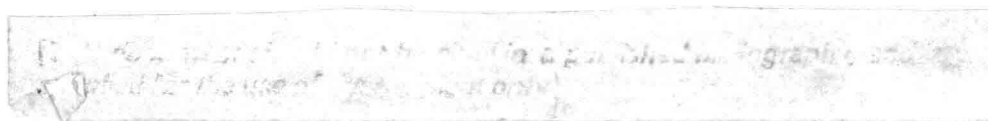
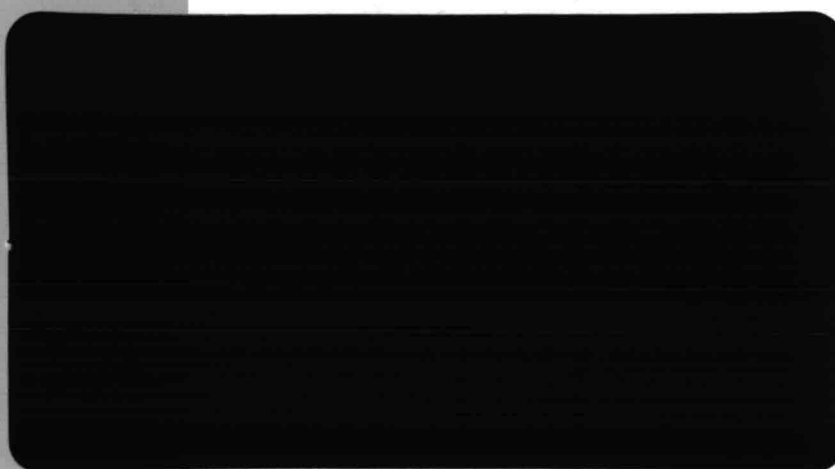


I.O.S.



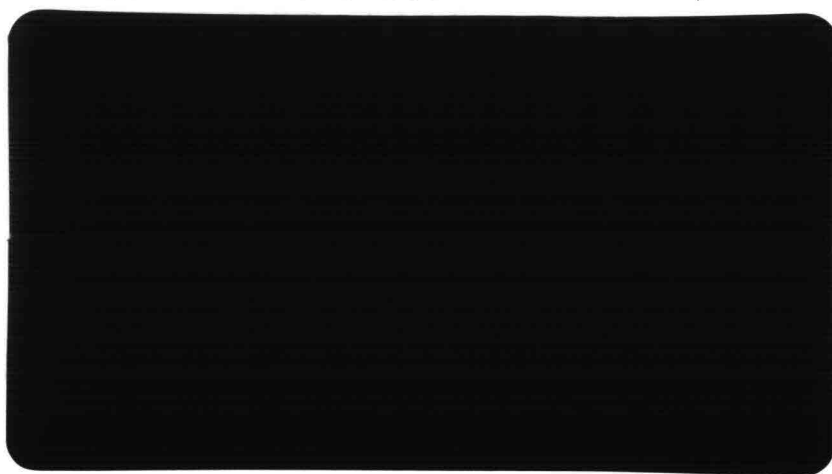
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OFFSHORE TIDE GAUGE DATA

Northern North Sea

(JONSDAP 76)

IOS DATA REPORT No 10, 1977

ALCOCK & VASSIE

Institute of Oceanographic Sciences
Bidston Observatory
Birkenhead Merseyside L43 7RA

TABLE OF CONTENTS

		Page
	Abstract	
1.	Introduction	1
2.	Loggers and Sensors	1
3.	Calibration	2
4.	Data Processing	3
5.	Analysis	4
6.	References	6
7.	Report Format	7
	Deployment Station	9
	53	
	54	11
	55	13
	56	15
	57	17

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ABSTRACT

This report describes the results obtained from five off Shore Tide Gauges (O.S.T.G.) deployed in the northern North Sea as part of the Joint North Sea Data Acquisition Programme (JONSDAP) during March and April 1976. The positions of the deployment stations are shown on Fig. 1 and lie on a line from Wick on the Scottish mainland, north-east as far as the $59^{\circ}20'$ line of latitude, and then due east to the Norwegian coast. Each station is identified by a reference code 53 to 57 inclusive.

Where necessary, a description of the loggers and sensors used on the gauges is given, followed by details of data reduction and analysis. Details of the launch and recovery phases of each deployment are included and the measurements made by each sensor are presented in graphical form and tables of harmonic constants.

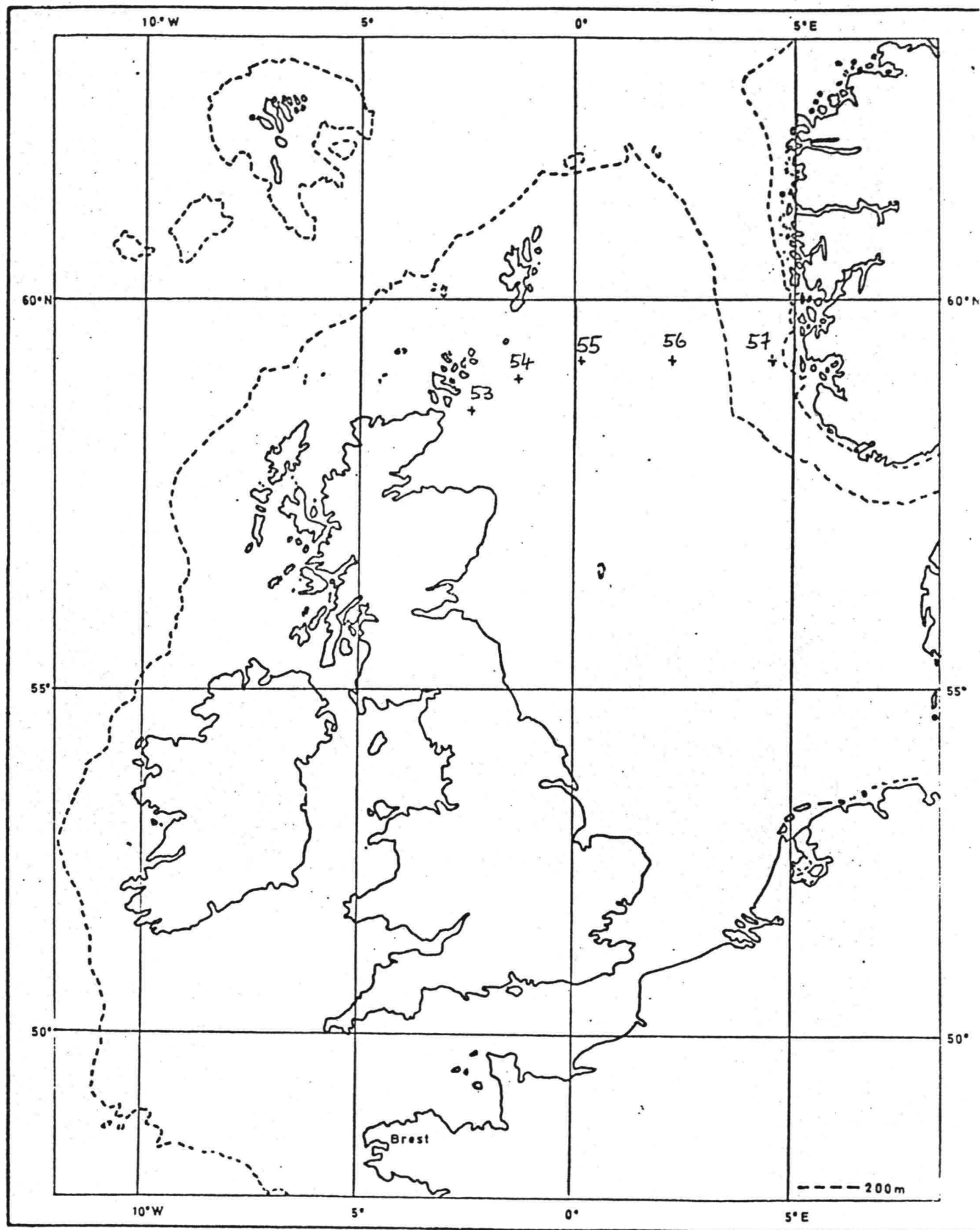


FIG 1 POSITIONS OF DEPLOYMENT STATIONS

1. INTRODUCTION

Five Off Shore Tide Gauges were deployed by staff from the Institute of Oceanographic Sciences, Bidston (IOS Bidston) as part of the JONSDAP '76 exercise which took place in the northern North Sea during March and April 1976. The location of the gauges between Wick on the Scottish mainland and Kopervik on the Norwegian coast is important to the JONSIS numerical modelling group because it is in an area which is considered to be the northern boundary of the North Sea, and in which tides and surges generated in the Atlantic enter the North Sea. The exact position of each tide gauge was determined prior to deployment using a numerical model to investigate the sensitivity of the results from the model to different deployment patterns along the Wick-Kopervik line. Ultimately the pattern shown in figure 1 was considered to be the optimum (Davies 1976).

Three types of tide gauge were used during the exercise: IOS types I and II and a design based on a modified Aanderaa logger. IOS types I and II have been discussed in IOS data report no. 7 (Alcock and Vassie 1975) and full details will not be repeated here; details of the Aanderaa gauge are given in section 2.

The data from all five tide gauges were analysed using an identical method to avoid inconsistencies. Prior to harmonic analysis, low frequency components of the signal which contained sensor drift, long period tides and a large proportion of the surge activity were removed by filtering the data. This was preferred to the normal method of drift removal, in which a polynomial is fitted to the drift component, because the surges had an amplitude which was comparable with the tidal signal.

2. LOGGERS AND SENSORS

The gauge deployed at station 53 was a bottom mounted rig which utilised a Digiquartz sensor, DIG 5/2, and an Aanderaa current meter (with the adaption of a small direction vane replacing the normal large vane), both interfaced into a modified Aanderaa current meter logger. (A.J. Harrison, personal communication). Current speed and absolute pressure count were integrated over

15 minutes and sampled by the logger every 15 minutes, together with spot readings of vane direction, temperature, elapsed time, and rig orientation. A quartz crystal clock was used for controlling the sampling interval and the data were recorded on $\frac{1}{4}$ inch magnetic tape as 10 bit binary words in serial form with the frequency count from the pressure sensor stored as most and least significant counts. The sensors were mounted approximately 0.5m above the rig base, and the rig was deployed and recovered in the same way as the Mk II OSTG (Alcock and Vassie 1975).

