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INTERNAL DOCUMENT 146

I.O.S.

WAVES AT SOUTH UIST - AUGUST 1980 to AUGUST 1981

Some results of relevance to the Wave Energy Programme

R GLEASON and J A CRABB

NATURAL ENVIRONMENT RESEARCH COUNCIL

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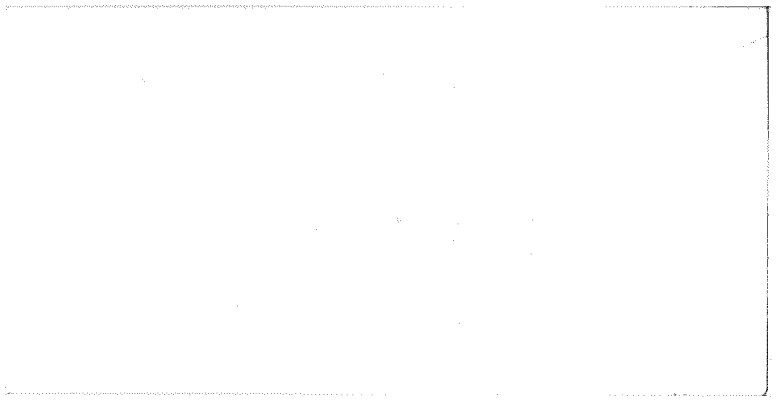

WAVES AT SOUTH UIST -
AUGUST 1980 to AUGUST 1981

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Internal Document No 146

October 1981

Institute of Oceanographic Sciences
Crossway
Taunton
Somerset

INTRODUCTION

This document contains a selection of results from recent analyses of the South Uist data. It extends the results previously presented in WESC (79) DA89 and WESC (81) DA126.

The data on which the presentations are based cover the period August 1980 to August 1981.

Data are presented for three buoys which were positioned at the following locations.

Deepwater buoy - positioned 057° 17' 48" N
007° 53' 54" W
in 98 m water during the period August 1980 to August 1981.

Offshore buoy - positioned 057° 18' 21" N
007° 38' 09" W
in 45 m water (approx) during the period August 1980 to August 1981.

Inshore buoy II - positioned 057° 19' 36" N
007° 29' 06" W
in 23 m water during the period August 1980 to January 1981.

and

Inshore buoy III - positioned 057° 17' 24" N
007° 29' 09" W
in 25 m water during the period March 1981 to August 1981.

All positions and depths are approximate as minor variations occur when buoys are replaced on service visits. Positions are indicated on the chart in figure 1.

The diagrams which constitute the main body of this report are arranged in five sections as follows:

1. Waves at the deepwater buoy.
2. Waves at the offshore buoy.
3. Waves at the inshore buoy.
4. Comparisons between deepwater and offshore sites.
5. Comparisons between inshore and offshore sites.

1. Waves at the deepwater buoy

Diagrams under this heading include:

Fig 1.1	Scatter diagram of H_s v T_e	Aug 80-Aug 81
Fig 1.2	Scatter diagram showing distribution of total energy with H_s and T_e	Aug 80-Aug 81
Fig 1.3-1.6	Time series of power	Aug 80-Aug 81
Fig 1.7-1.10	Time series of H_s	Aug 80-Aug 81
Fig 1.11-1.14	Time series of T_e	Aug 80-Aug 81

2. Waves at the offshore buoy

Fig 2.1-2.3	Time series of power	Aug 80-Aug 81
Fig 2.4-2.6	Time series of H_s	Aug 80-Aug 81
Fig 2.7-2.9	Time series of T_e	Aug 80-Aug 81

Note: There are no data for the period October 1980 to April 1981, with the exception of a few values in January and February 1981.

3. Waves at the inshore buoy

Fig 3.1-3.4	Time series of power	Aug 80-Aug 81
Fig 3.5-3.8	Time series of H_s	Aug 80-Aug 81
Fig 3.9-3.12	Time series of T_e	Aug 80-Aug 81

Note: Data from the inshore III position commence at the beginning of March 1981.

4. Comparisons between deepwater and offshore sites

Fig 4.1-4.8 Scatter plots of offshore against simultaneous deepwater wave power

Superimposed upon each plot is the straight line which results from a major axis regression analysis performed on each month's data. Note that the 'standard error' quoted in the figures is just the RMS perpendicular distance of the plotted points to the fitted line and has units of kW/m.

In addition to these monthly comparisons a standard y on x regression analysis was performed using all the data. Power at the offshore buoy as the independent variable and power at the deepwater the dependent variable. The results are set out below.

Slope of regression line	1.23
Intercept	0.29
Standard error of slope	0.01
Standard error of intercept	0.34
Correlation coefficient	0.958
Slope of regression hire constained to pass through (0,0)	1.24

5. Comparisons between inshore III and offshore sites

Fig 5.1-5.5 Scatter plots of offshore against simultaneous inshore III wave power

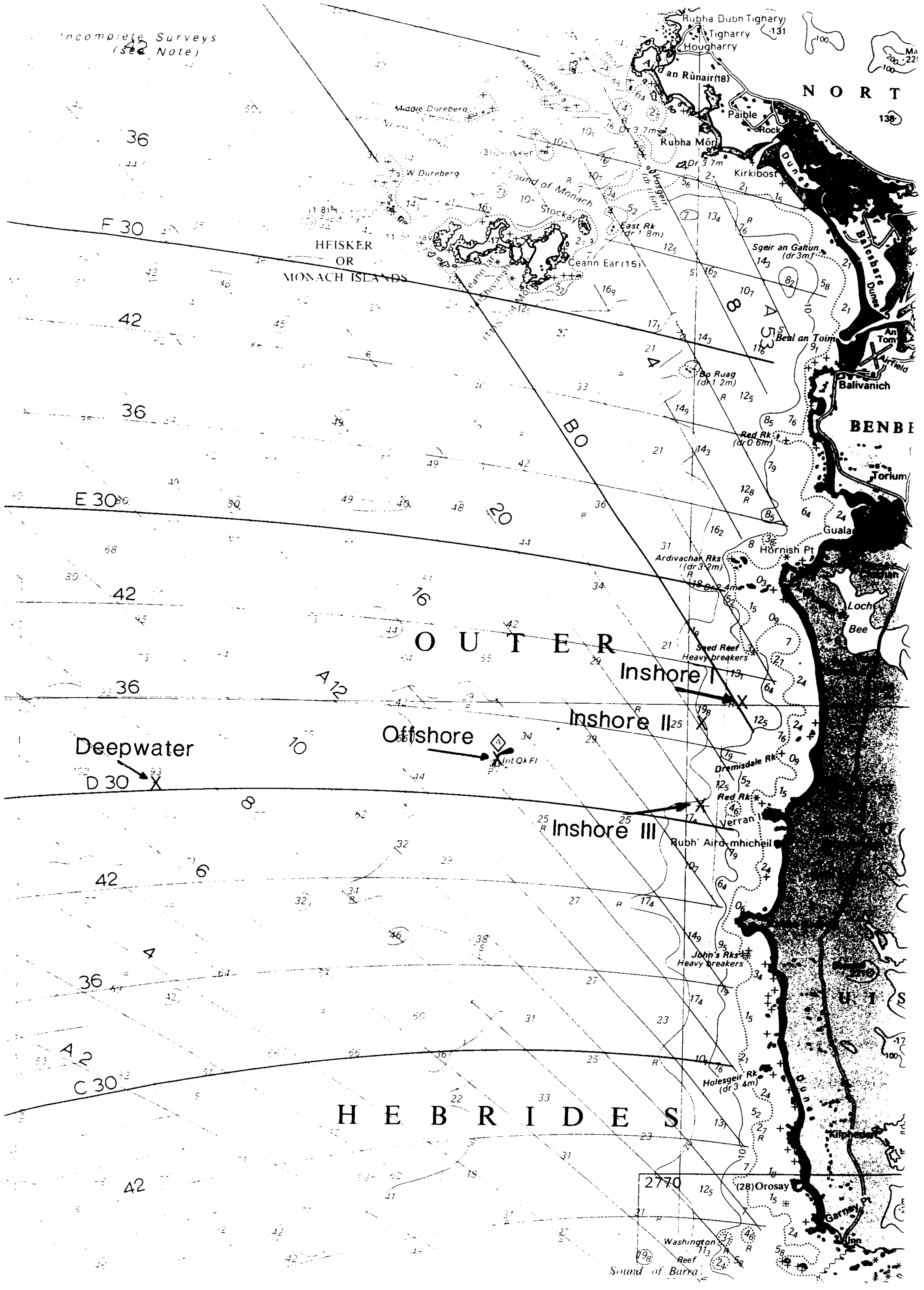
The results of the regression analysis performed on all the data are set out below.

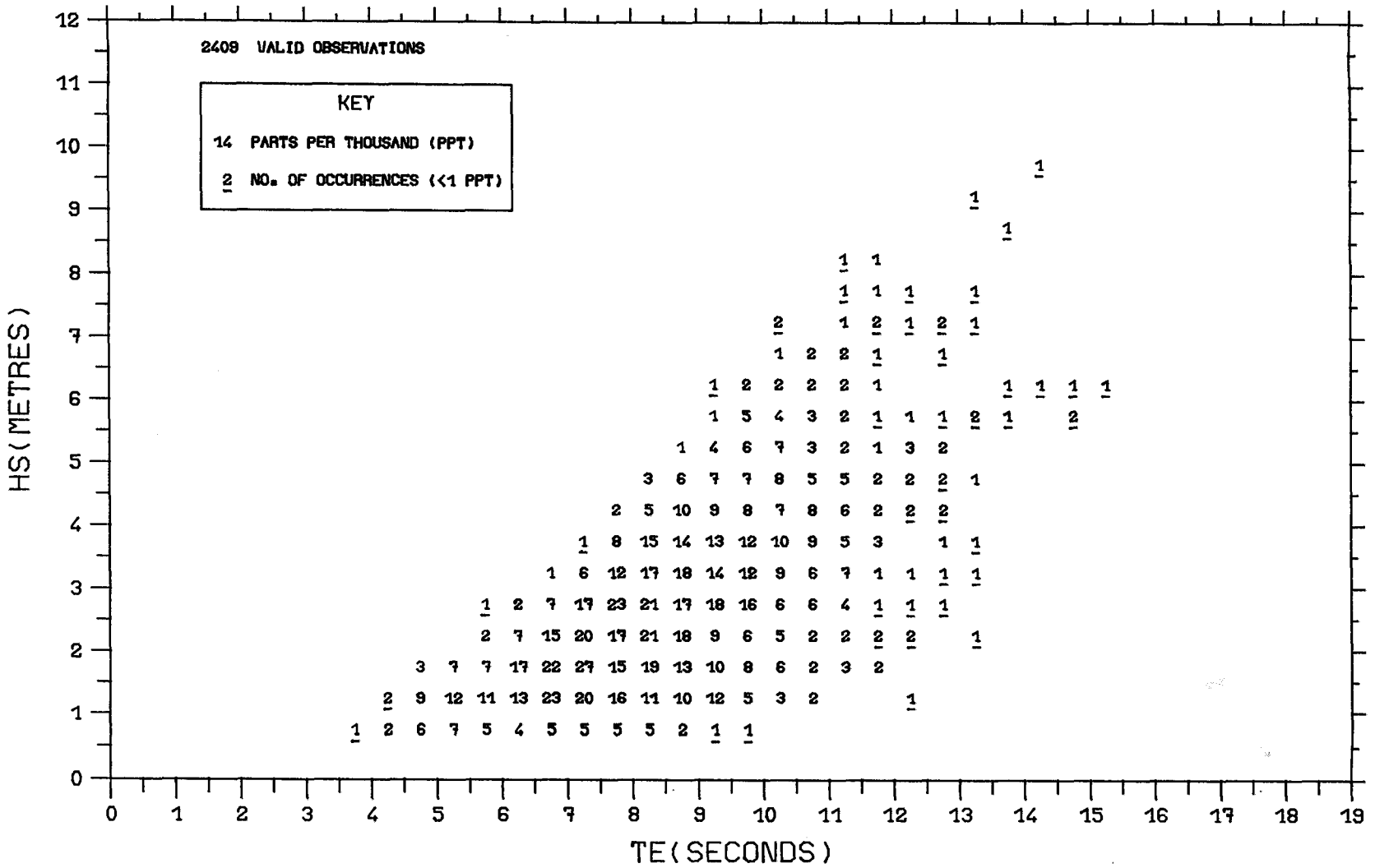
Slope of regression line	0.75
Intercept	0.37
Standard error of slope	0.01
Standard error of intercept	0.20
Correlation coefficient	0.937
Slope of regression line constained to pass through (0,0)	0.762

Implications of comparisons

The predicted long-term average power density at the offshore site is 47.8 kW/m and the results of the regression analysis may be used to scale this figure to form estimates of the long-term average power density at the deepwater and inshore III sites. The results are:-

Inshore III sites	36.2 ± 0.6 kW/m
Deepwater site	59.2 ± 0.9 kW/m

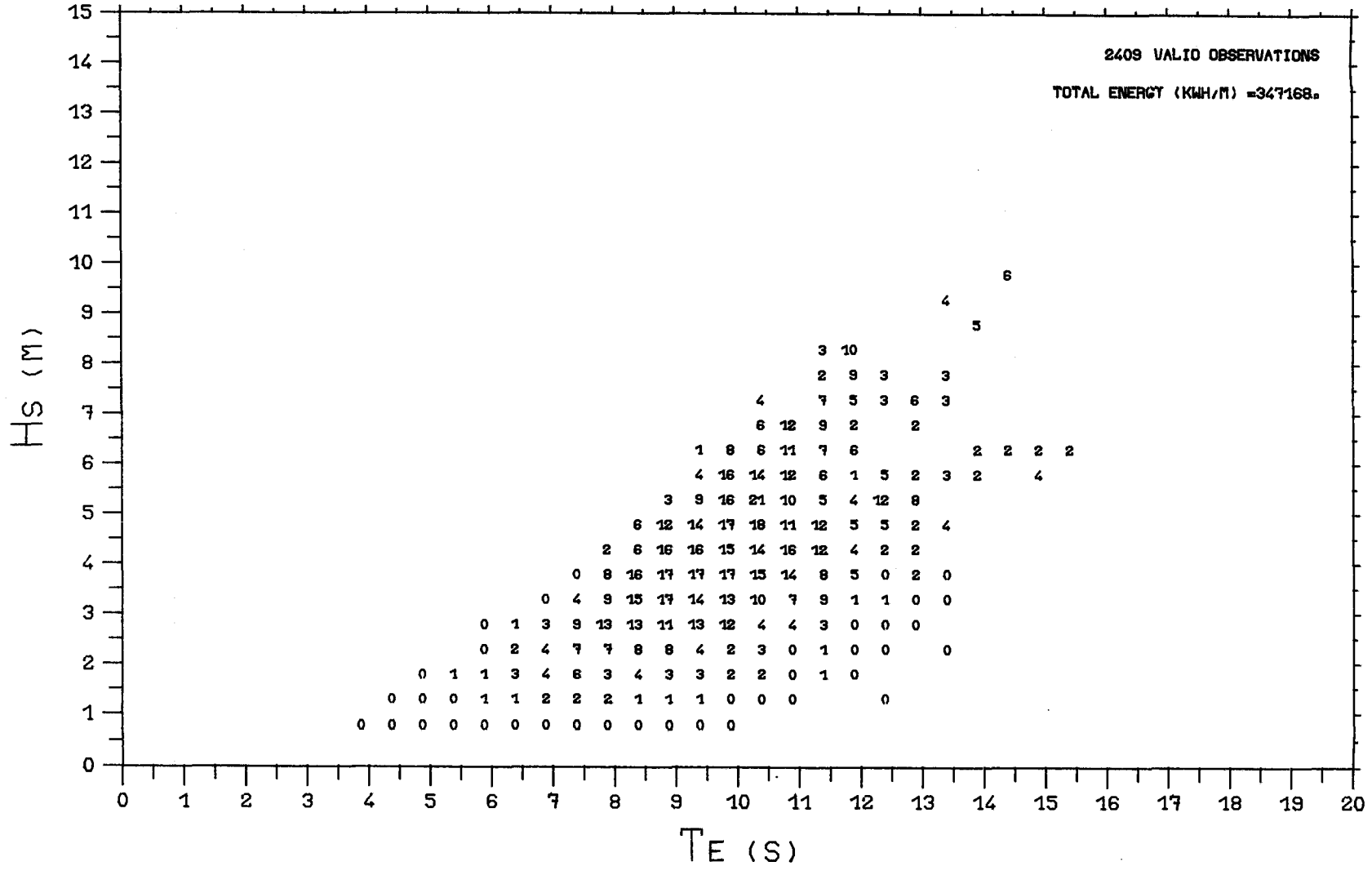

Incomplete Surveys
(see Note)
HEISKER
OR
MONACH ISLANDS
Sound of Monach
Stockay
Ceann Ear (15)
Middle Dureberg
W Dureberg
Rubha Dubh Tighary
Tigharry
Hougharry
an Rùnair (18)
NORT
Paible
Rock
Rubha Mór
Kirkibost
Dunes
Balesbare Dunes
East Rk
Sgeir an Galtun
(dr 3m)
Beal an Toim
Airfield
Balivanich
Bo Ruag
(dr 1·2m)
BENBE
Red Rk
(dr 0·6m)
Torlum
Gualan
Hornish Pt
Ardivachar Rks
(dr 3·2m)
Loch Bee
OUTER
Seed Reef
Heavy breakers
Inshore I
Inshore II
Offshore
Int Qk Fl
Deepwater
Dremisdale Rk
Red Rk
Inshore III
Verran I
Rubh' Aird-mhicheil
John's Rks
Heavy breakers
Holesgeir Rk
(dr 3·4m)
HEBRIDES
Kilphedel
2770
(28) Orosay
Garry Pt
Washington Reef
Sound of Barra
F 30
E 30
D 30
C 30
BO
A 12
A 2
A 53



SCATTER PLOT OF HS AND TE

S.UIST DEEPWATER WAVERIDER.AUGUST 1980-AUGUST 1981

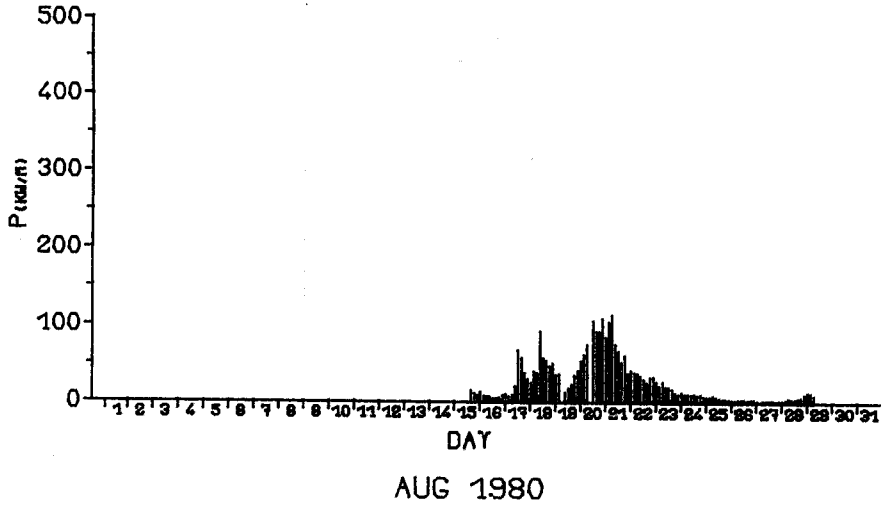
Fig. 1.1



DISTRIBUTION OF TOTAL MEASURED WAVE ENERGY
WITH Hs AND TE (PPT)

