NATIONAL INSTITUTE OF OCEANOGRAPHY
WORMLEY, GODALMING, SURREY

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M.V. RESEARCHER

CRUISE 3/72

31st August — 20th September 1972

AIR-SEA INTERACTION OBSERVATIONS
"JASIN 1972"

N. I. O. CRUISE REPORT No. 60
(1973)

N.I.O. CRUISE REPORTS

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2	Indian Ocean	
3	Expedition	
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INTRODUCTION

MV Researcher took part from 3rd-18th September in the observational phase of the JASIN 1972 Experiment. Three ships (Discovery, Researcher and Weather Adviser) and one aircraft worked in an area about 100 km across near Ocean Weather Station J (52°N 20°W).

This report is intended to show what work was undertaken by Researcher and to indicate the types of measurements made. No attempt has been made to assess the quality or scientific implications of the data collected.

The main part of Researcher's programme was to undertake series of measurements in parallel with those of the other ships and to contribute to the deployment of moored buoys. In addition, three spar buoys were launched on each of three occasions and a number of drogues were tracked. Detailed discussions of a number of the techniques used are given in NIO Cruise Report 57 (Discovery cruise 49).

SCIENTIFIC PARTICIPANTS

Mr. R.D. Adams	DAFS, Aberdeen	Drogues
Mr. T.R. Barber	NIO	Drogues
Dr. K.J. Bull	Imperial College	Meteorology
Mr. J. Bunting	NIO	Locate
Professor W.V. Burt	Oregon State University	Spar buoys
Professor H. Charnock	NIO (Principal Scientist)	Moorings/TSD
Mr. T. Cummins	Oregon State University	Spar buoys
Mr. D.I. Gaunt	NIO	Moorings/TSD
Mr. G. Mardell	NIO	TSD
Mr. J.H.A. Martin	DAFS, Aberdeen	Meteorology
Dr. R.D. Pingree	NIO	TSD
Mr. E.G. Pitt	NIO	Meteorology
Mr. A. Robinson	Oregon State University	Spar buoy
Lt. Willsteed	Hydrographic Department	Navigation
Mr. Wilson	The Plessey Company	Locate

NARRATIVE

Left Barry	31st August
Arrived Juliett area	3rd September
Left Juliett area	18th September
Arrived Barry	20th September

On leaving Barry course was set for the Juliett area near 52°N 20°W. Echo sounder observations were started, a trial radiosonde balloon launched and general preparations made for the subsequent work. Hourly meteorological observations were started at 0900 2nd September.

At 1400 2nd September the TSD winch was tested and a TSD station attempted but the results were unsatisfactory. During subsequent trials the winch hydraulic system failed and it proved unrepairable with the equipment available.

By 1200 3rd September Researcher was at position C2 where Discovery had laid a mooring with a surface buoy. A 10 m drogue was tracked relative to C2 and recovered at dusk when a pattern of 4 XBT's was made around C2. A parachute drogue with radar reflector was tracked overnight.

On 4th September Researcher laid mooring D1 and then tracked parachute drogues relative to it. These were recovered on 5th September and mooring D2 laid. A small winch transferred from Discovery was rigged so that shallow TSD dips could be made. Parachute drogues were tracked relative to D2 and recovered on 6th September.

Three surface spar buoys were rigged, laid and tracked overnight, to be recovered on 7th September. A co-operative series with Discovery and Weather Adviser of 2-hourly radiosondes was started at 1315 7th September. These and shallow TSD dips continued until 1315 10th September.

An attempt was made to repair the pressure sensor and later the antenna on Buoy B1, with moderate success. Difficulty with the Crawford sea-temperature bucket was dealt with on 9th September.

The three surface spar buoys were laid on 10th September and TSD dips, spar buoy and parachute drogue tracking continued.

On 11th September an attempt to locate D1 failed but D2 was found 4 miles toward 255° from where it had been laid.

