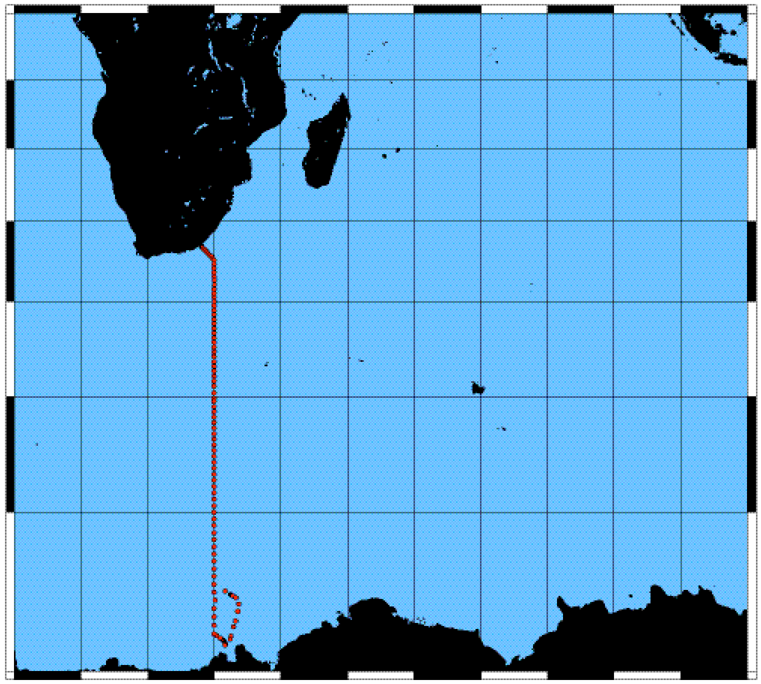
## Cruise report: I06S
*(Updated JUL 2009)*



# A. Highlights

## A.1. Cruise Summary Information

| | |
|---:|---|
| WOCE section designation | **I06S_2008** |
| Expedition designation (ExpoCodes) | **33RR20080204** |
| Chief Scientist | **Dr. Kevin G. Speer/FSU** |
| Co-Chief Scientist | **Dr Thorsten Dittmar/FSU** |
| Dates | 4 FEB 2008 - 17 MAR 2008 |
| Ship | *R/V Revelle* |
| Ports of call | Durban, South Africa – Cape Town, South Africa |
| Station geographic boundaries | 33° 12.3′ S<br>28° 4.0′ E 33° 40.1′ E<br>68° 36.9′ S |
| Stations | 106 |
| Floats and drifters deployed | 17 ARGO Floats Deployed |
| Moorings deployed or recovered | 0 |

**Chief Scientists' Contact Information:**

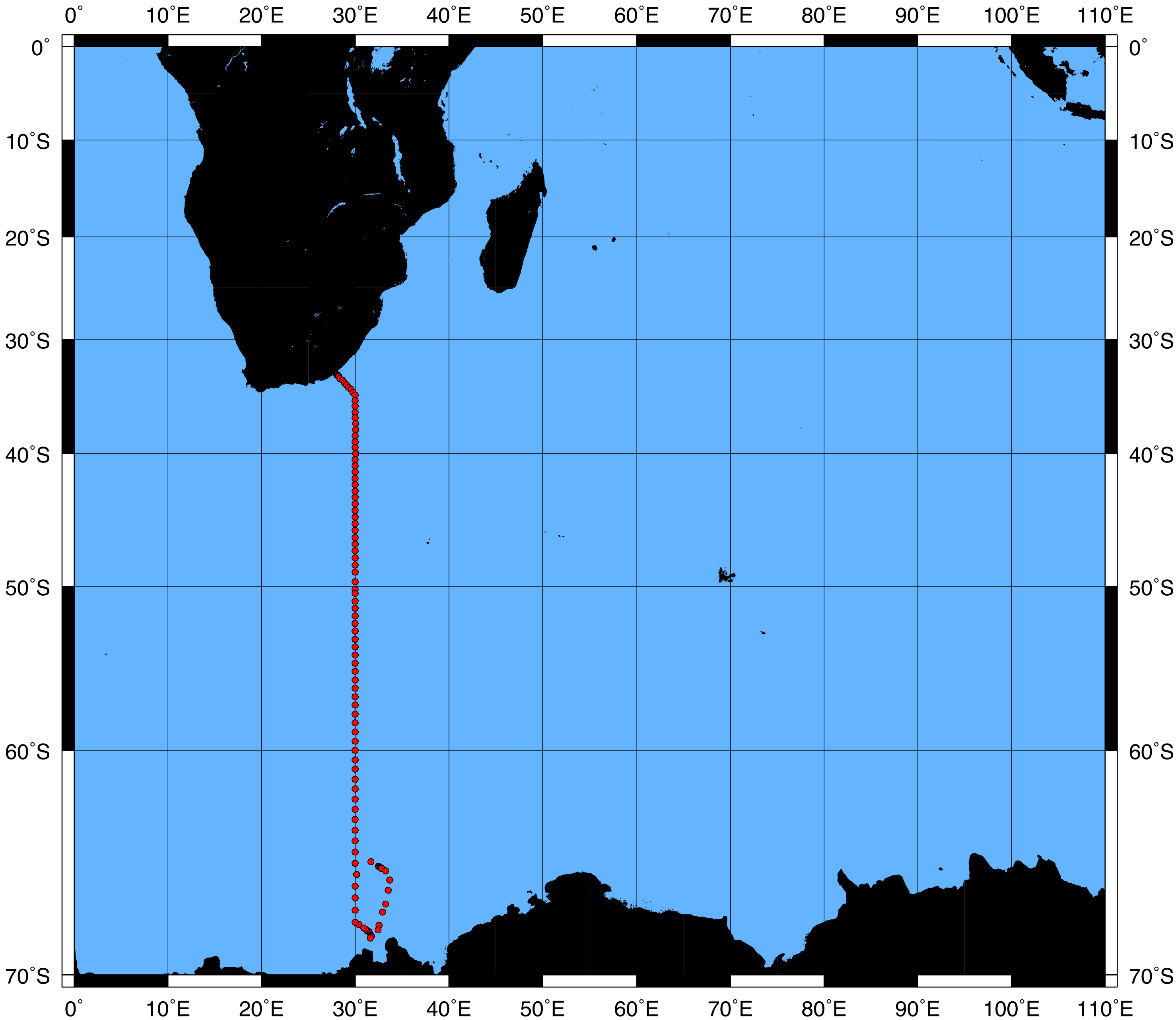

**Dr. Kevin G. Speer**
Rm 431a OSB
Dept. of Oceanography • Florida State University • Tallahassee, FL • 32306-4320
tel: (850) 645-4846
fax: (850) 644-2581
kspeer@ocean.fsu.edu

**Dr Thorsten Dittmar**
Rm 311 OSB
Dept. of Oceanography • Florida State University • Tallahassee, FL • 32306-4320
tel: (850) 645-1887
fax:(850) 644-2581
dittmar@ocean.fsu.edu

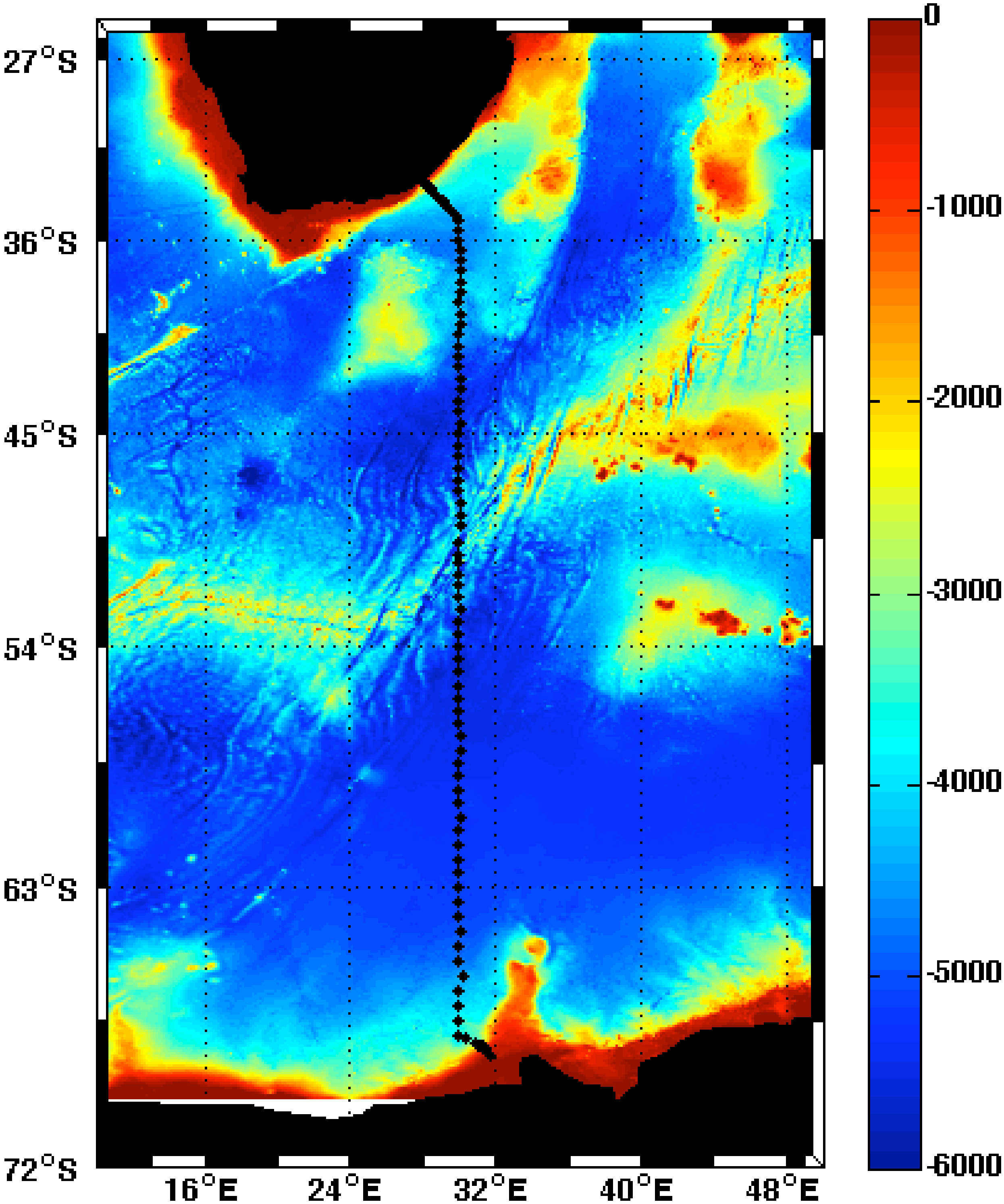
**Cruise and Data Information (links)**

Links to text locations. Shaded sections are not relevant to this cruise or were not available when this report was compiled

# Station Locations: I06S • 2008 • Speer/Dittmar • *R/V Revelle*




*Produced from .sum file by CCHDO*


27°S
36°S
45°S
54°S
63°S
72°S
16°E
24°E
32°E
40°E
48°E
0
-1000
-2000
-3000
-4000
-5000
-6000

Summary

A hydrographic survey consisting of CTD/LADCP/rosette sections, bio-optical casts, trace metals CTD/rosette casts, underway shipboard ADCP, was carried out mainly along the 30E line in the southern Indian Ocean in February and March 2008 (Fig. 1). The R/V Revelle departed Durban, South Africa on 4 February 2008. A total of 106 stations were occupied. These included 106 LADCP/CTD/Rosette casts, 80 trace metal rosette casts, 66 bio-optical casts from 4 February to 16 March. In addition, 17 ARGO were deployed. A couple dozen XBT drops were made for multibeam calibration and higher resolution sampling across fronts. Water samples (up to 36 10 liter containers) and CTD data were collected at each station. Aerosol samples were obtained throughout the cruise.

LADCP/CTD/rosette casts went to within 15-25 meters of the bottom, except in a few instances of rough topography or large waves where the closest approach was about 30m. Water samples were collected and measured for salinity, dissolved oxygen, nutrients, total DIC, Total Alkalinity, CFCs, and samples were collected and stored for CDOM, DOC, Helium/Tritium, silicon and oxygen isotopes, black carbon, and C14 analyses on land. While underway, surface pCO2, temperature, conductivity, dissolved oxygen, fluorometry, meteorological, and acoustical bathymetric and sediment layer measurements were made. The cruise ended in Cape Town, South Africa on 16 March 2008.

**OFFICERS AND CREW**

| Name | Position |
|---|---|
| David Murline | Master |
| Paul Mauricio | Chief Engineer |
| Murray Stein | 1st Mate |
| Joe Ferris | 2nd Mate |
| Melissa Turner | 3rd Mate |
| Jack Healy | 1st A/E |
| Lee Bernheisel | 2nd A/E |
| Matthew Peer | 3rd A/E |
| Paul Porcincula | Cook |
| Ahsha Staiger | 2nd Cook |
| James Pearson | Boatswain |
| Mark Johnson | Electrician |
| Brian Matthiesen | A/B |
| Michael Roth | A/B |
| Jerome Donnelly | A/B |
| Gary Curry | Bosun |
| Edwardo Angeles | Oiler |
| Darryl Churchill | Oiler |
| Phil Hogan | Oiler |
| Phillip Hawkins | Oiler |
| Jeff Van Wieren | Wiper |
| Brandon Covey | OS |

**SCIENCE PROGRAMS AND SCIENCE TEAM LEADERS**

| | | |
|---|---|---|
| CTDO/rosette/S/O2/nutrients | Jim Swift, UCSD/SIO | jswift@ucsd.edu |
| Transmissometer | Wilf Gardner, Texas A&M U | wgardner@ocean.tamu.edu |
| Underway bathymetry, meteorology, gravimetry, thermosalinograph | Frank Delahoyde, UCSD/SIO Shipboard Computer Group | frank@odf.ucsd.edu |
| Total alkalinity, pH | Andrew Dickson, UCSD/SIO | adickson@ucsd.edu |
| $CO_2$, DIC and underway $pCO_2$ | Rik Wanninkhof | Rik.Wanninkhof@noaa.gov |
| DOM | DOC/DON<br>Dennis Hansell, U Miami RSMS | Craig Carlson - lead contact<br>dhansell@rsmas.miami.edu |
| CDOM | Norm Nelson, UCSB | norm@icess.ucsb.edu |
| $^{13}C/^{14}C$, isotopic content of DIC | Ann McNichol, WHOI<br>Robert Key, Princeton | amcnichol@whoi.edu<br>key@Princeton.EDU |
| CFCs | Rana Fine | rfine@rsmas.miami.edu |
| He/Tr | Bill Jenkins | wjenkins@whoi.edu |
| ADCP/LADCP | Eric Firing, U Hawaii | efiring@soest.hawaii.edu |
| Trace elements | Chris Measures, U Hawaii<br>Bill Landing, FSU | chrism@soest.hawaii.edu<br>landing@ocean.fsu.edu |
| ARGO floats | Stephen Riser, U of Washington<br>Anne Thresher, CSIRO | riser@ocean.washington.edu<br>Ann.Thresher@csiro.au |
| Black Carbon | Thorsten Dittmar, FSU | dittmar@ocean.fsu.edu |
| O18 | Mike Meredith | mmm@bas.ac.uk |

**NARRATIVE**

CLIVAR I6S began 4 Feb 2008 on the R/V Roger Revelle, leaving Durban at dusk, heading south along the coast toward our first station, about a 25hr steam under typical conditions. The Agulhas Current pushed us with ADCP measured surface currents of more than 2 meters per second, giving us a speed over ground of more than 16 knots at times. We paused to carry out a test CTD station in approx. 1200m water depth, pop all the rosette bottles, and rewind the Trace Metal cable on the SeaMac winch to prepare this system for work. We arrived on station 1 Tuesday evening and began our section. The strong southwestward current and 2-3m opposing waves presented a challenge to the ship, but skillful maneuvering kept all operations going smoothly.

Soon we crossed the southern, returning, branch of the Agulhas Current which continues back to the Indian Ocean. The SST dropped to 18 C but surface salinity is still up above 35, indicating that we have not yet crossed the Subtropical Front. Once across, we were in the subpolar zone, with temperatures dropping again to near 10 C, and we began the trek across the Antarctic Circumpolar Current.

Before long, we encountered heavy weather and required several CTD wire re- terminations. These were accomplished rapidly with minimal time lost. At Station 23, wind waves, and currents were such that we had to heave to for several hours to let the worst of it pass. Weather subsequently improved and all had needed rest. Total cruise time lost to weather was 48 hrs, not bad for a cruise of such length in this region.

Trace metals did not have their winch due to shipping problems, but their casts proceeded well with the onboard SeaMac winch, rebuilt by the excellent services of the Engineers onboard. Since the rebuilt winch cannot lift a full rosette system, the strategy was to alternate single and double casts to get the full depth profiles as originally set out in the cruise plan. This plan was followed up to Station 43. During the upcast at station 43 the rosette system was lost when its Kevlar cable parted (see Trace Metals summary below). From this point TM samples were obtained by the traditional method of Niskin bottles attached to the wire, with a messenger to trip the bottles.

The other component of the TM group was atmospheric aerosols. These were obtained from air pumped into the lab from a specially constructed tower forward of the working area of the ship. Initial reports are of barely detectable levels of dust in the atmosphere - an important measurement for iron fertilization and other bio-geo-chemical flux studies.

After these difficulties we had reasonable weather for nearly a week and gained some time lost in previous hard weather and seas. However, a series of hardware failures, beginning with the secondary temperature sensor, CTD pump, and rosette carousel cost us most of one day. A full-depth CTD cast and bottom water sample bottle was made before the carousel problem arose, but once onboard a new cable fixed that problem and a shorter, 1000m, water-sampling cast completed the station.

By this time in the cruise, chemistry is beginning to be fed into the onboard data-base. This enables all of us to plot various quantities, check data, and start to interpret results. The CTD watch has been identifying fronts, calculating transport and mixed-layer heat and salt budgets.

Eventually, we were able to enjoy the more peaceful weather south of 60 S, though winds did not remain weak for long. Air temperatures dropped to just below 0 C, and some ice started building up on deck.

Notable pools of fresher cooler surface water were present from time-to-time according to the underway system and the CTD. We heard from colleagues on the German ice-breaker Polar Stern who also reported some of the freshest surface water observed in 10 years. The Polar Stern is at nearly the same latitude, but heading south along the Greenwich Meridian, then over to the German Antarctic Base.

On Feb 29 we modified the plan to account for a large storm with strong easterlies forecast to be south of 65 S. Thus we made a dog-leg east off 30 E toward the Gunnerus Ridge to avoid moving south so quickly. We then headed south along the ridge. The other point of this leg was to attempt twice to find the shallowest bathymetry outside the sea-ice edge and obtain observations on the shelf, across the Slope Current. Sea-ice images from NSIDC and FSU were helpful in preparing an approach plan.

In any case, winds built to 50 kt, with at least one gust to 70 kts . Seas peaked at 40 ft. But at about 1400 hrs a complete shift in winds and waves appeared with the winds dying down, and we put the CTD in the water. Our by now very experienced winch operators played a major role keeping tension down running the winch. CTD T failed on the way down, and the package was raised. We took advantage of this and the coming shallower
depths to remove the outer ring of bottles and proceed with 18 bottles, lowering the package area and helping to prevent large wire tension swings. In this fashion we continued down the Gunnerus Ridge, an underwater butte with a fairly flat top at about 1200m depth, decreasing in depth mainly at the southern end near the ice edge.

Finally, we met the sea-ice edge as depth reached 350m. After this cast we went back north to spend the (short) night doing a yo-yo station to be able to estimate time variability in the stratification over a partial tidal cycle. This will at the very least help us to produce better error estimates for our transport calculations. During this period we did 17 yo-yo CTD casts during the night, over about 7 hour period, the last one collecting water.

On the 5 March we awoke to a beautiful day. Sunrise produced a green "flash" lasting a whole second, with all on the bridge and the CTD watch on deck confirming the lasting color. As the sea-ice had cleared away during the night, we headed back south toward the Gunnerus Bank to look for shallower water. Enjoyed the beautiful weather and were able to follow an open path in broken sea-ice, stopping for TM and CTD casts. Finally, we reached the limit at Station 92, depth 300m.

We could see the Riiser-Larsen Peninsula in the distance to the SE like a giant white outcrop, moon-like, creviced and fissured in the early morning light. Later it was less well defined in the hazier light of the day. Very satisfying to see the continent, even a glacial part of it since I did not think we would ever be so lucky. Penguins also caught everyone's attention –at one point penguins were playing around the CTD as it was put in the water. Occasionally, whales were spotted.

Soon we began the trek back starting with the 600m station on the slope, in cloudy skies and snowfall. By nighttime we were watching several icebergs drift near the 800m station. These can have a debris field around them of smaller bergs. It was slow going in case of growlers (smaller bits of ice) in our path. Very fine driving by the Mates and guidance from the Captain brought us onto station. Ship-ADCP and lowered ADCP both showed a strong (0.5 kt) SW flow along most of the southern end of the line, consistent with a Slope Current.

Near 64 S the multi-beam bathymetry showed a 300-400m deep canyon that might be the outer portion of the Ritcher Canyon. It was a very well-defined canal-shaped seafloor feature that crossed and then paralleled our track. At the penultimate station we deviated east 4nm in order to sample in the canyon but found nothing special apparent in the CTD or LADCP data at first look. Message was sent to N Ott of AWI's Southern Ocean bathymetry project asking for further info. On 8 March we occupied our last station, #106. TM washed their bottles, then at about 1100 we were underway until 1230 for the local noon optics cast. Watches were maintained for underway sampling.

On the way back there are two fronts we wanted to sample more intensively, the Polar Front (PF) and the Subtropical Front (STF). They are part of a system of fronts from about 40-50 S in this sector that are difficult to distinguish along one path. We can see the STF on satellite SST maps and it usually is a very strong narrow front, but we also see that it is not a straight line but a convoluted stream. The PF is not clear on SST but does have a signal on SSH. However, fronts often split, form eddies, or merge and their signals can be confused. Based on near-real-time AMSRE-E SST and satellite altimetry SSH data the students made their best estimate of frontal locations and decided upon a plan to sample this region with XBT drops. From these position estimates we slowed the ship to get better underway Doppler-current data across the frontal region.

Once in the frontal region beginning near 51 S we went into an enhanced chemistry sampling schedule, taking salt, nuts, O2, DIC, pH, Alk every hour instead of every 2 hr across the system. Slowing the ship with this pace automatically got us higher resolution. Near latitude 39 S, we finished all underway chemical sampling to pack and prepare for arrival. Some slowing of the ship took place to record better ADCP data on the remaining part of the transit to Cape Town, as we crossed the Agulhas Current system and entered the South Atlantic Ocean. We arrived at the pilot point 0300 16 March, one day early, and berthed a few hours later at Duncan Docks, Cape Town.

# CLIVAR I06S

R/V Revelle, KNOX14RR

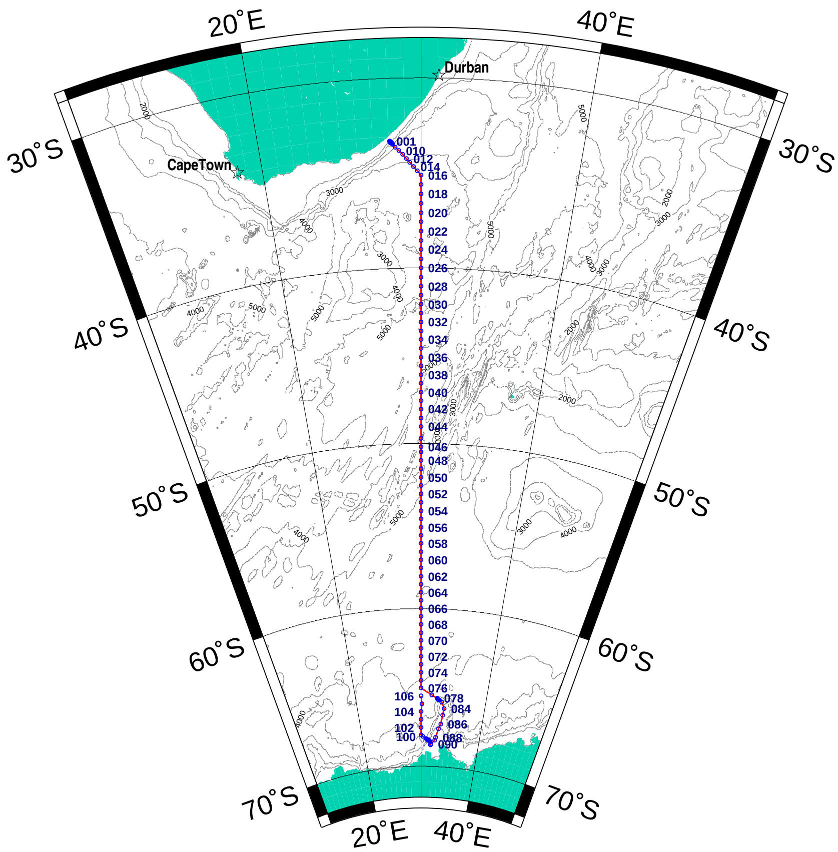
4 February - 17 March 2008

Durban, South Africa - Cape Town, South Africa

Chief Scientist: Dr. Kevin Speer

Co-Chief Scientist: Dr. Thorsten Dittmar

Florida State University




**Final ODF Cruise Report**

**6 May 2009**

*Data Submitted by:*


Oceanographic Data Facility + Shipboard Electronics Group

Shipboard Technical Support/Scripps Institution of Oceanography

La Jolla, CA 92093-0214

**Summary**

A hydrographic survey consisting of Rosette/CTD/LADCP sections, bio-optical casts, trace metal CTD/rosette sections, underway shipboard ADCP and float deployments was carried out mainly along the 30E line in the southern Indian Ocean in February and March 2008.

The R/V Revelle departed Durban, South Africa on 4 February 2008. A total of 106 stations were occupied. 111 Rosette/CTD/LADCP casts, 28 Trace Metal Rosette casts, 51 Trace Metal wire casts and 66 bio-optical casts were made from 4 February to 16 March. 46 XBT drops were made for multibeam calibration and higher resolution sampling across fronts; and 17 ARGO floats were deployed.

Water samples (up to 36) and CTD data were collected at each Rosette/CTD/LADCP station to within 15-30 meters of the bottom, dependent upon bottom topography and sea state. Salinity, dissolved oxygen and nutrient samples were analyzed for up to 36 water samples from each cast of the principal Rosette/CTD/LADCP program. Water samples were also measured on-board for DIC, Total Alkalinity, pH and CFCs. Samples were collected and stored for analysis ashore for CDOM, DOC/TDN, Helium/Tritium, C13/C14, Oxygen isotopes, Silicon isotopes and Black Carbon. Water samples for Al, Fe and Mn were collected during trace metal CTD/rosette casts.

Underway surface measurements were made for pCO2, temperature, conductivity, dissolved oxygen and fluorometry. Underway meteorological data, and multibeam acoustical bathymetry and sediment layer data, were also collected. Aerosol samples were obtained throughout the cruise. The cruise ended in Cape Town, South Africa on 16 March 2008.

**Introduction**

A sea-going science team gathered from 9 oceanographic institutions participated on the cruise. Several other science programs were supported with no dedicated cruise participant. The science team and their responsibilities are listed below.

**Principal Programs of CLIVAR I06S**

| | | | |
|---|---|---|---|
| CTDO/rosette,<br>Data Processing,<br>S, $O_2$, Nutrients | UCSD/SIO/STS | James H. Swift | jswift@ucsd.edu |
| Transmissometer | TAMU | Wilf Gardner | wgardner@tamu.edu |
| $CO_2$-Alkalinity, pH | UCSD/SIO | Andrew Dickson | adickson@ucsd.edu |
| $CO_2$-DIC,<br>Underway p$CO_2$ | PMEL/NOAA | Rik Wanninkhof | Rik.Wanninkhof@noaa.gov |
| CFCs | UM/RSMAS | Rana Fine | rfine@rsmas.miami.edu |
| $^3He$/Tritium | WHOI | Bill Jenkins | wjenkins@whoi.edu |
| $^{13}C/^{14}C$,<br>isotopic content of DIC | WHOI | Ann McNichol | amcnichol@whoi.edu |
| | Princeton U. | Robert Key | key@Princeton.EDU |
| DOC/TDN | UM/RSMAS | Dennis Hansell | dhansell@rsmas.miami.edu |
| CDOM | UCSB | Norm Nelson | norm@icess.ucsb.edu |
| | | Craig Carlson | carlson@lifesci.ucsb.edu |
| Black Carbon | FSU | Thorsten Dittmar | dittmar@ocean.fsu.edu |
| $O_{18}$ | BAS | Mike Meredith | mmm@bas.ac.uk |
| Silicon isotopes | ETHZ | Ben Reynolds | reynolds@erdw.ethz.ch |
| Oxygen isotopes | Princeton U. | Michael Hiscock | mhiscock@princeton.edu |
| | | Michael Bender | bender@princeton.edu |
| Trace Elements | U. of Hawaii | Chris Measures | chrism@soest.hawaii.edu |
| | UF | Bill Landing | landing@ocean.fsu.edu |
| Aerosols | UF | Bill Landing | landing@ocean.fsu.edu |
| ADCP/LADCP | U. of Hawaii | Eric Firing | efiring@soest.hawaii.edu |
| Underway Bathymetry,<br>Meteorology, Gravimetry,<br>Thermosalinograph | UCSD/SIO/STS | Computing<br>Resources | scg@ucsd.edu |
| ARGO Floats | UW | Stephen Riser | riser@ocean.washington.edu |
| | CSIRO | Anne Thresher | Ann.Thresher@csiro.au |

**Scientific Personnel CLIVAR I06S**

| Duties | Name | Affiliation | email |
|---|---|---|---|
| Chief Scientist | Kevin George Speer | FSU | kspeer@fsu.edu |
| Co-Chief Scientist | Thorsten Dittmar | FSU | dittmar@ocean.fsu.edu |
| Bottle Data | Justin Fields | UCSD/SIO/STS | jfields@ucsd.edu |
| ET/Salinity/Deck Leader | Rob Palomares | UCSD/SIO/STS | rpalomares@ucsd.edu |
| Nutrients/Deck | Susan Becker | UCSD/SIO/STS | sbecker@ucsd.edu |
| CTD Data | Parisa Nahavandi | UCSD/SIO/STS | parisa@ucsd.edu |
| Nutrients/Deck | Daniel George Schuller | UCSD/SIO/STS | dschuller@ucsd.edu |
| Salinity/Deck/ET | John Calderwood | UCSD/SIO/STS | jkc@ucsd.edu |
| O2/Deck | Erik William Quiroz | TAMU for UCSD/SIO/STS | erik@gerg.tamu.edu |
| O2/Deck | Brandi Murphy | UCSD/SIO/STS | murphyb@ucsd.edu |
| CTD Watch | Loic Jullion | UEA | l.jullion@uea.ac.uk |
| CTD Watch/Argo | Katherine Louise Hill | CSIRO | Katy.Hill@csiro.au> |
| CTD Watch -DOC/TN | Austin Charles Todd | FSU | todd@coaps.fsu.edu |
| CTD Watch | Jun Dong | FSU | dong@ocean.fsu.edu |
| CTD Watch/lADCP | Peter Lazarevich | FSU | plazarev@fsu.edu |
| ADCP/lADCP | Thomas Kilpatrick | U.of Hawaii | thomaski@hawaii.edu |
| CFC | Charlene Grall | RSMAS | cgrall@rsmas.miami.edu |
| CFC | James Happell | RSMAS | jhappell@rsmas.miami.edu |
| DIC/UW-pCO2 | Juliana D’Andrilli | FSU | jd04d@fsu.edu |
| DIC/UW-pCO2 | Esa Petri Peltola | NOAA | Esa.Peltola@noaa.gov |
| pH | Brendan Rae Carter | UCSD/SIO | brcarter@ucsd.edu |
| TALK | John Adam Radich | UCSD/SIO | jradich@ucsd.edu |
| TALK | George Cyril Anderson | UCSD/SIO | gcanderson@ucsd.edu |
| He/Tr/radioC | Brett Evans Longworth | WHOI | blongworth@whoi.edu |
| Black Carbon | Ji Young Paeng | FSU | paeng@ocean.fsu.edu |
| TM | William M. Landing | FSU | wlanding@fsu.edu |
| TM | Kathleen Gosnell | FSU | kjg06c@fsu.edu |
| TM-C14 sampler | Angela Milne | FSU | milne@ocean.fsu.edu |
| TM | William T. Hiscock | U.of Hawaii | hiscock@hawaii.edu |
| TM | Christopher Measures | U.of Hawaii | chrism@soest.hawaii.edu |
| TM | Maxime Marcel Grand | U.of Hawaii | maxime@hawaii.edu |
| Optics/CDOM/DON | Mary Elizabeth Russ | NASA/GSFC | meruss@neptune.gsfc.nasa.gov |
| Optics | David Barry Stroud | NASA | David.B.Stroud@nasa.gov |
| Computer Tech | Jon C. Meyer | UCSD/SIO/STS | scg@rv-revelle.ucsd.edu |
| Resident Tech | David Langner | UCSD/SIO/STS | restech@rv-revelle.ucsd.edu |

**Description of Measurement Techniques**

**1. CTD/Hydrographic Measurements Program**

The basic CTD/hydrographic measurements consisted of salinity, dissolved oxygen and nutrient measurements made from water samples taken on Rosette/CTD/LADCP casts, plus pressure, temperature, conductivity/salinity, dissolved oxygen, transmissometer, fluorometer and photosynthetically active radiation (PAR) from CTD profiles. A total of 106 Rosette/CTD/LADCP casts were made, usually to within 10-20m of the bottom. The distribution of samples is illustrated in figures 1.0 and 1.1.

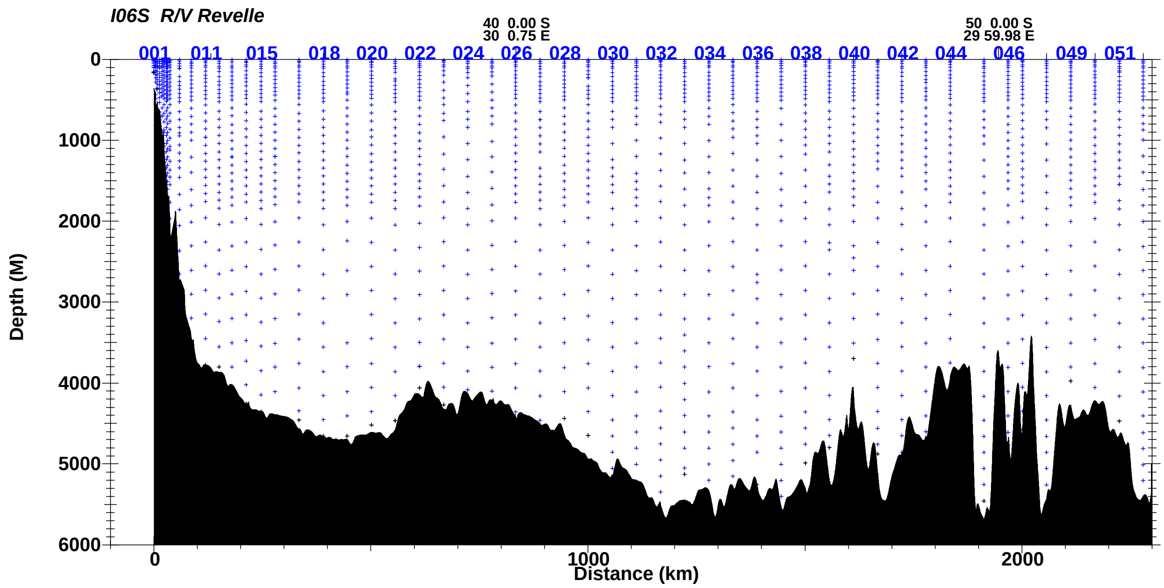



**Figure 1.0** Sample distribution, stations 1-52.

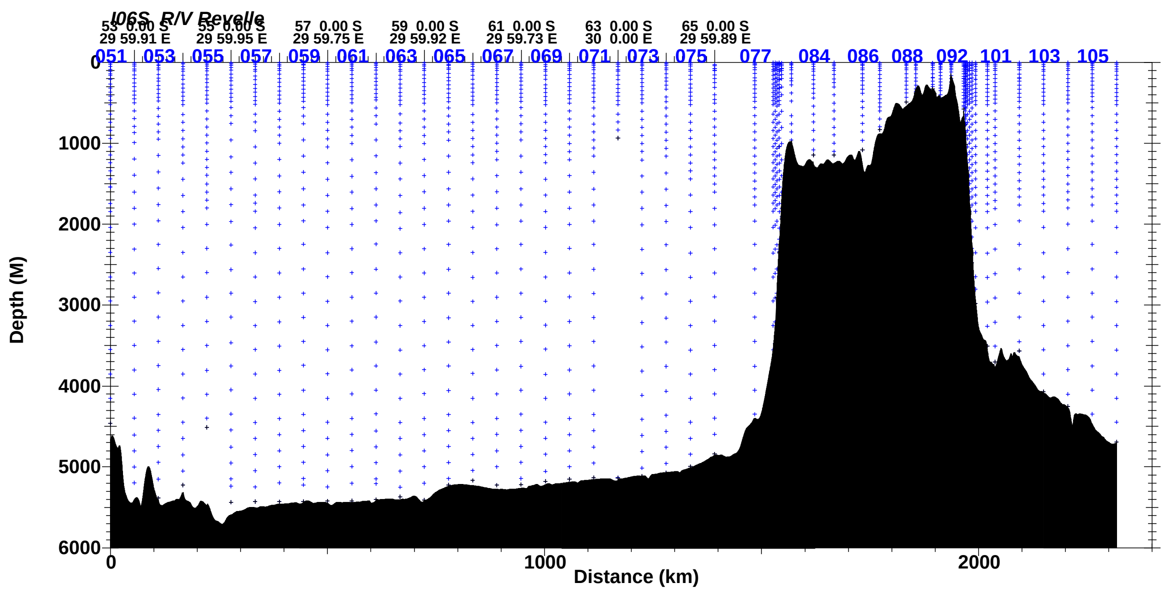



**Figure 1.1** Sample distribution, stations 51-106.

### 1.1. Water Sampling Package

Rosette/CTD/LADCP casts were performed with a package consisting of a 36-bottle rosette frame (SIO/STS), a 36-place carousel (SBE32) and 36 10L Bullister bottles (SIO/STS). Underwater electronic components consisted of a Sea-Bird Electronics SBE9*plus* CTD (SIO/STS #777/#381 and U. of Hawaii #725) with dual pumps, dual temperature (SBE3*plus*), dual conductivity (SBE4C), dissolved oxygen (SBE43), transmissometer (Wetlabs), fluorometer (Wetlabs CDOM), irradiance (Biospherical PAR), altimeter (Simrad) and LADCP (RDI).

The CTD was mounted vertically in an SBE CTD cage attached to the bottom of the rosette frame and located to one side of the carousel. The SBE4C conductivity, SBE3*plus* temperature and SBE43 dissolved oxygen sensors and their respective pumps and tubing were mounted vertically as recommended by SBE. Pump exhausts were attached to the sensor bracket on the side opposite from the sensors and directed downward. The transmissometer and fluorometer were mounted horizontally along the bottom of the rosette frame. The PAR was mounted in a pipe that was hose-clamped to a vertical post on the rosette; its sensor was about a foot above the upper crash ring. The altimeter was mounted on the inside of the bottom frame ring. The RDI LADCP was mounted vertically on one side of the frame between the bottles and the CTD. Its battery pack was located on the opposite side of the frame, mounted on the bottom of the frame.

The rosette system was suspended from a UNOLS-standard three-conductor 0.322" electro-mechanical sea cable. The R/V Revelle’s aft Markey DESH-5 winch, with newer wire, was used through station 12. The R/V Revelle’s forward Markey DESH-5 winch, with older, rusty wire, was used for the remainder of the casts.

New slip rings were installed on the aft winch before station 1. The aft winch-to-lab deck cable induced electrical noise in the CTD signal, so it was bypassed. A cable extension was rigged from the aft winch J-box slip ring output to the forward winch J-Box slip-ring input, thereafter using the forward-J-Box-to-lab connection.

The sea cable was reterminated at the beginning of I06S, and multiple times during the cruise. Reterminations were performed at the rosette end because of a kinked wire (after stations 11/1, 12/4, 21/3) and/or a broken electrical termination (after station 12/1 at rosette, 12/4 at rosette and slip ring, 15/2 at slip ring and 81/1 at rosette). A mechanical retermination was done before station 47/1, after observing 7 tight cork-screw twists in the wire between the rosette and the block following a wave in the rosette hangar.

