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Ministry of Agriculture, Fisheries and Food current meter system and data inventory, 1987-89

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1. INTRODUCTION

This is the ninth in a series of inventories of current meter data obtained from work carried out by the Lowestoft Laboratory of the Ministry of Agriculture, Fisheries and Food (MAFF), Directorate of Fisheries of Research (DFR) and it covers the years 1987 to 1989.

Previous inventories are in MAFF Fisheries Research Technical Reports Nos. 4, 7, 15, 38, 54, 65, 80 and 88 (Baxter and Bedwell, 1972; Bedwell, 1973; Bedwell *et al*., 1975; Medler, 1977; Jones, 1979, 1982, 1985, 1988).

The first of these inventories (Baxter and Bedwell, 1972) gave details of the moorings and types of instruments which were then employed. Now that two decades have passed it is thought appropriate to give updated details.

2. MOORINGS

2.1 Shelf seas

This design, of the 'U' type, is used for water depths of 15 to 300 m, where a prominent surface warning marker is needed and where nothing is to be left behind after recovery (Figure 1). The marker buoy is a 1.8 m diameter foam filled fibreglass toroid with a 2 m high stainless steel tower supporting a bulb-changer flashing light and a radar reflector (Figure 2). A 50 kg ballast weight in a 1 m long sub-tower is fitted below the buoy.
The buoy is anchored in position by a 50 m length of 12 mm steel chain terminated with a 400 kg bundle of large link scrap chain. If the water depth exceeds 35 m, a length of 16 mm wire rope is inserted between the buoy and the 12 mm chain to ensure that the total length of the buoy tow is approximately 1.5 times the water depth. For water depths of > 100 m the total buoy tow length becomes water depth + 50 m, ensuring that the 16 mm wire section never contacts the sea bed and any wear due to movement of the buoy is taken by the chain.

The current meters are supported by a foam-filled subsurface buoy providing 200 kg of upthrust (Figure 3), and anchored in position by a further 400 kg chain bundle via a length of 12 mm wire rope. Except in exceptional circumstances the buoy is held at least 10 m below the surface to allow shipping to pass over it and to keep it out of the wave disturbance zone. A pellet line of 6 mm courlene and small fishing buffs, attached to the sub-surface buoy, marks the position of the submerged part of the rig, both as an aid to deployment and recovery and as a warning to other shipping. The instruments are attached to, or into the wire, according to type, at the desired measuring depth; the range of instrument positions in the water column is generally from 3 m above the sea bed to 12 m below the surface.

If there is a need to place the instrument closer to the sea bed, a bottom frame is used that enables an MO21F meter to be placed at 0.6 m above the sea bed. On one occasion (1988) Interocean 'S4' current meters were held in the wave zone above the sub-surface buoy using a neutrally buoyant tether arrangement as described in Ellett *et al.* (1991).

The two chain anchors are joined by a 12 mm wire ground rope of length twice the water depth, but with a minimum of 150 m, to allow the mooring vessel manoeuvring space, and to provide a good target if 'dragging' is

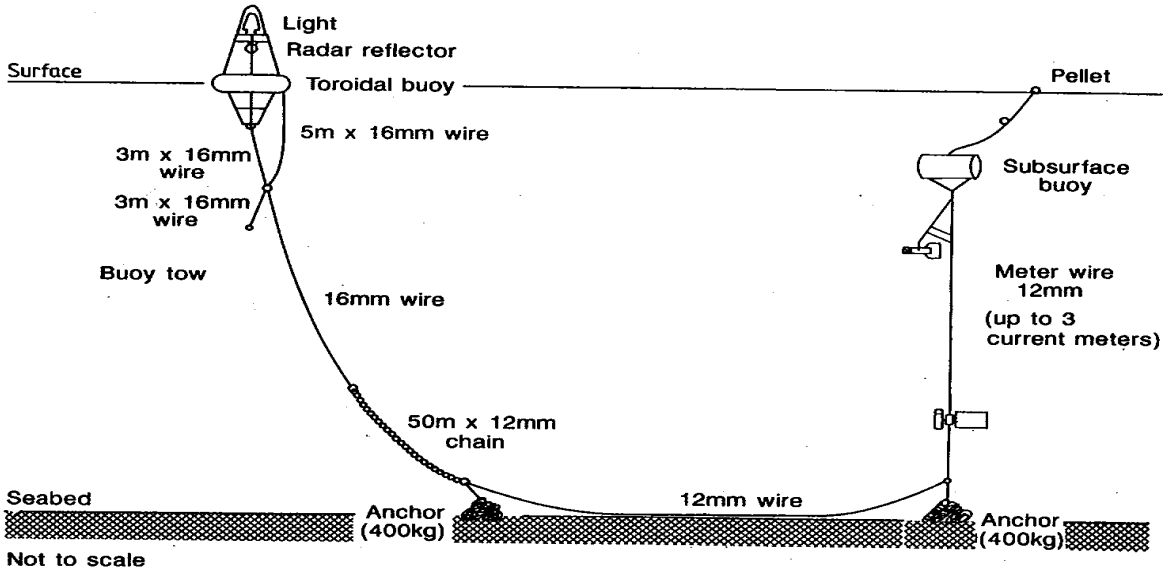

Figure 1. Shelf seas U-shaped mooring construction

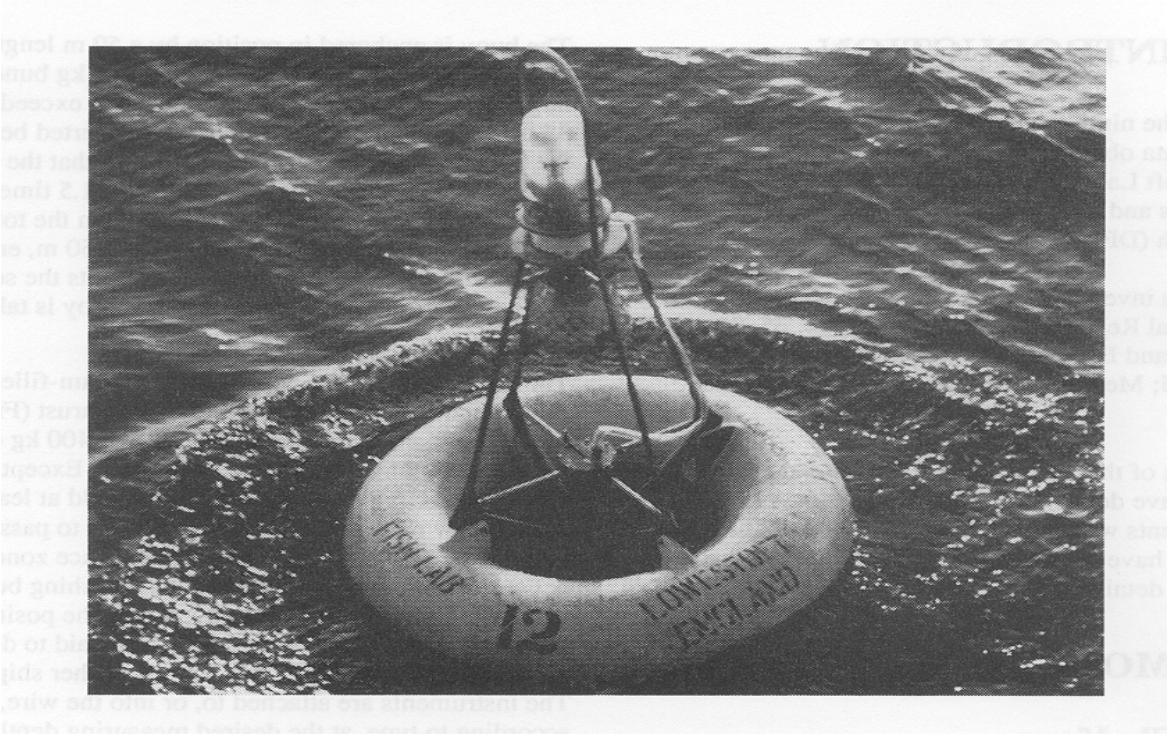

Figure 2. Shelf seas rig: surface marking buoy

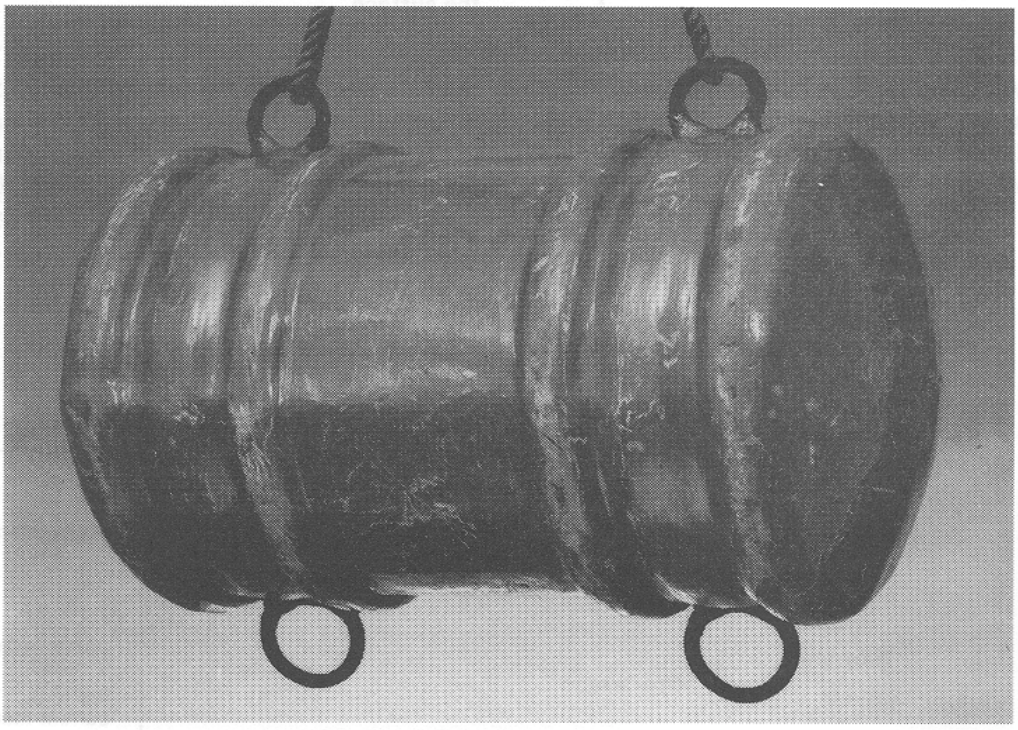

Figure 3. Sub-surface buoy

required for recovery in the event of the surface buoy being missing.

The positions of the moorings are notified to and cleared by, various authorities during the planning stage, and a 'Notice to Mariners' is issued in advance of deployment. Once deployed, the actual positions are broadcast by British Telecom coastal radio stations at regular intervals.

2.2 Deep sea

Instruments have been placed in ocean depths ranging from 400 m to 5 500 m using sub-surface moorings,

consisting of glass sphere buoyancy supporting a rope with instruments inserted and terminated with an acoustic release and a scrap chain anchor. The details of each mooring have varied depending on the length, the number of instruments and the expected peak flows. For relatively short, < 1 000 m, moorings in 'quiet' conditions, galvanised steel towers holding 9 or 10 glass spheres and providing 185 kg of buoyancy have been used to support moorings of 16 mm plaited torque-balanced 'Multiplat' polypropylene rope, 2 or 3 recording current meters and an IOS CR200 acoustic release, and with a 640 kg anchor weight (see Figure 3 in Medler *et al.* 1983).

Full depth moorings, i.e. 4 500 m long in 5 000 m water depth, but still in low current flows consist of 5 instruments spaced out in the mooring, still of 'Multiplat' but with the buoyancy of up to 24 x 45 cm diameter glass spheres distributed along the mooring with the instruments. This reduces the peak tensions in the mooring and allows partial recovery if the mooring parts. These moorings are anchored with up to 1 200 kg of chain.

