RV Franklin Cruise Fr 7/92 (09FA0792)

Itinerary

Depart Townsville 0800 Saturday 19th September, 1992
Arrive Brisbane   0630 Tuesday 6th October, 1992

Scientific programs

1. Ocean transport in the Tasman and Coral Seas

2. Dimethyl sulphide in surface and sub-surface waters

Principal Investigator

Dr John Church, CSIRO Division of Oceanography

Other Investigators

Dr Gary Meyers and Mr Fred Boland, CSIRO Division of Oceanography

Professor Matt Tomczak, Flinders University of South Australia

Dr Graham Jones, James Cook University

Cruise narrative

Weather was good when we departed Townsville - no clouds, wind of less than 10 knots. Boat drill at 0900 was followed by Master's and Chief Scientist's briefings.

The first single Niskin cast for Graham Jones was completed at about 1000 and these were continued at roughly four hour intervals. Several trichodesmium blooms were sampled. DMS and DMSP were detected.

Late Tuesday (September 22) we arrived at the mooring location and the 2,000 metre mooring was recovered. The 4,000 metre mooring was recoverd early Wednesday. However, both of the moored ADCPs were not functioning properly and we could not redeploy the moorings. The most offshore (4,400 metre) mooring was recovered on Thursday. By this time the deck was so cluttered that no more moorings could be recovered until some were redeployed. Friday (September 25) was lost to bad weather and on Saturday the most offshore mooring was redeployed in marginal conditions. The weather deteriorated during the deployment and the 4,000 metre mooring could not be deployed until 1430 on Sunday. On Monday 28 the weather was excellent. The 2,000 metre mooring was deployed by 0800 and the 700, 200 and 100 metre moorings were recovered by about 1300. On Tuesday, the final three moorings were deployed. During the nights when mooring work could not be undertaken, either the ADCPs for the moorings were tested or ship-mounted ADCP data was collected.

The short CTD section was finally commenced late on Tuesday, October 29. Only two stations were completed before the winds reached 45 knots. By

Wednesday the weather was good enough to continue CTD stations. Over the next few days, CTD stations were continued in sloppy weather and the final CTD station was completed about 2330 on Sunday. Franklin then steamed north and we arrived in Brisbane at 0630 Tuesday, October 6.

The CTD section is so short that it may not be useful for WOCE purposes.

The CTD station numbering starts at 15 - the first 14 numbers were used for bottle stations for the DMS work.

CTD Measurements During RV Franklin Cruise Fr7/92

The CTD used throughout this RV Franklin cruise Fr7/92 was CSIRO CTD No. 1 (A Neil Brown Instrument Systems MkIII B profiler, Serial Number: 01-1073). The Sensors on the profiler where :

Sensor	Manufacturer	Resolution	Accuracy
Temperature:	Rosemount PRT	0.0005C	0.003C
Conductivity:	EG&G NBIS	0.001mmho	0.005mmho
Pressure	Paine Instruments	0.1 dbar	6.5 dbar
Dissolved Oxygen	Beckman Polarographic		

The fast response thermistor had been removed prior to this cruise, in fact the thermistor had not been used on this instrument in the field.

CTD Temperatures are calibrated against water (0.010C) and phenoxybenzene (~27C) using platinum resistance thermometers as transfer standards. The lab which carries out this calibration (The CSIRO Division of Oceanography Calibration Facility) is accredited by NATA, Australia's National Association of Testing Authorities, to calibrate CTDs to 0.003C at the water triple point and 0.004C at the phenoxybenzene point. Both of these uncertainties are at the 99% level. Calibration is carried out as often as practicable given the Franklin's itinerary.

The CTD was calibrated in August 1992 and the constants from that calibration were used for this cruise.

All CTD temperatures are ITS-90.

The CTD pressure was calibrated against a deadweight tester in the "down cast" direction only. In addition, the pressure at the first "in water" sample were used to derive an offset for each station.

Salinity calibration are based on in situ bottle data. Laboratory checks are only maintained to ensure the sensor is operating correctly. Using 439 sample bottles out of a total of 491, the difference between the CTD salinities and the water samples showed a standard deviation of 0.0023psu for the whole water column.

The calibration technique follows that used by Bob Millard's group at WHOI closely. The stations (15 - 45) were treated as a single group.

Dissolved oxygen calibration is carried out using a method very similar to that described in Owens and Millard Jr (1985). This method is to fit the downcast profile of dissolved oxygen to the sample bottles collected during the upcast.

The difference between the CTD downcast oxygens and the sample bottle oxygens show a standard deviation of 2.51 umol/L (equivalent to 0.056 mL/L) for the whole water column.

Apart from the first three stations (15, 16 & 17) the dissolved oxygen sensor appeared to provide data of reasonable quality and consistency. There was no DO calibration for stations 15 - 17 as the sampling for these stations (15 - bottle test, 16 - no samples and 17 - too few satisfactory samples) was not suitable. Stations 23 and 24 had no samples, but the sensor performance seemed consistent for stations 19 through 25, allowing a satisfactory interpolation across this gap. A total of 417 of the 459 available bottles were used in the fitting.

