R.V. FRANKLIN

NATIONAL FACILITY
OCEANOGRAPHIC RESEARCH VESSEL

RESEARCH SUMMARY

CRUISE FR 1/90

Sailed: Hobart 1015 hrs 10 January 1990
Called: Triabunna 0705 hrs 13 January 1990
Called: Hobart 0820 hrs 16 January 1990
Arrived: Hobart 0920 hrs 30 January 1990

Principal Investigators

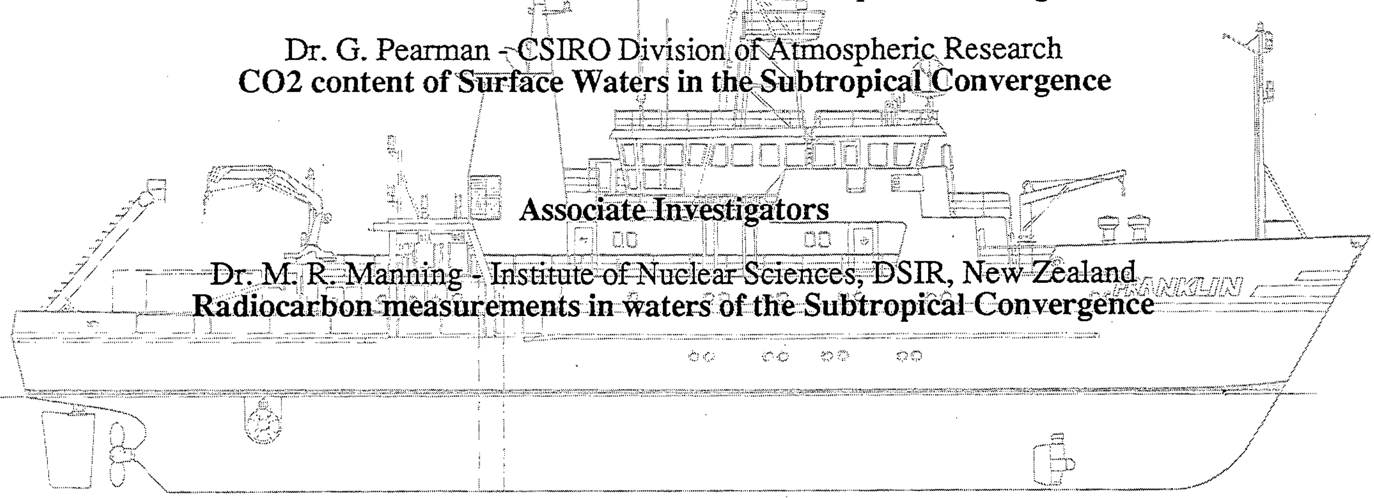
Dr. G. P. Harris - CSIRO Division of Fisheries and Director, COSSA
Subtropical Convergence: Physics, Chemistry and Biology

Dr. D. J. Mackey - CSIRO Division of Oceanography
CO2 content of Surface Waters in the Subtropical Convergence

Dr. G. Pearman - CSIRO Division of Atmospheric Research
CO2 content of Surface Waters in the Subtropical Convergence

Associate Investigators

Dr. M. R. Manning - Institute of Nuclear Sciences, DSIR, New Zealand
Radiocarbon measurements in waters of the Subtropical Convergence



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AUSTRALIA

R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

SUMMARY
RESEARCH CRUISE FR 1/90

ITINERARY

Depart Hobart 1015 hrs 10 January 1990
Arrive Triabunna 0705 hrs 13 January 1990
Depart Triabunna 0855 hrs 13 January 1990
Arrive Hobart 0820 hrs 16 January 1990
Depart Hobart 1220 hrs 16 January 1990
Arrived Hobart 0920 hrs 30 January 1990.

OBJECTIVES

1. To define the physical structure of the Subtropical Convergence (STC), and to determine the nutrients, biomass of phytoplankton and zooplankton, and primary production in relation to the physical structure of the Convergence and surrounding water masses.