The 16 mm 'Multiplat' rope is cheap, tough and buoyant but has a relatively large drag, which becomes critical in all but very low current flows when long lengths are involved. In such circumstances in recent years, 10 mm sheathed 'Kevlar' Aramid fibre rope has been used. This has greater strength than the 'Multiplat' and considerably less drag. It needs, however, specialist termination and much more careful handling.

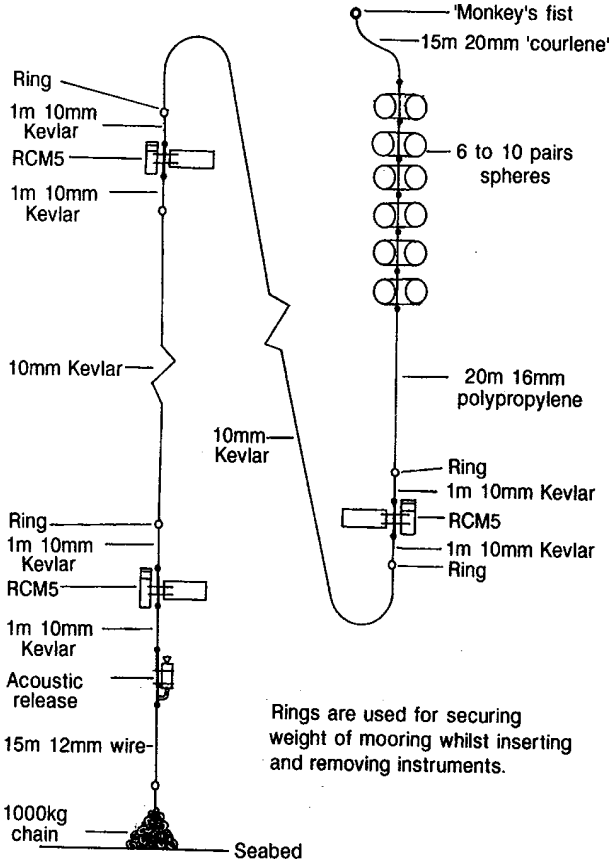

Figure 4. Denmark Strait mooring

The recent moorings in the Denmark Strait area and East Greenland, have used 'Kevlar' as, although they are typically only a few hundred metres in length, they have been moored for long periods in very energetic flows (Figure 4). Here the buoyancy is concentrated at the top of the mooring above the strongest near-bottom flows; consisting of 12-20 45 cm diameter glass spheres giving 322-460 kg upthrust. The design of these moorings has been aided by a computer 'Knock Down' program 'MOOR' developed and kindly supplied by Clark Darnell, National Oceanographic and Atmospheric Administration, Pacific Marine Environment Laboratory, Sand Point Way NE, Seattle, WA98115, USA.

3. INSTRUMENTATION

3.1 Recording current meters

(a) Plessey MO21 E and F (Figure 5(a))

Originally introduced in 1966, a stock of 40 were maintained until production ceased in 1976. These were for 12 years the sole type operated by DFR. In the early 1980s reliability problems led to a complete rebuild employing solid state switching and encoding of data, an Aanderaa encoder motor and gearbox for tape transport and Aanderaa tape drive components and compasses (Read *et al.*, 1981). A later redesign using a stepper motor for tape transport, giving basic measurements of current speed and direction, temperature, reference and sample counter and designated MO21F, is the type currently used. They are expandable up to 16 channels and four have recently been fitted with pressure sensors.

(b) Plessey 9021 (Later Grundy) (Figure 5(b))

Introduced, by Plessey, as a replacement for the MO21 in 1978, they were later manufactured and sold by Grundy Inc. of San Diego, USA. Early problems with the standard non-gimballed digital compasses jamming were resolved by fitting gimballed versions and the 16 instruments, although unwieldy, performed well in use. The basic three channel unit measured current speed and direction, as well as reference, with the option of temperature, signal count, conductivity and pressure. Most of the DFR units were lost in the North Channel and Irish Sea exercises in 1984-86.

Both the MO21 and 9021 instruments are hung from 'A' frames attached to the instrument wire.

(c) Aanderaa RCM5 (Figure 5(c)) (similar)

Originally bought as RCM4, 2 000 m depth instruments, these were converted to 6 000 m, RCM5 specification and used for deep sea current measurements from 1976, a stock of 50 being

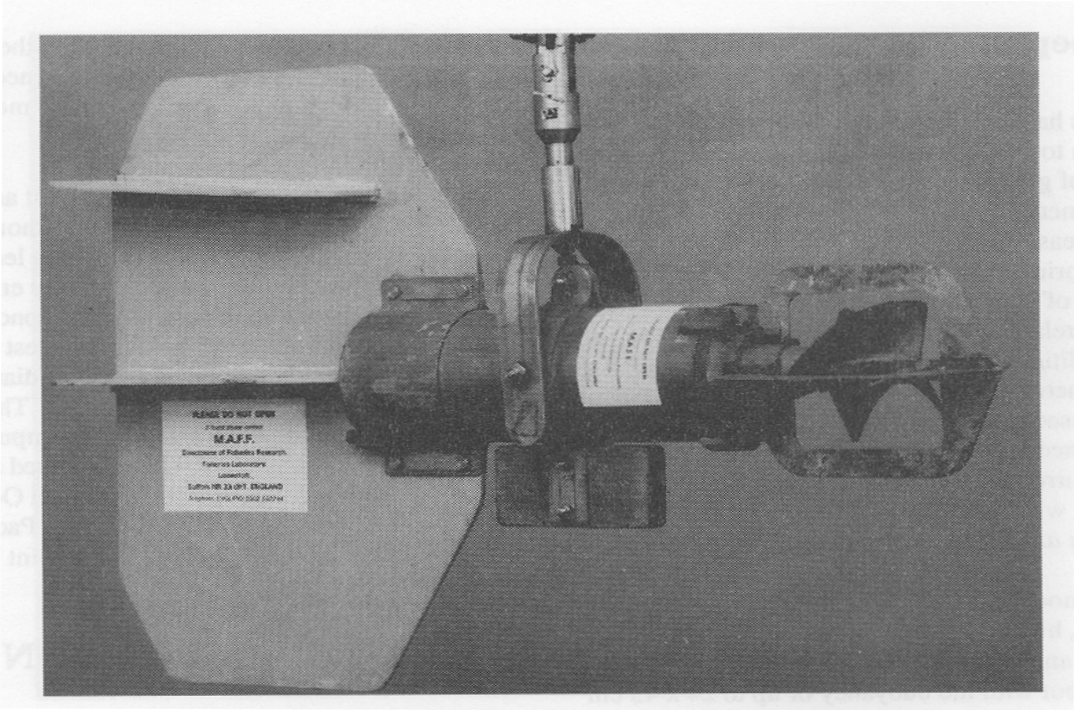

Figure 5(a). Plessey MO21-type current meter

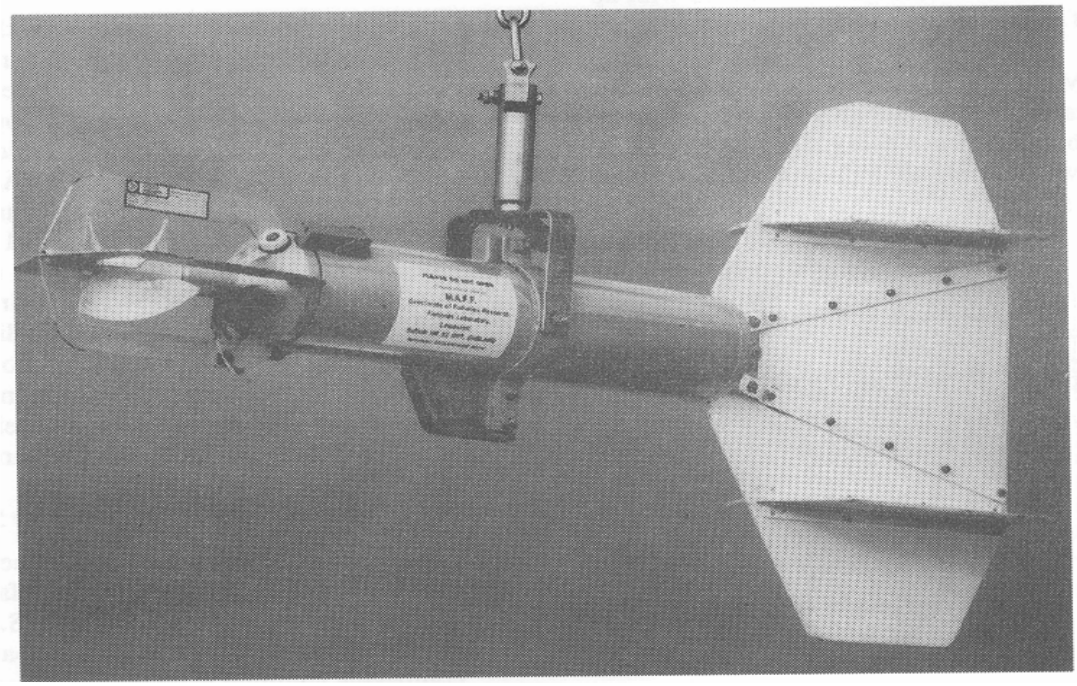

Figure 5(b). Plessey 9021 (later Grundy) current meter

maintained until 1986. All measure reference number, current speed and direction, and temperature, with special low range, high resolution temperature, conductivity and pressure on some.

(d) Aanderaa RCM4S (Figure 5(c)) (similar)

This version of the Aanderaa meter, with a partly shielded 'paddle wheel' rotor was introduced to counter the criticism of the original 'savonious' rotor's response in the turbulent current flows

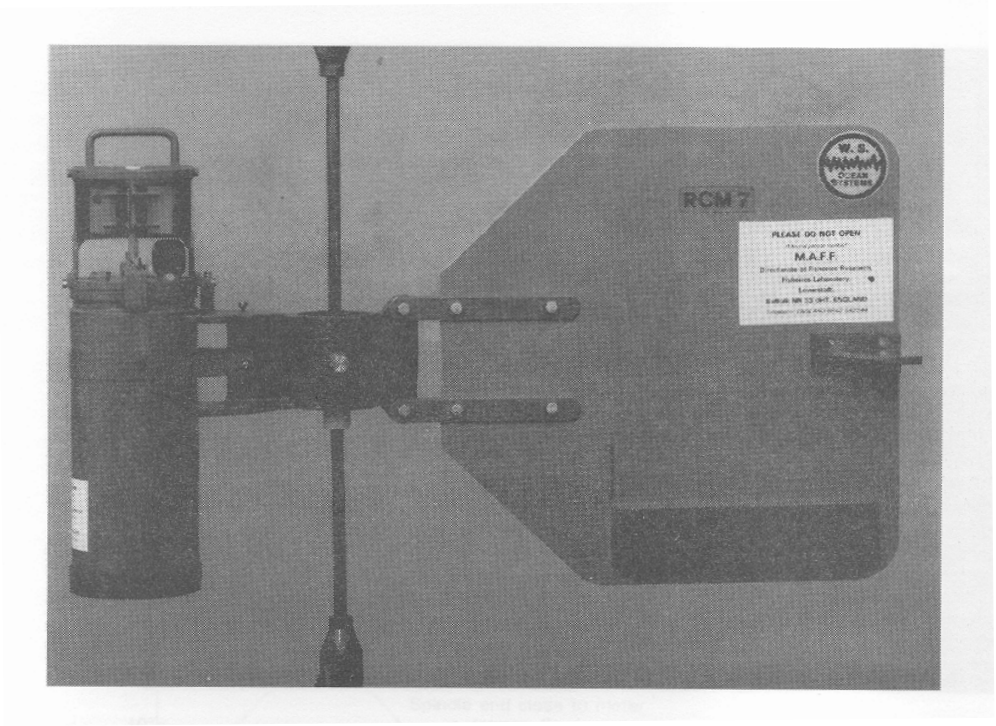

Figure 5(c). Aanderaa-type current meter

found in some shelf sea environments. Apart from the rotor they are identical to the earlier RCMs. One unit has been fitted with an interface that allows data from a Sea Tech transmissometer mounted in its fin to be recorded. They have been used on both shallow and suitable deep sea moorings.