The deck watch prepared the rosette 10-30 minutes prior to each cast. The bottles were cocked and all valves, vents and lanyards were checked for proper orientation. Once stopped on station, the rosette was moved out from the aft hanger to the deployment location under the squirt boom block using an air-powered cart and tracks. The CTD was powered-up and the data acquisition system in the computer lab started when directed by the deck watch leader. The rosette was unstrapped from its tiedown location on the cart. Tag lines were threaded through the rosette frame and syringes were removed from the CTD intake ports. The winch operator was directed by the deck watch leader to raise the package, the squirt boom and rosette were extended outboard and the package quickly lowered into the water. The tag lines were removed and the package was lowered to 10 meters, by which time the sensor pumps had turned on. The winch operator was then directed to bring the package back to the surface (0m. winch wireout) and to begin the descent.

Each rosette cast was lowered to within 15-30 meters of the bottom, using the altimeter, winch wireout, CTD depth and echosounder depth to determine the distance. Early in the cruise, three casts were unintentionally lowered to less than 2 meters off the bottom (stations 2/3, 6/1 and 7/1). There was no apparent damage to instrumentation; however, mud was still on the CTD after station 6/1 recovery.

During the upcast the winch operator was directed to stop the winch at each bottle trip depth. The CTD console operator waited 30 seconds before tripping a bottle to insure the package wake had dissipated and the bottles were flushed, then an additional 10 seconds after each bottle closure to insure that stable CTD comparison data had been acquired. Due to weather/sea-state issues, bottles on some casts were tripped *on the fly* (without stopping/soaking/flushing). During some later casts, the winch was slowed to 10-20mpm at trip time for these *on the fly* trips. *On the fly* bottles are noted in Appendix D (Bottle Quality Comments). Once the next-to-last bottle had been closed, the deck watch leader directed the package to the surface for the last bottle trip.

Standard sampling depths were used throughout CLIVAR I06S. These standard depths were staggered every station using 3 alternating sampling schemes.

Recovering the package at the end of the deployment was essentially the reverse of launching, with the additional use of poles and snap-hooks to attach tag lines. The rosette was secured on the cart and moved into the aft hanger for sampling. The bottles and rosette were examined before samples were taken, and anything unusual was noted on the sample log.

Each bottle on the rosette had a unique serial number. This bottle identification was maintained independently of the bottle position on the rosette, which was used for sample identification. Various parts of bottles were occasionally changed or repaired. The same bottles 1-36 were used throughout the cruise.

Routine CTD maintenance included soaking the conductivity and DO sensors in fresh water between casts to maintain sensor stability and occasionally putting dilute Triton-X solution through the conductivity sensors to eliminate any accumulating biofilms. Sensors and pump tubes were rinsed and drained between casts starting mid-way through the cruise, when air temperature dropped to 3°C, to prevent issues with water freezing in and damaging sensors and pump tubes in higher latitudes. Rosette maintenance was performed on a regular basis. O-rings were changed and lanyards repaired as necessary. Bottle maintenance was performed each day to insure proper closure and sealing. Valves were inspected for leaks and repaired or replaced as needed.

### 1.2. Underwater Electronics Packages

The SBE9*plus* CTDs were connected to an SBE32 carousel, providing for single-conductor sea cable operation. Within the 0.322 sea cable, two conducting wires were soldered together as positive and the third conducting wire was used as negative. The sea cable armor was not used for ground (return). Power to the CTDs and sensors, carousels and altimeters was provided through the sea cable from the SBE11*plus* deck unit in the main lab.

CTD data were collected with a Sea-Bird Electronics SBE9*plus* CTD. The CTDs supplied a standard SBE-format data stream at a data rate of 24 Hz. These instruments provided pressure, dual temperature (SBE3*plus*), dual conductivity (SBE4), dissolved oxygen (SBE43), PAR (Biospherical QCP) and altimeter (Benthos or Simrad 807) channels. The 36-place systems also provided fluorometer (Wetlabs CDOM) and transmissometer (Wetlabs CStar) channels. In addition, Surface PAR and GPS data were added to the data stream via the SBE11*plus* deck unit.

| | |
|---|---|
| Sea-Bird SBE11*plus* Deck Unit | S/N unknown |
| Markey DESH-5 Winch with 0.322" CTD Wire | (see Table 1.2.1A/B) |
| Biospherical QCR-2200 Surface PAR (SPAR) Sensor | S/N 20112 |
| Sea-Bird SBE32 36-place Carousel Water Sampler | |
| Sea-Bird SBE35 Reference Temperature Sensor | |
| Sea-Bird SBE9*plus* CTD | |
| Paroscientific Digiquartz Pressure Sensor | |
| Sea-Bird SBE3*plus* Temperature Sensor (Primary=T1 Secondary=T2) | |
| Sea-Bird SBE4C Conductivity Sensor (Primary=C1 Secondary=C2) | (see Table 1.2.1A/B) |
| Sea-Bird SBE43 Dissolved Oxygen Sensor | |
| Sea-Bird SBE5T Pump (Primary=Pump1 Secondary=Pump2) | |
| WET Labs C-Star Transmissometer | |
| Seapoint Chlorophyll Fluorometer OR WET Labs ECO-AFL Fluorometer | |
| Biospherical QCP-2000 PAR Sensor | |
| Simrad 807 Altimeter | S/N 9711091 |
| RDI Instruments BB150 150kHz broadband LADCP | S/N unknown |

**Table 1.2.1** CLIVAR I06S Rosette Electronics

<table>
<tr><td>Stations</td><td>1,2/1,3/2</td><td>2/3,4,5</td><td>6-12</td><td>13-32</td><td>33-38</td><td>39-71</td></tr>
<tr><td>Winch/Wire</td><td colspan="3">Aft/Newer Wire</td><td colspan="3">Forward/Older Wire</td></tr>
<tr><td>Carousel</td><td colspan="5">32-0187</td><td>32-0113</td></tr>
<tr><td>Ref.T</td><td colspan="6">35-0035</td></tr>
<tr><td>CTD</td><td colspan="6">777</td></tr>
<tr><td>Press</td><td colspan="6">88907</td></tr>
<tr><td>T1</td><td colspan="6">03P-4924</td></tr>
<tr><td>C1</td><td colspan="6">04-3057</td></tr>
<tr><td>CTDO*</td><td colspan="3">43-0872</td><td colspan="3">43-1129</td></tr>
<tr><td>Pump1</td><td>SIO-1</td><td colspan="2">SIO-3</td><td colspan="3">SIO-3/SIO-4(before sta.18?)</td></tr>
<tr><td>T2</td><td colspan="2">03P-2495</td><td colspan="4">03P-2322</td></tr>
<tr><td>C2</td><td colspan="6">04-2115</td></tr>
<tr><td>Pump2</td><td colspan="6">SIO-2</td></tr>
<tr><td>Trans</td><td colspan="6">CST-327DR</td></tr>
<tr><td>Fluor</td><td colspan="4">SP-2871</td><td colspan="2">AFLD-045</td></tr>
<tr><td>PAR</td><td colspan="6">QCP-70150</td></tr>
</table>

* stas 1-3 CTDO on SECONDARY pump circuit
stas 4-71 CTDO on PRIMARY pump circuit

**Table 1.2.1A** CLIVAR I06S Rosette Underwater Electronics, Stas 1-71.

<table>
<tr><td>Stations</td><td>72/3</td><td>72/5-77</td><td>78-80</td><td>81/1</td><td>81/3-87</td><td>88-106</td></tr>
<tr><td>Winch/Wire</td><td colspan="6">Forward/Older Wire</td></tr>
<tr><td>Carousel</td><td>32-0113</td><td colspan="5">32-0187?</td></tr>
<tr><td>Ref.T</td><td colspan="6">35-0035</td></tr>
<tr><td>CTD</td><td colspan="3">381</td><td colspan="3">725</td></tr>
<tr><td>Press</td><td colspan="3">58952</td><td colspan="3">90560</td></tr>
<tr><td>T1</td><td colspan="3">03P-4924</td><td colspan="3">03P-4297</td></tr>
<tr><td>C1</td><td colspan="3">04-3057</td><td colspan="3">04-2790</td></tr>
<tr><td>CTDO*</td><td colspan="3">43-1129</td><td colspan="3">43-0314</td></tr>
<tr><td>Pump1</td><td colspan="2">SIO-4</td><td>SIO-5?</td><td colspan="3">UH?</td></tr>
<tr><td>T2</td><td colspan="3">03P-4486</td><td>n/a</td><td colspan="2">03P-4486</td></tr>
<tr><td>C2</td><td colspan="3">04-2115</td><td>n/a</td><td colspan="2">04-2115</td></tr>
<tr><td>Pump2</td><td colspan="3">SIO-2</td><td>n/a</td><td colspan="2">SIO-2?</td></tr>
<tr><td>Trans</td><td colspan="6">CST-327DR</td></tr>
<tr><td>Fluor</td><td colspan="6">AFLD-045</td></tr>
<tr><td>PAR</td><td colspan="5">QCP-70150</td><td>n/a</td></tr>
</table>

* stas 72-78 CTDO on PRIMARY pump circuit
stas 79(-80?) CTDO on SECONDARY pump circuit
stas 81-106 CTDO on PRIMARY pump circuit

**Table 1.2.1B** CLIVAR I06S Rosette Underwater Electronics, Stas 72-106.

Each CTD was outfitted with dual pumps. Primary temperature, conductivity and dissolved oxygen were plumbed into one pump circuit and secondary temperature and conductivity into the other. Dissolved oxygen was plumbed into the secondary pump circuit for stations 1-3 and 79-80 only. The sensors were deployed vertically.

### 1.3. Navigation and Bathymetry Data Acquisition

Navigation data were acquired from the ship's GP90 GPS receiver beginning February 4 at 0000 UTC. The data were noisy and irregular, apparently because the GPS was transmitting at 2 Hz rather than the standard 1 Hz; this output too much data for serial transmission at 4800 baud. Raw GP90 ASCII NMEA strings output from the GPS receiver and stored by the ship's computers were used to convert and store data in an ODF-style Navigation file after the last station.

During final data checking ashore (early November 2008), unusual spacing was noted between stations 74/75 on the station track. The chief scientist had also noted a problem with similar positions for stations 92/93. A close inspection of the navigation data indicated numerous problems around stations 75 and 93, and probably elsewhere. Bogus timestamps with Julian date 2008072 were alternating with the correct date 2008060 near station 75; the wrong-date times/positions duplicated the valid data, but all the bad records had a course/speed of -9/-9. Using this course/speed pattern and a simple Linux command (grep -v), more than 57.5k records with course/speed of -9/-9 were eliminated from the navigation data.

There were also multiple duplicate date-/time-stamped levels in the Navigation data, as well as single skipped seconds nearby. The positions were essentially identical, with slight differences in course/speed. It was assumed these were artifacts of the faster-than-1 Hz data coming in from the GPS, and these data were left in place.

The remaining data were screened to check for timegaps greater than 5 minutes (300 seconds). Two more bogus Julian "2008072" levels were found and omitted, and two rather large "real" gaps in the data were also found. One gap was after station work had been completed, the other began just before station 5 until just after the start of station 7. In order to fill this gap to get correct timestamps for stations 5 through 7, NMEA times/positions were extracted from raw CTD data files for those stations and merged with the ship's filtered GP90 data.

Station/cast time/position data were re-extracted from the fixed Navigation data and updated into the ODF database for ALL casts, since this problem could have affected any cast. CTD and bottle data files were re-generated for CCHDO after the position updates. There were only a few differences in the new i06s.sum file: only positions for stations 5-7, 75, and 92 changed (the casts already noted above); any others changed by less than a few hundredths of a minute.

Bathymetric data were logged from the Ship's Simrad EM120 multibeam echosounder system, and were corrected using sound velocity profiles derived from XBT data. Depths were never merged with the ODF navigation time series, but were logged at the CTD Console real-time. These depths were later hand-entered into files and updated into the ODF database to be reported with other cast metadata.

### 1.4. CTD Data Acquisition and Rosette Operation

The primary CTD data acquisition system consisted of a networked generic PC workstation running Windows XP-SP2, with an IEEE-488 connection to an SBE-11*plus* (V2) deck unit.

Data for stations 1/2, 2/1, 4-13, and 16 were acquired using Seasave V7.14c (ascii-hex format). Stations 2/3 and 3/2 were acquired using Seasave Win32 V5.37d (binary format), after an attempt to utilize ODF's acquisition system apparently disabled the Seasave ascii-hex acquisition system. Stations 17-106 were acquired using Seasave V7.16a (ascii-hex format), which was uploaded from Sea-Bird's website in an attempt to remedy bottle 16 trip-confirmation problems.

Stations 14 and 15 were acquired using SIO/ODF's acquisition system (v.5.1.0-3.sts.el5). This CTD data acquisition system consisted of three networked generic PC workstations running CentOS-5.2 Linux (kernel 2.6.18-53.1.4.el5). These workstations were configured with color graphics displays, keyboards, trackballs and DVD+RW drives. One Linux system had 8 additional RS-232 ports via a Comtrol Rocketport PCI serial controller, and was connected to the SBE-11*plus* (V2) deck unit via RS-232. This workstation was designated the CTD console, and provided an interface and operational displays for controlling and monitoring a CTD deployment and closing bottles on the rosette. Another of the Linux workstations was designated as the website and database server and maintained the hydrographic database for I06S. All three systems were used to maintain redundant backups of the data.

The SIO/ODF systems were interconnected through a 1000BaseTX ethernet switch which was also connected to the ship’s network. These systems were available for real-time operational and CTD data displays, and provided for CTD and hydrographic data management and backup. Configuration problems plagued the Linux acquisition software, which was finally abandoned after a failed cast start-up at station 16. Seasave-acquired data were uploaded to the Linux systems after acquisition for each cast, then the Linux systems were used for post-cast CTD data processing.

CTD deployments were initiated by the console watch after the ship had stopped on station. The watch maintained a CTD Cast log containing a description of each deployment, a record of every attempt to close a bottle and any pertinent comments.

Once the deck watch had deployed the rosette, the winch operator would lower it to 10 meters. The SIO/ODF CTD sensor pumps were configured with a 5-second pump startup delay (vs. the Sea-Bird standard 60-second delay), and were usually on by this time. The console operator checked the CTD data for proper sensor operation, waited an additional 60 seconds for sensors to stabilize, then instructed the winch operator to bring the package to the surface, pause for 10 seconds, and descend to a target depth (wire-out). The profiling rate was no more than 30m/min to 50m, no more than 45m/min to 200m and no more than 60m/min deeper than 200m depending on sea cable tension and the sea state.

The console watch monitored the progress of the deployment and quality of the CTD data through interactive graphics and operational displays. Additionally, the watch created a sample log for the deployment which would be later used to record the correspondence between rosette bottles and analytical samples taken. The altimeter channel, CTD pressure, wire-out, pinger and bathymetric depth were all monitored to determine the distance of the package from the bottom, usually allowing a safe approach to within 10-20 meters.

Bottles were closed on the upcast by operating an on-screen control, and were optimally tripped at least 30 seconds after stopping at the trip location to allow the rosette wake to dissipate and the bottles to flush. The winch operator was instructed to proceed to the next bottle stop at least 10 seconds (ideally) after closing bottles to insure that stable CTD data were associated with the trip.

Bottles were purposely tripped *on the fly*, particularly in the top 300-800m of some casts, to prevent wire damage when wire tension and/or sea state warranted. Bottles from 2250m to the surface were tripped *on the fly* for station 47; all bottles were tripped *on the fly* for stations 81/3 through 85. All bottles tripped without stopping are indicated in Appendix D.

After the last bottle was closed, the console operator directed the deck watch to bring the rosette on deck. Once out of the water, the console operator terminated the data acquisition, turned off the deck unit and assisted with rosette sampling.

### 1.5. CTD Data Processing

Shipboard CTD data processing was performed automatically at the end of each deployment using SIO/ODF CTD processing software v.5.1.0-3.sts.el5. Only stations 14 and 15 were acquired using SIO/ODF’s acquisition system. During SIO/ODF acquisition, CTD data were processed to a 0.5-second time series realtime, and the raw data were backed up to another Linux workstation every 10 seconds. Raw CTD data and bottle trips acquired by SBE Seasave on the Windows XP-SP2 workstation were copied onto the Linux database and web server system after acquisition, then processed into a 0.5-second time series.

Raw CTD data were converted to engineering units, filtered, response-corrected, calibrated and decimated to a more manageable 0.5-second time-series (real-time for the ODF-acquired casts, post-cast for Seasave-acquired casts). Laboratory calibrations for pressure, temperature and conductivity were also applied. Both the raw 24 Hz data and the 0.5-second time-series were stored for subsequent processing, and a 2-decibar down-cast pressure series was created. CTD data at bottle trips were extracted from the 0.5-second time-series data and used for CTD pressure, temperature and salinity associated with each rosette bottle. CTD oxygen data extracted from the 2-decibar pressure series data were also stored in the bottle database after fitting/correction.

All CTD data were reprocessed ashore (SIO/ODF software v. 5.1.1-1.sts.el5), after carefully checking configuration files to verify sensor serial numbers and calibrations for each cast, and to confirm which bytes in the CTD data stream were assigned to each sensor.

Theta-Salinity and theta-$O_2$ comparisons were made between down and upcasts as well as between groups of adjacent deployments. Vertical sections of measured and derived properties from sensor data were checked for consistency.

Rosette CTD data were examined for sensor problems, calibration shifts and deployment or operational problems. The primary and secondary temperature sensors (SBE3*plus*) were compared to each other and to the SBE35 temperature sensor. CTD conductivity sensors (SBE4C) were compared to each other, then calibrated by examining differences between CTD and check-sample conductivity values. The CTD dissolved oxygen sensor data were calibrated to check-sample data. Additional theta-Salinity and theta-$O_2$ comparisons were made between down and upcasts as well as with adjacent deployments. Vertical sections were made of the various properties derived from sensor data and checked for consistency.

There were numerous problems during I06S with CTDs, sensors and related equipment, particularly during the first 18 stations and stations 69-81.

Signal noise started at 660db downcast on stations 2/1, and continued through 3/2; a short in the primary pump was discovered, and the pump was replaced after station 3. Station 2 was re-occupied and the cast repeated, but only to 376 db (2/1 max. pressure was 950 db). Secondary temperature began failing during station 2/3 and continued to fail near-surface until it was replaced prior to station 6.

Salinity/CTDO signal noise plagued stations 6-18: severe noise in all pumped sensors started abruptly 400-550db each downcast. The noise improved somewhat around 1000-1500db, where signals still "jittered" the rest of each downcast. Secondary signals were somewhat better (although still noisy) for stations 6-10 downcasts, primary data were better stations 11-18 downcasts. Upcasts were significantly worse than downcasts, then signal noise stopped just as abruptly between 275-190db each upcast. Attempts to resolve the noise problems included: hitting the package on the bottom, cutting kinked wire off and/or reterminating the wire at the rosette end multiple times, switching to back-up winch/older wire, reterminating slip rings at the winch end, replacing a pump and the CTDO sensor, and (Eureka!) replacing the cable between pumps and CTD.

There were problems getting trip confirmations for carousel position 16 (niskin 16) beginning station 11, whenever carousel S/N SBE32-0187 was used in combination with Seasave software (two different versions). SBE35 reference temperature data were not uploaded routinely until station 19 onward, at which point the stored SBE35 timestamps could be synced with Seasave trip times to get an accurate trip time. This trip time was then used to extract CTD trip data for bottle 16. For the few casts where no SBE35 data were available, CTD data with the best match to bottle salinity (approximately 30-40 seconds after the bottle stop that corresponded to the whole-minute console log trip-time) were selected for CTD trip data. Trip position 16 failed to confirm on stations 11-13, 16-37, 73-78, 81/3, 102 and 104-106. Other casts were either acquired by ODF software (14-15), did not need/avoided using bottle 16 (4-10, 38, 72, 79-80, 91, 93-101, 103), triggered bottle 16 from carousel position 17 (82-90, 92), or used a different carousel (39-71).

CTD #777 was on the main rosette through station 71. Secondary temperature failed during most of stations 70 and 71. Pumps failed to turn on during the first two cast attempts at station 72; CTD #777 was then replaced by CTD #381, and the secondary temperature sensor was also replaced. No bottle trips would confirm during the third cast, and the carousel was traded out at some point during station 72. A new cable fixed the tripping problem for the final cast of station 72.

CTD #381 was used for stations 72-81. Signal noise problems started during station 74, where CTDO and primary salinity offset simultaneously for two short segments on the downcast. The magnitude and duration of the offset/noisy segments increased with each cast, with impact on secondary salinity starting on station 75. The primary pump was changed out before station 78, CTDO was switched to the secondary pump circuit prior to station 79, and primary/secondary sensor pairs were input to their counterparts' endcap connectors (without physically relocating any sensors) before station 80, in a last attempt to diagnose/fix the problem. CTD #381 was removed after station 80; inspection showed one pin was entirely corroded away on an unused sensor plug-in, under a dummy plug, causing water to leak into the CTD casing.

U. of Hawaii's spare CTD #725 was borrowed and used for the main rosette for the rest of the cruise. The first cast, station 81/1, had only U. of Hawaii's primary sensors attached, but the primary temperature signal failed at 1000db downcast through most of the upcast. The wire was reterminated, a cable to the primary temperature sensor was replaced, and the previous secondary sensors and pump were added to the package before station 81/3.

Near-surface data were missing from downcasts for 8 of 10 casts through station 90 because there was no yoyo back to the surface after sensors stabilized (due to weather conditions), combined with the standard SBE 60-second pump-on delay in the U. of Hawaii CTD. Missing surface data were extrapolated from deeper data, and the result compared to upcast data to ensure nothing was distorted. Cold conditions caused water to freeze/stick in pump tubes at the start of at least 3 casts (stations 88, 97 and 98). Freezing/sensor instability was noticed by alert console operators, and lowering the CTD was delayed until after the pump tubes had cleared, sensors were stable, and the CTD was returned to near-surface.

A few more noisy signal problems reared their ugly heads during stations 101 and 102 for sensors in both pump circuits. Connections were checked/re-seated before station 103, and signs of corrosion on pins were noted. An engine room problem caused a 20-minute winch failure/delay on station 105, and there were a few more noisy data segments on the upcasts of stations 105 and 106, the last I06S rosette casts.

The primary temperature and conductivity sensors (T1C1) were used for all reported CTD data, with the exception of stations 6-9, 72-80 and 84. Secondary sensor (T2C2) data were reported instead for these casts because of problems with noisier data and/or offsets in the primary sensor data. In addition, secondary (T2C2) data were used for CTD data associated with bottle trips for the above casts, as well as stations 10-18 and 53, because of problems with primary sensor data during upcasts.

Downcast CTD pressure-series data were reported for all casts unless sensor fouling or noise problems warranted using upcast data instead. Upcast CTD pressure-series data were used for stations 56 and 74-76 only.

### 1.6. CTD Sensor Laboratory Calibrations

Laboratory calibrations of the CTD pressure, temperature, conductivity and dissolved oxygen sensors were performed prior to CLIVAR I06S. SIO/STS sensors were also calibrated within 5 months after the cruise. The calibration dates are listed in table 1.6.0.

| Sensor Description | Sensor S/N | Calibration Date/Facility Pre-Cruise | Post-Cruise |
|---|---|---|---|
| Paroscientific Digiquartz Pressure | 777 | 18-Jun-07/STS | 04-Jun-08/SBE |
| Paroscientific Digiquartz Pressure | 381 | 20-Jun-07/STS | 31-Jul-08/SBE |
| Paroscientific Digiquartz Pressure | 725 | 09-Nov-06/SBE | Unknown |
| Sea-Bird SBE3*plus* Temperature/T1 | 03P-4924 | 11-Jan-08/SBE | 07-May-08/SBE |
| Sea-Bird SBE3*plus* Temperature/T1 | 03P-4297 | 14-Nov-06/SBE | Unknown |
| Sea-Bird SBE3*plus* Temperature/T2 | 03P-2495 | 11-Jan-08/STS | 22-Aug-08/SBE |
| Sea-Bird SBE3*plus* Temperature/T2 | 03P-2322 | 11-Jan-08/STS | 08-Jul-08/SBE |
| Sea-Bird SBE3*plus* Temperature/T2 | 03P-4486 | 11-Jan-08/STS | 07-May-08/SBE |
| Sea-Bird SBE4C Conductivity/C1 | 04-3057 | 11-Dec-07/SBE | 18-Apr-08/SBE |
| Sea-Bird SBE4C Conductivity/C1 | 04-2790 | 22-Nov-06/SBE | Unknown |
| Sea-Bird SBE4C Conductivity/C2 | 04-2115 | 12-Dec-07/SBE | 09-May-08/SBE |
| Sea-Bird SBE43 Dissolved Oxygen | 43-0872 | 04-Dec-07/SBE | 13-May-08*/SBE |
| Sea-Bird SBE43 Dissolved Oxygen | 43-1129 | 30-Jun-07/SBE | 30-May-08*/SBE |
| Sea-Bird SBE43 Dissolved Oxygen | 43-0314 | Unknown | Unknown |

* post-cruise calibration done *after repairs*, not comparable.

**Table 1.6.0** CLIVAR I06S CTD sensor laboratory calibrations.

### 1.7. CTD Calibration Procedures

Three different CTDs were used during CLIVAR I06S: STS/ODF #777 (stations 1-71), STS/ODF #381 (stations 72-80) and U. of Hawaii #725 (stations 81-106). All CTD instruments, and Temperature, Conductivity and Dissolved Oxygen sensors were manufactured by SBE. The same STS/ODF sensors were used for primary TC on stations 1-80, and a single pair of U. of Hawaii sensors were used for primary TC on stations 81-106. Three different secondary T sensors were used for stations 1-5, 6-71 and 72-106; the same secondary C sensor was used throughout the cruise. An SBE35RT Digital Reversing Thermometer served as an independent calibration check for T1 and T2 beginning station 19. *In-situ* salinity and dissolved $O_2$ check samples collected during each cast were used to correct the conductivity and dissolved $O_2$ sensors.

#### 1.7.1. CTD Pressure

The two STS/ODF Paroscientific Digiquartz pressure transducers (S/N 88907, mounted on CTD#777 and S/N 58952, mounted on CTD#381) were calibrated in June 2007 at the SIO/STS Calibration Facility. The U. of Hawaii pressure transducer (S/N 90560, mounted on CTD#725) was also calibrated in June 2007 at Sea-Bird Electronics (SBE). Calibration coefficients derived from the calibration were applied to raw pressures during each cast. Residual pressure offsets (the differences between the last pressure before submerging at the start of cast, and the first pressure after emerging from the water at the end of the cast) and CTD pressure readings on-deck were monitored to check for calibration shifts.

The residual offsets were 0 to 0.6 db for CTD #777, 0.2 to 0.4 db for CTD #381, and -0.85 to -0.5 db for CTD #725. +0.7 db was added to the CTD #725 pressure calibration offset term, then raw data for stations 81-106 were re-processed. Final residual pressure offsets for all I06S casts ranged from 0 to 0.6 db at both cast start and cast end. No additional adjustments were made to the calculated pressures.

#### 1.7.2. CTD Temperature

Several SBE3*plus* temperature sensors were used during the cruise. Primary temperature sensor (T1 = S/N 03P-4924) was used for stations 1-80; when the entire package was changed to U. of Hawaii's CTD #725, their (T1 = S/N 03P-4297) was used as primary for stations 81-106. Secondary temperature sensor (T2 = S/N 03P-2495) served for stations 1-5, and was changed due to sensor failure. (T2 = S/N 03P-2322) was used on stations 6-71, also changed out due to failure during stations 70 and 71. (T2 = S/N 03P-4486) was used on stations 72-106, with the exception of station 81/1, where a secondary temperature sensor was not installed.

The SBE35RT Digital Reversing Thermometer is an internally-recording temperature sensor that operates independently of the CTD. It is triggered by the SBE32 carousel in response to a bottle closure. According to the manufacturer's specifications, the typical stability is 0.001°C per y ear. The SBE35RT on I06S (S/N 3528706-0034) was set to internally average over approximately one ship roll period (8 seconds). It was located equidistant between T1 and T2, with the sensing element aligned in a plane with the T1 and T2 sensing elements.

Calibration coefficients derived from the pre-cruise calibrations were applied to raw primary and secondary temperatures during each cast. Two independent metrics of calibration accuracy were examined. The primary and secondary temperatures were compared at each bottle closure, and the SBE35RT temperatures were compared to primary and secondary temperatures at each bottle closure.

The primary temperature sensor for stations 1-80, (T1 = S/N 03P-4924) was corrected using [T1-SBE35RT] vs. Pressure for pressures greater than 1000db, to avoid most bottles fired *on the fly*. To exclude generally noisy stations, only stations {1,2/3,4,5,19-76} were used to calculate the correction coefficients that were applied to T1 for all stations 1-80. The resulting first-order slope and offset as a function of pressure can be found in Appendix A. Corrections were not necessary for the primary temperature sensor (T1 = S/N 03P-4297) used on stations 81-106.

For stations 1-5, secondary temperature sensor (T2 = S/N 03P-2495) required a simple offset when compared to the SBE35RT temperature.

For stations 6-71, secondary temperature sensor (T2 = S/N 03P-2322) required a second-order correction with respect to pressure when compared to the primary ([T1-T2] vs. Pressure). A similar correction was observed when using [T2-SBE35RT], but [T1-T2] gave more consistent results. To avoid stations whose data were very noisy, only stations 19-57 and samples taken at pressures greater than 800 db were used to determine the quadratic correction to T1 as a function of pressure. This correction was applied to all casts for stations 6-71.

In addition to the aforementioned pressure dependence, the secondary temperature sensor experienced a slow drift of -0.0021°C from stations 57 to 71. Offsets that changed with each station# (time) were determined by comparing [T2-SBE35RT] vs. station. The new offsets were applied based on the following equation:

{NewT2Offset = OldT2Offset + (station# * 0.00014913440490445) - 0.008489915615745}

Secondary temperature sensor (T2 = S/N 03P-4486) required a pressure-dependent adjustment as well: it was corrected to the SBE35RT temperature values, using only values with pressures greater than 1000 db, where bottles were not fired *on the fly*. A first-order fit was applied, using [T2-SBE35RT] vs. Pressure. Noisy casts were excluded entirely by using only the following stations were to determine the correction coefficients: {72-76,81/3-101,103-106}. This linear T2 correction as a function of pressure was applied to all casts for stations 72-106.

The deep residual temperature differences after correction are shown in figures 1.7.2.0 through 1.7.2.5.

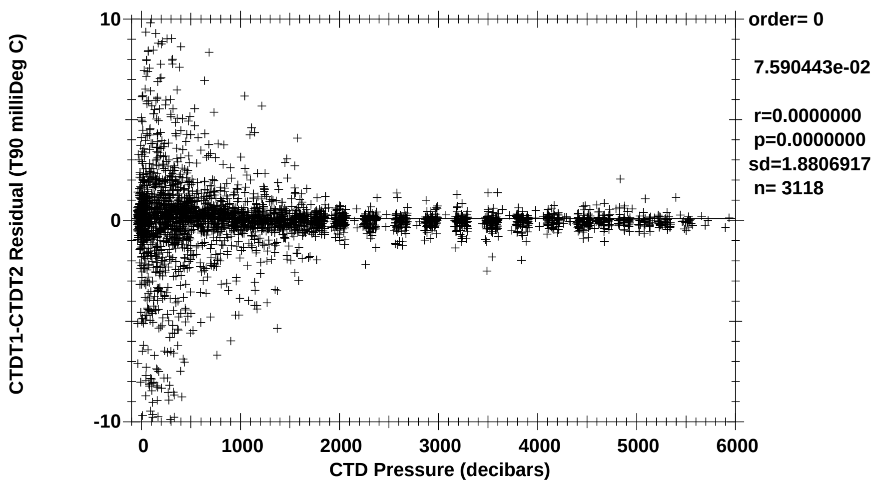



**Figure 1.7.2.0** T1-T2 by Pressure (-0.01°C ≤T1-T2≤0.01°C).

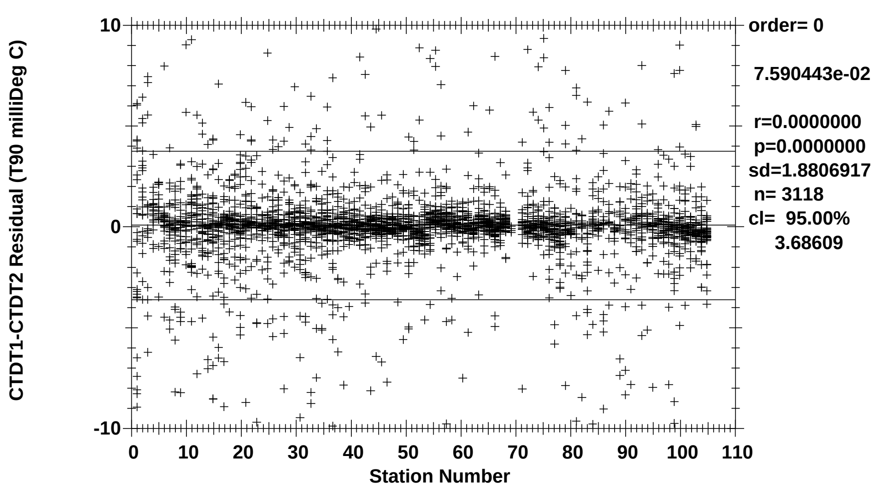



**Figure 1.7.2.1** T1-T2 by Station (-0.01°C ≤T1-T2≤0.01°C).

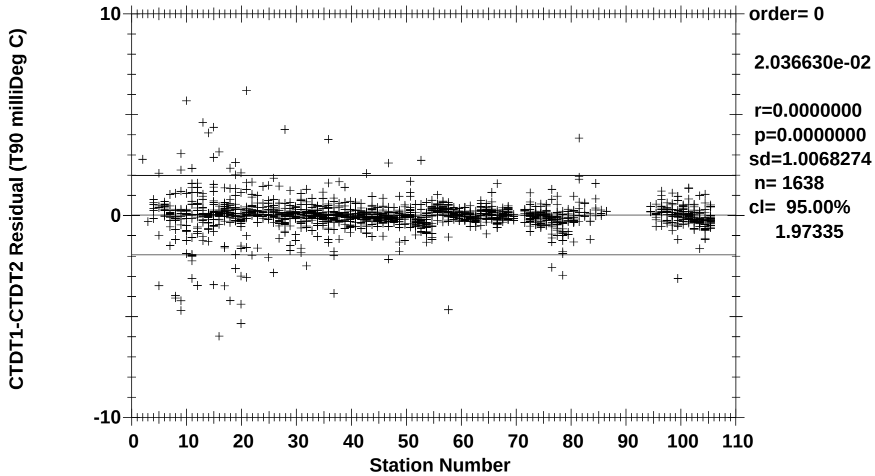



**Figure 1.7.2.2** T1-T2 by Station (Pressure > 800db).

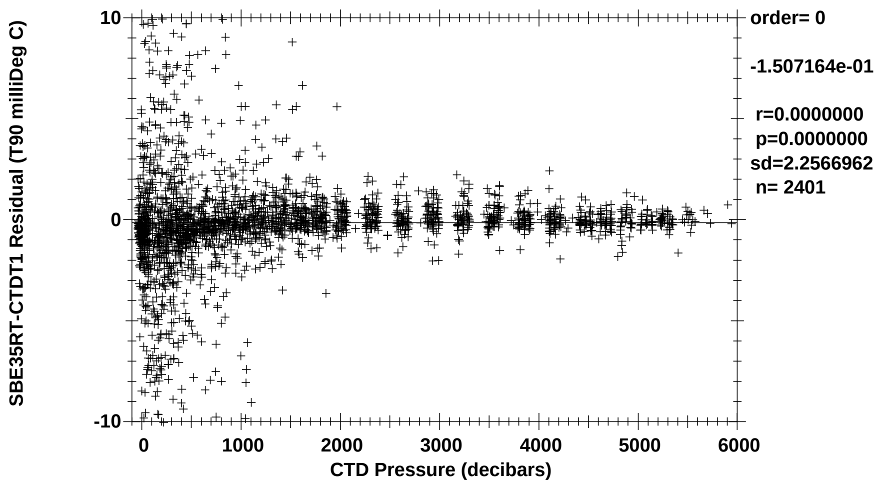



**Figure 1.7.2.3** SBE35RT-T1 by Pressure (-0.01°C ≤SBE35RT-T1≤0.01°C).

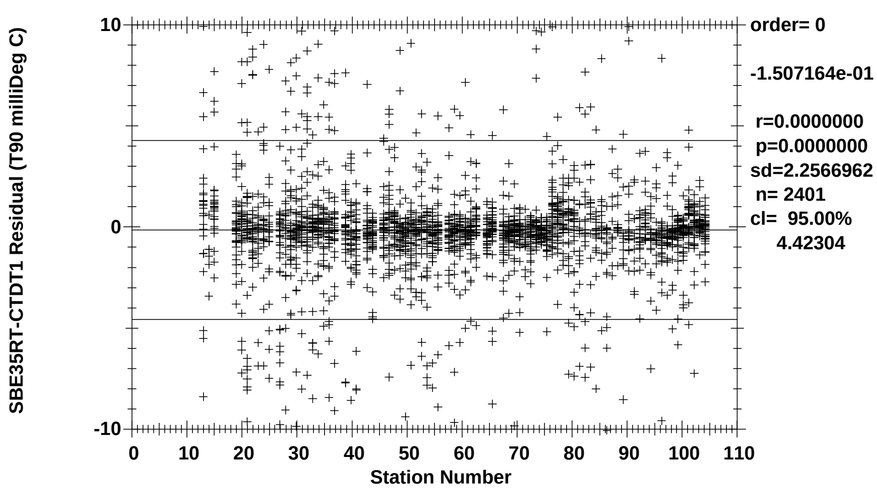



**Figure 1.7.2.4** SBE35RT-T1 by Station (-0.01°C ≤SBE35RT-T1≤0.01°C).

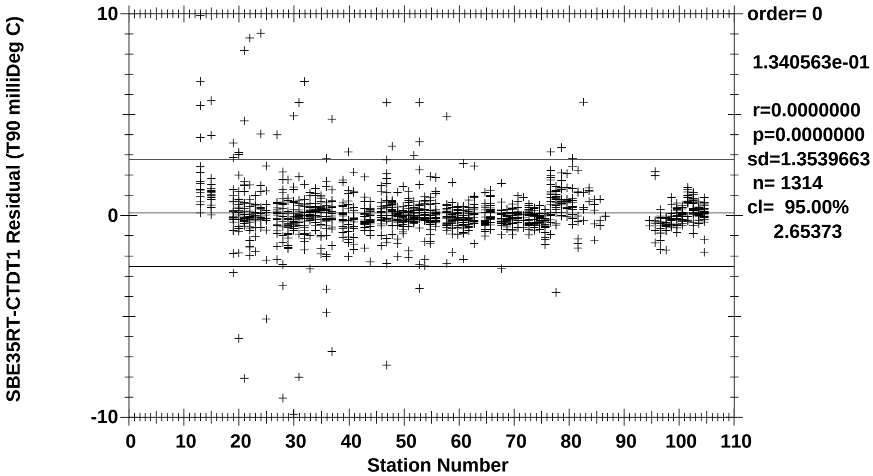



**Figure 1.7.2.5** SBE35RT-T1 by Station (Pressure > 800db).

The 95% confidence limit for the mean residual temperature differences is ±0.0037°C (lo wer-gradient T1-T2), and ±0.0044°C (lo wer-gradient SBE35RT-T1). The 95% confidence limit for deep residual temperature differences is ±0.0020°C for T1-T2, and ±0.0027°C for SBE35R T-T1.

### 1.7.3. CTD Conductivity

Several SBE4C conductivity sensors were used during I06S. Primary conductivity sensor (C1 = S/N 04-3057) was used for stations 1-80, and U. of Hawaii's (C1 = S/N 04-2790) served as primary for stations 81-106, when the entire U. of Hawaii CTD package was installed. Secondary conductivity sensor (C2 = S/N 04-2115) was used for all stations except the first cast of station 81, where there were no secondary sensors installed.

Conductivity sensor calibration coefficients derived from the pre-cruise calibrations were applied to raw primary and secondary conductivities. Comparisons between the primary and secondary sensors, and between each of the sensors to check sample conductivities (calculated from bottle salinities), were used to derive conductivity corrections. To reduce the contamination of the comparisons by package wake, differences between primary and secondary temperature sensors were used as a metric of variability and used to qualify the comparisons. The coherence of this relationship is illustrated in figure 1.7.3.0.

