

R.V. FRANKLIN

NATIONAL FACILITY OCEANOGRAPHIC RESEARCH VESSEL

RESEARCH SUMMARY

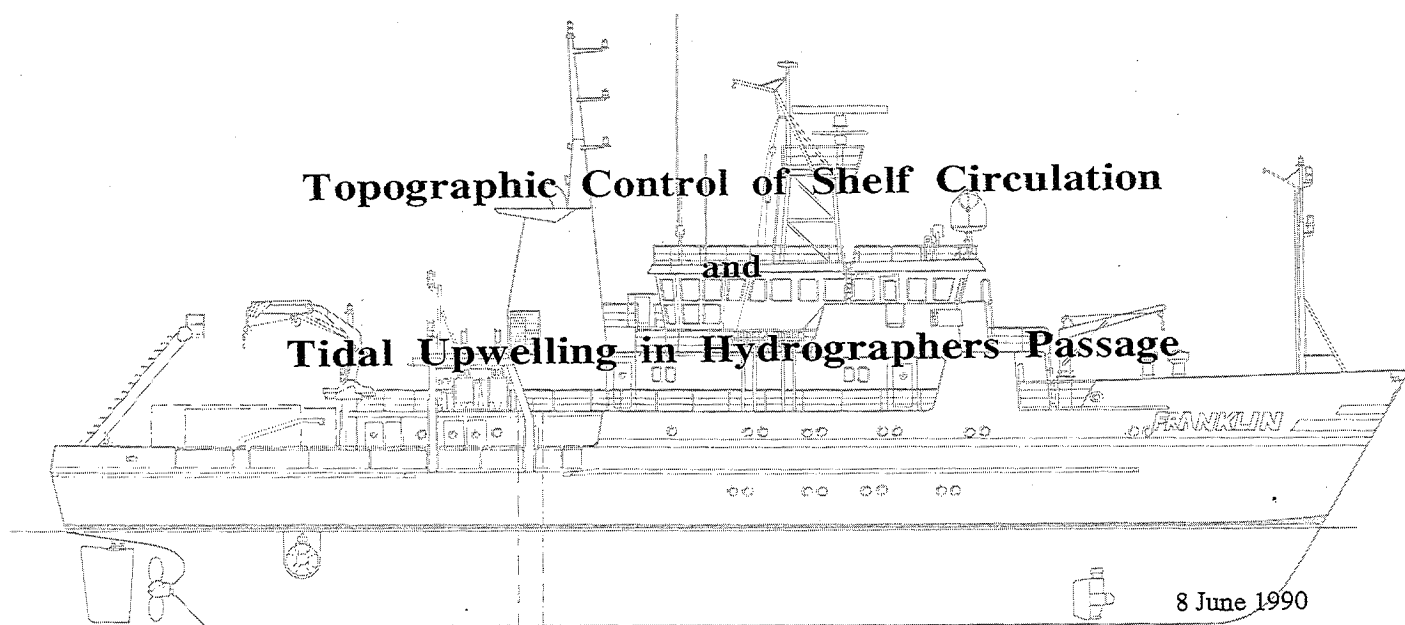
CRUISE FR 4/90

Sailed Newcastle 0100 Thursday 10 May 1990
Arrived Townsville 0900 Thursday 24 May 1990

Principal Investigator

Associate Professor Jason Middleton
School of Mathematics
University of New South Wales

Topographic Control of Shelf Circulation and Tidal Upwelling in Hydrographers Passage



8 June 1990

For further information contact

ORV Operations Manager
c/- CSIRO Division of Oceanography
GPO Box 1538, Hobart, Tas. 7001
Telephone (002) 20 6222
Telex AA 57182



R.V. FRANKLIN IS OWNED AND OPERATED BY CSIRO

CRUISE SUMMARY

R.V Franklin Cruise FR 4/90

1. Itinerary

Departed Newcastle: 0100 10 May, 1990.

Arrived Townsville: 0900 24 May, 1990.