2. To describe the relationship between sea surface temperature measured by satellite and the physical and chemical oceanography using underway surface sampling and CTD casts.

3. To relate ocean colour, as measured by an airborne ocean colour scanner on the COSSA research aircraft, and a hand-held multi-channel spectral radiometer, to both surface and water column chlorophyll, phytoplankton biomass, and primary production and zooplankton biomass.

4. To estimate the CO2 content in the surface water in and around the STC, and attempt to balance the CO2 content, primary production, grazing and sedimentation rates in and around the STC.

5. To determine the zoogeography and distribution of fish larvae and zooplankton in, and around, the STC.

6. To estimate mixing rates and processes across the STC by analyzing water samples for ambient levels of 14C and perhaps 3H.

WORK SUMMARY

- A total of 95 CTD stations along 5 transects were completed.
- Twenty-two CTD stations between 40°S and 50°30'S along 152°E were completed to 4000 m, with an additional 7 shallow stations for productivity work. Water property, current profile, light, particle size and fluorescence data collected concurrently. Up to 12 samples were taken per cast for estimation of natural carbon-14 levels along the transect.
- Fifty-eight stations to 500 m along transects 2 - 5 were completed, and water property, current profiles, light, particle size and fluorescence data were collected concurrently, as well as water for an additional 9 productivity stations.
- The underway system measuring salinity, temperature, fluorescence, pH, CO_2 saturation, particle size and surface nutrients (phosphate, nitrate and silicate) using the autoanalyzer was run almost continuously through the cruise.
- The Acoustic Doppler Current Profiler (ADCP) was run continuously during the cruise, and one transect along 46° 30'S was surveyed completely using the ADCP during a GPS window, and then the CTD was used to characterize the water properties along the reciprocal course.
- Two EZ net tows were made along 152°E, but rough weather prevented additional tows being made.
- Ground truthing, including both surface and column fluorescence and primary productivity, and radiance and irradiance measurements, for the Ocean Colour Scanner on board the COSSA aircraft was carried out.

NARRATIVE

Eastern summer time is used throughout this summary. Franklin sailed about 1015 hrs Wednesday, 10 January after being delayed 5 days due to bow thruster saga. We stopped near Cape Raoul at 1330 hrs for CTD and EZ net deployment and recovery practice because of the high portion of "first-timers" on board in both the scientific party and the ships complement. The trials were done in 25 knot NE winds - a portend of things to come. We left the test site about 1600 hrs for 40°S, 152°E, and reduced speed about 1800 hrs due to strong winds and moderate to heavy seas. We slowly got the underway sampling going - this was made difficult by the heavy weather and the lack of sea legs. Evidence from the ADCP, underway nutrients and fluorescence should that at least one eddy (near 42°35'S, 151°E) was crossed. The first EZ net tow was done upon arriving at 40°S, 152°E, late on 11 January. The CTD transect (using CTD u/w unit 1) down 152°E was begun early on 12 January, and examination of the results was difficult because of the very large offset (1.2 ppt) in salinity. This large offset did make checking the thermosalinograph salinities, and EZ net salinities, very difficult, as well as causing problems in contouring this section, particularly as we eventually changed CTD units. We used the 24 bottle rosette between 40°S and 43°S to obtain samples for G. Meyers at selected depths.

At 1200 on 12 January we altered course for Triabunna to drop Lesley Clementson off due to chronic illness. We dropped Lesley at 0830 on January 13, and returned to 152°E. The sea and swell were building as we began the transect again early on 14 January. We were hove-to for an hour on the evening of 14 January and completed a CTD station in marginal conditions (6 - 7 m seas, 25 -30 knot winds). A major salinity front was crossed on 15 January between 41°16' and 41°23'S, with the salinity changing from 35.0 to 34.3 ppt, temperature dropping about 1°C, and the fluorescence nearly doubling. The low salinity water was sitting on top of some 35.3 ppt water. Conditions began to moderate, and at 1200 the Master requested we alter course for Hobart as the Second Mate had suspected broken ribs, a result of being thrown across the bridge in heavy weather in the night. We headed for Hobart in 15-25 knot winds, 4 - 5m seas. The surface salinity stayed below 34.7 ppt until just off the shelf break, when we crossed a filament of warm, >35.1 ppt salinity water.