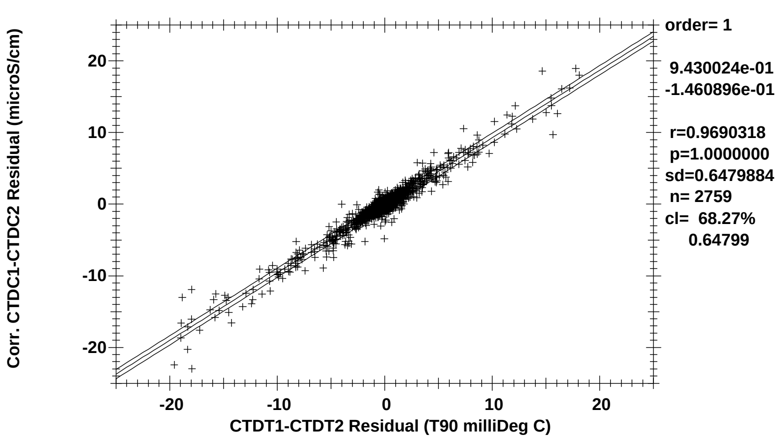



**Figure 1.7.3.0** C1-C2 by T1-T2, (-0.02°C ≤T1-T2≤0.02°C).

The uncorrected comparison between the primary and secondary conductivity sensors is shown in figure 1.7.3.1, and between C1 and the bottle conductivities in 1.7.3.2.

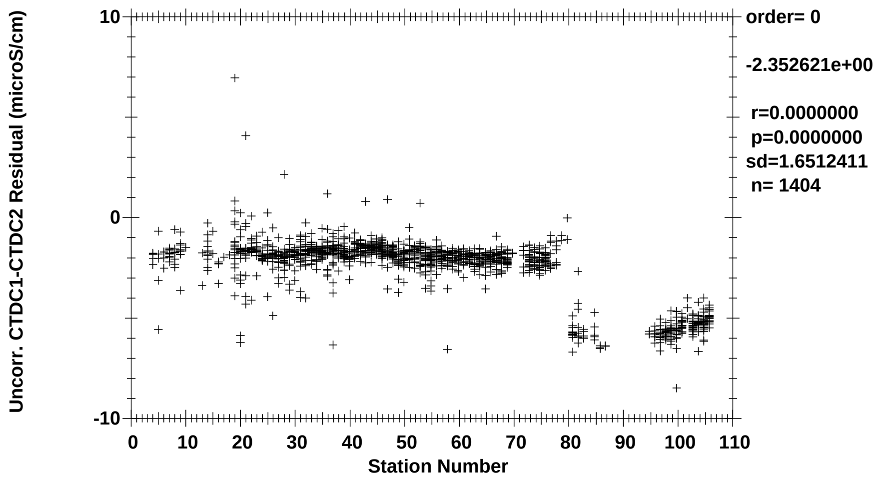



**Figure 1.7.3.1** Uncorrected C1-C2 by Station (Pressure > 800db).

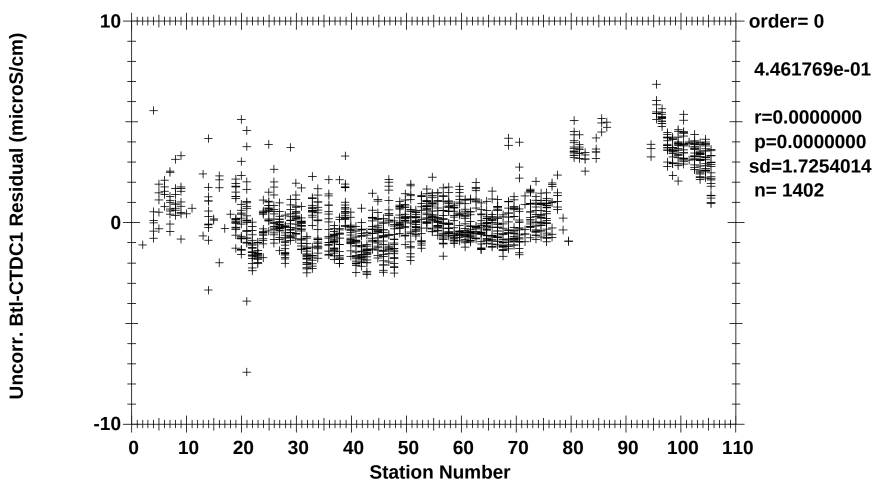



**Figure 1.7.3.2** Uncorrected BottleCond-C1 by Station (Pressure > 800db).

A first-order [BottleCond-C1] vs. Pressure fit was used to correct (C1 = S/N 04-3057) to bottle data for stations 1-80, using data with pressures over 1000 db to avoid bottles that were fired *on the fly*. To eliminate problem casts, only stations [1,2/3,4,5,19-76,79-80] were used to determine the first-order pressure-dependent corrections applied to all stations 1-80.

Bottle salinities were used to get a preliminary set of correction coefficients for the primary conductivity sensor (C1 = S/N 04-2790) for stations 81-106. A [BottleCond-C1] vs. Pressure slope and offset were determined using values with pressures greater than 800 db to avoid areas where bottles were fired *on the fly*. In addition, a first-order correction using [BottleCond-C1] residual differences vs. C1 was applied.

Once this preliminary C1 correction was applied to stations 81-106, first-order (C2 = S/N 04-2115) corrections for stations 1-106 were determined using [C1-C2] vs. Pressure. The fit only used non-problematic (noisy) stations {1,2/3,4,5,19-76,79-83,85-105}, and values with pressures over 1000 db.

After secondary conductivity was corrected for stations 1-106, primary conductivity sensor (C1 = S/N 04-2790) coefficients were fine-tuned using [C2-C1] differences for stations 81-106, since [C2-C1] displayed more consistent differences than [BottleCond-C1] for all stations. The combined pressure-dependent and C1-dependent first-order corrections were applied to C1 for stations 81-106.

A comparison of the primary and secondary conductivity sensors after applying corrections is summarized in figures 1.7.3.3 through 1.7.3.5.

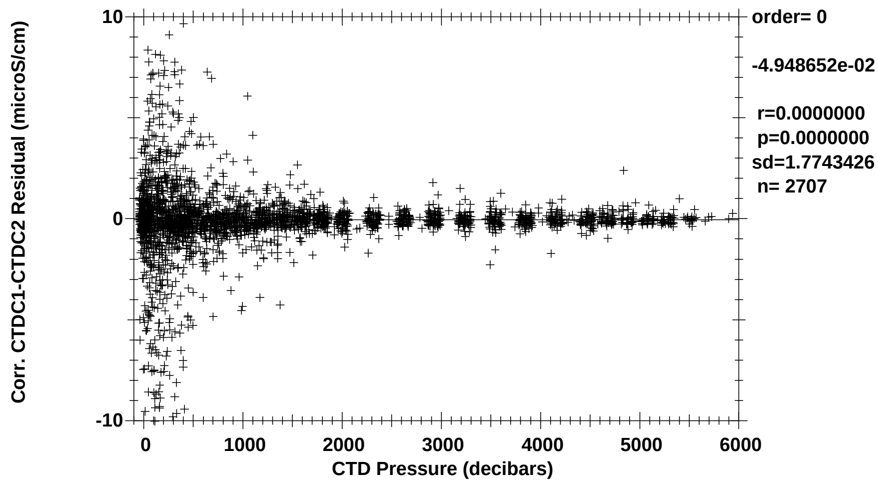



**Figure 1.7.3.3** Corrected C1-C2 by Pressure (-0.01°C ≤T1-T2≤0.01°C).

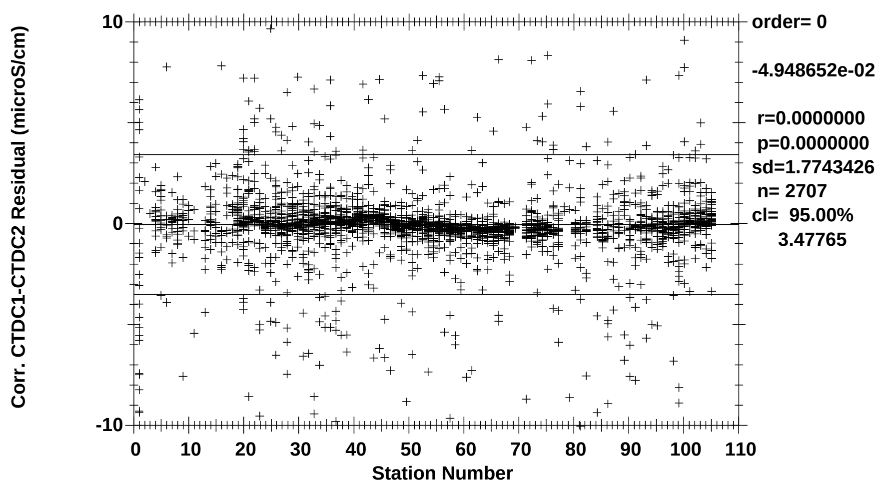



**Figure 1.7.3.4** Corrected C1-C2 by Station (-0.01°C ≤T1-T2≤0.01°C).

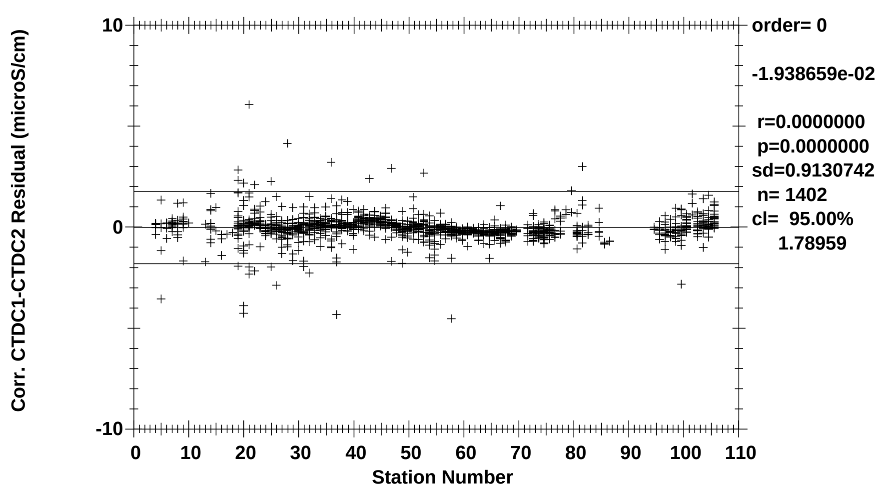



**Figure 1.7.3.5** Corrected C1-C2 by Station (Pressures > 800db).

C1 vs. Bottle Conductivity residuals after applying corrections are summarized in figures 1.7.3.6 through 1.7.3.8.

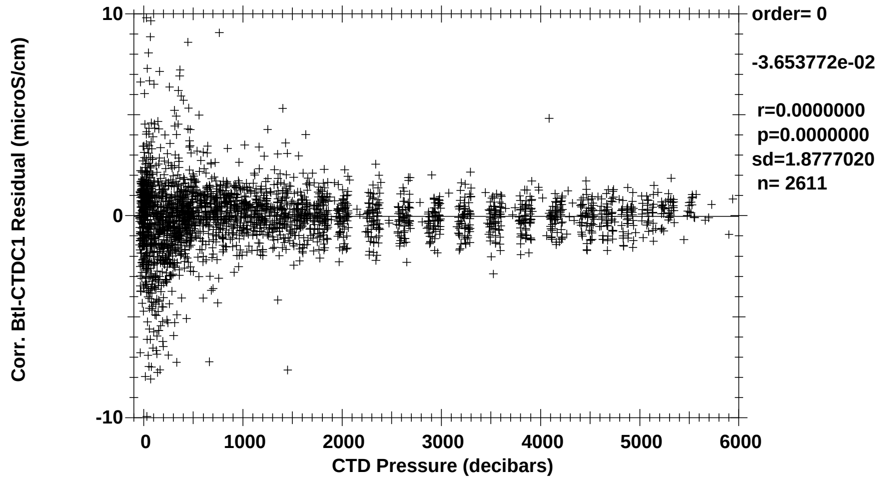



**Figure 1.7.3.6** Corrected BottleCond-C1 by Pressure (-0.01°C ≤T1-T2≤0.01°C).

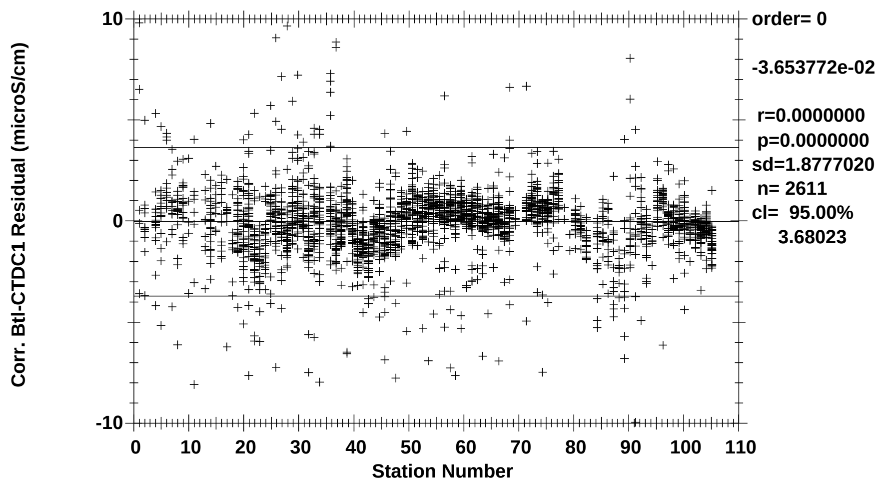



**Figure 1.7.3.7** Corrected BottleCond-C1 by Station (-0.01°C ≤T1-T2≤0.01°C).

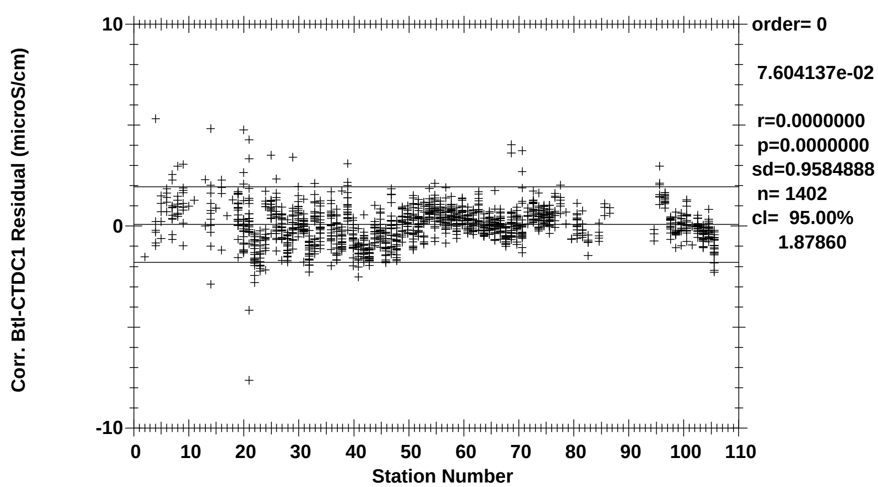



**Figure 1.7.3.8** Corrected BottleCond-C1 by Station (Pressures > 800db).

Salinity residuals after applying final temperature and Conductivity corrections are summarized in figures 1.7.3.9 through 1.7.3.14. Only CTD and bottle salinity data with "acceptable" quality codes are included in the differences. Note that only Salinity differences where [T1-T2] is within ±0.01°C were used in order to eliminate larger values in higher-gradient regions. This shows a more realistic picture of any residual pressure dependence.

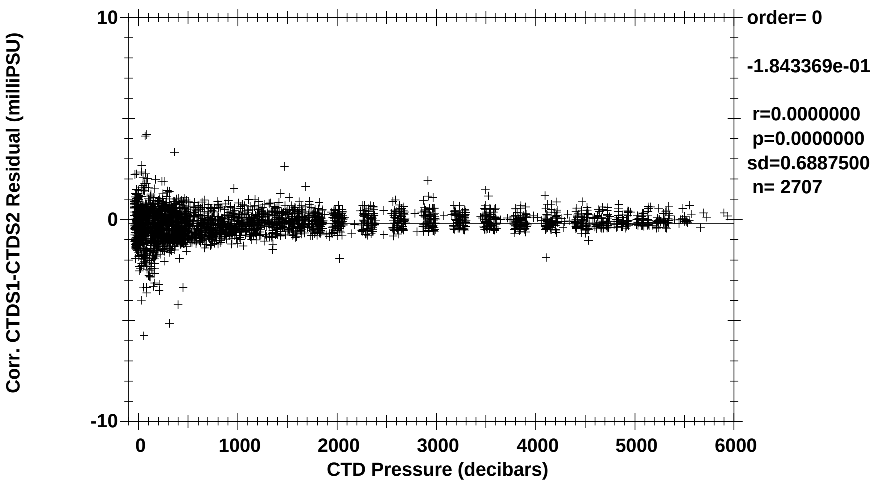



**Figure 1.7.3.9** Corrected S1-S2 by Pressure (-0.01°C ≤T1-T2≤0.01°C).

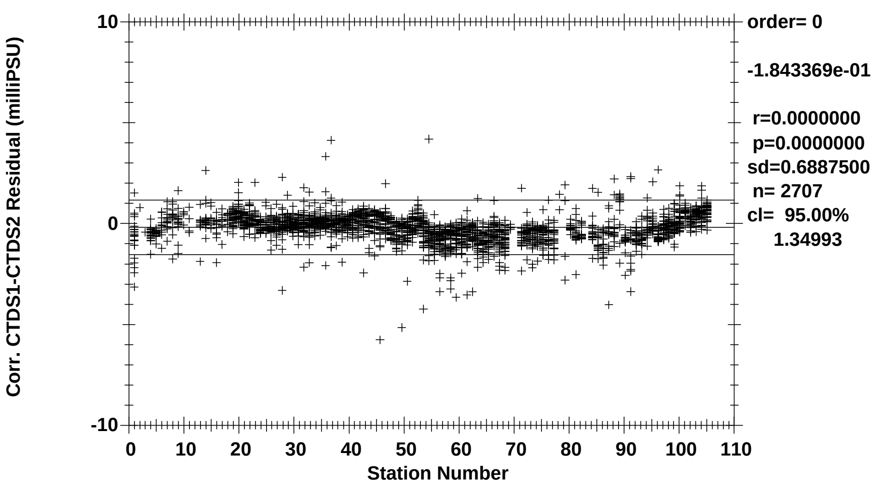



**Figure 1.7.3.10** Corrected S1-S2 by Station (-0.01°C ≤T1-T2≤0.01°C)

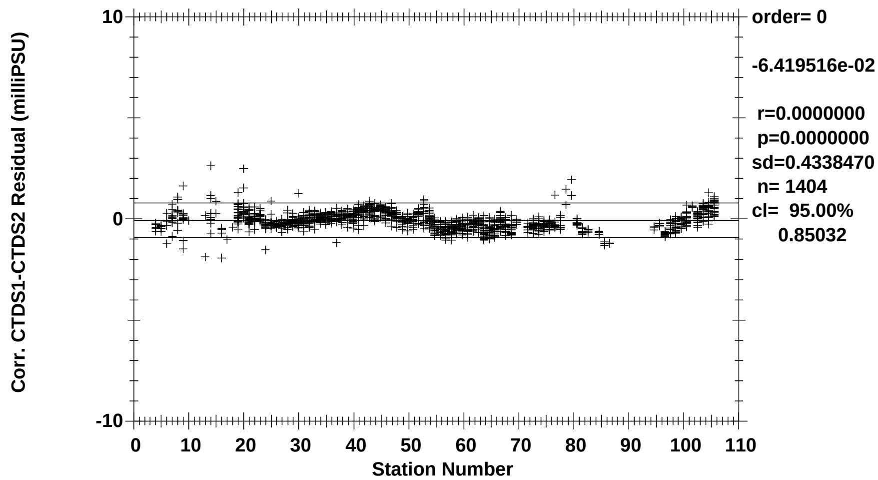



**Figure 1.7.3.11** Corrected S1-S2 by Station (Pressure > 800db)

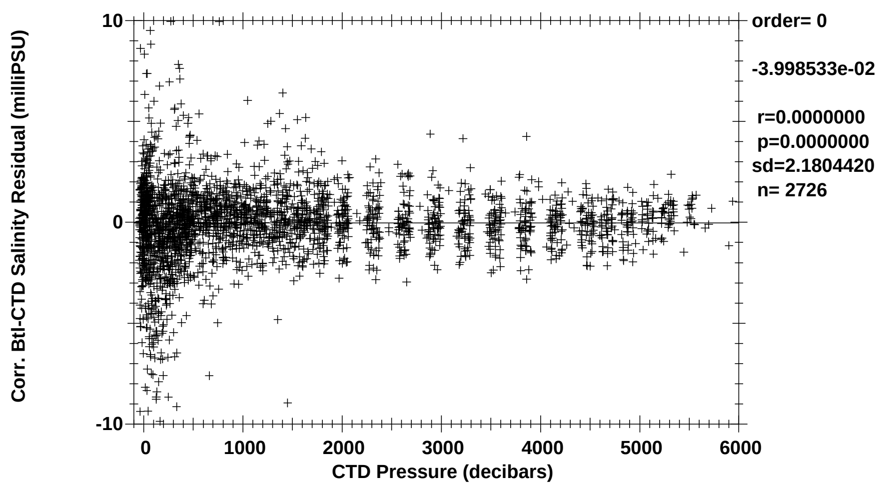



**Figure 1.7.3.12** Final Salinity residuals by Pressure (-0.01°C ≤T1-T2≤0.01°C).

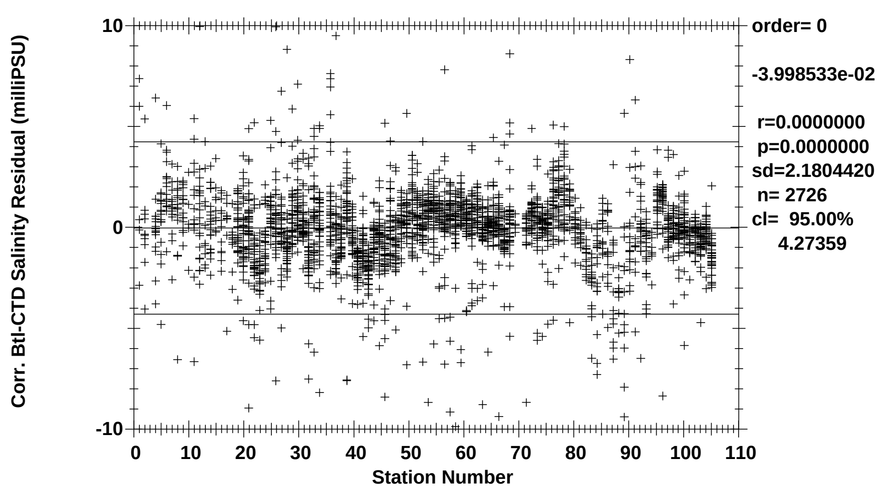



**Figure 1.7.3.13** Final Salinity residuals by Station (-0.01°C ≤T1-T2≤0.01°C)

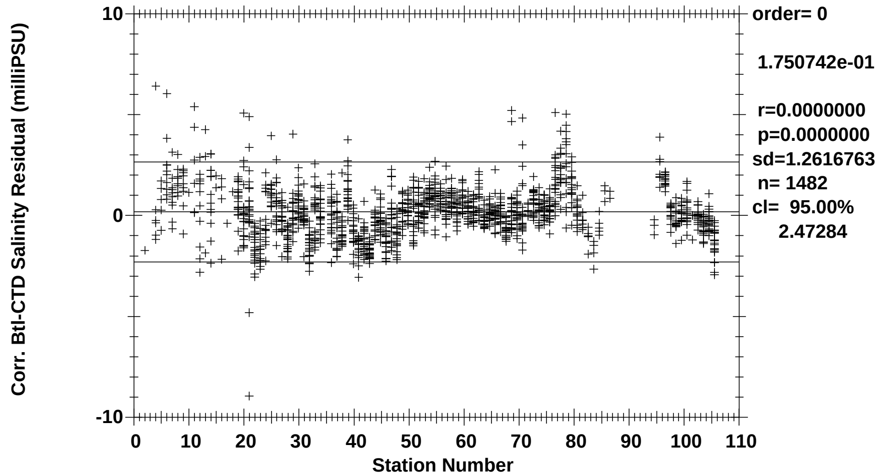



**Figure 1.7.3.14** Final Salinity residuals by Station (Pressure > 800db).

Figures 1.7.3.10 and 1.7.3.13 represent estimates of the low-gradient salinity accuracy of CLIVAR I06S; the 95% confidence limits are ±0.0013 PSU (low-gradient S2 relative to S1), and ±0.0043 PSU (low-gradient CTDS relative to Bottle Salts). Figures 1.7.3.11 and 1.7.3.14 estimate the deep salinity accuracy; the 95% confidence limits are ±0.0009 PSU (deep S2 relative to S1), and ±0.0025 PSU (deep CTDS relative to Bottle Salts). Tables of final Temperature and Conductivity corrections applied to I06S (non-Trace Metal) CTD casts can be found in Appendix A.

Bottle salinity data were analyzed with two different Autosals, and there was no notable difference between the results based on deep theta-salinity comparisons. CTD salinities were corrected to bottle salinity values (standardized to P-149 IAPSO standard seawater) for CLIVAR I06S.

Applying post-cruise Sea-Bird calibrations for the ODF conductivity sensors would make primary and secondary CTD salinities agree within 0.0005 PSU, but high by +0.002 to +0.0025 PSU compared to bottle data in deep water for stations in the 20s and 100s. The bottle-CTD salinity difference could be reduced to less than 0.001 PSU by adding a pressure-dependent correction to the SBE conductivity calibration results. These pressure effects are not measured in the SBE calibration facility, where conductivity calibrations are done at atmospheric pressure.

An additional factor was also considered for the remaining difference: SBE used IAPSO batch P-148 to standardize the reference/bath water used, and ODF used batch P-149 shipboard. Personal communication with Dr. Takeshi Kawano at JAMSTEC [Kawa09] confirmed that batches P-148/P-149 have been recently analyzed. He recommends +0.0002/+0.0008 PSU corrections to salinity data standardized by these batches, based on using recent batches with better accuracy as the "standards". These corrections, plus the need for a pressure-dependent slope to I06S conductivities, would bring the discrepancy between SBE post-cruise laboratory calibrations and ODF shipboard bottle analyses (and corrected CTD data) to less than 0.0005 PSU, well within WOCE standards.

### 1.7.4. CTD Dissolved Oxygen

Three SBE43 dissolved $O_2$ (DO) sensors were used during I06S. DO sensor (S/N 43-0872) was used during stations 1-12, and was replaced with (S/N 43-1129) in an attempt to resolve sensor noise issues. DO sensor (S/N 43-1129) was used during stations 13 through 80, then the entire package was replaced with the U. of Hawaii CTD and sensors. U. of Hawaii's DO sensor (S/N 43-0314) served for the remainder of the cruise. The sensors were plumbed into the primary T1/C1 pump circuit after C1 for all casts except stations 1-3 and 79-80, where they were plumbed into the secondary circuit.

The DO sensors were corrected to dissolved $O_2$ check samples at bottle stops by calculating CTD dissolved $O_2$, then minimizing the residuals using a non-linear least-squares fitting procedure. The fitting procedure determined the correction coefficients for the sensor model conversion equation, and was accomplished in stages. The time constants for the exponential terms in the model were first determined for each sensor. These time constants are sensor-specific but applicable to an entire cruise. Next, casts were fit individually to check sample data. The resulting correction coefficients were then smoothed and held constant during a refit to determine sensor slope and offset.

Standard and blank values for bottle oxygen data were smoothed and the bottle oxygen recalculated prior to the final fitting of CTD oxygen data. The time-constants and coefficients used to correct I06S CTD Oxygen data are listed in Appendix B.

Figures 1.7.4.0-1.7.4.2 show the residual differences between bottle and corrected CTD $O_2$ where both CTD and bottle oxygen data are quality-coded "acceptable". Note that only Dissolved Oxygen differences where [T1-T2] is within ±0.01°C w ere used, in order to eliminate larger values in higher-gradient regions. This shows a more realistic picture of any residual pressure dependence.

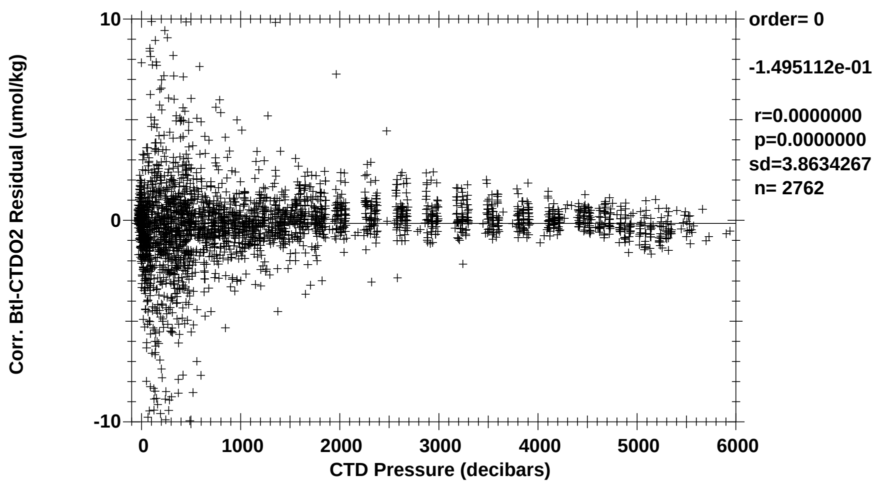



**Figure 1.7.4.0** $O_2$ residuals by Pressure (-0.01°C ≤T1-T2≤0.01°C).

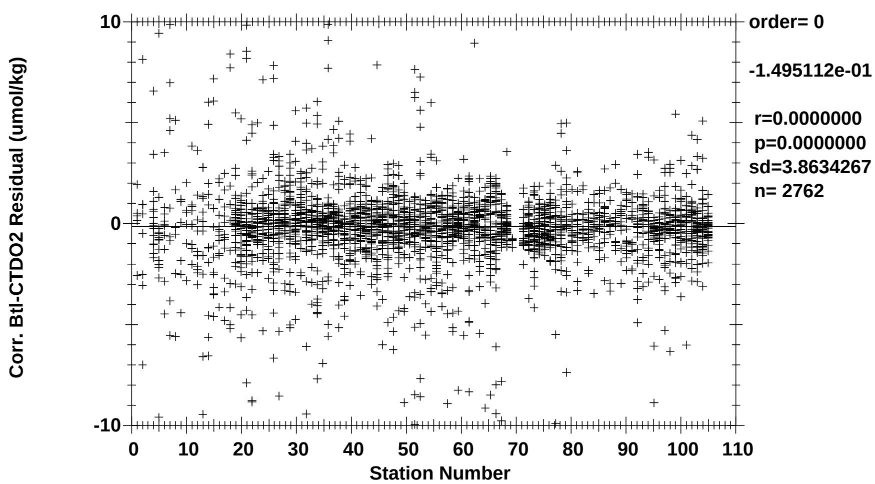



**Figure 1.7.4.1** $O_2$ residuals by Station (-0.01°C ≤T1-T2≤0.01°C).

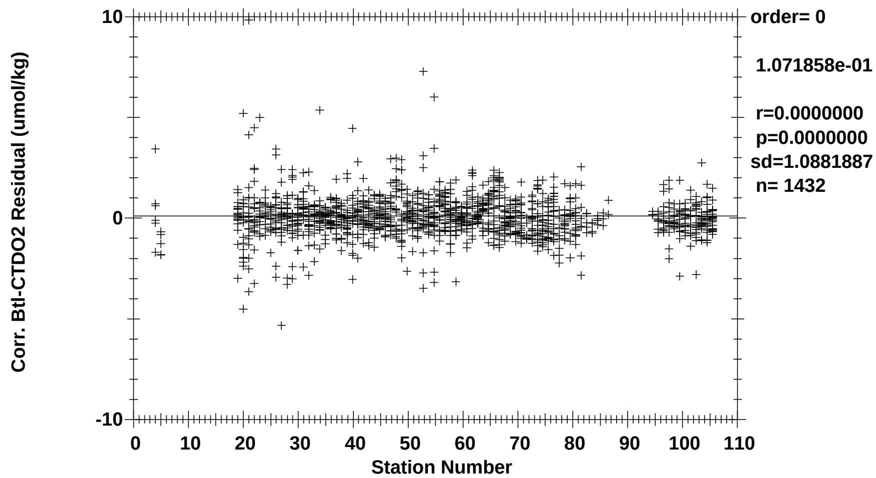



**Figure 1.7.4.2** $O_2$ residuals by Station (Pressure > 800db).

The standard deviations of 3.863 umol/kg for low-gradient oxygens and 1.093 umol/kg for deep oxygens are only presented as general indicators of goodness of fit. ODF makes no claims regarding the precision or accuracy of CTD dissolved $O_2$ data.

The general form of the ODF $O_2$ conversion equation for Clark cells follows Brown and Morrison [Brow78] and Millard [Mill82], [Owen85]. ODF models membrane and sensor temperatures with lagged CTD temperatures and a lagged thermal gradient. *In-situ* pressure and temperature are filtered to match the sensor response. Time-constants for the pressure response $\tau_p$, two temperature responses $\tau_{Ts}$ and $\tau_{Tf}$, and thermal gradient response $\tau_{dT}$ are fitting parameters. The thermal gradient term is derived by low-pass filtering the difference between the fast response ($T_f$) and slow response ($T_s$) temperatures. This term is SBE43-specific and corrects a non-linearity introduced by analog thermal compensation in the sensor. The $O_c$ gradient, $dO_c/dt$, is approximated by low-pass filtering 1st-order $O_c$ differences. This gradient term attempts to correct for reduction of species other than $O_2$ at the sensor cathode. The time-constant for this filter, $\tau_{og}$, is a fitting parameter. Dissolved $O_2$ concentration is then calculated:

$$O_2ml/l = [c_1 O_c + c_2] \cdot f_{sat}(S,T,P) \cdot e^{(c_3 P_l + c_4 T_f + c_5 T_s + c_6 \frac{dO_c}{dt} + c_7 dT)} \qquad (1.7.4.0)$$

where:

| | |
|---|---|
| $O_2ml/l$ | = Dissolved $O_2$ concentration in ml/l; |
| $O_c$ | = Sensor current ($\mu$amps); |
| $f_{sat}(S,T,P)$ | = $O_2$ saturation concentration at S,T,P (ml/l); |
| $S$ | = Salinity at $O_2$ response-time (PSUs); |
| $T$ | = Temperature at $O_2$ response-time (°C); |
| $P$ | = Pressure at $O_2$ response-time (decibars); |
| $P_l$ | = Low-pass filtered pressure (decibars); |
| $T_f$ | = Fast low-pass filtered temperature (°C); |
| $T_s$ | = Slow low-pass filtered temperature (°C); |
| $\frac{dO_c}{dt}$ | = Sensor current gradient ($\mu$amps/secs); |
| $dT$ | = low-pass filtered thermal gradient ($T_f$ - $T_s$). |

### 1.8. Bottle Sampling

At the end of each rosette deployment water samples were drawn from the bottles in the following order:

- CFCs
- $^{3}He$
- $O_2$
- Oxygen Isotopes
- Dissolved Inorganic Carbon (DIC)
- Total Alkalinity
- pH
- $^{13}C$ and $^{14}C$
- Dissolved Organic Carbon (DOC) and Total Dissolved Nitrogen (TDN)
- CDOM
- Nutrients
- Salinity
- Tritium
- Silicon Isotopes
- $^{18}O$ in $H_2O$
- Dissolved Black Carbon

One member of the sampling team was designated the *sample cop*, whose sole responsibility was to maintain this log and insure that sampling progressed in the proper drawing order.

Normal sampling practice included opening the drain valve and then the air vent on the bottle, indicating an air leak if water escaped. This observation together with other diagnostic comments (e.g., "lanyard caught in lid", "valve left open") that might later prove useful in determining sample integrity were routinely noted on the sample log. Drawing oxygen samples also involved taking the sample draw temperature from the bottle. The temperature was noted on the sample log and was sometimes useful in determining leaking or mis-tripped bottles.

Once individual samples had been drawn and properly prepared, they were distributed for analysis. Oxygen, nutrient and salinity analyses were performed on computer-assisted (PC) analytical equipment networked to the data processing computer for centralized data management.

### 1.9. Bottle Data Processing

Water samples collected and properties analyzed shipboard were eventually managed in a relational database (PostgreSQL-8.1.9-1.el5) running on a Linux system. A web service front-end (OpenACS-5.3.2-2.sts.el5 and AOLServer-4.5.0-1sts) provided ship-wide access to CTD and water sample data. Web-based facilities included on-demand arbitrary property-property plots and vertical sections as well as data uploads and downloads.

The sample log and any diagnostic comments were entered into the database once sampling was completed. Quality flags associated with sampled properties were set to indicate that the property had been sampled, and sample container identifications were noted where applicable (e.g., oxygen flask number).

Analytical results were provided on a regular basis by the various analytical groups and incorporated into the database. These results included a quality code associated with each measured value and followed the coding scheme developed for the World Ocean Circulation Experiment (WOCE) Hydrographic Programme (WHP) [Joyc94].

Table 1.9.0 shows the number of samples drawn and the number of times each WHP sample quality flag was assigned for each basic hydrographic property:

| Rosette Samples Stations 1-106 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Reported | WHP Quality Codes | | | | | | |
| | levels | 1 | 2 | 3 | 4 | 5 | 7 | 9 |
| Bottle | 3358 | 0 | 3332 | 2 | 5 | 0 | 0 | 19 |
| CTD Salt | 3358 | 0 | 3046 | 306 | 0 | 0 | 6 | 0 |
| CTD Oxy | 3295 | 0 | 2984 | 205 | 106 | 0 | 0 | 63 |
| Salinity | 3258 | 0 | 3211 | 26 | 21 | 48 | 0 | 52 |
| Oxygen | 3295 | 0 | 3276 | 7 | 12 | 7 | 0 | 56 |
| Silicate | 3300 | 0 | 3290 | 2 | 8 | 7 | 0 | 51 |
| Nitrate | 3301 | 0 | 3291 | 2 | 8 | 6 | 0 | 51 |
| Nitrite | 3301 | 0 | 3291 | 2 | 8 | 6 | 0 | 51 |
| Phosphate | 3300 | 0 | 3290 | 2 | 8 | 7 | 0 | 51 |

**Table 1.9.0** Frequency of WHP quality flag assignments.

Additionally, all WHP water bottle/sample quality code comments are presented in Appendix D.

Various consistency checks and detailed examination of the data continued during and after the cruise until final data were submitted to CCHDO.

## 1.10. Salinity Analysis

### Equipment and Techniques

Two Guildline Autosal 8400A salinometers (S/Ns 57-526 and 69-180), located in the hydro lab, were used for salinity measurements. Autosal 69-180 was employed at the start of the expedition, with the bath temperature set at 24°C. Autosal 57-526 was set up with the bath temperature set at 21°C for use when the lab temperature was low. When the function switch on Autosal 57-526 malfunctioned while running station 95, Autosal 69-180 bath temperature was re-set to 21°C and used for the remainder of the cruise.

The salinometers were configured by SIO/STS to provide an interface for computer-aided measurement.

### Sampling and Data Processing

The salinity analyses were performed after samples had equilibrated to laboratory temperature, for a minimum of 8 hours after collection. The salinometers were standardized for each group of analyses (usually 1-2 casts, up to ~75 samples) using at least two fresh vials of standard seawater per group.

Salinometer measurements were computer assisted, the analyst prompted by the software to change samples and flush.

3258 salinity measurements were made for the main rosette casts, plus 182 for Trace Metals casts and 127 for the underway system.

Salinity samples were drawn into 200 ml Kimax high-alumina borosilicate bottles, which were rinsed three times with sample prior to filling. The bottles were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. Prior to sample collection, inserts were inspected for proper fit and loose inserts replaced to insure an airtight seal. The draw time and equilibration time were logged for all casts. Laboratory temperatures were logged at the beginning and end of each run. PSS-78 salinity [UNES81] was calculated for each sample from the measured conductivity ratios. The difference (if any) between the initial vial of standard water and the next one run as an unknown was applied to the data as a linear function of elapsed run time. The corrected salinity data were then incorporated into the cruise database. The estimated accuracy of bottle salinities run at sea is usually better than ±0.002 PSU relative to the particular standard seawater batch used.

### Laboratory Temperature

The air temperature change during any particular run varied from -1.6 to +1.3°C with one run varying by 3.1°C. The water bath temperature was set and maintained at a value near the laboratory air temperature. Due to the fluctuating lab temperature the two Autosals were set up with different water bath temperatures. Autosal 69-180 was set at 24°C (21°C after station 95), and 57-526 was set at 21°C. The temperature in the salinometer laboratory varied from ~17 to 26°C, during the cruise. The lab temperature dropped to ~17°C when the ship's engineers cleared a clogged cooling pipe.