All loggers and sensor packs used on the Mk II OSTGs deployed at stations 54, 55 and 56 were as described in Alcock and Vassie (1975) except for strain gauge sensors SG 2/6 and SG 2/7 which incorporated improved temperature and pressure circuits to improve the stability (Banaszek and Palin 1977). A Digiquartz sensor pack, DIG 5/1, was used on the tide gauge deployed at station 54. The pressure sensor consists of a convoluted bellows linked to a 40 kHz quartz crystal resonator coupled by piezo electric action to an electronic resonator.

The Mk I tide gauge deployed at station 57 was of the "pop-up" type developed at the I.O.S. Wormley Laboratory (Collar and Spencer 1970) with strain gauge sensors 1/13 and 1/16 (Gwilliam and Collar 1974).

3. CALIBRATION

All the temperature and pressure calibrations for the sensor packs used on stations 53 to 56 inclusive were carried out by members of the Research Technology Group using equipment and facilities at Bidston. (Banaszek and Palin 1977).

For station 53, the DIG 5/2 sensor was used, with pressure sensitivity of 0.153 hz mb^{-1} and temperature coefficient of $0.4 \text{ mb } ^\circ\text{C}^{-1}$.

For station 54, the VIB 1/6, DIG 5/1, and SG 2/7 sensors were used, with pressure sensitivities of 0.037 hz mb^{-1} , 0.200 hz mb^{-1} , and 0.095 hz mb^{-1} respectively; and temperature coefficients of $11.8 \text{ mb } ^\circ\text{C}^{-1}$, $2.8 \text{ mb } ^\circ\text{C}^{-1}$, and $7.7 \text{ mb } ^\circ\text{C}^{-1}$ respectively.

For station 55, the VIB 1/4, OAR 4/1, and SG 2/2 sensors were used, with pressure sensitivities of 0.038 hz mb^{-1} , 0.045 hz mb^{-1} , and 0.069 hz mb^{-1} respectively; and temperature coefficients of $4.6 \text{ mb}^{\circ}\text{C}^{-1}$, $3.5 \text{ mb}^{\circ}\text{C}^{-1}$, and $208 \text{ mb}^{\circ}\text{C}^{-1}$ respectively.

For station 56, the VIB 1/1, OAR 4/2, and SG 2/6 sensors were used, with pressure sensitivities of 0.037 hz mb^{-1} , 0.041 hz mb^{-1} , and 0.087 hz mb^{-1} respectively; and temperature coefficients of $1.7 \text{ mb}^{\circ}\text{C}^{-1}$, $1.0 \text{ mb}^{\circ}\text{C}^{-1}$, and $6.2 \text{ mb}^{\circ}\text{C}^{-1}$ respectively.

For station 57, the strain gauge sensors 1/13 and 1/16 were used, with pressure sensitivities of 0.055 hz mb^{-1} and 0.007 mb^{-1} respectively; and temperature coefficients of $0.85 \text{ mb}^{\circ}\text{C}^{-1}$ and $2.8 \text{ mb}^{\circ}\text{C}^{-1}$ respectively.

4. DATA PROCESSING

The magnetic tape from each of the Mk II OSTGs was copied, with a density of 1800 bpi, onto a 9 track magnetic tape using the IBM 370/145 computer at the IBM data centre at Manchester; the 9 track tape was taken to the SRC Daresbury Laboratory and the data read into disk storage on the IBM 370/165 computer. As an initial check on the raw data, each temperature and pressure frequency channel was plotted. A program was then used to check the frequency data from each temperature sensor channel, calculate and plot the temperatures and store them on disk. A second program checked and calculated the frequencies from each pressure sensor channel, used the temperature value and the pressure frequency/temperature coefficient to convert each pressure frequency to the frequency at the reference temperature, and calculated the pressures using the pressure/frequency calibration. The $\frac{1}{4}$ hr values of pressure were plotted, stored on disk and punched on cards.

Processing of the data from the Mk I gauge was identical to that for the Mark II gauge except that the data was translated from the logger magnetic tape onto punched paper tape before it was loaded to disk file.

The magnetic tape from the logger of the tide gauge/current meter rig at station 53 was translated into two paper tapes which contained i) elapsed time, current meter and temperature data, and ii) elapsed time and pressure data. The data on the latter

tape were read into disk storage on the IBM 1130 computer at Bidston and the data transferred into disk storage on the IBM 370/165 at Daresbury using the 1130 as a RJE (Remote Job Entry) terminal, and the same programs as for the Mk II gauge used to compute the $\frac{1}{4}$ hr values of total pressure.

An interpolation program was used to produce an output on punched cards of hourly values, on the hour (GMT), of the pressure record. This program smoothed the data using a low pass filter, FLP03, of half length 18 and a cut-off frequency (half-power point) of 0.35 cycles per hour (126° per hour) - thus the amplitude response of the sixth diurnal band was -0.08 dB (1%). The resulting series was then interpolated, using a cubic spline, to obtain the hourly values, applying time corrections if the clock was fast or slow. (Exact times of scans at the beginning and end of the record were noted prior to launch and after recovery). Root mean square errors due to the interpolation method are of the order of 0.02 mb.

5. ANALYSIS OF TIDAL DATA

The series of hourly values of the sea bed pressure contained components of sensor drift and external surges as well as the desired tidal signal. Usually the sensor drift is removed by passing the data through a low power low pass filter which isolates the drift component. A low order polynomial is fitted to the drift curve and subsequently the polynomial is removed from the original series leaving the tidal signal uncontaminated. This technique was not powerful enough for records from these deployments because the surge component was comparable in amplitude to the tidal signal and had considerable energy in the low frequency spectrum normally occupied by the drift component. Therefore it was decided to filter the data with a high power high pass filter, FHP53, (Alcock and Vassie 1975) which removed jointly sensor drift, long period tides and surge activity, and isolated the tidal signal.

Tidal analyses of a 29 day period, or as close to 29 days as possible, of the drift-free record obtained from each deployment were carried out using the T.I.R.A. (Tidal Institute Recursive

Analysis) program which utilises the harmonic method of analysis. For all deployments, the amplitude and phase lag relative to Greenwich epoch of 27 major and 8 related constituents were computed, the time zone being Greenwich Mean Time (S=0). The constituents π_1 , P_1 , ψ_1 , ϕ_1 , $2N_2$, ψ_2 , T_2 and K_2 are not separable from the major harmonic constants with only one month of data, and so were related to the major constituents using values derived from the harmonic analysis of data from Lerwick for 1966 to 1971 inclusive.

The amplitude of each harmonic constant in the following tables is in units of pressure (millibars). It can be readily converted to sea surface elevation using the hydrostatic relation

$$h = P / \rho g, \quad (1)$$

where h is elevation in metres, P is pressure in pascals ($1\text{Pa} = 10^{-2}$ mb), ρ is sea water density in kilograms per cubic meter and g is acceleration due to gravity in metres per second squared. Values of ρ , derived from CTD casts, and g for each station are given in the launch and recovery details.

6. REFERENCES

- ALCOCK, G.A. and VASSIE, J.M. 1975. Off shore tide gauge data. Institute of Oceanographic Sciences, Data Report, No. 7, 38 pp.
- BANASZEK, A.D. and PALIN, R.I.R. 1977. IOS Report in preparation.
- COLLAR, P.G. and SPENCER, R. 1970. A digitally recording off-shore tide gauge. pp. 341-352 in, Electronic Engineering in Ocean Technology, proceedings of a conference held at Swansea. London: Institution of Electronic and Radio Engineers, 556 pp. (IERE Conference Proceedings No. 19)
- DAVIES, A.M. 1976. A numerical model of the North Sea and its use in choosing locations for the deployment of offshore tide gauges in the JONSDAP '76 oceanographic experiment. Deutsche Hydrographische Zeitschrift, 29, 11.24.
- GWILLIAM, T.J.P. and COLLAR, P.G. 1974. A strain gauge pressure sensor for measuring tides on the continental shelf. Institute of Oceanographic Sciences, Report, No. 14, 27 pp. + figs.

7. FORMAT

The report is split into sections, one for each deployment, each section comprising a page of launch and recovery details, a page of data reduction details, and the record from each sensor displayed in two computer plots and a table of the tidal constituents obtained by analysis of the tidal record.

Launch and recovery details

OSTG position	Station identification, General area, Year, Latitude and Longitude, Value of g.
Water depth	Measured at Launch by Precision Depth Recorder.
OSTG details	Type, Logger number, Sensor type (s) and number (s).
Time of deployment	Time of launch of gauge from ship, time that gauge was on sea bed.
Time of recovery	Time that gauge surfaced or was brought on board ship.
CTD casts	Time and duration of any CTD casts on station, Value of density computed from casts.
Comments	Comments on the launch and/or recovery.

Data reduction details

Timing	Times of specific scans and timing error
Raw data	Times of start and end of raw sea-bed pressure data.
Temperature data	Details of temperature record(s) available.
Drift-free data	Times of start and end of drift-free hourly pressure record. Method used to produce drift free data.
Tidal analysis	Method used, period analysed, station used for related constituents.
Comments	Comments on data reduction.

Computer plots

- (1) Plot of temperature record(s) if available
- (2) Plot of tidal and non tidal components of the hourly record of sea-bed pressure data.

Analysis

Table of amplitude and phase (G - referred to lunar transit at Greenwich and time zone $S = 0$) of 24 major and 8 related constituents of tidal record from each sensor.

OSTG position Station 53, North North Sea, 1976.
Lat $58^{\circ}37'11''$ N Long $02^{\circ}26'25''$ W.
 $g = 9.818 \text{ ms}^{-2}$.

Water depth 75m.

OSTG details Aanderaa logger no. 1747 with DIG 5/2
sensor and current meter no. 1747/4.

Time of deployment Tide gauge in water from RRS "Challenger"
at 0718 GMT day 069 (March 9th). On sea
bed at 0720 GMT.

Time of recovery Tide gauge out of water at 0620 GMT
day 106 (April 15th).

CTD casts 1 cast at 0753 GMT day 069.
1 cast at 0639 GMT day 106.
Density, $\rho = 1027.324 \text{ kg m}^{-3}$.

Comments A separate rig with current meters at
8m, 23m and 38m above sea bed was
deployed nearby and recovered intact.

Timing Scan no. 1. at 1314,42s GMT day 062.
Scan no. 5579 at 1558,33s GMT day 120.
Clock fast, gained 69s in 58 days and $2\frac{3}{4}$ hours.

Raw data Start 0737,04s GMT day 069
End 0451,20s GMT day 106.

Temperature data Record obtained from current meter no.
1747/4 and supplied by J. Howarth.

