	y=1.0424x-0.4034
9602	1		y=1.001x+0.0062	y=0.7261x+9.7598	y=1.2622x-1.2127	y=1.1098x-0.716
9603	1		y=1.0008x+0.0073	y=0.7239x+9.8323	y=1.1461x-0.6655	y=1.0084x-0.2735
9632	1		y=1.0009x+0.0032	y=0.7429x+9.1726	y=1.2659x-1.2276	y=1.0577x-0.4875
9633	2		y=1.00089x-0.0291	y=0.7076x+10.404	y=1.2709x-1.175	y=1.0079x-0.2735
9697	1		y=1.0x+0.0155	y=0.7259x+9.7584	y=1.2625x-1.2292	y=1.1205x-0.7919
9698	2		y=1.0033x-0.0026	y=0.7117x+10.268	y=1.1246x-0.5836	y=0.9804x-0.1546
9699	1		y=1.0x+0.0144	y=0.7251x+9.7886	y=1.178x-0.7957	y=1.0312x-0.3565

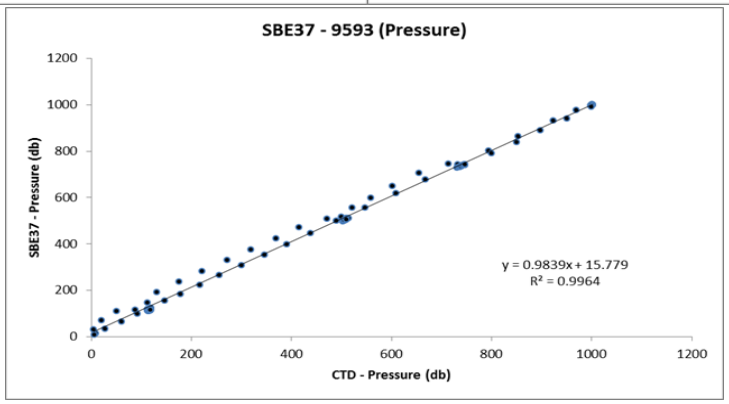
Pressure Regressions


SBE37 - 9582 (Pressure)
SBE37 - Pressure (db)
CTD - Pressure (db)
y = 0.9908x - 1.5046
R² = 0.9998

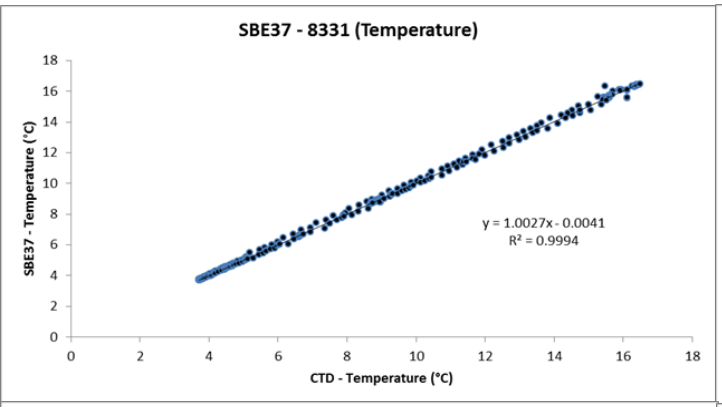

SBE37 - 9585 (Pressure)
SBE37 - Pressure (db)
CTD - Pressure (db)
y = 0.9907x - 1.5439
R² = 0.9995

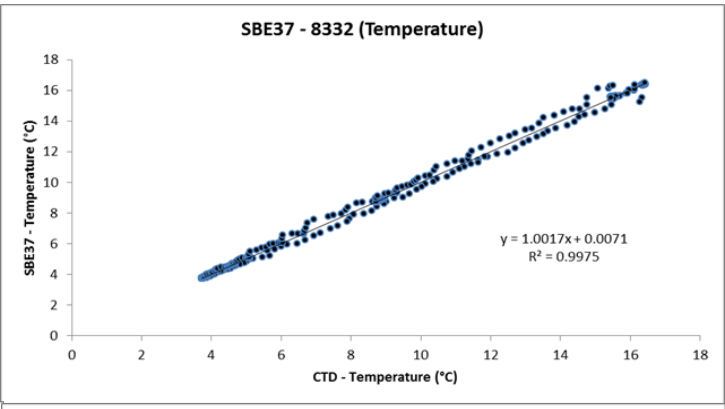

SBE37 - 9586 (Pressure)
SBE37 - Pressure (db)
CTD - Pressure (db)
y = 0.9895x - 0.8798
R² = 0.9996

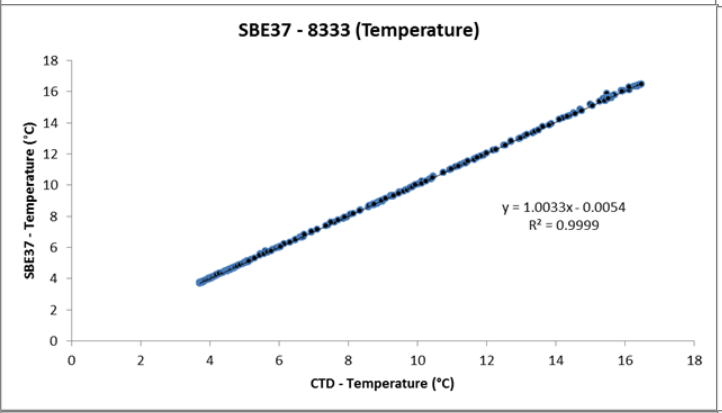

SBE37 - 9587 (Pressure)
SBE37 - Pressure (db)
CTD - Pressure (psu)
y = 0.9898x - 0.8558
R² = 0.9995

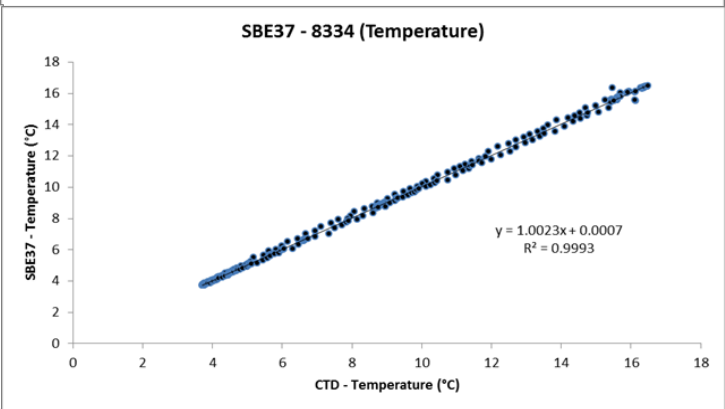

SBE37 - 9593 (Pressure)
SBE37 - Pressure (db)
CTD - Pressure (db)
y = 0.9839x + 15.779
R² = 0.9964

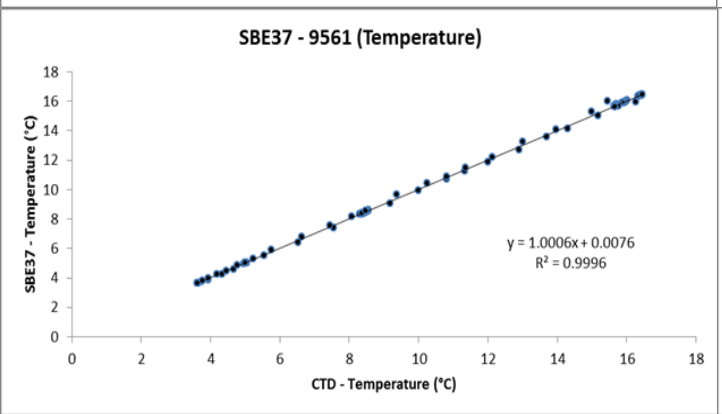
Temperature Regressions

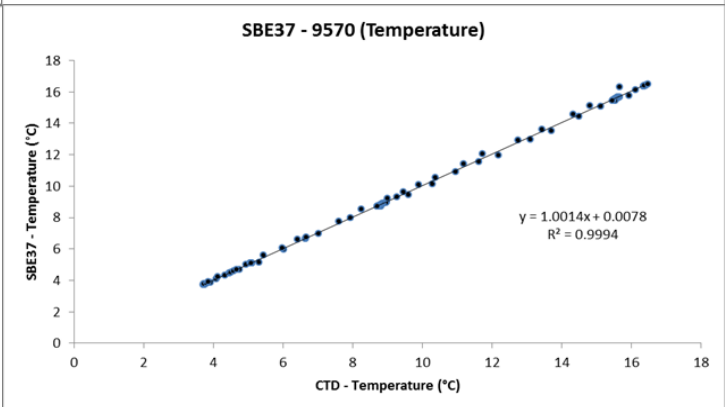

SBE37 - 8331 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0027x - 0.0041
R² = 0.9994

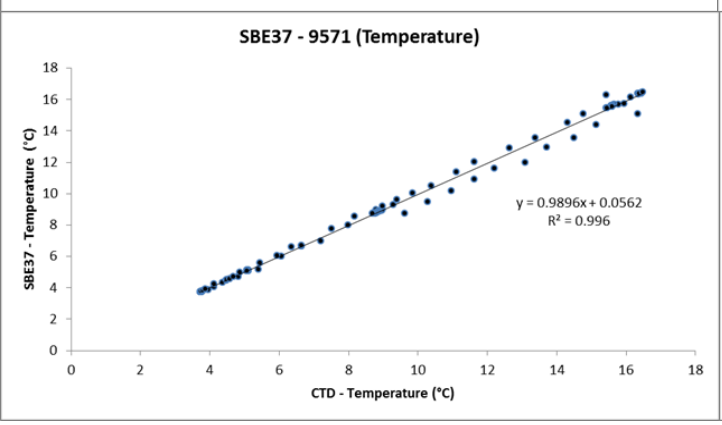

SBE37 - 8332 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0017x + 0.0071
R² = 0.9975

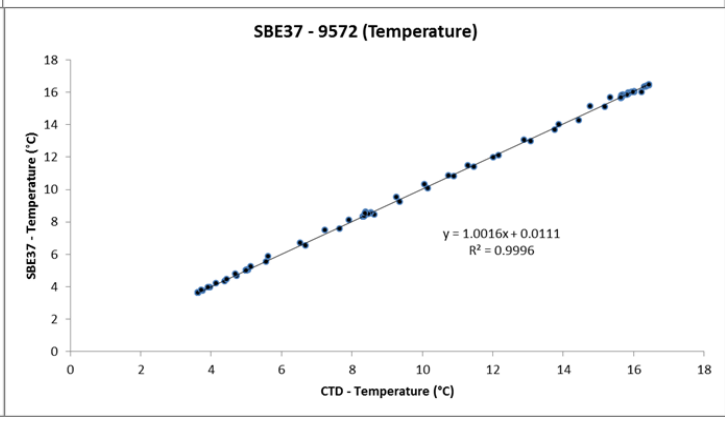

SBE37 - 8333 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0033x - 0.0054
R² = 0.9999

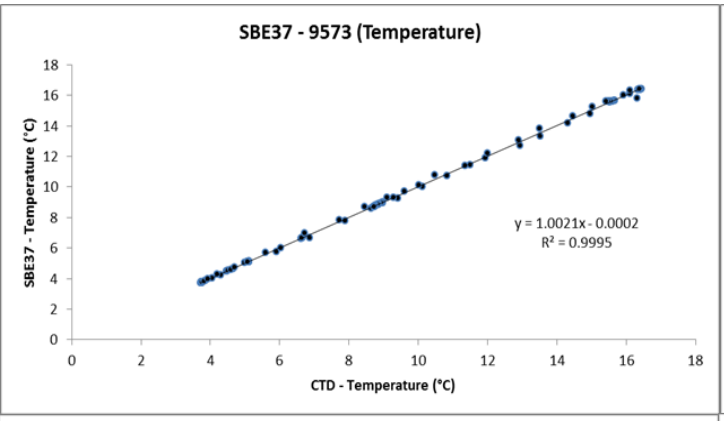

SBE37 - 8334 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0023x + 0.0007
R² = 0.9993

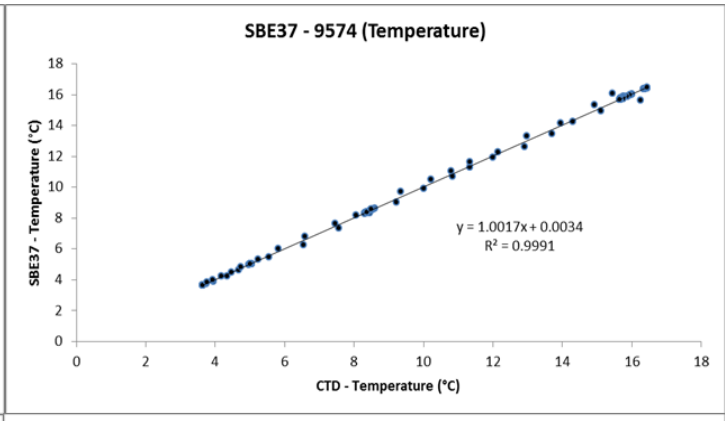

SBE37 - 9561 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0006x + 0.0076
R² = 0.9996

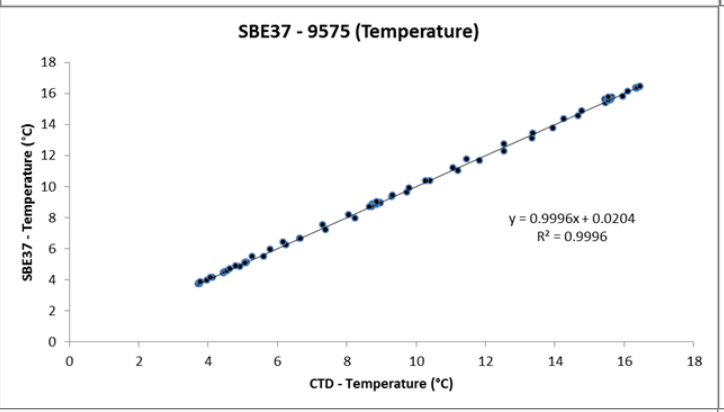

SBE37 - 9570 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0014x + 0.0078
R² = 0.9994

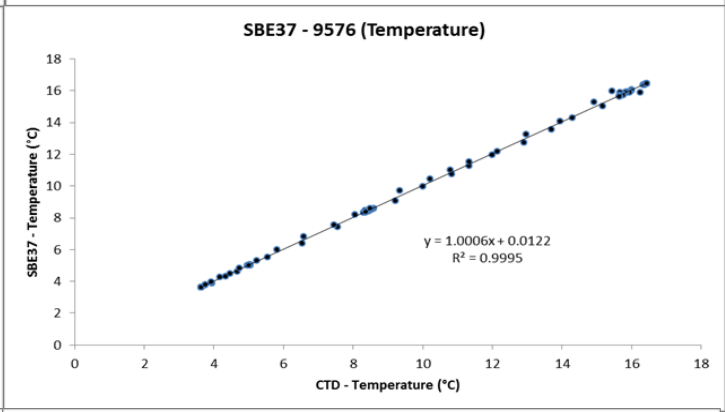

SBE37 - 9571 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 0.9896x + 0.0562
R² = 0.996

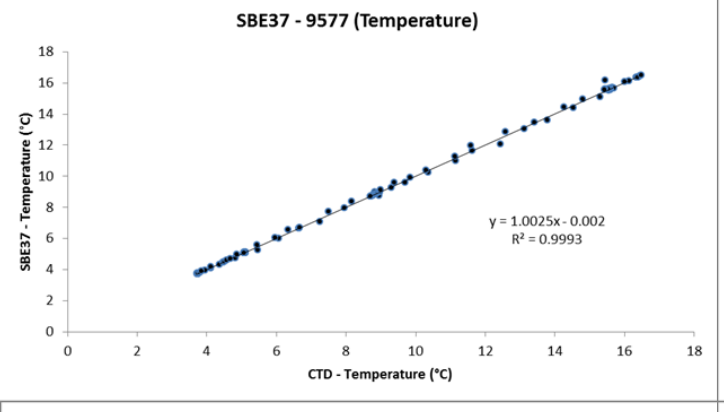

SBE37 - 9572 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0016x + 0.0111
R² = 0.9996