S.UIST DEEPWATER WAVERIDER AUG 80/AUG 81

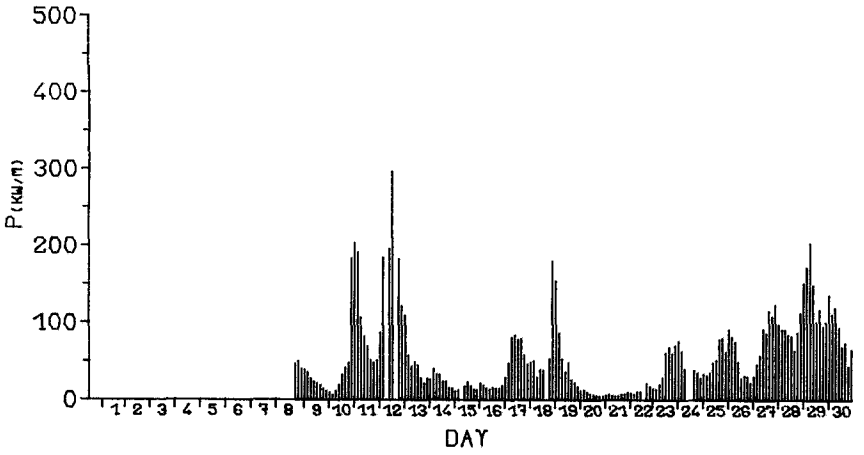
Fig. 1.2



TIME SERIES OF POWER

S.UIST DEEPWATER WAVERIDER

Fig. 1.3



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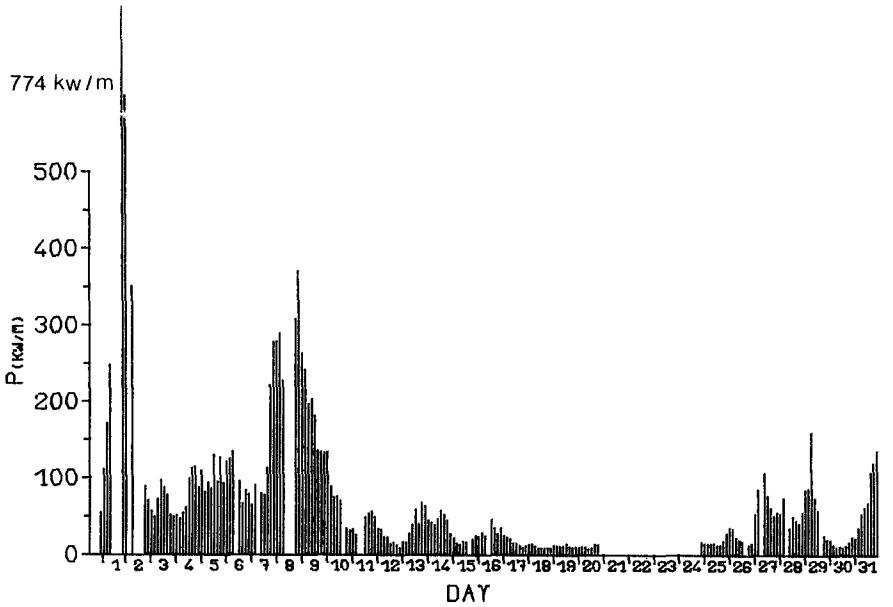

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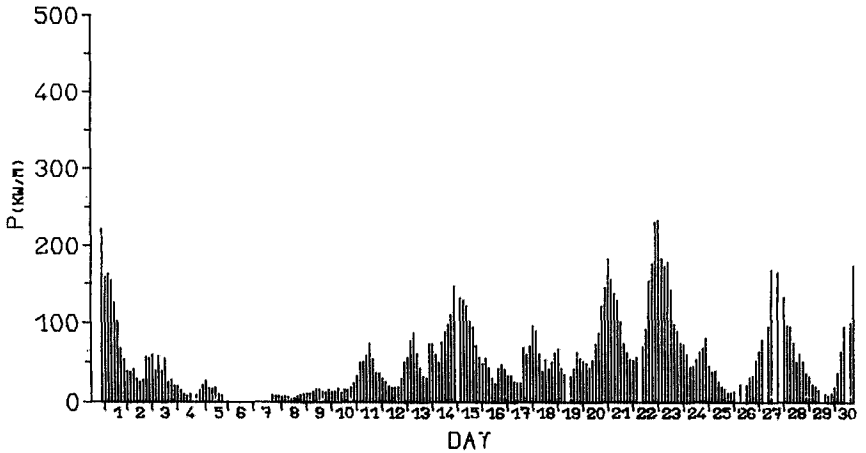

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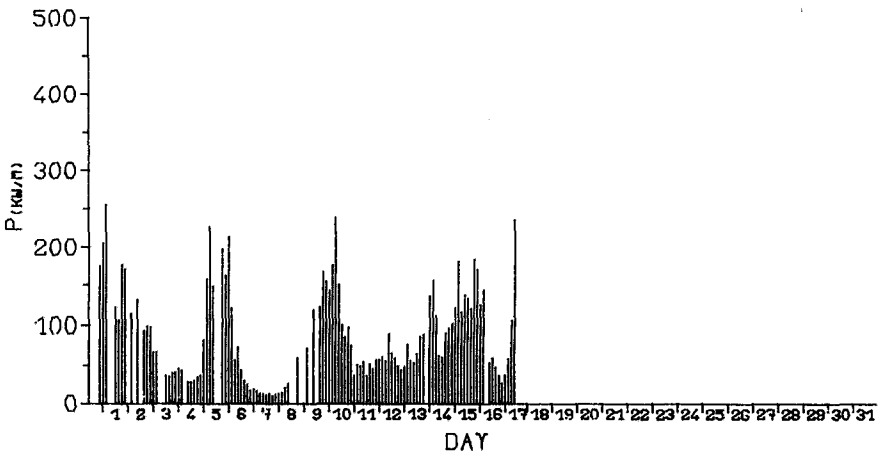
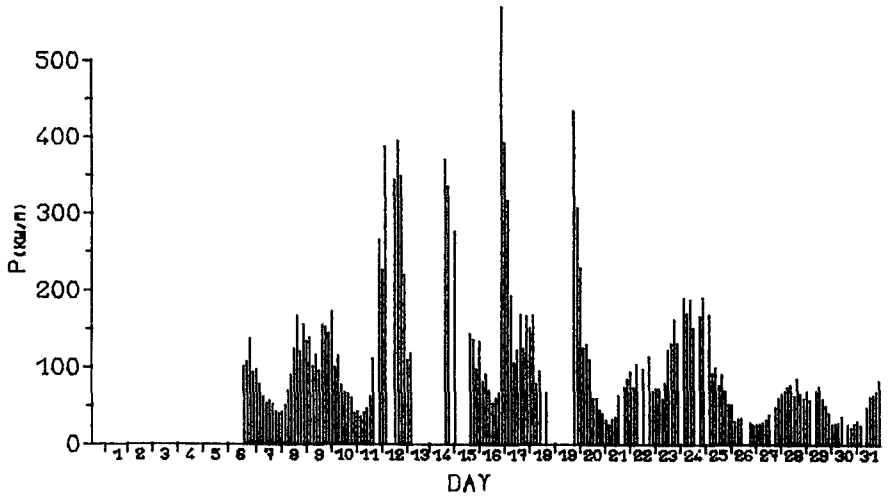


DEC 1980

TIME SERIES OF POWER

S.UIST DEEPWATER WAVERIDER

Fig. 1.4



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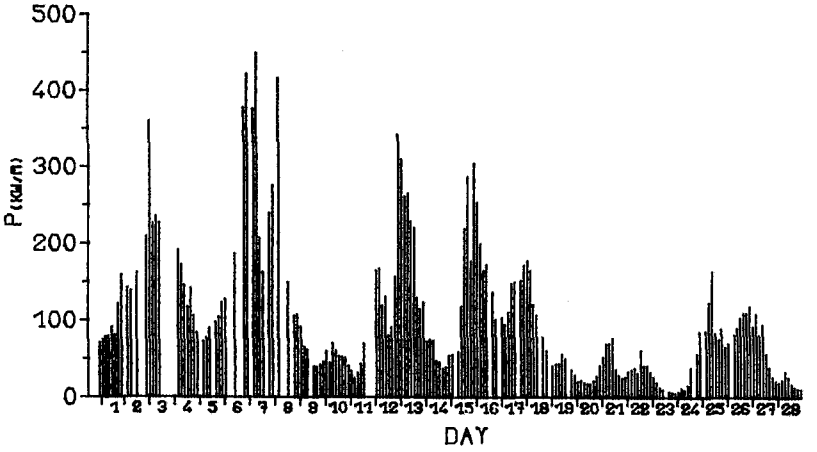
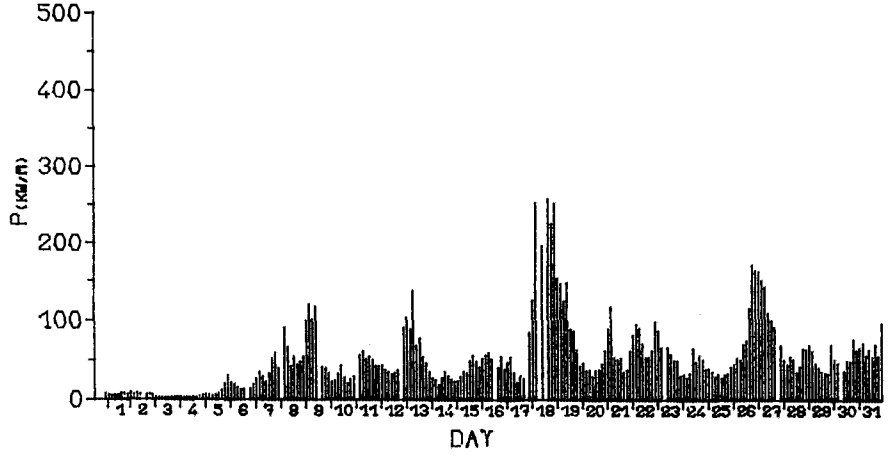


FEB 1981



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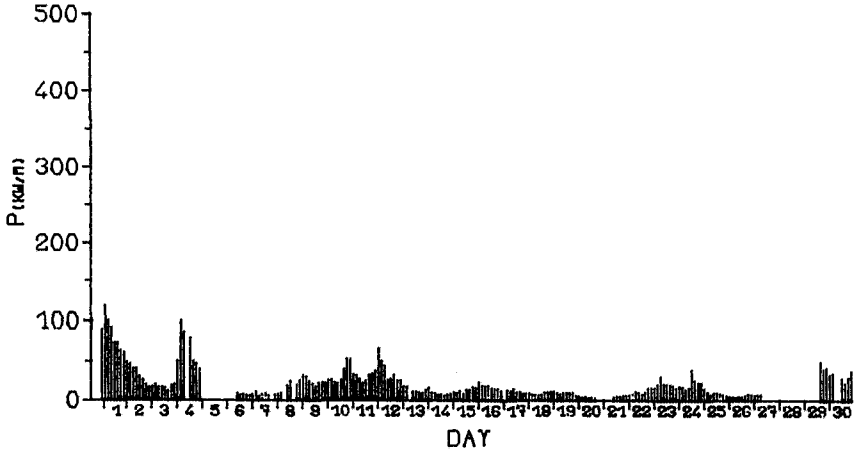
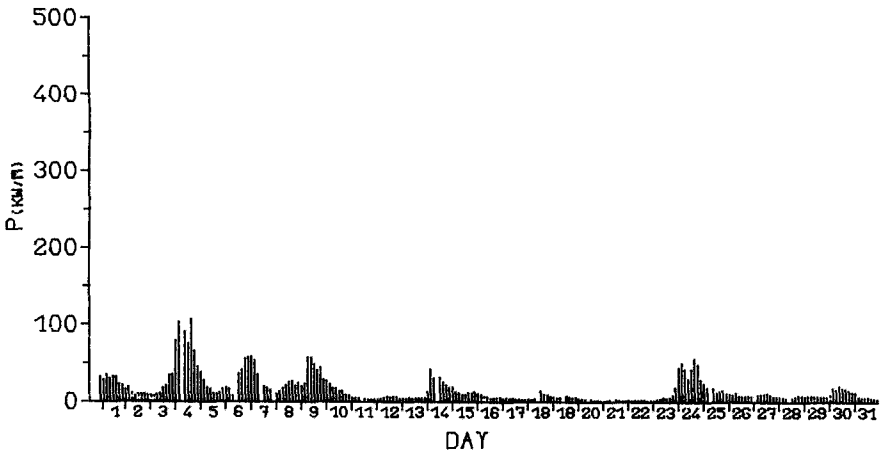


APR 1981

TIME SERIES OF POWER

S.UIST DEEPWATER WAVERIDER

Fig. 1.5



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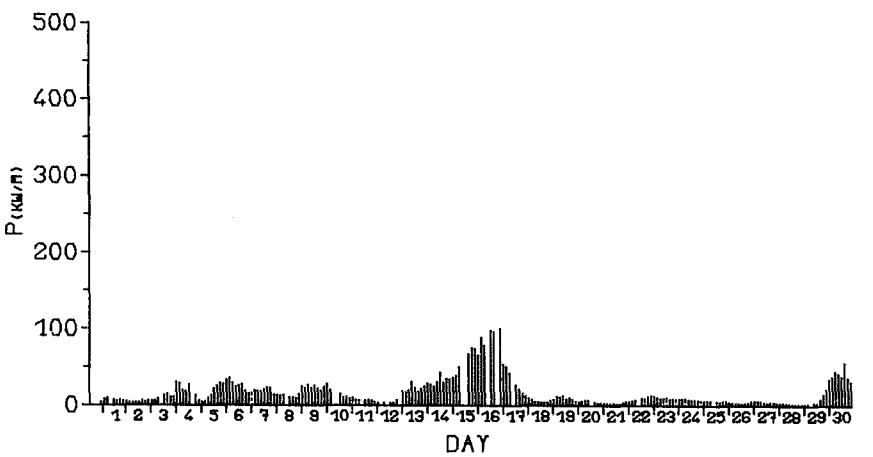

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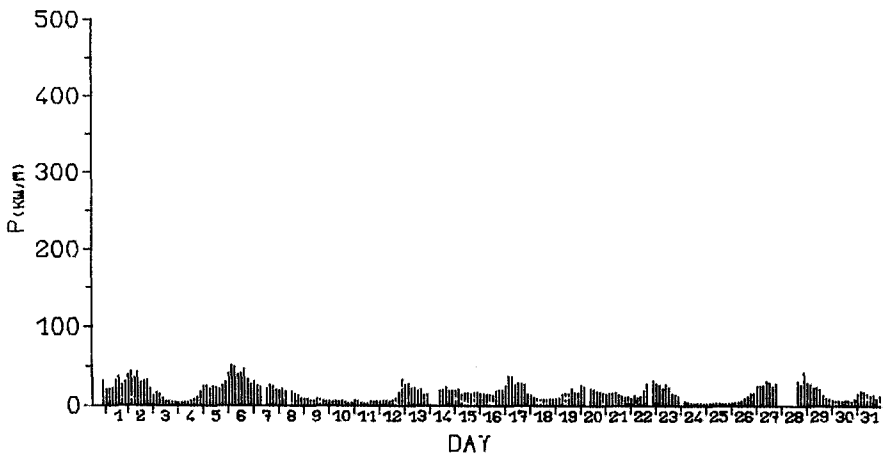

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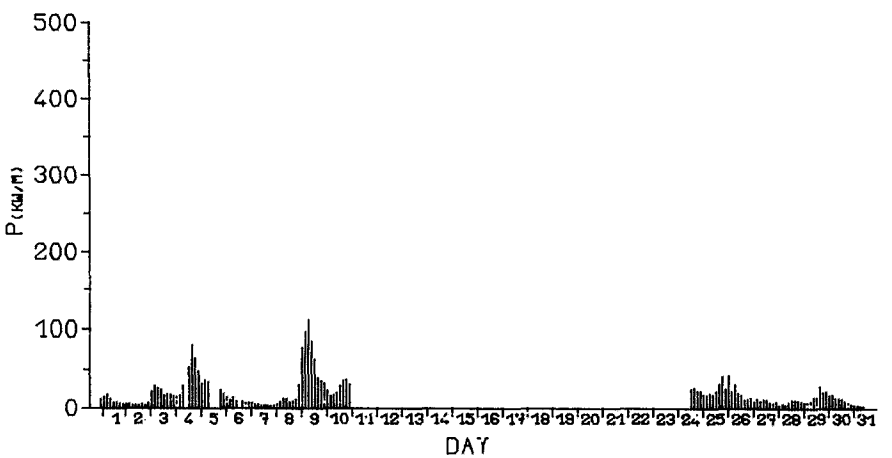
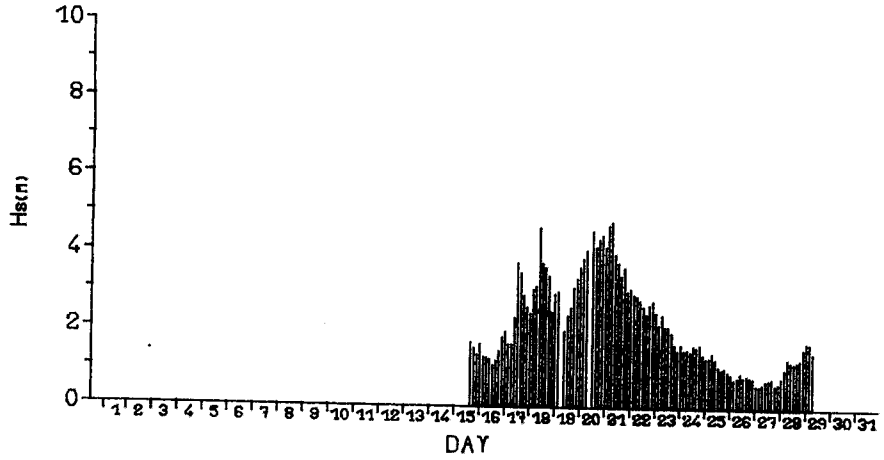