(e) Aanderaa RCM7 (Figure 5(c))

Introduced in 1988 this development of the Aanderaa RCM4S has solid state encoding and storage of data. The compass and rotor counter are sampled every 5 seconds and the readings converted into a northing and an easting, which are summed until the timed recording interval is reached. The total northing and easting is then converted into average speed and direction which is logged in the same format as the other Aanderaas in a removable 'Data Storage Unit'. Externally the instrument is as the 4S but the fin plate and the swivel rod are shorter. After some initial deployments of these meters, including some intercalibration exercises it became apparent that in periods of strong flows there was a distortion of the recorded direction. This was traced to the shorter suspension spindle fitted to these instruments allowing the mild steel mooring shackles to affect the instrument's compass when the instrument wire leaned over in strong flows (see subsection 3.3 below). A change to the longer RCM4 swivel appears to have cured the problem. They also have a component of their battery drain that is independent of the sampling period, due to the averaging feature. This will limit their use for extended deployment until a suitable increased capacity battery can be found.

(f) Valeport BFM208 (Figure 5(d))

A total of 12 of these instruments were bought in 1987 after a survey of the market found that they promised to be the best available at that time.

The meter reads compass and rotor every 5 seconds and converts them into a northing and an easting using look-up tables in the calibration EPROMs (Erasable-Programmable-Read-Only-Memory). These values are summed and written to memory at each sample time (typically 10 minutes). As supplied the EPROMs are programmed with 'ideal' values which assume that the compass sector boundaries occur at exactly 5.6 degree intervals. The meter outputs every 5 seconds via a communication connector, a complete data set including, when writing to memory, the corrected vector data, enabling its use as a 'Direct Reading' instrument. The instrument's major drawback is its relatively low resolution 6 bit compass. Results of inter-calibration exercises have tended to show that, although the averaging system improves its performance, its ability to describe accurately the environment it is moored in suffers as a result.

(g) Interocean S4

Four of these units were borrowed from the

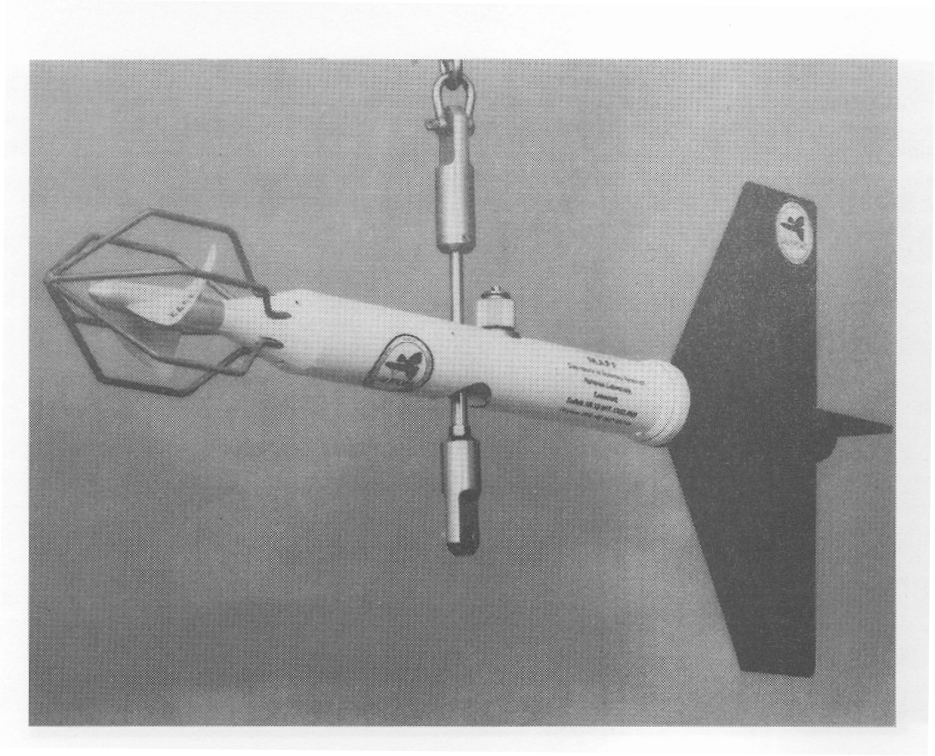

Figure 5(d). Valeport BFM208 current meter

Scottish Marine Biological Association, Dunstaffnage Marine Laboratory, Oban, Scotland during 1988 to attempt to measure currents in the surface layer. They consist of a 25 cm diameter sphere containing all the electronics and batteries. The current speed and direction are sensed by four electrodes spaced around the equator of the instrument. An internal compass and tilt sensor are used to correct the data collected (Ellett *et al.* , 1991).

3.2 Data translation

All instruments except the RCM7, BFM208 and S4 record on 6 mm magnetic tape using a 10 bit binary code of long and short pulses. These tapes are translated into ASCII code by an Aanderaa 2103 tape reader fitted with an elastic buffer and transferred to an Apricot micro-computer. The tape reader is modified to allow reading of the tapes from the MO21 and 9021 as well as the Aanderaas. The data from the RCM7 Data Storage Units are translated using an Aanderaa 'DSU Reader', and transferred to the Apricot microcomputer.

The BFM 208 data are translated by inhouse-developed computer software running on an Apricot micro-computer and written to file.

The S4 instruments were returned to their owners for data extraction and correction.

All data are then transferred to either an HP1000 or a VAX mini-computer for further processing, all transfers using the file transfer utility 'Kermit'.

3.3 Intercalibration

The introduction of new types of current meters led to the designing of several intercalibration exercises, where instruments of different types were moored on the same rig, as close together as possible, to compare their results. Comparisons between MO21F, RCM4S and BFM208 moored in the Irish Sea in 1987 (Read *et al.,* 1988) all showed similar responses but highlighted again the critical affect the meter's directional resolution and accuracy has in determining residuals, particularly in areas of strong tidal flow. (Gould, 1973).

Early tests between RCM4Ss and RCM7s in 1988 indicated that there was a problem with the short-spindled RCM7 in strong flows (Figure 6(a)). A set of compass calibrations with a short-spindled swivel and mooring hardware fitted, made to tilt as it would in strong flows in the sea, showed a dramatic change in the response of the compass, compared with when the swivel was vertical in weak flows (Figure 6(b)). This affect is not apparent with the longer RCM4 spindles which are now fitted by DFR.

3.4 Calibration

As directional accuracy is deemed to be the most important parameter in use, the major resources are spent on the calibration of the instrument compasses; over 500 individual calibrations have been performed since the beginning of 1988.

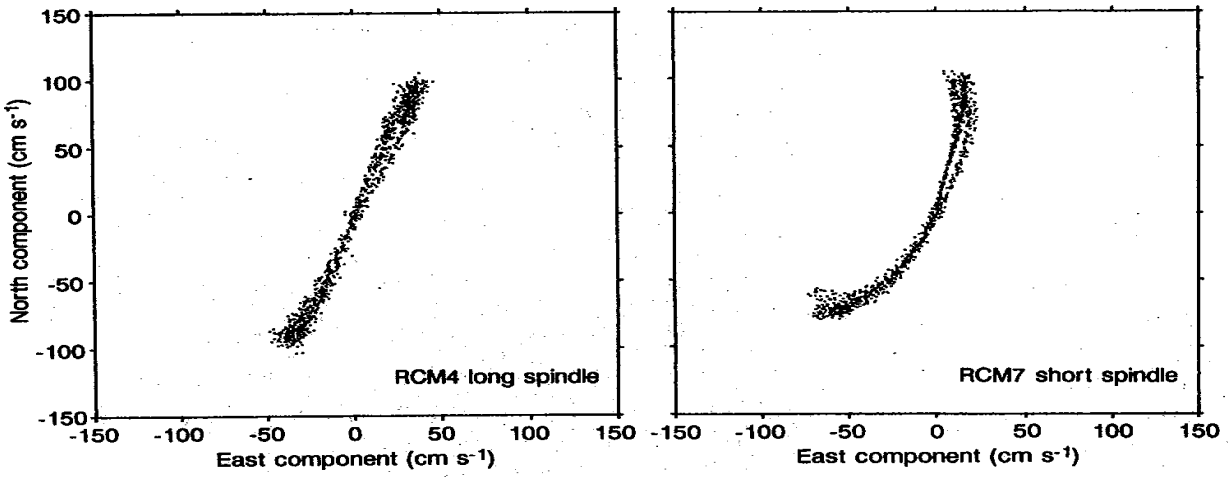

Figure 6(a). Comparison of scatter plots for RCM4 and RCM7 current meters

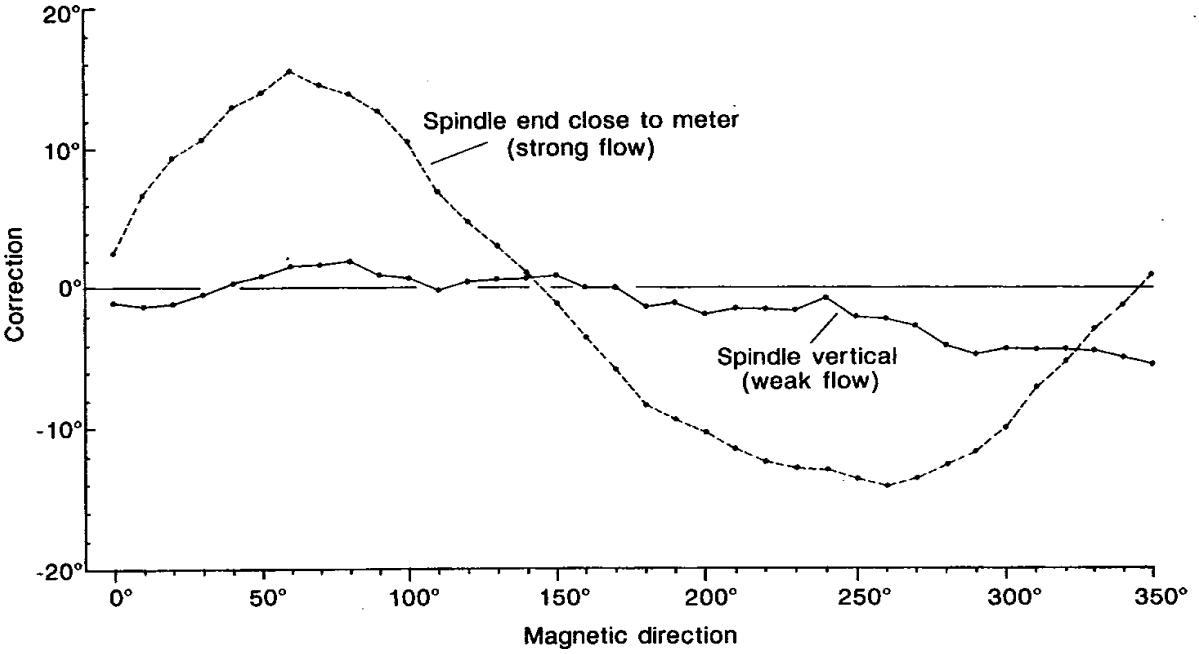

Figure 6(b). Comparison of compass corrections for RCM7 with short spindle in strong and weak flows. (The points are the mean of one clockwise and one counter-clockwise run of the calibration table)

In 1973 a large motor driven compass calibration rig was built, based on a design from the Bedford Institute of Oceanography, Canada. It enabled 4 instruments to be calibrated at one time (Talbot and Baxter, 1975). The arrival of the Valeport instruments in 1987, with their different requirements for compass calibration, and the deterioration of the original rig meant that a rebuild was necessary. The basic need was for accurate indexing of the rig in increments as small as 0.1° and the ability to respond to the compass readings of the meter under test, neither of which was possible with the original motor drive and controller. A large commercial 90:1 worm drive rotary stage, driven by a stepper motor, was found that would give a basic 0.01° degree movement per motor step, and this was fitted in place of the original motor and gearbox (Figure 7). To control it an ARCOM micro computer board-based unit was built, which supplies the stepper motor with correctly ramped trigger pulses to smoothly accelerate, rotate and decelerate the rig in the desired direction.