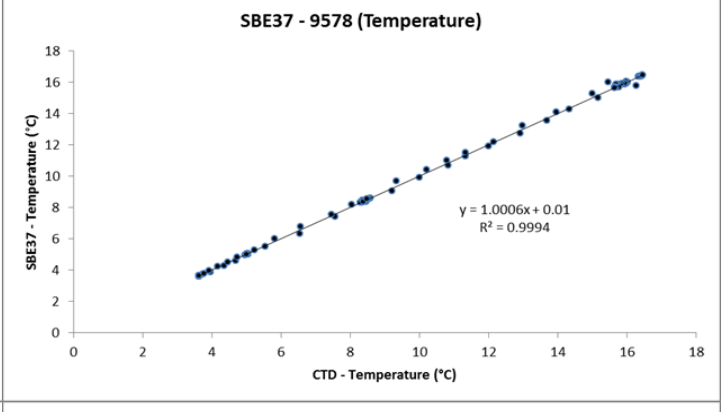

SBE37 - 9573 (Temperature)
y = 1.0021x - 0.0002
R² = 0.9995
SBE37 - Temperature (°C)
CTD - Temperature (°C)

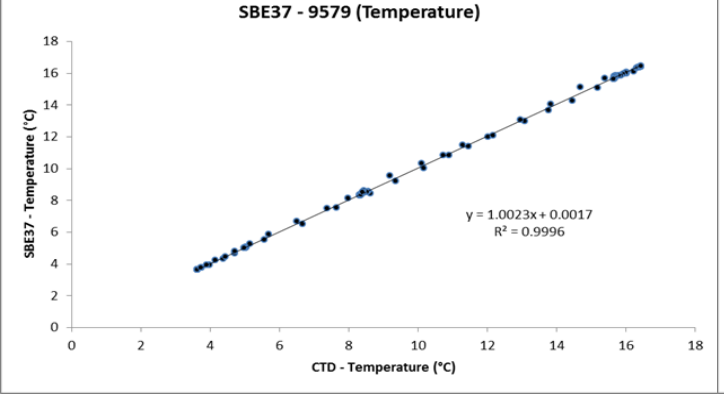

SBE37 - 9574 (Temperature)
y = 1.0017x + 0.0034
R² = 0.9991
SBE37 - Temperature (°C)
CTD - Temperature (°C)

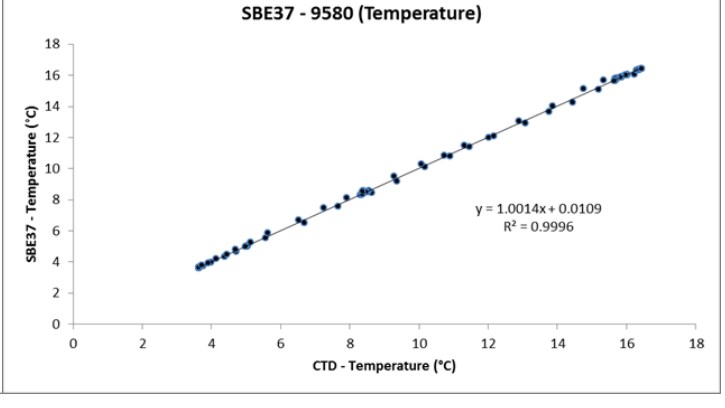

SBE37 - 9575 (Temperature)
y = 0.9996x + 0.0204
R² = 0.9996
SBE37 - Temperature (°C)
CTD - Temperature (°C)

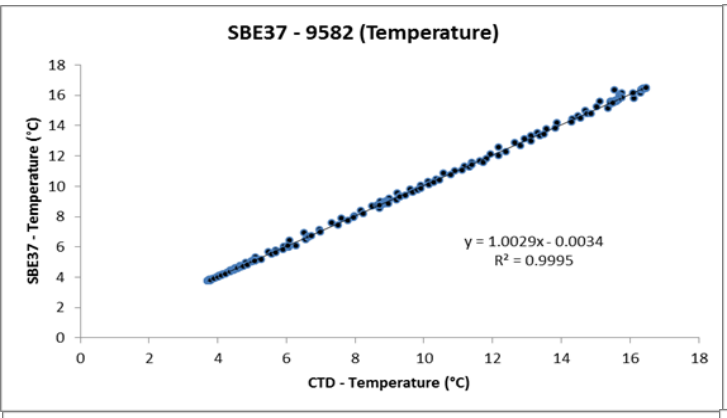

SBE37 - 9576 (Temperature)
y = 1.0006x + 0.0122
R² = 0.9995
SBE37 - Temperature (°C)
CTD - Temperature (°C)

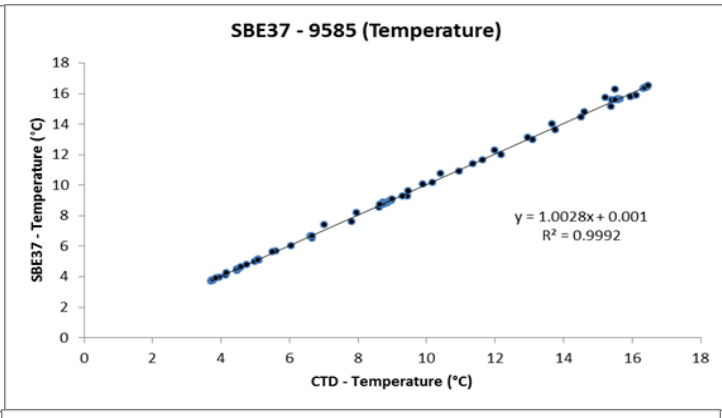

SBE37 - 9577 (Temperature)
y = 1.0025x - 0.002
R² = 0.9993
SBE37 - Temperature (°C)
CTD - Temperature (°C)

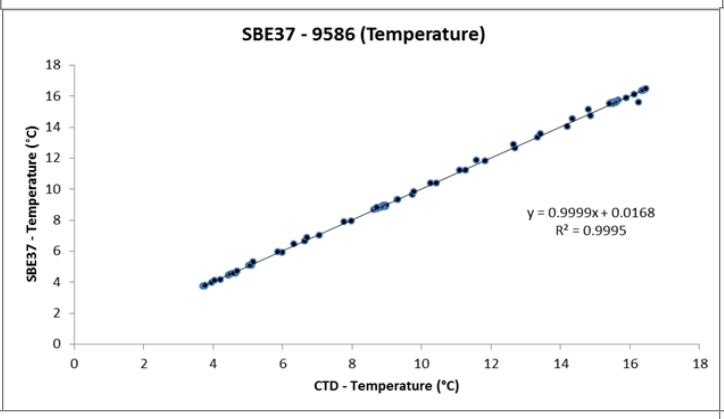

SBE37 - 9578 (Temperature)
y = 1.0006x + 0.01
R² = 0.9994
SBE37 - Temperature (°C)
CTD - Temperature (°C)

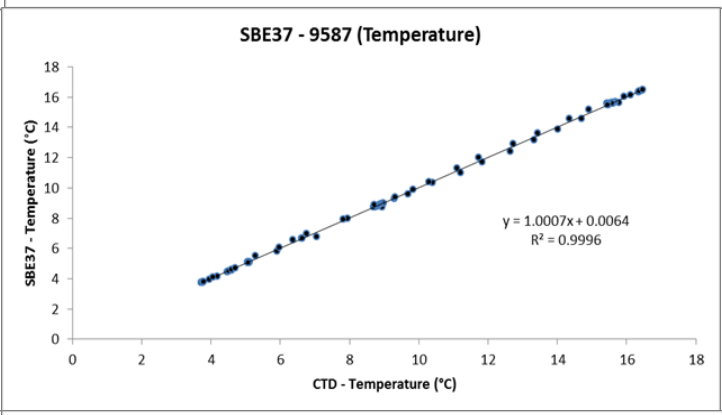

SBE37 - 9579 (Temperature)
y = 1.0023x + 0.0017
R² = 0.9996
SBE37 - Temperature (°C)
CTD - Temperature (°C)

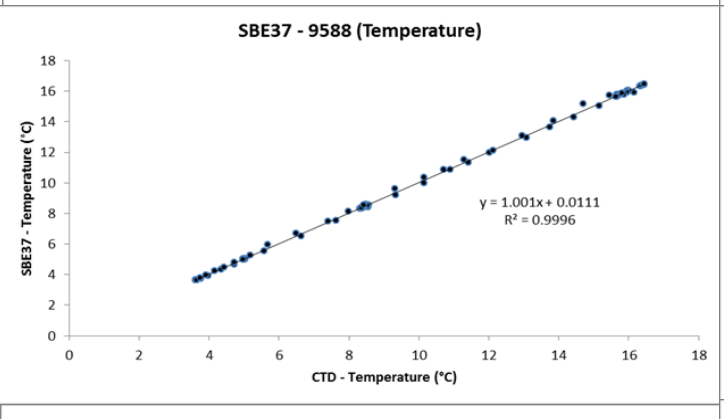

SBE37 - 9580 (Temperature)
y = 1.0014x + 0.0109
R² = 0.9996
SBE37 - Temperature (°C)
CTD - Temperature (°C)

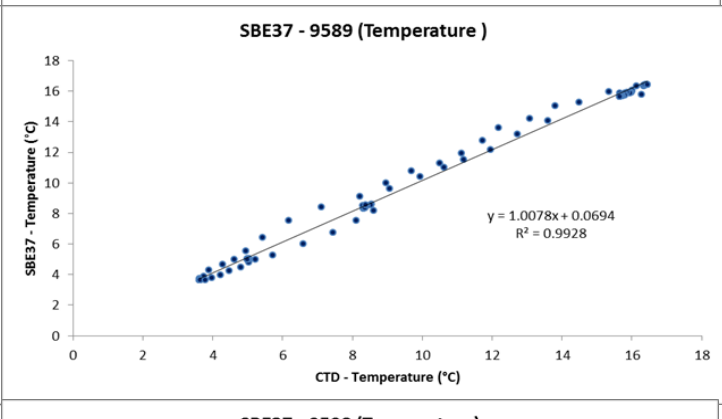

SBE37 - 9582 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0029x - 0.0034
R² = 0.9995

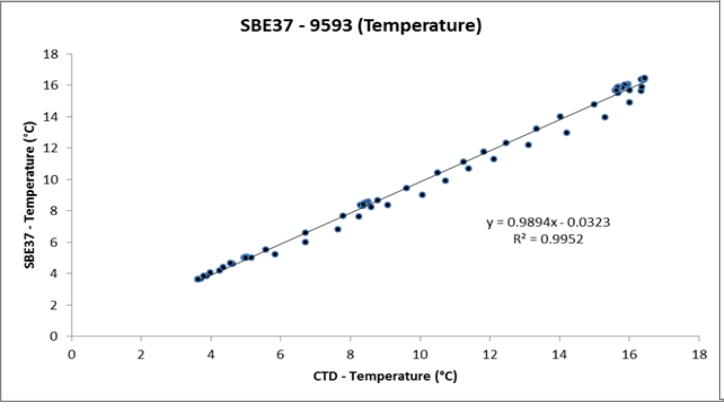

SBE37 - 9585 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0028x + 0.001
R² = 0.9992

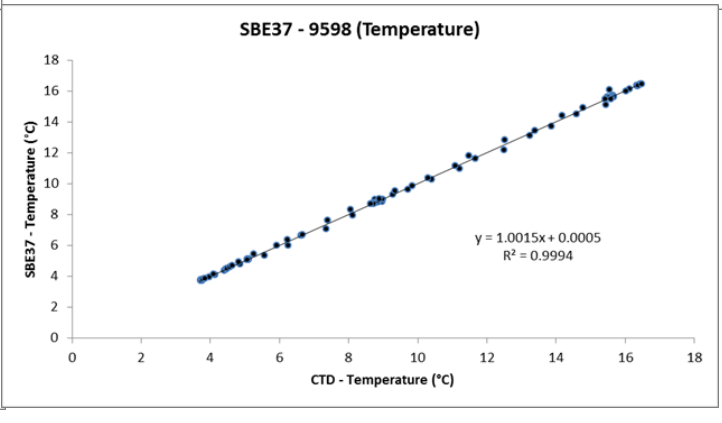

SBE37 - 9586 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 0.9999x + 0.0168
R² = 0.9995

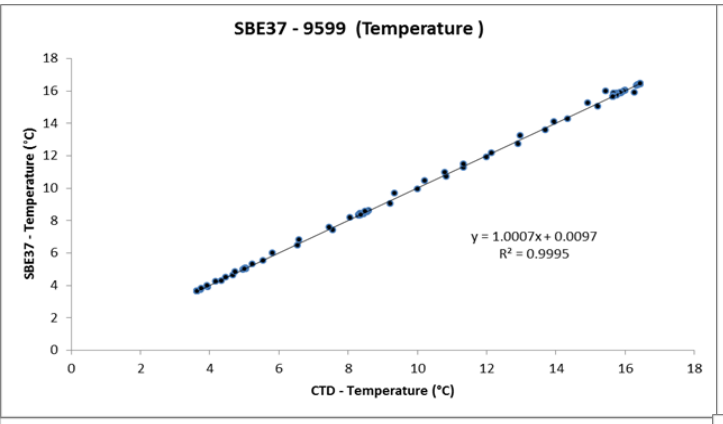

SBE37 - 9587 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0007x + 0.0064
R² = 0.9996

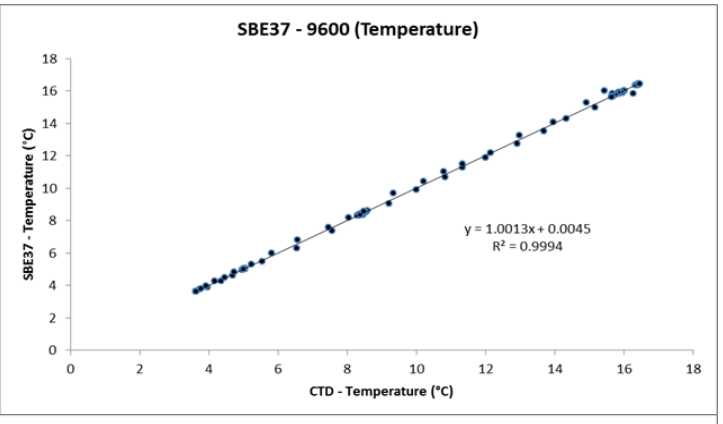

SBE37 - 9588 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.001x + 0.0111
R² = 0.9996

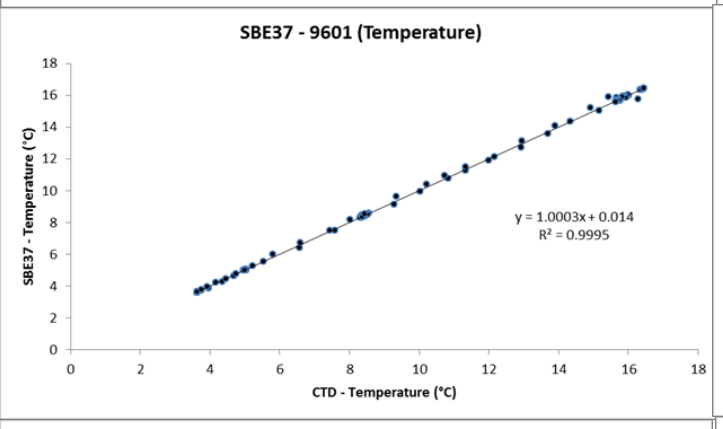

SBE37 - 9589 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0078x + 0.0694
R² = 0.9928

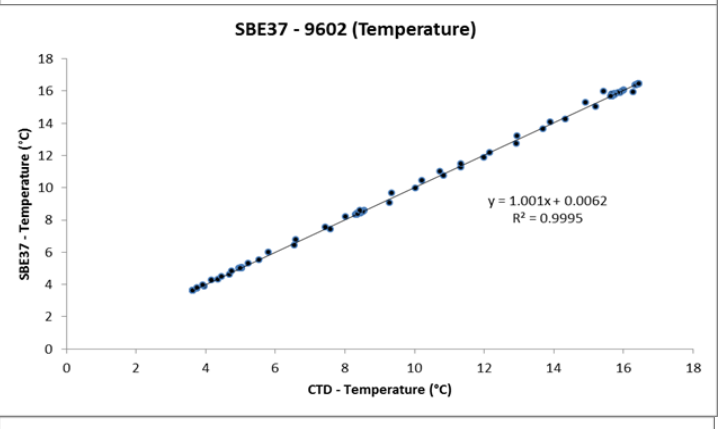

SBE37 - 9593 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 0.9894x - 0.0323
R² = 0.9952