Drift-free data Start 1200 GMT day 072
end 2000 GMT day 102
FHP filter used.

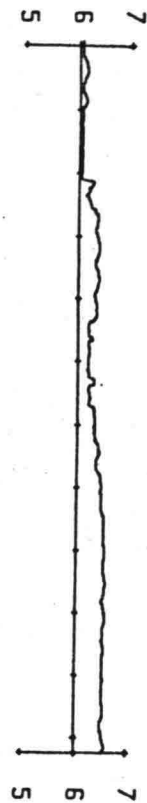
Tidal analysis TIRA, 0000 day 073 to 2300 day 101, 29 days,
using 27 major and 8 related constituents
from Lerwick 1966 to 1971 analysis.

Comments Logger error (no discontinuities) on 3
seabed scans corrected manually.

METER 1747/4 Station 53

TEMPERATURE

IN DEG C

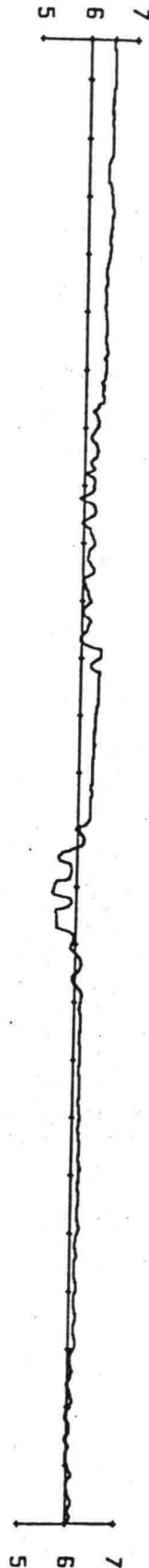


7TH APR 76

14TH APR 76

TEMPERATURE

IN DEG C



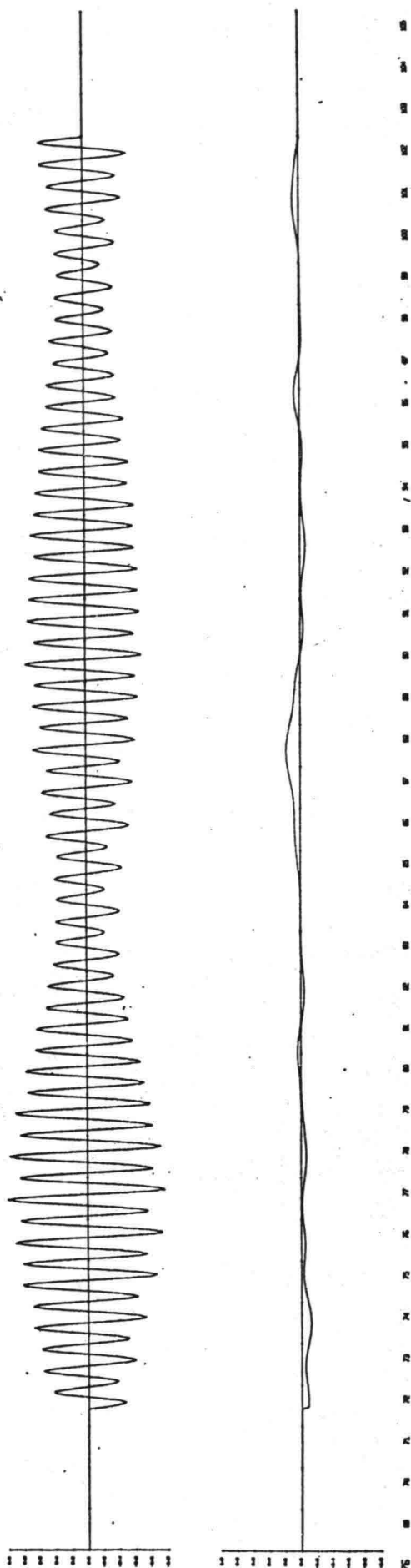
10TH MAR 76

17TH MAR 76

24TH MAR 76

31ST MAR 76

Station 53



FILTERED

FILTERED VALUE
ONLY TO SCALE 10
AND VALUE 0.000000

RESIDUALS

RESIDUALS
ONLY TO SCALE 10
AND VALUE 0.000000

TABLE 1

Station 53, N. North Sea, Lat $58^{\circ}37.11'N$ Long $02^{\circ}26.25'W$.
 Aanderaa CM/TG rig, DIG 5/2 sensor.
 Drift free total pressure (millibars) FHP53 filter.
 0000 day 073 to 2300 day 101 1976, 29 days.
 27 constituents + 8 related (*) using Lerwick 1966/71 analysis.

Constituent	H(mb)	G($^{\circ}$)
Q ₁	3.9	325.6
O ₁	9.9	31.7
M ₁	0.2	94.0
* Π ₁	0.2	126.5
* P ₁	2.4	169.9
K ₁	7.8	186.0
* $\downarrow$ ₁	0.2	198.3
* ϕ ₁	0.2	214.5
J ₁	0.9	292.7
OO ₁	0.6	258.1
* 2N ₂	2.3	285.1
μ ₂	2.6	295.1
N ₂	15.7	304.3
* $\downarrow$ ₂	2.9	304.7
M ₂	75.9	325.9
L ₂	2.3	309.4
* T ₂	1.3	349.1
S ₂	26.8	3.7
* K ₂	7.4	0.2
2SM ₂	0.7	64.5
MO ₃	0.2	166.7
M ₃	1.2	231.1
MK ₃	0.3	55.3
MN ₄	1.0	272.5
M ₄	1.9	308.1
SN ₄	0.6	155.1
MS ₄	1.0	47.2
2MN ₆	0.4	173.0
M ₆	0.7	173.0
MSN ₆	0.3	160.5
2MS ₆	0.8	216.0
2SM ₆	0.3	219.4

OSTG position Station 54, North North Sea, 1976,
Lat $58^{\circ}55'.98N$ Long $01^{\circ}15'W$,
 $g = 9.818 \text{ ms}^{-2}$.

Water depth 113m.

OSTG details Mk II, logger no. 002, sensors VIB 1/6,
DIG 5/1, SG 2/7.

Time of deployment In water at 1852 GMT day 069 (March 9th)
On sea bed at 1939 GMT.

Time of recovery Gauge surfaced at 2000 GMT day 106
(April 15th).

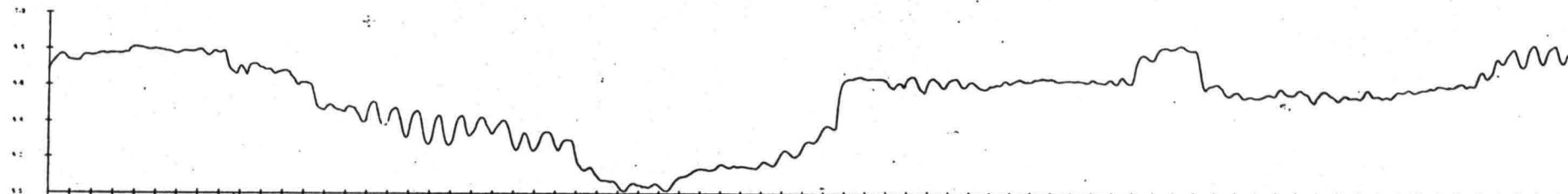
CTD casts 1 cast at 1824 GMT day 069
1 cast at 1556 GMT day 075
1 cast at 1714 GMT day 110
Density, $\rho = 1027.548 \text{ kg m}^{-3}$.

Comments Immersion test at 0215 GMT day 069.
Unsuccessful launch at 1420 GMT day 069.
A separate rig with current meters at
8m, 48m, 78m above sea bed was deployed
nearby, but not recovered.

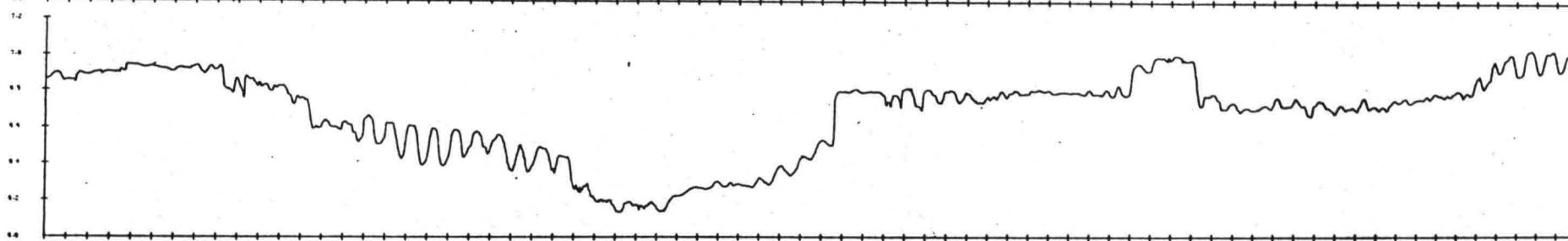
Timing	Scan no. 1 at 1200,02s GMT day 061. Test scan at 1159,50s GMT day 111. Clock fast, gained 12s in 50 days.
Raw data	Start 0152,29.5s GMT day 072 End 1852,23s GMT day 106 See Comment.
Temperature data	Complete temperature record for each sensor.
Drift-free data	Start 0600 GMT day 075 End 1400 GMT day 103 FHP53 filter used.
Tidal analysis	TIRA, 0600 day 075 to 1400 day 103, 28 days and 8 hours, using 27 major and 8 related constituents from Lerwick 1966 to 1971 analysis.
Comments	Discontinuity in record between seabed scans no. 196 and no. 198 (0045 and 0115 day 072), therefore first usable seabed scan taken after this.