AUG 1981

TIME SERIES OF POWER

S.UIST DEEPWATER WAVERIDER

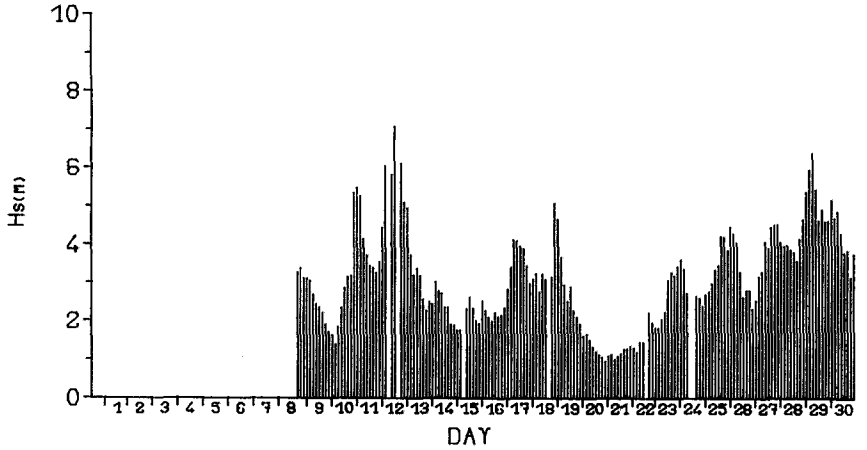
Fig. 1.6



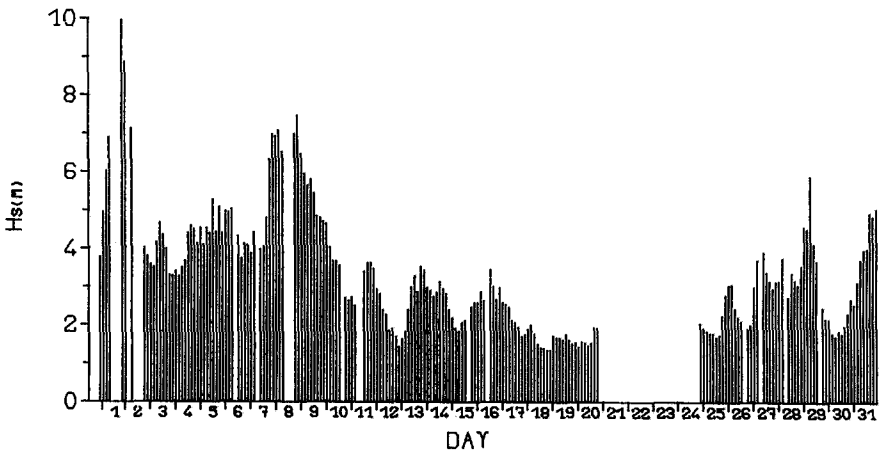
TIME SERIES OF Hs

S.UIST DEEPWATER WAVERIDER

Fig. 1.7



SEP 1980



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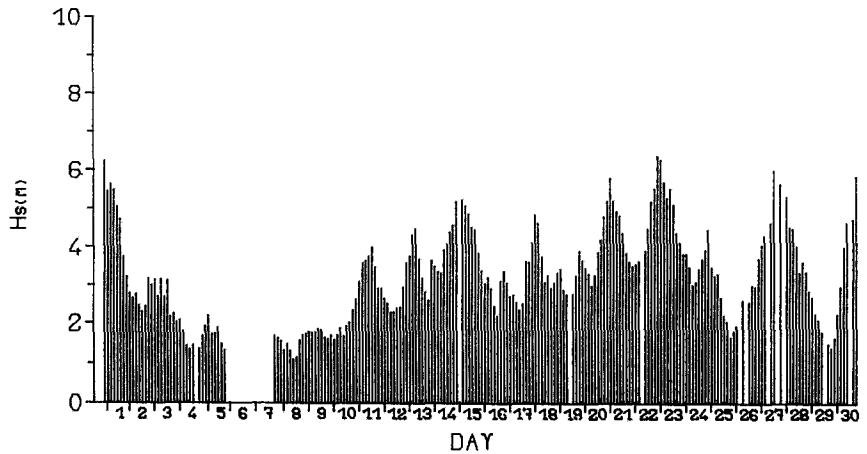

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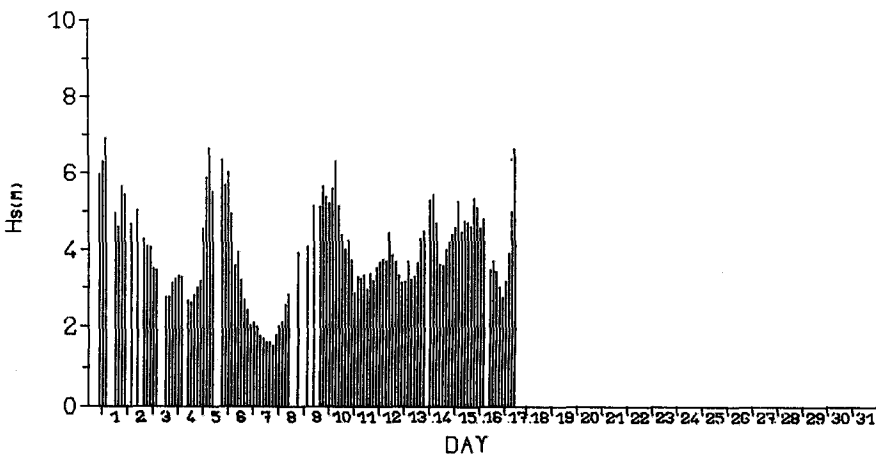
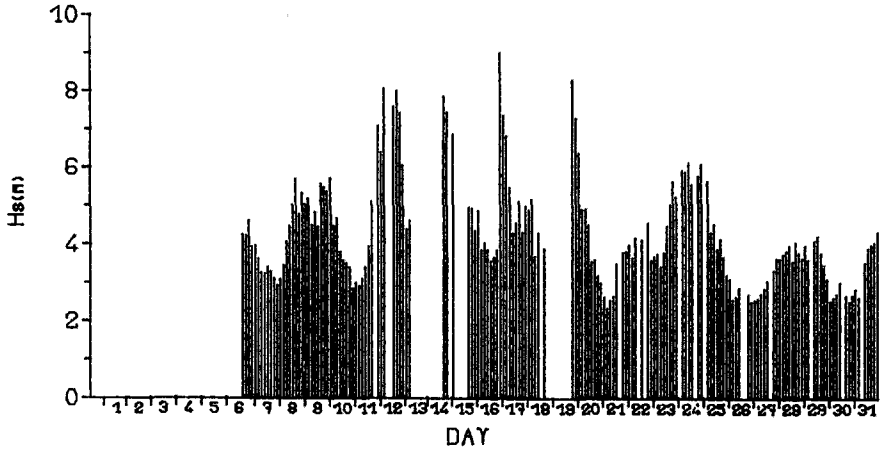


DEC 1980

TIME SERIES OF Hs

S.UIST DEEPWATER WAVERIDER

Fig. 1.8



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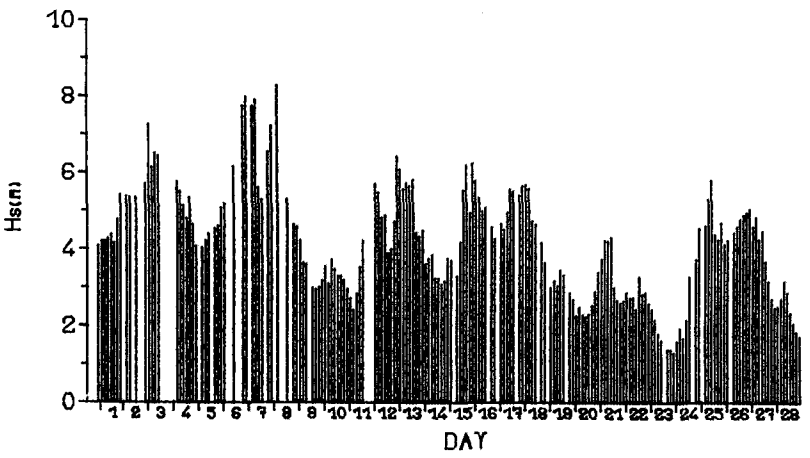

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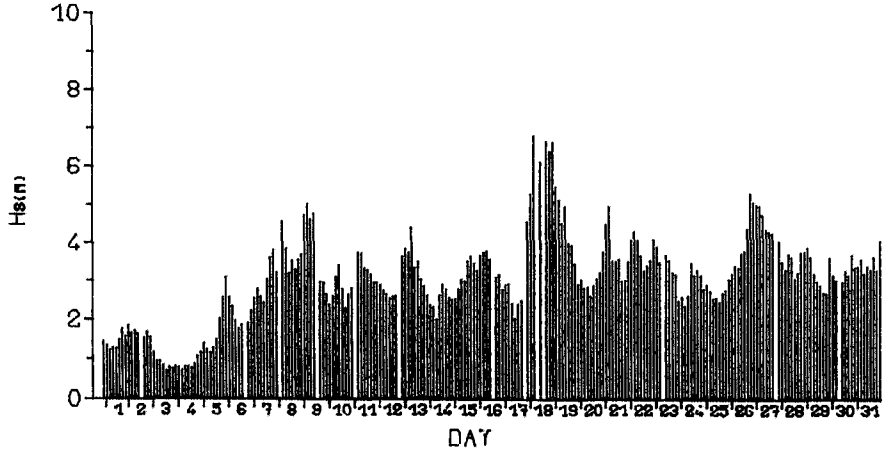

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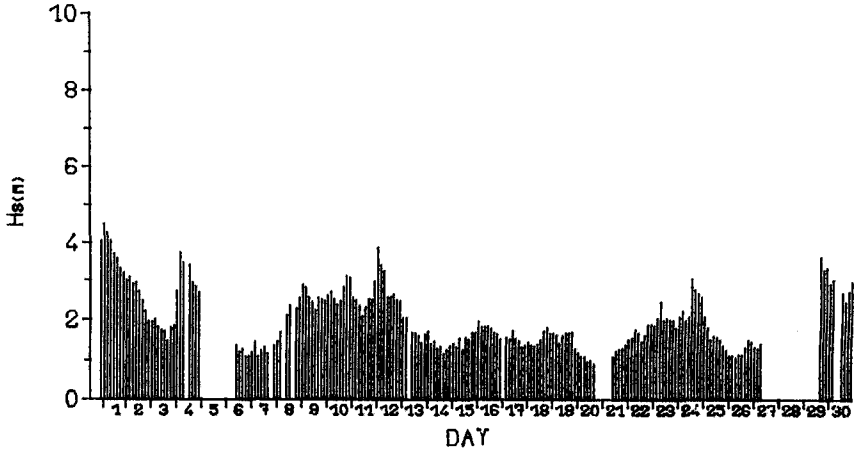
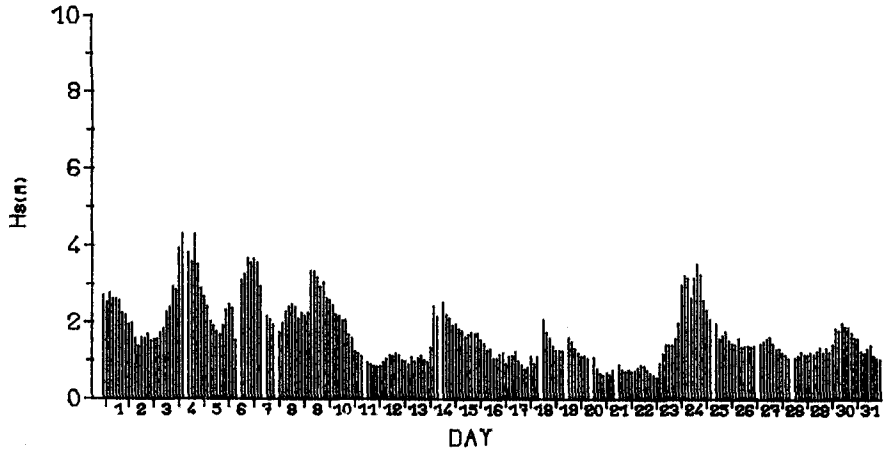


APR 1981

TIME SERIES OF Hs

S.UIST DEEPWATER WAVERIDER

Fig. 1.9



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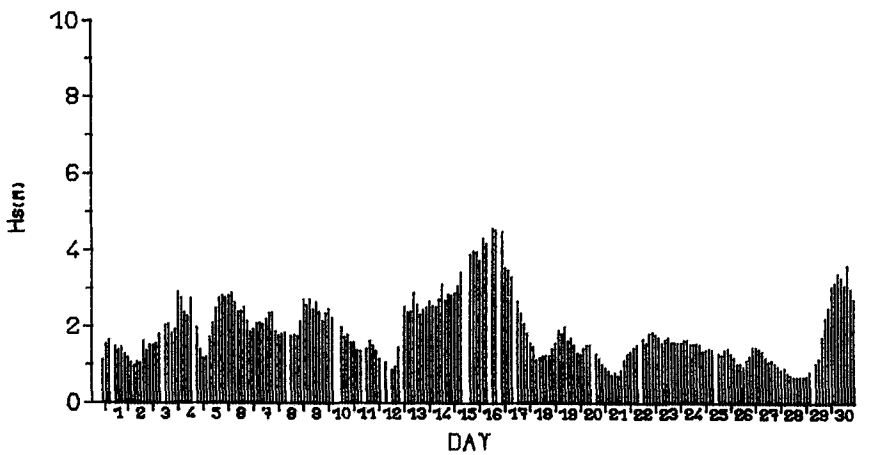

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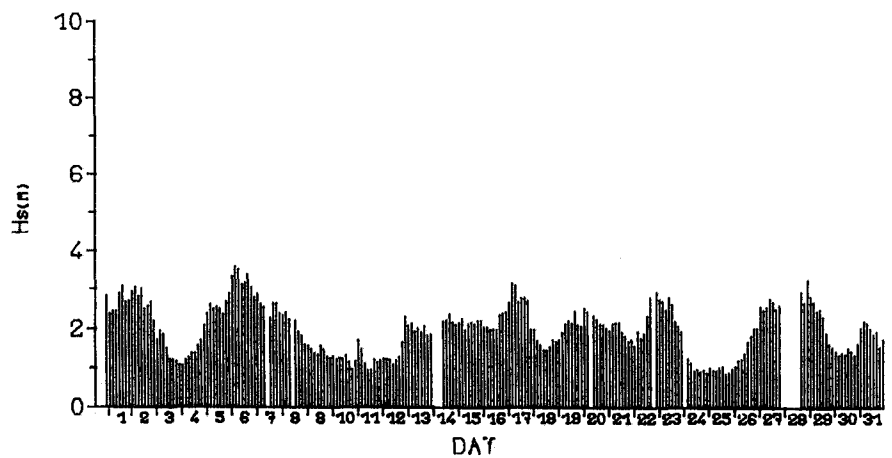

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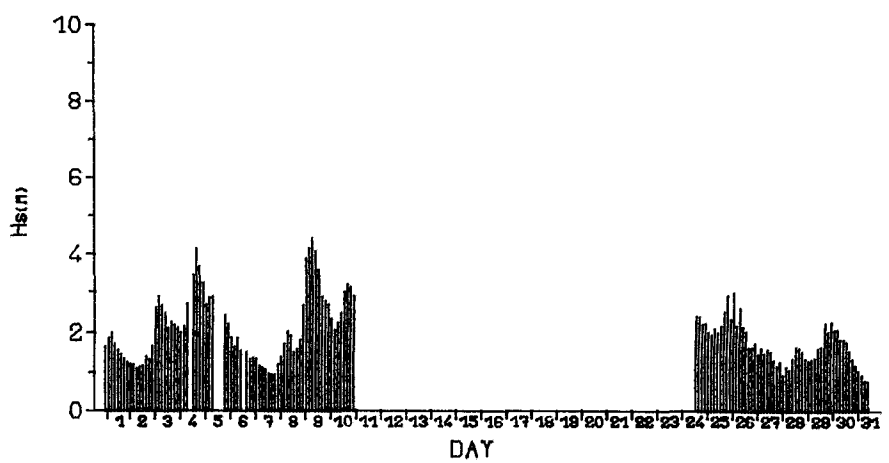
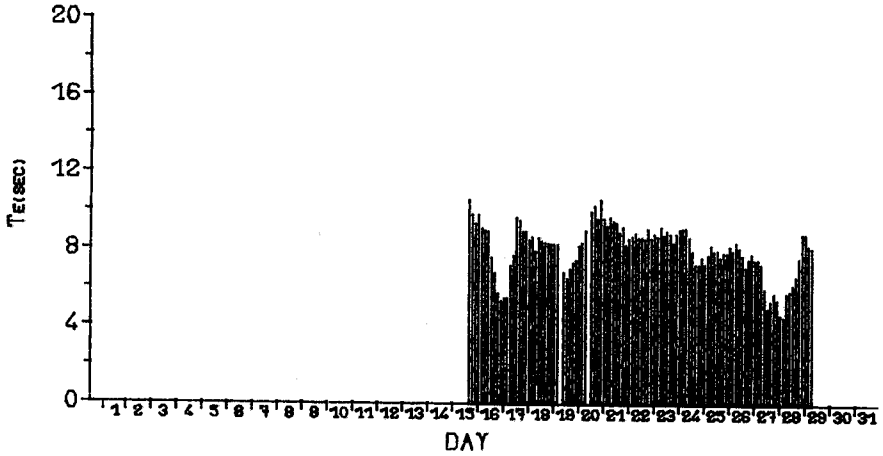


AUG 1981

TIME SERIES OF Hs

S.UIST DEEPWATER WAVERIDER

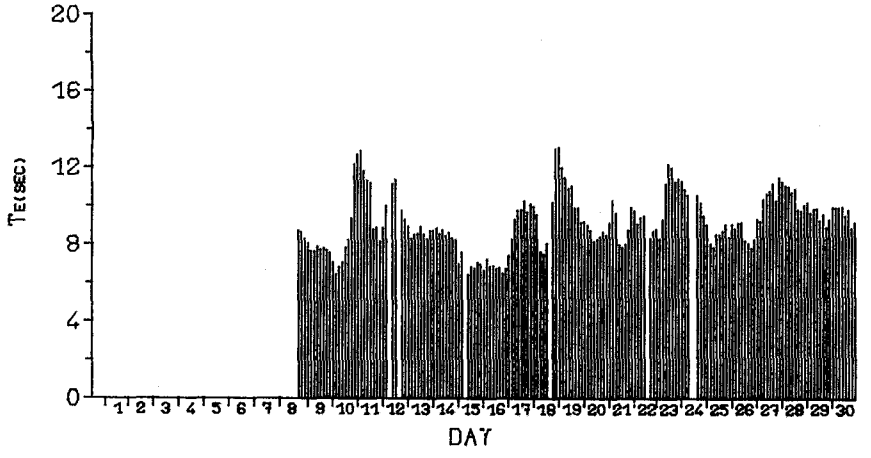
Fig. 1.10



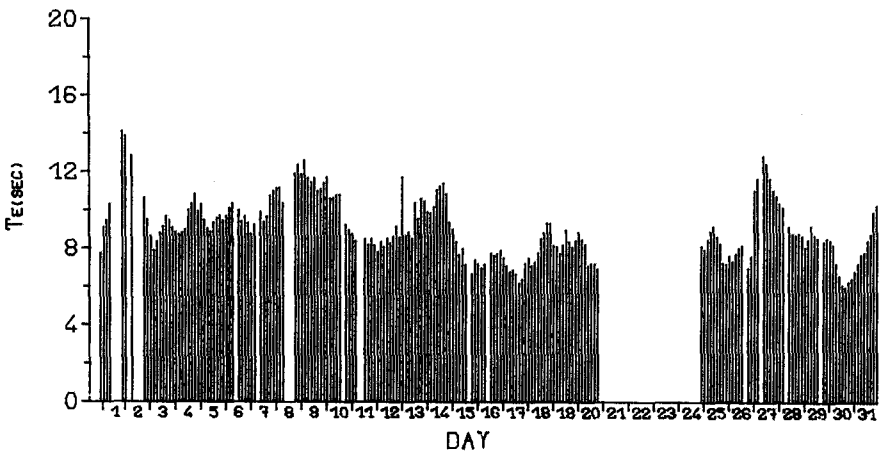
TIME SERIES OF T_E

S.UIST DEEPWATER WAVERIDER

Fig. 1.11



SEP 1980



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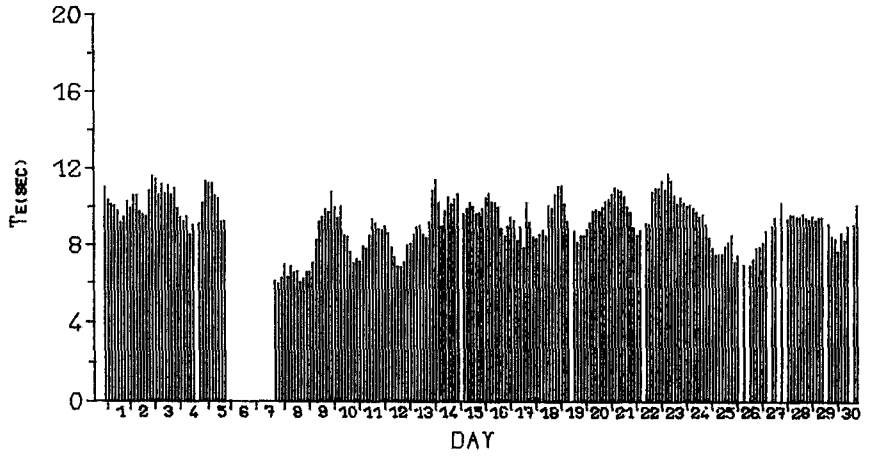