On 12th September the surface spar buoys were recovered and then Researcher went to lay parachute drogues at a position where Discovery had found interesting thermal structure. Two drogues were laid and one tracked overnight with TSD dips.

The TSD temperature sensor failed at midnight on 13th September - it was later repaired by staff transferred from Discovery. Then the parachute drogue was recovered and Researcher returned to D2 and then to B1 where parachute drogues and TSD dips were restarted.

An intensive co-operative radiosonde series was started at 1115 14th September but the wind remained light so after the 1715 balloon Researcher steamed westward to search an area where a passing freighter had reported an object resembling D1. Nothing was found; Researcher returned to B1 at 1945 15th September to restart TSD dips and parachute drogues. Another co-operative intensive series of radiosondes was done from 1115 16th September, though the Loran-C signal was bad and many sondes defective. The PES fish was recovered, the drogues recovered and then Researcher steamed to D2 and then to B2, doing TSD stations on the way.

On 18th September Researcher joined Discovery and Weather Adviser at B2 for intercalibration and transfer of gear. Course was set for Barry at 0930. Hourly meteorological observation ceased at midnight 18th September. Barry was reached at 1600 20th September.

NOTES ON EQUIPMENT AND OBSERVATIONS

1. TSD and water sampling (Pingree)

Due to the failure of the TSD winch an improvised system was used. This was limited to 167 m depth and was slow, since the wire was hauled in and paid out over a cargo capstan and stored on a hand-wound reel. The 9040 sea unit performed satisfactorily apart from one failure which was repaired. Records were made on magnetic tape and calibration was done as usual by a reversing bottle immediately above the sea unit on each cast. Salinities were measured on board using an Autolab salinometer and duplicate samples bottled for subsequent measurement at NIO.

Eighty-two casts were made to 167 m and 80 to various lesser depths. Fifty-four standard XBT's were dropped between 3.9.72 and 12.9.72: 6 of them were known or suspected to be faulty.

2. Radiosonde measurements (Bunting, Wilson)

A LOCATE Loran-C radiosonde system was used to obtain profiles of temperature, humidity and wind velocity up to about 3000 m height. In each case a double balloon system was used to obtain detailed measurements both during ascent and descent.

The following series of flights were obtained:-

(a) A three-day series of two-hourly flights from 1315Z/7 to 1315Z/10 (37 flights).

(b) Flights at six-hourly intervals from 1700Z/10 to 1115Z/12 (8 flights).

(c) Four flights at two-hourly intervals between 1100Z/14 and 1715Z/14.

(d) Hourly flights from 1100Z/16 to 1915Z/16 (10 flights)

(e) Two-hourly flights from 1915Z/16 to 1515Z/17 (9 flights)

3. Current meter moorings (Gaunt)

Two surface moorings (D1, D2) were laid by Researcher on 4th and 5th September and recovered later by Discovery. The buoys, lent by MOD(H), were the ones used by Hecla during JASIN (1970) but with different instruments.

Details of positions and instrumentation are given in Table 3 and of buoy deployment generally in the report of Discovery Cruise 49 - JASIN 1972.

4. Near-surface drogues (Adams, Barber)

A simple canvas cross with a small surface float and flag was used for daylight work. Parachutes attached to surface dan buoys with radar reflectors were used for radar tracking.

Currents at 10 m and 100 m were usually small in the vicinity of B1.

5. Surface meteorological observations (Pitt)

Hourly meteorological observations were started, on passage, at 0900 on 2nd September and ceased at midnight on 18th September after Researcher had left the Juliett area. Observations were synchronised with those of Discovery and Weather Adviser according to a prearranged schedule. Measurements were recorded on specially prepared forms common to the three participating ships. Inter-ship comparisons of instrument readings were made on a number of occasions to provide a basis for common calibration.

Hourly observations were made of the following variables:-

Wind speed and direction
Visibility
Present weather
Atmospheric pressure
Dry and wet bulb temperatures
Sea temperature
Cloud types and layers, total cloud
Waves
Swell

These data are on magnetic tape in addition to the original manuscript format.

