Prince Madog cruise 38/03
24, 25 September 2003
POL Coastal Observatory cruise 12
REPORT

1. Objectives

1. At 53º 32´ N 3º 21.8´ W, half a mile west of the Mersey Bar Light Vessel –

To recover
a) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCAT are fitted to the frame.
b) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
c) A toroid with Orbcomm instrumentation in trial mode.

To deploy
c) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCAT are also fitted to the frame.
d) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.

2. To conduct a CTD / LISST survey of 34 stations every 5 miles covering the eastern Irish Sea between the North Wales coast and Blackpool and the Lancashire coast and the Great Orme, to determine the effects of the rivers Dee, Mersey and Ribble on Liverpool Bay. To obtain calibration samples for salinity and for chlorophyll at selected stations.

2.1 Scientific personnel

Phil Knight
Andrew Lane
Mike Burke
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Mike Smithson
Marc Childs (CEFAS)
Stewart Cutchey
Anne Hammerstein (School of Ocean Sciences)

2.2 Ship's officers and crew

Steve Duckworth (Master)
A.D. Price (Chief Officer)
H. Owen (Chief Engineer)
N. Holmes (Second Engineer)
P. Roberts (Bosun)
T. Roberts (A.B.)
D. Lloyd-Jones (A.B.)
M. Downey (Cook)

3. Narrative (times in GMT)

The SmartBuoy, anchor chain, sea-bed frame and instrumentation were loaded onto RV Prince Madog on the afternoon of 23 September 2003. (The SmartBuoy toroid was rolled down the walkway.) The ADCP frame was set up on the afterdeck and the tower fitted to the SmartBuoy toroid. The benthos deck unit was found to be faulty when the acoustic releases were tested. The old spare was not on board and a trip back to POL was required. The spare was brought back, along with a new deck unit, which coincidently had been delivered to POL on the same day.

RV Prince Madog left Menai Bridge at 07:15 on 24 September. Recording of surface sampling and ADCP were switched on at 08:06, near Puffin Island. The mooring site was reached at 10:34. The weather was sunny, winds SW Force 4, with moderate swell. A calibration CTD was carried out at 10:42 for the transmissometer and MicroCAT.

The ADCP was released, with the new deck unit, at 11:15, inboard by 11:18 and its ballast weight inboard by 11:23. The frame was covered in 'furry' growth. The replacement ADCP was deployed at 11:42. The SmartBuoy was deployed between 11:54 and 12:12. Recovery of the SmartBuoy and anchor chain was between 12:18 and 12:26. The SmartBuoy had a covering of slimey growth. The toroid with Orbcomm transmitter was recovered at 12:39.

The CTD survey commenced with station 1 at 12:59, followed by stations 10 and 2 – 4, before the auto-pilot on the ship failed. This failure together with an un-well second officer resulted in the cancelling of the night-time CTD survey. The ship anchored at station 22. The underway sampling was stopped at 20:30 and the ADCP stopped at 20:31. At 05:31 on 25 September a CTD was carried out at station 22 (also two MicroCats were attached to the CTD frame for testing). The auto-pilot was rebooted and worked in a limited capacity. The underway and ADCP sampling were switched back on at 05:45.

CTD's were resumed and the following stations visited in the following order, 12, 11, 9, 8, 7, 6, 16, 15, 14, 13, 20, 21, 24, 23, 34 finishing at 15:20. Water bottle samples were also taken at the surface and bottom. These were used for salinity calibration (all visited stations), chlorophyll and nutrient calibration (stations 1, 6-9, and 11) and sediment calibration (all visited stations). Surface sampling was switched off at 17:43. RV Prince Madog was alongside at Menai Bridge at 19:33.

All of the mooring objectives were accomplished and 20 CTD sites visited. The area was in general well-mixed vertically. Surface temperatures varied between 15.79 and 16.60ºC and salinities between 31.91 and 33.66.

4. Moorings (times in GMT)

4.1 The set up of the recovered instruments was as follows:

a) Mean ADCP 600 kHz RDI 2391; battery case 3036
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor and 2 x 512 Mb memory; hourly wave recording enabled.

Clock set at 14:09:00 on 19 August 2003. Delayed start at 06:00 on 20 August 2003.
Downloaded data on 29/9/03 – clock 1 minute 39 seconds fast.