The following table provides a summary of the bath and lab temperature ranges.

| Stations Analyzed | Autosal Serial Number | Bath Temp °C | Lab Temp Range °C |
|---|---|---|---|
| 1-40 | 69-180 | 24 | 20.4-25.2 |
| 41-46 | 57-526 | 21 | 19.0-21.6 |
| 47-82 | 69-180 | 24 | 20.4-25.2 |
| 83-95 | 57-526 | 21 | 19.0-21.6 |
| 96-106 | 69-180 | 21 | 20.4-25.2 |

**Table 1.10.0** Salinometer Bath and Lab Temperatures I06S

### Standards

IAPSO Standard Seawater Batch P-149 (K15=0.99984) was used to standardize all casts. Approximately 164 vials of standard seawater were used during the cruise.

## 1.11. Oxygen Analysis

### Equipment and Techniques

Dissolved oxygen analyses were performed with an SIO/ODF-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365nm wavelength ultra-violet light. The titration of the samples and the data logging were controlled by a PC using LabView software. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0ml buret. ODF used a whole-bottle modified-Winkler titration following the technique of Carpenter [Carp65] with modifications by Culberson *et al.* [Culb91], but with higher concentrations of potassium iodate standard (~0.012N) and thiosulfate solution (~55 gm/l). Pre-made liquid potassium iodate standards were run daily (approximately every 2-4 stations), unless changes were made to the system or reagents. Reagent/distilled water blanks were also determined daily, or more often if a change in reagents required it to account for presence of oxidizing or reducing agents.

### Sampling and Data Processing

3295 oxygen measurements were made for the main rosette casts, plus 91 for the underway system. Samples were collected for dissolved oxygen analyses soon after the rosette was brought on board. Using a Tygon and silicone drawing tube, nominal 125ml volume-calibrated iodine flasks were rinsed 3 times with minimal agitation, then filled and allowed to overflow for at least 3 flask volumes. The sample drawing temperatures were measured with an electronic resistance temperature detector (RTD) embedded in the drawing tube. These temperatures were used to calculate umol/kg concentrations, and as a diagnostic check of bottle integrity. Reagents ($MnCl_2$ then $NaI/NaOH$) were added to fix the oxygen before stoppering. The flasks were shaken twice (10-12 inversions each time) to assure thorough dispersion of the precipitate, once immediately after drawing, and then again after about 20 minutes.

Samples were analyzed within 1-4 hours of collection, and the data incorporated into the cruise database.

Thiosulfate normalities were calculated from each standardization and corrected to 20°C. The 20°C normalities and the blanks were plotted versus time and were reviewed for possible problems. The blanks and thiosulfate normality was smoothed (linear fit) over the course of the cruise and the oxygen values recalculated.

### Volumetric Calibration

Oxygen flask volumes were determined gravimetrically with degassed deionized water to determine flask volumes at ODF's chemistry laboratory. This was done once before using flasks for the first time and periodically thereafter when a suspect volume is detected. The volumetric flasks used in preparing standards were volume-calibrated by the same method, as was the 10 ml Dosimat buret used to dispense standard iodate solution.

### Standards

Liquid potassium iodate standards were prepared in 6-liter batches and bottled in sterile glass bottles at ODF's chemistry laboratory prior to the expedition. The normality of the liquid standard was determined by calculation from weight. The standard was supplied by Alfa Aesar and has a reported purity of 99.4-100.4%. All other reagents were "reagent grade" and were tested for levels of oxidizing and reducing impurities prior to use.

## 1.12. Nutrient Analysis

### Equipment and Techniques

Nutrient analyses (phosphate, silicate, nitrate and nitrite) were performed on an ODF-modified 4-channel Technicon AutoAnalyzer II, generally within one to two hours after sample collection.

The methods used are described by Gordon *et al.* [Gord92]. The analog outputs from each of the four colorimeter channels were digitized and logged automatically by computer (PC) at 2-second intervals. After each group of samples was analyzed, the raw data file was processed to produce another file of response factors, baseline values, and absorbances. Computer-produced absorbance readings were checked for accuracy against values taken from a strip chart recording which is produced simultaneously with the computer. Concentrations were then calculated, any non-linear corrections applied, and data merged with other hydrographic measurements. Nutrients, reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure (0 db), in-situ salinity, and an assumed laboratory temperature of 25°C.

Silicate was analyzed using the technique of Armstrong *et al.* [Arms67]. An acidic solution of ammonium molybdate was added to a seawater sample to produce silicomolybdic acid which was then reduced to silicomolybdous acid (a blue compound) following the addition of stannous chloride. Tartaric acid was also added to impede $PO_4$ color development. The sample was passed through a 15mm flowcell and the absorbance measured at 660nm.

A modification of the Armstrong *et al.* [Arms67] procedure was used for the analysis of nitrate and nitrite. For the nitrate analysis, the seawater sample was passed through a cadmium reduction column where nitrate was quantitatively reduced to nitrite. Sulfanilamide was introduced to the sample stream followed by N-(1-naphthyl)ethylenediamine dihydrochloride which coupled to form a red azo dye. The stream was then passed through a 15mm flowcell and the absorbance measured at 540nm. The same technique was employed for nitrite analysis, except the cadmium column was bypassed, and a 50mm flowcell was used for measurement.

Phosphate was analyzed using a modification of the Bernhardt and Wilhelms [Bern67] technique. An acidic solution of ammonium molybdate was added to the sample to produce phosphomolybdic acid, then reduced to phosphomolybdous acid (a blue compound) following the addition of dihydrazine sulfate. The reaction product was heated to ~55°C to enhance color development, then passed through a 50mm flowcell and the absorbance measured at 820nm.

Explicit corrections for *carryover* in nutrient analyses are not made. In a typical AutoAnalyzer system, sample to sample carryover is ~1-2% of the concentration difference between samples. This effect is minimized by running samples in order of increasing depth such that concentration differences between samples are minimized. The initial surface samples were run twice since these samples followed standard peaks.

### Sampling and Data Processing

3301 nutrient samples were analyzed for the main rosette casts, plus 192 samples for Trace Metals casts and 95 underway samples.

Nutrient samples were drawn into 40 ml polypropylene screw-capped centrifuge tubes. The tubes and caps were cleaned with 10% HCl and rinsed once with de-ionized water and 2-3 times with sample before filling. Samples were analyzed within two hours after sample collection, allowing sufficient time for all samples to reach room temperature. The centrifuge tubes fit directly onto the sampler. Standardizations were performed at the beginning and end of each group of analyses (typically one cast, up to 36 samples) with an intermediate concentration mixed nutrient standard prepared prior to each run from a secondary standard in a low-nutrient seawater matrix. The secondary standards were prepared aboard ship by dilution from primary standard solutions. Dry standards were pre-weighed at the laboratory at ODF, and transported to the vessel for dilution to the primary standard. Sets of 7 different standard concentrations were analyzed periodically to determine any deviation from linearity as a function of absorbance for each nutrient analysis. A correction for non-linearity was applied to the final nutrient concentrations when necessary. A correction for the difference in refractive indices of pure distilled water and seawater was periodically determined and applied. In addition, a "deep seawater" high nutrient concentration check sample was run with each station as an additional check on data quality. The pump tubing was changed 3 times during I06S.

After each group of samples was analyzed, the raw data file was processed to produce another file of response factors, baseline values, and absorbances. Final nutrient concentrations were then determined from this file, and the data were added to the cruise database.

Nutrients, reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure (0 db), *in situ* salinity, and a per-analysis measured analytical temperature.

### Standards

Primary standards for silicate ($Na_2SiF_6$) and nitrite ($NaNO_2$) were obtained from Johnson Matthey Chemical Co.; the supplier reported purities of >98% and 97%, respectively. Primary standards for nitrate ($KNO_3$) and phosphate ($KH_2PO_4$) were obtained from Fisher Chemical Co.; the supplier reported purities of 99.999% and 99.999%, respectively. The efficiency of the cadmium column used for nitrate was monitored throughout the cruise and ranged from 99-100%.

No major problems were encountered with the measurements. The temperature of the laboratory used for the analyses ranged from 23.0°C to 24.5°C.

## 1.13. Historical Comparison

### Comparing 1996 and 2008 I06S and 2006 P16S and 2007 I08N T, S, O2, and nutrient values (J.Swift)

Head-to-head comparisons of recent ODF I06S, I08S and P16S salinity, dissolved oxygen, and nutrient data values show that meridional water mass variability dominates the differences. Water mass characteristics change considerably from I06S to I08S and to P16S, due to mixing and introduction of different source waters. All three data sets show very high internal quality and consistency, and the meridional changes are of the expected sign and magnitude in every case. These three sections can thus be expected to add considerably to knowledge and study of circumpolar southern hemisphere variations in water masses and circulation.

The 2008 I06S bottle salinity, oxygen, and nutrient data exhibit a high degree of internal consistency. Trends and the principal station-to-station fluctuations appear to be associated with oceanographic features.

For the most part deep temperatures - except for the 41-53°S band - are slightly warmer than the 1996 values, typically by a little more than 0.05°C. This is a relatively large difference and would seem to have oceanographic relevance.

Deep CTD salinity shows nearly the same pattern, and is a bit higher in 2008 than in 1996, again except for the 41-53°S band. The typical deep CTDS difference is in the 0.003-0.005 range.

The 41-53°S band is a steep frontal region and the changed sign of the differences there could have been the result of a shift northward in the front in 2008.

The 1996 I06S nutrient data are noisier than and in some cases offset from the 2008 nutrient data. For example, $SiO_3$ at 3000 meters at 57°S was *ca.* 152 umol/kg in 1996 and 131 umol/kg in 2008. Silicate differences were often *ca.* 10-20 umol/kg across the section, and of the same sign, except for *ca.* 41-53°S where the 2008 values were higher.

Deep $PO_4$ values are generally higher in the 2008 data than in the 1996 data (except perhaps for some of the 41-53°S band). The average offset is on the order of 0.05 umol/kg. Deep $NO_3$ values are also generally higher in a similar manner. The average offset appears to be a little less than 1 umol/kg.

Deep dissolved oxygens appear to be within a few hundredths of a ml/l of each other for the most part across the section. Differences are a little larger (2008 is higher) in the 41-53°S frontal range.

**References**

Arms67.

Armstrong, F. A. J., Stearns, C. R., and Strickland, J. D. H., “The measurement of upwelling and subsequent biological processes by means of the Technicon Autoanalyzer® and associated equipment,” *Deep-Sea Research,* 14, pp. 381-389 (1967).

Bern67.

Bernhardt, H. and Wilhelms, A., “The continuous determination of low level iron, soluble phosphate and total phosphate with the AutoAnalyzer,” *Technicon Symposia,* I, pp. 385-389 (1967).

Brow78.

Brown, N. L. and Morrison, G. K., “WHOI/Brown conductivity, temperature and depth microprofiler,” Technical Report No. 78-23, Woods Hole Oceanographic Institution (1978).

Carp65.

Carpenter, J. H., “The Chesapeake Bay Institute technique for the Winkler dissolved oxygen method,” *Limnology and Oceanography,* 10, pp. 141-143 (1965).

Culb91.

Culberson, C. H., Knapp, G., Stalcup, M., Williams, R. T., and Zemlyak, F., “A comparison of methods for the determination of dissolved oxygen in seawater,” Report WHPO 91-2, WOCE Hydrographic Programme Office (Aug. 1991).

Gord92.

Gordon, L. I., Jennings, J. C., Jr., Ross, A. A., and Krest, J. M., “A suggested Protocol for Continuous Flow Automated Analysis of Seawater Nutrients in the WOCE Hydrographic Program and the Joint Global Ocean Fluxes Study,” Grp. Tech Rpt 92-1, OSU College of Oceanography Descr. Chem Oc. (1992).

Joyc94.

Joyce, T., ed. and Corry, C., ed., “Requirements for WOCE Hydrographic Programme Data Reporting,” Report WHPO 90-1, WOCE Report No. 67/91 ., pp. 52-55, WOCE Hydrographic Programme Office, Woods Hole, MA, USA (May 1994, Rev. 2).

Kawa09.

Kawano, T. (2009). Personal communication with M. C. Johnson.

Mill82.

Millard, R. C., Jr., “CTD calibration and data processing techniques at WHOI using the practical salinity scale,” Proc. Int. STD Conference and Workshop, p. 19, Mar. Tech. Soc., La Jolla, Ca. (1982).

Owen85.

Owens, W. B. and Millard, R. C., Jr., “A new algorithm for CTD oxygen calibration,” *Journ. of Am. Meteorological Soc.,* 15, p. 621 (1985).

UNES81.

UNESCO, “Background papers and supporting data on the Practical Salinity Scale, 1978,” UNESCO Technical Papers in Marine Science, No. 37, p. 144 (1981).

**Argo Floats**

During the CLIVAR/CO2 2008 repeat of I6S, 17 autonomous CTD profiling floats were deployed along the cruise track in waters deeper than 2000 dbar. These floats are part of the Argo project (www.argo.ucsd.edu), and are provided by Dr. Steve Riser from the University of Washington and Dr. Ann Thresher of CSIRO, Australia.

Of these 17 floats, 2 contain oxygen sensors, and 13 floats use ice detection. Float #5257 Apf9iIdoOpt is an Iridium float that carries two O2 sensors aboard, the Seabird IDO Oxygen sensor and Anderaa Optode Oxygen sensor. Float #5221 Apf9aIdoIce is an Iridium float that carries the Seabird IDO Oxygen Sensor as well as ice detection. There were 12 Argos Ice Detection Floats (Apf9aIce) and one Iridium ice detection float (5221).

The ice detection floats are programmed to abort their surface mission if freezing temperatures are detected near the surface, and, in the case of the Iridium float, to store data when under sea ice. All floats were deployed at CTD stations, at the end of all station casts. All floats were deployed from the starboard stern of the ship, with the ship moving forward at about 0.5-1 knot. Deployment was done by using a rope to lower the floats from the deck to the water, except in the roughest conditions (see below). Data from all Argo floats are publicly available in real-time via the two global servers at www.usgodae.org and www.coriolis.eu.org.

Argo "Nitrate" float number 5146 (Apf9iIsus) was deployed at:

Date: 19 Feb 2008
Time: 1900
Lat: 50 12.00 S
Lon: 30 0.00 E
Depth: 4875m

This float was deployed in rough conditions (~ 35 kts, 3.5 m swell) following the recommended deployment procedure. The float was lowered into the water and began to drift away from the ship. One end was secured on a cleat, and the free end was thrown overboard. Unfortunately, as the float drifted off the line, the boat was pitching a lot so the line tensioned fast, causing it to foul on the free end. At this point a couple of big waves came through causing the boat to pitch violently and the line was pulled off the cleat, such that the float still has the line attached. Subsequently, the float has continued to profile at a somewhat deeper depth than that for which it was ballasted. For float deployments in large seas that followed this one the float was simply dropped off the starboard aft deck as a wave came up to its highest position, typically close to deck level. In this manner the rest of the floats were deployed without incident. As of the end of the cruise, the "Nitrate Float" was still operational and had completed 12 profiles (http://runt.ocean.washington.edu/argo/homographs/TP/5146.html).

The following are the approximate positions where the 14 floats were deployed (floats not designated CSIRO are from UW):

| | Lat | Float# | Description |
|---|---|---|---|
| 1 | -36 | 2853 | A2 - Magnet Start |
| 2 | -37 | 2854 | A2 - Magnet Start |
| 3 | -38 | 5195 | Apf9aIce |
| 4 | -39 | 5172 | Apf9aIce |
| 5 | -40 | 5173 | Apf9aIce |
| 6 | -41 | 5174 | Apf9aIce |
| 7 | -42 | 5175 | Apf9aIce |
| 8 | -43 | 5257 | Apf9iIdoOpt |
| 9 | -50 | 5146 | Apf9iIsus |
| 10 | -51 | 5279 | Apf9aIce |
| 11 | -52 | CSIRO | Apf9aIce - Magnet Start |
| 12 | -53 | CSIRO | Apf9aIce - Magnet Start |
| 13 | -54 | 5194 | Apf9aIce |
| 14 | -55 | CSIRO | Apf9aIce - Magnet Start |
| 15 | -56 | 5278 | Apf9aIce |
| 16 | -57 | CSIRO | Apf9aIce - Magnet Start |
| 17 | -62 | 5221 | Apf9aIdoIce |

**Lowered Acoustic Doppler Current Profilers**
(Tom Kilpatrick, UH.)

We used a 150 kHz broadband ADCP (BB150), manufactured by R.D.I. Instruments. The BB150 was built in the mid-1990s and provides greater profiling range than the newer 300 kHz instruments, mainly due to the lower frequency. The other, backup unit, was a 300kHz "work horse" ADCP from FSU. The LADCP system is self-contained, attached to the rosette but disconnected from the lab during deployment. The power source is a 52 V lead-acid gel cell battery system, contained in an oil-filled plastic box sealed by a urethane sheet. The battery system is known as the Safe Orange Battery (SOB) due to the case's color. After each CTD deployment, the rosette is recovered and brought into the hangar. Then the LADCP system is connected to the wet lab. The downloading of data and charging of SOB happen simultaneously.

The BB150 performed well during the cruise, with a few compromised casts due to SOB failure (see below). There were also several cable failures which did not affect the data.
In all, there is data for 125 casts, though I believe the data for station 97 is noise. There is no data at all for cast 17 of station 91 (yo-yo station).

**Cables**
The primary problem during the cruise was with the cables. A Y-cable is used to connect the BB150, SOB, and wet lab. The Y-cable is mounted on the rosette. Inside the Y-cable a diode exists to prevent voltage from the SOB reaching the inside of the wet lab (the user). Three diodes failed on the cruise: two in Y-cables; and one in a "star-cable," which is a Y-cable with two extra connectors and one extra diode. By the end of the

cruise we were using the last good diode. When the diode fails, continuity is destroyed and the SOB cannot be charged. The diode does not affect data download, which went smoothly the entire trip.

A strong possibility is that the diode failures were due to stress. When we charge the SOB, current runs through the Y-cable and heats the rubber. The outside of the Y-cable is cold from the water and the air temperatures. The differential stretching of the inside/outside might have been enough to break the diode or displace it from the wire. Clearly a new cable design is called for, or perhaps a Y-cable without a diode. Other than the nuisance of changing cables three times, the only consequence of the diode failures was that we did some casts without the SOB being fully charged. That is fine, as the SOB is believed to have a capacity of six casts without being charged (Eric Firing, personal communication).

**Battery**

The SOB failed to provide enough power to the BB150 on stations 91, and 97-99, but I believe those problems are separate from the diode failures. Station 91 was the ``yo-yo'' cast, when we did 16 consecutive ctd casts without recharging the battery. The instrument stopped pinging prior to the last cast, indicating that the battery was dead.

The signal/noise ratio deteriorates during the second half of the yo-yo cast, but the actual current measurements look okay through cast 16 (cast 17 missing). Current measurements from casts 14-16 are missing some of the shallower bins, presumably due to noise. We might be able to fill those gaps in with the shipboard ADCP. After the yo-yo casts the SOB recharged enough to work for 92-96 (though those were shallow casts). But on 97 the instrument again stopped pinging prior to CTD recovery. There are probably no good data from station 97. Stations 98 and 99 looked okay going down, but not going up. After 99 we replaced the SOB with the spare.

However, the SOB was acting strange earlier in the cruise. On stations 74-80, it was drawing very little current, sometimes completing charging in less than a minute (it normally takes more than 30 minutes). Since the cables were fine then, something was wrong with the SOB.

Another variable is that after we first changed the Y-cable (around station 47), we also modified the charging procedure. On the advice of Bruce Huber, after the current dropped to 0.5 A at the full 57 V, we reduced the voltage to 54 or 54.5 and let the SOB ``trickle-charge'' (0.1-0.3A) until the next station. Prior to Bruce's advice we turned the charger off at 0.5 A. Bruce told us that it can take a long to time to ``top off'' the SOB with the trickle-charge. It is possible that the modified charging procedure could be responsible for the odd behavior from stations 74-80, i.e. the SOB was so well-charged it didn't want to take much current.

UH uses the shear method of Fischer and Visbeck (1993) to calculate u and v. A shear estimate is made for each depth bin, and then the shear profile is integrated to give a baroclinic current profile. The reference velocity (i.e. offset or barotropic profile) is calculated using GPS measurements of ship position. In the UH processing, the down/up profiles are computed separately, so the agreement of the two gives some estimate of the error. At most stations, down and up agree to within a few cm/s. However there are some stations with large errors.

We use half-second time series of CTD data to help improve the depth estimate of the LADCP, a prime source of error. Most stations have been processed with the CTD data, the exceptions being 4-1,5-2,15-2,70-2,71-2,72-3,80-3.

*Observations of note*

We observed a deep eddy at stations 75 and 76, with anomalous water properties (Si and CFCs). At station 75 the current was centered at 3500 m, flowing NE. It appears to be slope water that has separated from the Gunnerus Ridge. Other stations appear to have deep eddies but have not been checked for anomalous water properties.

The yo-yo casts at 91 give us some idea of tidal variability, at least in the Gunnerus Bank area. The southwest flow does decrease in magnitude over the duration of the yo-yo, but does not reverse direction. Finally, at many stations there were strong scattering layers.

## Shipboard Doppler Current Profilers

The Revelle has three Doppler sonars for measuring ocean velocity. One of these, a commercial 150kHz narrowband instrument, is considered to be the primary shipboard current profiler for CLIVAR cruises. The other two "High- resolution Doppler Sonar System" (HDSS, 50kHz and 140kHz) were designed at Scripps Institute of Oceanography specifically for installation on the Revelle. Their design characteristics were optimized for high-quality ocean shear measurements, and the ability to provide high-quality ocean velocity is under evaluation. Comparison of the ocean velocity data from the HDSS and RDI instruments will enable a decision as to whether the HDSS velocities should be included in the shipboard final ocean velocity dataset.

## The CLIVAR Shipboard Ocean Velocity component

The primary instrument (NB150) was made by R.D. Instruments (now owned by Teledyne) in the late 1980s. The original commercial acquisition and averaging software ran under DOS and required a fairly slow computer. A new acquisition system written at the University of Hawaii is installed on an SIO-owned rack-mount unit.

The acquisition system (UHDAS, University of Hawaii Data Acquisition System) is written in C and Python; processing software is in C, Python, and Matlab. UHDAS acquires data from the NB150 instrument, gyro heading (for reliability), Ashtech heading (for accuracy), and GPS positions from various sensors. Single-ping data are converted from beam to earth coordinates using known transducer angles and gyro heading, and are corrected by the average Ashtech-gyro difference over the duration of the 5-minute profile. This scheme insulates the heading correction against short gaps or loss of fixes. For Ashtech gaps (up to 2 hours), the previous available correction is used.

Groups of single-ping ocean velocity estimates must be averaged to decrease measurement noise. These groups commonly comprise 5 minutes. Bad pings must be edited out prior to averaging. This is done by UHDAS using a collection of criteria tailored to the instrument type and frequency, and to the specific installation.

UHDAS uses a CODAS (Common Oceanographic Data Access System) database for storage and retrieval of averaged data. Various post-processing steps can be administered to the database after a cruise is over, but the at-sea data should be acceptable for preliminary work.

UHDAS provides access to regularly-updated figures and data via the ship's network. The software used is all open-source and is available via samba share and nfs export, as well as through the web interface. The shipboard web site has regularly-updated figures showing the last 5-minute ocean velocity profile with signal return strength, and hourly contour and vector plots of the last 3 days of ocean velocity.

**CFC-11, CFC-12, CFC-113, and $CCl_4$**

(Jim Happell and Charlene Grall, RSMAS)

*Sample Collection*

All samples were collected from depth using 10.4 liter Niskin bottles. None of the Niskin bottles used showed a CFC contamination throughout the cruise. All bottles in use remained inside the CTD hanger between casts.

CFC sampling was conducted first at each station, according to WOCE protocol. This avoids contamination by air introduced at the top of the Niskin bottle as water was being removed. A water sample was collected directly from the Niskin bottle petcock using a 100 ml ground glass syringe which was fitted with a three-way stopcock that allowed flushing without removing the syringe from the petcock. Syringes were flushed several times and great care was taken to avoid contamination by air bubbles. One duplicate sample was taken on most stations from random Niskin bottles. Air samples, pumped into the system using an Air Cadet pump from a Dekoron air intake hose mounted high on the foremast were run when time permitted, and for several days during the long steam to Capetown. Air measurements are used as a check on accuracy.

*Equipment and technique*

Chlorofluorocarbons CFC-11, CFC-12, and CFC-113 were measured on 106 stations for a total of 3,324 samples. Halocarbon analyses were performed on a gas chromatograph (GC) equipped with an electron capture detector (ECD). Samples were introduced into the GC-EDC via a purge and dual trap system. The samples were purged with nitrogen and the compounds of interest were trapped on a main Porapack N trap held at ~ -15$^{o}$C with a Vortec Tube cooler. After the sample had been purged and trapped for several minutes at high flow, the gas stream was stripped of any water vapor via a magnesium perchlorate trap prior to transfer to the main trap. The main trap was isolated and heated by direct resistance to 140$^{o}$C. The desorbed contents of the main trap were back-flushed and transferred, with helium gas, over a short period of time, to a small volume focus trap in order to improve chromatographic peak shape. The focus trap was also Porapak N and is held at ~ -15 $^{o}$C with a Vortec Tube cooler. The focus trap was flash heated by direct resistance to 155 $^{o}$C to release the compounds of interest onto the analytical pre-column. The pre-column was the first 5 meters of a 60 m Gaspro capillary column with the main column consisting of the remaining 55 meters. The analytical pre-column was held in-line with the main analytical column for the first 1.5 minutes of the chromatographic run. After 1.5 minutes, all of the compounds of interest were on the main column and the pre-column was switched out of line and back-flushed with a relatively high flow of nitrogen gas. This prevented later eluting compounds from building up on the analytical column, eventually eluting and causing the detector baseline signal to increase.

The syringes were stored in a flow-through seawater bath and analyzed within 8 -12 hours after collection. Bath temperature was recorded continuously for use in calculating the mass of water analyzed. Every 12 to 18 measurements were followed by a purge blank and a standard, gas7.175ml. The surface sample was held after measurement and was sent through the process in order to “restrip” it to determine the efficiency of the purging process.

*Calibration*

A gas phase standard, S39, was used for calibration. The concentrations of the CFCs in this standard are reported on the SIO 1998 absolute calibration scale. Six calibration curves were run over the course of the cruise. Estimated accuracy is +/- 2%. Precision for CFC-12, CFC-11, CFC-113 and $CCl_4$ was less than 1%. Estimated limit of detection is 0.010 pM/kg for CFC-12 and CFC-113, and 0.005 pM/kg for CFC-11 and $CCl_4$.

*Technical Problems*

In large part, sample collection and measurement were very successful. The integration of the computer software with the GC-EDC system hardware made the procedure almost completely automated. There were no incidents that caused significant instrument down time.

**Total $CO_2$ Measurements**
**(**Esa Peltola, NOAA AOML)

Samples for $TCO_2$ measurements were drawn according to procedures outlined in the *Handbook of Methods for $CO_2$ Analysis* (DOE 1994) from 10.4-L Niskin bottles into cleaned 294-mL glass bottles. Bottles were rinsed and filled from the bottom, leaving 6 mL of headspace; care was taken not to entrain any bubbles. After 0.2 mL of saturated $HgCl_2$ solution was added as a preservative, the sample bottles were sealed with glass stoppers lightly covered with Apiezon-L grease and were stored at room temperature for a maximum of 12 hours prior to analysis.

A total of 2105 $TCO_2$ samples were collected from variety of depths with one to three replicate samples. Typically the replicate seawater samples were taken from the surface and and/or bottom Niskin bottles and run at different times during the cell. No systematic difference between the replicates was observed.

The $TCO_2$ analytical equipment was set up in a seagoing laboratory van. The analysis was done by coulometry with two analytical systems (AOML3 and AOML4) used simultaneously on the cruise. Each system consisted of a coulometer (UIC, Inc.) coupled with a Dissolved Inorganic Carbon Extractor (DICE) inlet system. DICE was developed by Esa Peltola and Denis Pierrot of NOAA/AOML and Dana Greeley of NOAA/PMEL to modernize a carbon extractor called SOMMA (Johnson et al. 1985, 1987, 1993, and 1999; Johnson 1992). In the coulometric analysis of $TCO_2$, all carbonate species are converted to $CO_2$ (gas) by addition of excess hydrogen ion (acid) to the seawater sample, and the evolved $CO_2$ gas is swept into the titration cell of the coulometer with pure air or compressed nitrogen, where it reacts quantitatively with a proprietary reagent based on ethanolamine to generate hydrogen ions. In this process, the solution changes from blue to colorless, which triggers a current through the cell and causes coulometrical generation of $OH^-$ ions at the anode. The $OH^-$ ions react with the $H^+$, and the solution turns blue again. A beam of light is shone through the solution, and a photometric detector at the opposite side of the cell senses the change in transmission. Once the percent transmission reaches its original value, the coulometric titration is stopped, and the amount of $CO_2$ that enters the cell is determined by integrating the total charge during the titration.

The coulometers were calibrated by injecting aliquots of pure $CO_2$ (99.995%) by means of an 8-port valve outfitted with two sample loops with known gas volumes bracketing the amount of $CO_2$ extracted from the water samples for the two AOML systems.

The stability of each coulometer cell solution was confirmed three different ways: the Certified Reference Material (CRM), Batch 85, supplied by Dr. A. Dickson of SIO, was measured at the beginning; gas loops in the beginning and at the end; and the duplicate samples at the beginning, middle, and end of each cell solution. The coulometer cell solution was replaced after 25 mg of carbon was titrated, typically after 9–12 hours of continuous use.

The pipette volume was determined by taking aliquots at known temperature of distilled water from the volumes. The weights with the appropriate densities were used to determine the volume of the pipettes.

Calculation of the amount of $CO_2$ injected was according to the $CO_2$ handbook (DOE 1994). The concentration of $CO_2$ (*[$CO_2$]*) in the samples was determined according to:

$$[CO_2] \; = \; Cal.factor \; * \; \frac{(Counts - Blank * Run\ Time) * K\ \mu mol/count}{pipette\ volume * density\ of\ sample}$$

where *Cal. Factor* is the calibration factor, *Counts* is the instrument reading at the end of the analysis, *Blank* is the counts/minute determined from blank runs performed at least once for each cell solution, *Run Time* is the length of coulometric titration (in minutes), and *K* is the conversion factor from counts to µmol.

The instrument has a salinity sensor, but all $TCO_2$ values were recalculated to a molar weight (µmol/kg) using density obtained from the CTD's salinity and bottle salinity where CTD salinity was not available. The $TCO_2$ values were corrected for dilution by 0.2 mL of saturated $HgCl_2$ used for sample preservation. The total water volume of the sample bottles was 288 mL (calibrated by Esa Peltola, AOML). The correction factor used for dilution was 1.0007. A correction was also applied for the offset from the CRM. This correction was applied for each cell using the CRM value obtained in the beginning of the cell. The results underwent initial quality control on the ship using $TCO_2$-Pressure plots.

The overall performance of the instruments was good during the cruise. The computers had occasionally serial communication problems and valve 13 broke on both machines, on AOML4 twice.

**References**:


DOE (U.S. Department of Energy). 1994. *Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Seawater*. Version 2.0. ORNL/CDIAC-74. Ed. A. G. Dickson and C. Goyet. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Johnson, K. M., A. Körtzinger, L. Mintrop, J. C. Duinker, and D. W. R. Wallace. 1999. "Coulometric total carbon dioxide analysis for marine studies: Measurement and internal consistency of underway surface $TCO_2$ concentrations." *Marine Chemistry* 67:123–44.

Johnson, K. M., K. D. Wills, D. B. Butler, W. K. Johnson, and C. S. Wong. 1993. "Coulometric total carbon dioxide analysis for marine studies: Maximizing the performance of an automated gas extraction.

Johnson, K. M. 1992. *Operator's Manual: Single-Operator Multiparameter Metabolic Analyzer (SOMMA) for Total Carbon Dioxide (CT) with Coulometric Detection.* Brookhaven National Laboratory, Brookhaven, N.Y.

Johnson, K. M., P. J. Williams, L. Brandstrom, and J. McN. Sieburth. 1987. "Coulometric total carbon analysis for marine studies: Automation and calibration." *Marine Chemistry* 21:117–33.

Johnson, K. M., A. E. King, and J. McN. Sieburth. 1985. "Coulometric $TCO_2$ analyses for marine studies: An introduction." *Marine Chemistry* 16:61–82.

## pH

(Brendan Carter, SIO)

The I6S line was occupied from February 4th to March 17th 2008. Measurements of hydrographic parameters were made on seawater retrieved from depth with a sampling rosette at 106 stations. The carbon system was characterized by measurements of total alkalinity (TA), hydrogen ion concentration (pH), and dissolved inorganic carbon (DIC). The methods employed for the pH analyses are described below.
Roughly 2050 measurements of pH are reported. Whenever possible, pH samples were collected where DIC and TA were also collected. Precision of the reported values is estimated from roughly 300 pairs of duplicate analyses collected from single rosette bottles. Several procedural changes made during the course of the cruise were found to affect the precision. For stations 1-24 the precision is estimated at 0.003 pH units. For stations 25-73, the precision is estimated to be 0.001 pH units. For all remaining stations the precision is estimated at 0.0005 pH units.

Hydrogen ion concentration is reported on the total scale described in the DOE handbook as the negative logarithm base 10 of the concentration in mols/kg seawater. Measurements were made using a modified version of the procedure described in *Clayton and Byrne 1993* with spectrophotometric measurements of pH-sensitive m-cresol purple dye added to seawater. Measurements were made relative to 20°C for stations numbered 1-24, and at 13°C for all subsequent stations.

Sample handling and dye addition was performed with a Kloehn (V6) syringe pump automated with Labview 8.2 software. Spectrophotometric measurements were made using a 10 cm jacketed cell with a single-beam Agilent 8453 spectrophotometer. Several measures were taken to prevent introduction of bubbles from the Kloehn syringe into the beampath of the spectrophotometer including tilting the beampath, installing a HPLC debubbler, and including a pressure relief valve downstream of the spectrophotometer to keep the fluid line pressurized. Samples were refrigerated at 8°C in 250 mL Pyrex bottles with several different types of closures following collection from the rosette and before analysis.

**Reference**:

Clayton, T., Byrne, R., Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of *m*-cresol purple and at-sea results, *Deep-Sea Res. I,* **40** (10), 2115-2129, 1993

## Total Alkalinity

(George Anderson, SIO)

The total alkalinity analyses performed during I6S, were performed using a two-stage, potentiometric, open-cell titration and coulometrically analyzed hydrochloric acid. The acid was prepared using sodium chloride to give the solution an ionic strength of approximately 0.7. Using a calibrated pipet, a known volume of sample was acidified to a pH slightly above 3.5 with an aliquot of titrant. The solution was stirred for five minutes to allow the evolved CO2 to escape. The titration was then continued to a pH slightly below 3.0 and the equivalence point evaluated from titration points in the pH region 3.0 to 3.5, using a non-linear least squares procedure that corrects for the reactions with sulfate and fluoride ions. (Dickson paper reference will be found at the end of this write-up).

A LabView based software package was used on a Dell laptop computer to do the computer assisted sample analyses. This was the first time this combination of software/PC based computer have been used in the sea-going alkalinity system. There were a few hardware and software problems, none of which prevented the analyses from being completed.

With the exception of one station, (station 8) at which a surface sample only was collected, samples were collected at every level on the odd stations and half or more of the levels on the alternate stations. Samples were always taken when dissolved inorganic carbon (D.I.C.) or C-14 samples were taken. Typically duplicate samples were drawn one for each 10 Niskins cast at a station. For a 36 bottle cast, the duplicates were drawn from the surface or near surface Niskin (34-36), a mid-depth sample around Niskin 18 and the bottom or near bottom Niskin (bottles 1-3). The choice of Niskins for the duplicates depended on what other samples were to be drawn from a Niskin and the volume requirements for these samples.

Samples were drawn using a silicon drawing tube (as provided) into 250 ml pyrex serum bottles after triple rinsing. 0.057 milliliters of a saturated solution of mercuric chloride were added to all samples from stations north of 60 degrees south. This was done using an Eppendorf pipettor. Below this latitude, the mercuric chloride was only added to samples in the upper 300 meters of the water column to insure that poisoned samples could be discarded into the 55 gallon drums reserved for chemical waste.

Samples were analyzed using a two cell system: a sample being titrated in one cell while a sample was added to the second cell allowing time for the sample in this cell to come to temperature equilibrium while the sample in the first cell was being titrated. The sample cells were jacketted. A bath was used to keep sample temperatures at 20 degrees Celsius. With very cold samples, a small pail with water at or about 35 degrees C. was used to bring these samples to a temperature close to 20 degrees C.

The volume of sample titrated was measured using a calibrated pipet of approximately 100 mls. The calibration was performed using deionized water and a top loader balance readable to 0.01 grams. The balance was set up on the ship. The balance was stable within a range of plus or minus 0.20 grams, an unacceptable range for this calibration. The balance was moved to the pier adjacent to the ship. Although a bit awkward, using the balance on the pier worked quite well. The pipet volume had a standard deviation less than 0.01%.

As installed in the system (see next paragraph) the pipet was wrapped with insulation with the temperature of the water being determined using a calibrated YSI thermometer readable to 0.01 degrees C. The flat metal thermister of the thermometer probe was attached to the side of the pipet inside the insulation. Earlier tests in the laboratory, well before the cruise, confirmed that this scheme would provide a temperature good to better than 0.05 degrees C.

A semi-automated system was used to move the seawater from the sample bottles into and out of the pipet and into the jacketted titration vessels. This worked the entire cruise with no problems. This system consisted of a peristaltic pump, set to fill the pipet in about 60 seconds, an XT programmable controller to turn the pump, solenoid values, and an air pump on and off at appropriate times, the solenoid valves mentioned, and various fittings and tubing. The air pump was used to expel the sample from the pipet and allow a 15 second blow-out period to remove solution from the pipet and delivery tubing.

As samples were analyzed, the values were entered into an Excel spreadsheet into which preliminary bottle pressures had been entered. This enabled one to see an alkalinity versus pressure plot as one proceeded with the analyses. This proved very helpful in spotting samples that should or could be rerun.

System performance was monitored two ways: 1) bottles of a certified reference material, Batch 86 (Dickson lab) were run approximately once per watch, 2) duplicate samples were drawn and run on all but a few casts. On 36 bottle casts, the deep duplicate was the first sample analyzed. Samples were run surface to bottom. Just after running the sample from the mid-depth Niskin, the duplicate of the surface bottle was run. After the deepest sample was run, the duplicate of the mid-depth Niskin was run.

Preliminary data indicate that the samples are approximately 2 units higher than the certified alkalinity value for Batch 86. After rejecting 6 of 166 CRM runs, the standard deviation was about 1 umole/kg-sol. The duplicates typically agreed within 0 to 2 umoles/kg of each other, with most of the duplicates within 1 umole/kg of the first run.

A total of 2758 samples were analyzed plus 265 duplicates. This does not include the 95 samples run during the underway program.

**Reference**:

Dickson, A.G., Afghan, J.D. & Anderson, G.C., 2003. Reference materials for oceanic CO2 analysis: A method for the certification of total alkalinity. Marine Chemistry 80, 185-197).

**Trace metal hydrographic casts I6S**

(Chris Measures, Univ. of Hawaii)

Hydrographic sampling for the trace elements Al and Fe was conducted during the CLIVAR I6S cruise aboard the R.V Revelle. Samples were collected using a specially designed rosette system which consists of 12 x 12L Go-Flo bottles mounted on a powder-coated rosette frame. The package was equipped with a SeaBird SBE 911 ctd that also had an SBE 43 oxygen sensor and a Wet Labs FL1 flourometer. The package was lowered using a Kevlar conducting cable and bottles were tripped at pre-determined depths from the ship using a deck box.

The failure of the shipper to deliver the University of Hawaii winch to the Revelle before it sailed necessitated using a SeaMac winch that was already aboard the RV Revelle, that is normally used for streaming a magnetometer cable. After we had wound our cable onto this winch it became apparent that the winch was incapable of lifting our rosette package from the deck. Chief Engineer Paul Mauricio then replaced a large part of the winch's hydraulics, with parts he had on hand and managed to improve the performance to the point where it could safely lift our rosette with 8 full bottles. Consequently we adapted our sampling strategy to obtain 8 bottles from a single cast in the upper 850m which kept us within the 1 hour ship time budgeted for the trace metal operation. After we had implemented this approach successfully at the first few stations we expanded our sampling to two 6-bottle casts at alternate stations. This new sampling scheme was continued until station 43.