6. Navigation methods (Willsteed)

Researcher was fitted with a Loran-C receiver. This was compared with Decca in the Bristol Channel area and then used on passage and to locate moorings D1 and D2.

The adopted positions of D1, D2 and B1 were those established by the Discovery satellite navigation. Thereafter Researcher's position was usually got by radar from an appropriate surface buoy. The radar appeared to be accurate within its range, which was limited to about 2 miles of a near-surface reflector.

The Loran-C was used whenever Researcher was out of range of a moored buoy and as a check that the surface buoys were not drifting. The LOCATE balloon tracking system was a valuable adjunct as a check for lane slip.

7. Surface spar buoys (Burt, Cummins, Robinson)

Three sixty-ft long lightweight aluminium spar buoys with bottom damping plates were deployed for each of the three half-day periods. During two of these the buoys were launched 1 km apart on a line normal to the mean wind direction. During the third they were deployed in a triangle of roughly 3 km sides.

The following parameters were measured and recorded on magnetic tape:-

(a) Instantaneous wind direction at 5 m above mean water surface. Measurements were made every 6 seconds using heavily damped Aanderaa wind vanes and compasses.

(b) Integrated wind speed at the same height. Measurements were made every 6 seconds using Teledyne Geotech Model 1564B three-cup windspeed transmitters.

(c) Air temperature. Measurements were made every 6 seconds using a thermistor and an Aanderaa sun shield.

(d) Water temperature at the surface and at 2, 4, 7, 10, 15 and 20 m below. Measurements were made every 10 minutes using a thermistor chain.

An averaged current for the upper 15 m was estimated from buoy drift.

8. ES profiles

The echo-sounder was run on the outward passage and used to establish the depth for moorings D1 and D2. Because of navigational uncertainties the records are of limited interest.

TABLE 1a

Researcher Station Position Log - JASIN 1972

(TSD Stations)

Most of the positions were interpolated to ± 0.1' from the track charts drawn on board Researcher by the hydrographic cartographer Lt. Willsteed. When track charts were not drawn, positions were interpolated from whatever fixes (Loran, buoy bearings, DR) had been noted, positions then usually being given to the nearest minute (latitude and longitude). The accuracy of Researcher positions is probably about ± 0.5'.

TSD 9006 used for Stations 1-8
TSD 9040 used subsequently

Station No.	Date 9/72	Time Start	Time End	Lat. ° ' N	Long. ° ' W	Depth of dip m
1	2	1726	1947	52 17.0	15 10.0	Abandoned
2	6	1912	2100	52 42.3	19 45.5	Abandoned
3		2124	2217	52 42.8	19 46.6	Abandoned
4		2307	2358	52 42.8	19 48.6	167
5	7	0130	0203	52 42.7	19 45.7	168
6		0246	0322	52 42.7	19 44.7	168
7		0445	0521	52 42.3	19 48.5	166
8		0615	0745	52 41.8	19 47.0	165
9		1400	1426	52 47.6	20 02.0	100
10		1615	1629	52 47.1	20 01.5	75
11		1815	1840	52 47.2	20 00.7	141
12		1910	1946	52 47.3	20 00.5	167
13(1)		2113	2222	52 47.0	19 59.7	169
13(2)						167
14		2313	2347	52 46.1	20 00.0	167
15	8	0154	0231	52 46.1	20 00.0	167
16		0322	0357	52 46.0	20 00.1	167
17		0526	0600	52 46.2	20 00.3	167
18		0723	0757	52 46.0	20 00.4	168
19		0929	1005	52 46.1	19 59.9	168
20		1131	1206	52 45.2	19 59.8	168
21		1329	1358	52 45.5	19 59.8	168
22		1517	1555	52 45.6	19 59.5	168
23		1756	1830	52 47.8	20 00.7	167
24		1915	1952	52 48.1	20 01.2	168
25		2125	2202	52 47.9	20 00.8	168
26		2319	2355	52 47.2	20 00.4	168
27	9	0130	0207	52 46.5	19 59.0	167
28		0317	0353	52 46.3	19 59.2	167
29		0517	0553	52 45.7	20 00.9	167
30		0717	0754	52 45.8	20 02.3	167
31		1116	1152	52 46.5	20 03.0	167
32		1415	1444	52 46.3	20 02.1	130
33		1710	1748	52 46.1	20 03.2	167