Aanderaa pressure recorder BPR 445 / DSU 8123: clock set at 13:19:20 on 19 August 2003, 10 minute sampling, started at 13:30 on 19 August 2003. First reading at 13:30:47. Last reading at 15:50:42 on 30/9/2003, clock is 29 seconds slow.

25 cm Sea-Tech Transmissometer, ST557, recording in Aanderaa logger (RCM7 11814/ DSU 9107) fitted with temperature and conductivity sensors: Clock set at 16:58:30 on 19 August 2003. 10 minute sampling, started at 17:00 on 19 August 2003. Air readings between 17:30 and 20:50 on 19 August 2003. Blocked path readings between 21:00 on 19 August 2003 and 05:50 on 20 August 2003. Switched off at 11:15 on 30/9/2003 – clock is 49 seconds slow.

SeaBird MicroCAT temperature, conductivity recorder with pressure sensor (37IM29828-2506 – ID03):
Pre-deployment calibration dip CTD 1, 30-second sampling, started at 11:00 on 20 August 2003, in water at 11:23, on surface at 11:33.

Mean ADCP 1.2 MHz RDI 0572, battery case 0250 interfaced to SeaBird MicroCAT (37SM32218-2991 – ID01; RS485 interface).
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1})
60 x 0.5 m bins (1.1 – 31.6 m above the bed)
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with 2 x 85 Mb memory. The MicroCAT is polled by the ADCP at the start of each ensemble and its data stored within the ADCP. Because of mechanical constraints the 1.2 MHz ADCP was rotated 45° with respect to the 600 kHz ADCP.
Downloaded data on 29/9/03 – clock 18 seconds fast.

The frame, D2, was fitted with two Benthos releases, 7A (s/n 44041), 8A (s/n 44059), and a spooler with 200 m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring. Aanderaa current meter RCM7 9959 / DSU 8125 without fin at 10 m below the surface to log temperature and conductivity.
Clock set at 13:34:20 on 19 August 2003. 10 minute sampling, started at 13:40 on 19 August 2003. Switched off at 13:52 on 30/9/2003, clock 19 seconds slow.

The NAS nutrient analyser was fitted to the buoy, calibrated on the 14 August and set running standards at 12:00 14 August, last standard at 11:00 20 August 2003.

Water sampler WMS programmed to start at 00:00 21 August 2003. Loggers were working from 08:00 on 20 August 2003.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a ½ tonne clump of scrap chain.

c) Orbcomm toroid. Orbcomm unit, battery pack and GPS aerial. Anchored by ½ tonne clump of scrap chain. Switched on at 10:39 20 August 2003, set up to send GPS position by e-mail every 3 hours.

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Recovery Time	Date
ADCP	53º 32.151´	3º 21.745´	22.5	11:15	24/09/03
SmartBuoy	53º 32.084´	3º 22.000´	23.1	12:18	24/09/03
Orbcomm toroid	53º 31.960´	3º 21.315´	21.4	12:39	24/09/03

4.2 The set up of the deployed instruments was as follows:

d) Mean ADCP 600 kHz RDI 2390; battery case 3070
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor and 2 x 256 Mb memory; hourly wave recording enabled.
Clock set at 12:44 on 23 September 2003, delayed start 06:00:00 on 24 September, started on time.

Aanderaa pressure recorder BPR 1357: 10 minute sampling, Clock set at 13:04:30 on 23 September 2003, started 13:20 on 23 September, 2003; first reading at 13:20:48

25 cm Sea-Tech Transmissometer, ST631, recording in Aanderaa logger (RCM7 11820 /DSU 13101) fitted with temperature and conductivity sensors: 10 minute sampling, Clock set at 22:01:30 on 23 September, started at 22:10:00 on 23 September 2003.
First air reading 22:30 on 23/9/2003 & Last air reading 05:50 on 24/9/2003
First blocked reading 05:50 on 24/9/2003 & Last blocked reading 08:20 on 24/9/2003

SeaBird MicroCAT temperature, conductivity recorder (37IM29828-2010 – ID01). Clock set at 08:48:15 on 24/9/2003. Delayed start 10:20:00 on 24/9/2003, 10 second sampling. Sample num=326 restart 10 minute sampling, delayed start 11:30:00 on 24/9/2003.