We arrived in Hobart at 0820 hrs, and the Workshop made some minor repairs to various items of equipment before sailing at 1220 hrs into 25 knot S-SW winds and rising seas. Ms. Bonham had been feeling ill for the last couple of days, and on Doctors advice she did not continue the cruise.

The wind and seas vanished overnight, and 17 January was a beautiful day, with stations along 152°E being completed without problems. The surface fluorescence near 43°S was very high, and there were huge numbers of *Thetys* and other salps around the vessel. A second EZ net haul at 2200 hrs was successful, with many euphausiids being caught. No salps were caught in the shallowest depth fished (50 m) indicating they were aggregating very near the surface. We changed to the 12 bottle rosette, and CTD u/w unit 4, as we had completed the detailed dips for G. Meyers. The wind gradually increased (again!) and changed from 20 knots northerly to 20-30 knots SW on 18 January. We were hove-to for 4 hours on 19 January due to lumpy seas, but eventually restarted CTD'ing down 152°E. About this time we discovered that there were problems with water flow through the thermosalinograph, caused by the placement of the water take-off point for the underway surface nutrients. This problem was rectified, but surface salinity data to this time is suspect.

We were hove-to on 20 January for several hours waiting for 35 knot winds and a large confused sea to abate. We continued south, wondering where the southern edge of the Convergence was. We finally crossed into sub-antarctic water on 21 January between 49°30'S and 50°S, and continued to 50°30'S to make sure we were really south of the Convergence. We turned north in deteriorating weather to meet the aircraft at about 45°S, 152°E.

We met the COSSA research aircraft about 1430 hrs on 23 February, and steamed in a NW direction towards Tasman Island along the aircraft track to obtain ground truth data for the ocean colour scanner. We had the underway system (salinity, temperature, nutrients, fluorescence, pH, CO_2, particle size) fully operational, and did CTD dips to 500 m every 10 nautical miles along the track. Fluorescence and light as well as CTD profiles were done at each station, and at every 4th station, samples were taken for chlorophylls, nutrients, and PSA at 10, 25, 60, and 90m depths. Three productivity stations were also worked on this leg. We hove to for 10 hours on 24 January due to gale force NW winds about the middle of the transect, but then completed the transect on 25 January about 30 miles E of Tasman Island in fine sunny conditions but with a large swell.

One of the objectives of the cruise was to resolve some of the mesoscale activity seen on satellite imagery in the STC. To meet this objective, we decided to investigate the large, probably topographically trapped feature south of Tasmania seen on a satellite image received on the ship. We did a CTD station at 46°S, 146°30'E in cold water on the western side of the warm feature, and then began an ADCP run along 46°S across the feature during the GPS window We then reversed course and did a series of CTD stations to 500m at 10 mile intervals on 26 and 27n January. There was an increase of 4°C and 0.5 ppt across the front. The fluorescence increased by a factor of 4 within couple of miles on each side of the front, but rapidly fell back to "normal" values as we moved away from it. Once this run was completed, we began a transect north up 146°30'E to 44°38'S, again with stations at 10 mile intervals, but at 5 mile intervals as we crossed the neck of cold water at about 44°55'S (figure -). We turned east at 44°38'S, and continued a transect east until we ran out of time at about 148°49'E. This transect was interrupted during the evening of 28 January after a day of very thick fog by yet another burst of heavy weather, with winds gusting to 56 knots. At 1800 hours on 29 January we altered course for Hobart, arriving in 25 - 35 knot winds at 0920 hrs.

