CHALLENGER CRUISE 34/88

Report of Proceedings by the P.S.O.

This cruise, which formed the first process study of the North Sea Programme, was intended to study the density structure and flow field of the frontal system off the North Yorkshire coast. This location had been chosen to allow direct mapping of the surface currents by the OSCR HF radar system which was deployed for the duration of the cruise at cliff top sites near Whitby and Saltburn.

The principal objectives were:

(i) to map the density field on a fine grid approx 50 km x 40 km centred on the OSCR measurement area; three separate surveys covering the neaps-springs cycle were needed to initialise and test numerical models of the flow

(ii) to determine the vertical structure of the longshore and cross-shore velocity field on the principal section of OSCR area using the ADCP over two separate 25 hour periods

(iii) to undertake an initial trial of a cluster of Argo-Decca buoys with the intention of providing data on near-surface currents to validate the OSCR measurements and to test the flexibility of the experimental design for dispersion experiments planned for cruise 36 (Hill et al)

(iv) to provide sea surface data for an aerial survey of the frontal zone by the Daedalus scanner mounted on the NERC aircraft. Sea level measurements were to include irradiance meter measurements of reflection together with water samples for pigment and seston determination.

In addition to these primary goals, we also aimed to make some measurements of the T-S structure off Flamborough Head both as a reconnaissance exercise for cruise 36 and to investigate the possible occurrence of filament structures with a scale of 10 km which have been observed in satellite I-R images of the area.

Thanks to a carefully planned programme (for which Dr Matthews must take much of the credit), generally favourable weather and excellent support from all concerned, we were able to accomplish all of our objectives. Apart from some minor changes occasioned by the demands for media coverage of the cruise, we were able to follow the programme as planned.

The three CTD surveys were completed in full and supplemented by additional sections on the ADCP line. To facilitate rapid profiling, we used the small-frame CTD and, in good weather, were able to maintain a cycle time of 26 minutes per station including 15 minutes steaming. Safety of the CTD in this rapid profiling work was prejudiced by the continuing failure of the meter wheel block and the repair of this facility must be a priority for future cruises. A further worry during CTD operations, were the repeated breakdowns of the P.E.S. system which is needed to monitor depth-off-the-bottom at the most critical part of the cast. In most cases we were able to get the system going again in time but the equipment concerned is obselescent and many of the circuit boards and mechanical systems are in bad shape.

After a difficult start in some of the roughest weather that we experienced (force 6-7 on 21/8/88), the ADCP generally performed well. Section data were plotted by hand to monitor data quality and confirm continuity after turns at the end of sections. In spite of careful study of the software and the handbook, we were unable to increase the ping rate to greater than 0.5 Hz. which is an unfortunate limitation when working in water of depth < 70m. Efforts should be made to find a way round this restriction which limits the statistical reliability of the data.

We started the cruise with some worries about the Argos transmitters in the Argos-Decca buoys. Several units in the production batch were not giving fixes and a last minute delivery of extra units to Great Yarmouth was necessary to give us a working set of three buoys for the trial.

In the event, all the buoys electronic systems worked to specification. We enjoyed regular fixes from the Argos computer in Toulouse and the Decca tracking system produced regular data which we were able to verify on recovery. Precise location of the buoys to allow recovery was effected by two D.F. systems both of which provided unambiguous information to allow us to home on their transmissions.

The only problem we experienced with the buoys was a failure of the coupling to the drogues. Following the initial deployment on 20/8, heavy weather caused one of the drogues to become detached the next day and the other two failed on the 22/8. The three buoys, with a modified linkage design, were re-deployed and left unattended for four days. Two were intact on recovery though showing signs of fatigue in the wire linkage. The third was detached from its drogue (and flashing light) and was recovered in daylight on 27/8 during a survey of a second CTD grid off Flamborough Head.

By good fortune, the first day scheduled as priority for the aircraft flight (26/8) was by far the best weather day of the cruise with minimal cloud over the sea and light winds. The ship steamed the agreed sections under the flight plan and maintained good synchronisation for the first two surveys though we fell slightly behind on the last leg. Measurements with the UCNW irradiance meter and the UOR undulator (which was towed behind the ship on all survey legs) confirmed the existence of significant contrast in reflectance over the survey area. Aircraft navigation during the offshore sections should be confirmed by observation of the surface toroids of the MAFF current meter mooring array in the scanner images. All but one of these moorings was observed to be in position by the ship during the CTD grid survey.

As the cruise proceded, considerable progress was made in the processing and presentation of the data by the ABC computer system using the UNIRAS package. Almost nothing was available to us from the previous survey cruise in the way of summary maps and section plots of the type specified in the survey documentation. This was a serious deficiency both in terms of the needs of our Process Study and also for disseminating the survey information to the North Sea Community.

We have, therefore, given the development of the procedure to provide contoured maps and sections the highest priority. Andrew Lord of RVS worked at the problem with great industry and, with some help on the production side, was able to satisfy about a half of our basic requirement for the plotting of the data from the CTD and its auxilliary sensors.

The situation is still, however, far from satisfactory. Apparently the system was fully occupied even by the modest output we achieved and there is still a great deal of (very demanding) hand-plotting going on (e.g. ADCP data). Bearing in mind the heavy data output of the next 14 months, it is essential that the RVS computing section make urgent efforts to bring the system up to a level where it can cope with the majority of the plotting and prevent us being swamped by the data flow.

In other respects, support from RVS was of a good standard and we have no particular concerns beyond those mentioned above or already reported to Ian Innes except for a general point of the ergonomics of the CTD control position which needs emphasising.

The cast director has the crucial responsibility for the safety of the CTD system and the correct operation of the sampling procedures. It was the general view of those involved that the various systems needed to monitor and control the CTD cost should be arranged around the cast director's position in a more convenient way. Without moving he should have continuous access to the CTD profile display, the depth of the bottom indicator (presently the P.E.S.), the ships position and head indicator, the bridge and winch intercoms and the rosette firing control. In front of him should be a convenient space on which to write the log.

A rearrangement on these lines is essential if we are to get the best out of the system and ensure the highest levels of safety during the North Sea Programme.

We enjoyed throughout the cruise good relations with Captain Warne and the crew of Challenger. They handled all aspects of the work in a thoroughly professional manner and in particular showed considerable skill in the safe recovery of our drifting buoy systems. I am happy to record our thanks to them for helping to make this a most successful cruise.

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