On initial switch on, the unit, on command, runs through a zeroing sequence to ensure that the rig starts off at a set position, this has an accuracy of 0.05° and all directions are referenced to this point. The control unit has three modes:

(a) Manual: This mode allows rotation of the rig in

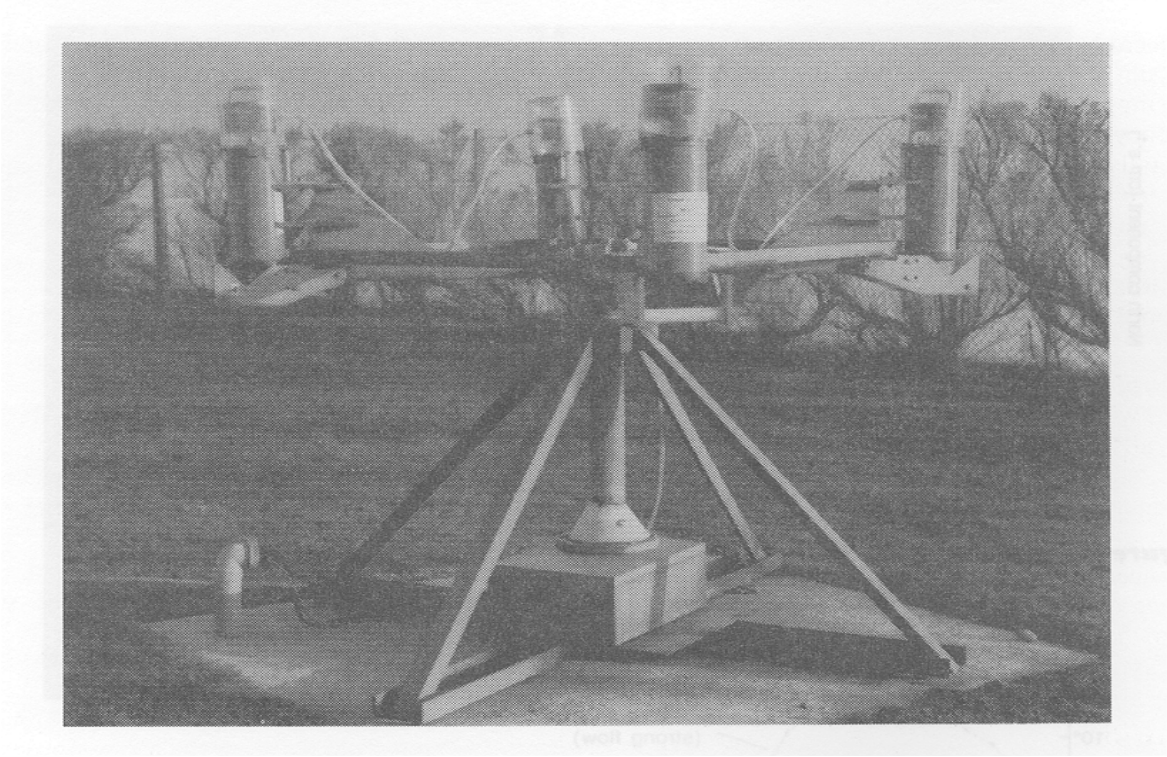

Figure 7. MAFF current meter calibration table

either direction and any angle using thumbwheel and toggle switches and is used for compass adjustments and the calibration of the rig itself.

(b) *Auto:* This mimics the operation of the old rig except that a wider variety of step sizes and time intervals are available by operating thumbwheel switches. It is used for all calibrations except the sector boundary logging on Valeports. Normally it rotates in 10° steps at 2 minute intervals, clockwise and counter-clockwise for four complete revolutions, the meters, set to record at 2 minute intervals and timed to operate whilst the rig is stationary thus recording four compass values at each of 36 directions which can be meaned and an error curve produced. Two such curves, from different cradles on the rig are produced and are meaned to give the final calibration. The difference between the clockwise and counter-clockwise readings give a measure of the hysteresis in the compass, a maximum value of 4° is allowed, giving an accuracy of ±2°, but typical values are between 0° and 2°. Compressed air is used to spin the rotors of the meters to ensure that any magnetic field from the rotor counter system is broken up and cannot affect the compass readings.

(c) *External:* This allows control from an external source. For Valeport compass calibrations, a Philips P2000C micro-computer is connected and used to read the output from the meter on the rig, which includes the raw compass readings. These are then used to instruct the rig to rotate to find the compass sector boundaries, which are logged to 0.5° accuracy. This is done with the rig rotating clockwise and counter-clockwise, and the results are then used to re-program the meter's calibration EPROMs with new lookup tables.

To check on the effect on the revised EPROM contents a check program was produced. The meter is fitted with a special battery pack containing an oscillator that produces the effect of a spinning rotor and is placed on the calibration rig. Running in auto mode, the rig rotates in 30° steps at 3 minute intervals. The meter, set to record at 1 minute intervals, therefore logs at each point 3 records, each consisting of corrected averages of 12 individual readings. Four circuits are completed, two clockwise and two counter-clockwise, the meter is removed and the data extracted. Of the three readings collected at each position one is contaminated by the turning of the rig and is therefore discarded, the remaining two are meaned, compared with the means collected at that position on the other circuits, and the set also meaned. This produces a 12- point calibration of the compass using the corrective effect of the EPROMs data. To be accepted, all points have to be less than 2° from the zero.

Temperature calibrations for all instruments are performed using a Guildline Instruments model 9734 controlled temperature bath having a stability of ±2 mk and an accuracy of ±30 mk. In most cases the instruments are totally immersed in the bath. For the high resolution, restricted ranges fitted to some Aanderaas, two Rosemount platinum resistance probes and an ASL

F17 resistance bridge are used, increasing the accuracy to ±10 mk. Resolution of the temperature measured by the instrument is limited to 0.1% of its range.

Where fitted, pressure sensors are calibrated using a Smith's dead weight tester. Accuracy is limited by the sensor, typically ±1% of range.

Samples of each type of rotor have been occasionally tested in the towing tank at the Institute of Oceanographic Sciences (IOS), Deacon Laboratory, Wormley. Inspection and replacement of components is done on a regular basis. Table 1 gives specifications for the meters discussed above.

3.5 Acoustic releases

DFR now have a policy of not using acoustic releases on shelf-seas current meter moorings, so that anchor chain is not left on the sea bed to impede fishing and other activities. The switch to chain tethers on the marking toroids has reduced dramatically the instances of surface buoy loss and improved navigation accuracy has improved the recovery rate of unmarked moorings by 'dragging' with creepers. Formerly MAFF designed units were used, employing both explosive cable cutters and later, motor driven mechanical release mechanisms.

For deep sea moorings releases are of course essential, and since 1976, model CR200 releases from IOS, Wormley have been used (Phillips, 1980).

4. DATA INVENTORY

This inventory comprises Table 2 which summarizes the current meter exercises on the shelf and gives details of losses and data return, Tables 3-14 which detail the data obtained, and Figures 8-15 which show the locations of the moorings referred to.

The type of meter used is shown in a note at the foot of each table. The recording interval is normally 10 min in the shelf seas and 1 h in the deep ocean. All meters record speed, direction and temperature except where indicated in the tables. The tables give the length of good data recorded by each meter; a note indicates why data recorded was less than expected in some cases. For the semi-permanent station at Sellafield (Table 2) the geographic position given is the nominal one; the variation about this position is 1.1'N-S and 0.7'E-W. The mean spring tidal range shown is taken from the Admiralty Co-tidal and Co-range Line Chart No. 5058 (Great Britain-Hydrographer of the Navy, 1974).

Table 1. Meter specification

Type	MO21F	9021	RCM5	RCM4S	RCM7	BFM208
Channels	5-16	3-8	6	6	6	3
Standard* measurand	RDSTN	RDS	RT—DS	RT—DS	RT—DS	TNoEa
Optional* measurand	P	PCN	CPT	CPT	CPT	P
Compass+ type	A	D1	A	A	A	D2
Impellor type	Prop	Prop	Savonious rotor	Paddle-wheel	Paddle-wheel	Prop
Duration records	13 000	10-22 000	10 000	10 000	10 900	13 000

** Measurand*
R = Reference number
D = Current direction
S = Current speed
T = Temperature
N = Signal number
P = Pressure
C = Conductivity
No = Northing
Ea = Easting

+ Compass type
A Aanderaa analogue
D1 Digicourse 8 bit digital
D2 Valeport 6 bit digital

Table 2. Basic data referring to moored current meter exercises in shelf seas during 1987-89

Exercise	Limits of duration (days)	Mean duration (days)	No. of rigs laid	Meters Used	Meters Lost	Percentage loss	Good days	Data percentage return
Sellafield								
14.12.86-1.3.88	21-71	37	12	12	0	0	332	74
						TOTAL	332	74
NE Irish Sea								
M 12.1.87-10.7.87	22-60	44	4	9	0	0	351	88
P 11.1.87-10.7.87	22-61	44	4	8	0	0	218	62
Q 11.1.87-10.7.87	22-64	45	4	9	0	0	188	46
R 11.1.87-10.7.87	22-61	44	4	9	0	0	196	50
S 12.1.87-23.4.87	41-60	50	2	4	0	0	160	80
U 23.4.87-28.8.87	22-55	40	3	7	0	0	206	74
V 12.1.87-16.7.87	29-60	46	4	9	0	0	393	95
W 13.3.87- 8.8.87	16-55	33	4	10	0	0	283	86
X 23.4.87-28.8.87	22-42	40	3	8	0	0	325	98
						TOTAL	2320	75
NE Coast								
1.10.87-4.10.87	3	3	1	3	0	0	5	56
5.10.87-6.10.87	1	1	1	2	0	0	2	100
						TOTAL	7	64
NE Irish Sea								
S 10.1.88-1.3.88	51	51	1	2	0	0	102	100
B 10.1.88-2.3.88	52	52	1	2	0	0	58	56
C 10.1.88-1.3.88	51	51	1	2	0	0	95	93
D 10.1.88-1.3.88	51	51	1	2	0	0	89	87
						TOTAL	344	85
Suffolk Coast								
T 28.4.88-6.5.88	8	8	1	3	2	66	8	33
U 28.4.88-6.5.88	8	8	1	3	0	0	24	100
						TOTAL	32	67
NE Coast								
E 23.6.88-14.10.88	21-49	37	3	3	0	0	111	100
F 23.6.88-14.10.88	20-49	37	3	6	0	0	222	100
G 23.6.88-14.10.88	21-49	37	3	6	0	0	222	100
H 23.6.88-14.10.88	21-49	37	3	6	0	0	205	92
J 22.6.88-14.10.88	25-47	37	3	6	0	0	170	76
K 22.6.88-14.10.88	25-47	37	3	6	2	33	92	41
L 22.6.88-13.10.88	25-47	37	3	6	1	16	166	75
M 22.6.88-14.10.88	24-47	37	3	6	0	0	222	100
N 16.7.88 - 1.9.88	47	47	1	3	0	0	141	100
P 16.7.88 - 1.9.88	47	47	1	3	1	33	94	67
Q 16.7.88 - 1.9.88	47	47	1	3	0	0	141	100
R 16.7.88 - 1.9.88	47	47	1	3	0	0	96	68
						TOTAL	1882	85
Aldeburgh (Suffolk coast)								
A 31.1.89-11.2.89	11	11	1	3	0	0	33	100
						TOTAL	33	100
North Cornwall								
T 10.3.89-13.4.89	34	34	1	3	3	100	0	0
U 10.3.89-13.4.89	34	34	1	3	0	0	71	69
V 10.3.89-13.4.89	34	34	1	2	0	0	43	63
W 10.3.89-13.4.89	34	34	1	2	0	0	31	45
X 10.3.89-13.4.89	34	34	1	2	1	50	4	6
Y 10.3.89-13.4.89	34	34	1	2	0	0	40	59
						TOTAL	189	40
NE Coast								
B 5.10.89-1.11.89	27	27	1	2	0	0	54	100
C 5.10.89-1.11.89	27	27	1	2	0	0	54	100
D 5.10.89-1.11.89	27	27	1	2	0	0	54	100
E 6.10.89-5.11.89	30	30	1	2	0	0	10	16
F 6.10.89-5.11.89	30	30	1	2	0	0	9	15
G 6.10.89-5.11.89	30	30	1	2	0	0	30	50
H 5.10.89-5.11.89	31	31	1	2	0	0	62	100
J 5.10.89-5.11.89	31	31	1	2	0	0	62	100
						TOTAL	335	72