OSTG MK11 02 MARCH/APRIL 1976
N. NORTH SEA JONSDAPS4 58 56N 01 15W

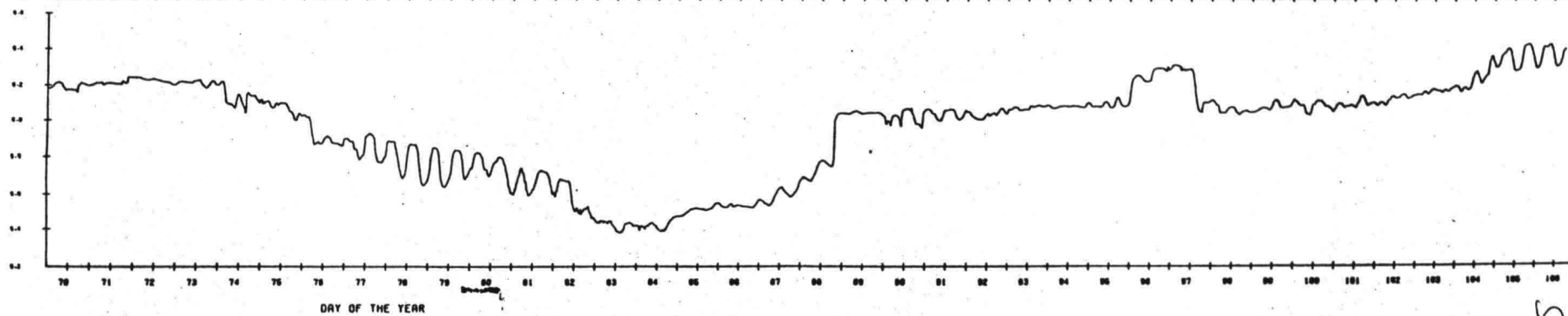
0105/1 TEMPERATURE
(DEGREES CELSIUS)



502/7 TEMPERATURE
(DEGREES CELSIUS)

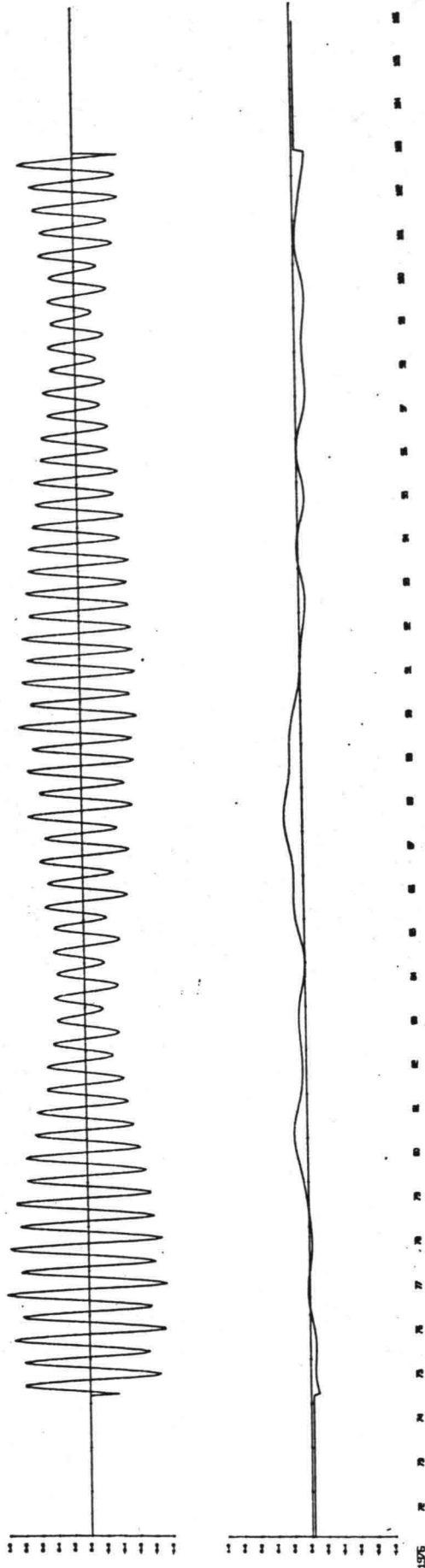


V181/6 TEMPERATURE
(DEGREES CELSIUS)



Station 54

Station 54

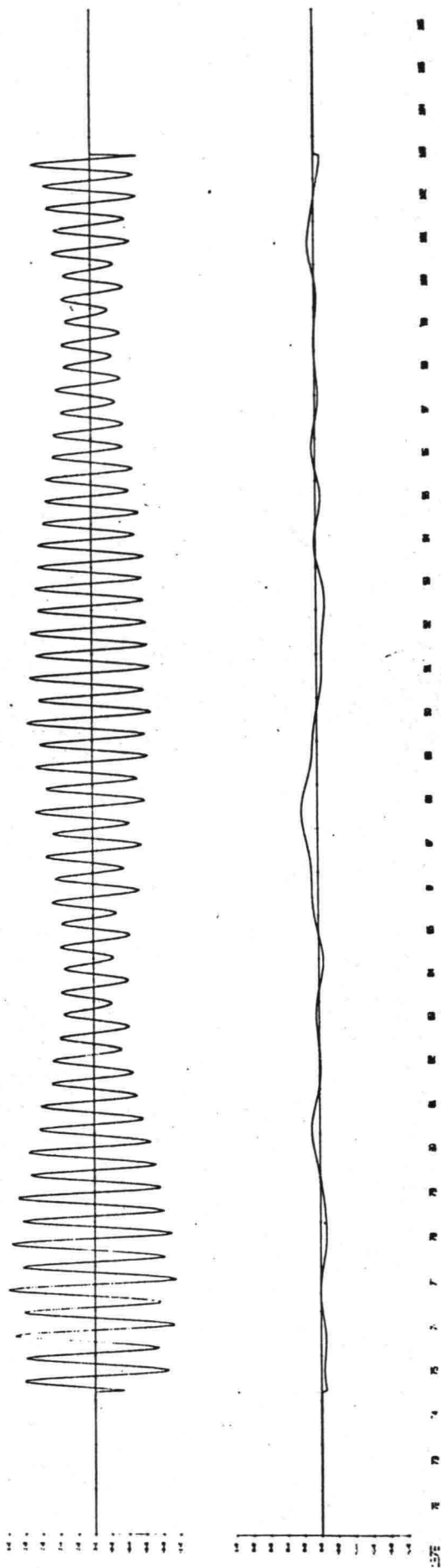


FILTERED VALUES
SCALE 10-0-1000000
DATA RANGE 1000000-0

RESIDUALS
SCALE 10-0-1000000
DATA RANGE 1000000-0

VIB. 116
JONDAFSA VIB. 116 TOTAL PRESSURE

Station 54



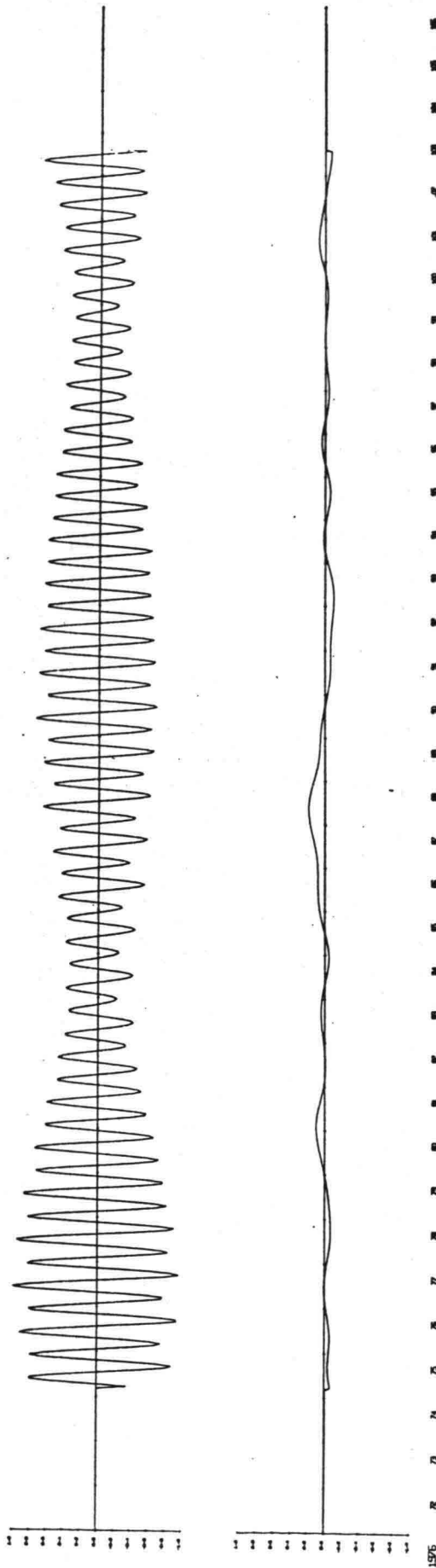
1000000
1000000
1000000

1000000
1000000
1000000

DIG 511

1000000 1000000 1000000

Station 54



FILTERED VALUES
 SCALE = 0.000000
 DATA FILED 0-000000 00

RESIDUALS
 SCALE = 0.000000
 DATA FILED 0-000000 00

SG217

N-NORTH SEA JON54 SG2/7 TOT. PRESSURE

Station 54

TABLE 2

Station 54, N. North Sea, Lat $58^{\circ}56'N$ Long $01^{\circ}15'W$.
 Drift free total pressure record (millibars), FHP53 filter.
 0600 day 075 to 1400 day 103 1976, 28 days + 8 hours.
 27 constituents + 8 related (*) using Lerwick 1966/71 analysis.

Constituent	DIG 5/1		VIB 1/6		SG 2/7	
	H (mb)	G ($^{\circ}$)	H (mb)	G ($^{\circ}$)	H (mb)	G ($^{\circ}$)
Q ₁	3.1	317.1	3.2	316.5	3.1	317.6
O ₁	9.1	37.1	9.1	37.4	9.0	36.9
M ₁	0.4	86.1	0.4	89.5	0.4	87.4
* P ₁	0.2	129.8	0.2	129.7	0.2	129.8
* P ₁	2.1	173.2	2.1	173.0	2.0	173.2
K ₁	6.6	189.3	6.6	189.2	6.6	189.3
* J ₁	0.2	201.5	0.2	201.4	0.2	201.6
* J ₁	0.1	217.8	0.1	217.6	0.1	217.8
J ₁	0.9	292.9	0.8	297.3	0.9	293.6
OO ₁	0.9	287.2	1.0	281.9	0.9	277.7
1						
* 2N ₂	2.1	282.0	2.1	282.1	2.0	282.0
μ ₂	2.5	275.8	2.6	275.6	2.4	276.2
N ₂	13.7	301.1	13.7	301.2	13.6	301.2
* J ₂	2.5	301.5	2.5	301.6	2.5	301.6
M ₂	66.8	313.2	66.6	323.3	66.5	323.2
L ₂	2.1	317.5	2.0	315.9	2.1	321.1
* T ₂	1.2	345.0	1.2	345.1	1.1	344.9
S ₂	23.9	359.6	23.8	359.7	23.7	359.5
* K ₂	6.6	356.1	6.6	356.2	6.6	356.0
2SM ₂	0.5	51.9	0.5	56.4	0.5	50.9
2						
MO ₃	0.2	131.0	0.2	124.0	0.2	139.6
M ₃	0.9	226.2	0.9	226.0	0.9	228.0
MK ₃	0.2	51.0	0.2	48.1	0.2	57.0
3						
MN ₄	0.8	253.8	0.8	252.2	0.8	255.2
M ₄	1.5	294.7	1.5	295.1	1.5	295.0
SN ₄	0.4	131.1	0.5	131.8	0.5	129.1
MS ₄	0.9	30.4	0.9	29.3	0.9	32.0
4						
2MN ₆	0.5	211.5	0.5	212.0	0.5	210.8
M ₆	0.8	218.0	0.8	218.7	0.7	217.4
MSN ₆	0.2	207.7	0.2	208.7	0.2	202.2
2MS ₆	1.0	266.4	1.0	266.6	1.0	266.0
2SM ₆	0.4	290.1	0.4	289.6	0.4	286.9
6						

OSTG position Station 55, North North Sea, 1976,
Lat $59^{\circ}19'18''\text{N}$ $00^{\circ}15'06''\text{E}$, $g = 9.819 \text{ ms}^{-2}$.