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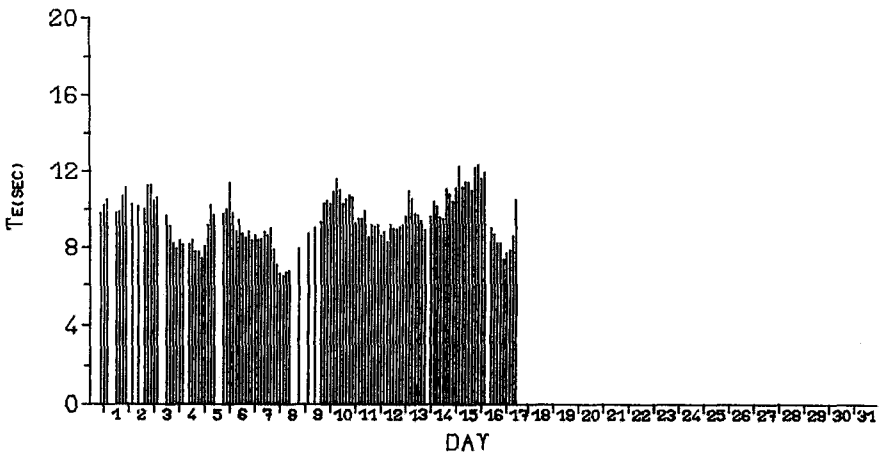
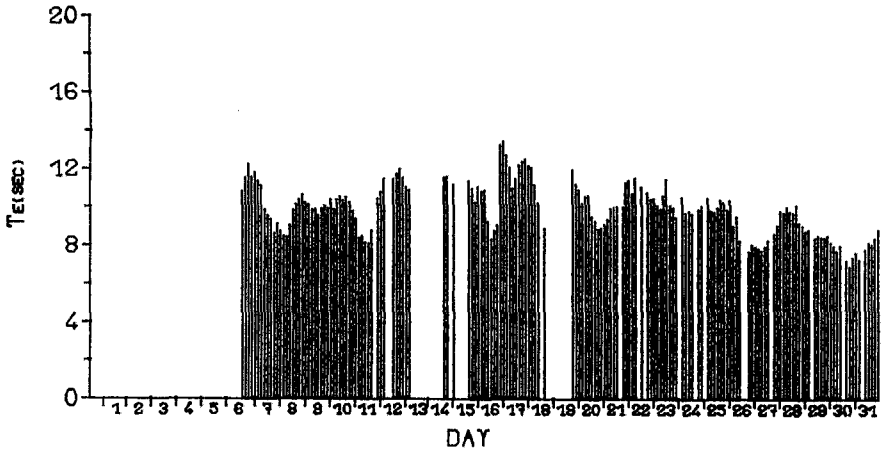


DEC 1980

TIME SERIES OF T_E

S.UIST DEEPWATER WAVERIDER

Fig. 1.12



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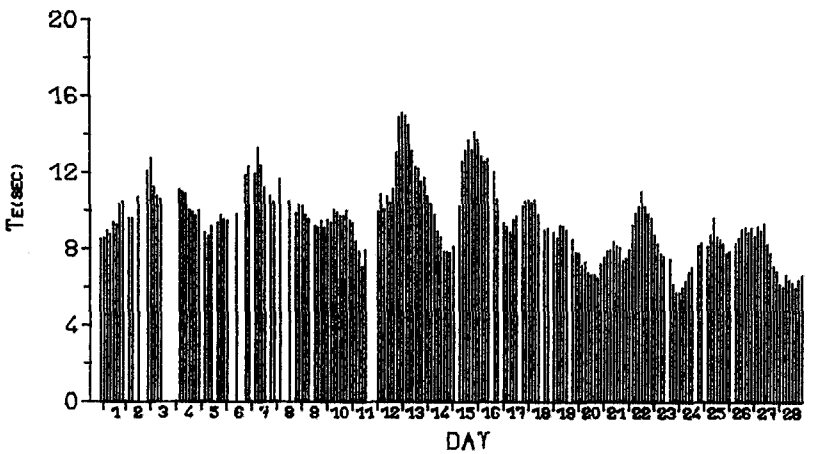

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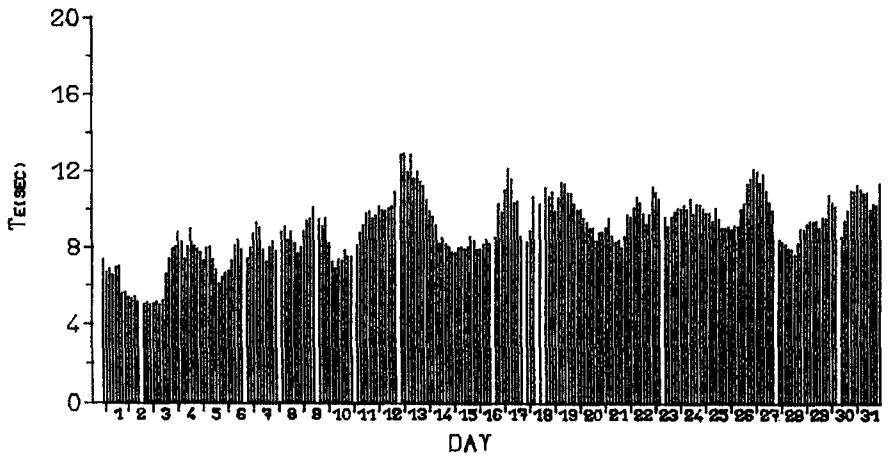

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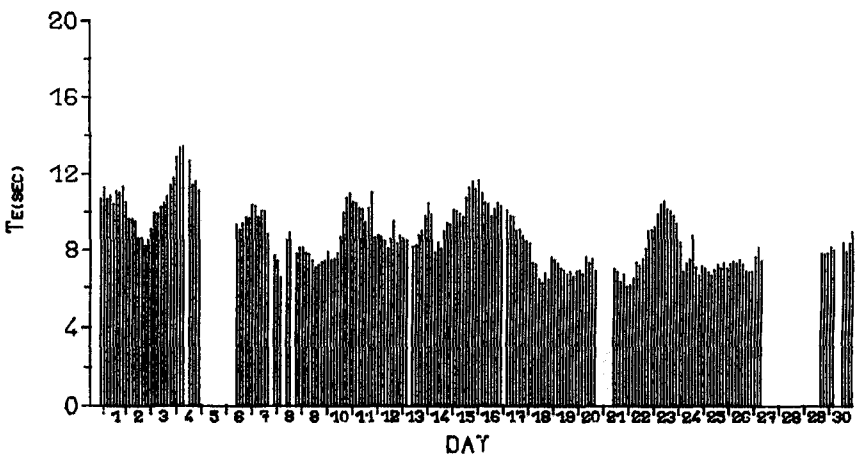
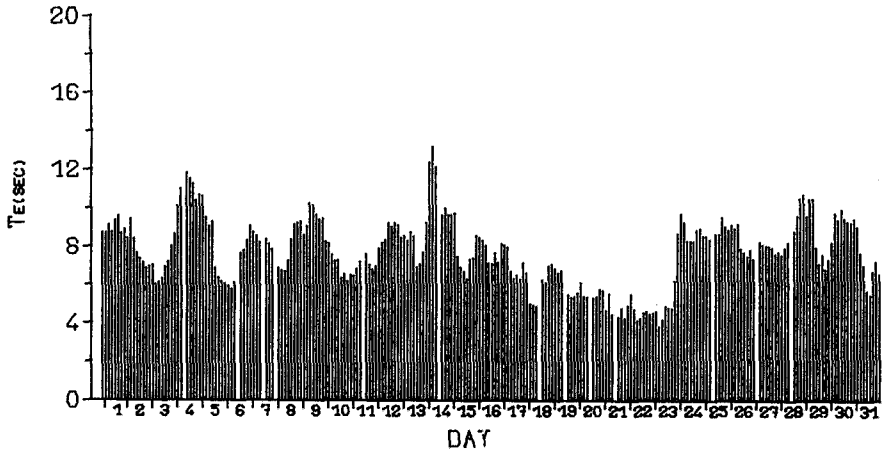


APR 1981

TIME SERIES OF T_E

S.UIST DEEPWATER WAVERIDER

Fig. 1.13



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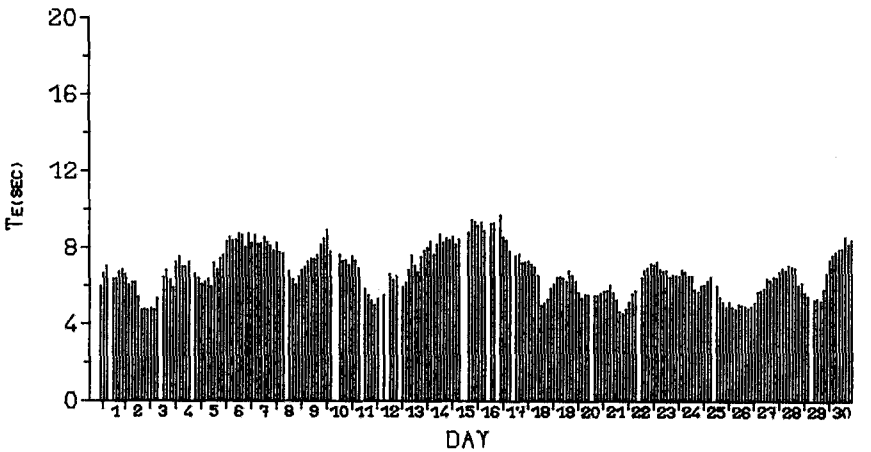

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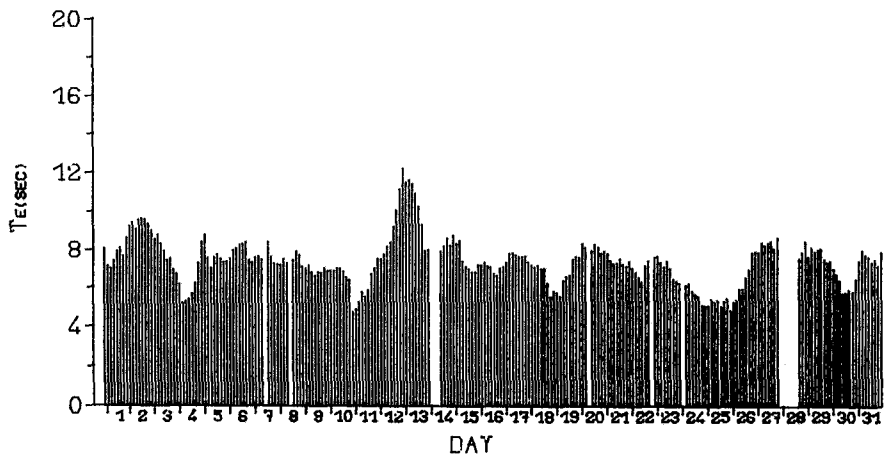

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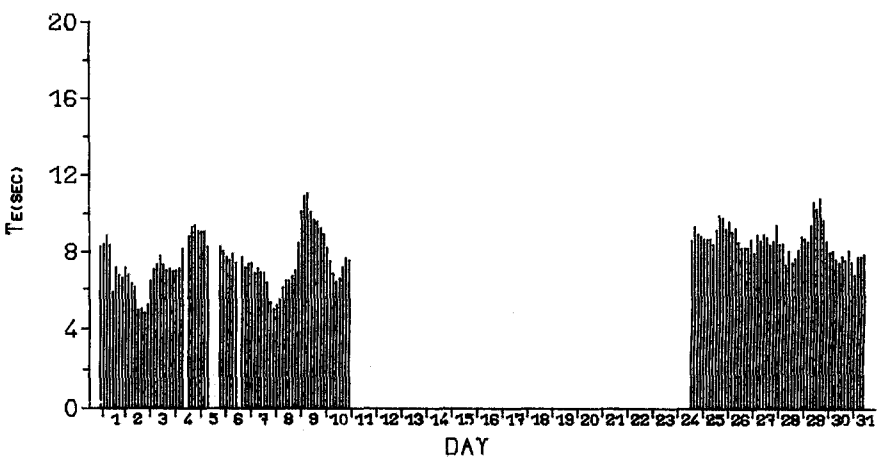
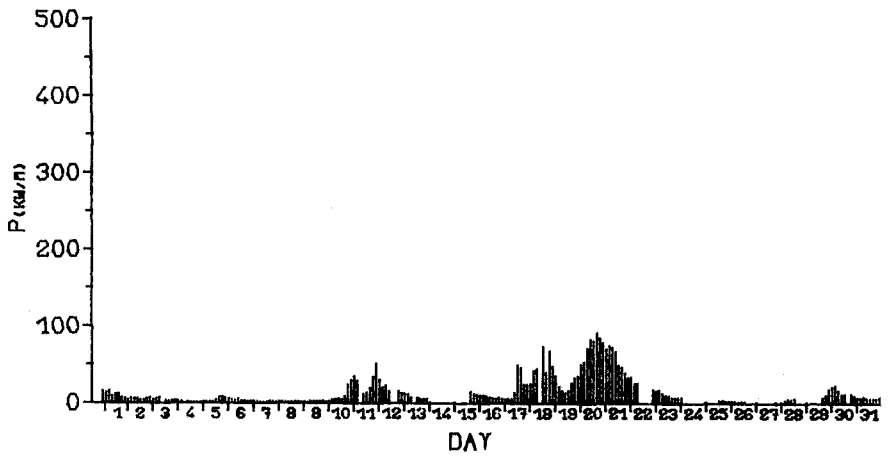