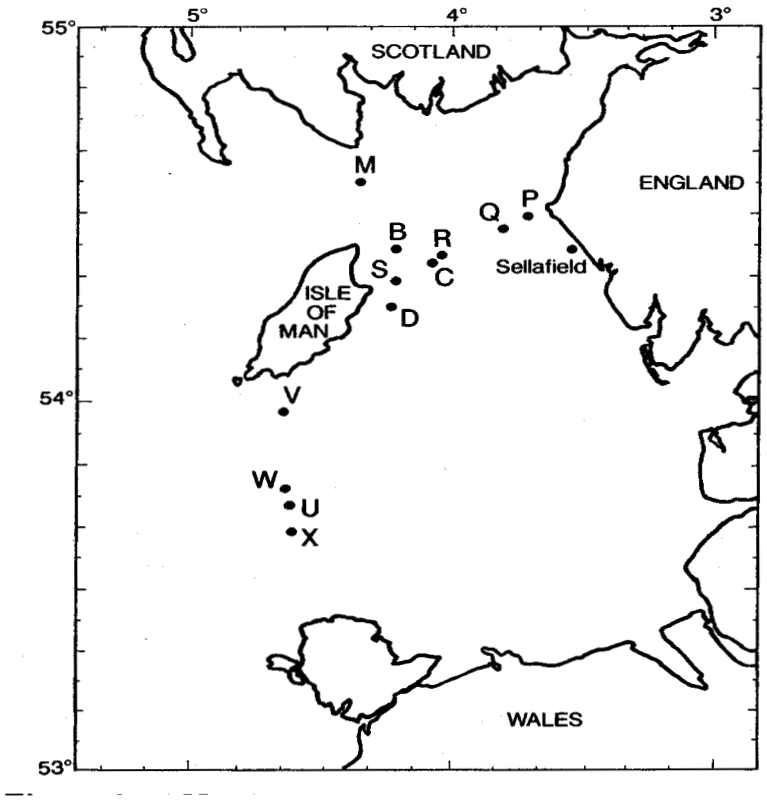

Figure 8. North-east Irish Sea stations (Tables 3, 4 and 5)

Table 3. Sellafield, 14 December 1986 - 1 March 1988 (Figure 8)
Position: 54° 24'N 03° 33'W. Water depth: 15 m. Tidal range: 7.2 m

Period		Meter no.*	Height of meter above bottom (m)	Length of record			discrepancy (min)	Timing Notes
				days	hours	min		
48	14.12.86-23.2.87	196	9	63	8	20	0	Tape ran out
49	23.2.87-16.3.87	320	9	17	19	01	-1	Zero speeds last 3d
50	16.3.87-14.4.87	410	9	28	22	45	-5	
51	14.4.87-6.5.87	196	9	21	20	52	-2	
52	6.5.87-12.6.87	320	9	29	9	27	-7	8 days deleted at start
53	12.6.87-10.7.87	410	9	8	17	23	-3	Remainder of record D+T only
54	10.7.87-18.8.87	196	9	39	3	20	0	Processed in 3 ports, not all have complete data
55	18.8.87-28.9.87	525	9	41	3	21	-1	
56	28.9.87-23.10.87	410	9	24	20	11	-1	Same zero speeds
57	23.10.87-14.12.87	320	9	51	21	9	-19	
58	14.12.87-22.1.88	525	9	-	-	-	-	No data
59	22.1.88-1.3.88	196	9	39	9	50	0	

** All meters are Plessey MO21F*

Table 4. North-east Irish Sea, 1987 (Figure 8)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Ht. of meter above bottom (m)	Length of record			discrepancy (min)	Timing Notes
					days	hours	min		
Station M	Tidal range = 5.8 m								
87M1	12.1.87	56	696+	33	60	11	50	0	
54° 35.0'N									
04° 22.1'W	13.3.87		360	4	60	12	30	0	
87M2	13.3.87	53	553	33	39	5	21	-1	No speeds
54° 34.9'N									
04° 22.4'W	22.4.87		752	4	39	5	20	0	
87M3	22.4.87	54	2+	33	57	8	10	0	No speeds last 3 days
54° 35.0'N									
04° 22.0'W	18.6.87		340	4	57	8	8	-8	No speeds last 25 days
87M4	18.6.87	54	284§	33	21	13	10	0	
54° 35.0'N			683	30	21	13	21	-1	
04° 22.0'W	10.7.87		155+	4	21	13	20	+10	
Station P	Tidal range = 7.2 m								
87P1	11.1.87	23	523+	10	60	11	0	0	Temperatures only
54° 29.6'N									
03° 41.8'W	13.3.87		933+	4	56	12	40	0	Failed last 4 days
87P2	16.3.87	18	525	10	37	7	41	-1	
54° 29.4'N									
03° 41.8'W	22.4.87		749	4	37	7	31	-1	
87P3	22.4.87	25	607+	10	56	18	10	0	
54° 29.8'N									
03° 41.5'W	18.6.87		482	4	56	18	10	0	No speeds last 49 days
87P4	18.6.87	25	620	10	22	5	30	0	No speeds
54° 29.8'N									
03° 41.5'W	10.7.87		523+	4	22	5	30	0	
Station Q	Tidal range = 7.0 m								
87Q1	11.1.87	31	607+	15	60	14	20	0	Poor record last 3 days
54° 27.4'N									
03° 48.8'W	16.3.87		290	4	63	18	21	-1	Same zero speeds
87Q2	16.3.87	26	456	15	-	-	-	-	No data; meter leaked
54° 27.5'N									
03° 48.6'W	22.4.87		620	4	40	1	20	0	Only 6 days speeds
87Q3	22.4.87	33	933+	15	13	4	10	0	Rig trawled
54° 27.5'N									
03° 48.7'W	18.6.87		241	4	13	4	10	0	Temperatures only
87Q4	18.6.87	33	286§	15	22	6	30	0	
54° 27.5'N			145	12	22	6	40	0	No speeds
03° 48.7'W	10.7.87		500#	4	22	6	30	0	
Station R	Tidal range = 6.6 m								
87R1	11.1.87	38	300+	23	59	7	0	0	Temperatures only, meter tangled
54° 22.9'N									with wire
04° 03.1'W	13.3.87		340	4	60	23	57	-7	
87R2	13.3.87	37	420	23	40	1	20	0	No speeds
54° 22.6'N									
04° 02.6'W	22.4.87		683	4	40	1	11	-1	No speeds after 18 days
87R3	22.4.87	40	300+	23	56	1	10	0	
54° 22.7'N									
04° 03.0'W	18.6.87		290	4	56	1	12	-2	No speeds after 16 days
87R4	18.6.87	40	283§	23	22	6	10	0	
54° 22.7'N			360	20	22	6	20	0	No speeds
04° 03.0'W	10.7.87		696+	4	22	6	20	0	

Table 4. Continued

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Ht. of meter above bottom (m)	Length of record days	hours	min	discrepancy (min)	Timing Notes
Station S	Tidal range = 6.3 m								
87S1	12.1.87	29	155+	11	60	1	50	0	
54° 19.4'N									
04° 14.2'W	13.3.87		500#	4	60	2	1	-1	
87S2	13.3.87	23	120	11	40	14	10	0	
54° 19.4'N									
03° 14.1'W	23.4.87		145	4	40	13	51	-1	No speeds
Station U	Tidal range = 6.1 m								
87U3	23.4.87	57	523+	42	54	22	20	0	
53° 43.3'N									
04° 38.6'W	17.6.87		749	4	54	22	20	0	No speeds
87U4	17.6.87	57	192+	42	22	2	8	+2	Some suspect directions
53° 43.2'N									
04° 38.6'W	9.7.87		420	4	22	2	4	-4	No speeds after 2 days
87U5	17.7.87	68	620	44	41	22	9	+1	
53° 43.1'N			300+	43	41	22	9	+1	
04° 38.7'W	28.8.87		607+	4	41	22	9	+1	
Station V	Tidal range = 5.9 m								
87V1	12.1.87	47	2+	27	59	18	18	+2	
53° 58.3'N									
04° 40.0'W	13.3.87		241	4	54	15	40	0	4 days zero speeds
87V2	13.3.87	48	192+	27	40	21	40	0	
53° 58.2'N									
04° 40.1'W	23.4.87		65x	4	40	21	34	-4	No temperatures
87V3	23.4.87	47	696+	27	55	9	11	-1	
53° 58.4'N									
04° 38.9'W	17.6.87		360	4	55	9	1	-1	
87V4	17.6.87	47	287§	27	28	19	50	0	
53° 58.4'N			749	24	28	19	50	0	
04° 39.8'W	16.7.87		120	4	28	19	40	0	
Station W	Tidal range = 6.0 m								
87W2	13.3.87	81	331+	55	41	2	2	-2	
53° 47.2'N									
04° 38.7'W	23.4.87		580	4	41	2	11	-1	No speeds for 13 days
87W3	23.4.87	75	500#	62	55	3	1	-1	
53° 46.9'N									
04° 39.6'W	17.6.87		444+	4	55	2	59	+1	
87W4	17.6.87	75	285	62	15	19	40	0	7 days lost
53° 46.9'N			752	59	22	0	0	0	
04° 39.1'W	3.7.87		65x	4	22	0	0	0	
87W5	17.7.87	68	420	57	21	23	0	0	
53° 46.8'N			444+	56	21	23	0	0	
04° 39.9'W	8.8.87		933+	4	-	-	-	-	No data, tape tangled
Station X	Tidal range = 6.0 m								
87X3	23.4.87	78	155+	65	45	12	20	0	Last 10 days lost - bad tape
53° 39.9'N			147	42	55	15	50	0	Poor speeds
04° 38.5'W	17.6.87		752	4	54	16	40	0	Temperatures only
87X4	17.6.87	78	580	65	22	3	30	0	
53° 39.9'N									
04° 38.5'W	9.7.87		331+	4	22	3	19	+1	
87X5	17.7.87	78	145	66	41	19	0	0	
53° 39.9'N			293§	65	41	19	0	0	
04° 38.4'W	28.8.87		2+	4	41	19	0	0	

**All meters are Plessey MO21F unless marked: + = Aanderaa RCM 4; x = Grundy 9021; # = Aanderaa RCM5; § = Valeport BFM208*