Table 1a (cont'd)

Station No.	Date 9/72	Time Start	Time End	Lat. ° ' N	Long. ° ' W	Depth of dip m	
34	9	1913	1952	52 46.3	20 01.8	167	
35		2113	2150	52 46.1	20 02.1	167	
36		2310	2345	52 46.7	20 03.1	167	
37	10	0118	0153	52 47.2	20 02.7	167	
38		0320	0358	52 47.6	20 02.0	168	
39		0520	0553	52 47.7	20 01.7	168	
40		0725	0759	52 48.3	20 01.7	168	
41		1013	1036	52 46.4	20 03.3	100	
42		1131	1206	52 46.9	20 03.8	167	
43		1412	1450	52 46.6	20 03.8	167	
44		1754	1830	52 46.8	20 00.0	167	
45		2112	2125	52 46.1	19 58.0	57	
46		2145	2222	52 45.9	19 57.7	167	
47	10/11	2346	0020	52 46.2	20 00.3	168	
48	11	0145	0221	52 45.9	20 00.2	167	
49		0306	0340	52 45.5	20 00.0	168	
50		0520	0601	52 46.0	20 00.8	167	
51		0656	0732	52 46.5	20 00.8	167	
52		2315	2352	52 47.2	20 01.1	167	
53	12	0020	0138	52 47.3	20 00.7	10	(14 dips)
54		0220	0310	52 46.7	19 59.0	168	
55		0535	0613	52 47.4	20 00.1	168	
56		0638	0702	52 47.7	20 00.0	5	(5 dips)
57		0845	0914	52 47.8	20 00.2	168	
58		1125	1202	52 46.0	20 02.0	167	
59		1642	1720	52 53.0	19 21.0	168	
60		1829	1905	52 50.0	19 02.0	168	
61		2003	2039	52 54.0	19 06.0	168	
62		2143	2218	52 55.0	19 11.0	168	
63		2307	2344	52 56.0	19 09.0	168	
64(b)	13	1743	1831	52 42.0	19 50.0	168	
65		1935	1943	52 45.0	20 01.0	35	
66		2030	2106	52 45.9	20 03.2	168	
67		2140	2146	52 46.2	20 03.8	35	
68		2211	2219	52 46.4	20 04.1	35	
69		2240	2248	52 46.5	20 04.3	35	
70		2313	2350	52 46.6	20 04.6	168	
71	14	0029	0036	52 46.7	20 05.4	35	
72		0100	0105	52 46.9	20 05.9	35	
73		0130	0137	52 47.1	20 06.2	35	
74		0200	0235	52 47.2	20 06.7	168	
75		0236	0243	52 46.7	20 05.8	35	
76		0303	0309	52 46.4	20 05.0	35	
77		0328	0335	52 46.5	20 05.8	35	
78		0404	0443	52 46.6	20 06.4	168	
79		0445	0451	52 46.9	20 06.8	35	
80		0500	0506	52 47.0	20 07.0	35	
81		0534	0541	52 46.8	20 05.8	35	
82		0602	0638	52 46.7	20 04.9	168	
83		0639	0645	52 46.8	20 05.1	35	
84		0703	0709	52 46.9	20 05.1	35	
85		0731	0737	52 46.9	20 04.9	35	

Table 1a (cont'd)