AUG 1981

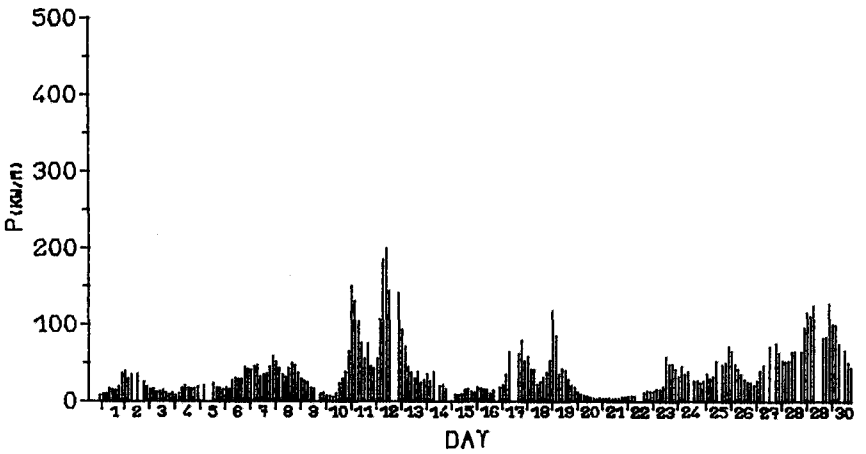
TIME SERIES OF T_E

S.UIST DEEPWATER WAVERIDER

Fig. 1.14



AUG 1980

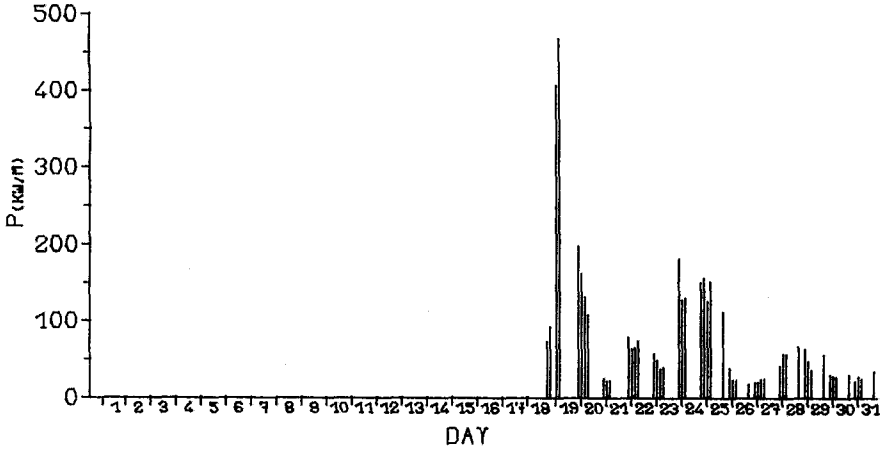


SEP 1980

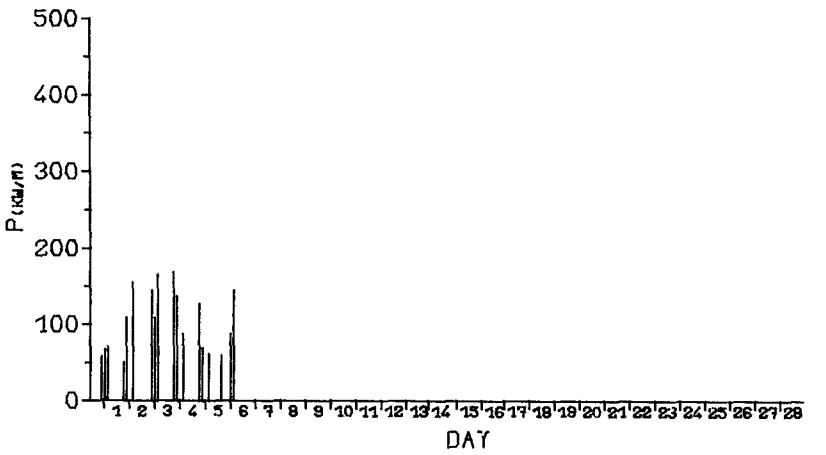
TIME SERIES OF POWER

S.UIST OFFSHORE WAVERIDER

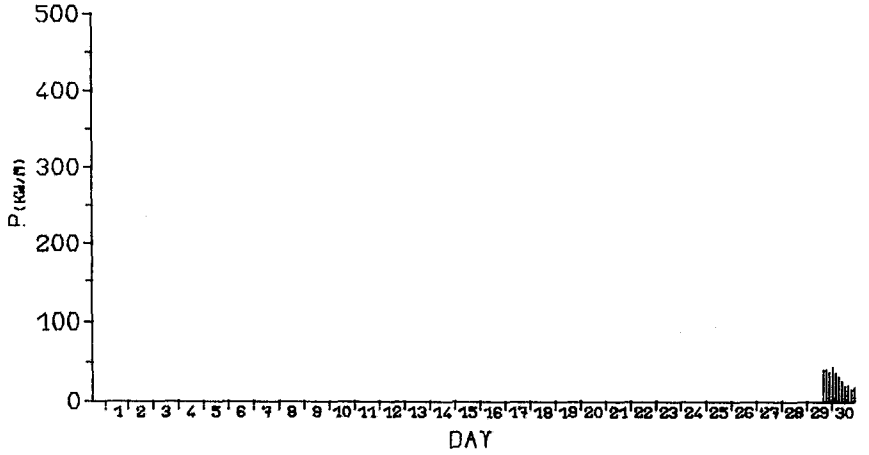
Fig. 2.1



JAN 1981



FEB 1981

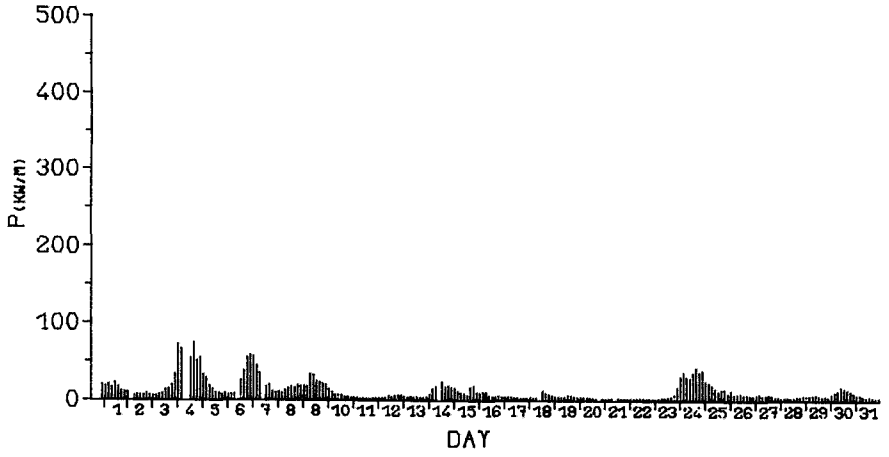


APR 1981

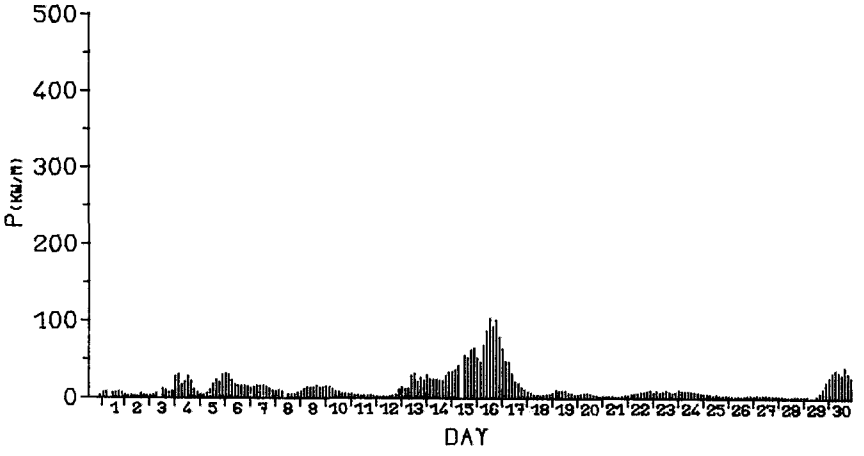
TIME SERIES OF POWER

S.UIST OFFSHORE WAVERIDER

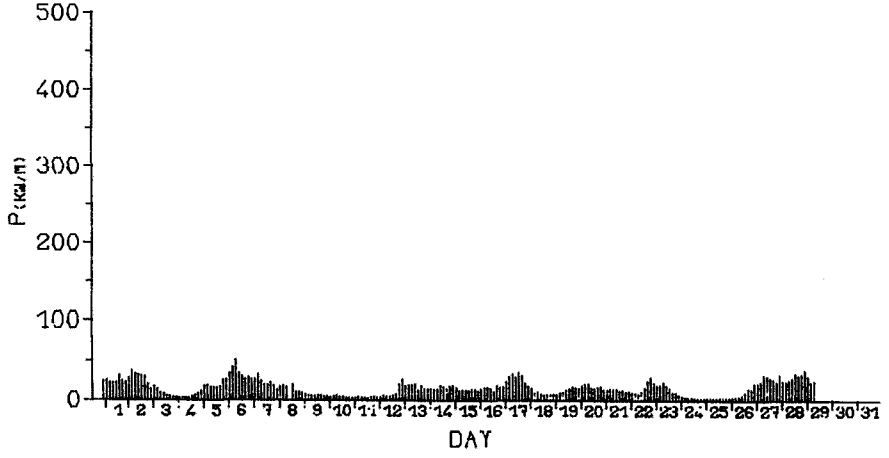
Fig. 2.2



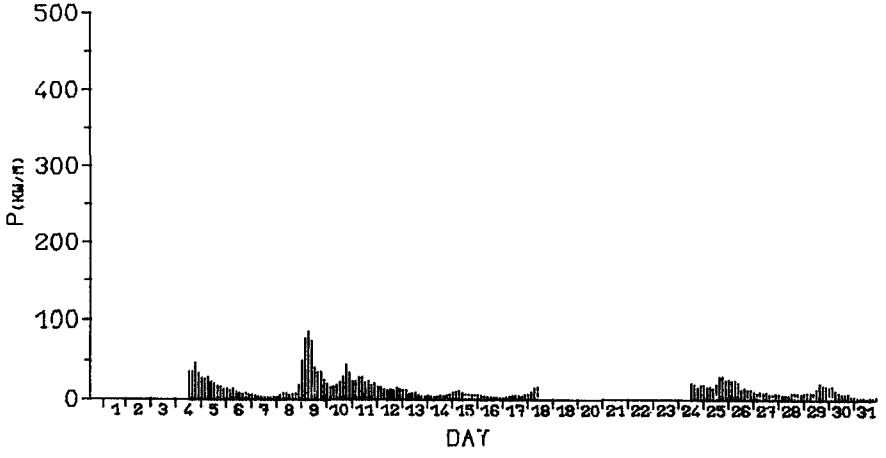
MAY 1981



JUN 1981



JUL 1981

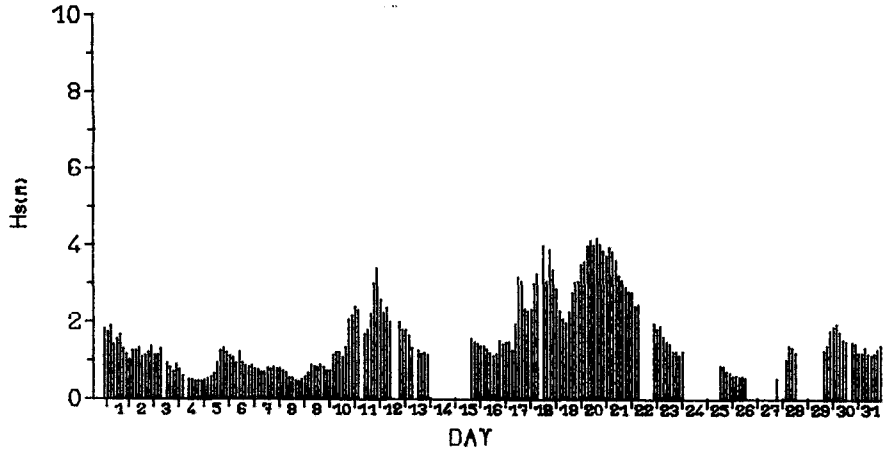


AUG 1981

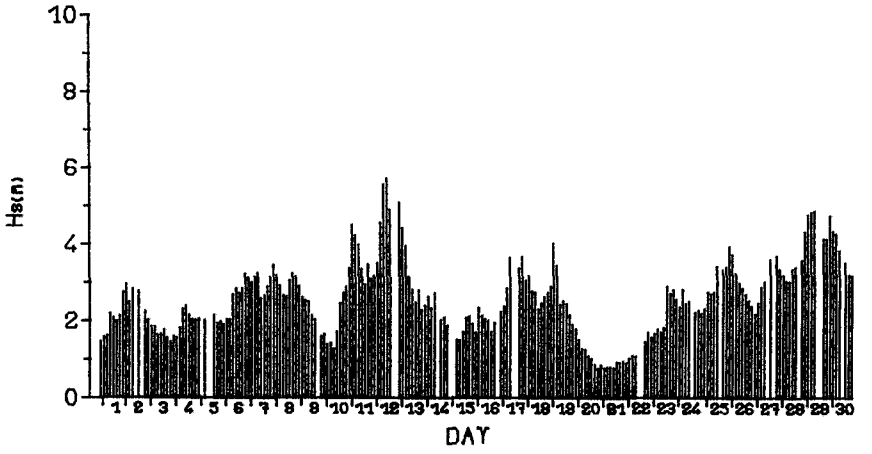
TIME SERIES OF POWER

S.UIST OFFSHORE WAVERIDER

Fig. 2.3



AUG 1980

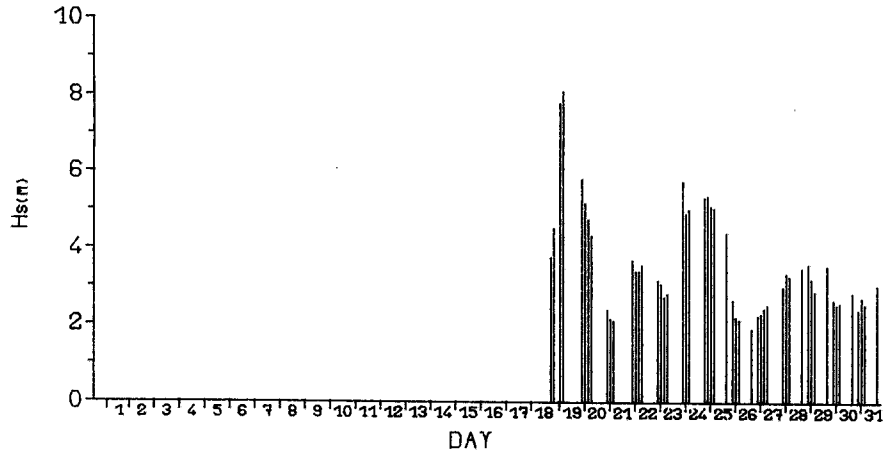


SEP 1980

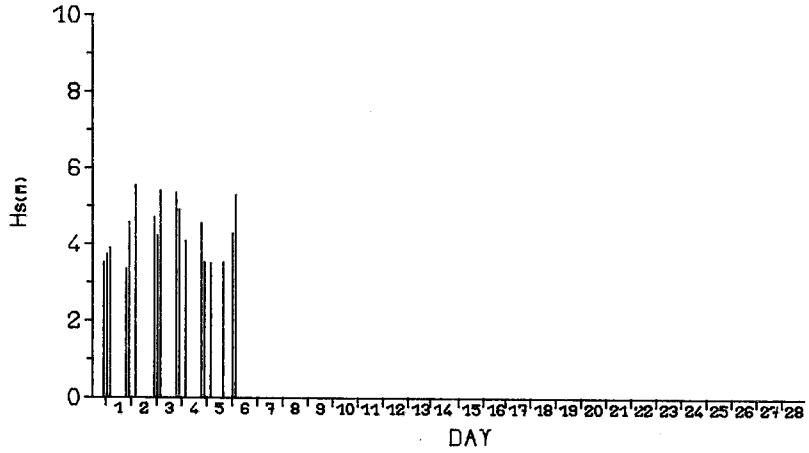
TIME SERIES OF Hs

S.UIST OFFSHORE WAVERIDER

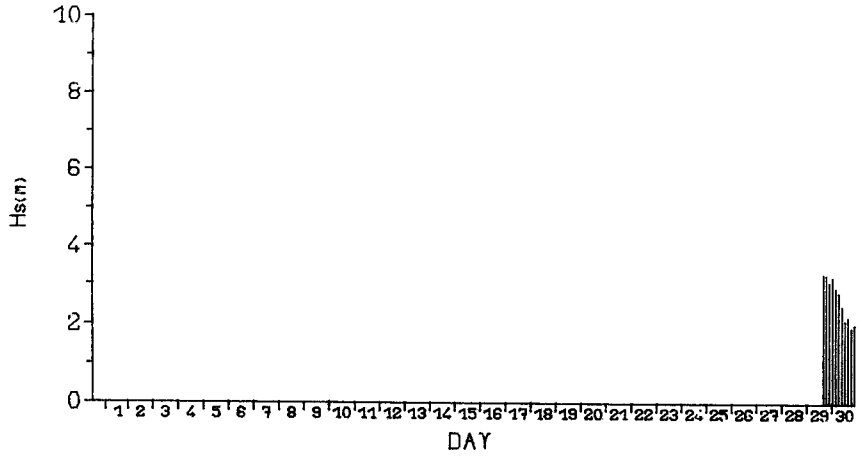
Fig. 2.4



JAN 1981



FEB 1981

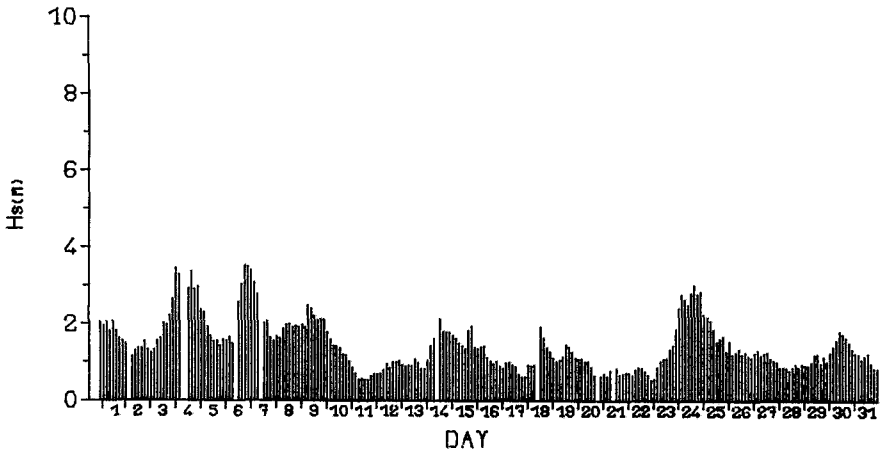


APR 1981

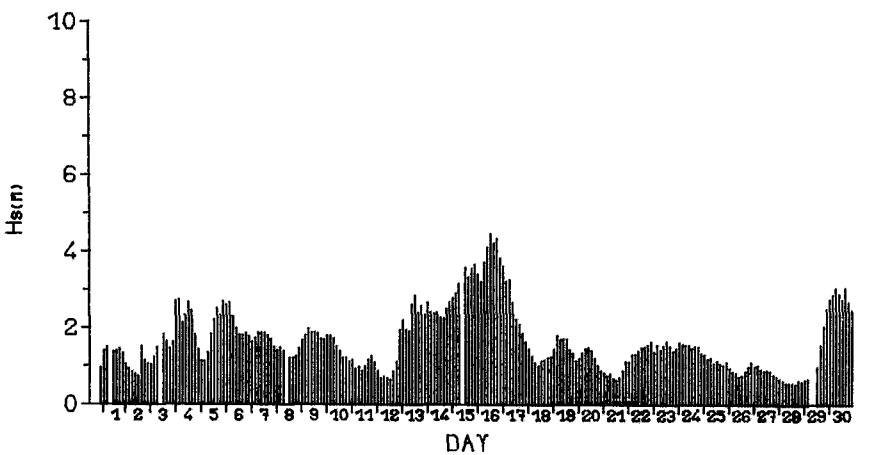