Water depth 135m.

OSTG details Mk II, logger no.004, sensors VIB 1/4,
OAR 4/1, SG 2/2.

Time of deployment Deployment started from RRS "Challenger"
at 1312 GMT day 070 (March 10th). Tide
gauge on seabed at 1351 GMT.

Time of recovery Recovery started from RRS "Challenger"
at 2100 GMT day 107 (April 16th).

CTD casts 1 cast at 1249 GMT day 074
1 cast at 1638 GMT day 109
Density, $\rho = 1027.717 \text{ kg m}^{-3}$.

Comments Immersion test at 2215 GMT day 069.

Timing Time check at 1330,05s GMT day 070.
Time check at 2200,09s GMT day 110.
Clock slow, lost 4s in 40 days and 8 hours.

Raw data Start 0122,35s GMT day 072
End 2007,39s GMT day 107
See Comments.

Temperature data Complete records from sensors OAR 4/1 and
SG 2/2, but VIB 1/4 has high frequency
noise after day 085, therefore OAR 4/1
temperature record used for correction of
VIB 1/4 pressure frequencies.

Drift-free data Start 0600 GMT day 075
End 1600 GMT day 104
FHP53 filter used.

Tidal analysis TIRA, 0600 GMT day 075 to 0600 GMT day 104,
29 days, using 27 major and 8 related
constituents from Lerwick 1966 to 1971
analysis.

Comments Discontinuity in pressure record between
seabed scans no.128 and no.130 (0045 to
0115 day 072), therefore first usable
seabed scan taken after this.

OSTO HK11 04 MARCH/APRIL 1976
N. NORTH SEA JONSDAPSS 59 19.2 00 15.1E

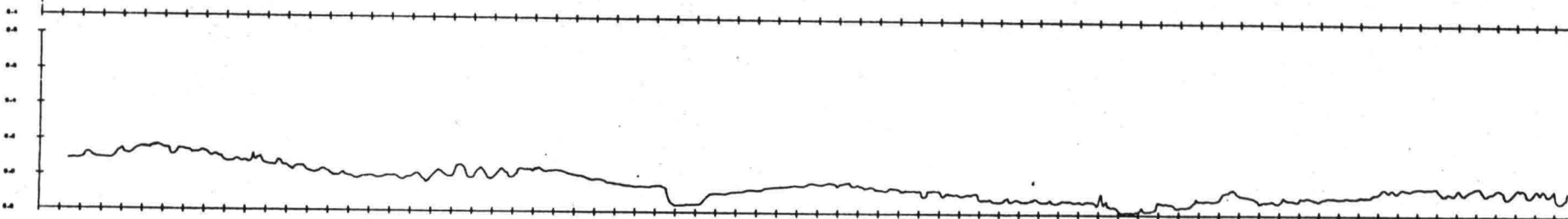
SG2/2 TEMPERATURE
(DEGREES CELSIUS)

SG2/2



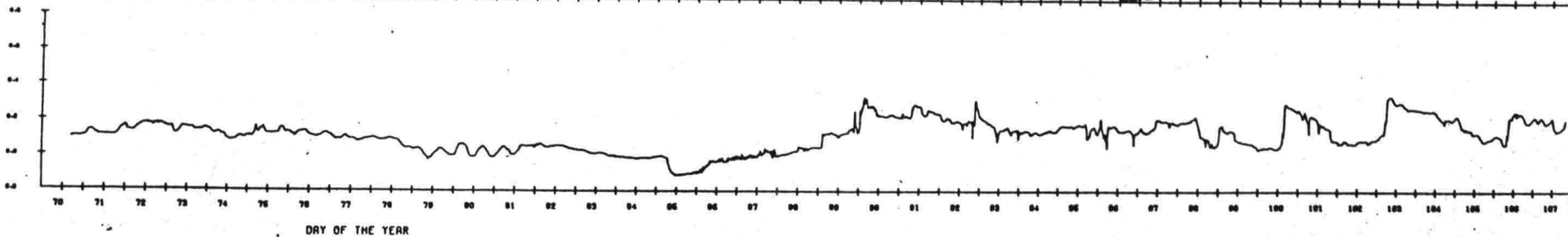
DAR4/1 TEMPERATURE
(DEGREES CELSIUS)

DAR4/1



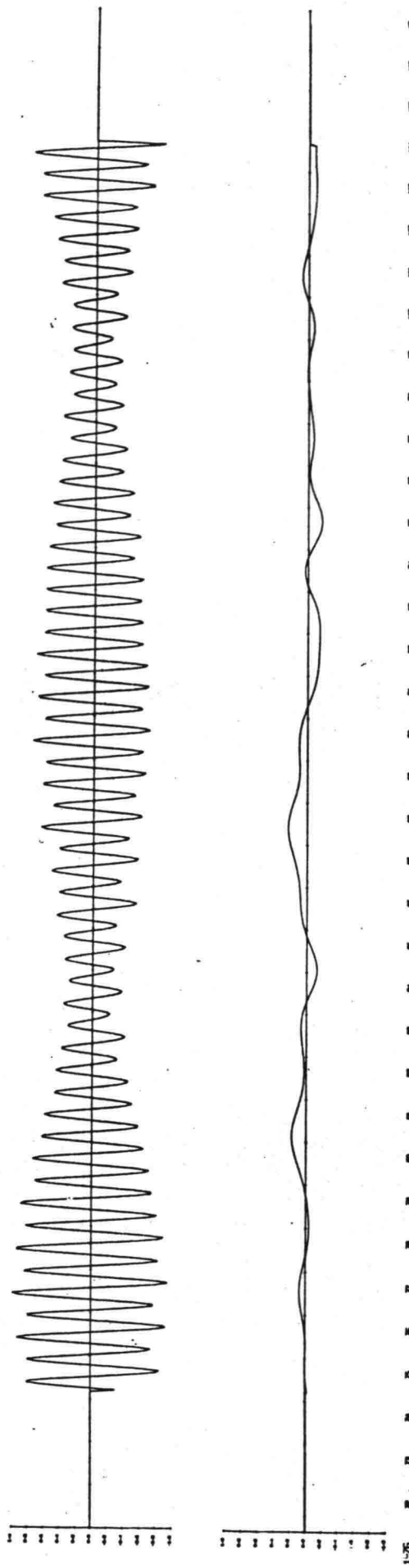
VIB1/4

VIB1/4 TEMPERATURE
(DEGREES CELSIUS)