DIFFICULTIES, PROBLEMS, SUGGESTIONS

The first major problem we encountered was the very large salinity offset (>1 ppt) in CTD unit 1. Although the offset was known, and the unit was used because of the additional sensors we required, we cannot understand why the unit was not recalibrated before it was sent to sea.

The second major problem encountered was that documentation for many of the programs is not sufficient for persons who are not familiar with the system on the vessel, and particularly when changes have been made to programs and the "how to" manuals have not been updated. Perhaps it should be a requirement that before any new additions or changes to programs that affect the way the occasional user would try and run these programs "according to the book" the manuals **must** be updated.

One strand of the armour on the CTD wire was broken at about the 4000 m area, and the wire needs replacing before any deep casts are done.

The air conditioning in the Ops room is very noisy.

The (temporary) position for the EZ Net computer is wrong, and needs to be moved, probably to the front of the Ops Room. As well, a microphone for contact with the bridge, and easier visual access to the Delph screen and echo sounder is necessary.

The organic solvent store outside the Chief Scientists cabin needs repairs, and must be emptied after each cruise. We had nowhere to store our solvents because the box was full.

The logging program for the underway particle size analyzer needs more work, as it would crash when the sensor registered over-concentrated.

A logging program for logging nutrient values from the autoanalyzer, particularly when the AA is be used for underway mode would be a decided advantage.

An obvious flow monitoring system for water flow through the thermosalinograph and underway pH/fluorescence debubblers needs to be provided to prevent the problems we had with low flow affecting underway salinity records.

There was a problem with the range recording on the Turner fluorometer which may be connected with the problems encountered on Fr 12/90.

SCIENTIFIC PARTY

CSIRO Division of Fisheries
- B. Griffiths (Chief Scientist)
- J. Parslow
- V. Lyne
- D. McKenzie
- P. Bonham (10 - 16 January)
- L. Clementson (10 - 13 January)

CSIRO Division of Oceanography
- V. Latham
- M. Rayner
- J. O'Sullivan
- P. Adams
- J. Dunn

CSIRO Division of Atmospheric Research
- M. Hayes

SHIP'S OFFICERS AND CREW

Captain:	N. Cheshire
Supernumerary Captain:	D. Gordon
Chief Engineer:	P. Noble
Second Mate:	B. Harris (10 January - 16 January)
	M. McCauley (16 January - 30 January)
Second Engineer	R. Parrott
Electrical Engineer	J. Cullen
Bosun	N. Marsh
AB's	K. Hallen
	G. Bilson
	B. Hughes
Greaser	P. McLure
Chief Cook	G. Hall
Second Cook	P. McGilchrist
Steward	J. Fitzgerald