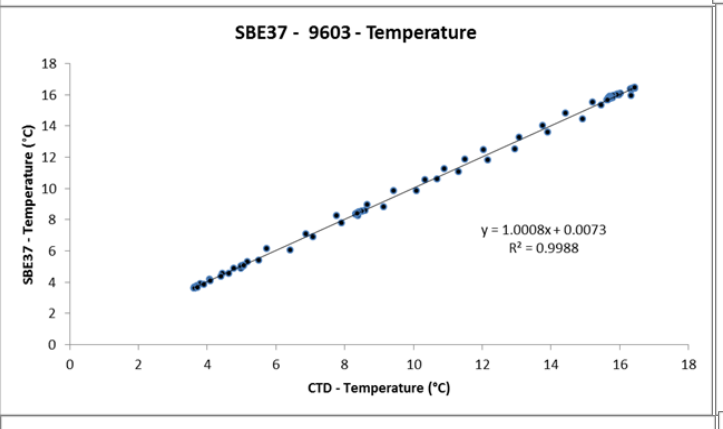

SBE37 - 9598 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0015x + 0.0005
R² = 0.9994

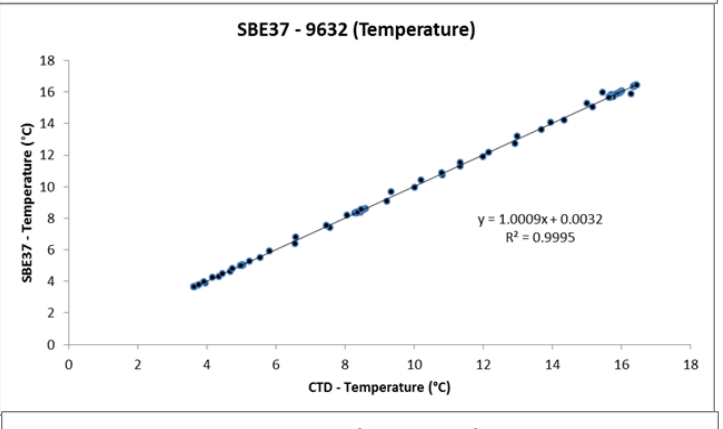

SBE37 - 9599 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0007x + 0.0097
R² = 0.9995

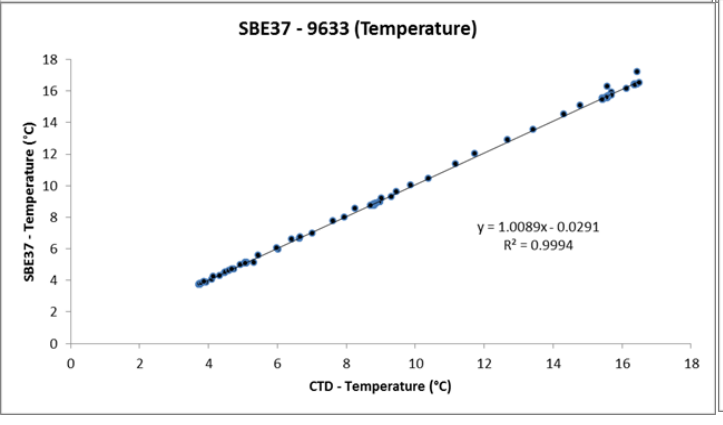

SBE37 - 9600 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0013x + 0.0045
R² = 0.9994

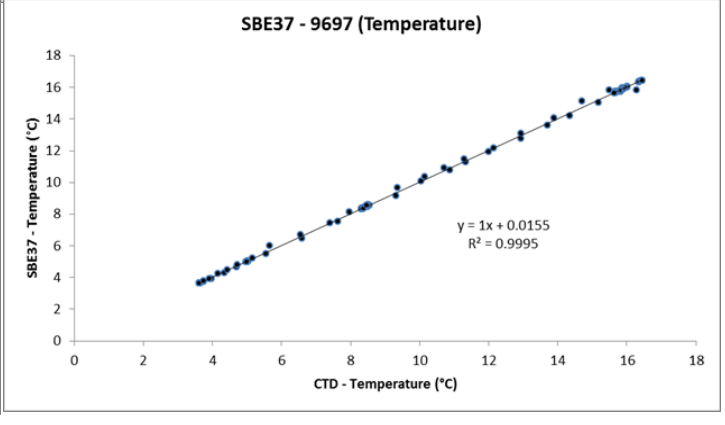

SBE37 - 9601 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0003x + 0.014
R² = 0.9995

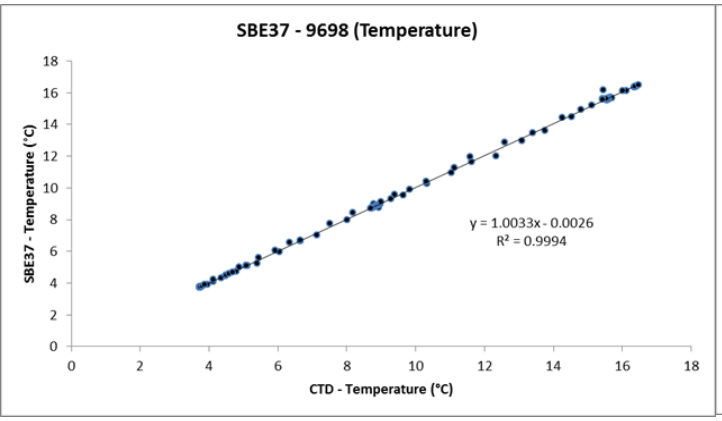

SBE37 - 9602 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.001x + 0.0062
R² = 0.9995

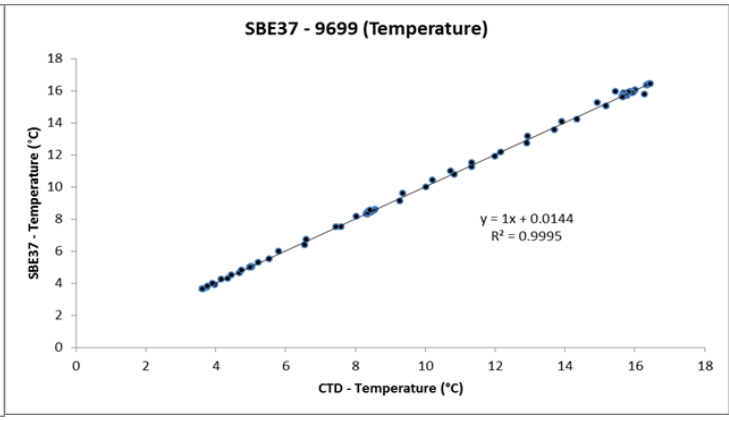

SBE37 - 9603 - Temperature
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0008x + 0.0073
R² = 0.9988


SBE37 - 9632 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0009x + 0.0032
R² = 0.9995

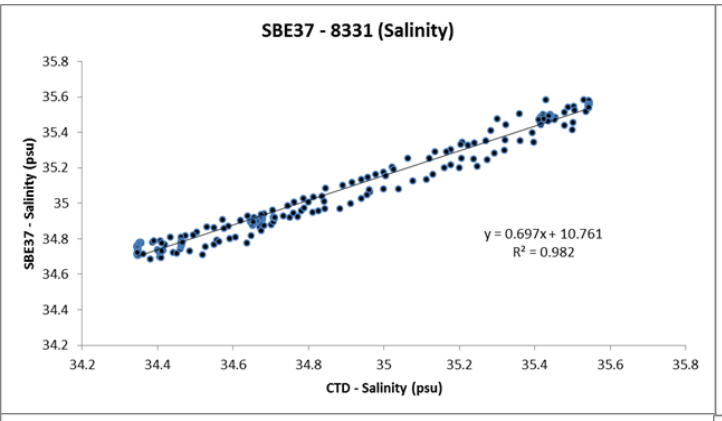

SBE37 - 9633 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0089x - 0.0291
R² = 0.9994

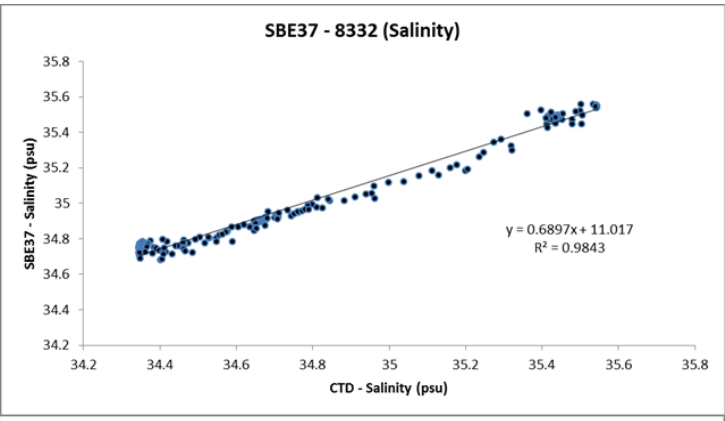

SBE37 - 9697 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1x + 0.0155
R² = 0.9995

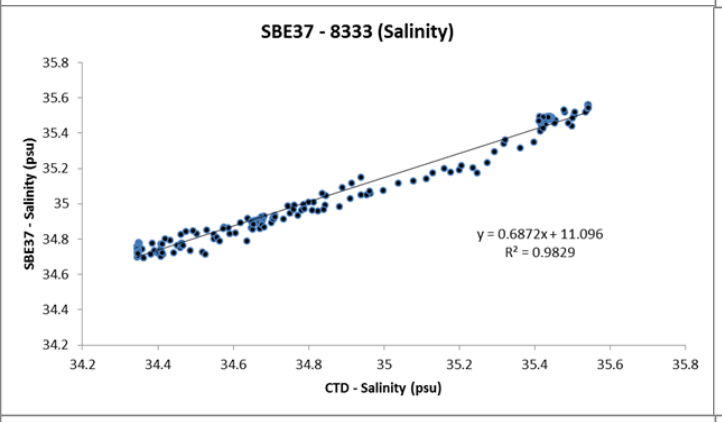

SBE37 - 9698 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1.0033x - 0.0026
R² = 0.9994
0
2
4
6
8
10
12
14
16
18

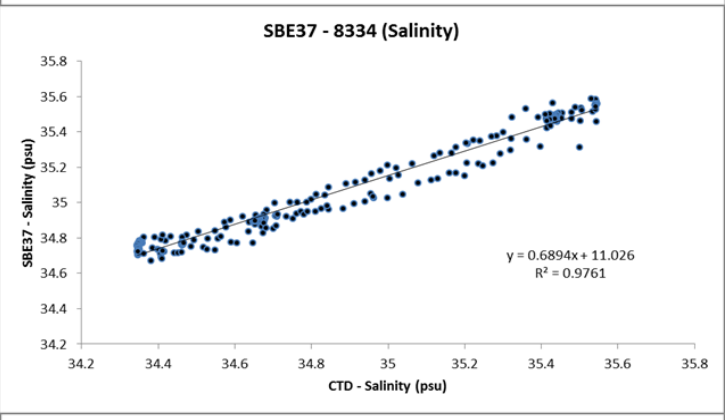

SBE37 - 9699 (Temperature)
SBE37 - Temperature (°C)
CTD - Temperature (°C)
y = 1x + 0.0144
R² = 0.9995
0
2
4
6
8
10
12
14
16
18

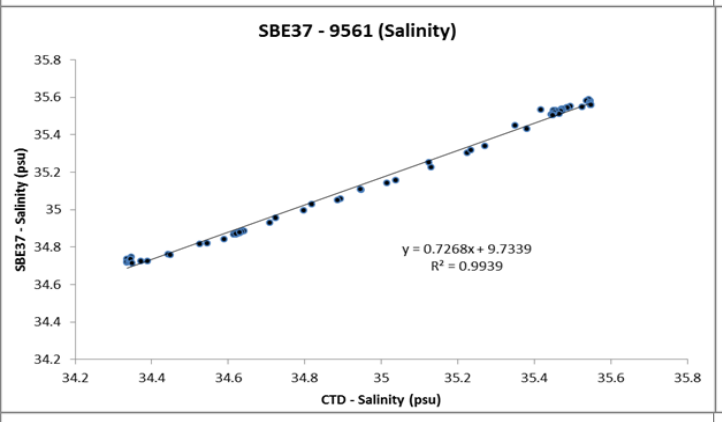
Salinity Regressions

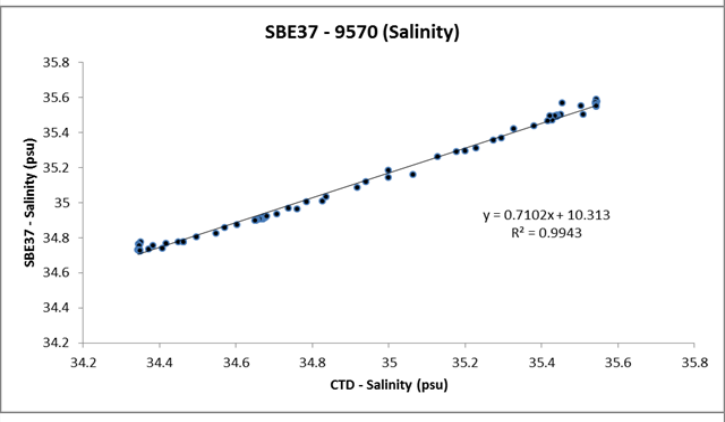

SBE37 - 8331 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.697x + 10.761
R² = 0.982

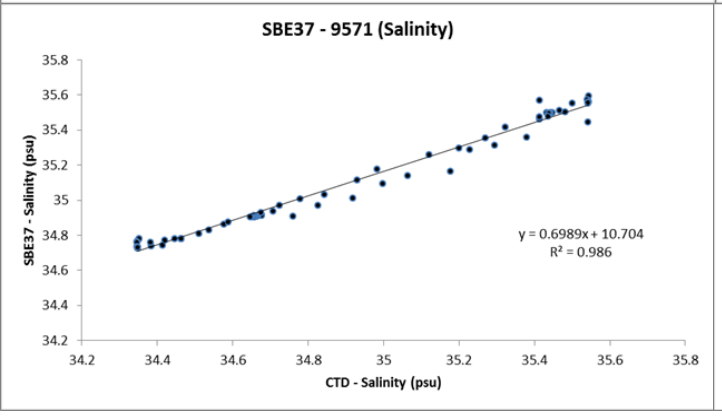

SBE37 - 8332 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.6897x + 11.017
R² = 0.9843

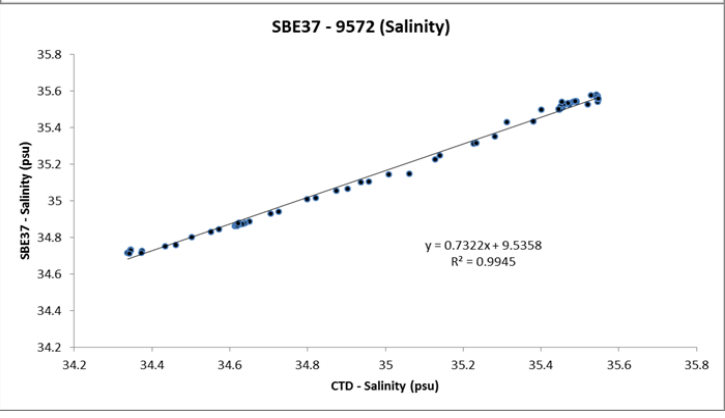

SBE37 - 8333 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.6872x + 11.096
R² = 0.9829

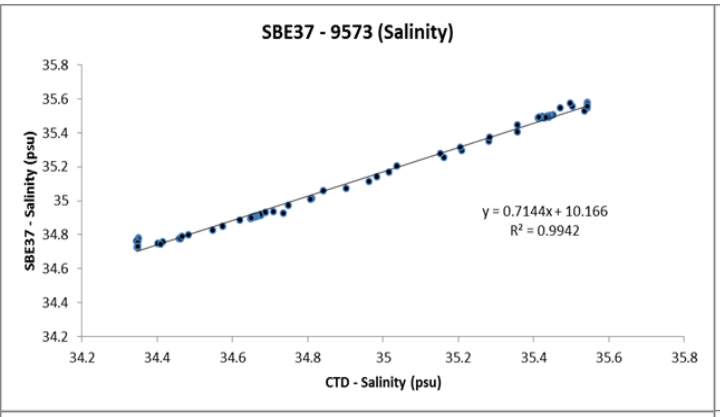

SBE37 - 8334 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.6894x + 11.026
R² = 0.9761