Table 5. North-east Irish Sea, 1988 (Figure 8)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Height of meter above bottom (m)	Length of record days	hours	min	Timing discrepancy (min)	Notes
Station S	Tidal range = 6.3 m								
88S1	10.1.88	27	338#	14	51	8	11	+9	
54° 19.3'N									
04° 14.1'W	1.3.88		607+	5	51	8	11	-1	
Station B	Tidal range = 6.3 m								
88B1	10.1.88	35	372#	21	51	17	0	0	No speeds after 7days
54° 24.0'N									
04° 14.6'W	2.3.88		155+	5	51	16	50	-10	
Station C	Tidal range = 6.5 m								
88C1	10.1.88	35	980#	20	51	0	20	0	
54° 21.9'N									
04° 05.5'W	1.3.88		300+	5	51	0	30	0	No speeds after 44 days
Station D	Tidal range = 6.3 m								
88D1	10.1.88	34	353#	16	51	0	52	+8	
54° 15.4'N									
04° 15.0'W	1.3.88		2+	4	51	0	40	-30	Temps only after 38 days

**All meters are Plessey MO21F unless marked: + = Aanderaa RCM4; # = Aanderaa RCM7*

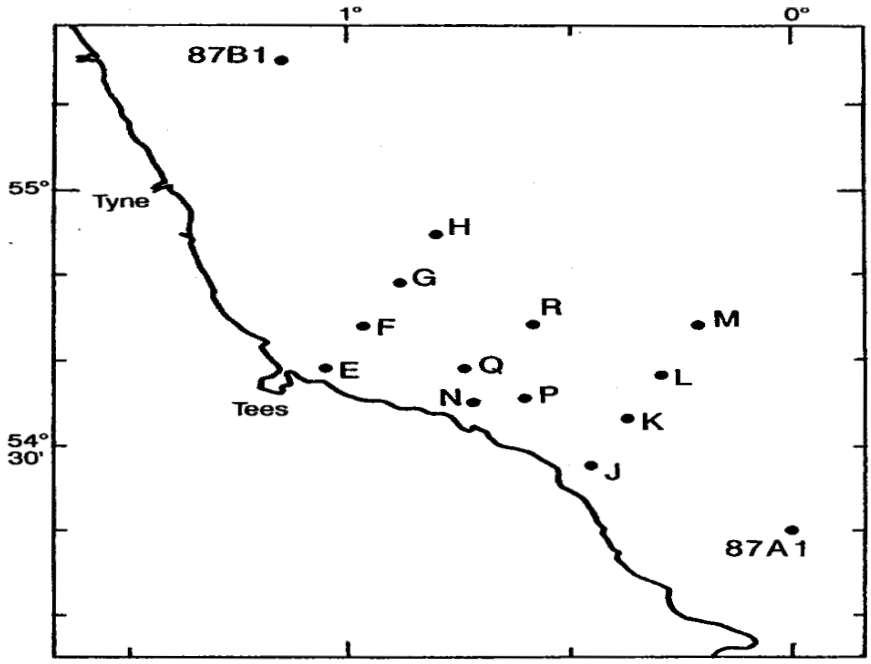

Figure 9. North-east coast of England stations, 1987-1988 (Tables 6 and 7)

Table 6. North-east coast of England, 1987 (Figure 9)

Station and position	Water depth (m)	Tidal range (m)	Meter no.*	Height of meter above bottom (m)	Length of record days	hours	min	Timing description (min)	Notes
1 October - 4 October 1987									
87A1	57	4.5	283§	42	-	-	-		Data suspect
54° 20.3'N			683	27	2	17	0	0	
00° 00.2'W			2+	5	2	17	0	0	
5 October - 6 October 1987									
87B1	89	4.1	607+	67	1	2	50	0	Temperature only
55° 15.3'N									
01° 10.1'W			749	17	1	3	40	0	

**Meters are Plessey MO21F unless marked: § = Valeport BFM208; + = Anderaa RCM4*

Table 7. North-east coast of England, 1988 (Figure 9)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Height of meter above bottom (m)	Length of record			Timing discrepancy (min)	Notes
					days	hours	min		
Station E	Tidal range = 4.6 m								
88E1	23.6.88	24	155+	5	21	17	50	0	
54° 38.7'N									
01° 02.9'W	15.7.88								
88E2	15.7.88	26	523+	5	49	5	40	0	
54° 38.8'N									
01° 03.1'W	2.9.88								
88E3	2.9.88	23	293§	5	41	23	48	-8	
54° 38.8'N									
01° 02.9'W	14.10.88								
Station F	Tidal range = 4.4 m								
88F1	23.6.88	53	300+	33	21	9	50	0	
54° 44.0'N									
00° 57.9'W	14.7.88		360	16	21	9	50	0	
88F2	15.7.88	53	353#	33	49	8	30	0	
54° 43.9'N									
00° 57.9'W	2.9.88		2+	16	49	8	20	0	
88F3	2.9.88	48	285§	33	41	23	20	0	No temperatures
54° 43.9'N									
00° 57.9'W	14.10.88		360	16	41	23	21	-11	
Station G	Tidal range = 4.2 m								
88G1	23.6.88	66	290§	45	21	9	51	-1	
54° 49.4'N									
00° 52.9'W	14.7.88		749	24	21	9	40	0	
88G2	14.7.88	65	292§	45	49	19	34	-4	
54° 49.3'N									
00° 53.0'W	2.9.88		340	24	49	19	27	-7	
88G3	2.9.88	63	290§	45	41	21	50	0	
54° 49.3'N									
00° 53.0'W	14.10.88		145	24	41	21	40	0	
Station H	Tidal range = 4.1 m								
88H1	23.6.88	73	525	50	-	-	-	-	No data
54° 54.5'N									
00° 47.9'W	14.7.88		293§	30	21	9	31	-1	
88H2	14.7.88	74	482	50	49	23	10	0	
54° 54.4'N									
00° 48.0'W	2.9.88		284§	30	49	23	14	-4	
88H3	2.9.88	70	683	50	41	21	41	-1	
54° 54.6'N									
00° 48.1'W	14.10.88		607+	30	41	21	40	0	
Station J	Tidal range = 4.6 m								
88J1	22.6.88	52	338#	36	25	0	10	0	Temperature only
54° 27.6'N									
00° 27.1'W	17.7.88		410	19	25	0	10	0	
88J2	17.7.88	52	420	36	46	19	0	0	Only temperatures last 11
days		54° 27.6'N							
00° 27.1'W	2.9.88		553	19	46	19	0	0	
88J3	2.9.88	53	696+	36	42	0	31	-1	
54° 27.7'N									
00° 27.2'W	14.10.88		512	19	22	18	40	0	Speeds fail

Table 7. Continued

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Height of meter above bottom (m)	Length of record			Timing discrepancy (min)	Notes
					days	hours	min		
Station K	Tidal range = 4.2 m								
88K1	22.6.88	61	22#	39	25	0	0	0	
54° 32.9'N									
00° 22.0'W	17.7.88		145	18	25	0	0	0	
88K2	17.7.88	59	291§	39	-	-	-	-	)
54° 32.8'N									) Meters lost
00° 22.2'W	2.9.88		290	18	-	-	-	-	)
88K3	2.9.88	59	283§	39	-	-	-	-	No data
54° 32.9'N									
00° 22.0'W	14.10.88		410	18	42	1	1	-1	
Station L	Tidal range = 4.0 m								
88L1	22.6.88	65	512	50	24	23	10	0	
54° 38.2'N									
00° 16.9'W	17.7.88		283§	27	24	23	12	-2	
88L2	17.7.88	65	196	50	-	-	-	-	Meter lost
54° 38.2'N									
00° 17.0'W	2.9.88		287§	27	46	19	33	-3	Temps only after 17 days
88L3	3.9.88	61	338#	54	39	21	20	0	)
54° 38.3'N			22#		7	19	53	-3	) Two parts combined. Meter
022		00° 17.1'W		13.10.88		155+	25	40	22 0 0)
Trawled up during 2nd part									
Station M	Tidal range = 3.8 m								
88M1	22.6.88	68	683	50	24	8	10	0	
54° 43.4'N									
00° 12.1'W	16.7.88		285§	27	24	8	22	-2	
88M2	17.7.88	68	320	50	47	23	38	-8	
54° 43.4'N									
00° 12.0'W	3.9.88		294§	27	47	23	45	-5	
88M3	3.9.88	67	580	50	40	22	19	+1	
54° 43.5'N									
00° 12.0'W	14.10.88		523+	27	40	22	20	0	
Station N	Tidal range = 4.5 m								
88N2	16.7.88	4.4	174ϕ	39	46	17	10	0	
54° 34.9'N			155+	22	46	17	0	0	
00° 42.9'W	1.9.88		620	5	46	17	0	0	
Station P	Tidal range = 4.4 m								
88P2	16.7.88	53	955ϕ	48	-	-	-	-	Meter lost
54° 35.3'N			980	36	46	18	30	0	
00° 37.1'W	1.9.88		607+	5	46	18	30	0	
Station Q	Tidal range = 4.4 m								
88Q2	16.7.88	53	958ϕ	48	46	16	50	0	
54° 38.9'N			752	36	46	17	11	-1	
00° 44.4'W	1.9.88		289§	5	46	17	13	-3	
Station R	Tidal range = 4.1 m								
88R2	16.7.88	63	957ϕ	58	46	17	10	0	
54° 43.8'N			300+	39	2	11	20	0	Tape tangled
00° 35.0'W	1.9.88		331+	5	46	17	10	0	Poor data after 20 days

**All meters are Plessey MO21F unless marked: + = Aanderaa RCM4; § = Valeport BFM 208; ϕ = Interocean S4; # = Aanderaa RCM7*

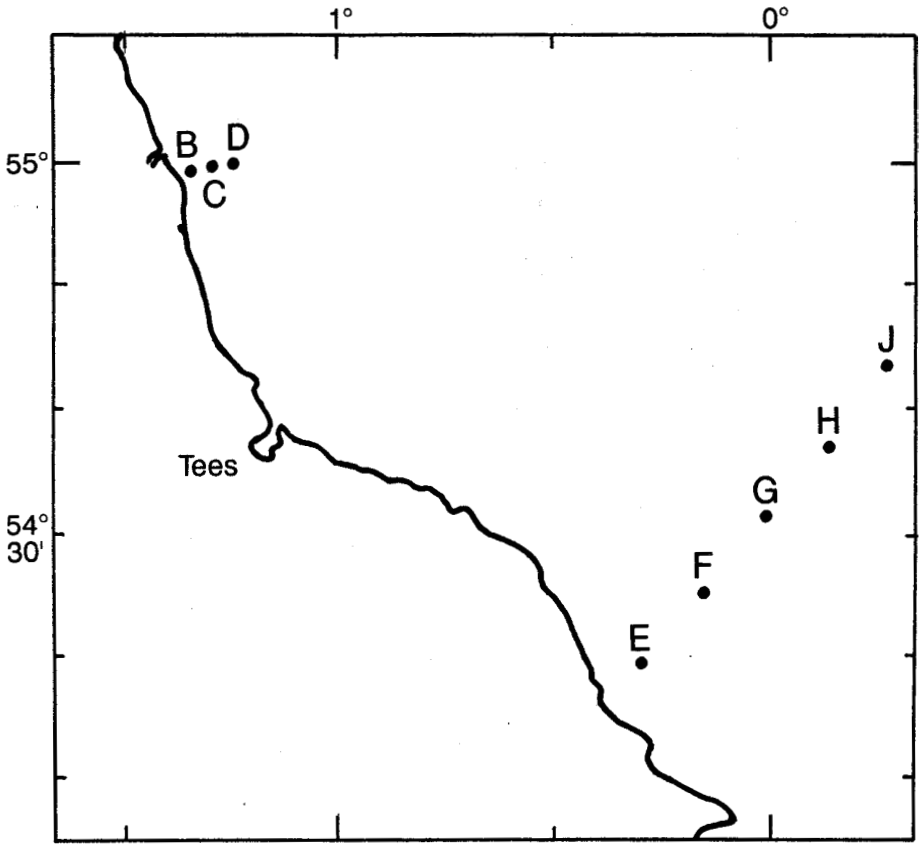

Figure 10. North-east coast of England stations 1989 (Table 8)