F. B. Griffiths
Chief Scientist

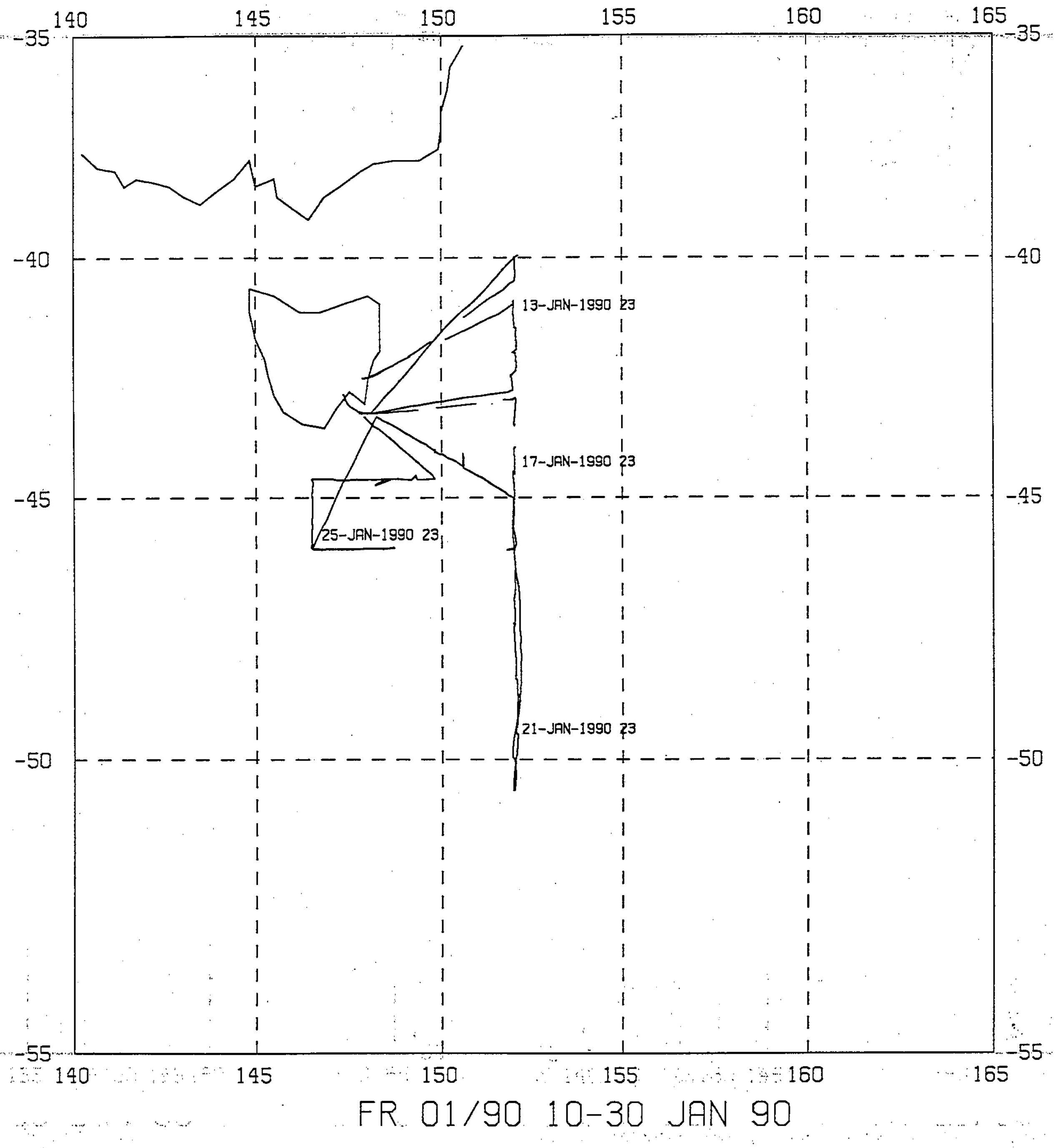
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Figure 1