Station No.	Date 9/72	Time Start	Time End	Lat. ° ' N	Long. ° ' W	Depth of dip m
86	14	0809	0848	52 46.9	20 04.8	168
87		0925	0933	52 47.3	20 05.4	36
88		0958	1004	52 47.6	20 06.0	35
89		1111	1147	52 48.6	20 04.3	167
90		1324	1400	52 48.1	20 04.8	168
91		1436	1443	52 47.5	20 05.5	35
92		1536	1612	52 46.5	20 05.0	167
93		1613	1621	52 46.2	20 04.5	35
94	15	2006	2043	52 45.6	20 10.0	168
95(a)		2102	2108	52 46.0	20 05.0	35
95(b)		2131	2139	52 47.0	20 04.0	35
96		2201	2208	52 47.1	20 02.9	35
97		2228	2236	52 46.2	20 01.9	35
98	16	0030	0037	52 45.5	20 01.2	35
99		0100	0106	52 46.2	20 01.7	35
100		0128	0134	52 46.0	20 01.1	35
101		0200	0206	52 45.8	20 00.5	35
102		0206	0243	52 45.9	20 00.5	168
103		0300	0306	52 46.2	20 00.4	35
104		0330	0336	52 46.3	20 00.5	35
105		0356	0402	52 46.4	20 00.5	35
106		0404	0437	52 46.4	20 00.5	168
107		0500	0506	52 46.6	20 01.1	35
108		0528	0535	52 46.4	20 01.0	35
109		0600	0606	52 46.1	20 01.0	35
110		0607	0643	52 46.1	20 01.0	168
111		0659	0705	52 46.5	20 01.2	35
112		0736	0744	52 46.1	20 01.3	35
113		0806	0812	52 45.9	20 01.3	35
114		0815	0850	52 45.9	20 01.4	168
115		0902	0910	52 46.3	20 01.3	35
116		0930	0938	52 46.5	20 01.5	35
117		1004	1012	52 46.6	20 01.7	35
118		1009	1048	52 46.6	20 01.7	167
119		1115	1144	52 46.4	20 01.4	140
120		1224	1246	52 46.3	20 01.3	100
121		1320	1352	52 46.4	20 01.5	150
122		1426	1448	52 46.3	20 02.0	100
123		1521	1548	52 45.9	20 02.1	130
124		1617	1640	52 45.6	20 01.7	100
125		1736	1803	52 45.2	20 01.2	100
126		1845	1908	52 45.2	20 02.2	100
127		2020	2050	52 45.3	20 02.6	120
128		2130	2136	52 45.4	20 03.1	35
129		2200	2206	52 45.6	20 03.1	35
130		2206	2239	52 45.6	20 03.0	150
131		2330	2336	52 45.8	20 02.7	35
132	17	0119	0127	52 46.4	20 02.7	35
133		0126	0201	52 46.5	20 02.6	168
134		0233	0241	52 47.0	20 02.5	35
135		0322	0330	52 47.0	20 02.4	35
136		0330	0402	52 47.0	20 02.4	168
137		0438	0446	52 47.1	20 02.4	35

Table 1a (cont'd)

Station No.	Date 9/72	Time Start	Time End	Lat. ° ' N	Long. ° ' W	Depth of dip m
138	17	0502	0510	52 47.1	20 02.4	35
139		0511	0548	52 47.2	20 02.4	168
140		0633	0641	52 47.0	20 03.0	35
141		0717	0725	52 46.6	20 03.5	35
142		0726	0800	52 46.6	20 03.5	168
143		0831	0837	52 46.4	20 04.1	35
144		0930	0938	52 46.4	20 04.5	35
145		0957	1003	52 46.4	20 04.7	35
146		1004	1035	52 46.4	20 04.7	150
147		1130	1136	52 46.7	20 04.4	35
148		1200	1206	52 47.0	20 04.3	35
149		1207	1239	52 47.0	20 04.3	168
150		1335	1342	52 46.8	20 04.8	35
151		1404	1410	52 46.5	20 04.9	35
152		1410	1445	52 46.5	20 04.8	168
153		1533	1539	52 46.2	20 05.0	37
154		1539	1545	52 46.2	20 05.0	37
155		1758	1832	52 40.5	19 52.0	168
156		1933	2009	52 41.0	19 32.0	168
157		2115	2149	52 41.0	19 16.0	168
158		2258	2334	52 41.5	19 06.0	167
159	18	0043	0120	52 42.0	18 58.0	168
160		0231	0308	52 42.0	18 46.0	168
161		0352	0427	52 42.0	18 35.0	167