TIME SERIES OF Hs

S.UIST OFFSHORE WAVERIDER

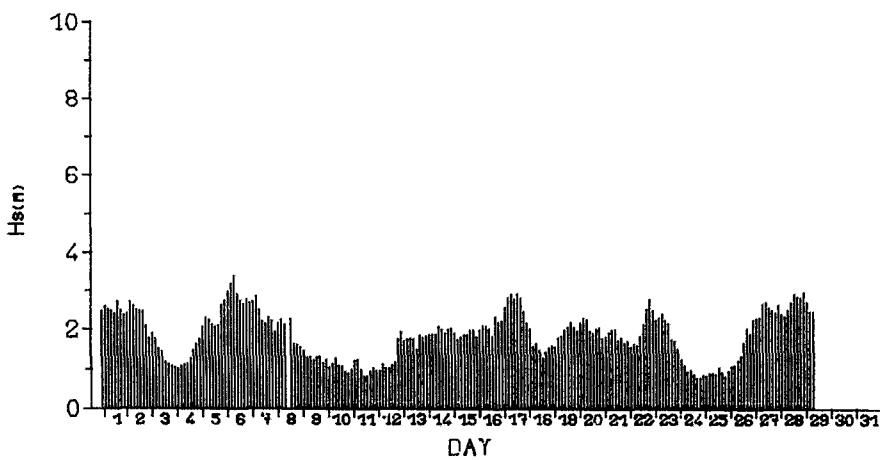
Fig. 2.5



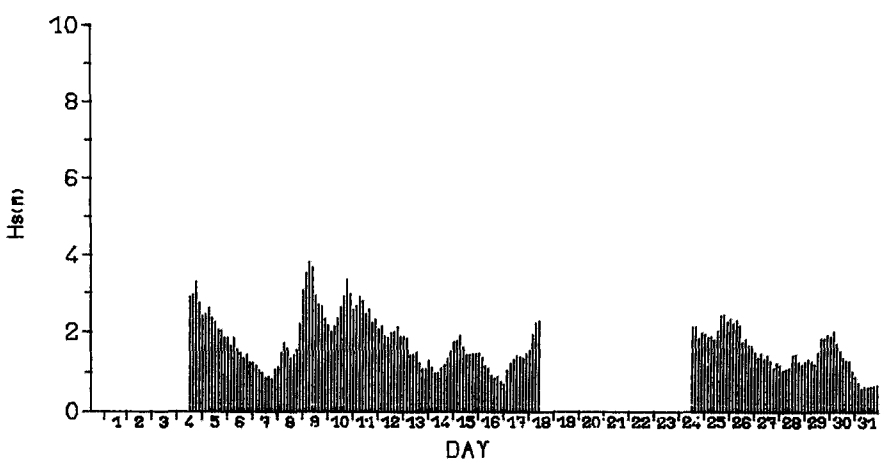
MAY 1981



JUN 1981



JUL 1981

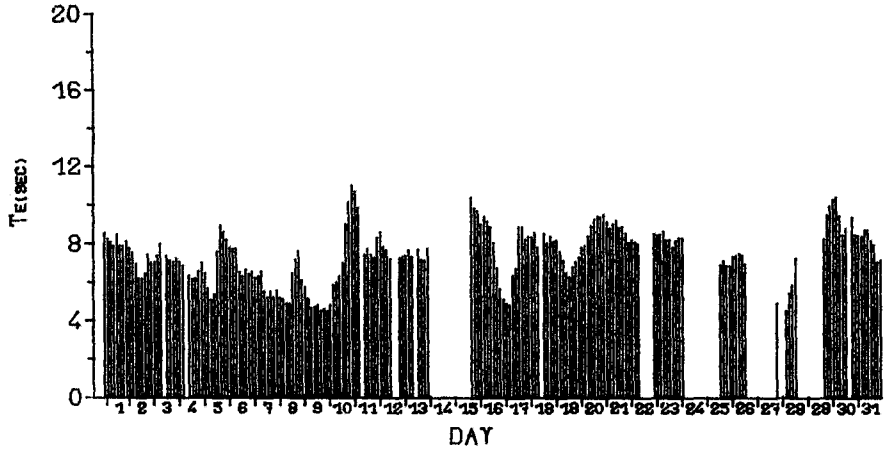


AUG 1981

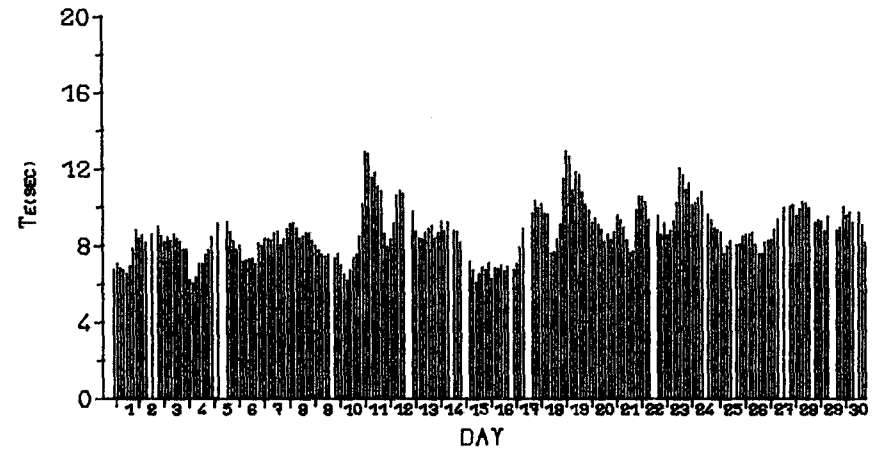
TIME SERIES OF Hs

S.UIST OFFSHORE WAVERIDER

Fig. 2.6



AUG 1980

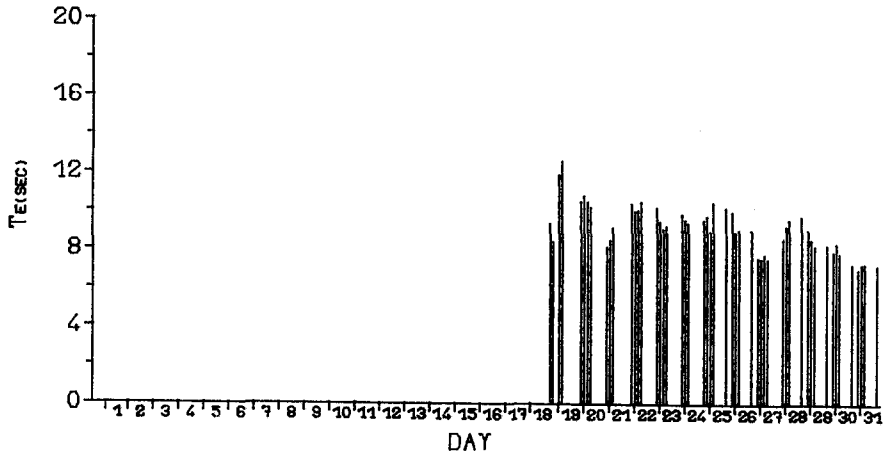


SEP 1980

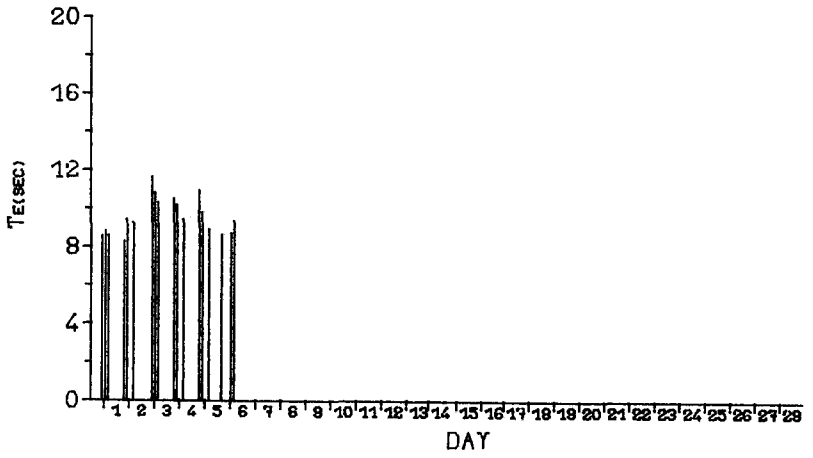
TIME SERIES OF T_E

S.UIST OFFSHORE WAVERIDER

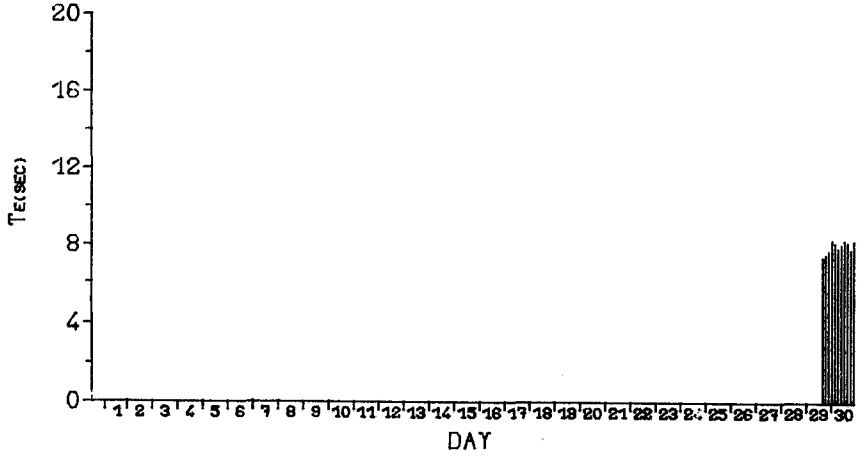
Fig. 2.7



JAN 1981



FEB 1981

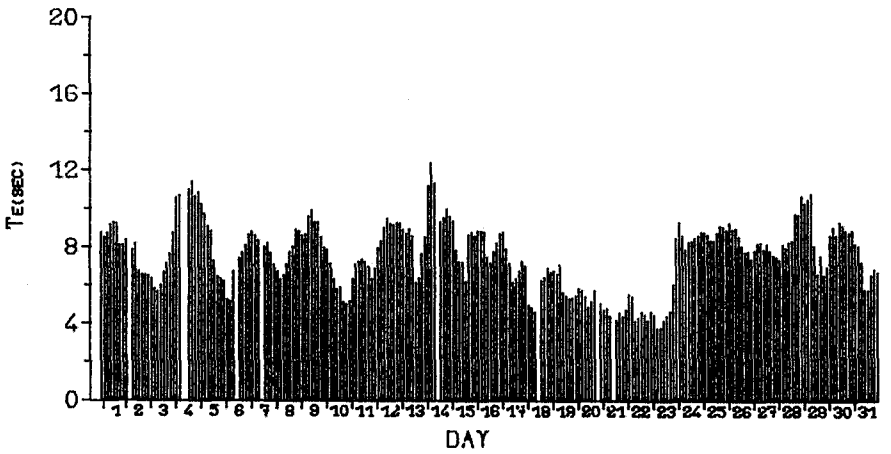


APR 1981

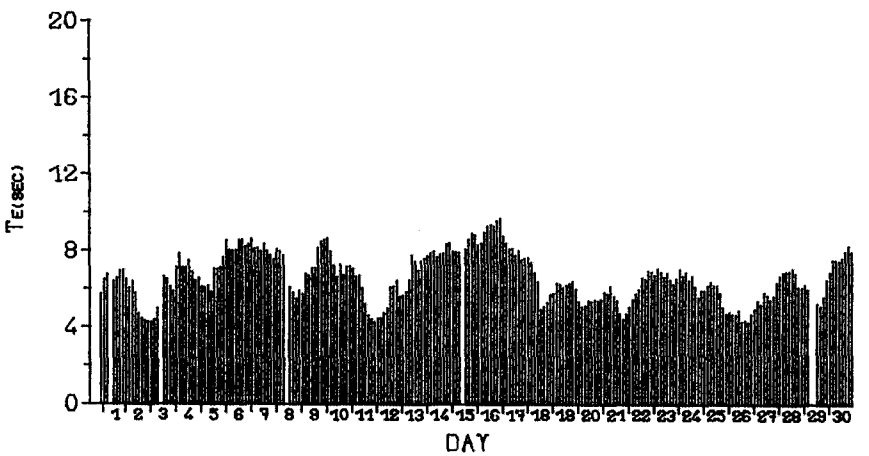
TIME SERIES OF T_E

S.UIST OFFSHORE WAVERIDER

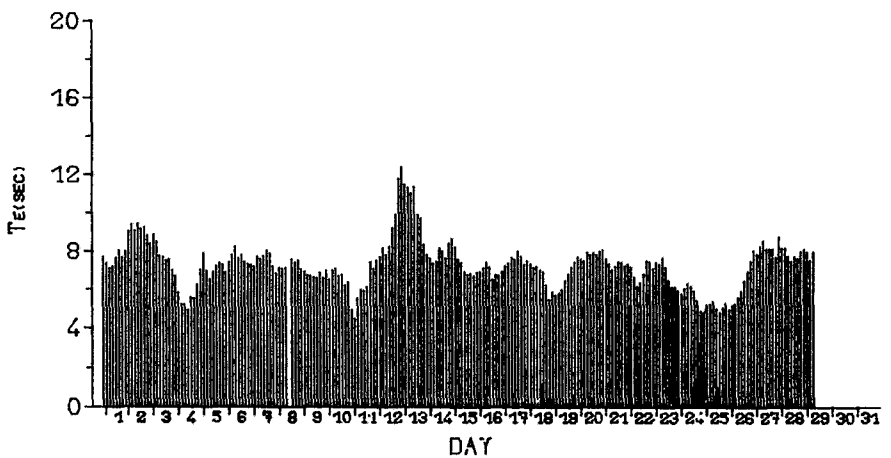
Fig. 2.8



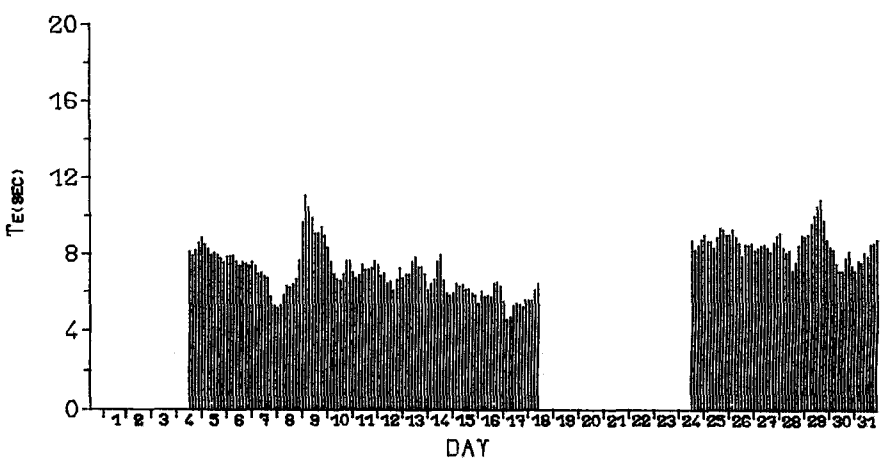
MAY 1981



JUN 1981



JUL 1981

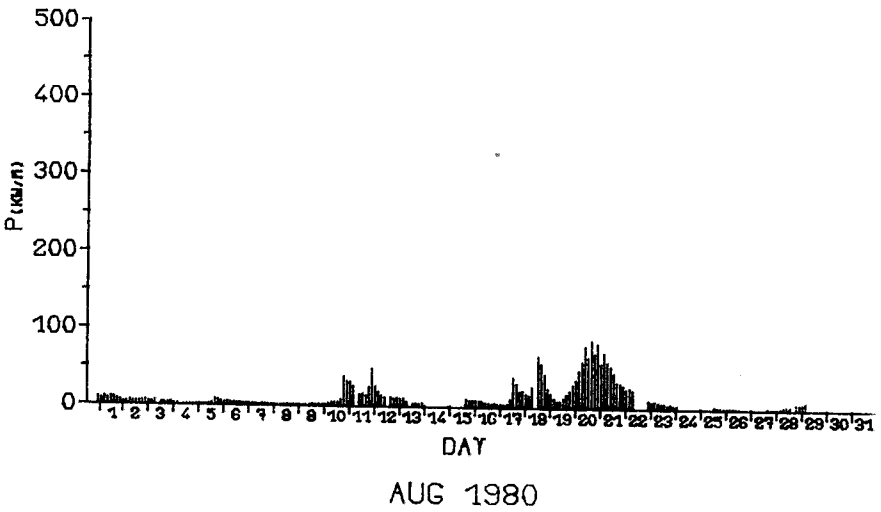


AUG 1981

TIME SERIES OF T_E

S.UIST OFFSHORE WAVERIDER

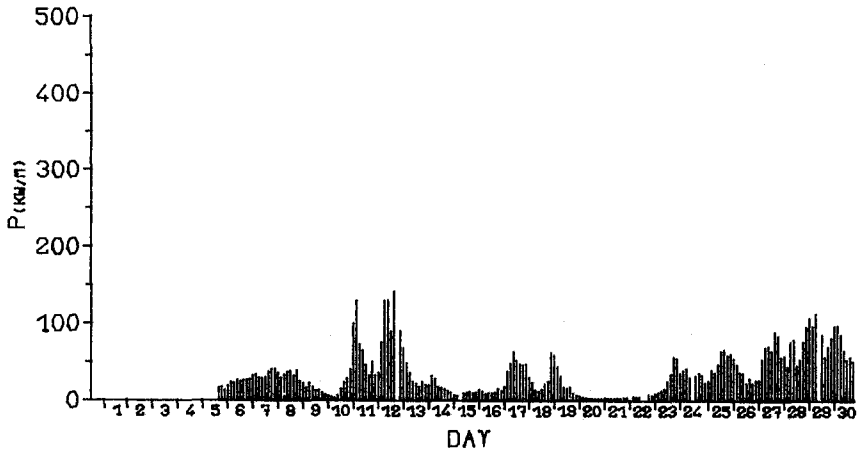
Fig. 2.9



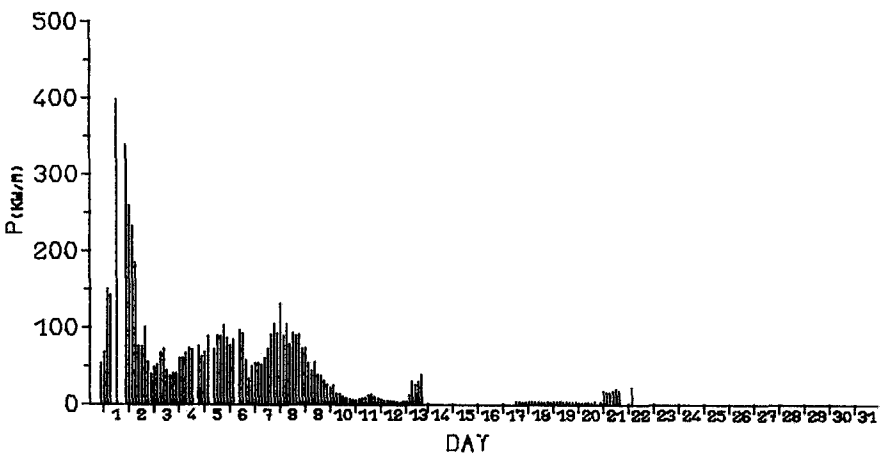
TIME SERIES OF POWER

S.UIST NEARSHORE 2 WAVERIDER