During the upcast at station 43 the rosette system was lost when its Kevlar cable parted. The loss occurred when an unusually large swell passed under the ship causing it first to sink in the water allowing the cable to the package to go slack. This was followed immediately by a sharp and rapid rise of the ship on the following very large wave crest that jerked the cable taught breaking the cable at its connection point with the package

The loss of the rosette and the 8 GO-FLO bottles that were mounted on it necessitated a change in our sampling. We attached one of our remaining Fiberglass encased 50 lb lead weights to the end of the Kevlar cable and attached a single GO-FLO bottle to the cable using wire clamps. This bottle was then deployed into the mixed layer at each of the subsequent stations and was triggered using a plastic messenger. After we had established the feasibility of this sampling approach we expanded our sampling to add a second bottle to the wire enabling us to obtain a 2 point profile. At 3 stations where time permitted we made 4 2 bottle casts in the upper 400m. A total of 80 casts were obtained on 61 stations. Of these, 30 were with the rosette system, 50 with a Niskin bottle configuration.

While our sampling plan was limited by the winch issues and then the rosette loss, it was still possible to obtain surface mixed layer samples along the entire cruise track which is important for calculating oceanic dust input as well as Fe availability in the photic zone. The additional 8 point profiles will allows us to delineate the effect of the Antarctic shelves in supplying Fe to the surrounding waters.

Dissolved Al and Fe were determined on surface water samples using shipboard FIA (C.I. Measures, University of Hawaii). In addition, samples were collected for shore-based ICP MS determinations of dissolved and dissolvable Fe, Ni, Cu, Zn, Cd, and Pb by isotope dilution (W.M. Landing, FSU). Particulate samples were also collected for shore-based determination of trace elements by EDXRF (Joe Resing, NOAA/PMEL).

**Aerosol Sampling**
(Dr. William M. Landing, Kathleen Gosnell, Angela Milne, Florida State University)

Aeolian transport and deposition of soluble aerosol Fe is believed to influence phytoplankton primary productivity in the majority of the open ocean (far from Fe inputs from rivers and coastal sediments). The purpose of the FSU aerosol sampling program is primarily to measure the concentration of total aerosol Fe, and to quantify the aerosol Fe fractions that are soluble in natural surface seawater and in ultra-pure deionized water. Additional analyses are conducted on the samples in an effort to understand the atmospheric processes that yield differences in the aerosol Fe solubility.

The aerosol sampling equipment consists of four replicate filter holders deployed on a 20' fold-down aerosol tower mounted on the forward, starboard corner of the 03 deck of the ship. One of the replicate filters (0.4 micrometer Nuclepore polycarbonate track-etched) is used for total aerosol measurements (see below); one replicate filter (0.45 micrometer polypropylene) is used to quantify the seawater-soluble fraction; one replicate filter (0.45 micrometer polypropylene) is used to quantify the ultra-pure deionized water soluble fraction; and one replicate filter (0.45 micrometer polypropylene) is used for precision (QA) tests or stored as a backup sample. Size-fractionated aerosols are also collected for 72 hour intervals starting every fourth day using a MOUDI cascade impactor (>3.2 micrometer, 1.0-3.2 micrometer, 0.56-1.0 micrometer, 0.056-0.56 micrometer).

Air is pulled through the filters using two high-capacity vacuum pumps. The sampling is controlled by a Campbell Scientific CR10 datalogger that immediately shuts off the flow when the wind might blow stack exhaust forward towards the sampling tower, or when the wind drops below 0.5 m/s. Air flow is measured using Sierra mass-flow meters.

We collected 24-hour integrated aerosol samples from February 5 through February 8, then switched to 48-hour integrated sampling from February 8 through March 9 due to the apparently very low aerosol loading we could see (visually) on the filters. The MOUDI cascade impactor was deployed five times (for 48 hours each time). Aerosol sampling was suspended on March 9 due to high winds and excessive sea-spray, which clogs the filters and yields nothing but sea-salt aerosols.

One of the replicate filters from each sampling period was leached with freshly-collected surface seawater (stored acidified). Another replicate filter was leached with ultrapure deionized water and stored frozen.

Analysis to be conducted on these filters and solubility extracts are:

Total aerosol Si, Al, Fe (to be analyzed using Energy Dispersive X-Ray Fluorescence by Dr. Joe Resing at NOAA/PMEL).
Seawater-soluble aerosol Al and Fe (to be run back at FSU).
Ultrapure water soluble Si, Al, Ti, Fe, chloride, sulfate, nitrate, sodium (to be run back at FSU).
The MOUDI size-fractionated aerosol filters are also leached with ultra-pure water for these same analytes.

*Other Trace Metals Sampling*

We collected archived samples from each trace metal cast for FSU shore-based analysis of dissolved Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb using isotope dilution ICPMS.

We (Gosnell and Milne) worked on developing a ship-board method for measuring dissolved Zn, with promising results. The detector we had available was not as sensitive as we had expected, so our detection limit was too high. We collected extra replicate samples from the each TM sampling; those will be analyzed at FSU when we have access to a more sensitive detector.

The Total Suspended Matter from each trace metal cast was collected on 47 mm 0.4 um Nuclepore filters for EDXRF analysis of total particulate Si, Mn, Fe, and Al (Joe Resing, NOAA/PMEL).

*Rain sampling*

Rain was collected on 2 different days, with enough volume to filter an aliquot for comparison between total and dissolved trace elements on February 11. The samples were filtered and frozen for analyses at FSU for soluble Si, Al, Ti, Fe, chloride, sulfate, nitrate, and sodium.

*Isotopes of Silicon and C14*

We took subsamples from our TM sampling and from the main rosette for Si isotopes (Ben Reynolds at ETH/Zurich). Over 600 discrete samples were collected for Si isotopes. Those samples will be shipped to ETH/Zurich from Cape Town.

We also collected over 390 subsamples for C-14 analysis from 18 profiles off the main rosette. Those samples will be shipped to WHOI.

**CDOM and Optics**
(Mary Russ, GSFC)

A free-fall profiler, designed to float away from the ship to avoid ship-induced perturbations to the in-water light field, was used for AOP data collection. The radiometric instrument that was used is a 19-channel Biospherical SuBOPS profiler. This profiler is specifically designed to maximize the sampling resolution of the near-surface layer, while minimizing in-water radiometry problems, such as perturbations from shading, optical complexity resolution, near-surface effects, and bottom hazards.

The SuBOPS profiler was tested, at the first test station during the I6S cruise, and weights adjusted to maximize a descent rate of ~ 50 cm $s^{-1}$. Temperature probes, attached to the instrument, provided knowledge of basic water column properties, like the depth of the mixed layer, and the presence of any distinct layers. To verify the data were acquired during stable illumination conditions and to provide the appropriate normalizations of the data products (discussed below), a separate irradiance sensor was mounted as high on the ship's superstructure as possible (thereby preventing shadows or reflection perturbations) to measure the total solar irradiance, $E_d\,(0^+)$. During I6S, two reference solar sensors were used, one capped, and mounted mid-ship, and uncapped daily during deployment of the profiler, and one on the bow, with other meteorological sensors, which remained uncapped throughout the cruise. Signals from the profilers and the solar references were combined in a deck box, software time stamped, and stored as American Standard Code for Information Interchange (ASCII) tab-delimited (spreadsheet) files for final processing in the laboratory after the cruise (when the total chlorophyll *a* concentration has been determined at the sampling sites).

The SuBOPS profiler was deployed at 24 stations throughout the cruise and for a total of 66 casts. Two to three casts per station were preformed, with 39 of the 66 casts (or 59% of the data) at the crucial 50 °S or higher latitudes. The maximum depths usually comprised one or two shallow casts (25 to 30 m) and one deeper cast to the 1% (75 to 110 m) or 10% (22 to 55 m) light levels.

During the cast, the angle, pitch, and roll of the instrument were monitored. High quality data will deviate from zero by ± 2°, with a deviation of ± 4° producing acceptable quality data. As illustrated in Fig. 3, most of the 66 casts taken had absolute angles within ± 4°, and the majority at or below ± 2°, demonstrating a viable data set for final analysis.

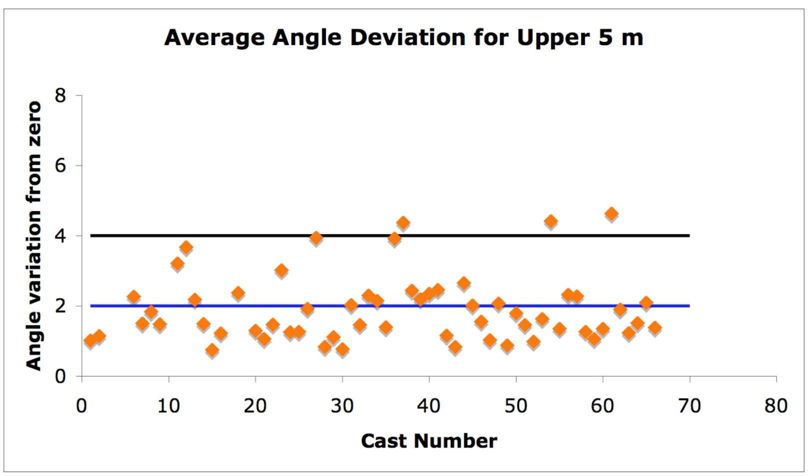



Fig. 3: SuBOPS stability in the water column during deployment, with stability defined by absolute angle deviation from zero (see text for details).

For AOP measurements, the basic equations relating the up-welled radiance field below the sea surface with that exiting at the surface, the angular bidirectional dependency of these fields, and the transformation of radiance or irradiance values into reflectances are detailed in Morel and Gentili (1996), Mobley (1999), and Mueller (2000). An important note is that the formulations given in (1) and (2), assumes no artificial perturbations to the $L_u$ and $E_d\,(0^+)$ measurements, and if present and unavoidable, correction schemes must be used. Artificial in-water perturbations for which corrections may be applied include instrument self-shading (Gordon and Ding, 1992) plus platform shading (Zibordi et al., 1999). The former is unavoidable, so a correction scheme will be applied during data processing, and the latter is rendered negligible by floating the profiler 30 to 50 m away from the ship prior to data collection.

Overall, the in-water AOP processing scheme used for the data analysis follows a well-established methodology (Smith and Baker, 1984) that has been evaluated in an international round robin (Hooker et al., 2001) and shown to be capable of agreement at the 1% level. Routine agreement between data products derived from simultaneous deployments of similar instruments is to within the calibration uncertainty, about 2–3% (Hooker and Maritorena, 2000). The $R_{rs}$ values calculated from AOP data will be used in the in-water radiometry computations and satellite algorithms to quantify chlorophyll *a* concentrations, which will be validated using in situ pigment data.

Several biogeochemical samples were also collected during the I6S cruise. After each AOP deployment, 20 to 25 L of water was collected from the ship's flow through system, and filtered, at low vacuum (~ 5 in Hg), through 25 mm GF/F filters for later in laboratory analyses of pigments (HPLC analysis), particulate absorption, and particulate organic carbon and nitrogen. Water was also filtered through Poretics 0.4µm polycarbonate filters for future analysis of total suspended matter. Further, water was collected from rosette water casts for several biogeochemical samples for Norm Nelson and Craig Carlson, at the University of California, Santa Barbara (UCSB). At over 30 stations, 60 mL of water was collected at 6 to 24 depths, for analysis of colored (or chromophoric) dissolved organic matter. Sub-samples (~ 2 mL) of this 60 mL of water were transferred into cryovials and fixed with formaldehyde, for later flow cytometry analysis. At approximately 40, 50, 60, and 68 °S, 45 mL of water was collected, from the rosette at the top 12 depths, for special CDOM characterization, and at approximately 40, 50, and 68 °S large volume (~ 2 L) of water was collected at ~ 25, 500, and 1000 m and filtered for future CDOM experiments that will be designed at UCSB.

**References**:


Gordon, H.R., and K. Ding, 1992. Shelf-shading of in-water optical instruments. *Limnology and Oceanography*, **37**: 491-500.

Hooker, S. B. and W. E. Esaias, 1993. An overview of the SeaWiFS project. *Eos, Transactions, American Geophysical Union*, **74**: 241-246.

Hooker, S.B., and S. Maritorena, 2000: An evaluation of oceanographic radiometers and deployment methodologies. *J. Atmos. Ocean. Technol.,* **17,** 811–830.

Hooker, S.B., G. Zibordi, J.F. Berthon, D. D'Alimonte, S. Maritorena, S. McLean, and J. Sildam, 2001. Results of the Second SeaWiFS Data Analysis Round Robin, March 2000 (DARR-00). S.B. Hooker and E.R. Firestone, editors, NASA TM/2001-206892, Volume15, NASA Goddard Space Flight Center, Greenbelt, MD.

McClain, C., S. Hooker, G. Feldman, and P. Bontempi, 2006: Satellite data for ocean biology, biogeochemistry, and climate research. *Eos, Trans. Amer. Geophys. Union,* **87,** 337, 343.

Mobley, C.D., 1999. Estimation of the remote-sensing reflectance from above-surface measurements. *Applied Optics*, **37**: 7,442-7,455.

Morel, A., and B. Gentili, 1996. Diffuse reflectance of oceanic waters. III. Implication of bidirectionality for the remote sensing problem. *Appl. Opt*., **35:** 4,850-4,862.

Mueller, J.L., 2000. Overview of measurement and data analysis protocols. In G.S. Fargion and J.L. Mueller, Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 2. NASA TM/200-209966, NASA Goddard Space Flight Center, Greenbelt, MD.

O'Reilly, J.E., S. Maritorena, B.G. Mitchell, D.A. Siegel, K.L. Carder, S.A. Garver, M. Kahru, and C. McClain, 1998: Ocean color chlorophyll algorithms for SeaWiFS. *J. Geophys. Res.,* **103,** 24,937–24,953.

Smith, R.C., and K.S. Baker, 1984. The analysis of ocean optical data. Ocean Optics VII, m. Blizard, editor, *SPIE*, **478**: 119-126.

Zibordi, G., J.P. Doyle, and S.B. Hooker, 1999. Offshore tower shading effects on in-water optical measurements. *Journal of Atmospheric and Oceanic Technology*, **16**: 1,767-1,779.

**Surface sampling I6S, during March 2008**

(George Anderson, SIO, coordinator of the underway sampling program)

After our last CTD station, a surface sampling program was carried out from 65.3 deg S, 29.9 deg E to 41.3 deg S, 20.3 deg E. (March 8: 10:00 GMT through March 14: 04:00 GMT). Surface samples were collected from the ship's uncontamined sea water line. Initially samples were collected every two hours, increasing in frequency to every hour at 50.8 deg S. 95 samples were collected.

In addition to recording readings from the ship's underway system, water samples were collected for salinity, oxygen, nutrients, dissolved inorganic carbon (D.I.C.), and alkalinity. Water from the same system, but at a different location on the ship, was continuously sampled and pH measurements were made every 15 and later every 30 minutes.

Salinity, nutrients and the oxygen samples were run by personnel from ODF, typically once per day. D.I.C. and alkalinity samples were run by the groups doing these analyzes during the cruise, also once per day.

Since salinity and oxygen are included in the ship's underway system, comparisons could be made between these values and those from the analytical analyses.

The salinity difference (bottle value less display value) averaged -0.02 +/- 0.01 units (91 of 95 values), but did appear to shift slightly from -0.017 at the southern part of the track to -0.025 at the northern end of the track.

Oxygen (bottle value less display value) showed an offset of approximately 0.45 ml/l in the cold southern waters. In the warmer salin waters near the northern end of the track, the offset appeared to be approximately +0.12 ml/l changing to -0.17 mls/l at the very end of the track. Rob suggested that the differences in the offset may be the result of sensor calibration. He believes that SeaBird calibrates its oxygen sensor at just one point, which would probably not be at zero degrees C. A note will be sent to SeaBird with these data.

During rough weather when the ship's bow came out of the water, air would be sucked into the underway seawater pump. Even with relatively slow flow rates in the tubing used to draw the samples, small bubbles were readily apparent in the samples. This fact was confirmed by higher than expected oxygen values. The data for D.I.C. have yet to be reviewed to see if the same problem exists with these data.

Occasionally errors could be found in the recorded data, e.g., incorrect oxygen flask numbers, a salinity value being recorded instead of the oxygen value, and a salinity of 35 being recorded as 33. Also, at the most, 3 times on one watch, oxygen flasks were found that had not been shaken the required second time.

Thanks should be expressed to the technicians of ODF who performed the analyses required as well as the students and watch leaders who helped with the sample collection. Special thanks to Susan who helped

coordinate/oversee sampling during the day shift and Dan who set up the display from which data could be recorded and the spreadsheet for entering all display data and merging the bottle data after analyses.

A thorough check of all recorded and analyzed data has yet to be completed.

**Dissolved Black Carbon**
**(**Thorsten Dittmar , Florida State University)

*Motivation***:** Organic products from biomass and fossil fuel combustion (black carbon) are abundant in the environment. Their importance in global element cycles is widely recognized, although basic information is still lacking. Estimates of black carbon production exceed accumulation and loss rates by far, and the existence of major unidentified black carbon pools or loss processes is likely. It has been suggested that a black carbon component in marine dissolved organic matter (DOM) may be one of the missing links. However, the available information on black carbon in marine DOM is extremely scarce and not sufficient to constrain robust global estimates. The only information on dissolved black carbon in the deep sea is from the remote Weddell Sea off Antarctica (Dittmar and Koch, 2006) where a significant proportion of DOM (>2.4%) was thermogenic. If this estimate is representative on a global basis, then the dissolved pool of thermogenic carbon in the ocean could be >17 Gt, which is similar to the sedimentary black carbon pool. This preliminary estimate indicates that DOM could be one of the largest pools of black carbon on earth. The turnover and dynamics of this potentially large reservoir are unknown. The main reason for the scarcity of information is the analytical difficulty to determine dissolved black carbon at the very low concentrations found in the deep sea. Recently, PI Dittmar and colleagues developed new analytical techniques (Koch and Dittmar, 2006; Dittmar, 2008), and we now have the necessary tools in hand to routinely quantify black carbon in marine DOM and to unambiguously confirm its pyrogenic source.

The objective of our participation on CLIVAR I6S is to establish first quantitative estimates for the inventory and turnover of dissolved black carbon for a major oceanic region.

*Sampling and onboard activities:*

Samples (4 l each) were taken along the I6S section at 1º intervals (every odd numbered cast) within the mixed layer and below the thermocline (2 samples per cast) from the main or trace metals cast. At 3º intervals the major water masses from surface to bottom were sampled from the main cast (8 samples per cast, 4 l each). Two casts, one north of the Antarctic front and one south of the front, were sampled more in detail at 27 depths each (2 l per sample). A total of 210 samples (approximately 800 l) were taken. Samples were collected in amber glass jars and acidified with HCl to pH=2 immediately after sampling. Dissolved organic matter was isolated from the seawater following the solid phase extraction procedure described in Dittmar et al. (2008). The salt-free and concentrated samples (6 ml per sample) will be analyzed for black carbon in Dittmar's lab at Florida State University and at the High Magnetic Field Laboratory in Tallahassee.

*Land-based analysis:*

Two new molecular methods using high-performance liquid chromatography (Dittmar, 2008) and ultra-high resolution mass spectrometry (Koch and Dittmar, 2006) will be used for this purpose. The combination of the two methods will yield quantitative (concentrations of black carbon) and important structural information. The identification of molecular structures in black carbon will provide clues on its origin, i.e. biomass combustion, fossil fuel combustion or geothermal processes. We plan to complete chemical analysis by August 2008.

The extensive physical and chemical dataset collected during I6S will provide valuable background information for the interpretation of the black carbon data, in particular for the estimation of flux and turnover rates.

*Subsampling for other groups:*

The sampling for dissolved organic carbon (DOC) and total dissolved nitrogen (TN) was overseen for PI Craig Carlson (University of California, Santa Barbara) whose group was unable to participate on I6S. Samples (40 ml) were taken at 1º intervals (every odd numbered cast) from 24 depths each. Samples from the upper 250 m were gravity-filtered through combusted Whatman GF/F filters directly from the Niskin bottles. All other samples were taken unfiltered. A total of approximately 1200 samples was taken. The samples were kept frozen (-5ºC) in polyethylene bottles and shipped frozen to PI Carlson for the analysis of DOC and TN.

**References:**

Dittmar T and Koch BP (2006) Thermogenic organic matter dissolved in the abyssal ocean. Marine Chemistry 102, 208–217.

Koch BP and Dittmar T (2006) From mass to structure: An aromaticity index for high-resolution mass data of natural organic matter. Rapid Communications in Mass Spectrometry 20, 926–932.

Dittmar T, Koch BP, Hertkorn N and Kattner G (2008) A simple and efficient method for the solid-phase extraction of dissolved organic matter (SPE-DOM) from seawater. Limnology and Oceanography: Methods. In press.

Dittmar T (2008) The molecular level determination of black carbon in marine dissolved organic matter. Organic Geochemistry. In press.

**Helium and Tritium**
**(**Brett Longworth, WHOI)

Samples for helium and tritium analysis were taken from every fourth station, and were generally both from the same stations and depths. One duplicate each for helium and tritium was collected at each station. 24 depths were sampled at all deep stations. At either end of the transect, the sampling plan was altered to best cover a selection of depths and spacings along the slope and shelf. In total, 530 helium and 542 tritium samples were taken at 28 stations.

*Method*

Water for helium analysis was taken in 90mL stainless steel cylinders using tygon and silicone tubing, and was taken after CFC sampling. Cylinders were flushed with about 10 volumes of sample water to rinse and remove air bubbles. Samples for tritium analysis were collected with no rinse in 1L glass bottles shipped clean and backfilled with argon. Dissolved gasses were extracted from samples within 24h of collection using a vacuum extraction line and stored in flame-sealed 25mL aluminosilicate ampoules. No major problems were encountered during sampling and extraction, and less than 10 samples were lost during processing.

**Oxygen Isotope O18 in H2O**
(Kevin Speer, FSU)

Starting at 53S, O18 samples were taken for post-cruise analysis in the UK, at the BAS. All even casts from stations 52-76 were sampled, thence stations 88, 90,91, 93, 94, 96, 98, 101, 103, 105. In total 343 samples taken (one bottle was chipped). The result should be a section with roughly 1 deg resolution, emphasizing the upper layers. Typical resolution was 20-100 m in the upper 500m, 100-500m below that depth.

**Student reports**

Austin C. Todd, Florida State University

The opportunity to participate in the 2008 CLIVAR I6S Cruise has been one of the most worthwhile experiences I have had during my academic career. I am extremely grateful for being able to have this opportunity. Not only have I been able to see real "blue water oceanography" as dubbed by one the scientists onboard, but I have also been able to learn a great deal about different disciplines of oceanography and some of the basic goals of the CLIVAR initiative. The overall around-the-clock dedication toward science of all the members aboard the R/V Roger Revelle made for a productive atmosphere that inspired me to learn as much as I could about the different data we were receiving. Also, the interaction with students and scientists from other institutions taught me to think about the data in ways I was not entirely familiar with beforehand.

One of the other benefits that I have gained from this cruise is knowledge of the important physical and chemical impacts of the Southern Ocean on global ocean circulation and climate variability. I had not previously studied the Southern Ocean other than in a basic physical oceanography course, and now feel like I have a better understanding of some of the basic processes in this part of the world ocean system. I have also learned about some other basic physical and chemical principles from the brilliant people onboard.

As far as the Revelle and its crew, I cannot complain. The ship's accommodations were great, the food was fantastic, and the people were very welcoming and friendly. Many of the crewmembers, while they may not have much knowledge of the scientific importance of our section, were eager to learn about our work and assist us in any way possible to reach our scientific objectives. Several times, the captain sat in on our science meetings simply because he was interested in learning about our progress. Most everyone met his or her duties with a smile and a great attitude. I can only hope to have such a great experience again in the future.

*Continuing the Science*
Collecting and gathering the data onboard allowed me to continually examine some of the major process occurring along our section. The CTD operations student group was lucky enough to plan a whole underway sampling and XBT launching plan for the return trip. I think this was actually one of the most beneficial exercises, as it really taught us to analyze all of the different data available in order to make important executive decisions as to when and where we were going to sample and launch XBTs. Not only this, but it also gave me quite a bit of motivation to complete a further study of the data after the cruise. I would love to be able to analyze the data that was my responsibility to gather, and make some conclusions about the fronts in our return section. Myself, along with some of the other CTD operations students, have already began to make some preliminary analyses of this data in preparation of possibly completing a report on our section, analyzing both the main I6S line and the return section.

Jun Dong, FSU

I6S is an observational program for carbon hydrographic and tracer measurements. It is a repeat of the WOCE I6 line. The investigation includes physical, chemical and biological environmental parameters measurement. The cruise departed from Durban, South Africa on Feb 4, 2008 and reached the southernmost station around latitude 69S; then ended at Cape Town, South Africa on Mar 17, 2008.

Our journey began with the extremely strong current, Agulhas Current, near the continental break, whose speed can exceed 2 m/s. The Agulhas Current with high temperature seawater flows to west and return to east south of it as retroflection current. Then we crossed three major fronts. The STF has strong surface expression with large temperature and salinity and the SAF has more subsurface expression. The PF associates with strong jet flow about 0.5 m/s. After that, we entered the "ice region", where the water property strongly influenced by the ice seawater interaction.

Our back trace was slightly west of the down trace. On the way back, we deployed XBT to get the section data and high resolution on the fronts. XBT measures upper 1000 m layer seawater temperature and is easy to deploy. We, CTD watch, worked together to finish this job.

There were other two groups doing casts on station too. Trace metal group did one or two casts every other station and Optics casts were deployed when the time were close to noon. Water sampling includes CFC, Oxygen, DOC, DIC, AKL, PH, Si isotope, Black Carbon. They are important water properties and some of them, such as CFC and Oxygen, are great traces to investigate the biochemical cycle in the ocean.

My job on cruise was CTD operation, water sampling and XBT dropping. At the beginning, I learned how to operate the CTD console and how to deploy the CTD. I got lots of experience on this cruise. It is great to be able see the data in the front of me and helpful to understand the data. By pre-process the data, I learned how to connect the data to the knowledge I got from book. I also learned how to pre-process the ADCP data, which will be helpful for my research too. I gain good experience to organize a small project and to corporate with other people. I believe I can do better job for next time.

Jiyoung Paeng, Florida State University

I collected and processed water samples for black carbon analysis on I6S. Black carbon is an inert carbon compounds produced during biomass burning and fossil fuel combustion. The main goal of this cruise is to quantify dissolved black carbon in the Southern Ocean and to identify its source and transport in different water masses. For details on sampling, sample processing and land-based analysis of black carbon refer to the respective section in the cruise report.

The samples collected on I6S are a central part of my master's thesis at Florida State University, Department of Oceanography. The black carbon data from this cruise will be compared with data from the fire-impacted coastal zone in the Northern Gulf of Mexico. Anthropogenic impact is minimal in the Southern Ocean and provides therefore an important baseline for my research project.

In addition, I took a class (FSU, OCE 5009L Marine Field Methods, 4 credit hours) that was thought onboard by Dr. Dittmar, with support form Drs. Speer, Landing and Measures. In this class we discussed the results form onboard analysis, in particular physical properties (fronts, currents, etc.) and water tracers (CFCs, nutrients, oxygen, etc.). As part of the class we also performed experiments with sea ice and extracted brine. My participation on this cruise provided me with a unique hands-on experience in oceanography. The class taught onboard kept me involved in the different research projects on the ship, and gave me the chance to experience science in a very different way than traditional class room teaching.

Kathleen Gosnell, Florida State University

During the CLIVAR 2008 I6S cruise I assisted in trace metal sampling. Trace metals are important components for biological systems, and iron has been shown to be a limiting nutrient for growth in some cases. Trace metal sampling involves a special rosette system which is deployed with GoFlow bottles that contain no metal on the inside in order to reduce contaimination risk. Concentraions of the metals we analyze are so minute in sea water that it is important that "clean" sampling techniques are used when samples are taken. One of the tasks I participated in was to help subsample each bottle depth for nutrients and salinity in addition to our trace metal samples. All of our samples are taken back to land where they are later analyzed in a clean lab. In addition to sampling sea water depths, I also helped sample for aerosols and rain water in order to help determine sources of trace metals to the ocean. Aerosols samples are taken from an aerosol tower which we have set up high on the ship where there is less of a risk for seaspray or smokestack contamination. The aerosols are obtained with a vacuum pump which sucks air through filters in order to collect inorganic traces floating in the atmosphere. Rain samples were obtained every time it rained, and we also attempted to get some snow samples on this leg. However, there were not a lot of rain on this cruise, so we obtained only several samples. For this cruise I was also attempting to learn and create a flow injection ship board method for measuring zinc. Currently there is not a lot of work being done on this element, and it is an important component for photosynthesis. Therefore it would be useful to become sufficient with this method for future cruises. Additionally I would like to create a thesis out of this technique as well. My main purpose was to determine if the method I had chosen will work, and to try to work out some of the issues that would be involved with accurately measuring samples. Although I didn't get as far as measuring sample profiles for I6S, I feel that this method shows promise to use in future research cruises.
In additon to research work, I was also a student in the Marine Sampling Techniques class that was offered for this cruise, as well as taking another class (Biological Oceanography) which I will complete when I return. I believe this class provided a good overview to what these cruises are sampling and working towards, since we talked about what other scientests and students were doing. So overall it was a positive experience since I felt as if I was more aware of the work and research that was going on around me rather than just the trace metal bubble.

Juliana D’Andrilli, Florida State University

Since this was my first experience on a research vessel, I had no
idea what to expect, so I kept all my assumptions to a minimum and took everything in stride. This was a smart line of thinking because from the very start of the trip, Esa Peltola and I were hit with bizarre obstacles, one right after the other.

After all the unpacking and organizing was finished, I was finally able to start my training for taking samples and learning how to use the Dissolved Inorganic Carbon instrumentation. This training session was crammed into about three hours, which initially made me nervous. Esa continued to calm my nerves by assuring me that everything would be learned easily through repetition. He was right. Everyday at midnight, my day would begin and cycle through the same line of work, day in and day out. I was lucky enough to work with a brilliant group of scientists and crew members, also working the night shift, who made the seemingly mundane process of sampling turn into one of the many highlights of my work day. We shared laughs, stories, and songs all around the rosette and bundled up together when the temperature was below zero. Our bunch became a sampling family, and I looked forward to it everyday.

Away from the rosette, I spent the rest of my work day running samples, working on my dissertation research for Florida State University, and watching the most beautiful sunrises. Every day that I went to work began a new adventure. There was always work to do, samples to run, stars and planets to gaze at, sea life to photograph, and shipmates to share experiences with. It has been an unforgettable journey.

Katy Hill

The cruise has been a great experience. I was a member of the midday to midnight CTD watch, and also responsible for Argo float preparation and deployment. As a member of the CTD watch, I was involved in running the console for CTD deployments, and/or working on deck helping to deploy/retrieve. This was probably my favourite part, as it got pretty interesting in rough weather! Some shifts, especially on the shelf edge, felt like a bit of a marathon - as stations were close together, we had to redeploy the rosette as soon as sampling had finished!

We had a number of issues with the instruments on the rosette, which gave me the opportunity to learn about how it all works. We also had a couple of amazing days in calm weather close to the ice - an experience I won't forget in a hurry!

**Appendix A**

## CLIVAR I06S: CTD Temperature and Conductivity Corrections Summary

| Sta/ Cast | ITS-90 Temperature Coefficients $corT = tp2*corP^2 + tp1*corP + t0$ tp2 | tp1 | t0 | Conductivity Coefficients $corC = cp1*corP + c1*C + c0$ cp1 | c1 | c0 | |
|---|---|---|---|---|---|---|---|
| 001/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 002/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 002/03 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 003/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 004/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 005/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 006/01 | -1.0149e-11 | -1.8589e-07 | 0.000589 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 007/01 | -1.0149e-11 | -1.8589e-07 | 0.000589 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 008/02 | -1.0149e-11 | -1.8589e-07 | 0.000589 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 009/02 | -1.0149e-11 | -1.8589e-07 | 0.000589 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 010/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 011/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 012/04 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 013/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 014/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 015/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 016/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 017/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 018/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 019/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 020/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 021/03 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 022/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 023/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 024/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 025/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 026/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 027/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 028/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 029/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 030/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 031/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 032/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 033/03 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 034/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 035/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 036/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 037/03 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 038/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 039/03 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 040/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 041/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |

| Sta/ Cast | ITS-90 Temperature Coefficients $corT = tp2 * corP^2 + tp1 * corP + t0$ tp2 | tp1 | t0 | Conductivity Coefficients $corC = cp1 * corP + c1 * C + c0$ cp1 | c1 | c0 | |
|---|---|---|---|---|---|---|---|
| 042/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 043/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 044/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 045/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 046/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 047/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 048/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 049/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 050/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 051/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 052/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 053/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 054/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 055/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 056/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 057/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 058/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 059/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 060/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 061/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 062/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 063/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 064/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 065/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 066/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 067/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 068/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 069/01 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 070/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 071/02 | 0.0000e+00 | -1.8510e-07 | -0.000030 | -3.35428e-07 | 0.00000e+00 | 0.000714 | |
| 072/03 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 072/05 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 073/02 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 074/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 075/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 076/03 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 077/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 078/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 079/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 080/03 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |
| 081/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 | |
| 081/03 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 | |
| 082/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 | |
| 083/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 | |
| 084/01 | 0.0000e+00 | -1.7577e-07 | -0.002013 | -2.26626e-07 | 0.00000e+00 | -0.001393 | T2C2 |

| Sta/ Cast | ITS-90 Temperature Coefficients $corT = tp2*corP^2 + tp1*corP + t0$ tp2 | tp1 | t0 | Conductivity Coefficients $corC = cp1*corP + c1*C + c0$ cp1 | c1 | c0 |
|---|---|---|---|---|---|---|
| 085/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 086/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 087/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 088/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 089/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 090/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 091/17 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 092/03 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 093/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 094/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 095/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 096/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 097/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 098/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 099/03 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 100/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 101/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 102/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 103/02 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 104/03 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 105/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |
| 106/01 | 0.0000e+00 | 0.0000e+00 | 0.000000 | -4.05469e-07 | -5.96618e-05 | 0.006166 |

**Appendix B**

## Summary of CLIVAR I06S CTD Oxygen Time Constants

(time constants in seconds)

| Temperature | | Pressure | $O_2$ Gradient | dT Gradient |
|---|---|---|---|---|
| Fast($\tau_{Tf}$) | Slow($\tau_{Ts}$) | ($\tau_p$) | ($\tau_{og}$) | ($\tau dT$) |
| 12.0 | 120.0 | 0.04 | 2.00 | 400.0 |

## CLIVAR I06S: Conversion Equation Coefficients for CTD Oxygen

(refer to Equation 1.7.4.0)

| Sta/ Cast | $O_c$ Slope ($c_1$) | Offset ($c_2$) | $P_l$ coeff ($c_3$) | $T_f$ coeff ($c_4$) | $T_s$ coeff ($c_5$) | $\frac{dO_c}{dt}$ coeff ($c_6$) | $T_{dT}$ coeff ($c_7$) |
|---|---|---|---|---|---|---|---|
| 001/02 | 1.0719e-03 | -6.3453e-01 | -1.9372e-03 | -1.1865e-02 | -1.0110e-02 | -1.9938e-06 | -0.00278289 |
| 002/01 | 1.9070e-04 | 4.4860e-02 | 4.4276e-04 | 2.2442e-02 | 4.4357e-03 | 1.9237e-06 | -0.0965536 |
| 002/03 | 3.0162e-04 | 1.0009e+00 | -1.8494e-03 | 5.7420e-02 | -7.1752e-02 | 1.9208e-06 | -0.0218562 |
| 003/02 | 1.9070e-04 | 4.4860e-02 | 4.4276e-04 | 2.2442e-02 | 4.4357e-03 | 1.9237e-06 | -0.0965536 |
| 004/01 | 3.2939e-04 | -6.5662e-02 | 2.2521e-04 | 1.9697e-02 | -6.2212e-03 | 1.4275e-06 | -0.0662805 |
| 005/02 | 2.1432e-04 | -3.6727e-02 | 4.4905e-04 | 2.6798e-02 | 1.7919e-03 | 4.0060e-06 | -0.124479 |
| 006/01 | 4.5370e-04 | -7.9490e-02 | 1.1969e-04 | 1.1755e-02 | -1.0569e-02 | 1.9177e-06 | 0.0166625 |
| 007/01 | 3.7214e-04 | -5.0091e-02 | 1.7973e-04 | 2.3694e-02 | -1.5804e-02 | 2.3555e-06 | -0.031538 |
| 008/02 | 3.9537e-04 | -3.8010e-02 | 1.4461e-04 | 2.4408e-02 | -1.9334e-02 | -6.1317e-07 | -0.0181314 |
| 009/02 | 4.8924e-04 | -4.9881e-02 | 6.8586e-05 | 1.0739e-02 | -1.3474e-02 | 3.5834e-06 | 0.0344883 |
| 010/01 | 3.2476e-04 | 5.9844e-02 | 1.1450e-04 | 3.1707e-02 | -2.3247e-02 | 8.1967e-07 | -0.0496859 |
| 011/01 | 4.4194e-04 | -6.9139e-02 | 1.0526e-04 | 9.5730e-03 | -7.2977e-03 | -1.3737e-07 | 0.0123479 |
| 012/04 | 4.6111e-04 | -6.3794e-02 | 9.2733e-05 | 8.2423e-03 | -8.1676e-03 | 1.5907e-06 | 0.0345339 |
| 013/01 | 4.1118e-04 | -7.5939e-04 | 8.7003e-05 | -2.4705e-02 | 2.6319e-02 | 3.5924e-06 | 0.0836915 |
| 014/02 | 6.2233e-04 | -2.4658e-01 | 1.0961e-04 | -1.2210e-02 | 3.7776e-03 | -1.5216e-03 | 0.0894215 |
| 015/02 | 5.4292e-04 | -1.8515e-01 | 1.0658e-04 | -2.0809e-03 | -1.6460e-03 | 2.0977e-06 | 0.0385654 |
| 016/01 | 5.0067e-04 | -1.6101e-01 | 1.2120e-04 | 1.6449e-03 | -2.2471e-03 | 6.4802e-07 | 0.0162857 |
| 017/01 | 5.2845e-04 | -1.9972e-01 | 1.2581e-04 | 1.7940e-02 | -1.9344e-02 | 7.1680e-06 | -0.00125953 |
| 018/01 | 5.3004e-04 | -2.0458e-01 | 1.2678e-04 | 3.5813e-02 | -3.7742e-02 | 3.6441e-06 | -0.0344097 |
| 019/01 | 4.9620e-04 | -2.0504e-01 | 1.4256e-04 | 1.7505e-02 | -1.5386e-02 | 9.1453e-07 | -0.012084 |
| 020/01 | 5.0163e-04 | -2.0553e-01 | 1.3925e-04 | 1.2422e-03 | 8.9380e-05 | 2.5316e-06 | -0.00185623 |
| 021/03 | 4.8799e-04 | -1.8585e-01 | 1.3615e-04 | -2.1173e-03 | 4.1829e-03 | -2.5184e-07 | 0.00831348 |
| 022/01 | 4.4939e-04 | -1.4497e-01 | 1.3759e-04 | -1.8236e-02 | 2.2365e-02 | 7.5340e-07 | 0.0214677 |
| 023/02 | 4.9714e-04 | -2.0597e-01 | 1.4172e-04 | 1.4862e-02 | -1.1683e-02 | 6.8734e-06 | -0.00248223 |
| 024/01 | 4.9922e-04 | -1.9784e-01 | 1.3477e-04 | -1.7335e-03 | 3.2601e-03 | 1.4803e-06 | 0.0146743 |
| 025/01 | 5.1889e-04 | -2.4809e-01 | 1.5344e-04 | 1.8881e-02 | -1.6886e-02 | 3.6832e-06 | -0.0230958 |
| 026/02 | 4.9286e-04 | -1.9812e-01 | 1.3975e-04 | 8.2309e-04 | 1.6673e-03 | 1.9945e-05 | 0.00435665 |
| 027/02 | 4.8885e-04 | -1.8636e-01 | 1.3499e-04 | -2.4002e-03 | 4.3268e-03 | 1.3345e-06 | 0.0169762 |
| 028/01 | 5.0234e-04 | -2.0985e-01 | 1.4075e-04 | 5.0750e-03 | -3.2387e-03 | 3.3735e-06 | 0.0111542 |
| 029/01 | 5.0817e-04 | -2.2934e-01 | 1.4927e-04 | 1.8414e-02 | -1.5608e-02 | 2.3588e-06 | -0.00603803 |
| 030/01 | 4.7580e-04 | -1.6650e-01 | 1.3122e-04 | -2.6179e-03 | 5.1255e-03 | -1.5011e-06 | 0.0152518 |
| 031/02 | 4.9811e-04 | -1.9941e-01 | 1.3716e-04 | -1.1176e-03 | 1.9772e-03 | -6.8565e-07 | 0.00646489 |
| 032/01 | 5.0453e-04 | -2.0922e-01 | 1.3941e-04 | 1.1609e-02 | -9.9758e-03 | 6.5446e-07 | 0.0231791 |
| 033/03 | 5.0554e-04 | -2.0778e-01 | 1.3786e-04 | -4.5196e-03 | 5.5482e-03 | 9.8796e-07 | 0.0299417 |