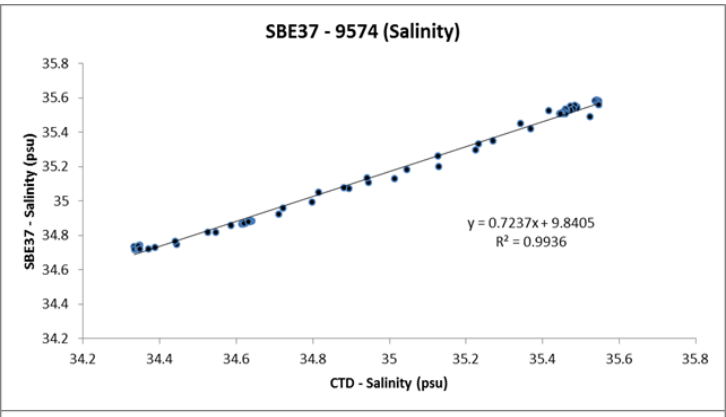

SBE37 - 9561 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7268x + 9.7339
R² = 0.9939

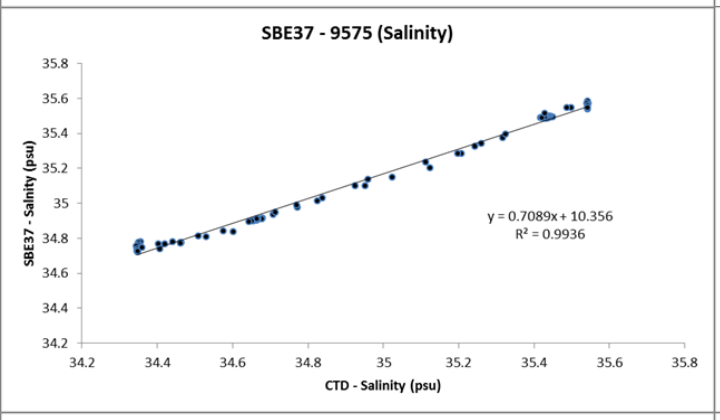

SBE37 - 9570 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7102x + 10.313
R² = 0.9943

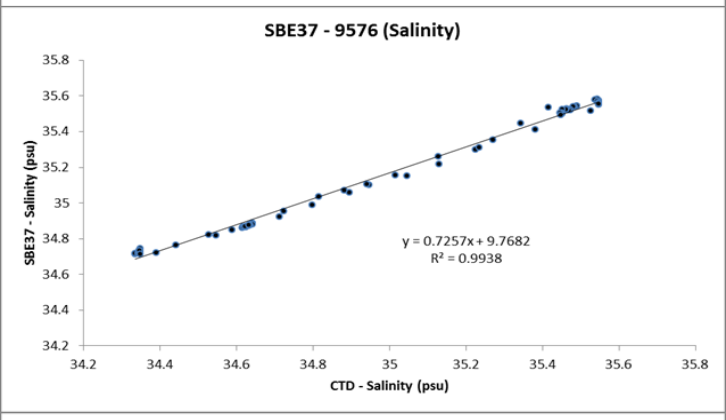

SBE37 - 9571 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.6989x + 10.704
R² = 0.986

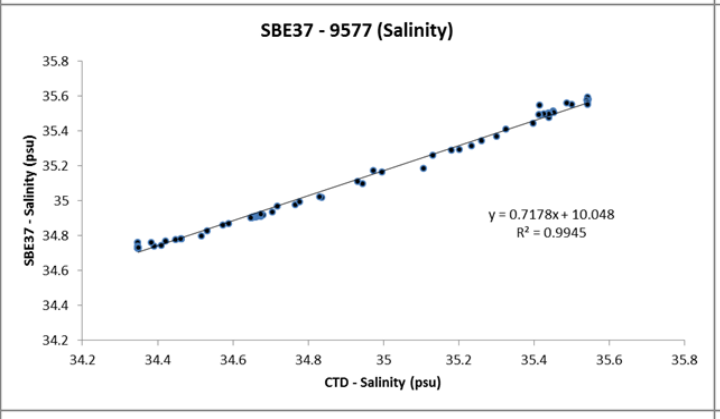

SBE37 - 9572 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7322x + 9.5358
R² = 0.9945

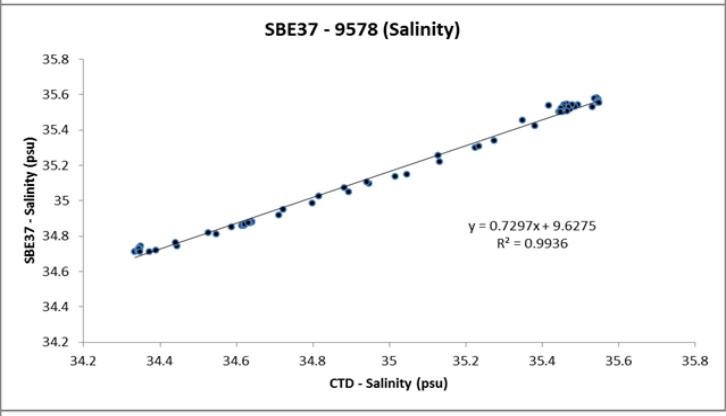

SBE37 - 9573 (Salinity)
y = 0.7144x + 10.166
R² = 0.9942
SBE37 - Salinity (psu)
CTD - Salinity (psu)

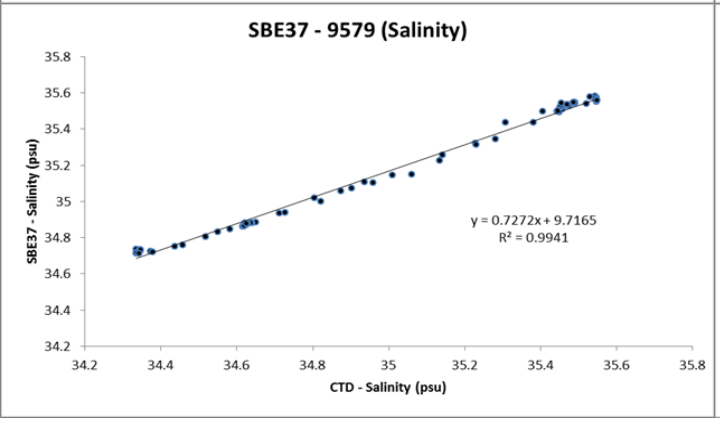

SBE37 - 9574 (Salinity)
y = 0.7237x + 9.8405
R² = 0.9936
SBE37 - Salinity (psu)
CTD - Salinity (psu)

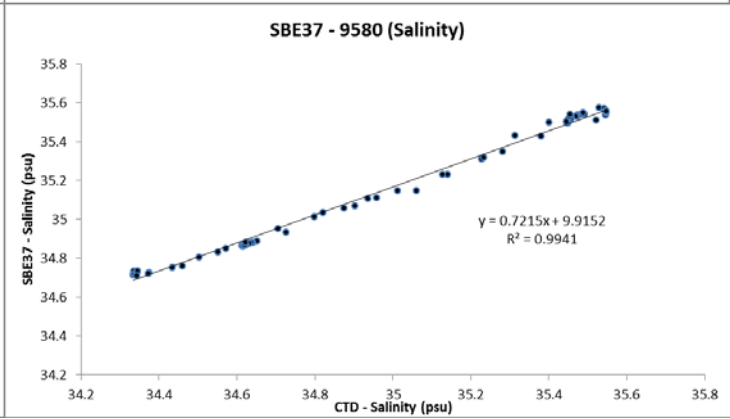

SBE37 - 9575 (Salinity)
y = 0.7089x + 10.356
R² = 0.9936
SBE37 - Salinity (psu)
CTD - Salinity (psu)

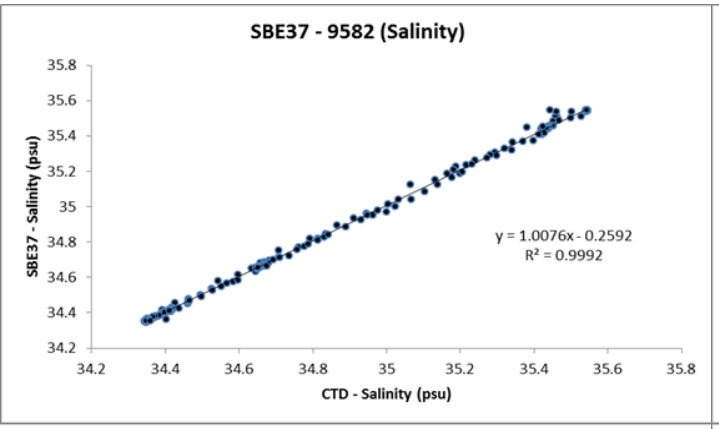

SBE37 - 9576 (Salinity)
y = 0.7257x + 9.7682
R² = 0.9938
SBE37 - Salinity (psu)
CTD - Salinity (psu)

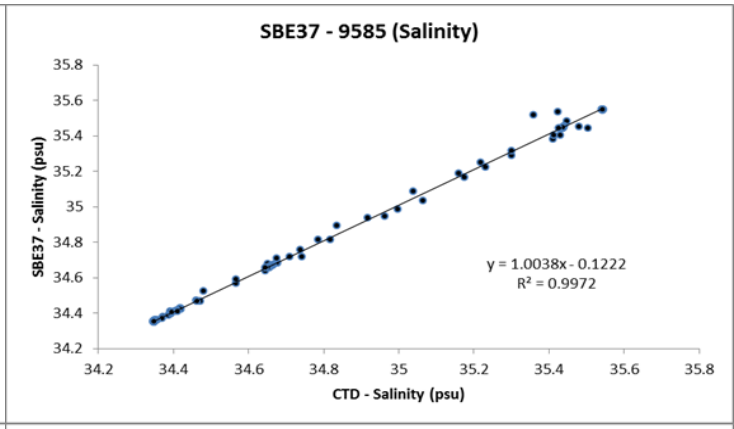

SBE37 - 9577 (Salinity)
y = 0.7178x + 10.048
R² = 0.9945
SBE37 - Salinity (psu)
CTD - Salinity (psu)

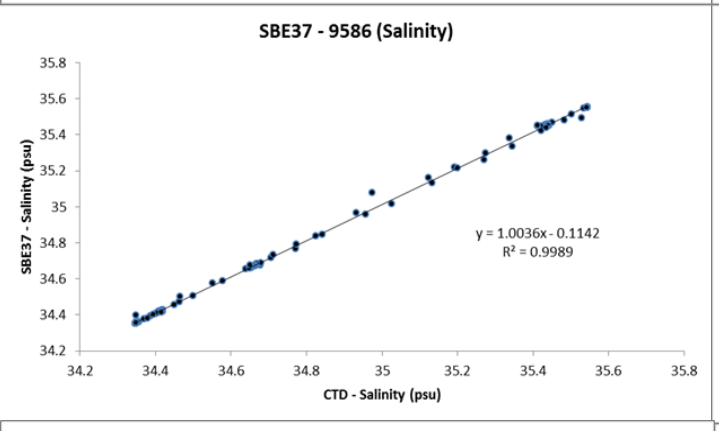

SBE37 - 9578 (Salinity)
y = 0.7297x + 9.6275
R² = 0.9936
SBE37 - Salinity (psu)
CTD - Salinity (psu)

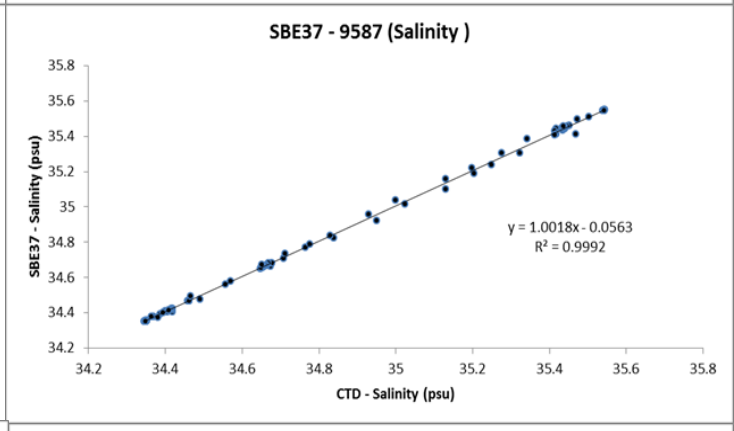

SBE37 - 9579 (Salinity)
y = 0.7272x + 9.7165
R² = 0.9941
SBE37 - Salinity (psu)
CTD - Salinity (psu)

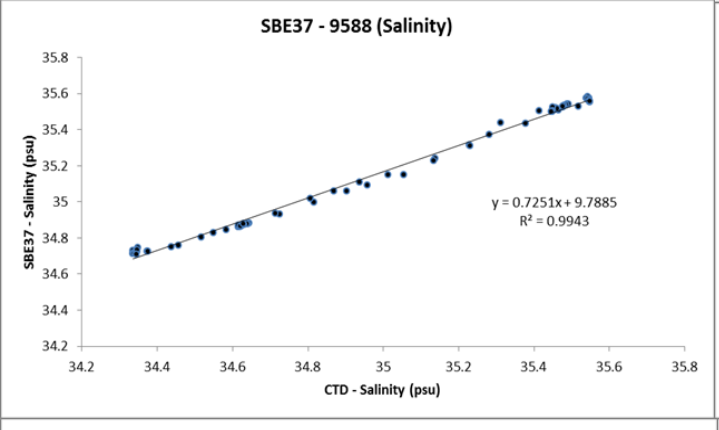

SBE37 - 9580 (Salinity)
y = 0.7215x + 9.9152
R² = 0.9941
SBE37 - Salinity (psu)
CTD - Salinity (psu)

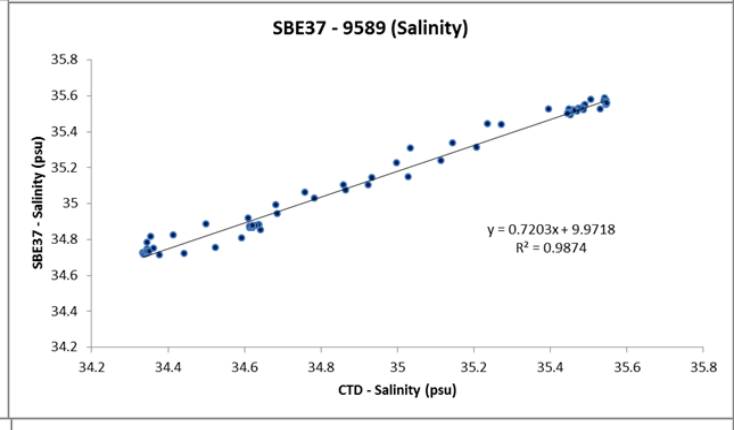

SBE37 - 9582 (Salinity)
y = 1.0076x - 0.2592
R² = 0.9992
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

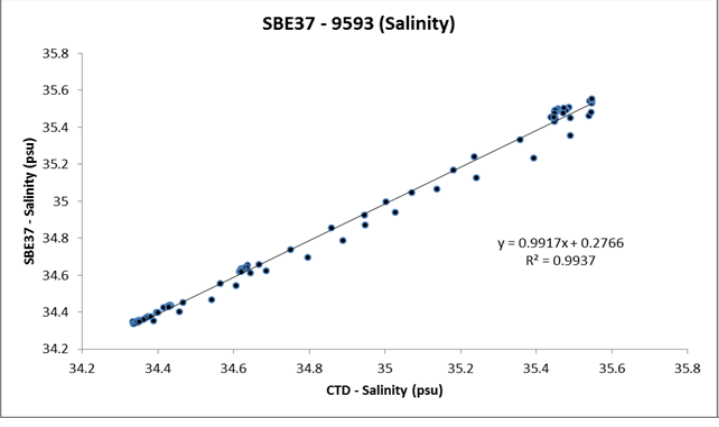

SBE37 - 9585 (Salinity)
y = 1.0038x - 0.1222
R² = 0.9972
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

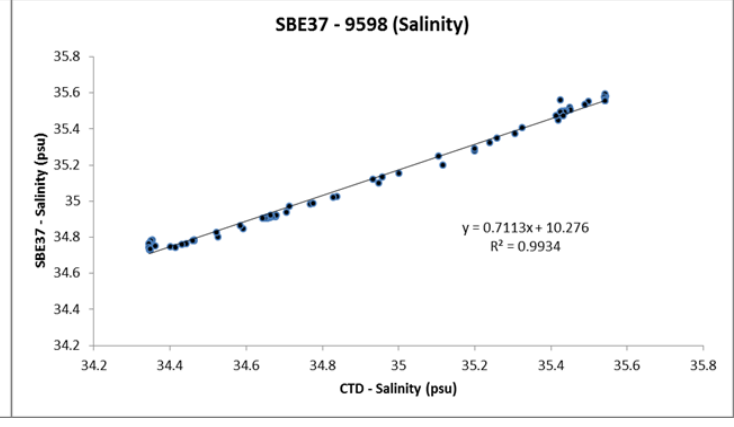

SBE37 - 9586 (Salinity)
y = 1.0036x - 0.1142
R² = 0.9989
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