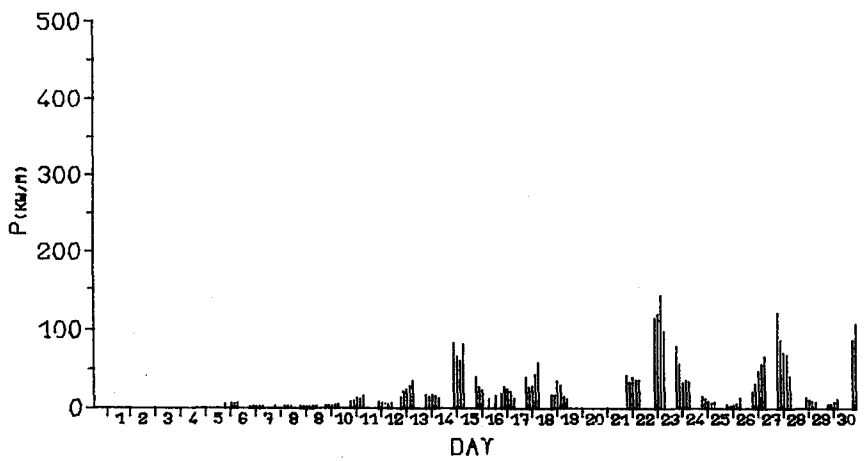
Fig. 3.1



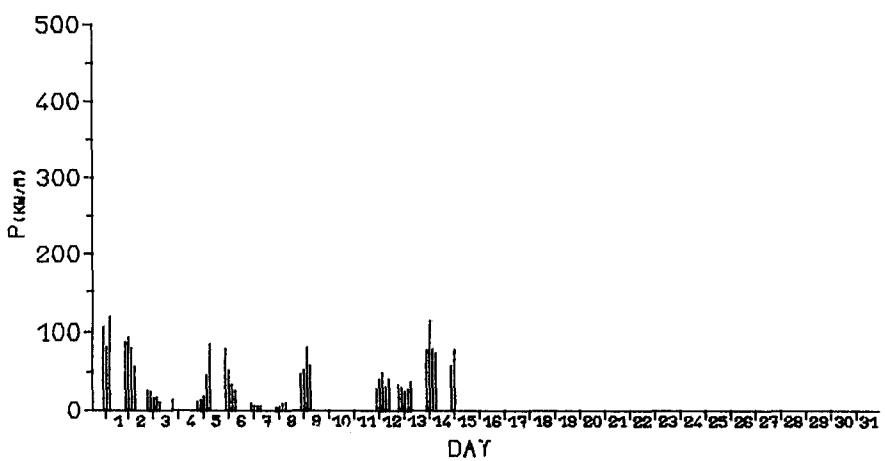
SEP 1980



OCT 1980



NOV 1980

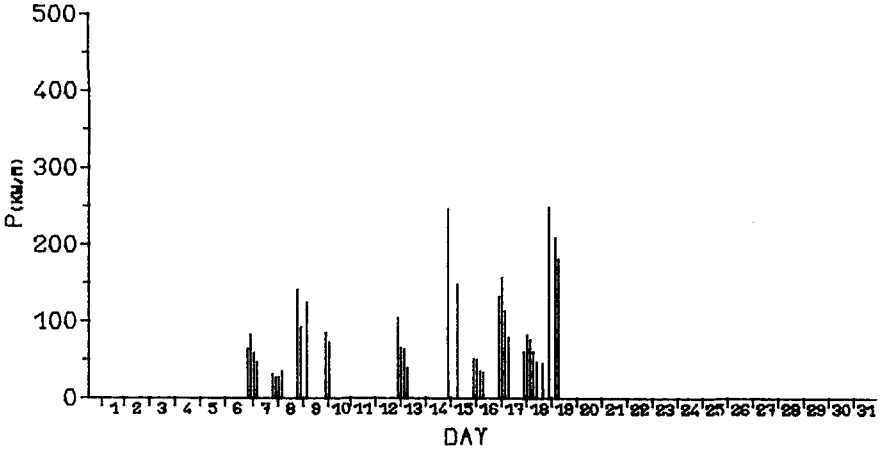


DEC 1980

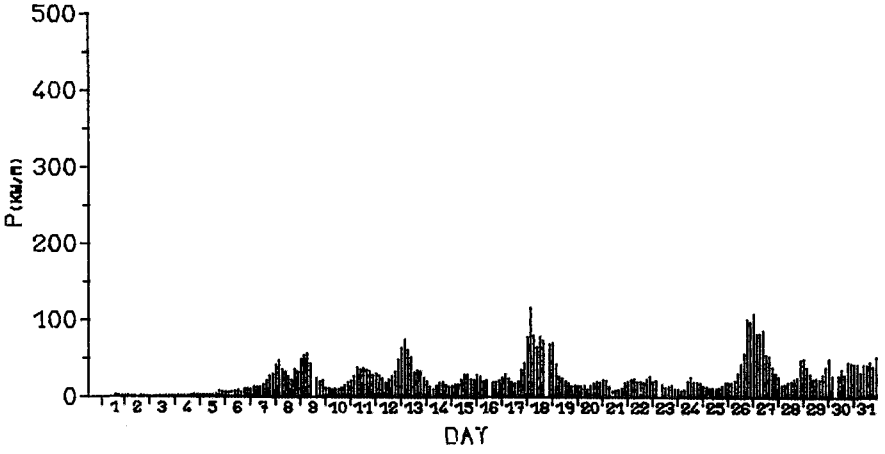
TIME SERIES OF POWER

S.UIST NEARSHORE 2 WAVERIDER

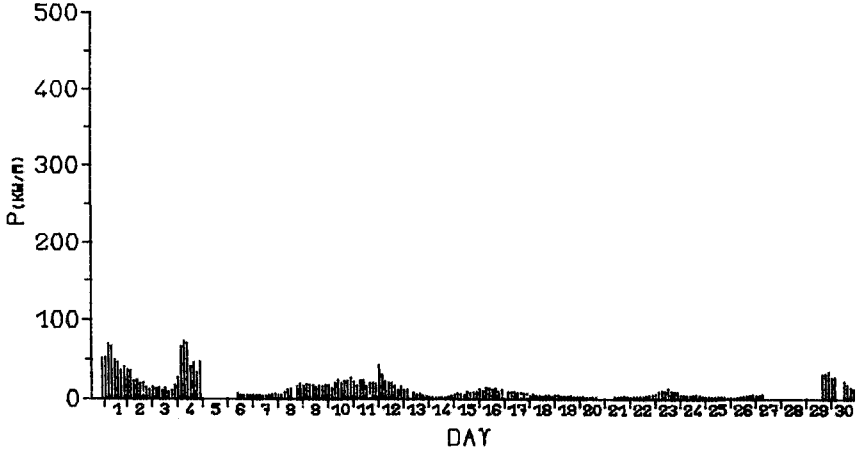
Fig. 3.2



JAN 1981



MAR 1981

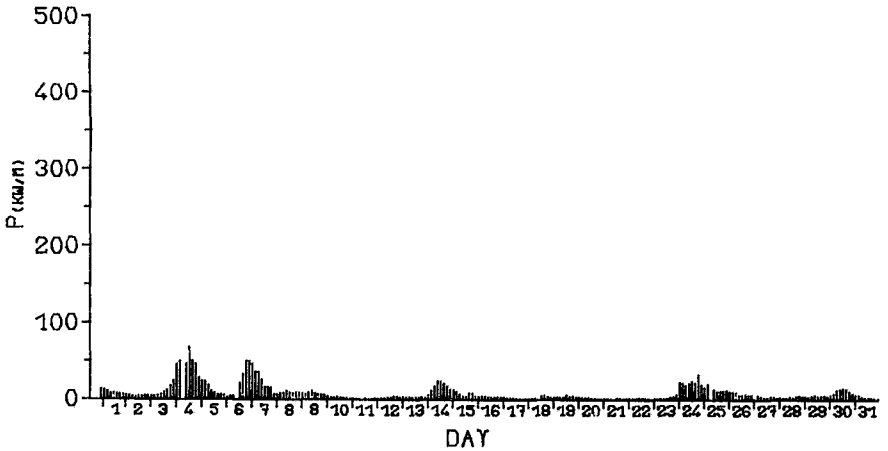


APR 1981

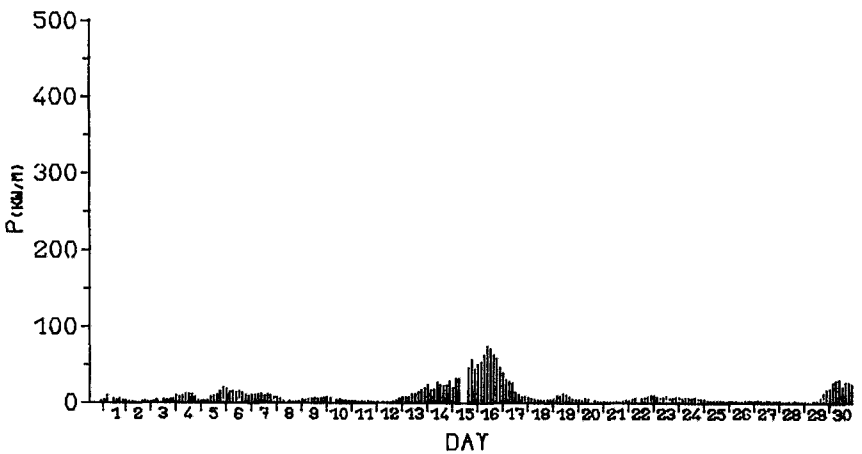
TIME SERIES OF POWER

S.UIST NEARSHORE 2 & 3 WAVERIDER

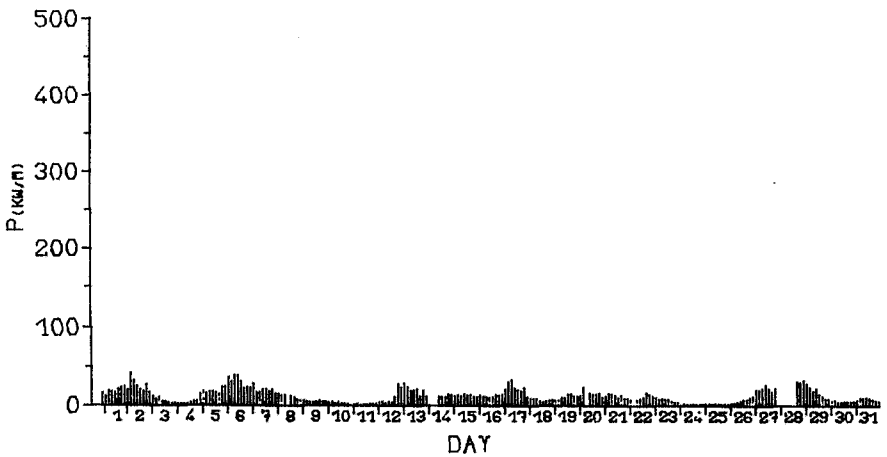
Fig. 3.3



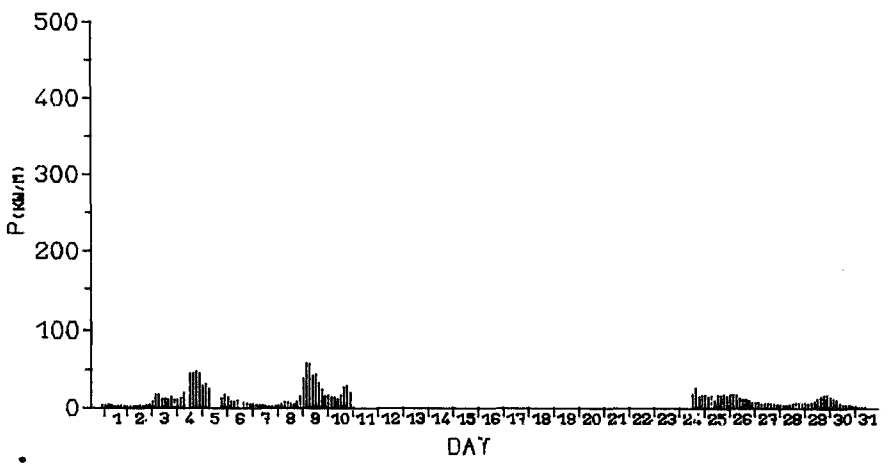
MAY 1981



JUN 1981



JUL 1981

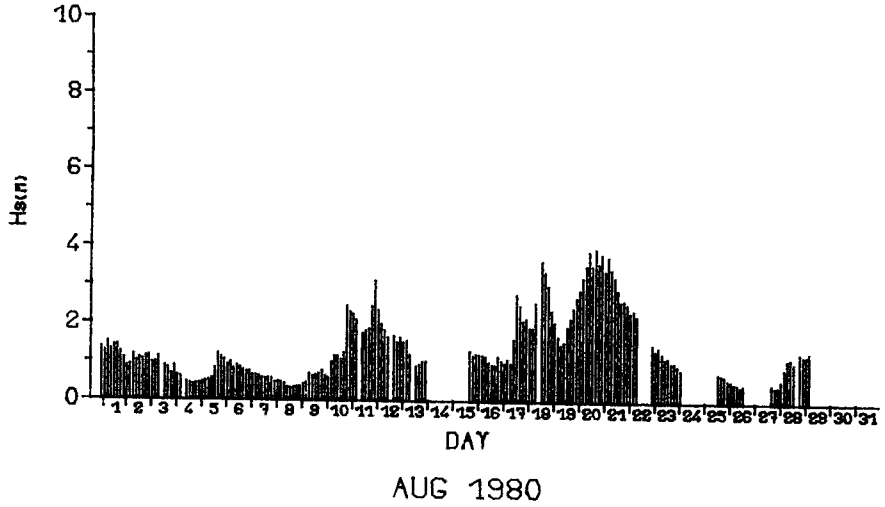


AUG 1981

TIME SERIES OF POWER

S.UIST NEARSHORE 3 WAVERIDER

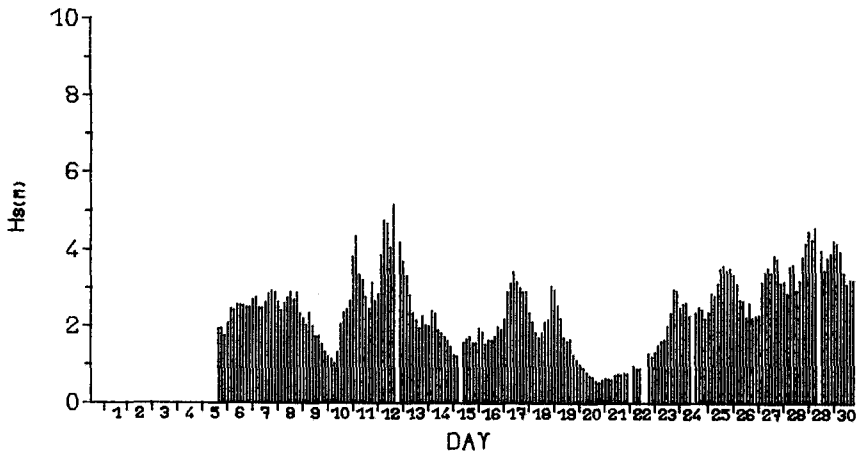
Fig. 3.4



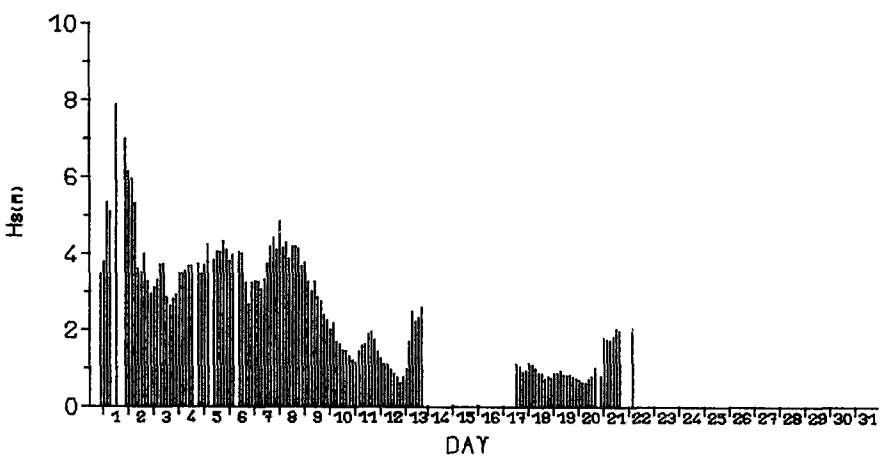
TIME SERIES OF Hs

S.UIST NEARSHORE 2 WAVERIDER

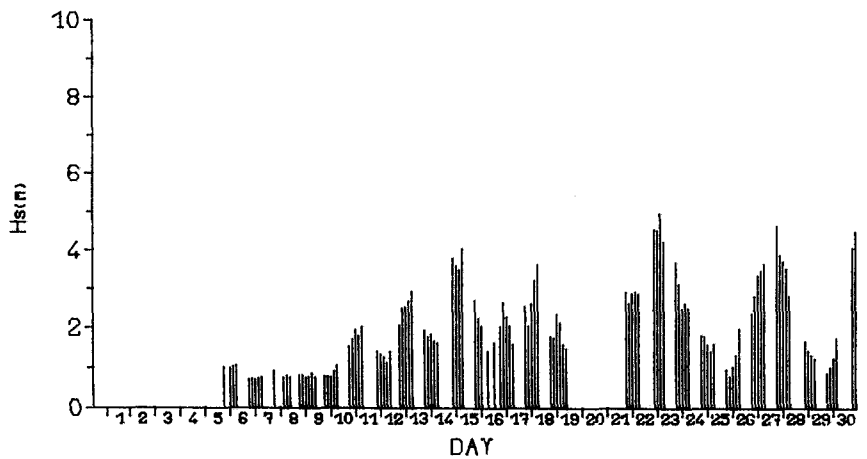
Fig. 3.5



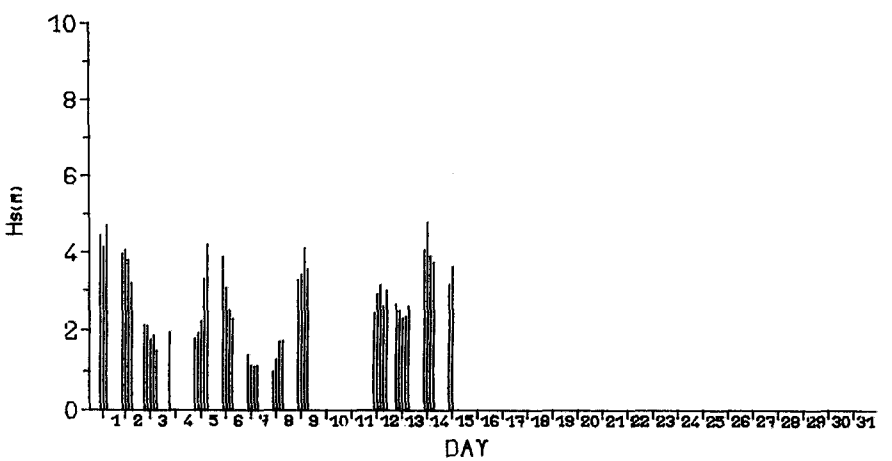
SEP 1980



OCT 1980



NOV 1980

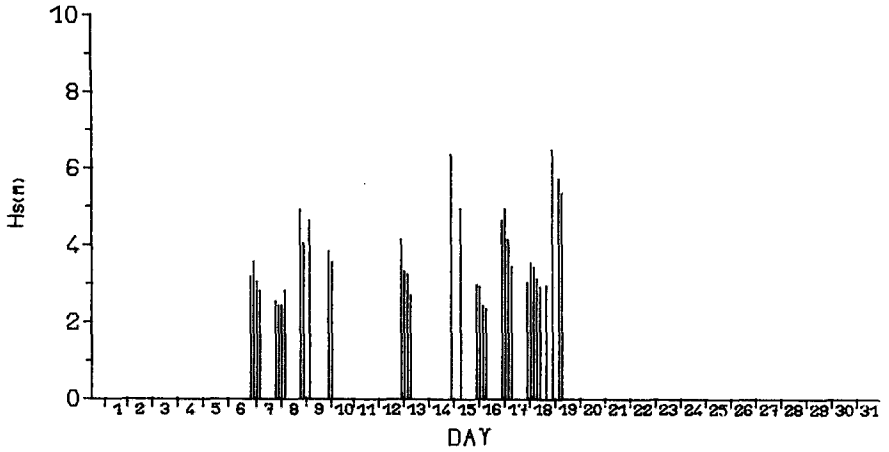


DEC 1980