Table 8. North-east coast of England, 5 October-5 November, 1989 (Figure 10)

Station and position	Water depth (m)	Tidal range (m)	Meter no.*	Height of meter above bottom (m)	Length of record days	hours	min	discrepancy (min)	Timing Notes
89B1	26	4.3	145	12	26	23	51	-1	
54° 58.9'N 01° 21.0'W			2+	4	26	23	50	0	Meter not balanced Directions not to be used
89C1	42	4.3	683	27	27	1	31	-1	
54° 59.7'N 01° 18.2'W			285#	4	27	1	34	+6	No temperatures
89D1	50	4.3	242#	41	26	21	53	-3	
55° 00.0'N 01° 15.1'W			320	3	26	21	46	-6	
89E1	48	4.5	213§	31	4	16	40	0	)
54° 19.8'N 00° 18.5'W			553	14	4	17	10	0	)Rig trawled up)
89F1	58	4.5	980§	41	9	5	40	0	)
54° 25.9'N 00° 09.8'W			512	19	-	-	-		) Rig sank)
89G1	68	4.0	353§	51	-	-	-		Meter failure
54° 31.6'N 00° 01.8'W			360	24	30	1	22	-2	
89H1	78	3.8	239§	61	30	11	41	-1	
54° 37.3'N 00° 07.7'E			752	25	30	11	41	-1	
89J1	68	3.5	284§	51	30	11	53	-3	
54° 42.9'N 00° 16.5'E			340	24	30	11	45	-5	

**All meters are Plessey MO21F unless marked: + = Aanderaa RCM4 ; § = Valeport BFM 208; # = Aanderaa RCM7*

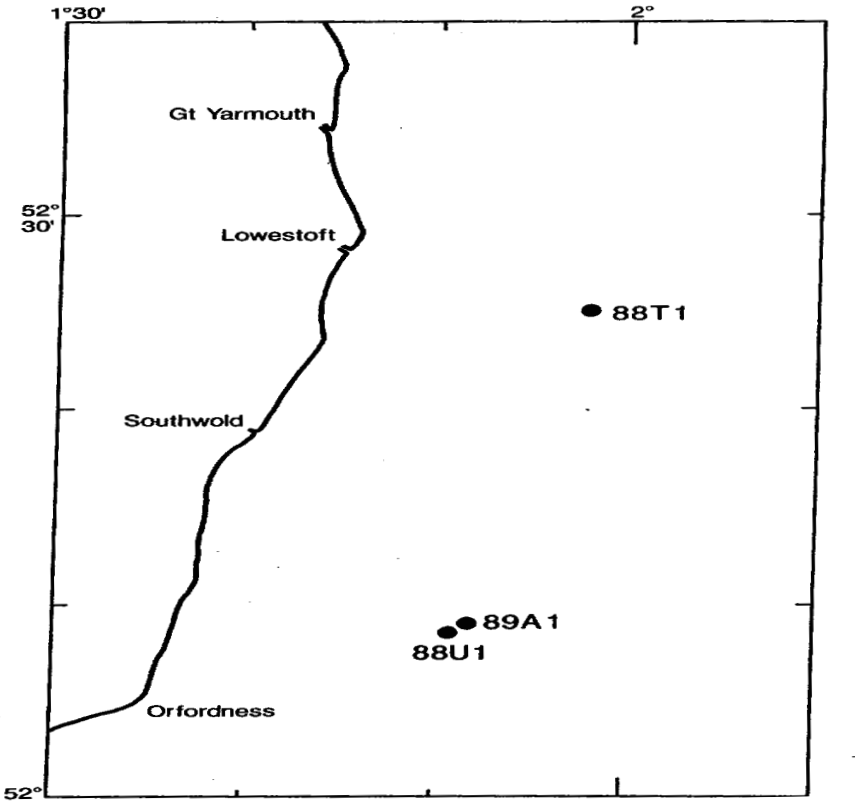

Figure 11. East Anglian coast stations (Tables 9 and 10)

Table 9. Suffolk Coast 28 April-6 May 1988 (Figure 11)

Station and position	Water depth (m)	Tidal range (m)	Meter no.*	Height of meter above bottom (m)	Length of record			Timing discrepancy (min)	Notes
					days	hours	min		
88T1	33	1.7	500#	19.5	7	18	50	0	
52° 25.5'N			885§	18.0	-	-	-		Meter lost
01° 58.0'E			241	4	-	-	-		Meter lost
88U1	31	1.7	192+	17.0	7	19	10	-10	
52° 08.8'N			022§	15.5	7	19	10	0	
01° 51.3'E			620	4	7	19	10	0	

**All meters are Plessey MO21F unless marked: # = Aanderaa RCM5; § = Aanderaa RCM7; + = Aanderaa RCM4*

Table 10. Aldeburgh (Suffolk coast) 31 January-11 February 1989 (Figure 11)

Station and position	Water depth (m)	Tidal range (m)	Meter no.*	Height of meter above bottom (m)	Length of record			Timing discrepancy (min)	Notes
					days	hours	min		
89A1	32	2.1	133	21	10	21	40	0	
52° 09.2'N			213	19	10	21	40	0	
01° 52.1'E			239	18	10	21	40	0	

**All meters are Aanderaa RCM7 recording at 5 minute intervals*

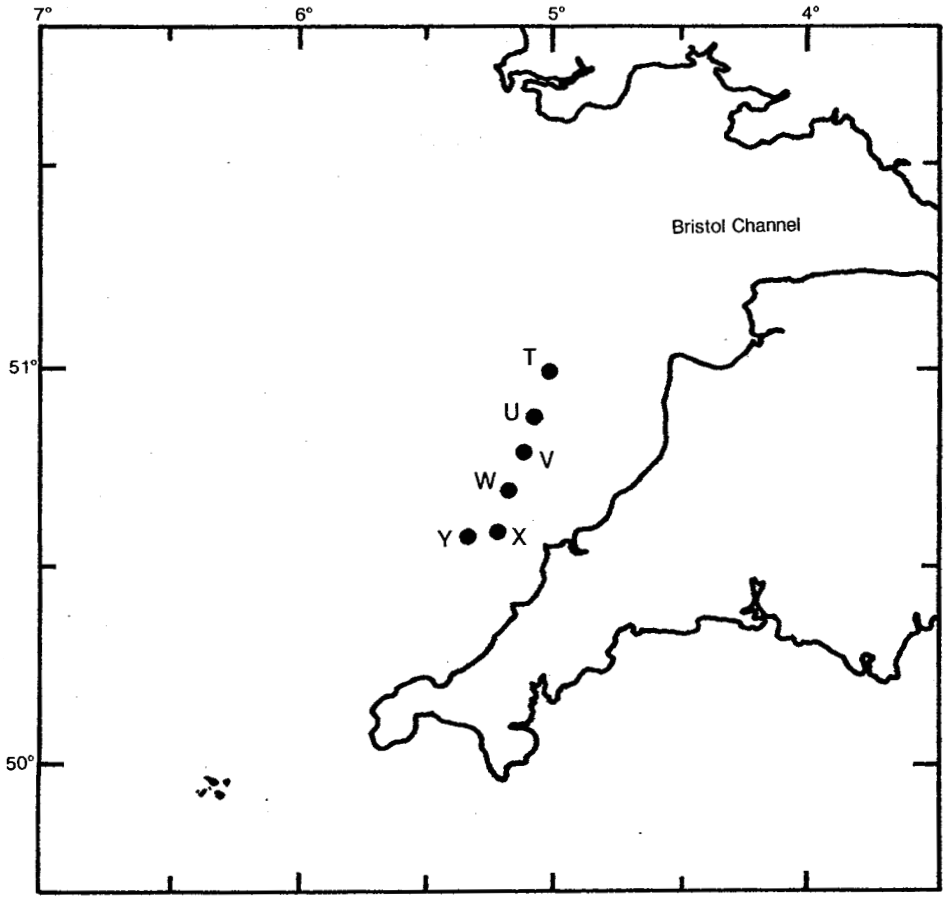

Figure 12. North Cornwall coast stations 1989 (Table 11)

Table 11. North Cornwall coast, 10 March-13 April 1989 (Figure 12)

Station and position	Water depth (m)	Tidal range (m)	Meter no.*	Height of meter above bottom (m)	Length of record days	hours	min	discrepancy (min)	Timing Notes
89T1	73	6.3	300+	59	-	-	-		)
51° 00.3'N			315#	58	-	-	-		) Meters lost
05° 01.0'W			482	4	-	-	-		)
89U1	70	6.3	155+	56	33	21	30	0	
50° 54.1'N			284§	55	33	21	40	0	
05° 04.4'W			340	4	3	6	50	0	Rotor broken
89V1	66	6.2	696+	48	28	16	11	-1	
50° 48.0'N									
05° 07.3'W			749	6	13	17	50	0	Fin broken
89W1	61	6.2	331+	43	-	-	-	-	No data
50° 42.0'N									
05° 10.6'W			320	6	31	22	17	-7	Rig dragged
89X1	57	6.1	523+	39	4	8	30	0	Meter trawled up
50° 36.6'N									
05° 13.1'W			580	6	-	-	-		Meter lost
89Y1	63	6.0	607+	45	5	19	50	0	Meter malfunc-
tion									
50° 35.6'N									
05° 20.0'W			752	6	33	19	40	0	

**All meters are Plessey MO21F unless marked: + = Aanderaa RCM4; § = Valeport BFM208; # = Anderaa RCM7*

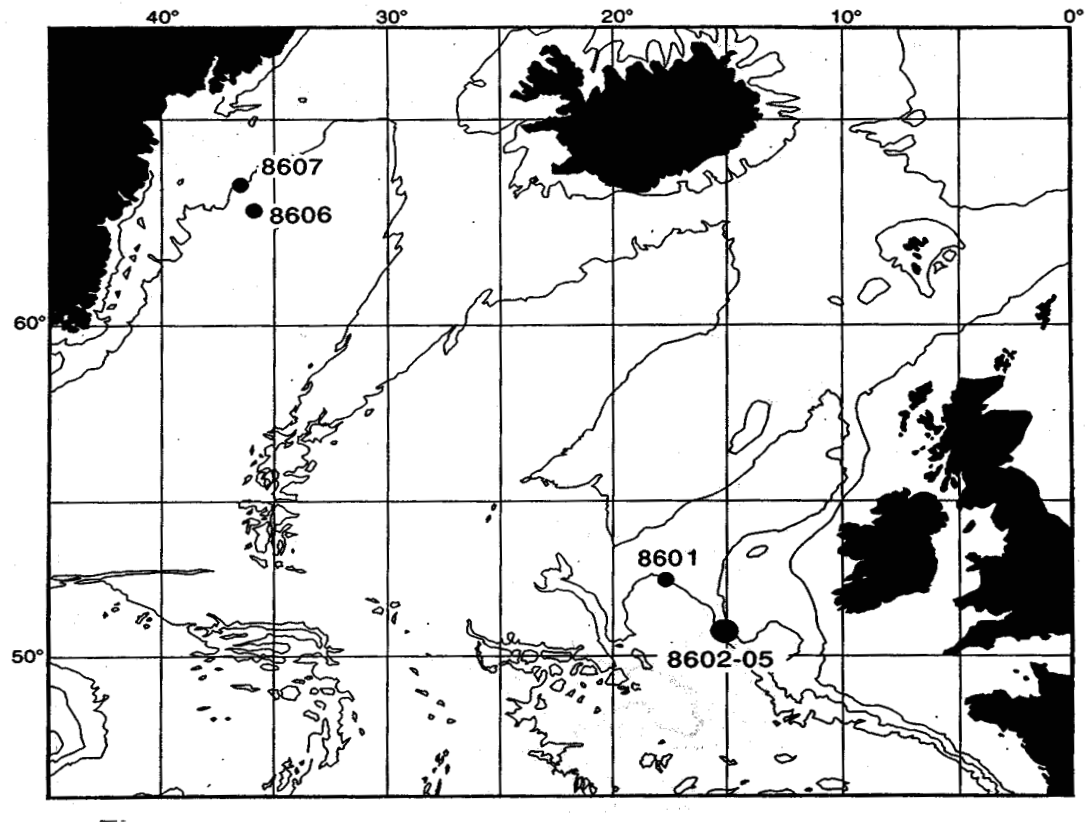

Figure 13. North-east Atlantic stations 1986-87 (Table 12)

