Prince Madog Celtic Sea Programme 27/7-13/8 2003
Cruise report PD 32/03

Aims and Objectives

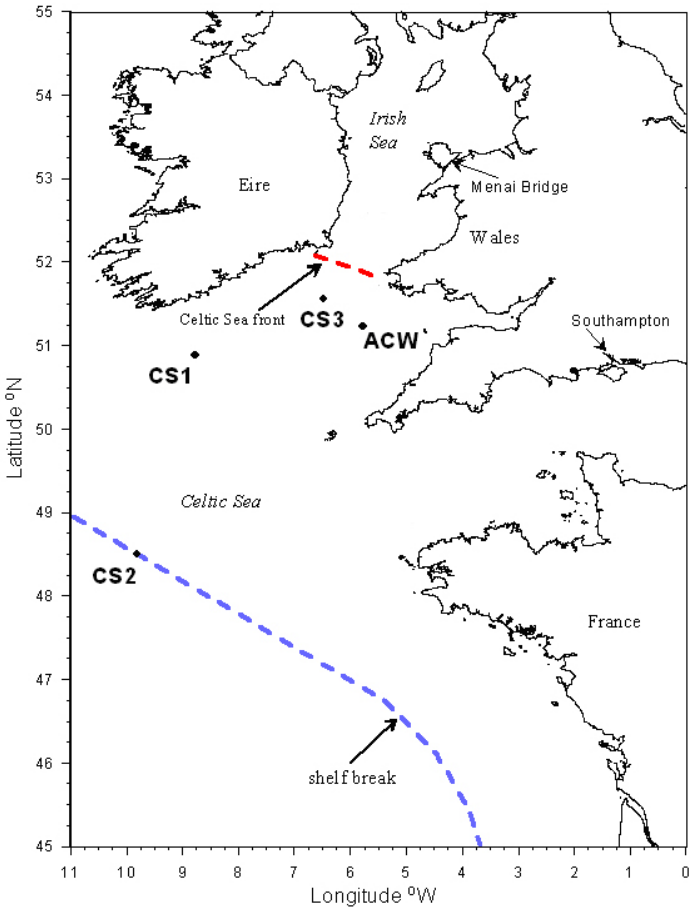
The main thrust of this combined exercise with the Sharples and Holligan group at SOC was to investigate the influence of turbulence on primary production in the seasonal pycnocline of the Celtic Sea. The programme involved over 30 scientists working on the James Clark Ross (JCR) and the Prince Madog. Much of the physics, including all of the turbulen dissipation measurements, were done from the Prince Madog by the SOS Turbulence and Mixing Group, while the much larger JCR concentrated mainly on biogeochemical and biological studies which involved a large number of scientists. In a parallel investigation, the relation between turbulence and suspended particle size and concentration was undertaken from both vessels.

The specific objectives of the PM contribution to the programme were:

1) To lay and recover one of two multi-component moorings equipped with ADCPs for mean flow and turbulence measurements.
2) To undertake a series of five 25 hour cycles of turbulence measurements supported by CTD profiles in parallel with JCR at positions from the shelf edge to the Celtic Sea front.
3) To sample particle concentrations and fall speeds at these same locations and in detailed surveys of the front.

Station positions
Four sites were visited during the Prince Madog Celtic Sea programme 27/7-13/8 2003, shown on the accompanying chart:

- CS1: 50º52.2'N 08º19.8'W (80-105m depth)
- CS2: 48º31.9'N 09º27.8'W (~200m depth)
- CS3: 51º28.4'N 06º25.8'W (95m depth)
- ACW: 51º16.0'N 05º44.6'W (85m depth)



Commentary

Phase 1 (27/7 – 3/8)
1) Despite poor weather, the exposed position of CS2 and the widespread seasickness amongst the scientists and crew, we met up with the JCR as planned and completed the FLY 25 hour series on the 29/7-30/7. No CTDs were possible due to the poor weather conditions.