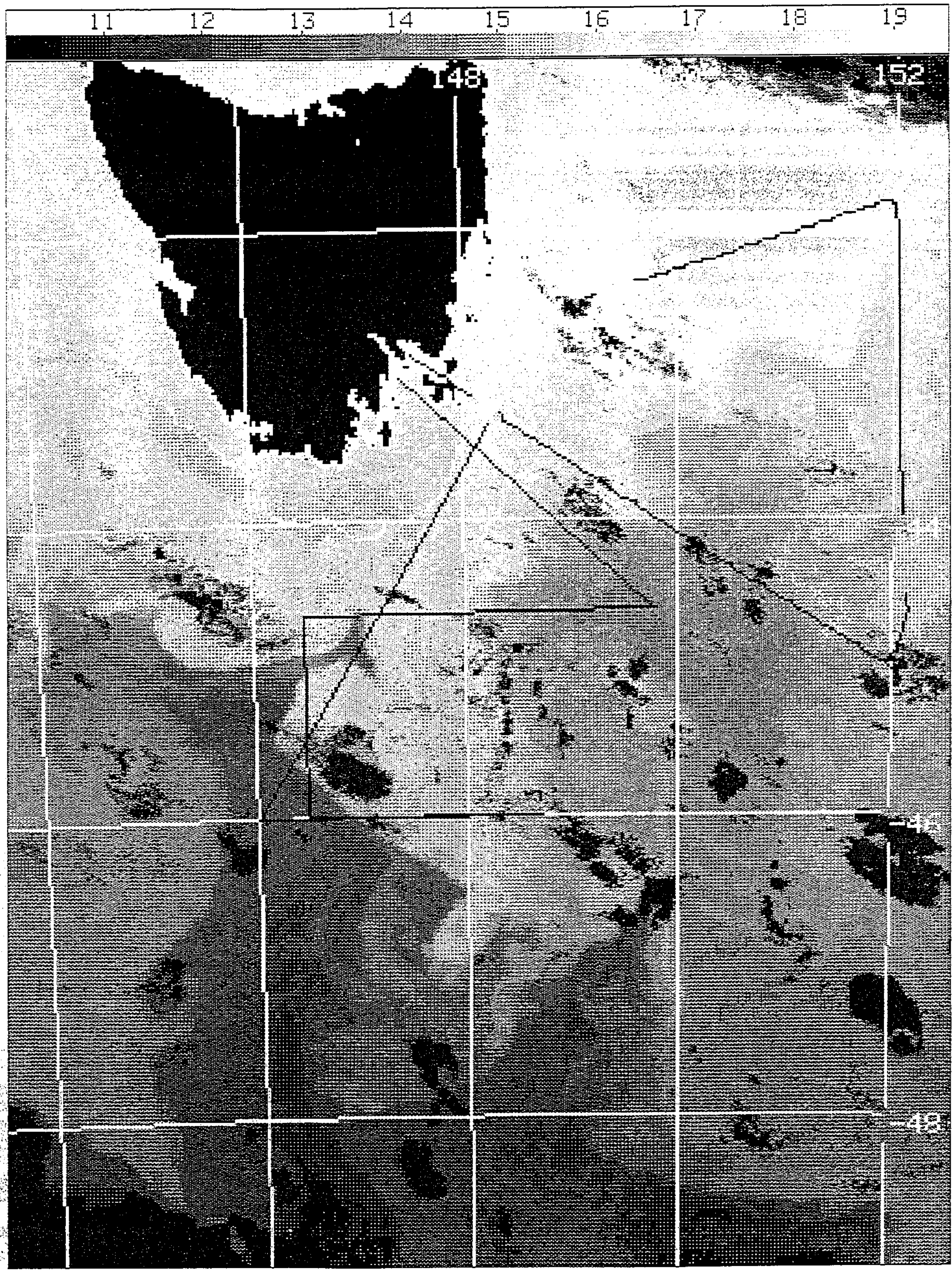

Figure 2: Cruise track through mesoscale features and aircraft track

COMPUTING REPORT
Jeff Dunn

There were no major disasters or developments on this cruise.

HARDWARE:

1. VAX

1.1 As usual, the air conditioner unit iced up many times.

1.2 The Vax crashed about 0550 on 13 Jan, and failed to reboot. After half an hour, it rebooted, but crashed again after 5 minutes, then auto-rebooted and ran ok.

1.3 About 0400 15 Jan there was a partial UPS failure, and the VAX would not accept files from micros and would not access its user disk. Rebooting set this right.

1.4 The temperature alarm reset button must be better protected, as I grazed it once and upset the VAX. When I broke it off, you have to poke a pencil in the hole to trip it.

1.5 After the above incident, the VAX was in a strange state of responding to SH DEF but not DIR or LOGOUT. This problem cleared after rebooting.

1.6 VAX tape drive refused to load (error 12) some tapes.

2. VT 241 (downstairs)

2.1 died. ? Dead I/O port?

3. General Purpose VT 240

3.1 Died with a NVR 10 error.

4. Micro 1

4.1 See Electronics report.

SOFTWARE

1. Filhan

2.1 The use of the 24 bottle rosette required that Filhan be disabled. It wasn't obvious or documented how this should be done, or what side effects might arise from meddling with this system.