SeaBird MicroCAT temperature, conductivity recorder (37IM29828-2081 – ID02). Clock set at 08:43:10 on 24/9/2003. Delayed start 10:20:00 on 24/9/2003, 10 second sampling. Sample num=353 restarted. Calibration dip CTD1 – Readings between 10:50 and 11:00.

The frame, D3, was fitted with two Benthos releases, 4A (s/n 44068) – Pyro OTD91, 4B (s/n 52302) – Pyro OTD93, and a spooler with 200 m of rope for recovery of the ballast weight.

e) SmartBuoy Mooring. Aanderaa current meter RCM7 9631 / DSU 3994 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Clock set at 13:17:30 on 23 September 2003, started at 13:30:00 on 23 September 2003.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 1 tonne clump of scrap chain.

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Date
SmartBuoy	53º 32.075′	3º 21.716′	25.0	12:12	24/09/03
ADCP	53º 32.104′	3º 21.630′	25.0	11:42	24/09/03

5. CTD

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients	Suspended Sediments
1	53º 32′	3º 21.8′	yes	yes	yes
2	53º 37′	3º 13.4′	yes		yes
3	53º 42′	3º 13.4′	yes		yes
4	53º 47′	3º 13.4′	yes		yes
5	53º 52′	3º 21.8′	no		
6	53º 47′	3º 21.8′	yes	yes	yes
7	53º 42′	3º 21.8′	yes	yes	yes
8	53º 37′	3º 21.8′	yes	yes	yes
9	53º 32′	3º 21.8′	yes	yes	yes
10	53º 27′	3º 13.4′	yes		
11	53º 27′	3º 21.8′	yes	yes	yes
12	53º 27′	3º 30.2′	yes		yes
13	53º 32′	3º 30.2′	yes		yes
14	53º 37′	3º 30.2′	yes		yes
15	53º 42′	3º 30.2′	yes		yes
16	53º 47′	3º 30.2′	yes		yes
17	53º 47′	3º 38.6′	no		
18	53º 42′	3º 38.6′	no		
19	53º 37′	3º 38.6′	no		
20	53º 32′	3º 38.6′	yes		yes
21	53º 27′	3º 38.6′	yes		yes
22	53º 23′	3º 38.6′	yes		yes
23	53º 23′	3º 47.0′	yes		yes
24	53º 27′	3º 47.0′	yes		yes
25	53º 32′	3º 47.0′	no		
26	53º 37′	3º 47.0′	no		
27	53º 42′	3º 47.0′	no		
28	53º 47′	3º 47.0′	no		
29	53º 47′	3º 55.4′	no		
30	53º 42	3º 55.4′	no		
31	53º 37′	3º 55.4′	no		
32	53º 32′	3º 55.4′	no		
33	53º 27′	3º 55.4′	no		
34	53º 22′	3º 55.4′	yes		yes

The Sea-Bird 911 CTD recorded temperature, conductivity, transmittance and fluorescence at 24 Hz. Since the frame was fitted with an altimeter measurements were taken to within 3 m above the bed. One water bottle was fired near the surface. Water samples from the second near surface bottle were filtered for chlorophyll and suspended sediment determination and some filtrate was preserved with mercuric chloride for nutrient determination. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system. Copies of the Sea-Bird binary files were taken off for processing at BODC / POL.

6. Surface sampling

The intake for the surface sampling system is located underneath RV Prince Madog, at about 3 m below sea level. The parameters recorded every minute by the WS Oceans system are: Date, Solar Radiation (W m^{-2}), PAR (µmols / m^2s), Air Temperature (ºC), Relative Humidity, Relative Wind Speed (m s^{-1}), Relative Wind Direction (º) – zero indicates wind on the bow, Transmissance, Hull Temperature (ºC), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Minimum Air Temp (ºC), Maximum Air Temp (ºC), Wind Gust (m s^{-1}), GPS Time, Latitude, Longitude, Barometric Pressure Minimum (mbar), Barometric Pressure Maximum (mbar), Conductivity sensor water temperature (ºC).

Data were recorded from 08:06 on 24 September at Puffin Island, until 20:31 at station 22. Recording was resumed at 05:45 on 25 September at station 22, until 17:42 at Puffin Island. Copies of the data were taken off the ship as an Excel file, along with a copy of the ship's navigation data.

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