Station 55

Station 55



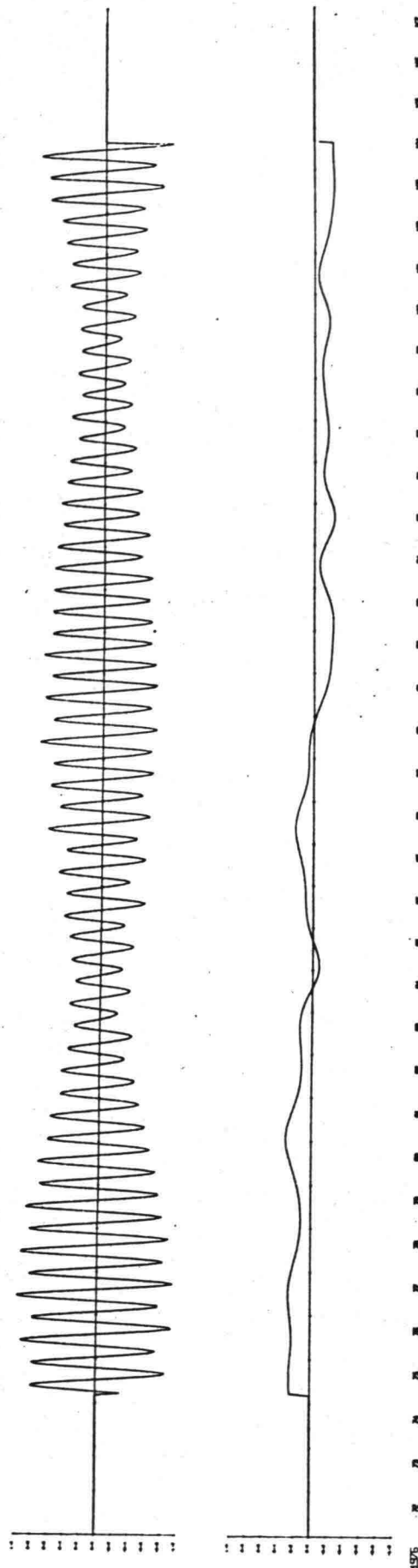
RAW DATA
DATE: 10-1-1964
TIME: 10:00 AM

RESIDUALS
DATE: 10-1-1964
TIME: 10:00 AM

VIB1/4

N-NORTH SEA JONES VIB1/4 TOT. PRESSURE

Station 55



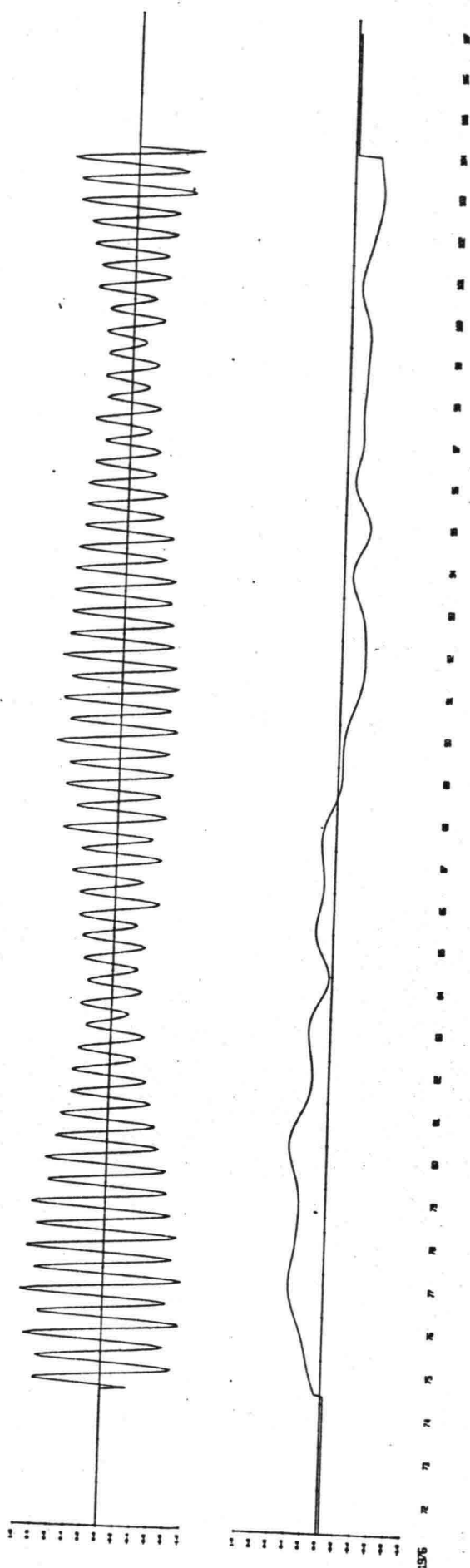
10 TONED VALUES
SCALE 10 0.00000 0.0
DATA VALUE 0.00000 0.0

RESIDUALS
SCALE 10 0.00000 0.0
DATA VALUE 0.00000 0.0

000411

N-NORTH SEA LINGS 000411 TOT. FREQUENCY

Station 55



FILTERED VALUES
SCALE TO 0.000000
ZERO VALUE 0.000000

RESIDUALS
SCALE TO 0.000000
ZERO VALUE 0.000000

SG212

N-NORTH SEA JONFF 502/2 TOT. PRESSURE

Station 55

TABLE 3

Station 55, N. North Sea, Lat 59°19'N Long 00°15'E.
 Drift free total pressure (millibars), FHP53 filter.
 0600 day 075 to 0600 day 104 1976, 29 days.
 27 constituents + 8 related (*) using Lerwick 1966/71 analysis.

Constituent	VIB 1/4		OAR 4/1		SG 2/2	
	H (mb)	G (°)	H (mb)	G (°)	H (mb)	G (°)
Q ₁	2.1	309.8	2.2	306.3	1.7	307.9
O ₁	6.6	39.9	6.8	39.8	6.4	39.0
M ₁	0.3	114.0	0.4	122.7	0.4	125.3
* P ₁	0.1	129.6	0.1	127.9	0.1	130.5
* K ₁	1.4	172.9	1.4	171.3	1.3	173.9
* J ₁	4.4	189.1	4.5	187.5	4.2	190.0
* φ ₁	0.1	201.3	0.1	199.7	0.1	202.2
* φ ₁	0.1	217.5	0.1	215.9	0.1	218.5
J ₁	0.7	313.3	0.5	316.4	0.8	338.1
OO ₁	0.9	282.9	0.8	284.6	1.0	294.0
* 2N ₂	1.5	277.8	1.5	278.0	1.4	276.9
N ₂	2.2	271.7	2.2	271.5	1.7	276.2
N ₂	10.1	296.9	10.3	297.2	9.3	296.1
* J ₂	1.8	297.3	1.9	297.6	1.7	296.5
M ₂	49.1	318.4	50.2	318.1	46.8	318.6
L ₂	1.5	307.1	1.6	306.0	1.4	324.0
* T ₂	0.9	339.3	0.9	339.0	0.9	339.1
S ₂	18.0	353.9	18.4	353.6	17.6	353.7
* K ₂	5.0	350.4	5.1	350.1	4.9	350.2
2SM ₂	0.4	37.7	0.3	40.0	0.8	54.8
MO ₃	0.3	140.6	0.3	142.3	0.4	163.8
M ₃	0.5	215.5	0.6	216.6	0.6	214.4
MK ₃	0.2	39.8	0.1	37.9	0.1	355.1
MN ₄	0.7	241.5	0.7	241.6	0.7	240.2
M ₄	1.3	275.5	1.4	275.2	1.3	275.7
SN ₄	0.4	90.8	0.4	95.8	0.3	104.6
MS ₄	0.9	6.8	1.0	6.1	0.9	9.1
2MN ₆	0.5	227.7	0.4	229.1	0.4	233.7
M ₆	0.7	240.5	0.7	240.4	0.6	230.5
MSN ₆	0.2	230.8	0.2	227.4	0.2	224.8
2MS ₆	0.9	281.9	1.0	282.9	0.9	278.0
2SM ₆	0.4	308.9	0.4	310.9	0.3	306.0

OSTG position

Station 56, North North Sea, 1976,
Lat $59^{\circ}19'51''$ N Long $02^{\circ}46'68''$ E,
 $g = 9.819 \text{ ms}^{-2}$.

Water depth

119m.

OSTG details

Mk II, Logger no. 001, sensors VIB 1/6,
OAR 4/2, SG 2/6.

Time of deployment

Tide gauge on seabed at 0213 GMT day
074 (March 14th).

Time of recovery

Recovery started 0700 GMT day 108
(April 17th).

CTD casts

1 cast at 0027 GMT day 074
1 cast at 0606 GMT day 109
Density, $\rho = 1028.623 \text{ kg m}^{-3}$.

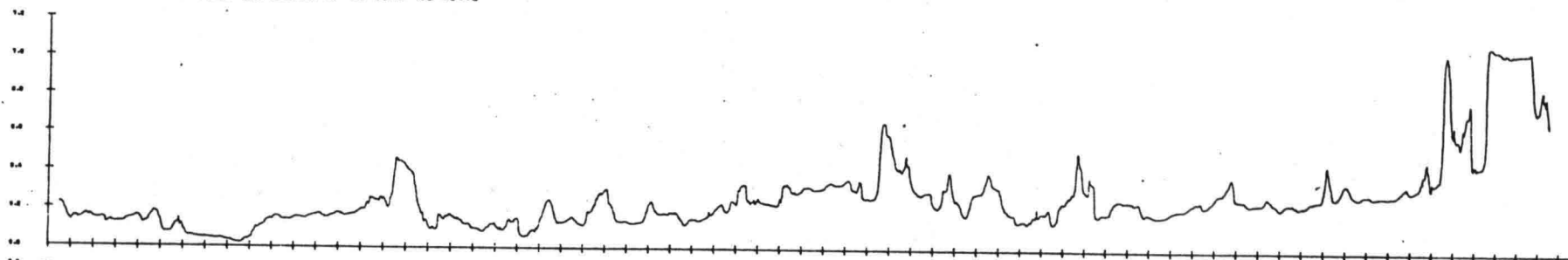
Comments

Immersion test at 2110 GMT day 070.

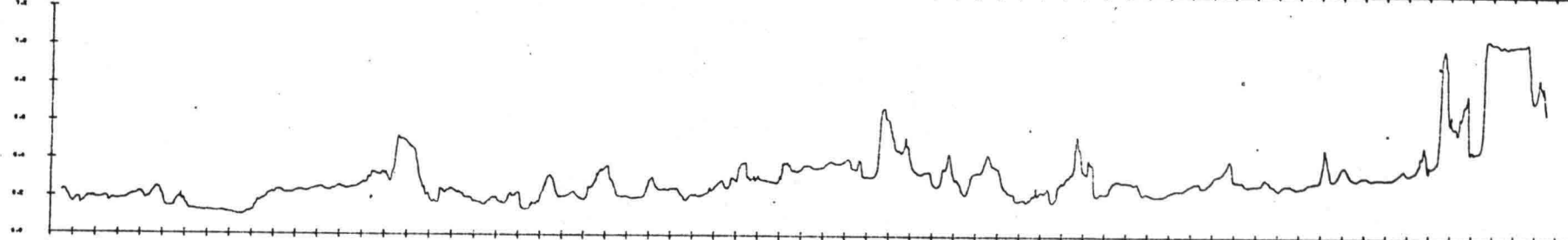
Timing	Time check at 0100,01s GMT day 074 Time check at 1659,55s GMT day 110 Clock fast, gained 6s in 36 days and 16 hours.
Raw data	Start 1552,31s GMT day 074 End 0652,25s GMT day 108 See Comments.
Temperature data	Complete temperature records from all sensors.
Drift-free data	Start 2000 GMT day 077 End 0200 GMT day 105 FHP53 filter used.
Tidal analysis	TIRA, 2000 day 077 to 0200 day 105, 28 days and 6 hours, using 27 major and 8 related constituents from Lerwick 1966 to 1971 analysis.
Comments	Discontinuity in pressure record at seabed scan no. 40 (1545 day 074), therefore first usable seabed scan taken after this.