2. Hydro

2.1 Some previously commented-out printer assignments in [OMS]login.com had to be reactivated before the HYDRO program would produce printouts.

3. FRNMON

3.1 I changed the decoding format for pH meter and Gyro data in all versions of FRNMON (except the VAX) as recommended by Bob Beattie. The new versions are yet to be included in the FRNMON object libraries. This stopped the pH meter-caused error but not the one from the gyros.

3.2 Occasionally when the micros were re-booted FRNMON crashed as it was invoked by startup procedures. Rebooting again always fixed this. An "array out of bound: error seemed to be the usual culprit. This may also have happened on the VAX and been the reason why the VAX on at least two occasions was not talking to FRNMON.

4. DELPH

4.1 Delph was pretty robust, having only a couple of crashes (when users were initiating some interaction). The only fault was that all the computers were always marked as "D" instead of "U".

5. Scintillation Counter

5.1 The use of this instrument is poorly supported. The driver program worked but the documentation is very sparse.

6. MTSPOL

6.1 Did not work between 10 - 15 January due to a hardware problem in Micro1. Manual backing up was performed, particularly as DU1 on Micro3 filled up pretty quickly. It seems that data was successfully passed to the VAX during this period.

6.2 MTSPOL generated error messages frequently (?hourly) when handling the FIX file. During the end of cruise cleanup the FIX file again caused endless error messages.

7. End-of-Cruise Cleanup

7.1 This extremely important process often has to be done amidst upheaval as one scientific party leaves and the next takes over the ship during s short port call. The software End-of-Cruise is great - robust and fully automated! However, any changes that make it quicker, more predictable, and more easily monitored would always be worthwhile. If endless identical error messages are normal, and must be allowed to run their course, this should be documented. The Cookbook provides a good section on End-of-Cruise, which naturally the novice will follow word for word. Therefore, it should contain **everything** that must be done for cleanup, including obvious things like how to produce the hydro data tape.

8. Accessing data during the cruise

8.1 The ADCP and CTD near-real-time accessing systems were used successfully.

8.2 A program called DENIS was provided to access chemistry data. This produced up to 5 records for each minute, so a system of sorting and collating was added. A system like this should really have:

- an easy system to set up which data is required, at the start of or during a cruise.
- Provision so that data is regularly collected (as well as manually, if near-real-time display is required.>
- Output options should include files with mean or instantaneous values for user defined time intervals.
- Ideally one could select from a range of graphical end-products, such as sections and annotated cruise tracks.

9. NAV programs

9.1 These had a few crashes, usually with "NAVLOG--Exiting due to Error 5 T-bit or BPT trap".

9.2 There was at least one such crash after Micro1 was repaired. NAV usually behaved after restarting.

10. ADCP

10.1 DOPGPS was modified so that its occasional "divide by zero" errors should no longer occur/

10.2 An unknown (?hardware) problem caused some corrupted records in the *SOP file which neither the VAX nor the Micro7 tape drive could cope with. A bug in MOP compounded this problem, but this has now been fixed. MOP also now produces tapes which are full rather than half full.

10.3 The 95% Confidence interval displayed as the central red curve has been replaced by the RMS error velocity, a parameter of similar magnitude and correlation with data quality, but which is not so sensitive to accelerations of the ship.

10.4 0.5 m/s lines were added to the display.

11. CTD

11.1 At one stage DU1 on Mircro 6 filled up during a downcast. The system handled the situation gracefully. It may be that CLE had been unable to send files to the VAX(?). The leeway on this disk is reduced when collecting light sensor data.

12. Satellite Images

12.1 Some tidying up of the programs was required to get this going. This will be nearer to a user-friendly "normal" Franklin facility now, and will be installed when required in account [CRUISUTIL]. Transfers between the VAX and Amiga are **very** slow.

13. Vertical Gyro Logging

13.1 Roll values were always zero, and pitch was something unknown which overflowed its F7.1 FRNMON field. Since the data was not required, we accepted a partially verified conclusion of a hardware fault. In such a case we need to be able to switch off the gyro logging, as a huge amount of useless GPG files were collected.