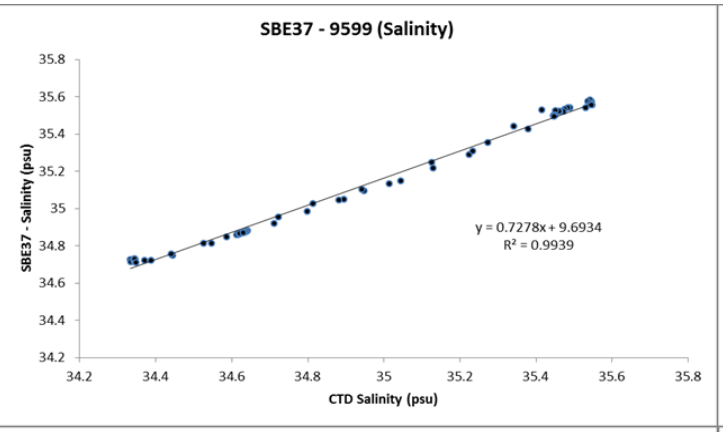

SBE37 - 9587 (Salinity)
y = 1.0018x - 0.0563
R² = 0.9992
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

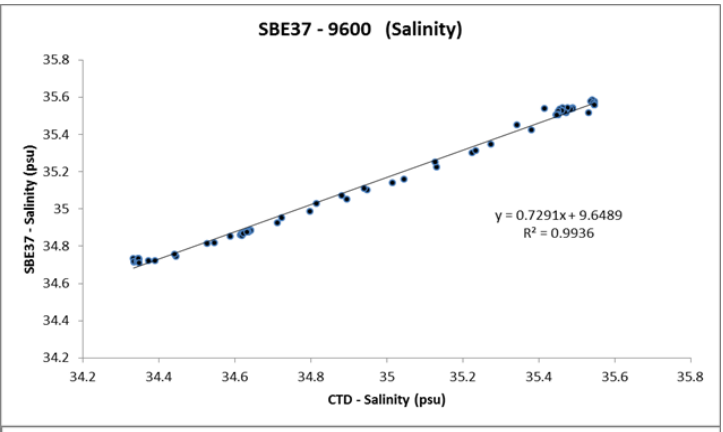

SBE37 - 9588 (Salinity)
y = 0.7251x + 9.7885
R² = 0.9943
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

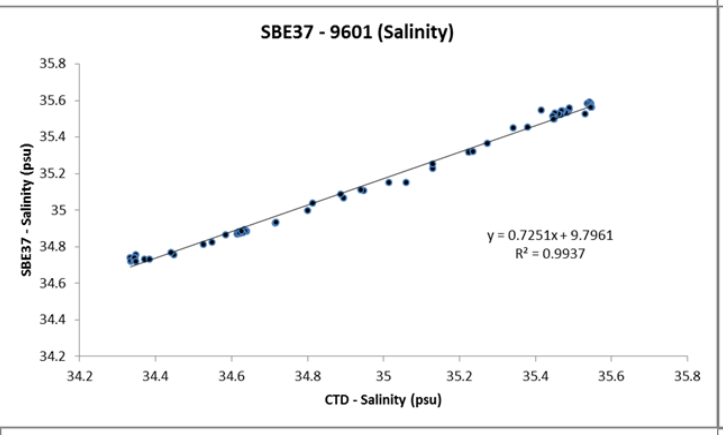

SBE37 - 9589 (Salinity)
y = 0.7203x + 9.9718
R² = 0.9874
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

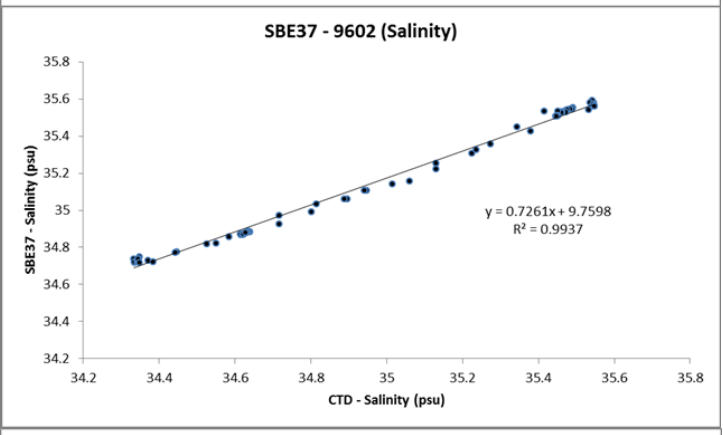

SBE37 - 9593 (Salinity)
y = 0.9917x + 0.2766
R² = 0.9937
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

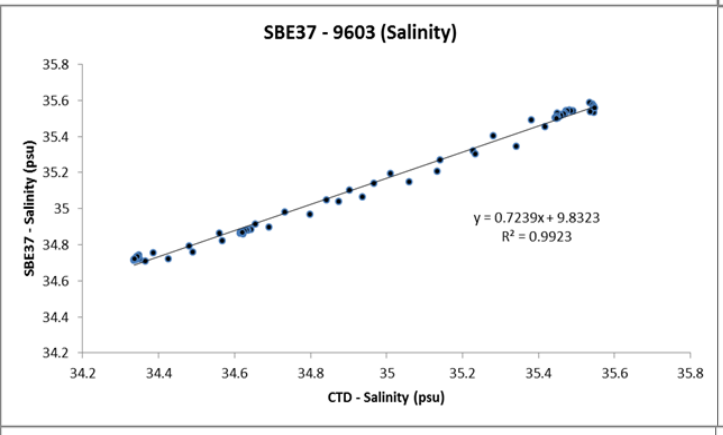

SBE37 - 9598 (Salinity)
y = 0.7113x + 10.276
R² = 0.9934
SBE37 - Salinity (psu)
CTD - Salinity (psu)
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

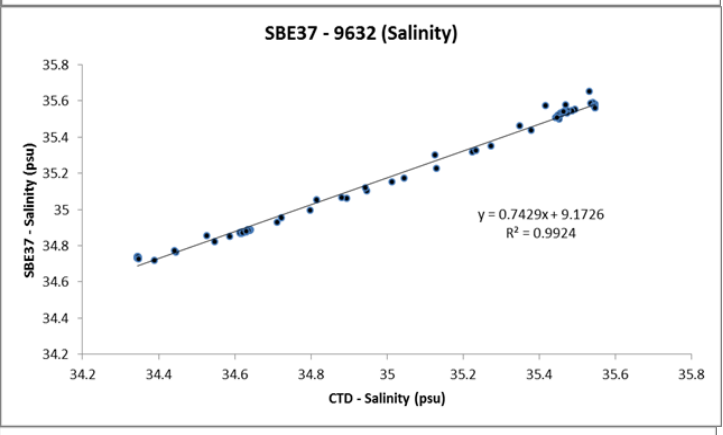

SBE37 - 9599 (Salinity)
SBE37 - Salinity (psu)
CTD Salinity (psu)
y = 0.7278x + 9.6934
R² = 0.9939

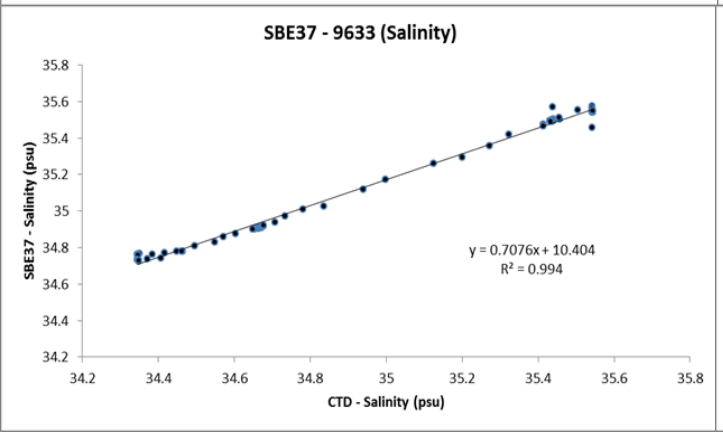

SBE37 - 9600 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7291x + 9.6489
R² = 0.9936

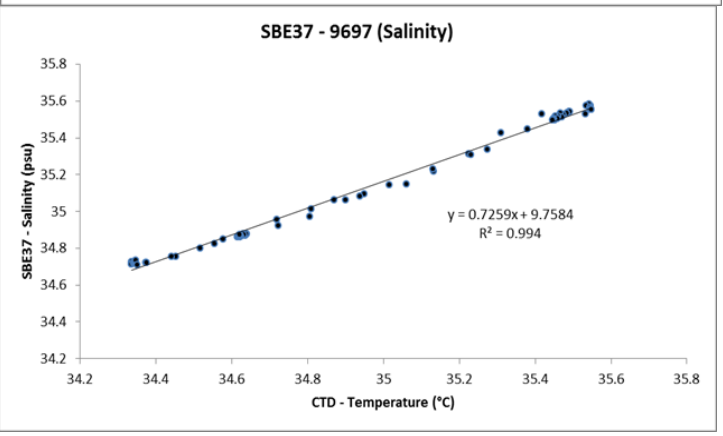

SBE37 - 9601 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7251x + 9.7961
R² = 0.9937

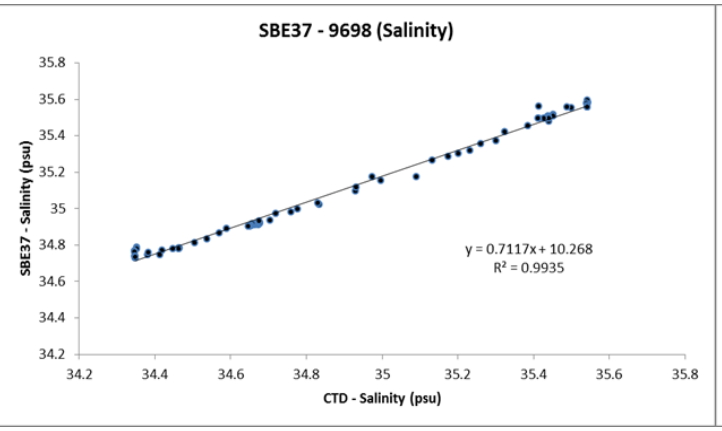

SBE37 - 9602 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7261x + 9.7598
R² = 0.9937

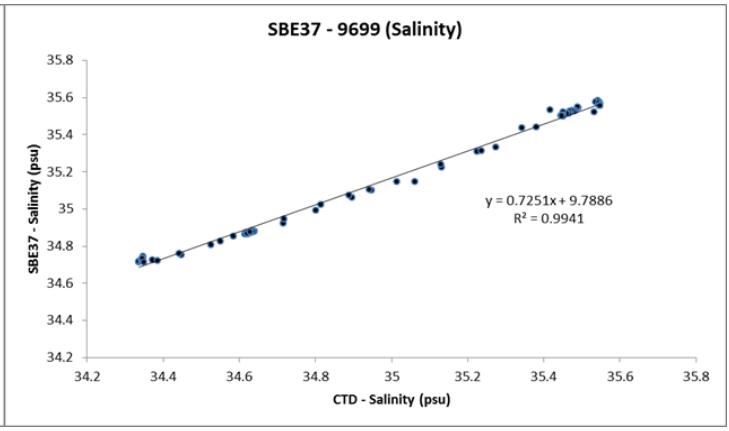

SBE37 - 9603 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7239x + 9.8323
R² = 0.9923


SBE37 - 9632 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7429x + 9.1726
R² = 0.9924

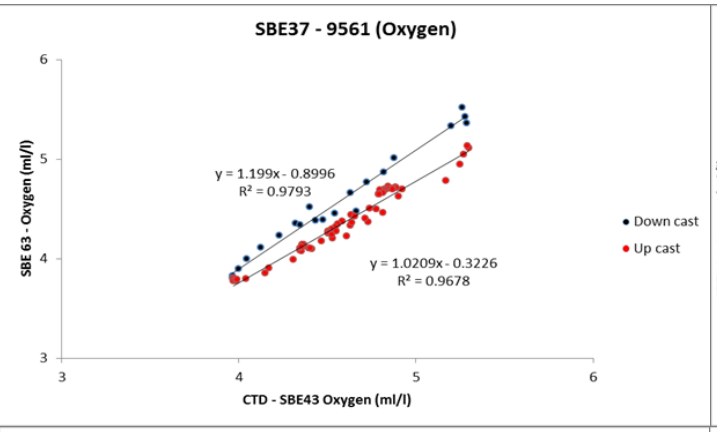

SBE37 - 9633 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7076x + 10.404
R² = 0.994

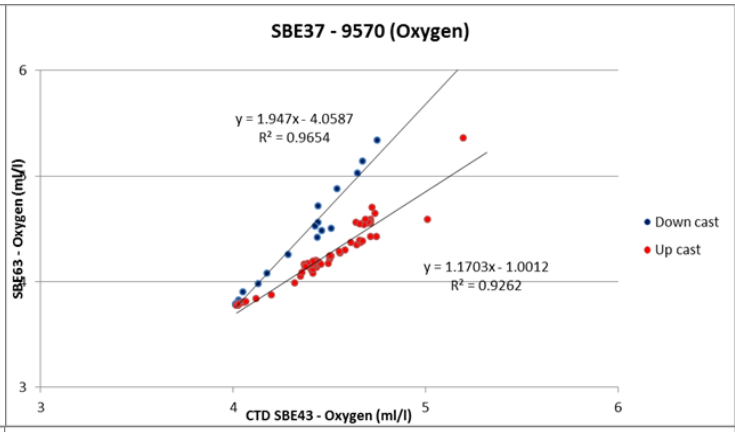

SBE37 - 9697 (Salinity)
SBE37 - Salinity (psu)
CTD - Temperature (°C)
y = 0.7259x + 9.7584
R² = 0.994

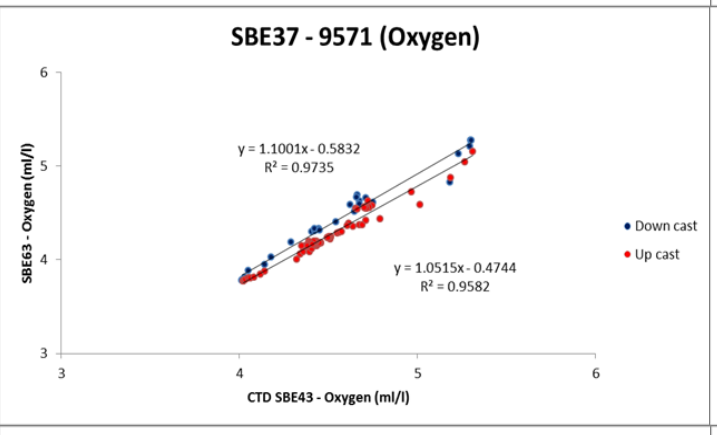

SBE37 - 9698 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7117x + 10.268
R² = 0.9935
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

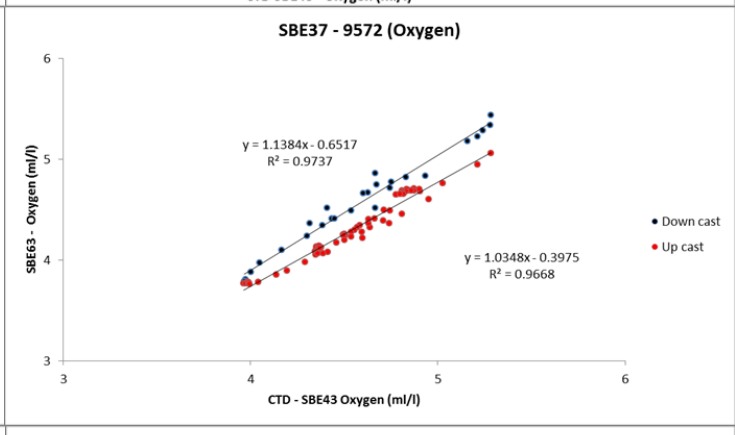

SBE37 - 9699 (Salinity)
SBE37 - Salinity (psu)
CTD - Salinity (psu)
y = 0.7251x + 9.7886
R² = 0.9941
35.8
35.6
35.4
35.2
35
34.8
34.6
34.4
34.2
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8

