RV Franklin Cruise Fr 10/91 (09FA1091)

Itinerary

Depart Sydney 1500 Friday 15th November, 1991
Arrive Noumea 1130 Tuesday 3rd December, 1991
Depart Noumea 1000 Wednesday 4th December, 1991
Arrive Sydney 0900 Sunday 15th December, 1991

Scientific programs

1. Ocean transport in the Tasman and Coral Seas

2. Application and validation of the along track scanning radiometer of ERS-1.

Principal Investigator

Dr John Church, CSIRO Division of Oceanography

Other Investigators

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

Drs Ian Barton and Fred Prata, CSIRO Division of Atmospheric Research

Cruise narrative

After sailing from Sydney, we steamed straight to the inshore end of the mooring section. We then steamed over the mooring section to get a better idea of what the bathymetry was like (there is very little bathymetry data available for this area). The first (inshore) mooring was deployed before breakfast on the 17th of November. The next two moorings were deployed on the same day. The fourth mooring was not attempted on this day because of deteriorating weather - the Doppler profilers could not be moved safely from the forward end of the rear deck in the conditions. The 30S CTD section was commenced overnight, and the remaining 3 moorings were deployed on the 18th in better conditions. The mooring work went without incident.

The 30S section was then continued, and was completed on the 26th of November. The new CTD deck unit, rosette unit and display system were being used for the first time on this cruise. The most serious problem with the CTD system was some misfires of the rosette.

The section from New Zealand was commenced on the 27th of November and was completed without incident (apart from a few misfires) on the 2nd of December. Because the port call had been moved back one day and because we had made up a substantial amount of time on the New Zealand - Noumea section, we did the first few stations of the 23S section before steaming into Noumea.

After leaving Noumea, we continued the 23S section in good, but mostly cloudy weather. CTD work continued, but the cloudy weather was not ideal for the ERS-1 verification work. The "Flying Fish' was deployed for the first time (without electronics) on the 5th of December and again after some adjustment to the harness on the 7th of December.

A number of satellite tracked drifters were deployed for George Cresswell along this section. In addition, Rick Bailey (who had joined the ship in Noumea) performed a number of XBT and XCTD trials and calibrations.

The 23S section was completed on the 9th of December and a number of transects across the East Australian Current using the Doppler profiler and XBTs were performed. The repeat of the inshore part of the 30S section was commenced on the 12th of December but was abandoned on the 13th of December because of deteriorating weather (40 knot north-easterly winds with stronger gusts and squalls). We then steamed towards Sydney, performing another ADCP/XBT transect across the EAC into Sugarloaf Point on the way.

CTD Measurements During RV Franklin Cruise Fr10/91

The CTD used throughout this RV Franklin cruise Fr10/91 was CSIRO CTD No. 4 (A Neil Brown Instrument Systems MkIII B profiler, Serial Number: 01-1197) 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 1991 and the constants from that calibration were used for this cruise. The next calibration, in August 1992, showed no significant change in the calibration of the CTD.

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 1717 sample bottles out of a total of 1931, the difference between the CTD salinities and the water samples showed a standard deviation of 0.0027psu for the whole water column.

The calibration technique follows that used by Bob Millard's group at WHOI closely. The station groupings used were 1-14, 15-18, 19-25, 26-46, 47-53, 54-69, 70-86, 87-90, 91-94, 95-103 and 104-121.

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 3.57 umol/L (equivalent to 0.080 mL/L) for the whole water column.

Problems were experienced with the dissolved oxygen sensors through this cruise. The sensor initially exhibited a lack of sensitivity which was compensated for by the fitting routines used in the calibration process. Stations 42 to 52 were fitted singly to account for this accelerated sensitivity loss. The cell was changed following station 52. Problems of noisy data generally continued and in particular a step like phenomenon appeared in the deep data until the cell was tightened in its mount prior to station 89. The general noise levels seemd to remain but the step like phenomenon disappeared.

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.

Salinity and Dissolved Oxygen Measurements made during RV Franklin Cruise Fr10/91 (09FA1091).

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 P112 (Cond Ratio: 0.99984).
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

All sounder data for this cruise was collected with the sounder using a sound speed of 1498 metres/second. The depth of the sounder below the water surface has been taken into account.

Table: Cruise Participants

Fr10/91 Sydney - Sydney 15 Nov - 15 Dec 1991

Name	Responsibility	Affiliation
Leg 1 - Sydney to Noumea		
Neil White	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
Ron Plaschke	Nutrients/Salts/DO's	CSIRO DO
Bob Griffiths	Nutrients/Salts/DO's	CSIRO DO
Phil Adams	Electronics	CSIRO DO
Bernadette Heaney	CTD watch	CSIRO DO
Phaedra Hay	CTD watch	Sydney University
Bob Cechet	ERS-1 validation	CSIRO DAR
Leg 2 - Noumea to Sydney		
Neil White	Chief Scientist	CSIRO DO
John Church	CTD watch	CSIRO DO
Kevin Miller	CTD watch	CSIRO DO
Rick Bailey	XCTD trials	CSIRO DO
Ron Plaschke	Nutrients/Salts/DO's	CSIRO DO
Bob Griffiths	Nutrients/Salts/DO's	CSIRO DO
Phil Adams	Electronics	CSIRO DO
Bernadette Heaney	CTD watch	CSIRO DO
Daniel Large	CTD watch	Sydney University
Bob Cechet	ERS-1 validation	CSIRO DAR
John Bennet	ERS-1 validation	CSIRO DAR

References

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