CTD Data Collection and Processing

A PDP 11/73 computer with a 150Mb hard disk was used as the primary data logging device. Data is logged directly to hard disk, whilst simultaneously recorded on audio tape. Logging is commenced before the CTD profiler is deployed and downcast is normally logged as a single file. Positions and times are logged automatically. Complete upcasts are recorded and the locations of samples are flagged in the data file. 15 second bursts are used for the calibration.

Following completion of the station uncalibrated averaged files are sent over the network to a VAX 11/750 for use on-board during the cruise and the raw data and pre-processed files are written to 9 track tape. The data is later transfered from tape to Exabyte cartridge using the VAX/VMS Backup utility. These cartridges contain all the raw data collected during a cruise and are permenantly archived.

Post-cruise processing follows the following scheme:

- there is an initial 'clean up' stage were station data is checked, unwanted casts are removed, etc.

- a set of uncalibrated 2dB average files are produced, as well as summaries of the data for each sample burst. At this stage temperature and pressure calibrations are put in.

- bad data (e.g. where something has got stuck in the conductivity cell) is removed.

- the sample data is merged with the hydrology data, and some samples are flagged as being 'unsuitable for calibration (e.g. due to large gradients). An iterative process then follows, where outliers are progressively removed and a calibration constant (a conductivity ratio) is determined for each station.

- once this has been done, calibrated 2dB average files are produced. A simple recursive filter is used to 'slow down' the faster sensors (pressure and conductivity) to the slowest sensor (temperature - the response time of the platinum resistance thermometer is ~.175 seconds). Values are checked for implausible gradients, and any ascending parts of the trace are ignored (i.e. any values for which the pressure is less than the maximum pressure for this cast so far are ignored). At the same time 2dB averages of oxygen current and oxygen temperature are calculated.

- the calibrated 2db averages are plotted, and the plots examined. In addition, T/S curves of groups are plotted and checked for agreement of the deep T/S values. The traces are also examined for density inversions, and sections removed if this seems appropriate.

Fr7/92 (09FA0792).
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Salinity. The water samples salinities where measured with a YeoKal Model 601MkIII Inductive Salinometer that was standardised daily with IAPSO Standard Sea Water (SSW) Batch P115 (Cond Ratio: 0.99986).
The accuracy of the salinnometer claimed by the manufacturer is 0.003 psu. (Yeo-Kal Electronics Pty Ltd, Brookvale, NSW, 2100, Australia)

Oxygen. The method used is a modified Winkler titration. All oxygen values (Bottle and CTD were converted from umol/l to umol/kg using the salinity of the sample and the nominal temperature (25C) of the lab in which the analyses were done.

Nutrient Analyses

Samples are collected in 15ml polypropylene tubes and frozen for up to one week before analysis using a Technicon AA2 system. They are thawed at room temperature.

Nitrate determination is based on the reduction of nitrate in the sample to nitrite using a granulated cadmium reductor column and imidazole buffer. Nitrite then reacts with sulphanilimide to form a diazonium ion which reacts with napthylethylene dihydrochloride to form a coloured azo dye which is measured at 550nm. Nitrite is also determined using the same chemistry without the use of a reductor column.

Dissolved phosphate is determined by reaction with acid molybdate in the presence of antimony ion. Phosphomolybdate is then reduced by ascorbic acid at 37C and the blue complex measured at 880nm.

Reactive silicate is combined with acid molybdate and the complex reduced by methylaminophenol. Interference by phosphate is eliminated by the addition of oxalic acid which reacts with excess molybdate and the blue colour is measured at 820nm.

Nutrients are converted from umol/l to umol/kg using the nominal temperature of the chemistry lab on RV Franklin (25C)

Miscellaneous

The sounder used a sound speed of 1500metres/second for this and all subsequent cruises.

Table: Cruise Participants

Fr7/92 Townsville - Brisbane 19 Sep - 6 Oct 1992

Name	Responsibility	Affiliation
John Church	Chief Scientist	CSIRO DO
Fred Boland	Moorings/CTD watch	CSIRO DO
Kevin Miller	Moorings/CTD watch	CSIRO DO
Danny McLaughlin	Moorings/CTD watch	CSIRO DO
Neil White	CTD watch	CSIRO DO

Val Latham	Nutrients/Salts/DOs	CSIRO DO
Mark rayner	Nutrients/Salts/DOs	CSIRO DO
Phil Adams	Electronics	CSIRO DO
Graham Jones	DMS	James Cook University
Mark Curran	DMS	James Cook University

References
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Owens, W. Brechner and Robert C. Millard Jr. " A new Algorithm for CTD Oxygen Calibration." Journal Of Physical Oceanography, 15, 621-631. 1985