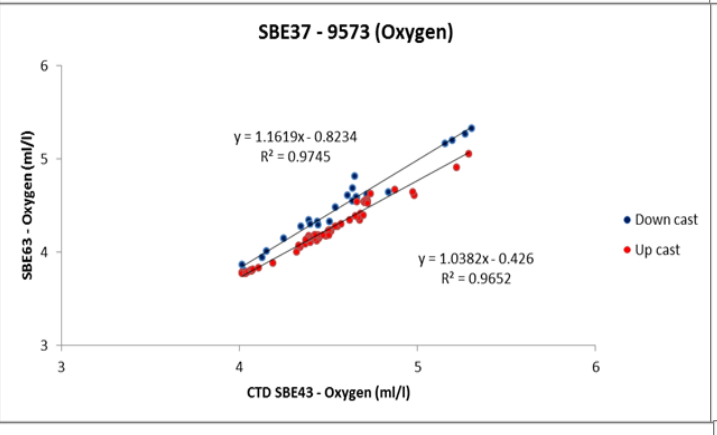
Oxygen Regressions

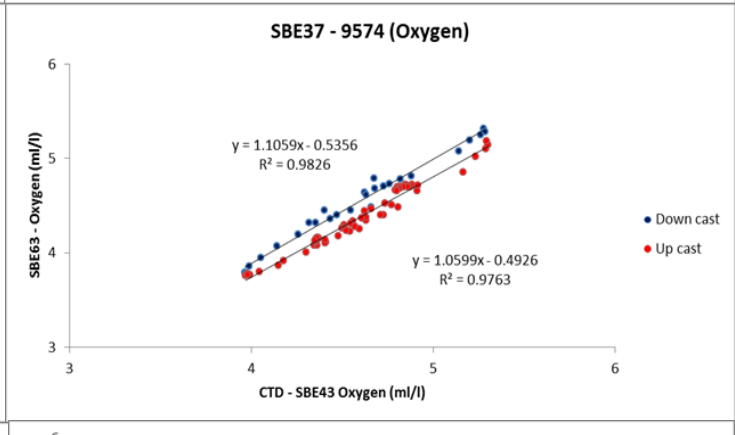

SBE37 - 9561 (Oxygen)
y = 1.199x - 0.8996
R² = 0.9793
y = 1.0209x - 0.3226
R² = 0.9678
Down cast
Up cast
SBE 63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

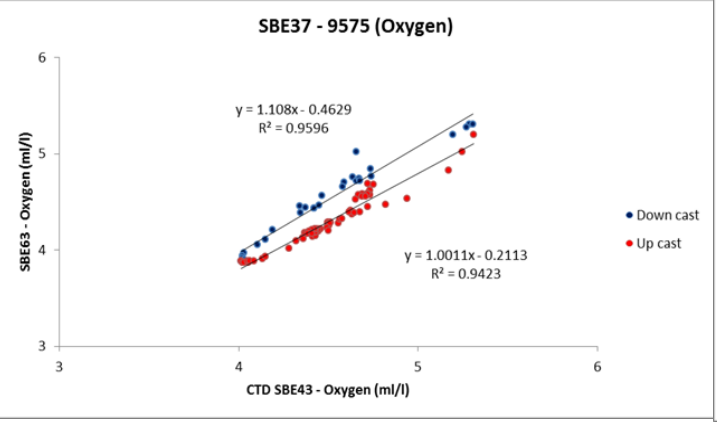

SBE37 - 9570 (Oxygen)
y = 1.947x - 4.0587
R² = 0.9654
y = 1.1703x - 1.0012
R² = 0.9262
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

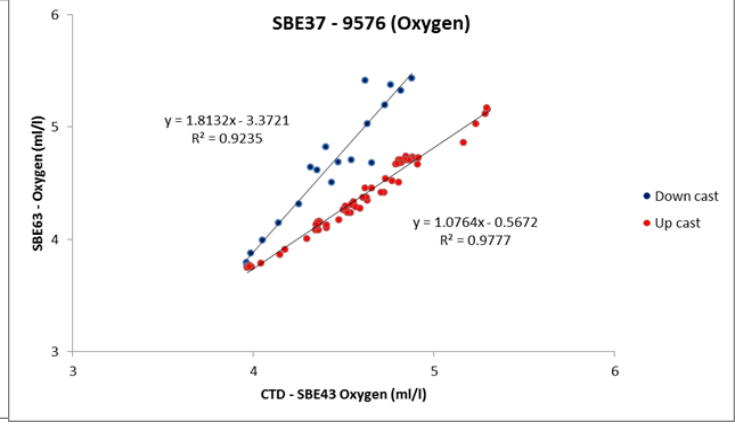

SBE37 - 9571 (Oxygen)
y = 1.1001x - 0.5832
R² = 0.9735
y = 1.0515x - 0.4744
R² = 0.9582
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

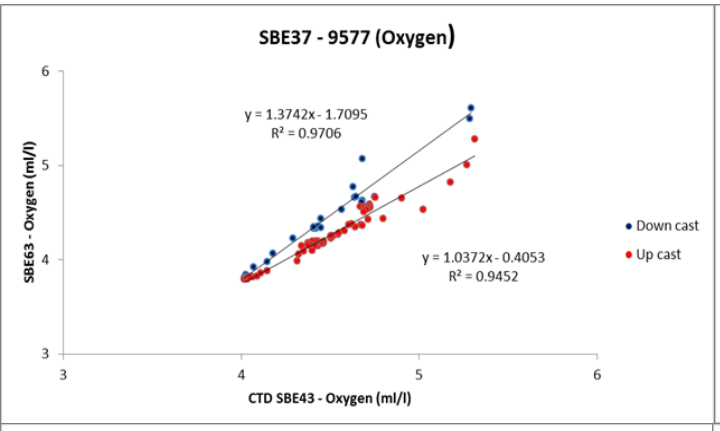

SBE37 - 9572 (Oxygen)
y = 1.1384x - 0.6517
R² = 0.9737
y = 1.0348x - 0.3975
R² = 0.9668
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

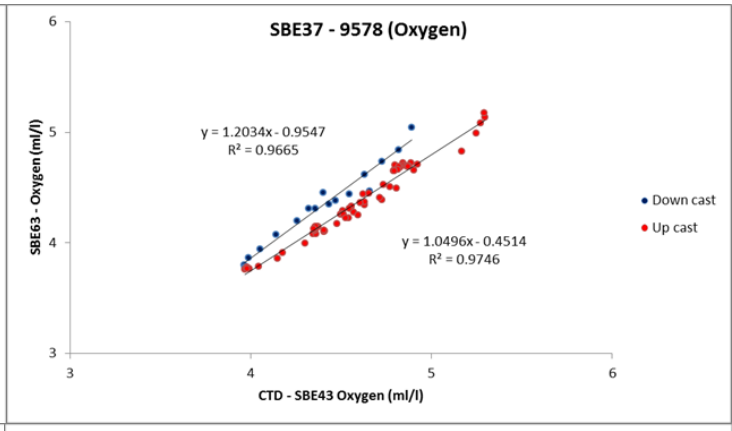

SBE37 - 9573 (Oxygen)
y = 1.1619x - 0.8234
R² = 0.9745
y = 1.0382x - 0.426
R² = 0.9652
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

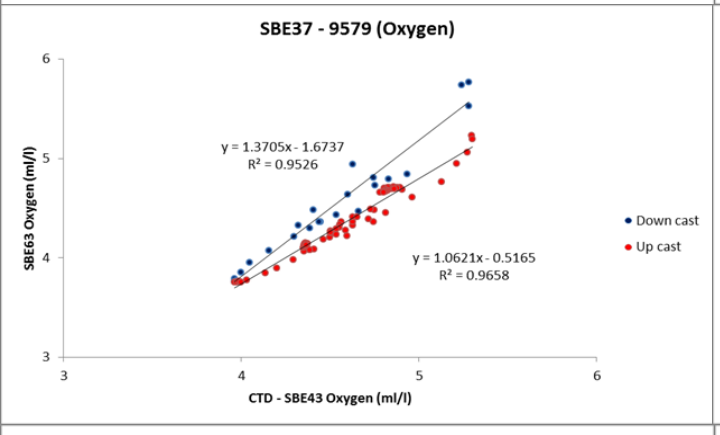

SBE37 - 9574 (Oxygen)
y = 1.1059x - 0.5356
R² = 0.9826
y = 1.0599x - 0.4926
R² = 0.9763
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

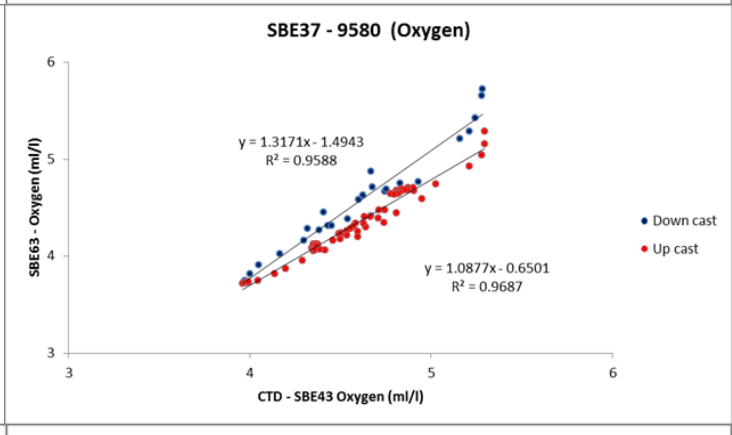

SBE37 - 9575 (Oxygen)
y = 1.108x - 0.4629
R² = 0.9596
y = 1.0011x - 0.2113
R² = 0.9423
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

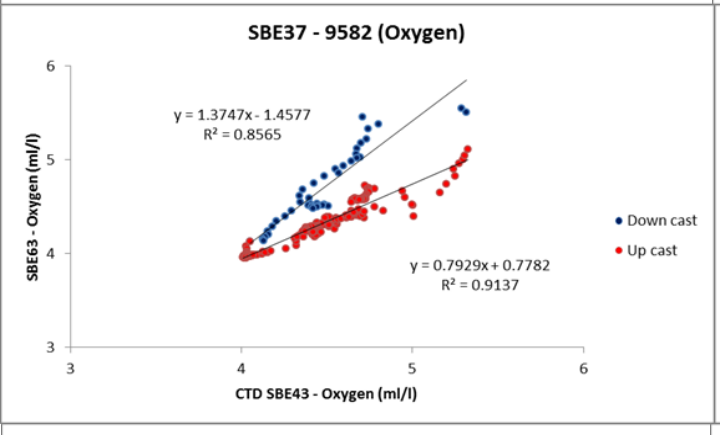

SBE37 - 9576 (Oxygen)
y = 1.8132x - 3.3721
R² = 0.9235
y = 1.0764x - 0.5672
R² = 0.9777
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

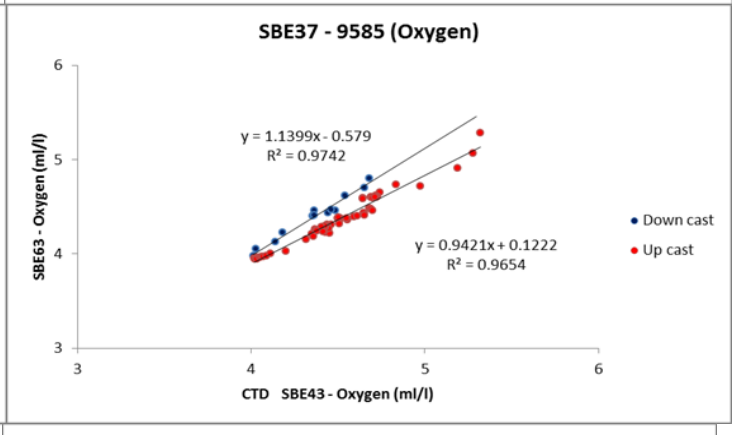

SBE37 - 9577 (Oxygen)
y = 1.3742x - 1.7095
R² = 0.9706
y = 1.0372x - 0.4053
R² = 0.9452
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

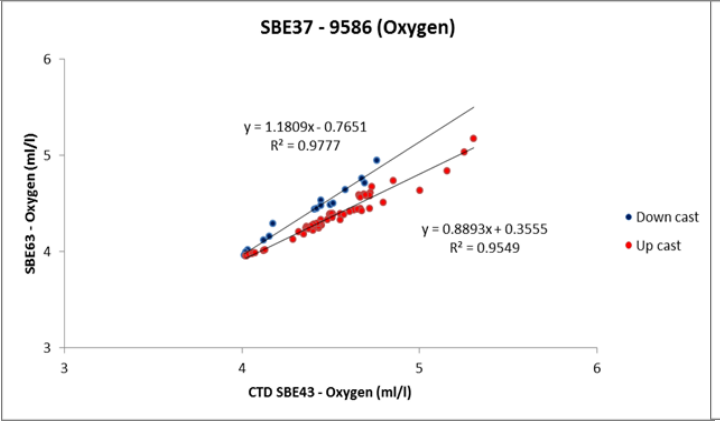

SBE37 - 9578 (Oxygen)
y = 1.2034x - 0.9547
R² = 0.9665
y = 1.0496x - 0.4514
R² = 0.9746
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

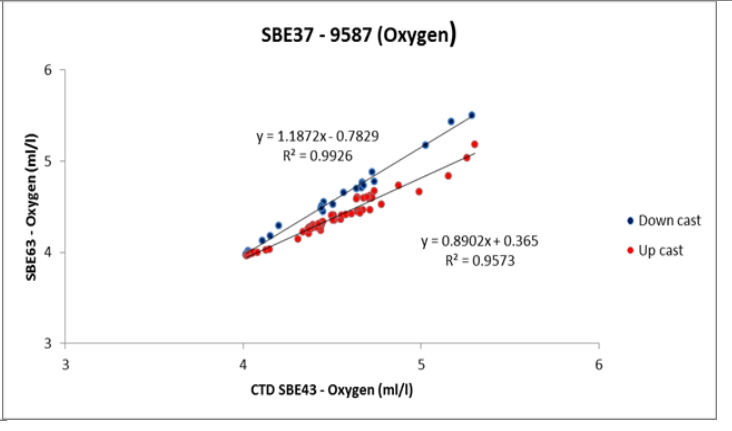

SBE37 - 9579 (Oxygen)
y = 1.3705x - 1.6737
R² = 0.9526
y = 1.0621x - 0.5165
R² = 0.9658
Down cast
Up cast
SBE63 Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

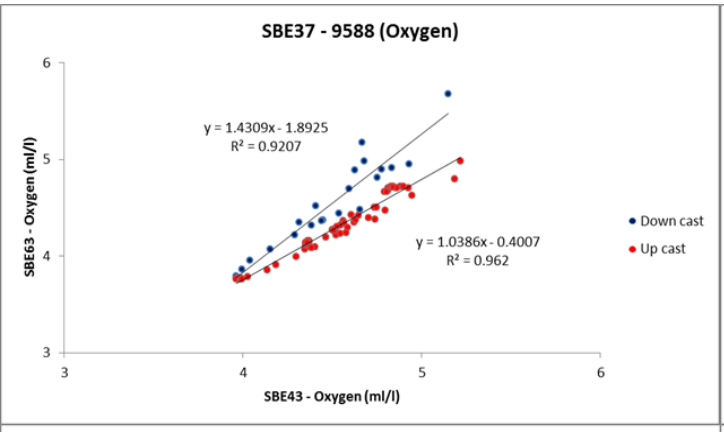

SBE37 - 9580 (Oxygen)
y = 1.3171x - 1.4943
R² = 0.9588
y = 1.0877x - 0.6501
R² = 0.9687
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)

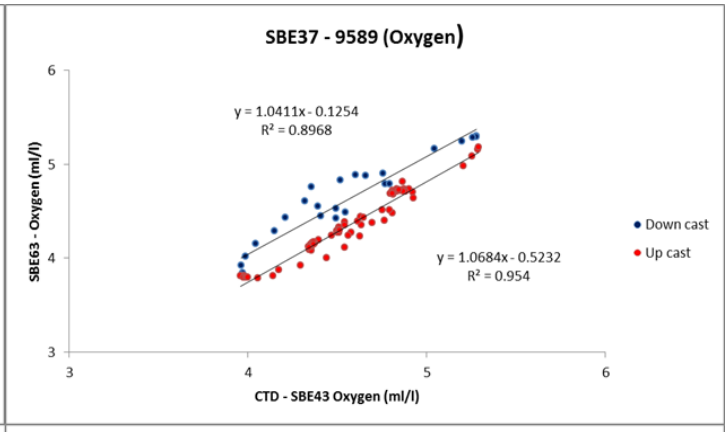

SBE37 - 9582 (Oxygen)
y = 1.3747x - 1.4577
R² = 0.8565
y = 0.7929x + 0.7782
R² = 0.9137
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