14. Particle Size Analyzer Logging

14.1 Did not stop when told to.

14.2 for some days produced constant LOCMSG reports until fixed by Ken Suber during the port call to Hobart.

14.3 was a little cryptic and unreliable when setting itself up, and would continue in setup mode (demanding "Select SF 00 on PSA in 60 seconds") when the device was correctly issuing error status, such as when bubbles were present in the water flow.

14. Regular incremental backups were performed on the VAX.

ELECTRONICS REPORT
Phillip Adams

1. CTD

1.1 CTD unit 1 was installed in the 24 bottle rosette along with pH, light, Variosens, and Altimeter sensors. The unit was known to have a large conductivity offset, but this was the only unit that had sufficient external connectors to accommodate the required sensors. The light sensor appeared very noisy. The conductivity offset was not linear and therefore the unit was not acceptable for the work being done.

1.2 The 24 bottle rosette and CTD u/w unit 1 were replaced by the 12 bottle rosette and CTD u/w unit 4.

1.3 On initial resting of the u/w unit 4, a fault was found with the pH sensor wiring of the Seacon connector. This fault killed communications when the pH sensor was plugged in. During tracing of this fault, an intermittent short was found on the supply line to the Variosens unit. Problems experienced prior to FR 12/89 may have been relevant to this fault. The noisy light meter sensor was modified, and the signal output was filtered to remove the unwanted noise. CTD u/w unit 4 then performed faultlessly during the rest of the cruise.

1.4 It appears that the documentation for the CTD SETUP is incorrect. Fluorescence should be analogue CH 3 and turbidity should be channel CH 2: it might be easiest to change the wiring to correct this.

1.5 During one CTD cast, the Captain noticed that one strand of the outer cable had broken at the 4000 m mark. The wire needs inspecting/replacing during the next port period.

2. Variosens

2.1 The batteries in the battery pack would not hold a charge, and two of the three batteries had to be changed. One more battery pack has been ordered, and will be installed on arrival. The battery pack connectors will need replacing prior to the next deployment.

3. Pitch and Roll Sensor

3.1 This unit failed to transmit any data. This is a continuation of a problem from the previous cruise, when it was found that the unit would transmit intermittently.

4. Underway pH Unit

4.1 Some internal modifications were required to get the DC offset meter working properly. The rest of the system worked well.

5. Personal Computers

5.1 The NEC 8201 has a faulty terminal program/RS232 port.

5.2 The Compaq requires a clock/memory backup battery.

6. Micro1

6.1 The MTSPOL program could not allocate the tape drive, and was giving other errors consistent with a tape drive fault. The tape drive was overhauled (heads cleaned, connectors checked), the tape controller board was replaced, and eventually a new tape drive was installed. The Micro then started crashing at regular intervals. The power supply lead was removed and cleaned, and the system then ran without fault for the rest of the cruise.

7. EZNET

7.1 The EZ net was used on three occasions during the cruise. The net on all occasions pitched excessively, and this was probably due to the solid bridle which was used for the first time. A new bridle will have to be designed for future use.

7.2 The remote readout on the bridge appeared to lose lock and scroll characters across the screen. This could be fixed by switching the unit off and then on.

8. Particle Size Analyzer

8.1 The wiring to the sensor was found to be incorrect, and the sensor lights damaged due to the faulty wiring. The cabling was rewired, but the sensor could not be recalibrated at sea.

9. Zeta Plotter

9.1 The plotter developed a coms error at the end of the cruise. The fault appears to be in the RS 232 usart an a spare could not be found on board.

10. Thermosalinograph

10.1 Prior to the cruise a take-off line to the autoanalyzer was installed on the inlet to the TSG header tank. This reduced flow to the TSG resulting in drift in the conductivity, possibly due to air bubbles. Any feeds from this line should come from the header tank overflow line.