RV Franklin Cruise Fr 3/94 (09FA0394)

Itinerary

Depart Hobart 1015 Saturday 10th March, 1994
Arrive Newcastle 0700 Sunday 3rd April, 1994

Scientific program

1. Ocean transport in the Tasman and Coral Seas

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

Cruise narrative

A disappointingly small proportion of the planned CTD work was completed due to the large (record) amount of time lost due to bad weather and to the longer than expected amount of time spent recovering the moorings. Both main CTD sections have substantial gaps.

However, nearly all of the mooring equipment was recovered. It will not be possible to summarise the results from the current meters until this data has been processed.

We sailed from Hobart at 1015 on Thursday the 10th of March after delays due to problems with the bow thruster. The weather was quite good until about 8am the next morning, at which point we hove to. By the end of the 4th day at sea we had been hove to for over three days. This is, apparently, the longest the Franklin has ever been hove to in one spell. Having achieved this unenviable record (one which we all hope will stand without serious challenge for many years) we continued CTD work along this section for a few days before having to heave to again because of strong winds and a big, steep swell from the South. After two days we were able to do one CTD in marginal conditions before conditions worsened again. It was eventually decided to abandon the 43S CTD section as there was little prospect of it being completed in a reasonable time.

We then steamed to Cape Reinga and started the section north from there. This section was completed without incident and we started the 30S section in good conditions. We decided to leave the section on the 25th of March and steam in to the moorings (near the NSW coast at 30S) and recover the moorings, starting early on the 28th. While steaming in a few CTDs were done when weather permitted - the weather had deteriorated again.

The first mooring was recovered without incident on the morning of the 28th.

The acoustic release on the second mooring didn't respond, so we went on to the next (in 700m of water) and recovered that without incident. The three inshore moorings were recovered on the 29th, leaving only the mooring which hadn't responded on the 28th. This mooring was in 4,400 metres of water. After trying to communicate with it again at first light on the 30th a release command was sent and that also had no effect. After several hours searching the top instruments were located (in the correct position) with the ships sounder. As the acoustic release would not release the only option left was to trawl for it. The daylight hours of the 31st of March and the 1st of April were spent trawling with the top part of the mooring being recovered on the afternoon of the 1st. Unfortunately the pressure case (rated to 2000m) of the ADCP at the top of the mooring had imploded - we think that this had happened some time before. Another unsuccessful attempt was made to release the mooring on the morning of the 2nd before steaming to Newcastle.

CTD Measurements During RV Franklin Cruise Fr3/94

The CTD used throughout this RV Franklin cruise Fr3/94 was CSIRO CTD No. 2 (A Neil Brown Instrument Systems MkIII B profiler, Serial Number: 01-1013). 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 immediately before this cruise in February 1994. The constants from this calibrations were used.

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 631 sample bottles out of a total of 788, the difference between the CTD salinities and the water samples showed a standard deviation of 0.0028psu for the whole water column.

The calibration technique follows that used by Bob Millard's group at WHOI closely. The stations groups used were 1-3, 4-8, 9-12, 13-16, 17-19, 20-22, 24-43 and 44-49.

There were a number of problems with CTD oxygen sensors on this cruise and the production of oxygen profile data was not attempted.

CTD Data Collection and Processing

Three Sun Sparcstations are now used for all logging and analysis tasks on RV Franklin. One is dedicated to data logging, another to user analysis and the third is a spare. The data that is logged (raw CTD data including flags at bottle firings) is very similar to that which was logged on the old system and the user interface is similar.

All new data files are copied to the other machines on the network within an hour and daily backups are made to exabyte on two of the three machines.

Uncalibrated 2 decibar averages are provided for user analysis.

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.

Salinity and Dissolved Oxygen Measurements made during RV Franklin Cruise Fr3/94 (09FA0394).

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 P122 (Cond Ratio: 0.99991).
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)

Table: Cruise Participants

Fr3/94 Hobart - Newcastle 10 Mar - 3 Apr 1994

Name	Responsibility	Affiliation
Neil White	Chief scientist	CSIRO DO
Helen Phillips	CTD watch	CSIRO DO
Fred Boland	Moorings/CTD watch	CSIRO DO
Kevin Miller	Moorings/CTD watch	CSIRO DO
Danny Mclaughlin	Moorings/CTD watch	CSIRO DO
Val Latham	Nutrients/Salts/DOs	CSIRO DO
Les Drury	Nutrients/Salts/DOs	CSIRO DO
Phil Adams	Electronics	CSIRO DO

References

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