TABLE 1b

Researcher XBT Log - JASIN 1972

Date 9/72	Time	No.	Lat. ° ' N	Long. ° ' W	Notes
3	1927	R 1 }	52 56.8	18 47.4	
	1952	R 2 } rejected	52 52.6	18 47.4	
	2017	R 3 }	52 52.5	18 40.2	
	2143	R 4 }	52 56.9	18 40.1	
4	2150	R 5	52 48.0	19 52.0	
10	1921	R 6	52 46.9	19 54.2	
11	0830	R 7 C	52 48.1	19 58.2	
	0845	R 8			Faulty
	0850	R 9 C	52 49.4	19 54.8	
	0900	R10			Faulty
	0904	R11 }	52 50.6	19 52.5	
	0915	R12 } rejected	52 51.6	19 50.5	
	0920	R13	52 52.3	19 50.0	
	0930	R14 × rejected	52 53.4	19 49.1	
	0945	R15	52 54.4	19 47.2	
	1000	R16	52 56.7	19 44.5	
	1015	R17	52 58.8	19 44.4	
	1030	R18	52 58.9	19 48.0	
	1045	R19	52 58.1	19 50.2	
	1100	R20	52 56.1	19 50.4	
	1115	R21 ×	52 53.5	19 50.3	Suspect
	1120	R22 C	52 52.8	19 50.3	
	1130	R23	52 51.2	19 50.2	
	1145	R24 ×	52 49.1	19 50.1	
	1200	R25			Faulty
	1206	R26 C	52 46.0	19 51.3	
	1215	R27 C	52 45.9	19 53.4	
	1230	R28 ×	52 45.9	19 57.8	
	1247	R29	52 46.0	19 58.9	
	1300	R30	52 46.2	19 59.8	
	1315	R31 ×	52 46.3	20 00.8	
	1330	R32	52 45.3	19 58.9	
	1345	R33	52 44.2	19 55.3	
	1400	R34	52 42.9	19 51.9	
	1415	R35			Faulty
	1420	R36	52 41.0	19 51.8	
	1430	R37	52 41.9	19 52.7	
	1445	R38	52 42.9	19 56.3	
	1500	R39	52 44.4	19 59.3	
	1515	R40	52 46.6	19 59.4	
	1530	R41	52 48.1	19 58.3	
	1545	R42 ×	52 51.2	19 56.4	
	1600	R43	52 53.4	19 54.9	
	1615	R44	52 56.0	19 53.7	
	1630	R45	52 56.8	19.49.0	
	1645	R46	52 54.5	19 58.7	
	1700	R47	52 52.0	19 49.0	
	1715	R48	52 49.3	19 48.9	

× rejected

C = partially accepted (> 100 m or ?)

Table 1b (cont'd)

Date 9/72	Time	No.	Lat. ° ' N	Long. ° ' W	Notes
11	1730	R49	52 48.3	19 52.3	
	1745	R50 ?	52 47.0	19 57.0	Suspect
	1746	R51	52 47.0	19 57.0	
	1800	R52	52 46.0	20 02.0	
12	0245	R53	52 46.7	19 59.0	
	0252	R54	52 46.6	19 58.9	

? look at carefully in case a front passed this at this minute.