Table 12. North-east Atlantic, 1986 deployments (8601-8607) (Figure 13)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Height of meter above bottom (m)	Length of record days	hours	min	discrepancy (min)	Timing Notes
86-01	8.7.86	4125	490	1022	349	5	55	+5	
52° 27.4'N									
17° 43.1'W	23.6.87		898	45	349	6	00	0	
(NEADS 6)									
86-02	12.7.86	3342	037	200	344	1	04	-4	
50° 33.3'N									
14°41.8'W	21.6.87		562	30	344	1	33	+27	
86-03	12.7.86	2978	046	2377	344	11	52	+8	
51° 02.9'N			743	1317	344	11	49	+11	
15° 09.9'W	22.6.87		703	97	344	11	4	-4	
			768	30	344	11	59	+1	
86-04	12.7.86	2945	879	200	344	8	01	-1	
50° 59.8'N									
15° 05.6'W	22.6.87		182	30	344	8	51	+9	
86-05	13.7.86	3220	960	323	344	5	8	-8	
51° 03.1'N									
15° 14.2'W	22.6.87		178	30	344	5	4	-4	
86-06	9.9.86	2640	606	660	289	14	52	+8	
62° 53.7'N									
35° 51.5'W	26.6.87		644	110	289	15	41	+19	
86-07	9.9.86	2046	351	510	289	19	39	+21	
63° 25.8'N									
36° 34.2'W	26.6.87		924	110	289	20	15	+45	

**All meters are Aanderaa RCM5, set to record at hourly intervals*

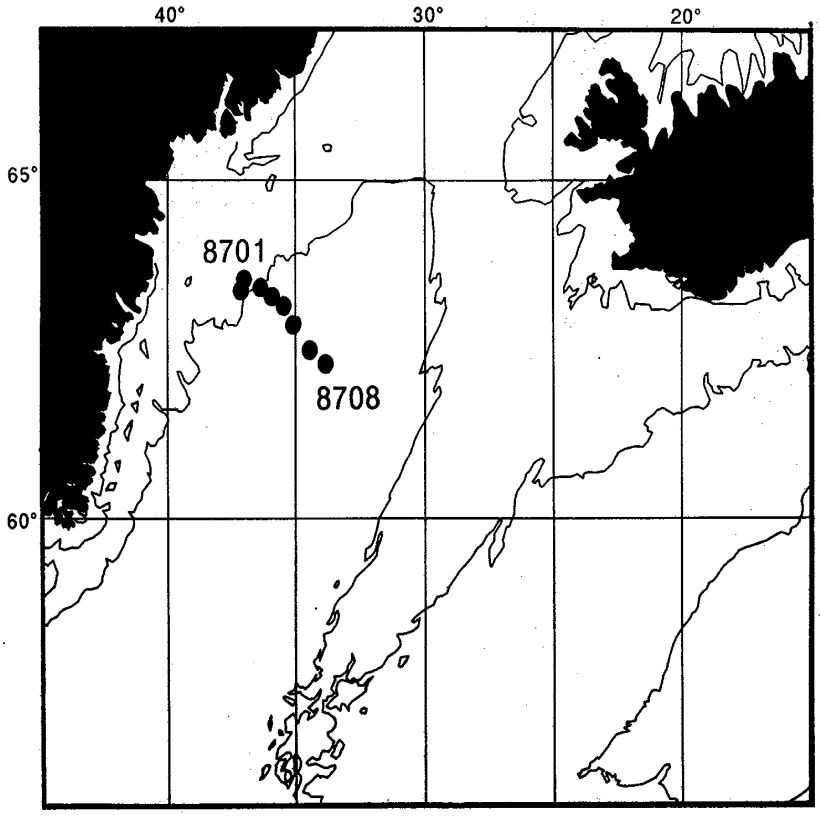

Figure 14. North-east Atlantic stations 1987-88 (Table 13)

Table 13. North-east Atlantic, 1987 deployments (8701-8708) (Figure 14)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Ht. of meter above bottom (m)	Length of record days	hours	min	Timing discrepancy (min)	Notes
87-01	26.6.87	1220	132	301	370	16	59	+1	Directions suspect
63° 42.4'N									
36° 58.3'W	1.7.88		759	100	370	17	04	-6	
87-02	27.6.87	1648	373	401	98	13	0	-	Meter malfunction
63° 36.3'N									
37° 01.9'W	1.7.88		855	100	369	22	59	+1	
87-03	27.6.87	1986	442	401	369	12	50	+10	
63° 29.1'N									
36° 17.4'W	30.6.88		397	100	369	13	03	-3	Directions suspect
87-04	27.6.87	2355	278	601	368	22	51	+9	
63° 16.7'N									
35° 53.6'W	30.6.88		825	100	368	23	07	-7	
87-05	28.6.87	2572	543	703	368	12	37	23	
63° 07.0'N									
35° 33.3'W	30.6.88		476	100	368	12	54	+6	
87-06	28.6.87	2706	128	803	367	21	41	+19	
62° 54.1'N									
35° 06.4'W	30.6.88		534	100	285	13	02	-2	Processed in two parts. No speeds for 82 d
87-07	28.6.87	2835	109	803	307	0	55	+5	Processed in two parts. Poor tape
62° 38.4'N									
34° 30.4'W	30.6.88		652	100	367	15	52	+8	
87-08	28.6.87	2916	879	903	-	-	-	-	Meter lost
62° 15.5'N									
33° 48.6'W	30.6.88		987	100	-	-	-	-	Meter lost

**All meters are Aanderaa RCM5, set to record at hourly intervals*

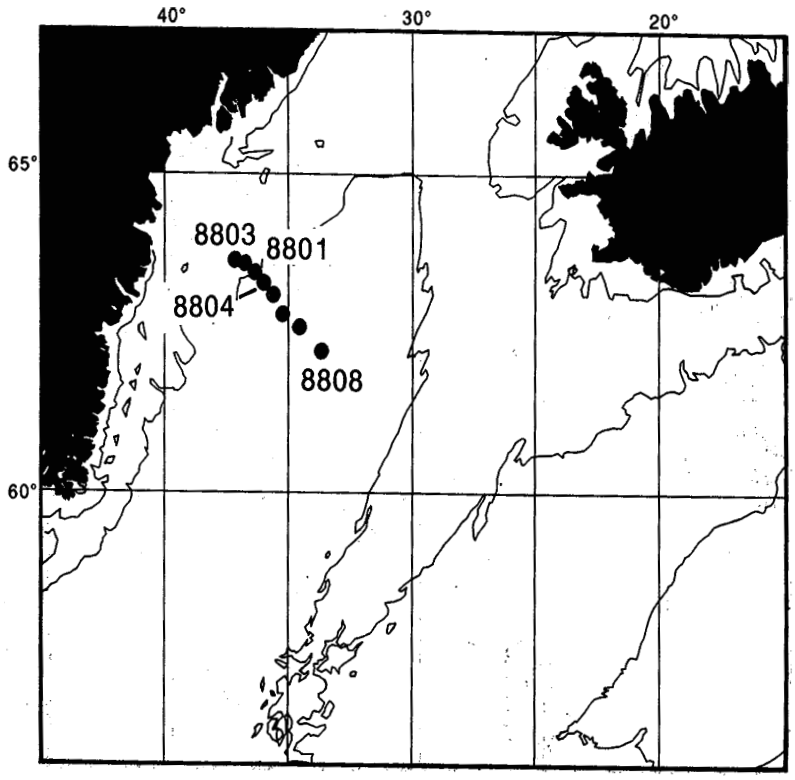

Figure 15. North-east Atlantic stations 1988-89 (Table 14)

Table 14. North-east Atlantic, 1988 deployments (8801-8808) (Figure 15)

Station and position	Deployed/ recovered	Water depth (m)	Meter no.*	Ht. of meter above bottom (m)	Length of record			Timing discrepancy (min)	Notes
					days	hours	min		
88-01	3.7.88	1984	192	362	292	20	1	-1	Encoder fault
63° 28.9'N			046	60	231	9	57	+3	Speeds lost
36° 17.9'W	29.6.89		924	19	360	22	55	+5	
88-02	3.7.88	1660	606	362	360	23	3	-3	
63° 37.1'N			124	60	-	-	-	-	Meter fault
36° 43.8'W	29.6.89		743	19	228	19	52	+8	Speeds lost
88-03	3.7.88	1260	279§	262	242	7	3	-3	Meter fault
63° 41.7'N			372§	60	-	-	-	-	Meter fail
36° 59.2'W	29.6.89		933+	19	360	23	1	-1	
88-04	3.7.88	2345	037	612	360	8	3	-3	Only temperatures valid
63° 17.4'N			562	60	53	8	0	0	Meter fault
35° 51.9'W	29.6.89		703	19	27	9	0	0	Meter fault
88-05	4.7.88	2569	182	674	88	16	58	+2	Only temperatures after 88 days
63° 07.1'N			801	60	359	18	21	-21	
35° 32.5'W	29.6.89		351	19	-	-	-	-	Meter fail
88-06	4.7.88	2706	073	835	359	5	5	-5	
62° 54.4'N			768	60	359	5	1	-1	
35° 06.6'W	28.6.89		960	19	77	17	2	-2	Meter fault
88-07	4.7.88	2827	178	775	358	22	4	-4	
62° 39.2'N			879	60	358	22	2	-2	
34° 30.8'W	28.6.89		490	19	52	14	59	+1	Meter fault
88-08	5.7.88	2917	644	875	214	21	50	+10	Meter fault
62° 14.2'N			886	60	263	18	2	-2	Meter fault
33° 48.6'W	28.6.89		898	19	359	23	2	-2	

** All meters are Aanderaa RCM5 unless marked: § = Aanderaa RCM7; + = Aanderaa RCM4*

5. DATA AVAILABILITY

The British Oceanographic data Centre (BODC) (fromerly Marine Information and Advisory Service) was set up to co-ordinate the archiving of all UK oceanographic data. Data from MAFF moored current meters are supplied to them on a routine basis. MAFF data are not freely available to the scientific and commercial community via BODC untiol two years have elapsed from the date of its receipt at BODC.

Data are available from BODC in a variety of formats to suit the customer's requirements. Enquiries should be made to BODC, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside, L43 7RA. Enquiries about MAFF data which are not in circulation should be made to the Director, MAFF, Fisheries Laboratory, Lowestoft, Suffolk NR33 OHT.

The Fisheries Research Data Report Series provides detailed presentation of results from selected moored current meter deployments. Those published to date (Jones and Norris, 1988; Medler *et al*., 1983, 1984, 1985; Norris, 1985, 1989; Norris and MacDougall, 1986) are detailed in the references.

The reference to proprietary products in this report should not be construed as an official endorsement of these products, nor is any criticism implied of similar products which have not been mentioned.

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