2. Scientific Programs

Topographic Control of Shelf Circulation

(a) Scattering of Coastal Trapped Waves by Fraser Island

The objectives of this program were to determine the processes responsible for scattering of coastal trapped waves around Fraser Island and the Capricorn Channel.

(b) Tidal Upwelling into Hydrographers Passage

The objectives of this program were to determine the tidally induced mixing processes on the continental slope near the Hydrographers Passage.

3. Principal Investigator

Associate Professor Jason H. Middleton
School of Mathematics
University of New South Wales
P.O. Box 1, Kensington NSW 2033

4 . Results

The main component of the scientific program concerned with the scattering of coastal trapped waves will utilise the analysis of the current meter records which will be obtained in November, 1990. As a consequence, little can be said of the results prior to the current meter data analysis. In addition, the interpretation of

the CTD and ADCP data will be undertaken simultaneously with the current meter data with regard to scattering mechanisms.

An understanding of the general physical oceanography of the region is, however, necessary to put the main program into perspective. In this regard the data have indicated the way in which the topography controls the general circulation, including the East Australia Current, and the interaction of shelf and slope water masses through mixing processes. In fact the EAC is seen to flow around the Marion Plateau, leaving the shelf break at the southern tip of the Swain Reefs, and rejoining the shelf adjacent to Fraser Island. The flow over the Marion Plateau is itself complex, but is consistent with the eddy postulated by Griffin, Middleton and Bode (Aust. J. Mar. Freshw. Res., 1987). In addition, it is clear that the shelf waters (made denser by the Autumn cooling cycle) mix with the slope waters at the shelf break and that this mixing is effected by the tidal flood and ebb. This tidal mixing provides an effective supply of nutrients onto the continental shelf.

The tidal mixing processes themselves form a major component of the cruise objectives, and Hydrographers Passage was chosen because the tidal currents are known to be stronger here than at any other accessible location in the southern Great Barrier Reef. This component of the program produced very interesting results. Analysis of CTD data indicate that upwelling processes can draw water from about 160 m depth up the continental slope to the 80 m depth contours, where the associated strong tidal currents flowing over topography cause the water to mix thoroughly. This well mixed water is subsequently drawn over the sill (at 30 m depth) and into the slightly deeper waters inside the outer line of reefs. Analysis of the nutrient data in conjunction with the CTD and ADCP data will enable quantitative estimates to be made of the overall nutrient supply onto the shelf for each tidal cycle. The observed data will be compared to existing models of tidal flow, and new models will be developed as required.

5 Cruise Narrative

Thursday 10th May. The first 24 hours of the cruise were uneventful, and amounted to familiarising the scientific personnel with the ADCP, CTD and computer systems.

Friday 11th May. We arrived at 1530 at Double Island Point

and deployed our first mooring (S1) just off the point in 40 m water. Heading offshore, the first 8 CTD stations were taken at distances of 7 nm. The ADCP was monitored on this transect, and again on the run inshore.

Saturday 12th May. Moorings were deployed at 110 m depth (S2) and 350 m depth (S3), and later that day a transect of ADCP was taken off Fraser Island at 25 30 S.

Sunday 13th May, In the early hours of Sunday morning, an ADCP section was completed off Sandy Cape, and mooring F was deployed in 110 m depth. A CTD section comprising stations 10-17 was then completed offshore.

Monday 14 th May. Heading north, we took CTD station 18 at 60 nm offshore from the coast near Bundaberg, and conducted an ADCP run back into Curtis Channel, conducting CTD stations 19 and 20. Mooring C1 was deployed in 27 m of water on the inshore end of the Lady Musgrave Island section, and a CTD section was begun offshore at 7 nm spacing, with CTD station 21-30.

Tuesday 15th May. The ADCP was monitored closely as we headed back toward the coast, and moorings C3 and C2 were subsequently deployed in 350m and 110 m of water, respectively, directly offshore Lady Musgrave Island. Later that day, a CTD section was begun running northwest up the Curtis Channel inshore of the islands. Here we conducted CTD stations 31-34.