| Sta/ Cast | $O_c$ Slope ($c_1$) | Offset ($c_2$) | $P_l$ coeff ($c_3$) | $T_f$ coeff ($c_4$) | $T_s$ coeff ($c_5$) | $\frac{dO_c}{dt}$ coeff ($c_6$) | $T_{dT}$ coeff ($c_7$) |
|---|---|---|---|---|---|---|---|
| 034/01 | 5.0310e-04 | -2.0102e-01 | 1.3567e-04 | 3.6042e-03 | -1.4038e-03 | 2.8590e-06 | 0.0421217 |
| 035/01 | 5.1959e-04 | -2.2617e-01 | 1.4102e-04 | 7.1610e-03 | -7.0090e-03 | 3.2009e-06 | 0.0177188 |
| 036/01 | 5.3587e-04 | -2.5506e-01 | 1.4840e-04 | 2.3432e-02 | -2.4553e-02 | 1.9907e-06 | -0.0271988 |
| 037/03 | 5.1315e-04 | -2.1921e-01 | 1.4069e-04 | 1.3994e-03 | -2.4467e-04 | 1.4313e-06 | 0.00282423 |
| 038/01 | 5.0257e-04 | -2.0171e-01 | 1.3719e-04 | 1.0226e-02 | -7.7726e-03 | 7.0655e-07 | 0.0121067 |
| 039/03 | 4.7850e-04 | -1.8438e-01 | 1.4128e-04 | -3.7235e-04 | 1.0230e-02 | 9.9689e-07 | -0.0568972 |
| 040/01 | 5.4504e-04 | -2.5121e-01 | 1.4166e-04 | -9.4129e-04 | -5.0959e-03 | 8.7874e-08 | 0.0492012 |
| 041/01 | 5.3572e-04 | -2.4361e-01 | 1.4280e-04 | 3.0905e-03 | -6.1540e-03 | 1.9366e-06 | 0.0418171 |
| 042/01 | 4.8314e-04 | -1.8828e-01 | 1.4150e-04 | 2.2501e-03 | 7.9427e-03 | 2.3619e-06 | 0.0142321 |
| 043/02 | 6.0010e-04 | -2.9049e-01 | 1.3121e-04 | -2.8848e-02 | 3.6959e-03 | 1.6446e-06 | 0.175343 |
| 044/01 | 4.3467e-04 | -1.5285e-01 | 1.5106e-04 | 1.7772e-02 | 1.5522e-02 | 1.4533e-06 | -0.180003 |
| 045/01 | 5.0099e-04 | -2.1443e-01 | 1.4635e-04 | 1.4215e-02 | -5.8046e-03 | -2.3291e-07 | -0.0655017 |
| 046/02 | 4.4955e-04 | -1.6117e-01 | 1.4957e-04 | -3.1536e-04 | 2.5437e-02 | 1.6465e-06 | -0.0395302 |
| 047/01 | 3.5981e-04 | -1.0434e-01 | 1.7779e-04 | 2.5548e-02 | 5.2704e-02 | 3.1965e-06 | -0.178084 |
| 048/01 | 5.2220e-04 | -2.3188e-01 | 1.4357e-04 | 3.7935e-02 | -3.5063e-02 | 1.7337e-06 | 0.0219696 |
| 049/01 | 4.6018e-04 | -1.8774e-01 | 1.6629e-04 | 2.9403e-02 | 1.1405e-02 | 1.5552e-06 | 0.0576895 |
| 050/01 | 5.2360e-04 | -2.2814e-01 | 1.4122e-04 | -3.2665e-04 | 3.1887e-03 | 2.4562e-06 | 0.00932968 |
| 051/01 | 5.1038e-04 | -2.2493e-01 | 1.4927e-04 | 2.6512e-03 | 1.1901e-02 | 1.9519e-06 | -0.0388949 |
| 052/02 | 5.3804e-04 | -2.4073e-01 | 1.3905e-04 | 3.8749e-02 | -4.3776e-02 | -1.2658e-07 | -0.00158746 |
| 053/01 | 5.7531e-04 | -2.7579e-01 | 1.3669e-04 | 7.4501e-02 | -9.2820e-02 | 1.4339e-06 | 0.091435 |
| 054/02 | 5.0369e-04 | -2.0873e-01 | 1.4191e-04 | -1.0965e-02 | 2.1387e-02 | 1.2001e-06 | -0.055222 |
| 055/02 | 4.9190e-04 | -2.0857e-01 | 1.5086e-04 | 3.1756e-02 | -6.4111e-03 | 9.7951e-07 | -0.184108 |
| 056/01 | 5.5815e-04 | -2.3627e-01 | 1.2594e-04 | 6.1023e-04 | -2.6468e-02 | 2.0515e-03 | 0.0621401 |
| 057/01 | 5.1688e-04 | -2.1511e-01 | 1.3776e-04 | -1.6832e-02 | 2.1896e-02 | 2.2968e-06 | 0.0300992 |
| 058/01 | 5.2032e-04 | -2.2833e-01 | 1.4386e-04 | -7.8589e-03 | 1.9197e-02 | 2.7610e-06 | 0.0308552 |
| 059/01 | 5.2253e-04 | -2.2733e-01 | 1.4124e-04 | 1.4734e-02 | -7.7364e-03 | 2.7770e-06 | -0.0549327 |
| 060/01 | 5.1894e-04 | -2.1843e-01 | 1.3818e-04 | -8.8847e-03 | 1.4676e-02 | 2.0616e-07 | -0.0432293 |
| 061/02 | 5.2635e-04 | -2.1649e-01 | 1.3226e-04 | -4.4637e-02 | 3.6376e-02 | 2.1332e-06 | 0.0861762 |
| 062/01 | 5.3217e-04 | -2.1981e-01 | 1.3127e-04 | 5.4543e-03 | -1.5911e-02 | 2.7929e-06 | 0.230185 |
| 063/01 | 5.2587e-04 | -2.2778e-01 | 1.3915e-04 | 8.0598e-03 | -5.0867e-03 | 9.8301e-07 | -0.0566753 |
| 064/02 | 5.1994e-04 | -2.1570e-01 | 1.3633e-04 | 1.7921e-02 | -1.3630e-02 | 2.1589e-06 | 0.0494831 |
| 065/01 | 5.1925e-04 | -2.2684e-01 | 1.4436e-04 | -4.2365e-03 | 2.0236e-02 | 1.5470e-06 | -0.0160705 |
| 066/01 | 5.2103e-04 | -2.3051e-01 | 1.4590e-04 | 1.3645e-03 | 1.6806e-02 | 1.6987e-06 | 0.000276312 |
| 067/02 | 5.1827e-04 | -2.2981e-01 | 1.4795e-04 | -1.2317e-02 | 3.7023e-02 | 2.0878e-06 | 0.0442998 |
| 068/02 | 5.2332e-04 | -2.2065e-01 | 1.3759e-04 | 5.7480e-03 | 1.5468e-03 | 9.9323e-07 | -0.0778716 |
| 069/01 | 5.2889e-04 | -2.2292e-01 | 1.3504e-04 | 4.1206e-03 | -2.5000e-03 | 2.1413e-07 | -0.0560485 |
| 070/02 | 5.2877e-04 | -2.3723e-01 | 1.4451e-04 | 8.0099e-03 | 8.9299e-03 | 7.2988e-07 | -0.077044 |
| 071/02 | 5.2077e-04 | -2.1929e-01 | 1.3878e-04 | 2.2937e-03 | 1.0646e-02 | 5.9864e-07 | -0.0624633 |
| 072/03 | 5.2301e-04 | -2.3145e-01 | 1.4600e-04 | 4.1518e-03 | 2.0077e-02 | 5.4640e-07 | -0.0810117 |
| 072/05 | 5.5798e-04 | -2.9429e-01 | 1.9095e-04 | -4.2066e-03 | 1.1731e-02 | 1.1416e-06 | 0.123954 |
| 073/02 | 5.2903e-04 | -2.3276e-01 | 1.4214e-04 | 5.7163e-03 | 1.1266e-02 | -1.6435e-07 | -0.0827708 |
| 074/01 | 5.2554e-04 | -1.9857e-01 | 1.2385e-04 | 3.0028e-03 | -2.6135e-02 | 1.1506e-04 | 0.00312071 |
| 075/01 | 4.9000e-04 | -1.2846e-01 | 1.0540e-04 | -4.4444e-02 | -6.2632e-03 | -3.5036e-04 | 0.0405129 |
| 076/03 | 5.0191e-04 | -1.4820e-01 | 1.0945e-04 | -5.7203e-02 | 8.9902e-03 | -7.4821e-05 | 0.0644376 |
| 077/01 | 5.5187e-04 | -2.8332e-01 | 1.5909e-04 | 2.7507e-02 | 1.9683e-02 | 9.6467e-07 | -0.106477 |
| 078/01 | 5.3016e-04 | -2.2498e-01 | 1.2925e-04 | 1.9549e-02 | 1.1055e-02 | 4.0061e-07 | -0.188281 |

| Sta/ Cast | $O_c$ Slope ($c_1$) | Offset ($c_2$) | $P_l$ coeff ($c_3$) | $T_f$ coeff ($c_4$) | $T_s$ coeff ($c_5$) | $\frac{dO_c}{dt}$ coeff ($c_6$) | $T_{dT}$ coeff ($c_7$) |
|---|---|---|---|---|---|---|---|
| 079/01 | 5.3462e-04 | -2.4115e-01 | 1.4197e-04 | 1.1818e-02 | 1.2157e-02 | 5.7221e-07 | -0.0534564 |
| 080/03 | 5.1253e-04 | -1.8890e-01 | 1.2366e-04 | -3.5146e-03 | -1.0101e-02 | 1.7878e-07 | 0.0435988 |
| 081/01 | 4.8712e-04 | -2.1483e-01 | 1.5302e-04 | 2.4501e-02 | -1.1985e-02 | 1.0806e-06 | -0.00766075 |
| 081/03 | 5.0061e-04 | -2.3093e-01 | 1.4819e-04 | 1.3464e-02 | 9.4020e-03 | 5.9832e-07 | -0.0839724 |
| 082/01 | 4.9901e-04 | -2.3413e-01 | 1.5576e-04 | -2.6313e-03 | 2.0456e-02 | 5.0460e-07 | 0.0428336 |
| 083/01 | 4.7942e-04 | -1.8993e-01 | 1.3818e-04 | 9.4257e-03 | -5.2678e-04 | 1.6187e-06 | -0.0105632 |
| 084/01 | 4.8530e-04 | -2.0764e-01 | 2.0083e-04 | 8.7095e-03 | -2.2914e-02 | 1.2714e-06 | 0.0611817 |
| 085/01 | 4.8230e-04 | -1.9213e-01 | 1.3671e-04 | 1.8831e-02 | -4.2209e-03 | 4.1204e-07 | -0.0702944 |
| 086/01 | 4.6439e-04 | -1.2894e-01 | 8.4210e-05 | 3.5542e-02 | -4.3872e-03 | 4.0219e-07 | -0.164395 |
| 087/01 | 3.9726e-04 | 4.5783e-02 | -5.8126e-05 | 2.9310e-02 | 2.2866e-02 | 1.2224e-07 | -0.190937 |
| 088/01 | 5.1925e-04 | -2.6768e-01 | 1.6585e-04 | -9.7597e-03 | 1.9867e-02 | 3.8011e-07 | 0.0583696 |
| 089/01 | 4.3785e-04 | -1.0159e-01 | 7.1860e-05 | -5.7321e-03 | -2.3744e-03 | -9.1196e-09 | 0.0619657 |
| 090/01 | 5.1889e-04 | -2.5897e-01 | 1.6484e-04 | -1.5755e-02 | 3.0867e-02 | 2.0440e-07 | 0.00573727 |
| 091/17 | 4.1883e-04 | -1.3009e-02 | -8.7826e-05 | -4.0621e-03 | 2.7987e-02 | 1.1917e-03 | -0.0534441 |
| 092/03 | 6.4032e-04 | -4.0881e-01 | 1.9747e-04 | 3.4571e-02 | 5.5894e-02 | 1.1064e-06 | -0.321872 |
| 093/02 | 4.5162e-04 | -1.1529e-01 | 6.4733e-05 | -2.1940e-02 | 3.0879e-02 | 1.7133e-07 | 0.0100288 |
| 094/02 | 4.0734e-04 | 1.8904e-02 | -4.5432e-05 | -8.1863e-03 | 4.3503e-02 | 1.0167e-06 | -0.0853469 |
| 095/02 | 4.2229e-04 | -1.6767e-02 | 4.3345e-06 | 5.7451e-03 | 3.9289e-02 | -1.6450e-07 | -0.190124 |
| 096/02 | 4.8181e-04 | -1.8344e-01 | 1.2949e-04 | -3.9558e-03 | 1.7211e-02 | -3.1250e-07 | -0.040233 |
| 097/01 | 5.0099e-04 | -2.1448e-01 | 1.3182e-04 | 1.8249e-02 | 1.1756e-03 | 1.0633e-06 | -0.0814092 |
| 098/01 | 5.0765e-04 | -2.3362e-01 | 1.4224e-04 | -1.8253e-04 | 2.2745e-02 | 1.3799e-06 | -0.0456053 |
| 099/03 | 4.9221e-04 | -2.0673e-01 | 1.3735e-04 | 9.3311e-03 | 1.9108e-03 | 6.5201e-07 | -0.0261423 |
| 100/01 | 4.9177e-04 | -2.0599e-01 | 1.3776e-04 | -6.8981e-03 | 1.4155e-02 | 1.1306e-06 | -0.00285198 |
| 101/02 | 4.6977e-04 | -1.6481e-01 | 1.2875e-04 | 1.2121e-03 | -2.6649e-03 | 4.1977e-07 | 0.00859448 |
| 102/01 | 4.7606e-04 | -1.7713e-01 | 1.3121e-04 | 6.0107e-03 | 3.4914e-04 | 4.8694e-07 | -0.00990871 |
| 103/02 | 5.0774e-04 | -2.3979e-01 | 1.4948e-04 | -1.4458e-02 | 3.6841e-02 | 2.8770e-07 | 0.0248785 |
| 104/03 | 4.6837e-04 | -1.4621e-01 | 1.2105e-04 | 2.2698e-03 | -1.5330e-02 | 1.6819e-06 | 0.0390798 |
| 105/01 | 4.6331e-04 | -1.3650e-01 | 1.1975e-04 | -2.1238e-02 | 7.7454e-03 | -1.1281e-08 | 0.0647692 |
| 106/01 | 4.9560e-04 | -1.9925e-01 | 1.3649e-04 | 7.5213e-03 | 3.9321e-03 | 6.6492e-07 | -0.0165157 |

**Appendix C**

# CLIVAR I06S CTD Cast Problems and Comments

| Key to Abbreviations | |
|---|---|
| RO | Raw CTDO data offset to match surrounding data prior to fitting to bottle data |
| Q3/Q4/Q7 | specified CTD sensor questionable/bad/despiked (quality code 3/4/7) |
| Q5/Q9 | specified CTD sensor malfunctioning/absent (quality code 5/9) |
| T1C1 | Primary CTD Temperature/Conductivity sensors (default TC for most casts). |
| T2C2 | Secondary Temperature/Conductivity sensors (used for final CTD data when primary sensors noisier). |
| UP | use UP CAST for final pressure-series data (default: DOWN CAST) |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 1/2 | New slip rings, new wire termination. CTDO plumbed to secondary pump circuit until sta 4. | |
| 2/1 | CTDS/CTDO noisy from 644db downcast through entire upcast; T2C2 noisier; T1C1 stepping upcast | Use T1C1; Despike CTDS/Despike CTDO; CTDT-Q3 / CTDS-Q3 / 660-950db(btm), CTDO-Q3 / 644-950db(btm) |
| | Altimeter readings random, rapid changes in bottom depth (±400m) | Stopped winch at 400m when target depth was 800m, package brought up quickly. |
| | No bottle oxygens above 69db or below 826db | Added three near-surface bottles from sta 2/3, 950db bottle from sta 3/2 for CTDO fitting. |
| 2/3 | Sta 2/3 was done AFTER sta 3/2 | Returned to sta 2 position before cast. |
| | CTDT2 cutout 220-265db downcast + top 102db upcast; very noisy T2C2 signal. | Use T1C1: primary sensors ok. |
| | CTDO noisy | CTDO-Q3 / 0-24db, CTDO-Q3 / 88-376db(btm) |
| 3/2 | Rapid changes in bottom depth during cast (±400m). | |
| | CTDS/CTDO noisy throughout; T1C1 stepping upcast; T2C2 not stepping, but noisier CTDS2. | Use T1C1; Discovered/replaced? a faulty PUMP1 after cast: pin 2 (power +) shorted to the pump case. |
| | T1C1/CTDO signals noisy, even after despiking | RO/0-12db; Despike CTDS/Despike CTDO; CTDT-Q3 / CTDS-Q3 / CTDO-Q3 / 0-966db(btm) |
| 4/1 | CTDO sensor switched to primary pump circuit before cast. | |
| | CTDT2 cutout top 280db downcast + top 80db upcast | Use T1C1: primary sensors ok. |
| | No bottle oxygen at bottom. | Added 2 deepest bottles from sta 6 for CTDO fitting. |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 5/2 | CTDT2 cutout top 290db downcast and top 92db upcast. | Use T1C1: primary sensors ok. |
| 6/1-18/1 | Severe CTDS/CTDO noise, started abruptly 400-550db downcasts; stopped abruptly upcasts 275-190db. CTDS noisy but improved below 1000-1500db downcast; upcasts significantly WORSE all casts. | T2C2 downcasts less noisy stas 6-9 only: used T2C2 for stas 6-9, T1C1 for stas 10-18. T2C2 used for all CTD [upcast] data at bottle trips (somewhat less noisy). |
| 6/1 | Changed CTDT2 sensor from S/N 2495 to S/N 2322 before cast. | |
| | Package hit bottom | Tension/wire ok, but mud on CTD. |
| | T1C1/T2C2 signals both noisy | Use T2C2; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 328-1182db |
| | CTDO noisy; T2C2/CTDO on different pump circuits | Despike CTDO-Q3 / 520-2334db(btm) |
| 7/1 | T1C1/T2C2 signals both noisy | Use T2C2; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 340-1238db |
| | CTDO noisy; T2C2/CTDO on different pump circuits | Despike CTDO-Q3 / 514-2342db(btm) |
| 8/2 | T1C1/T2C2 signals both noisy | Use T2C2; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 312-1232db |
| | CTDO noisy; T2C2/CTDO on different pump circuits | Despike CTDO-Q3 / 434-2970db(btm) |
| 9/2 | Several 8-11.5db yoyos between 2880-3027db downcast | OK, probably from ship-roll. |
| | T1C1/T2C2 signals both noisy | Use T2C2; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 232-1652db |
| | CTDO noisy; T2C2/CTDO on different pump circuits | Despike CTDO-Q3 / 322-3086db(btm) |
| 10/1 | T1C1/T2C2/CTDO signals noisy | Use T1C1; Despike CTDS/Despike CTDO; CTDT-Q3 / CTDS-Q3 / CTDO-Q4 / 540-1830db; CTDO-Q3 / 1832-3798db(btm). |
| | CTDC signal noisy: sigma theta high, CTDS high on theta-S overlays | Despike CTDS; CTDT-Q3 / CTDS-Q3 / 3530-3758db |
| | 2-minute delay at 3762 db (bottom at 3798 db) | |
| 11/1 | Wire kinked 3.2m above termination | 100m wire removed/RETERMINATED after cast. |
| | T1C1/T2C2 signals both noisy | Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 544-1710db |
| | CTDO drop/signal noisy | Despike CTDO-Q4 / 544-1710db; CTDO-Q3 / 1712-3826db; CTDO-Q4 / 3828-3842db(btm) |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 12/1 | ABORTED at 346db: abrupt signal loss/communications failure starting 315db. | Cast not reported. Rebooted Seasave host. RETERMINATED Wire after cast; electrical connection broken/repaired. |
| 12/4 | Found another kink<br><br>T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | Cut wire/shift to older wire/forward winch after cast. RETERMINATED during transit.<br><br>Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 552-1874db<br><br>Despike CTDO-Q4 / 552-1874db, CTDO-Q3 / 1876-3790db, CTDO-Q4 / 3790-3864db(btm) |
| 13/1 | CTDO sensor changed from S/N 0872 to S/N 1129 before cast.<br><br>Problem with new winch/CTD connection<br><br>T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | <br><br>Both electrical ends RETERMINATED before cast.<br><br>Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 562-1712db<br><br>Despike CTDO-Q4 / 562-1712db, CTDO-Q3 / 1714-4030db, CTDO-Q4 / 4032-4108db(btm) |
| 14/2 | Primary sensors better above 2290db, secondary sensors better below 2290db<br><br>T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal VERY noisy | Reported both sensor pairs, both still very noisy but better in different sections.<br><br>Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 556-1598db, CTDT-Q3 / CTDS-Q3 / 2290-2894db, CTDT-Q4 / CTDS-Q4 / 2896-4328db(btm)<br><br>Despike CTDO-Q4 / 556-4328db(btm) |
| 15/2 | No kinks on recovery, "ugly looking" electrical connection from the wire into the slip rings<br><br>T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | Redid connection after cast.<br><br>Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 546-1246db<br><br>Despike CTDO-Q4 / 546-1246db, CTDO-Q3 / 1248-4254db, CTDO-Q4 / 4256-4434db(btm) |
| 16/1 | Pump replaced before cast. ODF acquisition failed.<br><br>T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | Cast re-started in-water at 12db with Seasave software.<br><br>Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 568-1334db<br><br>Despike CTDO-Q4 / 568-1334db, CTDO-Q3 / 1336-4400db, CTDO-Q4 / 4402-4504db(btm) |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 17/1 | T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 538-1380db<br><br>Despike CTDO-Q4 / 538-1380db, CTDO-Q3 / 1382-4470db, CTDO-Q4 / 4472-4538db(btm) |
| 18/1 | T1C1/T2C2 signals both noisy<br><br>CTDO drop/signal noisy | Use T1C1; Despike CTDS; CTDT-Q3 / CTDS-Q3 / 550-1390db<br><br>Despike CTDO-Q4 / 550-1390db, CTDO-Q3 / 1392-4544db, CTDO-Q4 / 4546-4740db(btm) |
| 19/1 | Replaced pump cable, ran water through pump tubing before cast to ensure it was not plugged. | Profiles look good. |
| 21/3 | CTDO not equilibrated at surface<br><br>Kink in wire about 4m above rosette. | RO / CTDO-Q7 / 0-6db<br><br>RETERMINATED wire after cast |
| 22/1 | Fluorometer unresponsive, no data<br><br>8db yoyo / 1.5-minute delay at 4002 db downcast (bottom at 4134 db) | FLUOR-Q5 |
| 23/1 | ABORTED at 165db due to extreme weather conditions. | Cast not reported. No samples taken; hove to for 9hrs to let wind/seas improve. |
| 23/2 | Added some weight to rosette and removed 9 bottles from outer ring of rosette to improve sink rate.<br><br>Fluorometer unresponsive, no data<br><br>CTDO not equilibrated at surface | <br><br><br><br>FLUOR-Q5<br><br>RO / CTDO-Q7 / 0-8db |
| 24/1 | Fluorometer unresponsive, no data<br><br>CTDO not equilibrated at surface | FLUOR-Q5<br><br>RO / CTDO-Q7 / 0-6db |
| 25/1 | Fluorometer non-responsive, no data | FLUOR-Q5 |
| 26/2 | All 36 bottles back on rosette.<br><br>Fluorometer unresponsive, no data | <br><br>FLUOR-Q5 |
| 27/2 | Fluorometer unresponsive, no data | FLUOR-Q5 |
| 28/1 | Fluorometer unresponsive, no data<br><br>+0.07 density gradient in top 10db | FLUOR-Q5 |
| 29/1 | Fluorometer unresponsive, no data | FLUOR-Q5 |
| 30/1 | Fluorometer (S/N 2871) noted to be unresponsive during cast, apparently failing since sta 22.<br><br>Two 10-second gaps in deep data at 5190-5194db and 5216-5222db | FLUOR-Q5, removed after cast. Both main (S/N 2871) and spare (S/N 2838) Seapoint fluorometers non-responsive to light during bench test post-cast.<br><br>Pressure-sequenced data interpolated using nearby data. |
| 31/2 | No Fluorometer on rosette this cast | FLUOR-Q9 |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 32/1 | No Fluorometer on rosette this cast<br>CTDO not equilibrated at surface<br>Bottom depth readings varied by 200m. | FLUOR-Q9<br>RO / CTDO-Q7 / 0-6db |
| 33/3 | U. of Hawaii Fluorometer (ECO-AFL S/N AFLD-045) installed before cast.<br>+0.06 density gradient at surface in top 10db | |
| 37/3 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-6db |
| 38/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-6db |
| 39/3 | Replaced carousel S/N 0187 with S/N 0113 before cast.<br>CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-6db |
| 42/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 43/2 | 3-minute delay at 4266 db down, reason not documented | |
| 44/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-10db |
| 47/1 | Wave in hangar before cast.<br>CTDO not equilibrated at surface | Mechanical RETERMINATION before cast (preventative)<br>RO / CTDO-Q7 / 0-8db |
| 48/1 | Wind down to 20 kts, calm enough to leave on all bottles and sample underway.<br>CTDO not equilibrated at surface<br>2-minute delay at 5894 db (bottom at 5922 db) | RO / CTDO-Q7 / 0-10db |
| 51/1 | Noisy Fluorometer. Relatively calm weather.<br>2-minute delay at 4460 db (bottom at 4554 db) | |
| 53/1 | CTDO not equilibrated at surface<br>Offset/drop in primary CTDC sensor starting btl 3/5050db upcast | RO / CTDO-Q7 / 0-6db<br>Use T2C2 for all CTD trip data. |
| 55/2 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 56/1 | CTDO not equilibrated at surface<br>CTDS and CTDO offset ~1010-1110db, CTDS only ~1510-1630db downcast. | RO / CTDO-Q7 / 0-6db<br>UP |
| 57/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-6db |
| 58/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-10db |
| 59/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 60/1 | CTDO not equilibrated at surface<br>1.5-minute delay at 5484 db (bottom at 5544 db) | RO / CTDO-Q7 / 0-6db |
| 61/2 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 62/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 63/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 64/1 | ABORTED near surface: tagline tied on rosette at start. | Cast not reported. |
| 64/2 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 70/2 | CTDT2 cutout from btl 105/4492db to surface upcast. | Use T1C1 |
| 71/2 | CTDT2 cutout from 1345db downcast through end of upcast. | Use T1C1 |
| 72/1 | ABORTED at 24db: pressure at surface read -900db, pumps did not turn on. | Cast not reported. |
| 72/2 | ABORTED: also failed (no details logged). | Cast not reported. |
| 72/3-80/3 | Large CTDO offset segments on downcasts starting sta. 74, CTDS1 "jittery" in same areas; offsets/noise far worse CTDS1 on upcasts. | Use T2C2: small-scale noise, but cleaner signal throughout cast; degrades substantially by sta. 80 |
| 72/3 | NEW CTD/PRESSURE (#381/58952), new CTDT2 (4486) at or before cast 3.<br><br>Full-depth cast; Multiple upcast restarts attempted to fix trip-confirm problems.<br><br>Bottle data only at cast max.pressure<br><br>CTDO noisy | Use T2C2<br><br><br><br><br>Used 073/02 CTDO corrections (next deep cast with same sensors).<br><br>Despike CTDO-Q7 / 3272-3323db, CTDO-Q7 / 3364-3441db, CTDO-Q7 / 3558-3598db |
| 72/5 | New cable fixed carousel problem. Carousel 0187 probably swapped back in sometime during sta 72 as well. Cast to 1000m only.<br><br>CTDO not equilibrated at surface | <br><br><br><br><br>RO / CTDO-Q7 / 0-8db<br><br>Use T2C2 |
| 73/2 | | Use T2C2 |
| 74/1 | CTDO noisy/offset (low) segments downcast ~1700±20db and 2500-2550db. | Use T2C2/UP |
| 75/1 | CTDO noisy/offset (low) segments downcast ~1600-2680db and 2900-3000db | Use T2C2/UP |
| 76/3 | CTDO noisy/offset (low) segments downcast ~1550-1670db, 1700-1750db and 2370-2570db.<br><br>Both CTDC sensors and CTDO noisy (sensor fouling?) 1410-1470db upcast<br><br>Wire out zeroed at ~2500m downcast, reset at 4000m.<br><br>50db yoyo / 7-minute delay at 4756 db back to 4806 db upcast (after bottom bottle at 4945 db already tripped) | Use T2C2/UP<br><br><br><br><br>Despike CTDS-Q7 / 1424-1470db; Despike CTDO-Q7 / 1420-1476db<br><br>Added 4000m to wire out |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 77/1 | CTDO noisy/long offset (low) segments downcast 3910-4248db and 4314-4454db, ~4140-1260db upcast: continuous/worse on upcast with noisy T/C/S as well. | Use T2C2: T1C1 much noisier. |
| | CTDO signal offset low and/or noisy | Despike CTDO; RO / CTDO-Q7 / 1474-1776db and 3900-4474db |
| 78/1 | Replaced PUMP1 before this cast. | |
| | Long CTDO offset segment (low) 1532db downcast to ~1150db upcast. Noisier on upcast with spiky T/C/S as well. | Use T2C2: T1C1 MUCH noisier. |
| | CTDO signal offset low and noisy, still noisy 1600db downcast to bottom | Despike CTDO; RO / CTDO-Q7 / 1514-1598db, CTDO-Q3 / 1600-4020db(btm) |
| 79/1 | CTDO switched to secondary (PUMP2) circuit before cast. | |
| | T/C/S noisy, CTDO noisy/long offset segment (low) 1534-1574db downcast and 1700db downcast to ~1200db upcast. Primary C/S drops out starting btl 14/1220db | Use T2C2: T1C1 MUCH noisier. |
| | CTDO signal offset low and noisy, still problems 3426db downcast to bottom | Despike CTDO-Q7 / 1524-1574db, RO / CTDO-Q7 / 1700-3424db(btm), CTDO-Q3 / 3426-3532db(btm) |
| 80/2 | ABORTED cast to replace spigot. | Cast not reported. |
| 80/3 | T1C1 plugged into CTD endcap connectors for T2C2, and *vice versa*. Sensors on same pumps and not physically relocated. | |
| | T/C/S noisy, CTDO noisy/long offset segment (low) 750db downcast to 200db upcast (T1C1 MUCH noisier). | Use T2C2; Change out CTD after cast: inspection of CTD found one pin entirely corroded away on an unused sensor plug-in, under the dummy plug. |
| | CTDO signal offset low and noisy, still bad 2826db downcast to bottom | Despike CTDO; RO / CTDO-Q7 / 750-2824db, CTDO-Q3 / 2826-2956db(btm) |
| 81/1-90/1 | Did not wait 60 secs. for non-ODF SBE pumps to turn on. | Only stas 85/89 go back up to 2-4db, other casts had no stop at surface, top 10-18db data useless/extrapolated. |
| 81/1 | Switch to U. of Hawaii spare CTD (#725) before cast, CTDO on primary circuit; no T2C2 this cast. | |
| | CTDO not equilibrated at surface; NO STOP at surface, pump on at 8m. | RO / CTDO-Q7 / 0-14db, top 8db extrapolated. |
| | 3.5-minute delay/several yoyos between 56-72db down | |
| | CTDT1 sensor cutout from 1000db downcast to 450db upcast. | Downcast pressure-sequenced data only reported to 998db (cast to 1148db). |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 81/3 | RETERMINATED, changed cable between CTD endcap/CTDT1 sensor. Added secondary pump/T2C2 sensors before cast. | |
| | 18 of 36 btls removed from rosette. | |
| | CTDO not equilibrated at surface: NO STOP at surface, pump on at 16m. | RO / CTDO-Q7 / 0-24db; top 16db extrapolated. |
| | NO STOP at bottom, min winch speed=20m/min. | |
| | Multiple small yoyos up to 11db during downcast | Probably due to ship-roll. |
| 82/1 | CTDO not equilibrated at surface: NO STOP at surface, pump on at 11m. | RO / CTDO-Q7 / 0-14db; Top 8db extrapolated. |
| 83/1 | CTDO not equilibrated at surface: NO STOP at surface, pump on at 15m. | RO / CTDO-Q7 / 0-20db; top 12db extrapolated. |
| 84/1 | CTDO not equilibrated at surface: NO STOP at surface, pump on at 10m. | RO / CTDO-Q7 / 0-16db; Top 10db extrapolated. |
| | CTDS1 spiky/noisy 200-500db downcast (sensor fouling?) | Use T2C2 |
| | Three small (7-10db) yoyos near bottom of cast | Probably due to ship-roll. |
| 85/1 | CTDO not equilibrated at surface | RO / CTDO-Q7 / 0-8db |
| 86/1 | CTDO not equilibrated at surface: NO STOP at surface, pump on at 11m. | RO / CTDO-Q7 / 0-14db; Top 8db extrapolated. |
| 87/1 | CTDO not equilibrated at surface: NO STOP at surface, pump on at 8m. | RO / CTDO-Q7 / 0-12db; Top 8db extrapolated. |
| | Hooked cable during recovery at end of cast. | LOST PAR sensor and mounting. |
| 88/1-106/1 | No PAR sensor attached (lost sta. 87) | PAR-Q9 |
| 88/1 | Apparently frozen water in pump tubes until 39db(T1C1)/17db during yo-back(T2C2). | Yoyo back and forth for 5 minutes from 51 db downcast until sensors thawed. |
| | Yoyo back to 17db only before starting downcast | Top 16db extrapolated. |
| 90/1 | Apparently frozen water in pump tubes top 3db(T1C1)/16db(T2C2); NO STOP at surface, pump on at 14m. | Top 14db extrapolated. |
| | 38db yoyo / 5.5-minute delay 310db back to 272db downcast | |
| 91/2-91/16 | 15 yoyo casts during 7 hrs overnight preceded cast 17. | Cast not reported. |
| 91/17 | Data starts in-water at 20m at end of yoyo cast 16. | Top 18db extrapolated. |
| 97/1 | CTDO not equilibrated at surface: Apparently frozen water in pump tubes until 23db(T1C1)/12db(T2C2) | Yoyo back from 23db to 12db only, top 10db extrapolated; RO / CTDO-Q7 / 0-16db |
| | | |

| Cast | Problem/Comment | Action Taken |
|---|---|---|
| 98/1 | CTDO not equilibrated at surface: Apparently frozen water in pump tubes until 8.5db(T1C1)/13db(T2C2) | Yoyo back from 23db to surface before starting downcast; RO / CTDO-Q7 / 0-10db. |
| 101/2 | Offset/noise problems all (CTDT+CTDC/CTDO) sensors, 3400db downcast to 3612db upcast; CTDS1/CTDS2/CTDO offset/drop between trips 1220-1115db upcast, T2C2 noisier. | Despike CTDS/RO; CTDT-Q3 / CTDS-Q3 / CTDO-Q3 / 3400-3766db(btm), report downcast T1C1 |
| 102/1 | Offset/noise problems all (CTDT+CTDC/CTDO) sensors, 2580db downcast to ~1130db upcast; T2C2 or upcasts worse | Despike CTDS/RO; CTDT-Q3 / CTDS-Q3 / CTDO-Q3 / 2580-3634db(btm), report downcast T1C1 |
| 103/2 | Connectors checked before cast, signs of corrosion on pins noted. | CTDS/CTDO appear ok this cast. |
| 105/1 | Winch failed after btl 23/568db trip (engine room issues).<br><br>Large CTDS(CTDS1+CTDS2) offsets/spiking, CTDO offset/drop between trips/1475-1370db upcast. | 20+ minute delay in cast, wire out re-zeroed at 560m.<br><br>OK, reported downcast. |
| 106/1 | Spike in CTDS/CTDO at 3145db upcast; large CTDS(CTDS1+CTDS2)/CTDO offset/drop between trips/1565-1460db upcast. | OK, reported downcast. |

Appendix D

## CLIVAR I06S: Bottle Quality Comments

Comments from the Sample Logs and the results of STS/ODF's investigations are included in this report. Units stated in these comments are degrees Celsius for temperature, Unless otherwise noted, milliliters per liter for oxygen and micromoles per liter for Silicate, Nitrate, Nitrite, and Phosphate. The sample number is the cast number times 100 plus the bottle number. Investigation of data may include comparison of bottle salinity and oxygen data with CTD data, review of data plots of the station profile and adjoining stations, and re-reading of charts (i.e. nutrients).