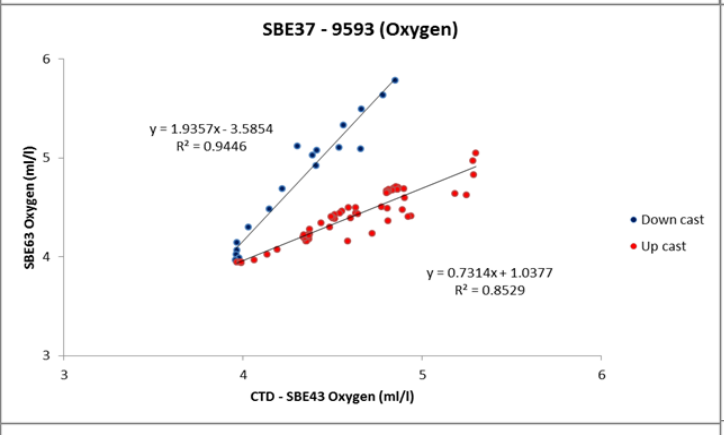

SBE37 - 9585 (Oxygen)
y = 1.1399x - 0.579
R² = 0.9742
y = 0.9421x + 0.1222
R² = 0.9654
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

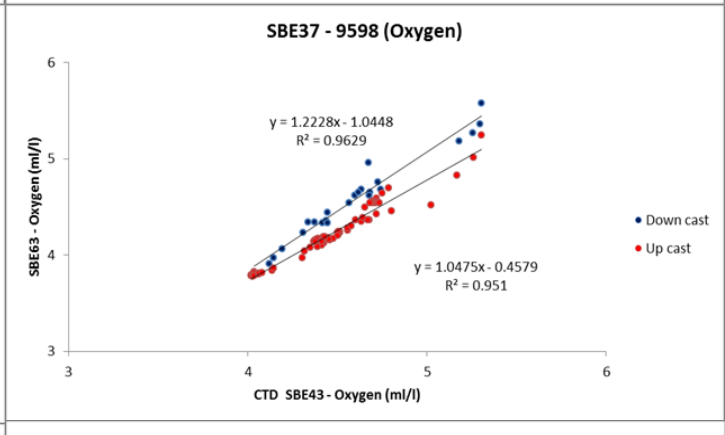

SBE37 - 9586 (Oxygen)
y = 1.1809x - 0.7651
R² = 0.9777
y = 0.8893x + 0.3555
R² = 0.9549
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

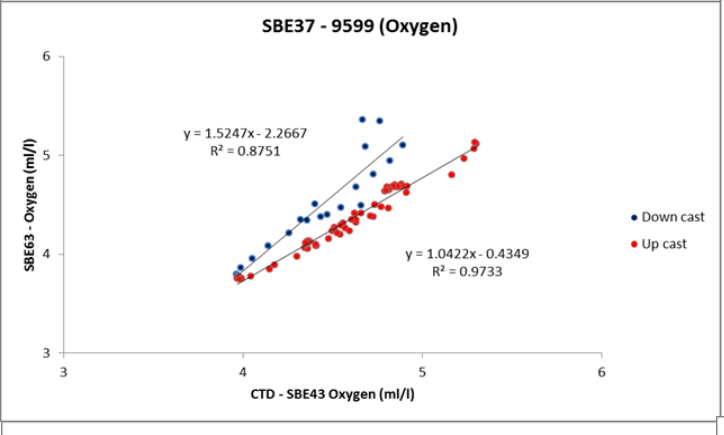

SBE37 - 9587 (Oxygen)
y = 1.1872x - 0.7829
R² = 0.9926
y = 0.8902x + 0.365
R² = 0.9573
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

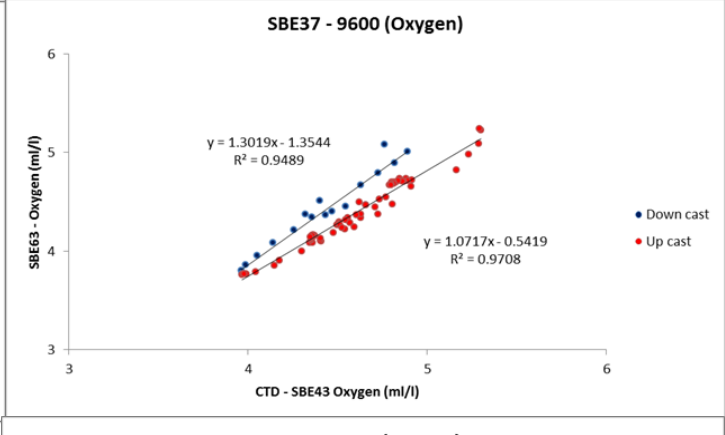

SBE37 - 9588 (Oxygen)
y = 1.4309x - 1.8925
R² = 0.9207
y = 1.0386x - 0.4007
R² = 0.962
Down cast
Up cast
SBE63 - Oxygen (ml/l)
SBE43 - Oxygen (ml/l)
6
5
4
3
3
4
5
6

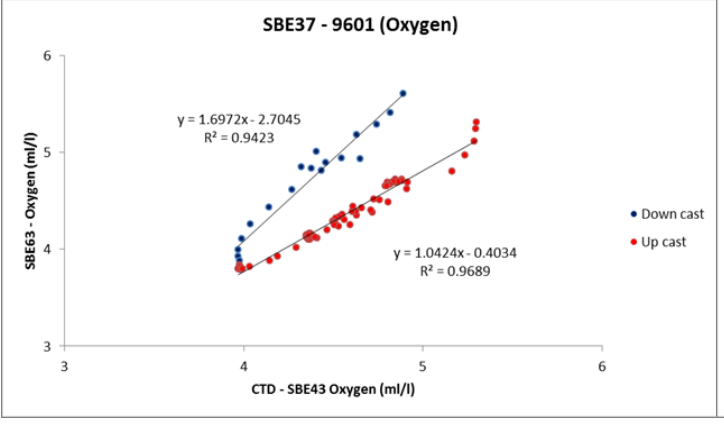

SBE37 - 9589 (Oxygen)
y = 1.0411x - 0.1254
R² = 0.8968
y = 1.0684x - 0.5232
R² = 0.954
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

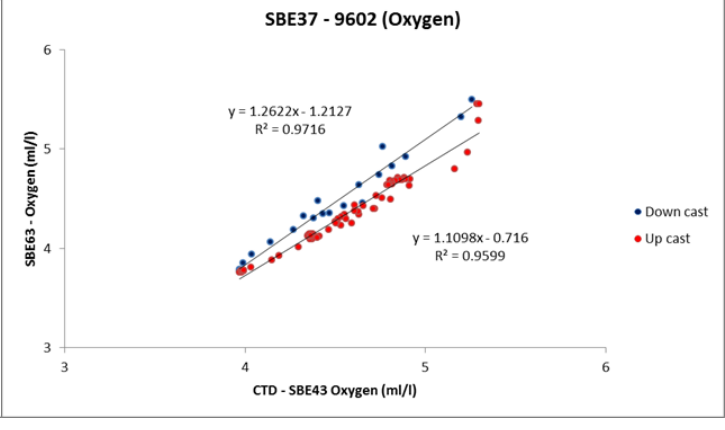

SBE37 - 9593 (Oxygen)
y = 1.9357x - 3.5854
R² = 0.9446
y = 0.7314x + 1.0377
R² = 0.8529
Down cast
Up cast
SBE63 Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

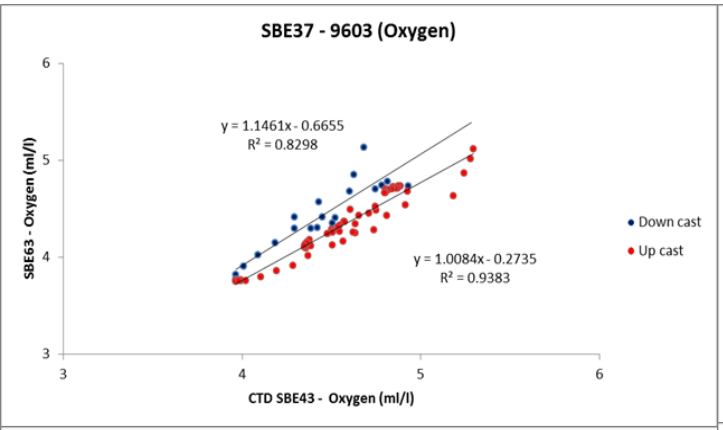

SBE37 - 9598 (Oxygen)
y = 1.2228x - 1.0448
R² = 0.9629
y = 1.0475x - 0.4579
R² = 0.951
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)
6
5
4
3
3
4
5
6

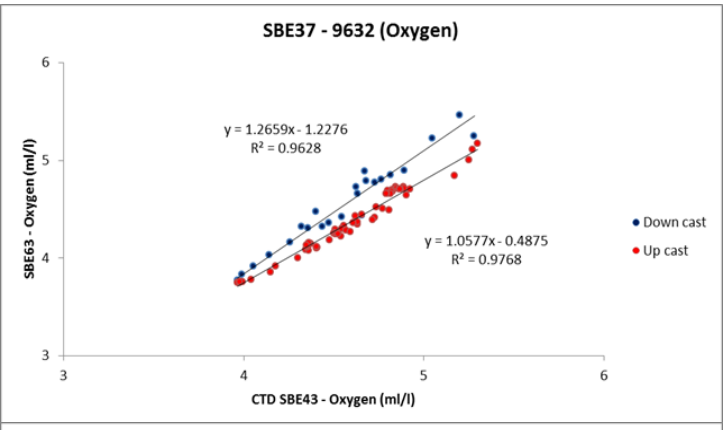

SBE37 - 9599 (Oxygen)
y = 1.5247x - 2.2667
R² = 0.8751
y = 1.0422x - 0.4349
R² = 0.9733
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

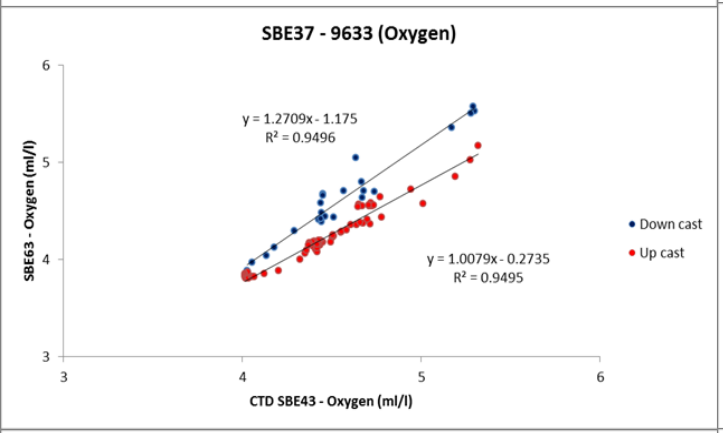

SBE37 - 9600 (Oxygen)
y = 1.3019x - 1.3544
R² = 0.9489
y = 1.0717x - 0.5419
R² = 0.9708
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

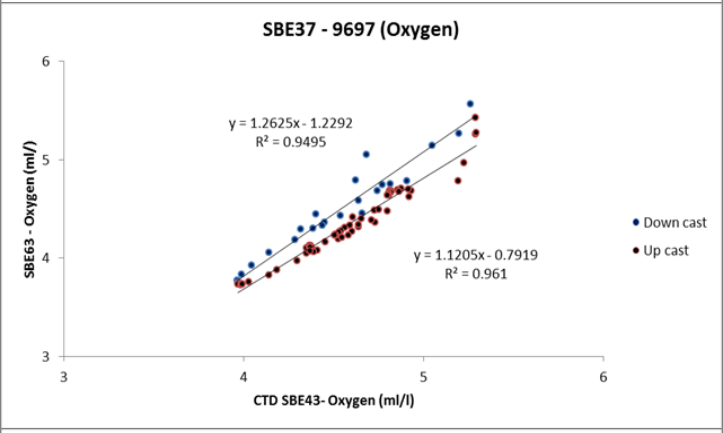

SBE37 - 9601 (Oxygen)
y = 1.6972x - 2.7045
R² = 0.9423
y = 1.0424x - 0.4034
R² = 0.9689
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

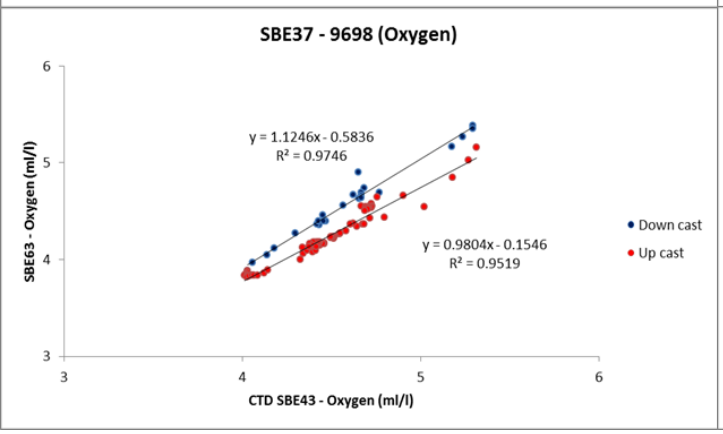

SBE37 - 9602 (Oxygen)
y = 1.2622x - 1.2127
R² = 0.9716
y = 1.1098x - 0.716
R² = 0.9599
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD - SBE43 Oxygen (ml/l)
6
5
4
3
3
4
5
6

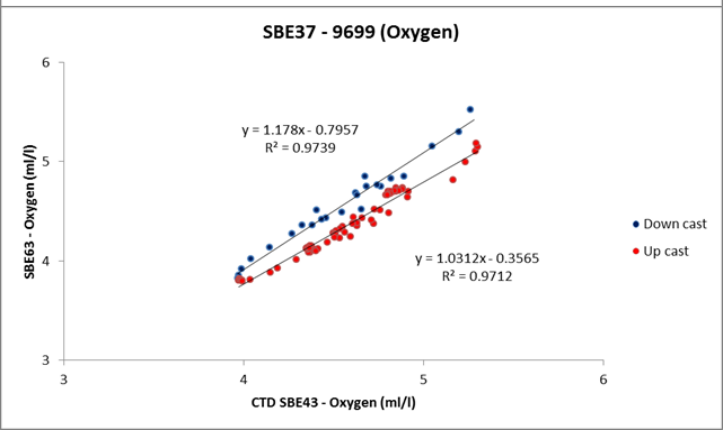

SBE37 - 9603 (Oxygen)
y = 1.1461x - 0.6655
R² = 0.8298
y = 1.0084x - 0.2735
R² = 0.9383
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)


SBE37 - 9632 (Oxygen)
y = 1.2659x - 1.2276
R² = 0.9628
y = 1.0577x - 0.4875
R² = 0.9768
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)


SBE37 - 9633 (Oxygen)
y = 1.2709x - 1.175
R² = 0.9496
y = 1.0079x - 0.2735
R² = 0.9495
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)


SBE37 - 9697 (Oxygen)
y = 1.2625x - 1.2292
R² = 0.9495
y = 1.1205x - 0.7919
R² = 0.961
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43- Oxygen (ml/l)


SBE37 - 9698 (Oxygen)
y = 1.1246x - 0.5836
R² = 0.9746
y = 0.9804x - 0.1546
R² = 0.9519
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)


SBE37 - 9699 (Oxygen)
y = 1.178x - 0.7957
R² = 0.9739
y = 1.0312x - 0.3565
R² = 0.9712
Down cast
Up cast
SBE63 - Oxygen (ml/l)
CTD SBE43 - Oxygen (ml/l)

ANNEXURE II
Mooring Deployment diagrams

Mooring 1 (SAMBA M7)