Wednesday 16th May. CTD stations 38 to 42 were conducted in the early hours in the mouth of the Capricorn Channel, and mooring M was deployed in 110 m of water in the centre of the channel. CTD stations were then taken out toward Saumarez Reef

Thursday 17th May. Stations were conducted east of Saumarez Reef to 1000m depth where a leak test for the Niskin bottles was done at the salinity minimum (CTD 56). After transiting back to 350m depth, mooring N3 was deployed, following by N2 in 110 m depth. Later, the XBT survey of Marion Plateau was begun with XBT's 1-6 taken.

Friday 18th May. After entering the East Australia Current, at the edge of the Plateau, XBT's 9-18 were taken back toward the Capricorn Channel, where CTD stations 57-60, XBT's 19-23 and CTD stations 60-64 were taken. The 200m contour was then followed back to Sandy Cape.

Saturday 19th May. The 200m contour section to Sandy Cape was finished with XBT 29, and the ship headed east, searching for the EAC. This was found at the edge of the Plateau at 1120, and an XBT survey conducted back toward Capricorn Channel.

Sunday 20th May. We arrived 5 nm east of Peaked Island and deployed mooring N1 in 48m water. CTD stations were then conducted at 30 nm intervals toward Hydrographers Passage, and at 12 nm intervals within the passage itself, finishing with station 74.

Monday 21st May. We began a CTD run out of Hydrographers Passage at 0300 to investigate the flooding tide, and on completion at 0700, conducted CTD stations 75-79. The return leg back to Bugatti Reef was also monitored on the ADCP to look at the very start of the next flood tide. At 1630, an outbound CTD section was begun with stations at 1 nm intervals. To facilitate quick stations under adverse navigation difficulties of 3 to 4 kn, no Niskin bottles were used. Station 97 was completed at 2030.

Tuesday 22nd May. At 0030, an extensive ADCP calibration run was conducted with 4 legs to the NE-SW and 2 to the SE-NW. After return into Hydrographers Passage, a section of CTD stations (this time with nutrient bottles) was undertaken at 2 nm spacing from 20 S out to the 200 m contour. The end of this section was station 107. After moving out to the 300m contour, a low tide section was conducted back in toward the passage, culminating with station 111 in 70 m depth. We then returned inside the passage and conducted short ADCP surveys behind Ben Reef and Wup Reef. Further work out the outer end of the Passage was then made practically impossible by a strong Northeast wind and lack of GPS. We therefore headed down the Passage.

Wednesday 23rd May. A wake study was undertaken behind Scawfell Island between 0430 and 0900 on the flood tide, following which we departed for Townsville.

Thursday 24th May. Arrived Townsville at 0900.

6 Summary

All major and the vast majority of minor activities which were planned for the cruise were successfully completed, and I am very pleased with the overall success of the cruise. The ship proved suitable for all operations, even the operationally difficult task of conducting (quick) CTD stations in 3-4 kn in Hydrographers Passage. All moorings were deployed without incident in a safe and efficient manner.

In all, 11 moorings with 20 current meters and 2 tide-gauges were deployed, 111 CTD stations were taken and 38 XBT's deployed.

Nutrients were collected at selected depths (0,25,50,75,100,150, 200,300,500,750,1000 and 1200m) on all stations except 17 quick stations in Hydrographers passage. The weather was kind, and R.V. Franklin crew and CSIRO scientific personnel were helpful and friendly. The snide comments about the Chief Scientist from the crew concerning the 0100 start were carefully deflected toward Bob Edwards!

7. Personnel

Jason Middleton (UNSW), Chief Scientist
Gregory Nippard (UNSW)
Mark Merrifield (UNSW)
David Griffin (UNSW)
Andrew Mc Taggart (UNSW)
Anthony Macks (UNSW)
Peter Coutis (UNSW)
Bob Beattie (CSIRO), Cruise Manager
Phil Adams (CSIRO)
Mark Raynor (CSIRO)

8. Appendices

A cruise track is appended, with CTD stations designated by a square, and XBT stations by a cross.