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 1/2 | 208 | bottle | 9 | Bottle did not shut at the correct depth, no samples taken. |
| 1/2 | 229 | o2 | 2 | Lost a drop when stopper was pulled out of oxygen sample. QCC: Oxygen as well as salinity and nutrients are acceptable. |
| 2/1 | 101 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/1 | 102 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/1 | 102 | salt | 3 | Salinity high compared to noisy CTDS, and compared to nearby casts on theta-S comparison. Code salinity questionable. |
| 2/1 | 103 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/1 | 106 | o2 | 2 | Bubble in oxygen flask. QCC: Oxygen data checked against nutrients and bottle salt all acceptable. |
| 2/1 | 113 | bottle | 9 | Bottle did not close (carousel tried to trip bottles 1 and 2 again). |
| 2/1 | 114 | bottle | 9 | Bottle did not close (carousel tried to trip bottles 1 and 2 again). |
| 2/1 | 115 | bottle | 9 | Bottle did not close (carousel tried to trip bottles 1 and 2 again). |
| 2/3 | 301 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 302 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 303 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 304 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 305 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 306 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 307 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 308 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 2/3 | 312 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 201 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 201 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 202 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 202 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 203 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 203 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 204 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 204 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 205 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 205 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 206 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 206 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 207 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 3/2 | 207 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 208 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 208 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 209 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 209 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 210 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 210 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 211 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 211 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 212 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 212 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 213 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 213 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 214 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 214 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 215 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 215 | ctds | 3 | CTDC noisy/low at trips until surface mixed layer. Code questionable. |
| 3/2 | 216 | ctdo | 3 | noisy signal (CTDTC/CTDO on different pump circuits) |
| 3/2 | 217 | bottle | 9 | Bottle did not trip. |
| 4/1 | 101 | o2 | 2 | Wrong stopper (1272 w/667). QCC: oxygen data checked against nutrients all data acceptable. |
| 4/1 | 111 | o2 | 4 | Bottle o2 low compared to bottle 110, tripped 1.5 db deeper, adjoining stations and CTDO. No analytical problems noted. Salinity and nutrients are acceptable, code oxygen bad. |
| 4/1 | 120 | o2 | 5 | Oxygen missing. No notes indicating a problem. Suspect sampling error, not drawn. Code oxygen lost. |
| 5/2 | 224 | bottle | 4 | Bottle appears to have mis-tripped. All nutrients high, salinity and oxygen low. Code bottle did not trip as scheduled and samples bad. |
| 5/2 | 224 | no2 | 4 | |
| 5/2 | 224 | no3 | 4 | |
| 5/2 | 224 | o2 | 4 | |
| 5/2 | 224 | po4 | 4 | |
| 5/2 | 224 | salt | 4 | Bottle salinity is low compared with CTDS, CTD data clean. Code salinity code bad. |
| 5/2 | 224 | sio3 | 4 | |
| 6/1 | 101 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 101 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 102 | bottle | 9 | Bottle misfired, no samples taken |
| 6/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 6/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 110 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 111 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 112 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 120 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 120 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 121 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 122 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 122 | ctds | 7 | CTDC drop at trip, despiked. |
| 6/1 | 123 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 123 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 124 | ctdo | 3 | CTDO noisy: signal problems starting 520 db down on primary pump circuit. Code CTDO questionable. |
| 6/1 | 124 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 125 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 126 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 127 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 128 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 129 | ctds | 3 | CTDC drop at trips, code questionable. |
| 6/1 | 130 | ctds | 3 | CTDC drop at trips, code questionable. |
| 7/1 | 101 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 7/1 | 111 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 111 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 111 | o2 | 3 | Sample was overtitrated and backtitrated by accident. QCC: over titration was not good put orig titer back in and value appears high. Code oxygen questionable, salinity and nutrients are acceptable. |
| 7/1 | 112 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 112 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 120 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 120 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 121 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 121 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 122 | ctdo | 3 | CTDO noisy: signal problems starting 514 db down on primary pump circuit. Code CTDO questionable. |
| 7/1 | 122 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 123 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 124 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 124 | salt | 2 | 3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable. |
| 7/1 | 125 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 126 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 127 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 128 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 129 | ctds | 3 | CTDC noisy, spiking at trips above 1100 db; signal clears up just after 203 db trip. Code questionable. |
| 7/1 | 129 | salt | 2 | 5 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable. |
| 7/1 | 133 | o2 | 2 | Oxygen appears high compared with adjoining stations and CTD down trace. CTD up trace indicates a higher oxygen, leave as is. Oxygen as well as salinity and nutrients are acceptable. |
| 8/2 | 201 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 202 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 203 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 8/2 | 204 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 205 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 206 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 207 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 208 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 209 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 209 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 210 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 210 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 211 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 211 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 212 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 212 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 220 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 220 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 221 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 221 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 222 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 222 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 223 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 223 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 224 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 224 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 225 | bottle | 2 | All nutrients high, o2 low. Salinity agrees with adjoining stations. Data are acceptable. |
| 8/2 | 225 | ctdo | 3 | CTDO noisy: signal problems starting 434 db down on primary pump circuit. Code CTDO questionable. |
| 8/2 | 225 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 226 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 227 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 228 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 229 | ctds | 3 | CTDC very noisy, code questionable. |
| 8/2 | 232 | salt | 2 | 3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable. |
| 8/2 | 233 | bottle | 2 | Bottle leaking. Samples taken. Oxygen and well as salinity and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 9/2 | 201 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 202 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 203 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 204 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 205 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 206 | o2 | 5 | Oxygen sample overtitrated. Sample run aborted? Sample was lost. |
| 9/2 | 207 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 208 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 208 | ctds | 3 | CTDC noisy, spiking.  Code questionable. |
| 9/2 | 209 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 210 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 211 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 211 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 212 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 212 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 213 | bottle | 9 | This bottle shows up in the Seasave .bl file, no notes were made by the console operator.  No samples were taken. |
| 9/2 | 213 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 220 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 220 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 221 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 221 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 222 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 222 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 223 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 223 | ctds | 2 | CTDC noisy; however, ctds1/ctds2/bottle salts agree.  Code acceptable. |
| 9/2 | 224 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 224 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 225 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 225 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |
| 9/2 | 226 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 226 | ctds | 3 | CTDC noisy, severe spiking.  Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 9/2 | 227 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 227 | ctds | 3 | CTDC noisy, severe spiking. Code questionable. |
| 9/2 | 228 | ctdo | 3 | CTDO noisy: signal problems starting 322 db down on primary pump circuit. Code CTDO questionable. |
| 9/2 | 228 | ctds | 3 | CTDC noisy, severe spiking. Code questionable. |
| 9/2 | 229 | ctds | 3 | CTDC noisy, severe spiking. Code questionable. |
| 9/2 | 230 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 213 db trip, secondaries at 113 db. |
| 9/2 | 230 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 213 db trip, secondaries at 113 db. |
| 9/2 | 230 | salt | 3 | Salinity high compared to CTDS. Code salinity questionable. |
| 9/2 | 231 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 213 db trip, secondaries at 113 db. |
| 9/2 | 231 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 213 db trip, secondaries at 113 db. |
| 10/1 | 101 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 102 | ctds | 3 | CTDC noisy, spiking at trips. Code questionable. |
| 10/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 103 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 104 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 105 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 106 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 106 | salt | 3 | Bottle salinity is high compared with CTDS, downcast or upcast. Salt code questionable. |
| 10/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 540 db down. Code CTDO questionable. |
| 10/1 | 107 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 108 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 108 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 108 | no2 | 5 | |
| 10/1 | 108 | no3 | 5 | |
| 10/1 | 108 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 10/1 | 108 | sio3 | 5 | |
| 10/1 | 109 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 109 | ctds | 3 | CTDC noisy, spiking at trips. Code questionable. |
| 10/1 | 110 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 110 | ctds | 3 | CTDC noisy, spiking. Code questionable. |
| 10/1 | 111 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 10/1 | 111 | ctds | 3 | CTDC noisy, spiking at trips. Code questionable. |
| 10/1 | 112 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 112 | ctds | 3 | CTDC noisy, spiking at trips. Code questionable. |
| 10/1 | 120 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 120 | salt | 9 | Salinity supposed to be, but not, drawn: sample log slot empty. |
| 10/1 | 121 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 122 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 123 | ctdo | 4 | CTDO VERY noisy: signal problems starting 540 db down. Code CTDO bad. |
| 10/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 127 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 128 | ctds | 3 | CTDC noisy, severe spiking at trips. Code questionable. |
| 10/1 | 129 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 10/1 | 129 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 10/1 | 130 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 10/1 | 130 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 10/1 | 131 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 10/1 | 131 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 258 db trip, secondaries above 140 db. |
| 11/1 | 101 | ctdo | 4 | CTDO drop/noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 101 | ctds | 2 | Use primary sensors for CTD bottle trip data: secondaries worse at bottom trip. |
| 11/1 | 101 | ctdt | 2 | Use primary sensors for CTD bottle trip data: secondaries worse at bottom trip. |
| 11/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 102 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 103 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 105 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 107 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 11/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 544 db down. Code CTDO questionable. |
| 11/1 | 108 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 109 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 110 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 110 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 111 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 112 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 113 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 113 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 114 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 114 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 115 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 115 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Code acceptable. |
| 11/1 | 116 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 116 | ctdt | 7 | CTDT noisy, low at trip; despiked/fixed. |
| 11/1 | 117 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 117 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 118 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 118 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 119 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 119 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 120 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 121 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 544 db down. Code CTDO bad. |
| 11/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 11/1 | 126 | ctdt | 7 | CTDT noisy, low at trip; despiked/fixed. |
| 11/1 | 127 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 11/1 | 127 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 128 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 128 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 129 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 129 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 129 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 11/1 | 130 | ctds | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 11/1 | 130 | ctdt | 2 | Use primary sensors for CTD bottle trip data: primaries came back at 260 db up, secondaries near 98 db trip. |
| 12/4 | 401 | ctdo | 4 | CTDO drop/noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 402 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 403 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 403 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 404 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 405 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 406 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 406 | salt | 3 | Bottle salinity is high compared with CTDS, downcast or upcast. Salt code questionable. JHS: Agree with the salinity coding, also noted are true features seen in oxygen and nutrients which are acceptable. |
| 12/4 | 407 | ctdo | 3 | CTDO noisy: signal problems starting 552 db down. Code CTDO questionable. |
| 12/4 | 408 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 409 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 410 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 411 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 412 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 413 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 413 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 414 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 415 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 415 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 12/4 | 416 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Code acceptable. |
| 12/4 | 416 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 416 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 417 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 417 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 418 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 418 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 419 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 419 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 419 | o2 | 3 | Oxygen is high compared with adjoining stations. No analytical problems noted. Code oxygen questionable, salinity and nutrients acceptable. |
| 12/4 | 420 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 552 db down. Code CTDO bad. |
| 12/4 | 420 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 421 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 422 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 12/4 | 424 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 101 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down. Code CTDO bad. |
| 13/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 103 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 104 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 105 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 106 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 107 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 107 | no3 | 2 | All nutrients low, o2 high, salinity agrees with adjoining stations. Salinity, oxygen and nutrients are acceptable. |
| 13/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |
| 13/1 | 108 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 13/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 13/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 562 db down.  Code CTDO questionable. |
| 13/1 | 110 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 111 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 111 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 111 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 13/1 | 112 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 112 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 112 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 13/1 | 113 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 113 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 114 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 114 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 115 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 115 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data.  Code acceptable. |
| 13/1 | 116 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 116 | reft | 3 | Apparently bottle fired on the fly 31 secs. after bottle 15, AFTER winch started moving.  SBE35RT did not have 10 seconds to take its reading, code questionable. |
| 13/1 | 117 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 117 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 117 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 13/1 | 118 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 118 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 119 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 119 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 120 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 121 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 122 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 562 db down.  Code CTDO bad. |
| 13/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 123 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 13/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |
| 13/1 | 127 | ctds | 3 | CTDC noisy, severe spiking at trip.  Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 13/1 | 131 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 14/2 | 201 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 202 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 202 | ctds | 3 | CTDC noisy, spiking at trip. Code questionable. |
| 14/2 | 203 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 204 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 205 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 206 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 207 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 208 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 209 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 210 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 211 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 211 | ctds | 3 | CTDC noisy, spiking at trip. Code questionable. |
| 14/2 | 212 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 212 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 213 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 214 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 215 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 216 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 217 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 217 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 218 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 218 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 219 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 219 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 220 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 220 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 221 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 221 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 14/2 | 222 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 556 db down. Code CTDO bad. |
| 14/2 | 222 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 223 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 224 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 225 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 225 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 14/2 | 226 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 227 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 14/2 | 232 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 14/2 | 235 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 15/2 | 201 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 202 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 203 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 203 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 204 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 204 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 205 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 205 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 206 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 206 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 207 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 207 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 208 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 208 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 209 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 209 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 210 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 210 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 211 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 211 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 212 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 212 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 213 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 213 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 15/2 | 214 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 214 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 214 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 15/2 | 215 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 215 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 216 | bottle | 3 | Bottle leaking. |
| 15/2 | 216 | ctdo | 3 | CTDO noisy: signal problems starting 546 db down. Code CTDO questionable. |
| 15/2 | 216 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 216 | no2 | 4 | |
| 15/2 | 216 | no3 | 4 | |
| 15/2 | 216 | o2 | 4 | |
| 15/2 | 216 | po4 | 4 | |
| 15/2 | 216 | salt | 4 | |
| 15/2 | 216 | sio3 | 4 | |
| 15/2 | 217 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 217 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 217 | no2 | 5 | |
| 15/2 | 217 | no3 | 5 | |
| 15/2 | 217 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 15/2 | 217 | sio3 | 5 | |
| 15/2 | 218 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 218 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 219 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 219 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 219 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 15/2 | 220 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 220 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 221 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 221 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 221 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 15/2 | 222 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 546 db down. Code CTDO bad. |
| 15/2 | 222 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 223 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 224 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 225 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 226 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 227 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 227 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |
| 15/2 | 228 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 15/2 | 228 | ctdt | 7 | CTDT spiking/low at trip, despiked/fixed. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 15/2 | 230 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 16/1 | 101 | ctdo | 4 | CTDO drop/noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 102 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 103 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 104 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 105 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 106 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 107 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 108 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 111 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 111 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 112 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 112 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 113 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 114 | ctdo | 3 | CTDO noisy: signal problems starting 568 db down. Code CTDO questionable. |
| 16/1 | 114 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 115 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 115 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Code acceptable. |
| 16/1 | 116 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 116 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 117 | bottle | 2 | Bottle fired at same depth as bottle 16. |
| 16/1 | 117 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 16/1 | 117 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 118 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 118 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 119 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 119 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 120 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 121 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 122 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 123 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 568 db down. Code CTDO bad. |
| 16/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 127 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 16/1 | 128 | ctds | 3 | CTDC noisy, severe spiking at trip. Code questionable. |
| 17/1 | 101 | ctdo | 4 | CTDO drop/noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 102 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 103 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 104 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 105 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 106 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 107 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 17/1 | 108 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 109 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 110 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 111 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 111 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 112 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 112 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 113 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 113 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 114 | ctdo | 3 | CTDO noisy: signal problems starting 538 db down. Code CTDO questionable. |
| 17/1 | 114 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 115 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 115 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Code acceptable. |
| 17/1 | 116 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 116 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 117 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 117 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 118 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 118 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 119 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 119 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 17/1 | 120 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 121 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 122 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 123 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 538 db down. Code CTDO bad. |
| 17/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 127 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 17/1 | 128 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just below bottle 129 stop. Code questionable. |
| 18/1 | 101 | ctdo | 4 | CTDO drop/noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 101 | o2 | 2 | Oxygen low compared with adjoining stations. No analytical problems noted. Within accuracy of measurement, salinity, oxygen and nutrients acceptable. JHS: Oxygen is acceptable. |
| 18/1 | 102 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 102 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 103 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 103 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 104 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 104 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 105 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 105 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 106 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 106 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 18/1 | 107 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 107 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 108 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 108 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 109 | bottle | 2 | Nutrient values slightly higher than adjacent stations. However, value fits profile. No analytical problems noted. Code nitrate acceptable. JHS: Same feature in oxygen, nutrients are acceptable. |
| 18/1 | 109 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 109 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 110 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 110 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 111 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 111 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 112 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 112 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 113 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 113 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 114 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 114 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 115 | ctdo | 3 | CTDO noisy: signal problems starting 550 db down. Code CTDO questionable. |
| 18/1 | 115 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Code acceptable. |
| 18/1 | 116 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 116 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 117 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 117 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 18/1 | 118 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 118 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 119 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 119 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 120 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 120 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 121 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 121 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 122 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 122 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 123 | ctdo | 4 | CTDO drop/VERY noisy: signal problems starting 550 db down. Code CTDO bad. |
| 18/1 | 123 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 124 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 125 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 126 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 127 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 128 | ctds | 3 | CTDC noisy, severe spiking at trip; signal clears up just before 275 db trip. Code questionable. |
| 18/1 | 129 | bottle | 2 | All nutrients low. Salinity agrees with adjoining stations and CTD. Nutrients and oxygen agree with Station 19. Data are acceptable. |
| 18/1 | 134 | o2 | 2 | Oxygen low, SiO3 high, feature seen in NO3 and PO4, salinity low. Data are acceptable. |
| 19/1 | 101 | bottle | 2 | Release valve was open. Oxygen as well as salinity and nutrients are acceptable. |
| 19/1 | 106 | bottle | 2 | Did not trip at intended depth of 3200m. Instead tripped at 2904m. Suspect this refers to modification of sampling scheme 1. Salinity, oxygen slightly high and nutrients appear slightly low, but all within accuracy of the measurements. |
| 19/1 | 108 | bottle | 2 | Did not trip at intended depth. Instead tripped at 2240m. Suspect this refers to sampling scheme. Salinity, oxygen and nutrients are acceptable. |
| 19/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 20/1 | 101 | o2 | 5 | Oxygen missing. No notes indicating a problem. Suspect sampling error, not drawn. Code oxygen lost. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 20/1 | 105 | salt | 3 | Bottle salinity is higher than both CTD salinity and adjacent stations, and does not fit profile. Oxygen and nutrients are acceptable. Code salt questionable. |
| 20/1 | 106 | salt | 2 | Bottle salinity is high compared with CTD. Slight gradient area. Salinity, oxygen and nutrients are acceptable. |
| 20/1 | 115 | no2 | 5 | |
| 20/1 | 115 | no3 | 5 | |
| 20/1 | 115 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 20/1 | 115 | sio3 | 5 | |
| 20/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 20/1 | 117 | o2 | 2 | Oxygen is about 10 umol high, but similar feature is seen in station 21. Oxygen is acceptable. |
| 20/1 | 117 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 20/1 | 118 | salt | 2 | Bottle salinity is high compared with CTD. Gradient area. Salinity, as well as oxygen and nutrients are acceptable. |
| 20/1 | 130 | bottle | 2 | Nutrient values are higher than expected and does not fit profile. However, there is a corresponding o2 feature. No analytical problems noted. Nutrients, oxygen and salinity values are acceptable. |
| 21/3 | 301 | o2 | 9 | Oxygen not sampled, duplicate depth. |
| 21/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 21/3 | 316 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 21/3 | 330 | bottle | 2 | Bottle was fired on the fly by mistake. Oxygen, salinity and nutrient values are acceptable. Code bottle acceptable. |
| 21/3 | 330 | reft | 3 | SBE35RT high vs CTDT: Bottle fired on the fly, SBE35RT needs 10 seconds for reading; code questionable. |
| 21/3 | 336 | bottle | 2 | Bottle was fired on the fly as required by sea-state conditions. Values for oxygen, salinity and nutrients are acceptable and fit profile. Code bottle acceptable. |
| 22/1 | 103 | bottle | 4 | Bottle was tripped at the wrong depth. Bottle did not trip correctly and coded bad. |
| 22/1 | 103 | no2 | 4 | Bottle was tripped at the wrong depth. Nitrite code bad. |
| 22/1 | 103 | no3 | 4 | Bottle was tripped at the wrong depth. Nitrate code bad. |
| 22/1 | 103 | o2 | 4 | Bottle was tripped at the wrong depth. Oxygen code bad. |
| 22/1 | 103 | po4 | 4 | Bottle was tripped at the wrong depth. Phosphate code bad. |
| 22/1 | 103 | salt | 4 | Bottle was tripped at the wrong depth. Salt code bad. |
| 22/1 | 103 | sio3 | 4 | Bottle was tripped at the wrong depth. Silicate code bad. |
| 22/1 | 116 | bottle | 2 | No trip confirmation on bottle 16. Used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 22/1 | 125 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 126 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 127 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 128 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 22/1 | 129 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 130 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 131 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 131 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 22/1 | 132 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 132 | salt | 3 | Salinity low compared to CTDS, bottom of mixed layer. Code salinity questionable. |
| 22/1 | 133 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 134 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 135 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 22/1 | 135 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 23/2 | 210 | salt | 2 | Bottle salinity is low compared with CTD. Gradient area, salinity as well as oxygen and nutrients are acceptable. |
| 23/2 | 216 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 23/2 | 216 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 23/2 | 230 | bottle | 2 | All nutrients low, salt and o2 high. Salinity and oxygen agree with CTD. Data are acceptable. |
| 23/2 | 232 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 23/2 | 233 | o2 | 2 | Wrong stopper (1693 w/1327). QCC: data checked against nutrients all acceptable. |
| 23/2 | 234 | reft | 3 | Bottle fired on the fly, in a gradient. Code SBE35RT questionable. |
| 24/1 | 104 | salt | 2 | 03 attempts for a good salinity reading. Salinity is a little low compared with CTD. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 24/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 24/1 | 121 | o2 | 2 | Oxygen as well as salinity and nutrients are acceptable. |
| 25/1 | 101 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 25/1 | 114 | no2 | 5 | |
| 25/1 | 114 | no3 | 5 | |
| 25/1 | 114 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 25/1 | 114 | sio3 | 5 | |
| 25/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 25/1 | 125 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 26/2 | 207 | no2 | 3 | |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 26/2 | 207 | no3 | 3 | Nutrient values are higher than adjacent stations and does not fit profile. No corresponding oxygen feature and no analytical problems noted. Salinity value coded questionable, possible mis-trip. Code salinity and nutrients questionable. |
| 26/2 | 207 | po4 | 3 | |
| 26/2 | 207 | salt | 3 | Bottle salinity is low compared with CTD and adjoining stations. Nutrient values are higher than expected and questionable. However, oxygen is acceptable. JHS: There is no intrusion seen in the CTD, therefore, agree with questionable code. |
| 26/2 | 207 | sio3 | 3 | |
| 26/2 | 216 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 26/2 | 226 | bottle | 2 | Bottle leaking. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 26/2 | 233 | bottle | 2 | Bottle leaking. Salinity, oxygen and nutrient values acceptable. Bottle code acceptable. |
| 27/2 | 216 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 27/2 | 222 | bottle | 2 | Pressure valve was open. Salinity, oxygen and nutrient values are acceptable. Bottle code acceptable. |
| 27/2 | 223 | bottle | 2 | Pressure valve was open. Salinity, oxygen and nutrient values are acceptable. Bottle code acceptable. |
| 28/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 28/1 | 124 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 125 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 126 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 127 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 128 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 129 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 130 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 130 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 28/1 | 131 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 28/1 | 131 | reft | 3 | SBE35RT low vs CTDT: Bottle fired on the fly, SBE35RT needs 10 seconds for reading; code questionable. |
| 28/1 | 132 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 133 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 134 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 135 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 28/1 | 136 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrient values are acceptable and have profiles similar to adjacent stations. Bottle coded acceptable. |
| 29/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 29/1 | 117 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 29/1 | 132 | bottle | 2 | Nutrients high, o2 low, ctd trace shows same, real. Salinity as well as oxygen and nutrients are acceptable. |
| 29/1 | 133 | reft | 3 | SBE35RT high vs CTDT: rosette started up before SBE35RT finished reading; code questionable. |
| 30/1 | 101 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 101 | salt | 3 | Salinity slightly high vs both CTDS sensors. Code salinity questionable. |
| 30/1 | 102 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 103 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 104 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 105 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 106 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 107 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 108 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 109 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 110 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 111 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 112 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 30/1 | 113 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 114 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 115 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 30/1 | 117 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 118 | bottle | 3 | Bottle had both top vent and spigot open during cast. Oxygen, salinity and nutrient values questionable. Possible contamination. Code bottle leaking and samples bad. |
| 30/1 | 118 | no2 | 4 | Nitrite value questionable due to possible contamination. No analytical problems noted. However, bottle, oxygen, salinity and other nutrient values bad. |
| 30/1 | 118 | no3 | 4 | Nitrate value lower than adjacent stations and does not fit profile. No analytical problems noted. However, both oxygen and salinity values and bottle questionable. Code nitrate bad. |
| 30/1 | 118 | o2 | 4 | Oxygen value higher than adjacent stations and does not fit profile. No analytical problems noted. However, both nutrient and salinity values and bottle questionable. Code oxygen bad. |
| 30/1 | 118 | po4 | 4 | Phosphate value lower than adjacent stations and does not fit profile. No analytical problems noted. However, both oxygen and salinity values and bottle questionable. Code phosphate bad. |
| 30/1 | 118 | salt | 4 | Salinity value higher than both CTD salinity and adjacent stations. No analytical problems noted. However, both oxygen and nutrient values and bottle questionable. Code salt bad. |
| 30/1 | 118 | sio3 | 4 | Silicate value lower than adjacent stations and does not fit profile. No analytical problems noted. However, both oxygen and salinity values and bottle questionable. Code silicate bad. |
| 30/1 | 119 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 120 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 121 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 122 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 123 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 124 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 125 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 126 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 127 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 128 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 30/1 | 129 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 130 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 131 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 132 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 133 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 133 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 30/1 | 134 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 135 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 30/1 | 136 | bottle | 2 | All top vents were open during cast. Oxygen as well as salinity and nutrients are acceptable. |
| 31/2 | 210 | o2 | 5 | Oxygen sample lost. No magnetic stirrer added during analysis. |
| 31/2 | 216 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 31/2 | 225 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 226 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 227 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 228 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 229 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 230 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 231 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 232 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 233 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 234 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 235 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 31/2 | 236 | bottle | 2 | Bottle fired on the fly. Data are acceptable. |
| 32/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 32/1 | 122 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 32/1 | 123 | o2 | 2 | Oxygen appears high compared with CTD and station profile and adjoining stations. Adjoining stations have similar features, just not at this level. Oxygen as well as salinity and nutrients are acceptable. JHS: Oxygen is acceptable for local oceanography. Leave as code 2. |
| 32/1 | 123 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 32/1 | 124 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 32/1 | 127 | reft | 3 | SBE35RT high vs CTDT; fired on the fly, unstable SBE35RT reading, code questionable. |
| 32/1 | 128 | reft | 3 | SBE35RT high vs CTDT; fired on the fly, unstable SBE35RT reading, code questionable. |
| 32/1 | 130 | reft | 3 | SBE35RT high vs CTDT; fired on the fly, unstable SBE35RT reading, code questionable. |
| 32/1 | 133 | bottle | 2 | Bottle leaking. Oxygen as well as salinity and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 32/1 | 136 | salt | 2 | Salinity appears high compared with CTD and adjoining stations. No analytical problems noted. Salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 308 | salt | 2 | Bottle salinity is high compared with CTD. 5 attempts for a good salinity reading. First reading resolves the difference. Salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 309 | salt | 2 | 3 attempts for a good salinity reading. Last two reading averages resolve difference. Salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 33/3 | 317 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved the salinity difference. Salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 326 | sio3 | 2 | SiO3 low, ˜4, compared with adjoining stations. Low salinity feature, other nutrients slightly lower and high signal in O2. SiO3 as well as other nutrients and salinity and oxygen are acceptable. |
| 33/3 | 327 | salt | 2 | 4 attempts for a good salinity reading. Salinity high compared with CTD. First reading gave a better comparison, salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 329 | salt | 2 | Bottle salinity is low compared with CTD, lower than adjoining stations, feature seen in CTD. Salinity as well as oxygen and nutrients are acceptable. |
| 33/3 | 332 | bottle | 2 | Salinity a little high, O2 high, PO4 or NO3 low, NO2 high also a high NO2 signal at 33. Transmissivity and fluorescence do not show a high feature. JHS: Agrees that bottle and data are acceptable. |
| 33/3 | 333 | bottle | 2 | Bottle continues to leak, despite checks. Salinity a little high, within accuracy, O2, PO4 and NO3 acceptable, NO2 high also a high NO2 signal at 32. Transmissivity nor fluorescence do not show a high feature. |
| 34/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 35/1 | 101 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 102 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 103 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 104 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 105 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 106 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 107 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 108 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 109 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 110 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 111 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 112 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 113 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 114 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 115 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 35/1 | 116 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 117 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 118 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 119 | salt | 5 | Salinity data lost, operator may have deleted the file. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 35/1 | 120 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 121 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 122 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 123 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 124 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 125 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 126 | no2 | 4 | |
| 35/1 | 126 | no3 | 4 | All nutrients look identical to sample 125, suspect both were sampled from the same niskin. Code nutrients bad, oxygen is acceptable. |
| 35/1 | 126 | po4 | 4 | |
| 35/1 | 126 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 126 | sio3 | 4 | |
| 35/1 | 127 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 128 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 129 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 130 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 131 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 132 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 133 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 134 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 135 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 35/1 | 136 | salt | 5 | Salinity data lost, operator may have deleted the file. |
| 36/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 36/1 | 127 | ctdt | 7 | CTDT spikes low at trip, despiked/fixed. |
| 37/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 37/3 | 321 | salt | 3 | In a gradient, but salinity lower than lowest CTDS. Code salinity questionable. |
| 37/3 | 333 | reft | 3 | SBE35RT high vs CTDT: somewhat unstable SBE35RT reading, code questionable. |
| 38/1 | 129 | bottle | 2 | Spigot was open. Oxygen as well as salinity and nutrients are acceptable. |
| 38/1 | 130 | salt | 4 | Bottle salinity is high compared with CTDS. Appears to be a drawing error, drawn from 31. Code salinity bad, oxygen and nutrients are acceptable. |
| 38/1 | 135 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 38/1 | 136 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 39/3 | 310 | bottle | 2 | Nutrients high, salt and o2 low, seen on ctd salinity trace, real. |
| 39/3 | 311 | bottle | 2 | Nutrients high, salt and o2 low, seen on ctd salinity trace, real |
| 39/3 | 320 | bottle | 9 | Bottle did not fire, no samples were taken. |
| 39/3 | 321 | bottle | 2 | The vent was open. Oxygen as well as salinity and nutrients are acceptable. |
| 39/3 | 326 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 326 | o2 | 4 | Sample was overtitrated and backtitrated. Oxygen value high does not match CTD trace or adjoining stations. QCP: Code oxygen bad, salinity and nutrients are acceptable. |
| 39/3 | 327 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 39/3 | 328 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 329 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 330 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 331 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 332 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 333 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 334 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 335 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 39/3 | 336 | bottle | 2 | Bottle fired on the fly. With the exception of 326, bottle oxygen values agree with CTDO and are acceptable. Bottle salinity agrees with CTDS. Both salinity and nutrient values are acceptable. Bottles coded acceptable. |
| 40/1 | 102 | bottle | 2 | The pressure valve was open. Oxygen as well as salinity and nutrients are acceptable. |
| 40/1 | 107 | bottle | 2 | Nutrients high, salt and o2 low, feature seen on CTD salinity and oxygen trace, real. |
| 40/1 | 120 | bottle | 9 | Bottle did not fire, no samples were drawn. Bottle did fire just did not trip. |
| 41/1 | 116 | salt | 2 | 4 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable. |
| 41/1 | 125 | no2 | 3 | |
| 41/1 | 125 | no3 | 3 | All nutrients look identical to sample 124, suspect both were sampled from the same niskin. Code nutrients questionable, salinity and oxygen are acceptable. |
| 41/1 | 125 | po4 | 3 | |
| 41/1 | 125 | sio3 | 3 | |
| 41/1 | 130 | salt | 4 | 3 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Salinity is high compared with CTD. Code salinity bad, oxygen and nutrients acceptable. |
| 43/2 | 223 | bottle | 9 | Bottle did not fire, no samples were drawn. Bottle fired just did not trip. |
| 43/2 | 226 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 227 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 43/2 | 228 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 229 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 230 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 231 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 232 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 233 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 234 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 235 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 43/2 | 236 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 44/1 | 106 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. No analytical problem noted for this unacceptable value. Code salinity bad, oxygen and nutrients are acceptable.. |
| 44/1 | 123 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 124 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 125 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 126 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 127 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 128 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 128 | ctds | 7 | CTDT/C1 spike at trip, despiked/fixed. |
| 44/1 | 128 | ctdt | 7 | CTDT/C1 spike at trip, despiked/fixed. |
| 44/1 | 129 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 130 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 130 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 44/1 | 131 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 132 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 133 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 134 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 44/1 | 135 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 45/1 | 118 | sio3 | 2 | Sil peak is high, does not match other nutrients or fit profile. Nutrients, oxygen and salinity acceptable. JHS: SiO3 acceptable for regional oceanography. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 45/1 | 126 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 127 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 128 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 129 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 130 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 131 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 132 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 133 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 134 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 135 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 45/1 | 136 | bottle | 2 | Bottle fired on the fly. Oxygen as well as salinity and nutrients are acceptable. |
| 46/2 | 210 | no3 | 2 | Nitrate value higher than adjacent stations. No analytical problems noted and there are corresponding oxygen and salinity features. Code nitrate acceptable. |
| 46/2 | 210 | o2 | 5 | Sample was overtitrated and backtitrated. Code oxygen sample lost. |
| 46/2 | 210 | po4 | 2 | Phosphate value higher than adjacent stations. No analytical problems noted and there are corresponding oxygen and salinity features. Code phosphate acceptable. |
| 46/2 | 210 | sio3 | 2 | Silicate value higher than adjacent stations. No analytical problems noted and there are corresponding oxygen and salinity features. Code silicate acceptable. |
| 46/2 | 222 | bottle | 2 | Vent was not tight. However, oxygen, salinity and nutrients are acceptable. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Bottle coded acceptable. |
| 46/2 | 223 | bottle | 2 | Vent was not tight. However, oxygen, salinity and nutrients are acceptable. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Bottle coded acceptable. |
| 46/2 | 225 | salt | 3 | Salinity high compared to CTDS, not in a gradient. Code salinity questionable. |
| 46/2 | 226 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 227 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 228 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 229 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 230 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 230 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 46/2 | 231 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 232 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 233 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 234 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 46/2 | 235 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 46/2 | 236 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 109 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 110 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 111 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 112 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 113 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 114 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 115 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 116 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 117 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 118 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 119 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 120 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 47/1 | 121 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 122 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 123 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 124 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 125 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 126 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 127 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 128 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 129 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 130 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 131 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 132 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 132 | reft | 3 | SBE35RT high vs CTDT: Bottle fired on the fly, SBE35RT needs 10 seconds for reading; code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 47/1 | 133 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 134 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 135 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 47/1 | 136 | bottle | 2 | Bottles were fired on the fly; large tension on the winch. Speed increased from 10m/min. to 20m/min. at 13. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 104 | no2 | 5 | |
| 48/1 | 104 | no3 | 5 | |
| 48/1 | 104 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 48/1 | 104 | sio3 | 5 | |
| 48/1 | 112 | bottle | 9 | Bottle did not trip. |
| 48/1 | 120 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 121 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 122 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 123 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 124 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 125 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 126 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 127 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 128 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 129 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 130 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 131 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 132 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 132 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 48/1 | 133 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 134 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 135 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 48/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 49/1 | 106 | salt | 3 | Bottle salinity is low compared with CTD and adjoining stations. Salt code questionable. |
| 49/1 | 127 | salt | 3 | Bottle salinity is high compared with CTDS. Salt code questionable. |
| 49/1 | 128 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 49/1 | 131 | no2 | 5 | |
| 49/1 | 131 | no3 | 5 | |
| 49/1 | 131 | po4 | 5 | Nutrients missing. Analyst: These are all sampling errors (empty tubes brought to the lab) as annotated in the autoanalyzer lab book. Code nutrients lost. |
| 49/1 | 131 | sio3 | 5 | |
| 49/1 | 135 | salt | 9 | Salinity not drawn per sampling strategy. |
| 50/1 | 103 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. Appears to be a drawing error. Oxygen and nutrients are acceptable. Code salinity bad. |
| 50/1 | 119 | salt | 4 | Bottle salinity is low compared with CTD and adjoining stations. Salinity analyst indicated that bottle was only 2/3 full. Oxygen and nutrients are acceptable. Code salinity bad. |
| 50/1 | 125 | no3 | 2 | Nitrate value high compared with adjoining stations. Feature also observed in phosphate and there is a corresponding decrease in the oxygen value. No analytical problems noted and charts rechecked. Code nitrate acceptable. |
| 51/1 | 112 | bottle | 2 | No trip confirmation on bottle 12 at first trip attempt (1640m), did trip/confirm at next stop (1540m); oxygen, salinity and nutrients indicate bottle tripped at confirmed level (1540m). Code acceptable. |
| 52/2 | 223 | bottle | 2 | All nutrients high, salt slightly low, within accuracy, and o2 high. CTDO uptrace shows oxygen feature. Data are acceptable. JHS: Agrees that data are acceptable. |
| 52/2 | 227 | salt | 2 | 3 attempts for a good salinity reading. Additional reading resolved discrepancy. Salinity as well as oxygen and nutrients are acceptable. |
| 53/1 | 101 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 102 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 103 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 104 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 105 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 106 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 107 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 53/1 | 108 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 109 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 110 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 111 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 112 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 113 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 114 | ctdo | 2 | CTDO drop/real feature on downcast, not seen on upcast. Code CTDO acceptable. |
| 53/1 | 114 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 114 | o2 | 2 | Bottle oxygen matches upcast CTDO, downcast CTDO feature is real. Code oxygen acceptable. |
| 53/1 | 115 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 116 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 117 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 118 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 119 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 120 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 121 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 122 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 123 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 124 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 125 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 126 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 127 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 127 | o2 | 2 | Bottle oxygen higher than both CTDO and adjacent stations and does not fit profile. Both salinity and nutrients are acceptable. CTD up trace validates oxygen. |
| 53/1 | 128 | bottle | 2 | JHS: O2 high, no2 high, cfc12 high, maybe an oddball structure. Keep 128 parameters code 2. DP: CTD up trace shows a structure not seen in the down trace. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 53/1 | 128 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 128 | o2 | 2 | Bottle oxygen higher than both CTDO and adjacent stations and does not fit profile. Both salinity and nutrients are acceptable. CTD up trace validates oxygen. |
| 53/1 | 129 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 129 | o2 | 2 | Bottle oxygen higher than both CTDO and adjacent stations and does not fit profile. Both salinity and nutrients are acceptable. CTD up trace validates oxygen. |
| 53/1 | 130 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 130 | o2 | 2 | Bottle oxygen higher than both CTDO and adjacent stations and does not fit profile. Both salinity and nutrients are acceptable. CTD up trace validates oxygen. |
| 53/1 | 131 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 132 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 133 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 134 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 135 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 53/1 | 136 | ctds | 2 | CTDS offset from 103 bottle stop to surface upcast. Use secondary CTDTC for all trip data. |
| 54/2 | 201 | salt | 2 | Bottle salinity is high compared with CTDS, but agrees with adjoining stations and fits profile. No analytical problems noted. Both oxygen and nutrients are acceptable. Salt coded acceptable. |
| 54/2 | 229 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 230 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 230 | salt | 2 | Bottle salinity is high compared with CTDS, but agrees with adjoining stations and fits profile. No analytical problems noted. Both oxygen and nutrients are acceptable. Salt coded acceptable. |
| 54/2 | 231 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 232 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 233 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 234 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 235 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 54/2 | 236 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 55/2 | 202 | reft | 3 | Unstable SBE35RT reading; code questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 55/2 | 221 | bottle | 2 | Lanyard was broken on recovery. Bottle was sampled first by freon, o2, DOC, and DIC. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Code bottle acceptable. |
| 55/2 | 226 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 227 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 228 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 229 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 230 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 231 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 232 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 232 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 55/2 | 233 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 234 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 235 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 55/2 | 235 | o2 | 4 | Removed burette too early. QCC: data no good since tip was removed before end of titration. Code oxygen bad. |
| 55/2 | 236 | bottle | 2 | Bottle fired on the fly; speed was reduced to 10m/min. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Code bottles acceptable. |
| 56/1 | 104 | salt | 3 | Bottle salinity is high compared with CTD and adjoining stations. Salt code questionable. |
| 56/1 | 112 | salt | 3 | Bottle salinity is high compared with CTD and adjoining stations. Salt code questionable. |
| 56/1 | 118 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 119 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 120 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 56/1 | 121 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 122 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 123 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 124 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 125 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 126 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 127 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 128 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 129 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 130 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 131 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 132 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 133 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 134 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 135 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 56/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 112 | salt | 2 | Bottle salinity is high compared with CTDS. However it agrees with adjoining stations and fits profile. No analytical problems noted. Oxygen and nutrients are acceptable. Salt coded acceptable. |
| 57/1 | 120 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 57/1 | 122 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 123 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 124 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 125 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 57/1 | 126 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 127 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 128 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 129 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 130 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 131 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 132 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 133 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 134 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 135 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 57/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 58/1 | 123 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 124 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 125 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 126 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 127 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 127 | ctds | 7 | CTDT/CTDS noisy at trip, ok after despiking. Code despiked. |
| 58/1 | 127 | ctdt | 7 | CTDT/CTDS noisy at trip, ok after despiking. Code despiked. |
| 58/1 | 127 | o2 | 3 | JHS: O2 and CFC12 values are a little high. Code oxygen questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 58/1 | 128 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 129 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 130 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 131 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 131 | o2 | 3 | Bottle oxygen value lower than CTDO and adjoining stations, and does not fit profile. No analytical problems noted. Salinity and nutrients are acceptable. Oxygen coded questionable? |
| 58/1 | 132 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 133 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 134 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 135 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 58/1 | 136 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 121 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 122 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 123 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 124 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 125 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 126 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 127 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 59/1 | 128 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 129 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 129 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 59/1 | 129 | salt | 2 | Bottle salinity is low compared with CTDS. However, it agrees with adjoining stations and fits profile. No analytical problems noted. Oxygen and nutrients are acceptable. Salt coded acceptable. |
| 59/1 | 130 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 131 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 131 | salt | 2 | Bottle salinity is low compared with CTDS. However, it agrees with adjoining stations and fits profile. No analytical problems noted. Oxygen and nutrients are acceptable. Salt coded acceptable. |
| 59/1 | 132 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 133 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 134 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 135 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 59/1 | 136 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 60/1 | 123 | bottle | 2 | The vent was not tightly closed. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 60/1 | 129 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 130 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 130 | no2 | 9 | No nutrients drawn, reason not indicated. |
| 60/1 | 130 | no3 | 9 | No nutrients drawn, reason not indicated. |
| 60/1 | 130 | po4 | 9 | No nutrients drawn, reason not indicated. |
| 60/1 | 130 | sio3 | 9 | No nutrients drawn, reason not indicated. |
| 60/1 | 131 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 131 | salt | 3 | Salinity low compared to CTDS, even after accounting for gradient. Code salinity questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 60/1 | 132 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 133 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 134 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 135 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 60/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 215 | o2 | 4 | Oxygen value low, does not match profile or ctd trace. Salinity and nutrients are acceptable. |
| 61/2 | 228 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 229 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 230 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 231 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 232 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 232 | reft | 3 | SBE35RT high vs CTDT: rosette started up before SBE35RT finished reading; code questionable. |
| 61/2 | 233 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 234 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 235 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 61/2 | 236 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottles coded acceptable. |
| 62/1 | 117 | o2 | 5 | Problems during O2 titration-plot failed, sample lost. |
| 62/1 | 120 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 121 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 122 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 123 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 124 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 62/1 | 125 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 126 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 127 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 128 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 129 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 130 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 131 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 131 | reft | 3 | SBE35RT low vs CTDT: Bottle fired on the fly, SBE35RT needs 10 seconds for reading; code questionable. |
| 62/1 | 132 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 133 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 134 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 62/1 | 135 | bottle | 9 | The spigot on bottle broke off on recovery. No samples were taken. |
| 62/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 101 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. Salinity analyst reports that the bottle was low. Oxygen and nutrients are acceptable. Code salinity bad. |
| 63/1 | 101 | sio3 | 2 | Silicate value appears high. However, it agrees with adjacent stations and indicates silicate regeneration in deep Antarctic waters. No analytical problems noted. Code silicate acceptable. |
| 63/1 | 102 | po4 | 2 | Phosphate value appears to be slightly lower than adjacent stations. However, it matches the profile trends of adjacent stations. No analytical problems noted and charts rechecked. Code phosphate acceptable. |
| 63/1 | 103 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. Salinity analyst reports that the bottle was low. Oxygen and nutrients are acceptable. Code salinity bad. |
| 63/1 | 122 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 63/1 | 123 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 124 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 125 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 126 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 127 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 128 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 129 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 130 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 131 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 132 | bottle | 2 | Bottle fired on the fly. Both bottle oxygen and bottle salinity agree with CTDO and CTDS respectively. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 132 | no3 | 2 | Nitrate value slightly higher than adjacent stations. Feature also observed in other nutrients. No analytical problems noted and charts rechecked. Code nitrate acceptable. |
| 63/1 | 132 | salt | 4 | Bottle salinity is low compared with CTD and adjoining stations. Salinity analyst reports that the bottle were low. Oxygen and nutrients are acceptable. Code salinity bad. |
| 63/1 | 133 | bottle | 2 | The spigot was lost.  Bottle fired on the fly. Only salinity and nutrients drawn, bottle/CTD salinity agree. Salinity and nutrients are acceptable. |
| 63/1 | 133 | reft | 3 | SBE35RT high vs CTDT: Bottle fired on the fly, SBE35RT needs 10 seconds for reading; code questionable. |
| 63/1 | 134 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 135 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 63/1 | 136 | bottle | 2 | Bottle fired on the fly. Bottle/CTD oxygen and salinity agree. Oxygen, salinity and nutrients are acceptable. Bottle coded acceptable. |
| 64/2 | 203 | po4 | 2 | Phosphate value appears slightly lower than adjacent stations. No analytical problems noted and charts rechecked. Value decrease insignificant. Code phosphate acceptable. |
| 64/2 | 206 | bottle | 2 | Vent caps for bottles were open. Oxygen as well as salinity and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 64/2 | 207 | bottle | 2 | Vent caps for bottles were open. Oxygen as well as salinity and nutrients are acceptable. |
| 64/2 | 208 | bottle | 2 | Vent caps for bottles were open. Oxygen as well as salinity and nutrients are acceptable. |
| 64/2 | 222 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 223 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 224 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 225 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 226 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 227 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 228 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 229 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 230 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 231 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 232 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 233 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 234 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 235 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 64/2 | 236 | bottle | 2 | Bottle fired on the fly. Salinity, oxygen and nutrients are acceptable. |
| 65/1 | 133 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 66/1 | 108 | o2 | 2 | Sample was overtitrated and backtitrated. No good endpoint. QCC: over titration not good, put orig titer back in which resolved the high oxygen value. Oxygen as well as salinity and nutrients are acceptable. |
| 68/2 | 206 | salt | 3 | Bottle salinity is high compared with CTD and adjoining stations. Salt code questionable. |
| 68/2 | 231 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 69/1 | 131 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 69/1 | 132 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 69/1 | 136 | ctds | 7 | CTDS spike at surface trip, very near surface. Despiked/ok. |
| 71/2 | 218 | no3 | 2 | Nutrients low all other parameters look ok. JHS: Okay as is. Code nutrients acceptable. |
| 71/2 | 218 | po4 | 2 | Nutrients low all other parameters look ok. JHS: Okay as is. Code nutrients acceptable. |
| 71/2 | 218 | sio3 | 2 | Nutrients low all other parameters look ok. JHS: Okay as is. Code nutrients acceptable. |
| 72/3 | 301 | bottle | 2 | spare CTD starting this cast, no trip confirmation at all trip attempts; used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 72/3 | 301 | salt | 2 | Salinity samples run as cast 4, but sample and console logs indicate these are all from cast 3. Changed cast number in salinity run file, salinity differences indicate all values acceptable. |
| 72/3 | 302 | bottle | 2 | spare CTD starting this cast, no trip confirmation at all trip attempts; SBE35RT data missing bottle 2, used trip time within 10 seconds of bottle 1 (while SBE35RT still taking bottle 1 reading). Code acceptable. |
| 72/3 | 302 | salt | 2 | Salinity samples run as cast 4, but sample and console logs indicate these are all from cast 3. Changed cast number in salinity run file, salinity differences indicate all values acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 72/3 | 303 | bottle | 2 | spare CTD starting this cast, no trip confirmation at all trip attempts; used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 72/3 | 303 | salt | 2 | Salinity samples run as cast 4, but sample and console logs indicate these are all from cast 3. Changed cast number in salinity run file, salinity differences indicate all values acceptable. |
| 72/3 | 304 | bottle | 2 | spare CTD starting this cast, no trip confirmation at all trip attempts; used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 72/3 | 304 | salt | 2 | Salinity samples run as cast 4, but sample and console logs indicate these are all from cast 3. Changed cast number in salinity run file, salinity differences indicate all values acceptable. |
| 72/5 | 533 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 72/5 | 534 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 73/2 | 205 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 73/2 | 209 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. No problem noted during analysis. Appears to be drawing error. Code salinity bad, oxygen and nutrients are acceptable. |
| 73/2 | 216 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 73/2 | 226 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 74/1 | 101 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 74/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 74/1 | 124 | o2 | 2 | Sample was overtitrated and backtitrated. QCC: data checked against nutrients all acceptable. |
| 75/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 75/1 | 117 | salt | 3 | Bottle salinity is high compared with CTD and adjoining stations. Salt code questionable. |
| 75/1 | 123 | bottle | 2 | Bottle leaking due to a loose cap. Oxygen as well as salinity and nutrients are acceptable. cms |
| 76/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 76/3 | 334 | bottle | 2 | Bottle 34 triggered at bottle 33 depth, no bottle left for surface trip. |
| 77/1 | 106 | bottle | 4 | Bottle appears to have mis-tripped. Oxygen low salinity high, nutrients high. Code bottle did not trip as scheduled and samples bad. |
| 77/1 | 106 | no2 | 4 | |
| 77/1 | 106 | no3 | 4 | |
| 77/1 | 106 | o2 | 4 | |
| 77/1 | 106 | po4 | 4 | |
| 77/1 | 106 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. Code salinity bad. |
| 77/1 | 106 | sio3 | 4 | |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 77/1 | 112 | bottle | 2 | Oxygen is slightly low, nutrients high, salinity appears reasonable. Bottle and data are acceptable. |
| 77/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 77/1 | 126 | salt | 3 | Salinity high compared to CTDS, in a slight gradient. Matches well with CTDS at bottle 24. Code salinity questionable. |
| 77/1 | 128 | salt | 3 | Salinity high compared to CTDS, not in a gradient. Matches well with CTDS at bottle 26. Code salinity questionable. |
| 78/1 | 101 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 102 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 103 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 103 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1180 db. Code questionable. |
| 78/1 | 103 | salt | 2 | 3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable. |
| 78/1 | 104 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 104 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1180 db. Code questionable. |
| 78/1 | 105 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 105 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1180 db, but settles down/ok at stops/trips. Code acceptable. |
| 78/1 | 106 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 106 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1180 db. Code questionable. |
| 78/1 | 107 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 108 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 109 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 110 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 111 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 112 | ctdo | 3 | CTDO sensor offset/noise problems, still noisy starting 1600 db downcast. Code CTDO questionable. |
| 78/1 | 113 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1180 db. Code questionable. |
| 78/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 78/1 | 133 | bottle | 2 | Bottle was leaking. Oxygen as well as salinity and oxygen are acceptable. |
| 79/1 | 101 | ctdo | 3 | CTDO sensor offset/noise problems, still problems starting 3426 db downcast. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 79/1 | 102 | ctdo | 3 | CTDO sensor offset/noise problems, still problems starting 3426 db downcast. Code CTDO questionable. |
| 79/1 | 103 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 dbar, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 104 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 105 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 106 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db. Code questionable. |
| 79/1 | 107 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 108 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 109 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 110 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 111 | ctds | 3 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db. Code questionable. |
| 79/1 | 112 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 113 | ctds | 2 | CTDC noisy, spiking/drops after bottom 2 trips until 1231 db, but settles down/ok at stops/trips. Code acceptable. |
| 79/1 | 115 | bottle | 2 | Target depth overshot, back down 31m before tripping. |
| 80/3 | 301 | ctdo | 3 | CTDO sensor offset/noise problems, still bad starting 2826 db downcast. Code CTDO questionable. |
| 80/3 | 301 | o2 | 4 | Duplicate sample depth and a flier. |
| 80/3 | 302 | ctdo | 3 | CTDO sensor offset/noise problems, still bad starting 2826 db downcast. Code CTDO questionable. |
| 80/3 | 303 | ctdo | 3 | CTDO sensor offset/noise problems, still bad starting 2826 db downcast. Code CTDO questionable. |
| 80/3 | 303 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 304 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 305 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 306 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 307 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 308 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 309 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 310 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 311 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 80/3 | 312 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 313 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 314 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 315 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 317 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 318 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db. Code questionable. |
| 80/3 | 319 | ctds | 2 | CTDC noisy, spiking/drops from 2899 db trip until 200 db, but settles down/ok at stops/trips until 600 db. Code acceptable. |
| 80/3 | 320 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 321 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 322 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 323 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 324 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 325 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 326 | ctds | 3 | CTDC noisy, spiking/drops from 2899 db trip until 200 db; noise ramps up above 600 db and sensors do not settle down at stops/trips. Code questionable. |
| 80/3 | 327 | bottle | 9 | Bottle did not trip. No samples were taken. |
| 80/3 | 328 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 81/1 | 113 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 114 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 115 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 117 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 118 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 119 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |
| 81/1 | 120 | ctds | 3 | SBE35RT data used to convert CTDC to CTDS: gives CTDS values 0.03 high. Code CTDS questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 81/1 | 126 | reft | 3 | SBE35RT low vs CTDT (no CTDT sensor this cast); unstable SBE35RT reading, code questionable. |
| 81/1 | 127 | reft | 3 | SBE35RT high vs CTDT (no CTDT sensor this cast); unstable SBE35RT reading, code questionable. |
| 81/1 | 127 | salt | 3 | Salinity low compared to CTDS, not in a gradient. Code salinity questionable. |
| 81/1 | 129 | reft | 3 | SBE35RT high vs CTDT (no CTDT sensor this cast); unstable SBE35RT reading, code questionable. |
| 81/1 | 129 | salt | 3 | Salinity low compared to CTDS, high gradient. Code salinity questionable. |
| 81/3 | 302 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 304 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 306 | bottle | 9 | Bottle fired on the fly, no stop time listed. Bottle leaking. No samples drawn. |
| 81/3 | 308 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 310 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 312 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 314 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Bottle fired on the fly, no stop time listed. Salinity, oxygen and nutrients also acceptable. Code acceptable. |
| 81/3 | 318 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 320 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 322 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 324 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 326 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 328 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 330 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 81/3 | 332 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 334 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 81/3 | 336 | bottle | 2 | All bottles fired on the fly, including bottom bottle. No stop times were listed for any of the bottles on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 102 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 104 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 106 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 108 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 110 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 112 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 114 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 116 | bottle | 2 | Bottle fired on the fly, no stop time listed. Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 82/1 | 118 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 120 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 122 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 124 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 126 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 126 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 82/1 | 128 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 82/1 | 129 | bottle | 9 | Bottle was tripped accidentally and on the fly, no stop time listed. No samples were drawn. |
| 82/1 | 130 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 132 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 134 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 82/1 | 136 | bottle | 2 | All bottles fired on the fly, including bottom bottle. Slowed to 20m/min for 102-112 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 104 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 106 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 108 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 110 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 112 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 112 | o2 | 3 | Wrong stopper (1126 w/1132). QCC: data checked against nutrients all acceptable. |
| 83/1 | 114 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 116 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 83/1 | 118 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 120 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 122 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 122 | o2 | 2 | Bottle-CTDO (downcast) difference 23 umol/kg. Bottle matches upcast CTDO, low feature is shallower on downcast. Code bottle and CTDO acceptable. |
| 83/1 | 124 | bottle | 4 | Bottle fired on the fly, no stop time listed. Bottle mis-tripped, all samples bad. |
| 83/1 | 124 | no2 | 4 | |
| 83/1 | 124 | no3 | 4 | |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 83/1 | 124 | o2 | 4 | Wrong stopper (1132 w/1126). QCC: data checked against nutrients and bottle salts all indicate possible mis-trip. |
| 83/1 | 124 | po4 | 4 | |
| 83/1 | 124 | salt | 4 | |
| 83/1 | 124 | sio3 | 4 | |
| 83/1 | 126 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 128 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 130 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 132 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 132 | reft | 3 | SBE35RT high vs CTDT; unstable SBE35RT reading, code questionable. |
| 83/1 | 134 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 83/1 | 136 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-110 only. No stop times were listed for any bottle except 102 on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 102 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 104 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 104 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 106 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 106 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 108 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 108 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 110 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 110 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 112 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 112 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 84/1 | 114 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 114 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 116 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 116 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 118 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 118 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 120 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 120 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 122 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 122 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 124 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 124 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 126 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 126 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 128 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 128 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 130 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 130 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 132 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 132 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 84/1 | 134 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 134 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 84/1 | 136 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-108 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 84/1 | 136 | ctds | 2 | Use secondary temperature/conductivity for CTD trip data; primary data noisy, sensors probably fouled. |
| 85/1 | 104 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 106 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 108 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 110 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 112 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 114 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 116 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 118 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 120 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 122 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 124 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 126 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 128 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 85/1 | 130 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 132 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 134 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 85/1 | 136 | bottle | 2 | All bottles fired on the fly, brief stop at bottom only. Slower winch speed for 104-116 only. No stop times were listed for any bottle on the CTD Log. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 114 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 116 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 118 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 120 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 122 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 124 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 126 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 128 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 130 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 130 | reft | 3 | Bottle fired on the fly, in a gradient, unstable SBE35RT reading. Code SBE35RT questionable. |
| 86/1 | 130 | salt | 3 | Bottle salinity is low compared with CTDS. Salt code questionable. |
| 86/1 | 132 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 134 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 86/1 | 136 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 106 | bottle | 2 | Vent cap was open on bottle. Oxygen as well as salinity and nutrients are acceptable.cms |
| 87/1 | 116 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 87/1 | 118 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 120 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 120 | o2 | 4 | Sample was overtitrated and backtitrated. NO GOOD ABORT. QCC: overtitration not good data not acceptable. |
| 87/1 | 122 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 87/1 | 124 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 126 | bottle | 2 | Bottle fired on the fly at 10m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 128 | bottle | 2 | Bottle fired on the fly at 20m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 130 | bottle | 2 | Bottle fired on the fly at 20m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 132 | bottle | 2 | Bottle fired on the fly at 20m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 134 | bottle | 2 | Bottle fired on the fly at 20m/min. Salinity, oxygen and nutrients are acceptable. |
| 87/1 | 136 | bottle | 2 | Bottle fired on the fly at 20m/min. Salinity, oxygen and nutrients are acceptable. |
| 88/1 | 116 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 88/1 | 116 | salt | 2 | 3 attempts for a good salinity reading. Additional reading resolves difference. Salinity as well as oxygen and nutrients are acceptable. |
| 88/1 | 122 | salt | 2 | 4 attempts for a good salinity reading. Additional readings would result in a higher salinity value. Within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 88/1 | 126 | salt | 2 | 3 attempts for a good salinity reading. Additional readings would make salinity lower. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 89/1 | 112 | salt | 3 | 3 attempts for a good salinity reading. Additional readings do not resolve salinity difference. Suspect poor sampling technique. Salinity is questionable, oxygen and nutrients are acceptable. |
| 89/1 | 114 | salt | 2 | 3 attempts for a good salinity reading. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 89/1 | 116 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 89/1 | 116 | salt | 3 | 4 attempts for a good salinity reading. Additional readings do not resolve salinity difference. Suspect poor sampling technique. Salinity is questionable, oxygen and nutrients are acceptable. |
| 89/1 | 118 | bottle | 2 | Bottle was tripped off target. Salinity as well as oxygen and nutrients are acceptable. |
| 89/1 | 118 | salt | 2 | 3 attempts for a good salinity reading. Within accuracy of the measurement. |
| 90/1 | 114 | salt | 2 | 3 attempts for a good salinity reading. Duplicate trip with 12, this bottle has better agreement with CTD. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 90/1 | 116 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 90/1 | 116 | salt | 2 | 3 attempts for a good salinity reading. Bottle salinity is low compared with CTD. Additional readings do not resolve difference. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 90/1 | 118 | salt | 2 | 3 attempts for a good salinity reading. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 90/1 | 120 | salt | 4 | 4 attempts for a good salinity reading. Bottle salinity is low compared with CTDS. Seems it would be higher. Code salinity bad, oxygen and nutrients are acceptable. |
| 90/1 | 128 | salt | 2 | 4 attempts for a good salinity reading. Additional readings do not resolve difference. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 90/1 | 130 | salt | 2 | 4 attempts for a good salinity reading. Additional readings do not resolve difference. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 91/17 | 1702 | o2 | 2 | Sample was overtitrated and backtitrated, Failed. Abort Sample. Oxygen as well as salinity and nutrients are acceptable. |
| 91/17 | 1714 | bottle | 9 | Bottle did not fire, the lanyard got caught on zip tie. |
| 92/3 | 316 | bottle | 2 | Bottle 16 triggered from carousel slot 17. Code acceptable. |
| 93/2 | 213 | salt | 3 | Salinity low compared to CTDS and bottle salt taken at same depth. Code salinity questionable. |
| 93/2 | 219 | reft | 3 | Unstable SBE35RT reading; code questionable. |
| 94/2 | 211 | salt | 2 | 3 attempts for a good salinity reading. First reading results in a slightly higher salinity value, but still slightly low. Within accuracy of the measurement, salinity as well as oxygen and nutrients are acceptable. |
| 95/2 | 208 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 209 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 210 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 211 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 212 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 213 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 214 | bottle | 9 | No samples drawn. The bottom cap on bottle was open. |
| 95/2 | 214 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 215 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 217 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 218 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 95/2 | 219 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 95/2 | 220 | salt | 5 | Salinity log indicates a switch malfunction sample run discontinued at bottle 7. It appears that the remaining samples were not analyzed. Code salinity lost. |
| 96/2 | 203 | o2 | 2 | Sample was overtitrated and backtitrated. Oxygen as well as salinity and nutrients are acceptable. QCC: overtitration not good put orig titer back in which resolved the high oxygen. Oxygen as well as salinity and nutrients are acceptable. |
| 96/2 | 204 | o2 | 2 | Sample was overtitrated and backtitrated, failed Abort Sample. QCC: overtitration not good put orig titer back in which resolved the high oxygen. Oxygen as well as salinity and nutrients are acceptable. |
| 96/2 | 212 | bottle | 2 | The valve was open. Oxygen appears slightly high but agrees with CTDO up trace. Oxygen as well as salinity and nutrients are acceptable. |
| 97/1 | 126 | o2 | 5 | Sample lost due to broken flask. |
| 99/3 | 301 | sio3 | 2 | Silicate value higher than previous adjacent stations. However, it fits the profile when compared to later adjacent stations. Indicates silicate regeneration in deep Antarctic waters. No analytical problems noted. Code silicate acceptable. |
| 99/3 | 304 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings resolved difference within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 99/3 | 307 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings resolved difference. Salinity as well as oxygen and nutrients are acceptable. |
| 99/3 | 312 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve difference. Code salinity bad, oxygen and nutrients are acceptable. |
| 99/3 | 320 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Additional readings resolved difference within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 99/3 | 327 | bottle | 4 | Bottle appears to have mis-tripped. Code bottle did not trip as scheduled and samples bad. |
| 99/3 | 327 | no2 | 4 | |
| 99/3 | 327 | no3 | 4 | |
| 99/3 | 327 | o2 | 4 | |
| 99/3 | 327 | po4 | 4 | |
| 99/3 | 327 | salt | 4 | Bottle salinity is low compared with CTD and adjoining stations; same salinity as bottle 329, possibly mis-sampled. Code salinity bad. |
| 99/3 | 327 | sio3 | 4 | |
| 99/3 | 334 | salt | 5 | Sample log indicates that salinity was to be drawn, but salinity log indicates there were only 32 samples not 33. |
| 101/2 | 201 | ctdo | 3 | CTDO sensor offset/noisy starting 3398 db downcast. Code CTDO questionable. |
| 101/2 | 201 | ctds | 3 | CTDS sensor offset/noisy until about 3600 db upcast. Code CTDS questionable. |
| 101/2 | 202 | ctdo | 3 | CTDO sensor offset/noisy starting 3398 db downcast. Code CTDO questionable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 101/2 | 204 | o2 | 3 | Bottle oxygen low compared to downcast or upcast CTDO. Code oxygen questionable. |
| 102/1 | 101 | ctdo | 3 | CTDO sensor offset/noisy/spiking 2580db down until 1140db up. Code CTDO questionable. |
| 102/1 | 101 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 102 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 102 | o2 | 9 | No oxygen sample drawn, duplicate trip for Black Carbon. |
| 102/1 | 103 | ctdo | 3 | CTDO sensor offset/noisy/spiking 2580db down until 1140db up. Code CTDO questionable. |
| 102/1 | 103 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 104 | ctdo | 3 | CTDO sensor offset/noisy/spiking 2580db down until 1140db up. Code CTDO questionable. |
| 102/1 | 104 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 105 | ctdo | 3 | CTDO sensor offset/noisy/spiking 2580db down until 1140db up. Code CTDO questionable. |
| 102/1 | 105 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 106 | ctdo | 3 | CTDO sensor offset/noisy/spiking 2580db down until 1140db up. Code CTDO questionable. |
| 102/1 | 106 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 107 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 108 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 109 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 110 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 111 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 112 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 113 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 114 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 115 | ctds | 3 | CTDC noisy, spiking/drops from 2580db down until 1140db up. Code CTDS questionable. |
| 102/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 102/1 | 123 | bottle | 9 | No samples drawn, reason not indicated. |
| 102/1 | 128 | o2 | 9 | No oxygen sample drawn, duplicate trip for Black Carbon. |
| 102/1 | 128 | salt | 9 | No salt sample drawn, no water, duplicate trip for Black Carbon. |
| 102/1 | 134 | o2 | 9 | No oxygen sample drawn, duplicate trip for Black Carbon. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 103/2 | 201 | sio3 | 2 | Silicate value appears to be higher than adjacent stations. However, it matches the trends of later deep adjacent stations. Indicates silicate regeneration in deep Antarctic waters. No analytical problems noted. Code silicate acceptable. JHS: High dissolution from sediments expected here, SiO3 acceptable. |
| 103/2 | 223 | bottle | 9 | No samples drawn, reason not indicated. |
| 103/2 | 233 | o2 | 3 | Oxygen low compared with CTD and adjoining station profile. No analytical problems noted. Code oxygen questionable, salinity and nutrients acceptable. |
| 104/3 | 316 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 104/3 | 317 | o2 | 2 | Wrong stopper (1511 w/1124). QCC: data checked against nutrients and all acceptable. |
| 104/3 | 320 | bottle | 2 | No gases on 20, strap made bottom cap leak. Oxygen was drawn and is acceptable as well as salinity and nutrients. |
| 104/3 | 323 | o2 | 2 | Wrong stopper (1124 w/1511). QCC: data checked against nutrients and all acceptable. |
| 104/3 | 324 | sio3 | 2 | Silicate value higher than adjacent stations. Feature also observed in other nutrients and oxygen. No analytical problems noted and charts rechecked. Salinity agrees with CTD and adjoining stations. Code silicate acceptable. |
| 105/1 | 101 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 105/1 | 110 | po4 | 2 | Phosphate value slightly lower than adjacent stations. Feature also observed in silicate. No analytical problems noted and charts rechecked. Code phosphate acceptable. |
| 105/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, used SBE35RT data to get precise trip time to recover CTD trip data. Code acceptable. |
| 105/1 | 125 | o2 | 2 | Oxygen high, ˜0.1, no analytical problems noted. Slight feature seen in SiO3 and feature seen in Station 104. |
| 105/1 | 131 | reft | 3 | SBE35RT low vs CTDT; unstable SBE35RT reading, code questionable. |
| 105/1 | 133 | salt | 3 | Bottle salinity is low compared with CTDS. Salt code questionable. |
| 105/1 | 134 | salt | 4 | Bottle salinity is high compared with CTD and station profile. 4 attempts for a good salinity reading. Additional readings do not resolve the discrepancy. Code salinity bad, oxygen and nutrients acceptable. |
| 106/1 | 101 | salt | 2 | Bottle salinity is low compared with CTD agrees with adjoining stations. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 106/1 | 105 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve the discrepancy. Code salinity bad |
| 106/1 | 106 | salt | 2 | Bottle salinity is high compared with CTD agrees with adjoining stations. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 106/1 | 108 | salt | 2 | Bottle salinity is high compared with CTD and adjoining stations. 6 attempts for a good salinity reading. First reading resolved discrepancy. Salinity as well as oxygen and nutrients are acceptable. |
| 106/1 | 110 | salt | 2 | Bottle salinity is high compared with CTD agrees with adjoining stations. Within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable. |