TABLE 2

Researcher radiosonde flights

s = Single balloon flight
d = Double balloon flight

Launch No.	Time (GMT)/ Date	Type	Maximum Height mb	Ascent Rate ms^{-1}	Descent Rate ms^{-1}	Comments
R 1	1315/7	d	697	4.3	1.7	
R 2	1505/7	d	753	1.3	3.1	Poor humidity signal
R 3	1703/7	d	733	4.1	2.7	
R 4	1905/7	d	781	2.8	2.8	
R 5	2102/7	d	713	4.0	2.0	
R 6	2305/7	d	690	3.7	1.8	
R 7	0116/8	d	670	4.0	1.9	
R 8	0306/8	d	717	3.1	3.7	Baroswitch setting incorrect
R 9	0515/8	d	767	4.5	1.5	
R10	0715/8	d	749	4.5	0.7	
R11	0916/8	d	818	-	-	No temperature signals
R12	1110/8	d	714	4.0	2.3	
R13	1310/8	d	595	3.4	3.6	
R14	1509/8	d	566	4.1	2.0	
R15	1703/8	d	567	3.6	2.0	Poor ventilation during descent
R16	1907/8	d	652	4.0	1.9	
R17	2106/8	d	549	3.4	2.0	
R18	2312/8	d	640	3.5	1.6	
R19	0115/9	d	643	3.2	1.8	Transmitting aerial lost
R20	0310/9	d	663	4.2	4.9	
R21	0504/9	d	594	4.1	2.3	
R22	0707/9	d	646	3.9	3.3	
R23	0904/9	d	674	3.9	1.5	Poor humidity signal
R24	1108/9	d	640	4.0	1.5	
R25	1316/9	d	740	3.3	2.3	No met. data above 830 mb or on descent
R26	1517/9	d	647	3.3	1.8	Poor signals - ship turning
R27	1708/9	d	649	2.7	2.7	Interference from Discovery sonde
R28	1908/9	d	651	3.5	2.1	
R29	2106/9	d	723	3.9	1.9	Poor temperature and wind signals
R30	2303/9	d	652	3.6	2.0	
R31	0109/10	d	602	3.4	2.1	
R32	0311/10	d	598	2.5	2.0	Wind data poor - sky wave
R33	0510/10	d	660	3.5	2.5	Wind data poor - sonde oscillated
R34	0710/10	d	624	3.8	2.2	Wind data lost - sonde oscillated
R35	0910/10	d	721	3.5	1.9	
R36	111/10	d	639	3.4	2.0	
R37	1339/10	d	736	3.5	1.9	
R38	1654/10	d	682	3.9	1.8	
R39	2321/10	d	646	2.7	2.7	
R40	0510/11	d	657	3.9	2.3	

Table 2 (cont'd)

Launch No.	Time (GMT)/ Date	Type	Maximum Height mb	Ascent Rate ms^{-1}	Descent Rate ms^{-1}	Comments
R41	1122/11	d	-	-	-	Sonde failure
R42	1711/11	d	681	3.9	2.0	
R43	2311/11	d	772	3.8	-	Sonde failed during ascent
R44	0514/12	d	774	2.9	2.1	
R45	1107/12	d	735	4.1	4.5	
R46	1709/13	d	140	3.3	-	Balloon leaked
R47	1104/14	d	702	3.5	1.4	
R48	1311/14	d	777	4.0	2.5	
R49	1522/14	d	786	2.8	2.0	
R50	1712/14	d	723	3.3	1.5	Some wind data lost
R51	1714/15	d	709	3.1	1.8	
R52	1109/16	d	761	3.2	1.7	
R53	1207/16	d	798	3.3	1.5	
R54	1314/16	d	-	-	-	Interference from Discovery sonde
R55	1414/16	d	864	2.9	1.5	
R56	1508/16	d	802	3.5	1.5	
R57	1604/16	d	811	3.3	1.6	
R58	1715/16	d	-	-	-	Lower balloon burst
R59	1729/16	d	768	2.7	1.4	No wind data
R60	1825/16	d	-	-	-	No met. data
R61	1914/16	d	738	3.6	2.7	Temp. only for part of profile
R62	2112/16	d	731	3.9	1.3	
R63	2307/16	d	790	3.7	1.3	Loran reception poor
R64	0315/17	d	716	3.3	1.7	Much humidity data lost. Poor Loran
R65	0710/17	d	705	4.3	1.7	
R66	0907/17	d	770	3.8	1.3	
R67	1103/17	d	794	3.7	1.3	
R68	1319/17	d	775	3.2	1.6	
R69	1515/17	d	774	3.1	1.5	