Sea Level

200m

1 x Aural recorder

49" FT Float Serial no: J7937-005

300m

500m

SBE37 SMP-ODO & P – Serial no: 37-9585

75kHz RDI ADCP – Serial no: 15521

49" FT Float Serial no: J7937-010

Argos Beacon – AS900A Serial no: A06-097

502m

163m

665m

SBE37 SMP-ODO – Serial no: 37-9570

165m

488m

830m

SBE37 SMP-ODO & P – Serial no: 37-9593

160m

982m

SBE37 SMP-ODO – Serial no: 37-9598

990m

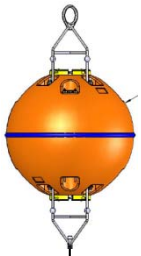
4 Glass spheres
on 3m 14mm ELL chain

2 Benthos 865-A releases Serial number: 46772 & 46773

1000m

Anchor Weight (1665kg)

Mooring 2 (SAMBA M8)



SBE37 SMP-ODO & P – Serial no: 37-9587

75kHz RDI ADCP – Serial no: 15520

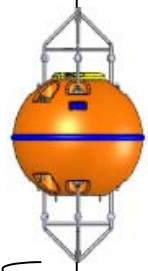
Argos Beacon – AS900A Serial no: W09-075

49" FT Serial no: J7937-007

Sea Level

500m

18m cable with 1m 14mm ELL chain onto 1st buoy



520m

36" FT Float Serial no: J07167-002

522m

188m

710m

SBE37 SMP-ODO – Serial no: 37-9575

210m

920m

SBE37 SMP-ODO – Serial no: 37-9578

80m

1000m

478m

1008m

122m

1130m

SBE37 SMP-ODO Serial no:37-9577

120m

1250m

90m

1340m

SBE37 SMP-ODO Serial no:37-9633

210m

1550m

SBE37 SMP-ODO Serial no:37-9571

210m

1760m

SBE37 SMP-ODO Serial no:37-9573

222m

1982m

SBE37 SMP-ODO Serial no:37-9698

982m

8 Glass spheres on 8m 14mm ELL chain

1000m

522m

4 Glass spheres on 3m 14mm ELL chain

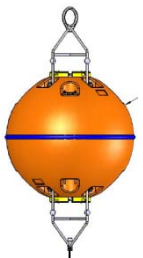
1990m

2 Benthos 865-A releases Serial no: 52734 & 52735

2000m

Anchor Weight (1620kg)

Mooring 3 (SAMBA M9)



Sea Level

SBE37 SMP-ODO & P – Serial no: 37-9582

75kHz RDI ADCP – Serial no: 18259

49" FT Float Serial no: J07168-002

Argos Beacon – AS900A Serial no: Y02-023

500m

18m cable with 1m 14mm ELL chain onto 1st buoy

520m

36" FT Float Serial no: J07167-004

478m

522m
278m
522m
200m
1000m

SBE37 SMP-ODO – Serial no: 37-9699

1000m

8 Glass spheres on 8m 14mm ELL chain

992m

1008m
92m
1100m
300m
1400m
300m
1700m
100m
1800m
200m
2000m

SBE37 SMP-ODO – Serial no: 37-9632
SBE37 SMP-ODO – Serial no: 37-9589
SBE37 SMP-ODO – Serial no: 37-9599
SBE37 SMP-ODO – Serial no: 37-9602
SBE37 SMP-ODO – Serial no: 37-9574

2000m

8 Glass spheres on 8m 14mm ELL chain

982m

2008m
152m
2160m
140m
2300m
220m
2520m
80m
2600m
300m
2900m
82m
2982m

SBE37 SMP-ODO – Serial no: 37-9576
SBE37 SMP-ODO – Serial no: 37-9600
SBE37 SMP-ODO – Serial no: 37-9601

2990m

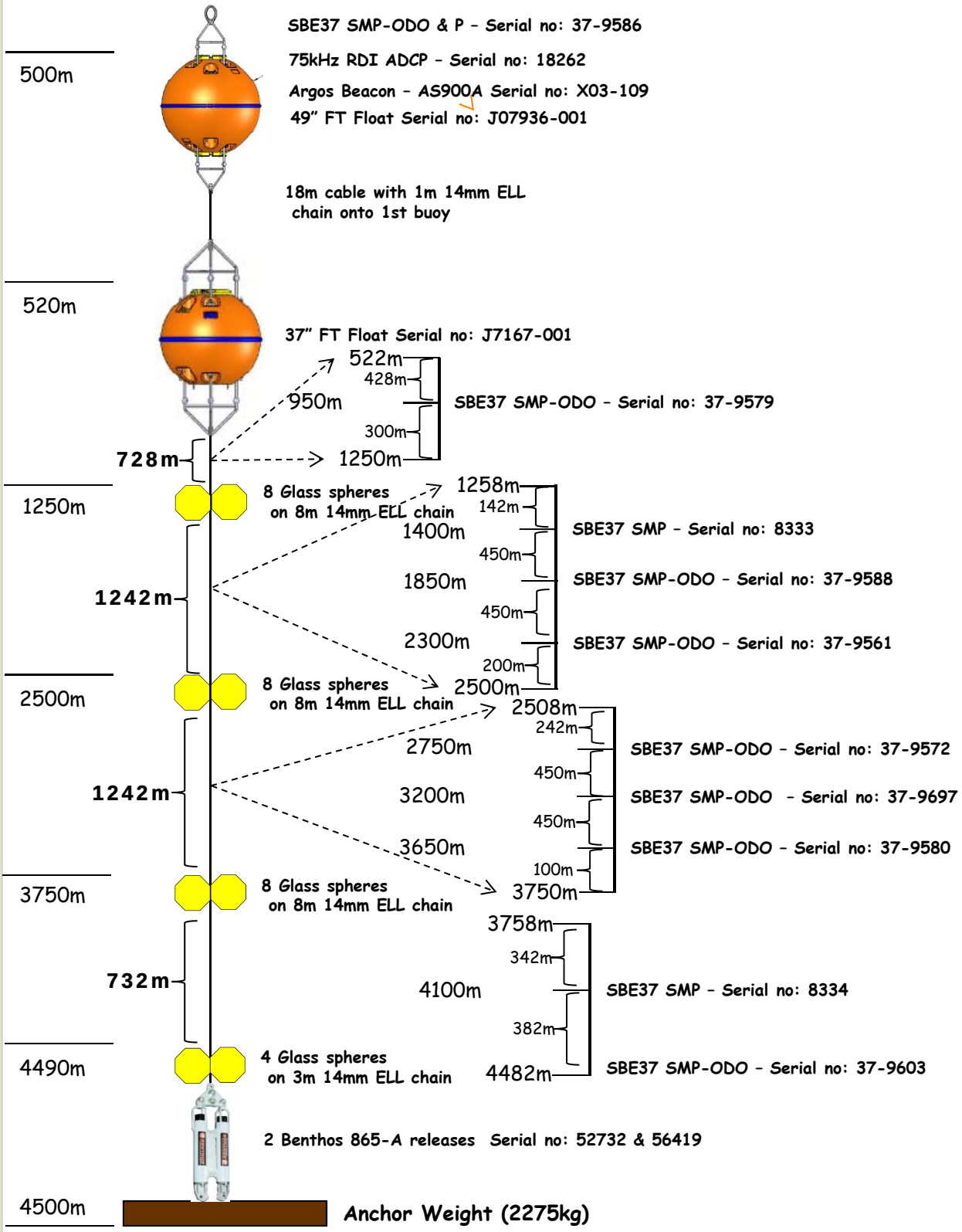
4 Glass spheres on 3m 14mm ELL chain

2 Benthos 865-A releases Serial no: 52733 & 52736

3000m

Anchor Weight (1886kg)

Mooring 4 (SAMBA M10)



ANNEXURE III
Mooring Deployment sheets

MOORING DEPLOYMENT SHEET - SAMBA EASTERN BASIN (SOUTH AFRICA)

Cruise:	ALG210	**Mooring:**	SAMBA M7
Date:	16-Sep-14		
Site Arrival Time:		**Set-up Distance:**	2 nmile (200m over)
Start Time:	13h09	**End Time:**	14h32
Start Latitude:		**End Latitude:**	34° 23.6357 S
Start Longitude		**End Longitude**	17° 35.6644 E

MOORING INSTRUMENT DEPLOYMENT:

Item	Serial #:	Time (on mooring)	Comment:		
1. 49" FT Float	J7937-005	13h09	1 x Aural recorder mounted in float		
Argos beacon	A06-097				
2. 49" FT Float	J7937-010		300m 6mm steel cable (plastic coated)		
75kHz ADCP	15521		upwards looking		
SBE37 SMP-ODO&P	37-9585				
3. SBE37 SMP-ODO	37-9570		488m 6mm steel cable (plastic coated)		
4. SBE37 SMP-ODO&P	37-9593				
5. SBE37 SMP-ODO	37-9598				
6. 4 x 17" Glass Spheres			3m 14mm ELL chain		
7. 2 x Benthos 865-A releases	46773		Alkaline batteries		
	46772		Alkaline batteries		
8. Chain link weights		14h32	1665kg		

Acoustic Releases: **Enable Code:** F **Enable Code:** E
Release Code: **Release Code:**
Frequency: 11.0 kHz **Frequency:** 10.5 kHz

ARGOS Beacon ID #: A06-097 (DEA) - 120489 / AF7C498

Anchor Release: **Latitude:** 34° 23.6357 S
Longitude: 17° 35.6644 E

Water Depth (including draft): 1126m

Technicians: **Instruments:** Marcel van den Berg
Moorings: Bradley Blows / Gavin Louw/ Leon Jacobs

MOORING DEPLOYMENT SHEET - SAMBA EASTERN BASIN (SOUTH AFRICA)

Cruise:	ALG210	**Mooring:**	SAMBA M8
Date:	17-Sep-14		
Site Arrival Time:		**Set-up Distance:**	1.5 nmile (400m over)
Start Time:	09h18	**End Time:**	10h09
Start Latitude:	34° 30.2081 S	**End Latitude:**	34° 29.9611 S
Start Longitude	17° 19.6637 E	**End Longitude**	17° 17.7505 E

MOORING INSTRUMENT DEPLOYMENT:

Item	Serial #:	Time (on mooring)	Comment:		
1. 49" FT Float	J7937-007	09h18	1m 14mm ELL chain below bouy		
75kHz ADCP	15520		upwards looking		
SBE37 SMP-ODO&P	37-9587				
Argos Beacon	W09-075				
2. 36" FT Float	J07167-002		18m 6mm steel cable (plastic coated)		
3. SBE37 SMP-ODO	37-9575		478m 6mm steel cable (plastic coated)		
4. SBE37 SMP-ODO	37-9578				
5. 8 x 17" Glass Spheres			8m 14mm ELL chain		
6. SBE37 SMP-ODO	37-9577		982m 6mm steel cable (plastic coated)		
7. SBE37 SMP-ODO	37-9633				
8. SBE37 SMP-ODO	37-9571				
9. SBE37 SMP-ODO	37-9573				
10. SBE37 SMP-ODO	37-9698				
11. 4 x 17" Glass Spheres			3m 14mm ELL chain		
12. 2 x Benthos 865-A releases	52735		Alkaline batteries		
	52734		Alkaline batteries		
8. Chain link weights		10h09	1620kg		

Acoustic Releases:

Enable Code:	F	**Enable Code:**	D
Release Code:		**Release Code:**	
Frequency:	11.50 kHz	**Frequency:**	11.25 kHz

ARGOS Beacon ID #: W09-075 (BCRE) - 88940 / 81F82C7

Anchor Release: **Latitude:** 34° 29.9611 S

Longitude: 17° 17.7505 E

Water Depth (including draft): 2099m

Technicians: **Instruments:** Marcel van den Berg

Moorings: Bradley Blows / Gavin Louw/ Leon Jacobs

MOORING DEPLOYMENT SHEET - SAMBA EASTERN BASIN (SOUTH AFRICA)

Cruise:	ALG210	**Mooring:**	SAMBA M9
Date:	17-Sep-14		
Site Arrival Time:		**Set-up Distance:**	2.5 nmile (600m over)
Start Time:	13h34	**End Time:**	14h50
Start Latitude:	34° 31.0 S	**End Latitude:**	34° 29.8146 S
Start Longitude	17° 10.6 E	**End Longitude**	17° 07.9686 E

MOORING INSTRUMENT DEPLOYMENT:

Item	Serial #:	Time (on mooring)	Comment:
1. 49" FT Float	J07168-002	13h34	1m 14mm ELL chain below bouy
75kHz ADCP	18259		upwards looking
SBE37 SMP-ODO&P	37-9582		
Argos Beacon	Y02-023		
2. 36" FT Float	J07167-004		18m 6mm steel cable (plastic coated)
3. SBE37 SMP-ODO	37-9699		478m 6mm steel cable (plastic coated)
4. 8 x 17" Glass Spheres			8m 14mm ELL chain
5. SBE37 SMP-ODO	37-9632		992m 6mm steel cable (plastic coated)
6. SBE37 SMP-ODO	37-9589		
7. SBE37 SMP-ODO	37-9599		
8. SBE37 SMP-ODO	37-9602		
9. SBE37 SMP-ODO	37-9574		
10. 8 x 17" Glass Spheres			8m 14mm ELL chain
11. SBE37 SMP-ODO	37-9576		979m 6mm steel cable (plastic coated)
12. SBE37 SMP-ODO	37-9600		(3m removed - damaged when spooling)
13. SBE37 SMP-ODO	37-9601		
14. 4 x 17" Glass Spheres			3m 14mm ELL chain
15. 2 x Benthos 865-A releases	52733		Alkaline batteries
	52736		Alkaline batteries
16. Chain link weights		14h50	1886kg

Acoustic Releases:

Enable Code:	C		**Enable Code:**	E
Release Code:			**Release Code:**	
Frequency:	11.00	kHz	**Frequency:**	11.75 kHz

ARGOS Beacon ID #: Y02-023 (BCRE) - 46522

Anchor Release:

Latitude: 34° 29.8146 S

Longitude: 17° 07.9686 E

Water Depth (including draft): 2975m

Technicians:

Instruments: Marcel van den Berg

Moorings: Bradley Blows / Gavin Louw/ Leon Jacobs

MOORING DEPLOYMENT SHEET - SAMBA EASTERN BASIN (SOUTH AFRICA)

Cruise:	ALG210	**Mooring:**	SAMBA M10
Date:	19-Sep-14		
Site Arrival Time:		**Set-up Distance:**	3.5 nmile (900m over) **
Start Time:	19h59	**End Time:**	21h50
Start Latitude:	34° 31.0 S	**End Latitude:**	34° 29.8146 S
Start Longitude	17° 10.6 E	**End Longitude**	17° 07.9686 E

MOORING INSTRUMENT DEPLOYMENT:

Item	Serial #:	Time (on mooring)	Comment:
1. 49" FT Float	J07936-001	19h59	1m 14mm ELL chain below bouy
75kHz ADCP	18262		upwards looking
SBE37 SMP-ODO&P	37-9586		
Argos Beacon	X03-109		
2. 36" FT Float	J07167-001	20h00	18m 6mm steel cable (plastic coated)
3. SBE37 SMP-ODO	37-9579		728m 6mm steel cable (plastic coated)
4. 8 x 17" Glass Spheres		20h18	8m 14mm ELL chain
5. SBE37 SMP	37-8333		1242m 6mm steel cable (plastic coated)
6. SBE37 SMP-ODO	37-9588		
7. SBE37 SMP-ODO	37-9561		
8. 8 x 17" Glass Spheres		20h52	8m 14mm ELL chain
9. SBE37 SMP-ODO	37-9572		1242m 6mm steel cable (plastic coated)
10. SBE37 SMP-ODO	37-9697		
11. SBE37 SMP-ODO	37-9580		
12. 8 x 17" Glass Spheres		21h24	8m 14mm ELL chain
13. SBE37 SMP	37-8334		732m 6mm steel cable (plastic coated)
14. SBE37 SMP-ODO	37-9603		
15. 4 x 17" Glass Spheres			3m 14mm ELL chain
16. 2 x Benthos 865-A releases	56419		Alkaline batteries
	52732		Alkaline batteries
17. Chain link weights		21h50	1886kg

Acoustic Releases:

Enable Code:	K		**Enable Code:**	B
Release Code:			**Release Code:**	
Frequency:	13.00	kHz	**Frequency:**	10.75 kHz

ARGOS Beacon ID #: X03-109 (BCRE) - 93909 / 9B07C5F

Anchor Release: **Latitude:** 34° 29.8146 S

Longitude: 17° 07.9686 E

Water Depth (including draft): 4479m

Technicians: **Instruments:** Marcel van den Berg

Moorings: Bradley Blows / Gavin Louw/ Leon Jacobs

** Weight drop point was 900m + 360m = 1260m