| Station /Cast | Sample No. | Property | Quality Code | Comment |
|---|---|---|---|---|
| 106/1 | 116 | bottle | 2 | No trip confirmation on bottle 16, no SBE35RT data for timestamp (lost); used combination of COLog time (whole minutes), average of 2 nearest trip times, 30+ seconds after winch stop and salinity differences (logical guess) to recover CTD trip data. Bottle/CTD oxygen and salinity agree. Code acceptable. |
| 106/1 | 120 | salt | 2 | 3 attempts for a good salinity reading. Salinity is high compared with CTD agrees with adjoining stations. Additional readings brought within specifications of measurement. Salinity as well as oxygen and nutrients are acceptable. |
| 106/1 | 123 | salt | 4 | Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Additional readings did not resolve the discrepancy. Code salinity bad, oxygen and nutrients acceptable. |

## CCHDO Data Processing Notes

| Date | Contact | Data Type | Action |
|---|---|---|---|
| 05/01/08 | Diggs | BOT | No data online until verified by ODF |
| | Swift and Sanborn agreed to delay data being put online until ODF has a chance to verify accuracy of data. | | |
| 11/03/08 | Swift | BTL | Data are Public |
| | Yes, the I6S bottle data may now go on line | | |
| 11/07/08 | Johnson, Mary | CTD/BTL/SUM | PRELIMINARY |

Expo: 33RR20080204 Line: I06S
Date: 2008-02-04
Action: Place Online

>> Posted November 7, 2008 (M.C.Johnson/P.Nahavandi)

CLIVAR - I06S-2008 PRELIMINARY CTD + Bottle data

Preliminary CTD and Bottle data are available in several formats:
WHP-Exchange format (_hy1.csv/_ct1.csv)
WHP90.1 format (i06s.sum/i06s.sea/*.ctd) and WHP NetCDF format (CTD only, *.nc).
Descriptions of formats and parameter names can be found at:

http://cchdo.ucsd.edu/format.htm

Full ODF documentation will be available when final processed data are released.

Since Oct. 2008, a few problems in the stored GPS navigation (position) data were resolved, resulting in updated position data for stations 5-7, 75 and 93. Quality codes for despiked (code 7) and interpolated (code 6) CTD levels have been applied, but quality code 3 or 4 supersedes either of these codes in the CTD data files.

CTD data T and C/O2 have been corrected to SBE35RT and bottle data (respectively), grouped by sensor serial numbers; no casts have been adjusted individually. T/S and T/O2 overlay plots will be used to fine-tune corrections, then final Pressure/Property plots will be examined to insure any remaining problems with individual casts are investigated, documented and/or quality-coded.

There is a 0.002 mS/cm difference between pre- to post-cruise Sea-Bird Conductivity calibration results and shipboard salinity values (shipboard values are lower). Discussions with SeaBird are continuing, and comparisons of two different IAPSO SSW standard batches are pending. The issue will be addressed and documented before data are finalized.

There are major problems with noisy CTD data (signal transmission, sensor and/or pump problems, to name a few) on stations 2/1, 3/2, 6-18, late 60s through 80, 84, 102 and 103 (perhaps others). Secondary T/C sensors were used where it was possible to improve the quality of the CTD data by using them. Broad despiking filters were applied to these noisy casts, and attempts were made to do preliminary coding of bigger CTD data problems. No special fitting of T/C/O2 to SBE35RT/bottle data for these casts with major noise/pump problems was attempted, but rather they were substantially coded questionable.

The files named "i06s*.zip" were created with the Linux zip (v2.31) utility for the benefit of PC users. The data can be expanded into the directory "./I06S-2008" using "unzip" or "pkunzip" utilities. Note that pkunzip 2.04g or unzip 5.0p1 (or later versions) must be used to extract files produced by pkzip 2.04 or zip 2.3. Earlier versions are not compatible.

CONTENTS of the directory ./I06S-2008 (approximately 39 Mbytes expanded), broken down by .zip-file contents:

| | |
|---|---|
| README.I06S | comments regarding prelim. data release/documentation |
| i06s_hy1.csv | bottle data in WHP-Exchange format |
| i06s.sum | station-cast description file in WHP90-1/rev.2 (WOCE) format |
| i06s.sea | bottle data in WHP90-1/rev.2 (WOCE) format |
| i06s_ct1.zip | CTD data in WHP-Exchange format (I06S-2008/ssscc_ct1.csv) |
| i06s_ctd.zip | CTD data in WHP90-1/rev.2 (WOCE) format (I06S-2008/ssscc.ctd) |
| i06s_nc.zip | CTD data in NetCDF format (I06S-2008/ssscc.nc) |

109 CTD casts reported (stations 1-106, 2 casts reported for stas 2,72,81)
only last yoyo cast (17) reported for sta 91
(sss = station number cc = cast number)

QUESTIONS:

Chief Scientist:

Dr. Kevin Speer email: kspeer@fsu.edu phone: 850-645-4846
Oceanography
Florida State University
105 N. Woodward Ave.
Tallahassee, FL 32306-4320

Questions regarding ODF data should be directed to:

Bottle: Kristin M. Sanborn email: ksanborn@ucsd.edu phone: 858-534-1903
STS/ODF, Mail Code 0214
SIO/UC San Diego
9500 Gilman Drive
La Jolla, CA 92093-0214

CTD: Parisa Nahavandi email: parisa@ucsd.edu phone: 858-534-8262 or
Mary Carol Johnson email: mcj@ucsd.edu phone: 858-534-1906
(both same physical address as Kristin)

| | | | |
|---|---|---|---|
| 11/13/08 | Fields | CTD/BTL/SUM | PRELIMINARY DATA ONLINE |

I've placed the sum file, exchange bottle, and exchange ctd files up on cchdo.These data are marked as preliminary.

| | | | |
|---|---|---|---|
| 11/14/08 | Dickson | ALKALI | Submitted: FINAL DATA |

THESE DATA HAVE BEEN SUBMITTED TO THE CCHDO AND ARE SCHEDULED TO BE MERGED INTO THE ONLINE BOTTLE DATA FILES SOON. THE ALKALINITY DATA IN THE BOTTLE FILES ARE STILL PRELIMINARY AT THIS TIME.

Andrew Dickson wrote: "Here are our final I06S total alkalinity data (together with the rest). I am now finalizing our report on this data set, and hope to have it to you shortly."

| Date | Contact | Data Type | Action |
|---|---|---|---|
| 03/05/09 | Willey | Cruise Report | Submitted: CFC report correction |
| | This submission is a correction to the documentation file. This paragraph should replace the Calibration paragraph in the CFC section of the documentation. | | |
| 03/05/09 | Willey | CFCs | Submitted: Final/Public |
| | I am submitting the final CFCs for I06S 2008. In addition, I will submit a correction to the documentation. | | |
| 03/06/09 | Johnson, Mary | CTD/BTL/SUM | Submitted: Revised data |
| | Nov. 2008 - Mar. 2009 revisions: a few quality codes were corrected for CTD data, fluorometer quality codes 5 or 9 were added for a malfunctioning or absent fluorometer on stas 22-32. "Uncalibrated data" code 1 was added for fluorometer, transmissometer, PAR and SPAR for stations 72-77 and 84, where those codes were missing; they were already coded as such for all other casts. The CTD calibrations were updated for stations 81-106; the changes should only cause minor changes to the reported CTD data.<br><br>A few more bottle data issues were also found and resolved; most were conflicts between Sample Log notations and samples uploaded into the ODF database for a few analyses. | | |
| 03/09/09 | Fields | CTD/BTL/SUM | Website Updated: new files online |
| | Mary sent updated ctd, bottle, and sum files on March 6th, I put them online on March 9th. | | |
| 04/30/09 | Fields | CDOM/CFCs | Website Updated: data online |
| | I noticed that the bottle files for I06s have CFC-113 instead of CFC113. I changed CFC-113 to CFC113.<br><br>I06S_2008_CFCs.csv from Debra Willey<br>In this file data from station 64 was listed form cast 1.<br>According to the sum file there was only a rosette cast 2, no 1.<br>• I changed all of the cast values to 2 for station 64.<br>• Station 91 has cast 2. There were 17 casts for this station, with cast 17 looking like the one that actually collected bottle data. I changed all cast values for station 91 to 17.<br>• Station 92 has multiple cast values. The sum file lists only cast 3. I changed all station 92 cast values to 3. This seems like the most questionable change, as Debra Willey had casts 1,2, and 3 listed for station 92.<br>• Station 1 had cast 1. I changed this to cast 2.<br>In summary, I made the following cast changes:<br>Station 1 1 => 2<br>Station 52 1 => 2<br>Station 64 1 => 2<br>Station 91 2 => 17<br>Station 92 1 => 3, 2 => 3<br><br>After making these changes I was able to merge the following columns:<br>CFC-11,CFC-11_FLAG_W,CFC-12,CFC-12_FLAG_W,CFC113,CFC113_FLAG_W<br><br>ucsb_cdom_i6s_s7a_20090130.txt CDOM data from Norman Nelson at UCSB<br>• I first ran this translate command on the file: tr '\r' '\n'<br>• Changed data from tab delimited to csv.<br>• Translated CDOM names and quality flags to match our parameter list.<br>• The parameter CDOM was already in the bottle files, with units of 325_1/M. I removed the CDOM column since CDOM325 was included with the new merge file. | | |

| Date | Contact | Data Type | Action |
|---|---|---|---|

The following parameters were merged:

- CDOM325,CDOM325_FLAG_W,CDOM340,CDOM340_FLAG_W,CDOM380,CDOM380_FLAG_W,
- CDOM412,CDOM412_FLAG_W,CDOM443,CDOM_443_FLAG_W,CDOM490,CDOM490_FLAG_W,
- CDOM555,CDOM555_FLAG_W,CDOMSL,CDOMSL_FLAG_W,CDOMSN,CDOMSN_FLAG_W

I created a new woce bottle file from this exchange file. Two columns from the old woce bottle file are missing in the new one that was generated from the exchange bottle file: CTDRAW and THETA. I have not created a new netcdf archive for these data.

| Date | Contact | Data Type | Action |
|---|---|---|---|
| 05/07/09 | Nahavandi | CTD/BTL/SUM | Submitted: revised data & documentation |

Nahavandi CTD/BTL/SUM Submitted: revised data & documentation
>> Posted May 6, 2009 (M.C.Johnson/P.Nahavandi)

CLIVAR - I06S-2008 FINAL CTD + Bottle data and Documentation

Final CTD and Bottle data are available in several formats:
WHP-Exchange format (_hy1.csv/_ct1.csv)
WHP90.1 format (i06s.sum/i06s.sea/*.ctd)
and WHP NetCDF format (CTD only, *.nc).

Descriptions of formats and parameter names can be found at
http://cchdo.ucsd.edu/format.htm

Full ODF documentation is now available.

------------------

May 2009 revisions: a few more quality code errors were found and corrected for CTD and bottle data. Both bottle files have been regenerated and include the coding changes; the .sum file was re-created but has not changed.

Data files for CTD stations 9/2, 10/1, 101/2 and 102/1 have been rewritten to update quality coding. CTD station 14/2 is still reported using primary TC data (01402 standard file prefix), but secondary TC data is somewhat better at deeper pressures. The secondary TC data are now also reported in separate files (01402-2 file prefix), so end-users can pick and choose the data set with the least noise for the area of greatest interest.

ODF documentation has been finalized and is included with the data.

------------------

Nov. 2008 - Mar. 2009 revisions: a few quality codes were corrected for CTD data, fluorometer quality codes 5 or 9 were added for a malfunctioning or absent fluorometer on stas 22-32. "Uncalibrated data" code 1 was added for fluorometer, transmissometer, PAR and SPAR for stations 72-77 and 84, where those codes were missing; they were already coded as such for all other casts. The CTD calibrations were updated for stations 81-106; the changes should only cause minor changes to the reported CTD data.

A few more bottle data issues were also found and resolved; most were conflicts between Sample Log notations and samples uploaded into the database for a few analyses. The parameter lists for each cast in the .sum file may differ as a result of some of these changes.

------------------

Oct. 2008 - Nov. 2008 revisions: a few problems in the stored GPS navigation (position) data were resolved, resulting in updated positions for stations 5-7, 75 and 93. Quality codes for despiked (code 7) and interpolated (code 6) CTD levels have been applied, but quality code 3 or 4 supersedes either of these codes in the CTD data files.

------------------

There are major problems with noisy CTD data (signal transmission, sensor and/or pump problems, to name a few), particularly on stations 2/1, 3/2, 6-18, late 60s through 80, 84, 102 and 103. Secondary T/C sensors were used where it was possible to improve the quality of the CTD data by using them. Broad despiking filters were applied to these noisy casts, and attempts were made to do preliminary coding of bigger CTD data problems. No special fitting of T/C/O2 to SBE35RT/bottle data for these casts with major noise/pump problems was attempted, but rather they were substantially coded questionable. Details are provided in the accompanying documentation.

Only the most basic processing (block-averaging) was performed on the Trace Metal CTD data; 2007 SBE calibration information was provided by U. of Hawaii and applied to Pressure, Temperature and Conductivity (Salinity). No corrections were applied to Fluorometer data, and very basic oxygen fits using nearby casts' oxygen data were applied to TM Oxygen data in order to get them in the ballpark.

The files named "i06s*.zip" were created with the Linux zip (v2.31) utility for the benefit of PC users. The data can be expanded into the directory "./I06S-2008" (or ./I06S-TM-2008 for TM casts) using "unzip" or "pkunzip" utilities. Note that pkunzip 2.04g or unzip 5.0p1 (or later versions) must be used to extract files produced by pkzip 2.04 or zip 2.3. Earlier versions are not compatible.

CONTENTS of the directory ./I06S-2008 (approximately 39 Mbytes expanded), broken down by .zip-file contents:

README.I06S   comments regarding prelim. data release/documentation
i06s_hy1.csv  bottle data in WHP-Exchange format
i06s.sum      station-cast description file in WHP90-1/rev.2 (WOCE) format
i06s.sea      bottle data in WHP90-1/rev.2 (WOCE) format

i06s_ct1.zip  CTD data in WHP-Exchange format (I06S-2008/ssscc_ct1.csv)
i06s_ctd.zip  CTD data in WHP90-1/rev.2 (WOCE) format (I06S-2008/ssscc.ctd)
i06s_nc.zip   CTD data in NetCDF format (I06S-2008/ssscc.nc)
(sss = station number cc = cast number)

09 CTD casts reported (stations 1-106, 2 casts reported for stas 2,72,81)
only last yoyo cast (17) reported for sta 91
NOTE: files named 01402-2.* contain secondary TC data for station 01402

Added Nov. 18, 2008: PRELIMINARY Trace Metal bottle data and CTD casts (i06s-tm.zip).

Trace Metal data in WHP-Exchange format (sub-directory I06S-TM-2008):
I06S-TM-2008/i06s-tm_hy1.csv    I06S TM bottle data
I06S-TM-2008/ssscc_ct1.csv      I06S TM CTD data
30 TM CTD casts, stations 1-43, typically every other cast
(2 casts each for stas 11,12,21,25,29,33,37,41)

Added May 6, 2009: FINAL ODF DOCUMENTATION files (in i06s_doc.zip):

I06S_DOC/i06sdoc.pdf  I06S documentation in Adobe pdf format

| | | | |
|---|---|---|---|
| | I06S_DOC/i06sdoc.tx I06S documentation in ascii/plain text - no figures<br><br>QUESTIONS:<br><br>Chief Scientist:<br>Dr. Kevin Speer email: kspeer@fsu.edu phone: 850-645-4846<br>Oceanography<br>Florida State University<br>105 N. Woodward Ave.<br>Tallahassee, FL 32306-4320<br><br>Questions regarding ODF data should be directed to:<br><br>Bottle: Kristin M. Sanborn email: ksanborn@ucsd.edu phone: 858-534-1903<br>STS/ODF, Mail Code 0214<br>SIO/UC San Diego<br>9500 Gilman Drive<br>La Jolla, CA 92093-0214<br><br>CTD: Parisa Nahavandi email: parisa@ucsd.edu phone: 858-534-8262<br>or Mary Carol Johnson email: mcj@ucsd.edu phone: 858-534-1906<br>(both same physical address as Kristin) | | |
| 07/07/09 | Kappa | Cruise Report | Updated PDF & txt files online |
| | New cruise report includes: ODF CTD & Bottle data reports, Updated Data Processing Notes | | |