OSTO MKII 01 MARCH/APRIL 1976
N-NORTH SEA JONSDAP56 59 19.5 02 46.7E

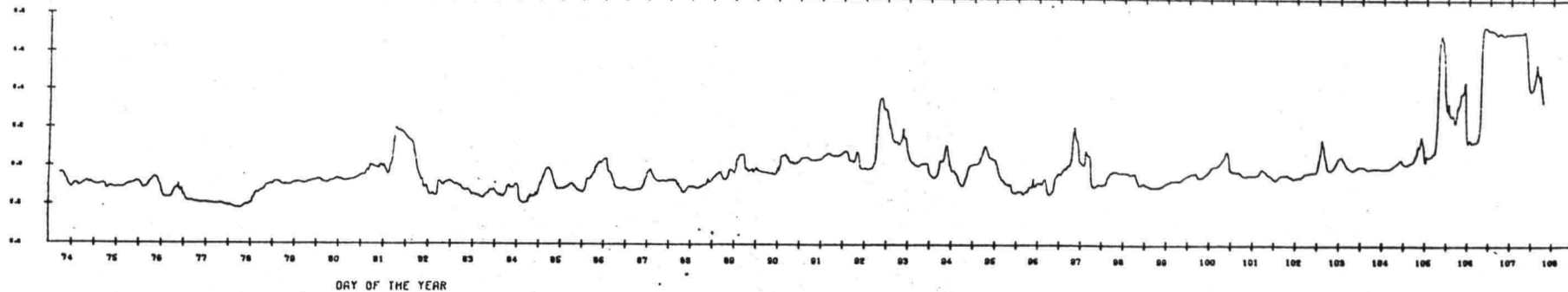
SD2/6 TEMPERATURE
(DEGREES CELSIUS)



DR4/2 TEMPERATURE
(DEGREES CELSIUS)

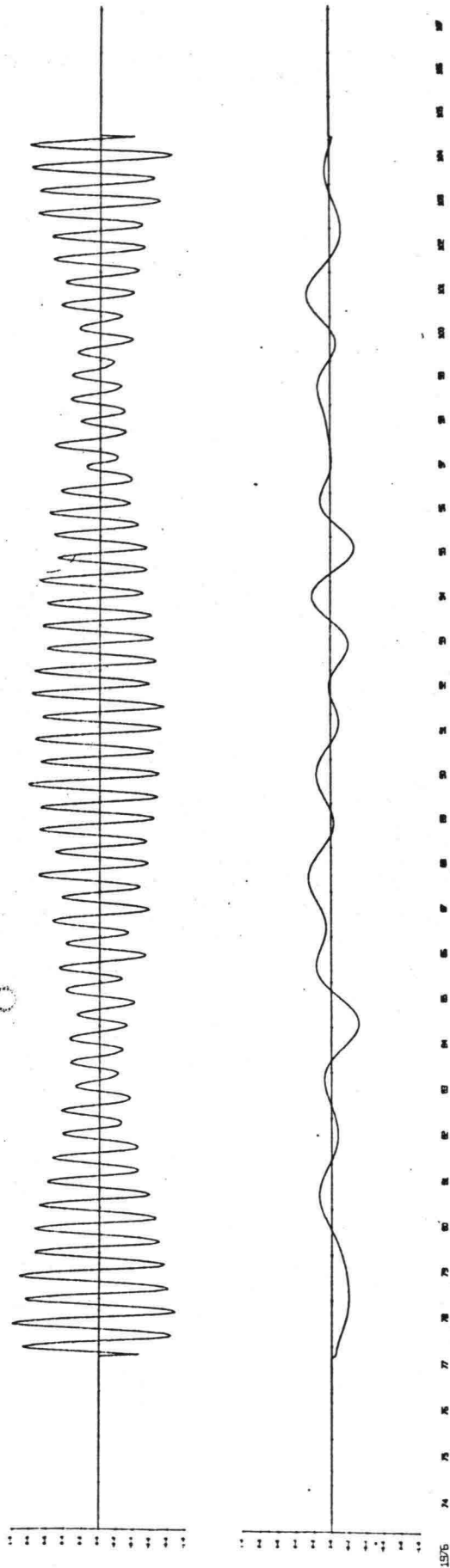


V161/1 TEMPERATURE
(DEGREES CELSIUS)



Station 56

Station 56



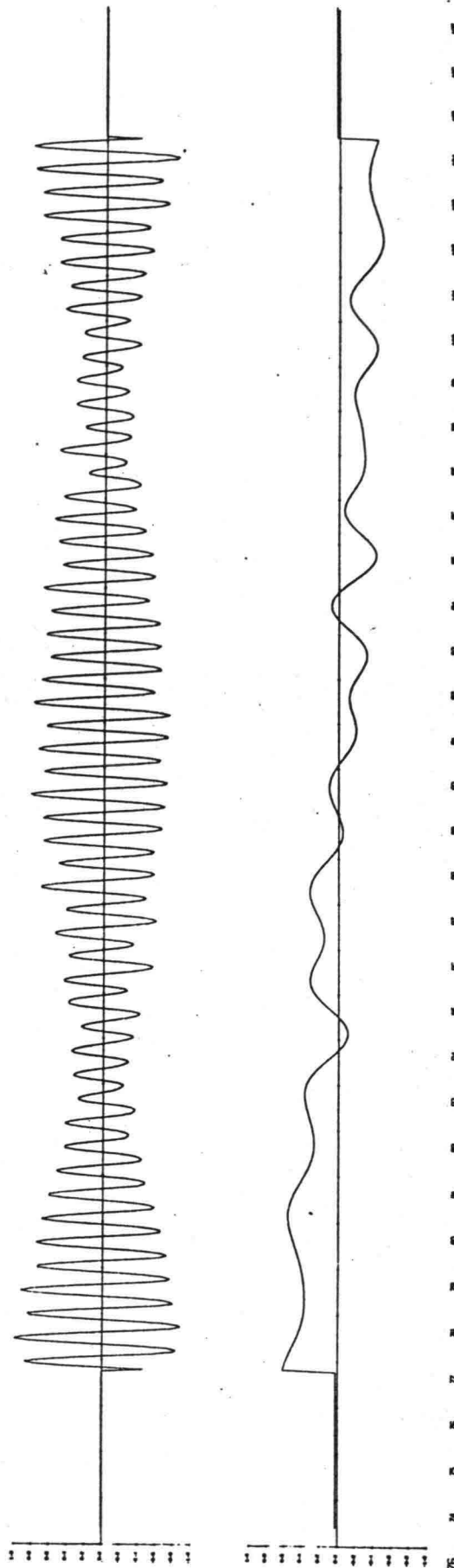
FILTERED VALUES
SCALE TO 0.000000
ZERO VALUE 0.000000

RESIDUALS
SCALE TO 0.000000
ZERO VALUE 0.000000

VIB1/1

N-NORTH SEA JUN56 VIB1/1 TOT. PRESSURE

Station 56



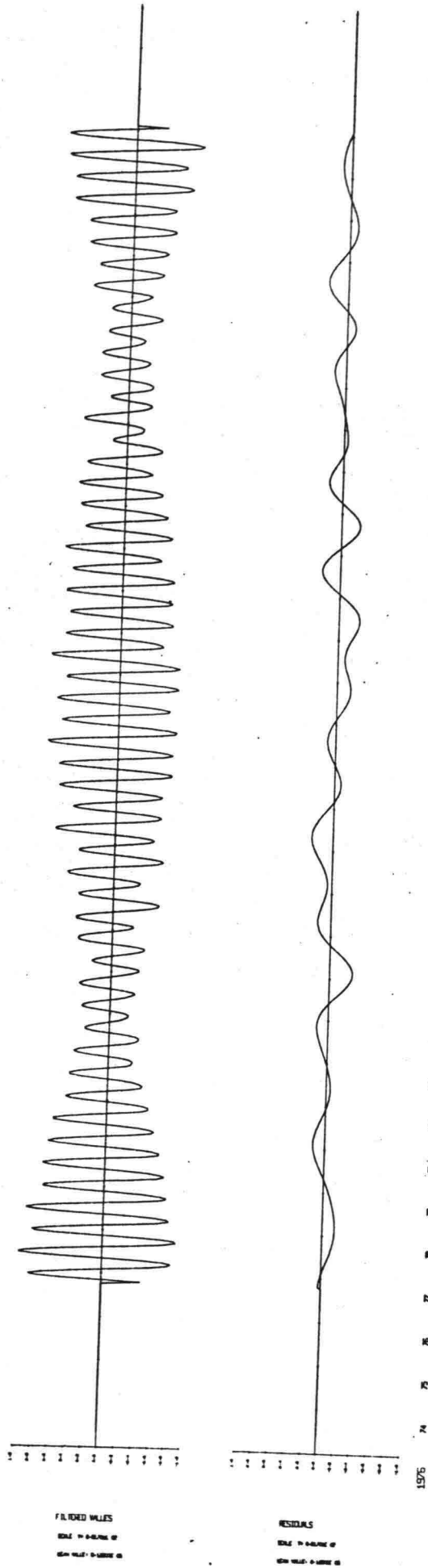
PL. NORTH HILLS
VAL. 10-10-10
VAL. 10-10-10

RESIDUALS
VAL. 10-10-10
VAL. 10-10-10

OAR 412

N-NORTH HILLS DAMPP. 101-101-101

Station 56



SG216
N-NORTH SEA JUNE 502/6 TOT. PRESSURE

Station 56

TABLE 4

Station 56, N. North Sea, Lat $59^{\circ}19' .5N$, Long $02^{\circ}46' .68E$.
 Drift free total pressure (millibars), FHP 53 filter.
 2000 day 077 to 0200 day 105 1976, 28 days and 6 hours.
 27 constituents + 8 related (*) using Lerwick 1966/71 analysis.

Constituent	VIB 1/1		OAR 4/2		SG 2/6	
	H (mb)	G ($^{\circ}$)	H (mb)	G ($^{\circ}$)	H (mb)	G ($^{\circ}$)
Q ₁	1.5	280.8	1.8	272.6	2.1	256.9
O ₁	3.7	56.1	3.7	51.6	3.9	48.4
M ₁	0.2	204.5	0.2	196.3	0.3	196.9
* P ₁	0.1	121.6	0.1	124.3	0.1	124.5
* P ₁	0.8	165.0	0.8	167.7	0.8	167.9
K ₁	2.6	181.1	2.6	183.8	2.5	184.0
* Y ₁	0.1	193.4	0.1	196.0	0.1	196.3
* Q ₁	0.1	209.6	0.1	212.3	0.05	212.5
J ₁	0.5	10.5	0.5	26.2	0.6	17.9
OO ₁	1.4	299.0	1.0	291.2	1.1	294.9
* 2N ₂	0.9	267.7	1.0	267.1	0.9	266.2
N ₂	1.8	271.7	1.8	271.7	1.8	274.6
N ₂	6.3	286.8	6.4	286.2	6.3	285.3
* S ₂	1.2	287.2	1.2	286.6	1.2	285.7
M ₂	32.0	308.8	32.6	308.7	32.2	308.9
L ₂	1.0	292.6	1.0	296.7	1.0	295.6
* T ₂	0.6	330.6	0.6	330.4	0.6	330.6
S ₂	12.5	345.2	12.7	345.0	12.5	345.2
* K ₂	3.5	341.7	3.5	341.5	3.5	341.7
2SM ₂	0.4	30.1	0.2	19.1	0.03	357.6
MO ₃	0.2	145.0	0.3	142.0	0.3	138.7
O ₃	0.3	220.4	0.3	193.3	0.3	180.9
MK ₃	0.2	346.8	0.1	315.8	0.1	249.0
MN ₄	0.4	233.7	0.5	227.8	0.4	228.0
M ₄	1.2	263.6	1.2	261.4	1.2	261.8
SN ₄	0.3	56.4	0.3	56.9	0.3	54.2
MS ₄	0.9	4.3	0.9	1.7	1.0	0.2
2MN ₆	0.5	21.9	0.4	27.4	0.4	27.1
M ₆	0.6	43.3	0.6	46.4	0.6	48.5
MSN ₆	0.1	55.1	0.1	31.5	0.1	24.2
2MS ₆	0.6	101.3	0.7	105.1	0.7	105.3
2SM ₆	0.1	170.6	0.2	156.0	0.2	153.9

OSTG position	Station 57, North North Sea, 1976, Lat $59^{\circ}20'N$, Long $04^{\circ}34'E$, $g = 9.819 \text{ ms}^{-2}$.
Water depth	271m.
OSTG details	Mk I, Logger no. 15, Sensors 1/13, 1/16, and 1/T2 (temperature).
Time of deployment	Tide gauge on sea bed at 1100 GMT day 073.
Time of recovery	Gauge out of water at 1400 GMT day 108.
CTD casts	1 cast at 1530 GMT day 073 1 cast at 1936 GMT day 108 ₃ Density, $\rho = 1027.384 \text{ kg m}^{-3}$.
Comments	Sensors 1/13 and 1/16 have no built-in temperature sensors so a separate sensor, 1/T2 was used to measure temperature.