TABLE 3

Moorings laid by Researcher and recovered by Discovery

D1 surface

Set 1713Z/4.9.72 Lat. 52°53.8'N Long. 19°47.6'W
Recovered 0924Z/24.9.72 53°00.8'N 20°05.4'W

Water depth : 2650 m

Instrument	Serial No.	Depth (m)	Remarks
Aanderaa met. package	60	-	(OSU)* on surface buoy
Aanderaa CM	308	10	Suspension rod bent
Aanderaa therm. logger	82	29	(OSU)
Aanderaa therm. chain	77	30-80	(OSU)

D2 surface

Set 1453Z/5.9.72 Lat. 52°41.6' N Long. 19°45.2'W
Recovered 0921Z/23.9.72 52°41.6' N 19°52.3'W

Water depth : 2522 m

Instrument	Serial No.	Depth (m)	Remarks
Aanderaa met. package	88	-	(OSU) on surface buoy
Aanderaa CM	312	10	
Aanderaa therm. logger	83	29	(OSU)
Aanderaa therm. chain	78	30-80	(OSU)

* OSU = Oregon State University

TABLE 4

Researcher near-surface drogues tracked (September 1972)

The drogue fixes are based on the following mooring positions -

Mooring	Lat. ° ' N	Long. ° ' W
B1	52 46.1	20 02.5
C2	52 55.0	18 43.2
D1	52 53.8	19 47.6
D2	52 41.6	19 45.2

SF = Square frame drogue
P = Parachute drogue

Drogue	Type	Depth m	First Fix Time/ Date	First Fix Lat. ° ' N	First Fix Long. ° ' W	Last Fix Time/ Date	Last Fix Lat. ° ' N	Last Fix Long. ° ' W	Mean Velocity cm/s	Mean Velocity °T
RA	SF	10	1657/3	52 57.5	18 41.1	1905/3	52 58.5	18 40.7	25.9	013
RB	P	10	0018/4	52 52.3	18 43.6	0900/4	52 57.2	18 47.0	31.5	337
RC	P	10	2005/4	52 51.4	19 49.8	1000/5	52 52.1	19 50.7	3.4	320
RD	P	100	2200/4	52 51.0	19 51.4	1000/5	52 51.5	19 52.7	3.9	304
RE	SF	10	1555/5	52 41.8	19 44.7	1814/5	52 41.8	19 44.4	3.5	078
RF	P	100	2021/5	52 41.7	19 45.8	0900/6	52 41.3	19 45.5	1.8	156
RG	P	10	2042/5	52 41.5	19 45.8	0900/6	52 41.8	19 44.7	3.2	061
RH	SF	10	0932/10	52 46.3	20 02.7	1517/10	52 47.6	20 03.1	12.2	349
RI	P	100	1917/10	52 46.7	19 59.1	1810/11	52 50.6	19 58.7	8.9	003
RJ	P	20	2020/13	52 45.9	20 03.1	1035/14	52 48.3	20 05.9	10.6	324
RK	P	10	2335/15	52 45.2	20 00.5	1615/17	52 47.1	20 05.0	4.2	305
RL	P	20	2337/15	52 45.2	20 00.5	1940/16	52 44.3	20 03.0	4.4	240
RM	P	0	2350/15	52 45.3	20 00.5	1646/17	52 46.1	20 00.5	1.1	001
RN	P	20	2007/16	52 45.3	20 02.5	0030/17	52 46.1	20 02.5	8.8	001