2) Completed 25 hour FLY series at CS1 on the 31/7-1/8, although there was a 4 hour gap between 12.00 – 16.00 as the FLY termination failed and had to be replaced.

3) The mooring deployment at CS3 went ahead as planned on the 1/8. The position of this mooring was determined in advance by a CTD survey undertaken from JCR. At

this stage we deployed our CTD and found that the data was being degraded; it emerged later that this was due to a pump failure.

4) We began the FLY frontal survey as planned aware that the Captain's mother had become very ill. Samples were taken from the ships flow through system for chlorophyll. At 13.00 on 2/8 it was decided to cut short the frontal survey in order to go to Rosslare so that the Captain could return to the UK on compassionate leave.

Phase 2(4/8 – 13/8)

1) Joint time series at CS3 with JCR (5-6/8): Initial problems with CTD solved by pump replacement with spare kindly supplied by JCR in boat exchange of equipment. FLY and CTD series satisfactory. LISST time series with samples for calibration. Outstanding problems with second FLY: (i) noisy connector caused data transmission failure (ii) trouble with new pressure sensor also traced to connector (no replacement available on board but 9-way substitute installed for pressure link).

2) Anti-Clockwise Station (ACW 6-8/8): Pyramid mooring deployed and FLY /CTD series commenced but we lost 12 hrs time due to FLY cable –damaged by use in heavy weather at shelf edge . Cable replaced and broken pigtail shortened. No significant problems thereafter
ADCP Pyramid mooring recovery ok except that pellet line was twisted around frame during upward ascent of instrument. (Insert swivel ?)
Currents rotated anti-clockwise as predicted by models with positive ellipticity ~0.4.

4) Cross-frontal survey (8-9/8). Some delay at the start due to difficulties choosing an optimal section. Most recent I-R image was a composite and already out of date. Small differences in mean current amplitude and direction and direction of section are critical in tracking water columns. Flow through useful in checking position relative to front (but cannot print out time series or plot x-y graphs). Complex structure in front but transition stands out clearly in T and Fl plot.

5) Second joint time series at CS3 with JCR (10-11/8 Neap tides). FLY and CTD performing well. Chl maximum significantly weaker.

6) Mooring recovery (11/8) in force 4-5. No problems except for the loss of one T micro-logger logger which snagged on the hull. The 1200 kHz ADCP on the bed frame apparently recorded data for only half the deployment.

7) Particle sampling programme across front (11/8). Samples were taken with Settling Velocity Tubes and the CTD Rosette at positions close to and in the frontal zone. In between samples, a number of trials of the Veteran FLY #4 to calibrate the new depth sensor and confirm that conductivity sensor

Assessment

Overall this was a highly successful cruise. In spite of adverse weather conditions during phase I, the mooring systems were deployed and the FLY series at CS2 successfully accomplished. In Phase 2, we enjoyed good weather throughout with the winds not exceeding force 5. This together with solution of early technical

problems (CTD and FLY) meant that we were able to accomplish all the goals of the original programme and give additional time to the particle sampling study.

A number of issues relating to the instrumentation, computing facilities and the services in the ship's laboratories are detailed below. An item of immediate safety concern is the presence of **a 90 V AC potential difference** between the "clean supply" earth and the local earth in the wet lab. **This requires urgent attention**.

The policy of operating two FLY systems and carrying a spare cable was clearly vindicated. Sustained effort on technical support (principally Ben Powell) meant that we finished the programme with two working FLY systems. There is, however, considerable room for improvement in pre-cruise preparation and calibration of FLY and, as detailed below, some spares need to be ordered urgently .

There are also a number of issues about the fuller use of data processing facilities in the dry lab. Considerable progress was made in the transfer of CTD data for on board analysis, but better facilities for using and plotting the ship's ADCP data are urgently needed especially on a relatively long cruise of this kind.

Finally I would like to put on record our appreciation the fulsome support from the whole ship's crew and especially from the captain, for whom this was a very difficult time, and his replacement who dealt admirably with our demanding requirements.

August 29, 2003
John Simpson