Timing 1st scan at 1100 GMT day 069
 Last scan at 1811,58s GMT day 111
 Clock fast, gained 3m 2s in 1115 $\frac{1}{4}$ h
 (42 days 7 $\frac{1}{4}$ hours).

Raw data Start 1107, 45s GMT day 073
 End 1320, 18s GMT day 108

Temperature data Complete temperature record from sensor
 1/T2.

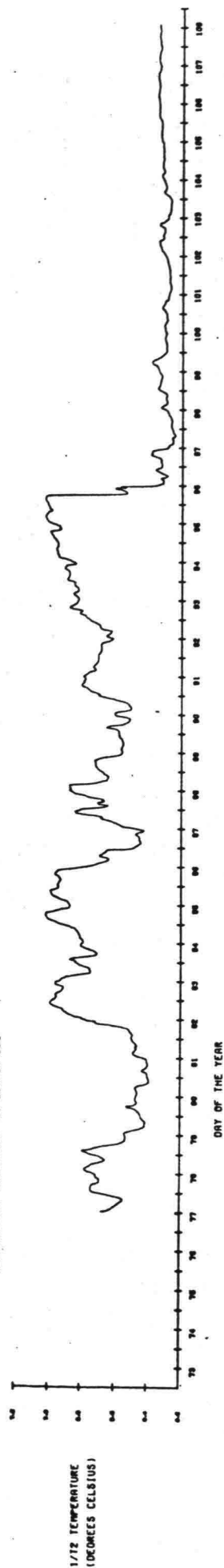
Drift-free data Start 1600 GMT day 076
 End 0900 GMT day 105
 FHP53 filter used.

Tidal analysis TIRA, 1600 day 076 to 0900 day 105, 28 days
 and 17 hours, using 27 major and 8 related
 constituents from Lerwick 1966 to 1971
 analysis.

Comments

Station 57

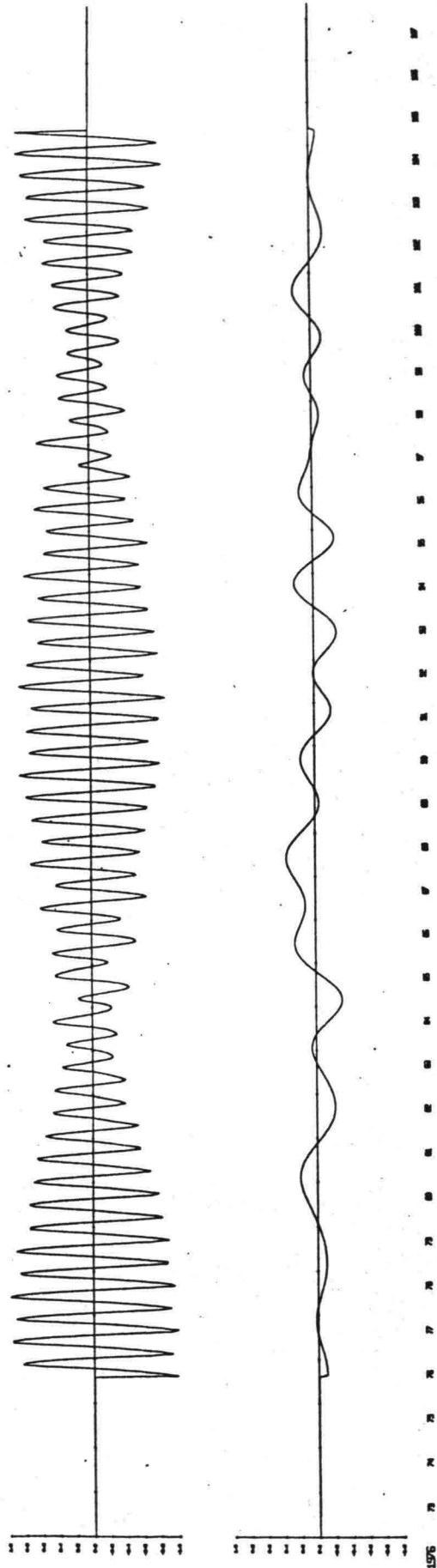
OSTO HKJ 15 MARCH/APRIL 1976
N. NORTH SEA JONSDR57 59 20N 04 30E



1/12 TEMPERATURE
(DEGREES CELSIUS)

DAY OF THE YEAR

Station 57



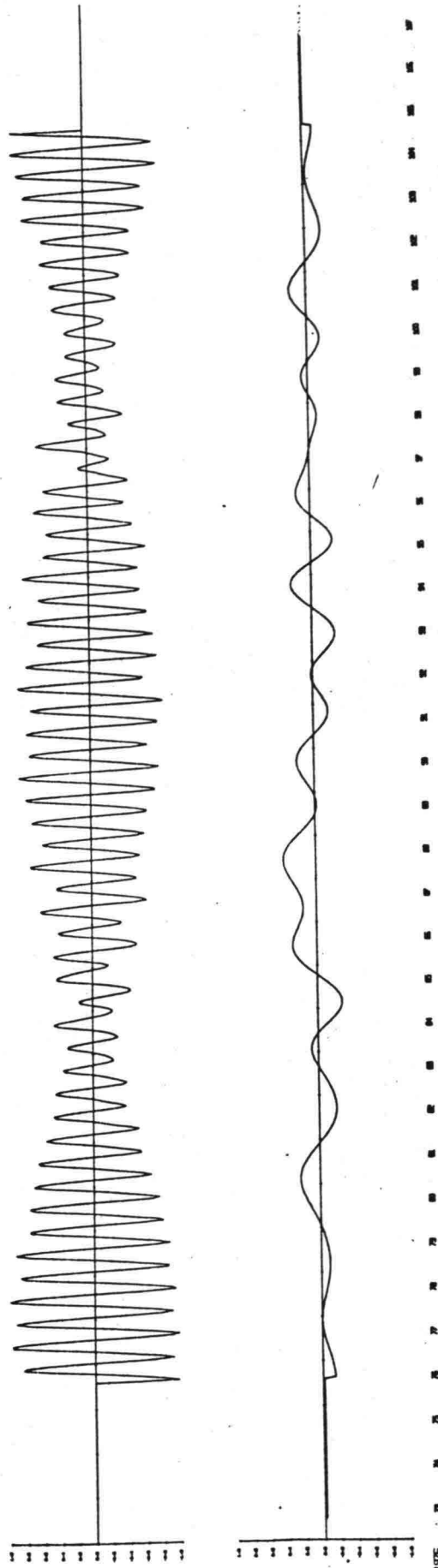
FILTERED VALUE
DATE: 11-1-2007 12
TIME: 12:00-12:00:00

RESIDUAL
DATE: 11-1-2007 12
TIME: 12:00-12:00:00

SENSOR 1

JONESAP57 SENSOR1 TOT. PRESSURE

Station 57



FILTERED VALUES
SCALE TO 4-DIGIT 10
DATA VALUE 0-9999 10

RESIDUALS
SCALE TO 4-DIGIT 10
DATA VALUE 0-9999 10

SENSOR 2

JONSCAP57 SENSOR2 TOT. PRESSURE

Station 57

TABLE 5

Station 57, N. North Sea, Lat $59^{\circ}20'N$, Long $04^{\circ}31'E$.
 Drift free total pressure (millibars), FHP 53 filter.
 1600 day 076 to 0900 day 105 1976, 28 days and 17 hours.
 27 constituents + 8 related (*) using Lerwick 1966/
 1971 analysis

Constituent	1/13		1/16	
	H (mb)	G ($^{\circ}$)	H (mb)	G ($^{\circ}$)
Q ₁	1.8	261.5	1.7	261.9
O ₁	2.3	39.6	2.3	39.7
M ₁	0.4	254.4	0.4	256.3
* Π ₁	0.05	106.2	0.04	106.1
* P ₁	0.6	149.6	0.6	149.5
K ₁	2.0	165.8	2.0	165.7
* γ ₁	0.1	178.0	0.1	177.9
* ϕ ₁	0.04	194.2	0.04	194.1
J ₁	0.1	39.4	0.1	22.4
OO ₁	1.1	296.1	1.1	294.1
* 2N ₂	0.7	242.7	0.7	242.7
μ ₂	1.5	277.4	1.5	277.5
N ₂	4.7	261.8	4.7	261.8
* γ ₂	0.9	262.2	0.9	262.2
M ₂	24.5	286.1	24.5	286.1
L ₂	1.2	264.3	1.1	264.5
* T ₂	0.5	313.7	0.5	313.7
S ₂	9.9	328.3	9.9	328.3
* K ₂	2.8	324.8	2.8	324.8
2SM ₂	0.2	7.3	0.1	6.1
MO ₃	0.3	146.4	0.3	146.7
O ₃	0.2	178.5	0.2	180.2
MK ₃	0.1	345.6	0.1	351.2
MN ₄	0.3	215.0	0.3	214.9
M ₄	1.1	260.2	1.1	259.4
SN ₄	0.4	42.2	0.4	41.8
MS ₄	0.9	5.2	0.9	4.7
2MN ₆	0.7	45.3	0.7	45.0
M ₆	1.0	68.5	1.0	68.5
MSN ₆	0.2	61.9	0.2	65.8
2MS ₆	1.1	122.3	1.1	122.3
2SM ₆	0.3	170.0	0.3	168.2