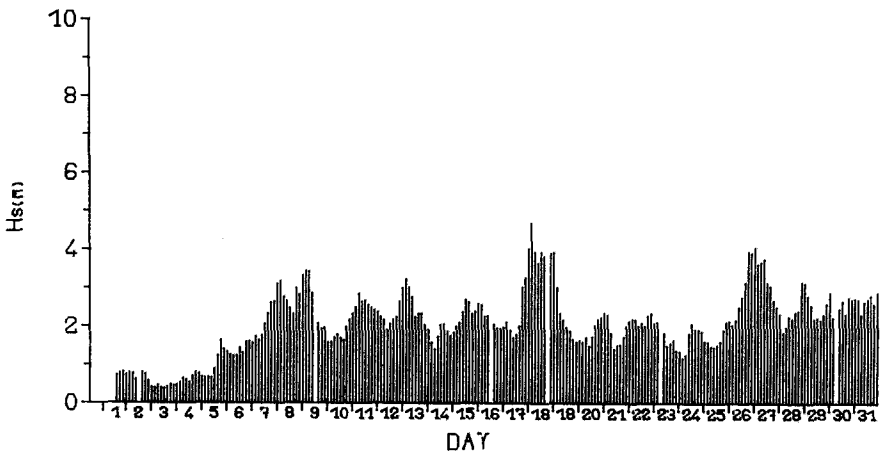
TIME SERIES OF Hs

S.UIST NEARSHORE 2 WAVERIDER

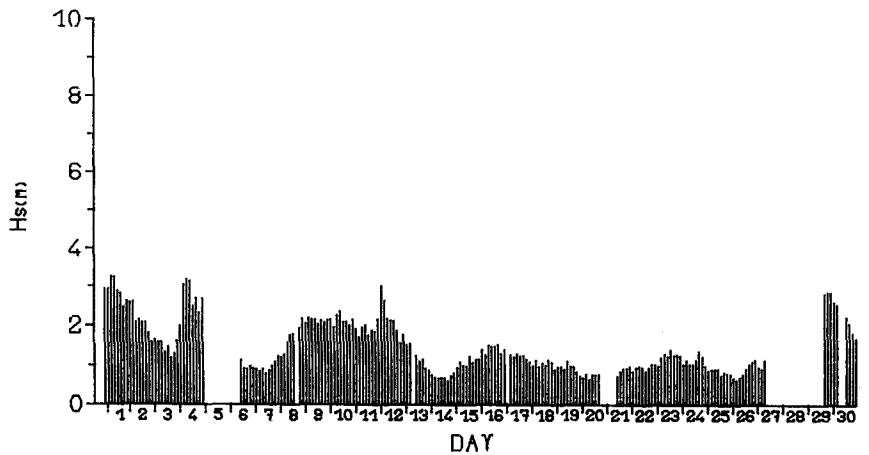
Fig. 3.6



JAN 1981



MAR 1981

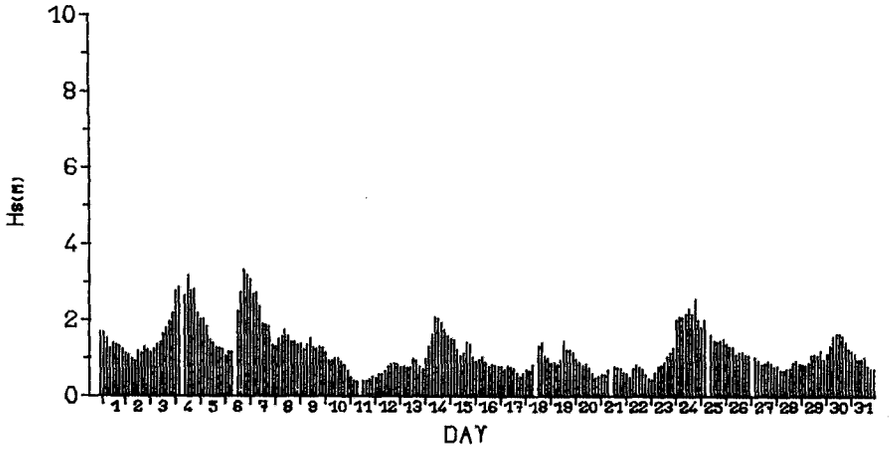


APR 1981

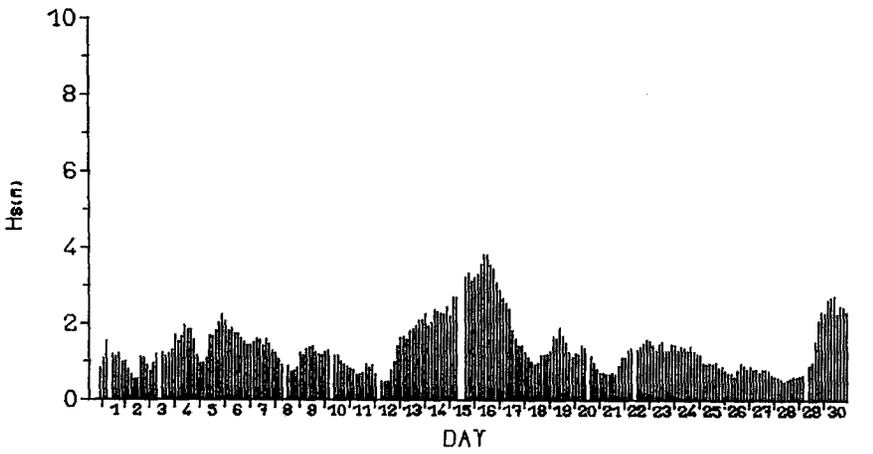
TIME SERIES OF Hs

S.UIST NEARSHORE 2 & 3 WAVERIDER

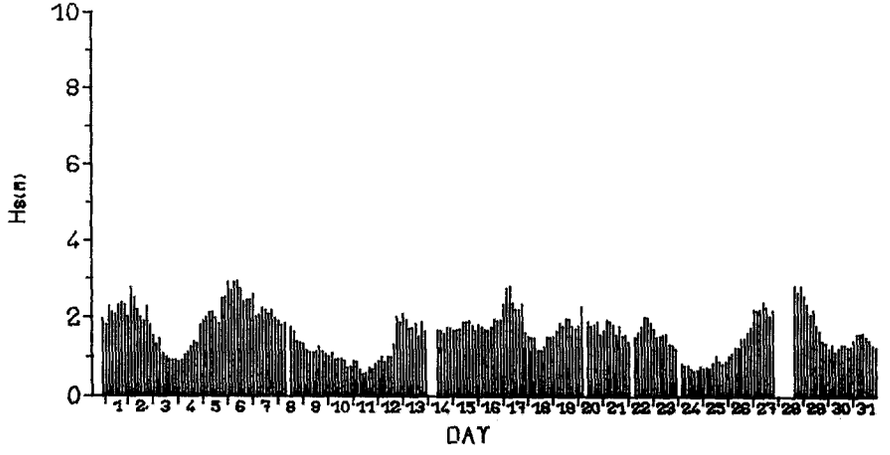
Fig. 3.7



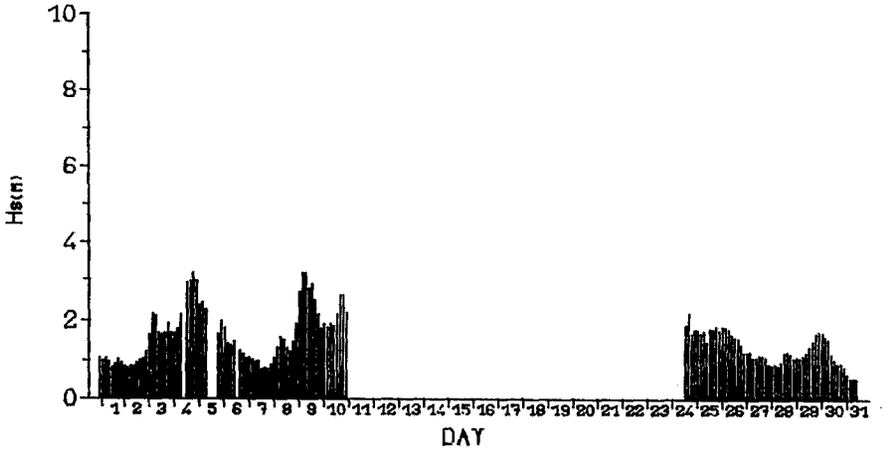
MAY 1981



JUN 1981



JUL 1981

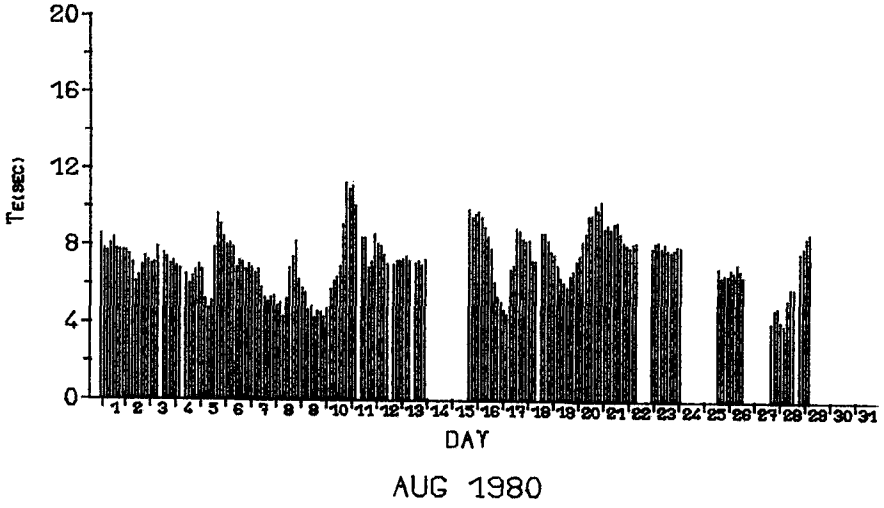


AUG 1981

TIME SERIES OF Hs

S.UIST NEARSHORE 3 WAVERIDER

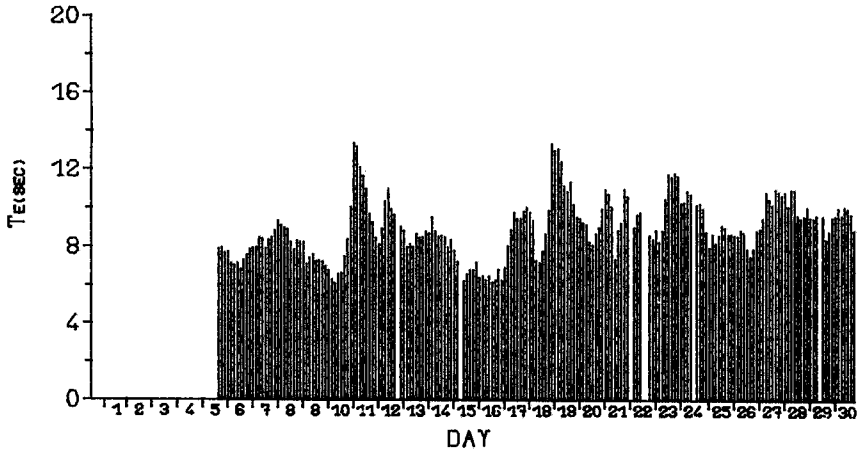
Fig. 3.8



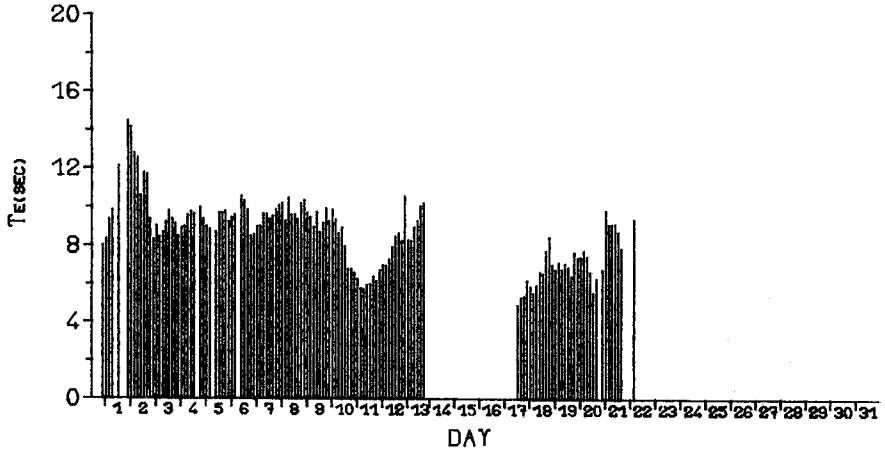
TIME SERIES OF T_E

S.UIST NEARSHORE 2 WAVERIDER

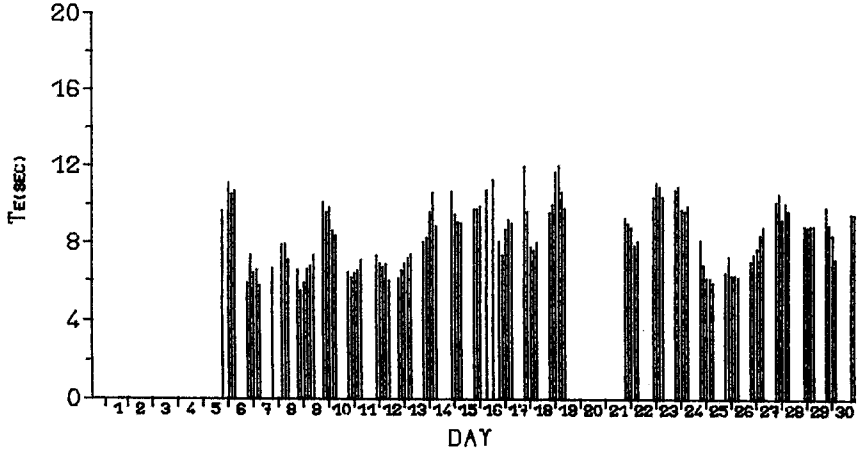
Fig. 3.9



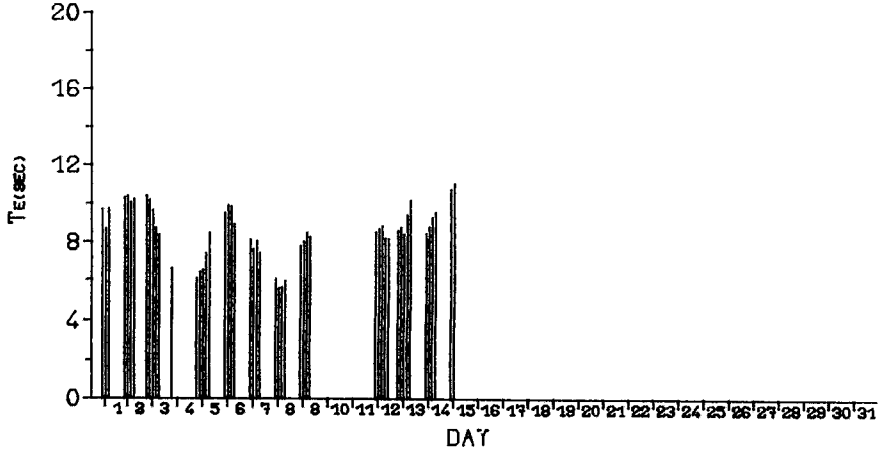
SEP 1980



OCT 1980



NOV 1980

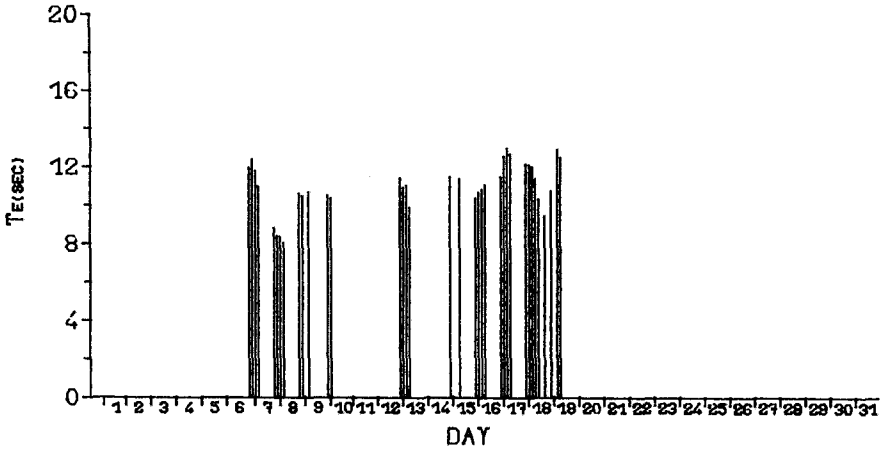


DEC 1980

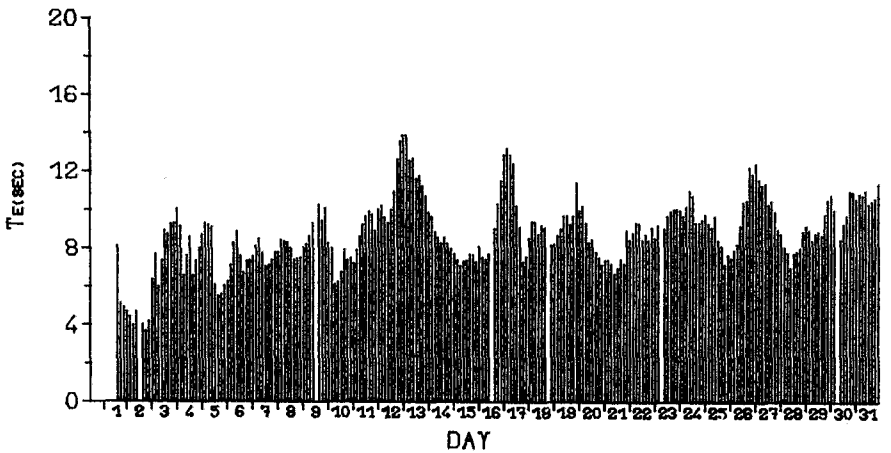
TIME SERIES OF T_E

S.UIST NEARSHORE 2 WAVERIDER

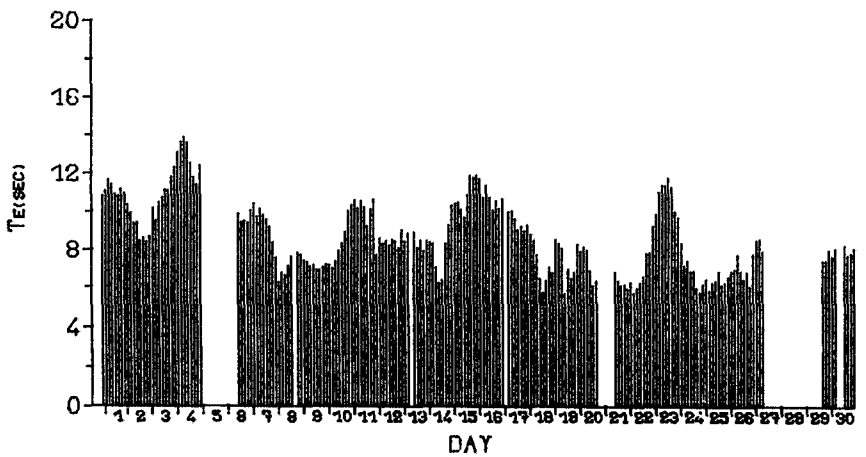
Fig. 3.10



JAN 1981



MAR 1981

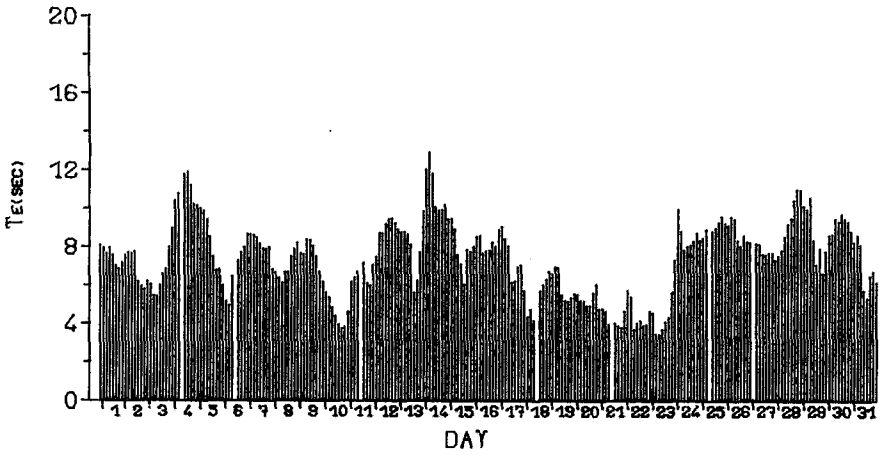


APR 1981

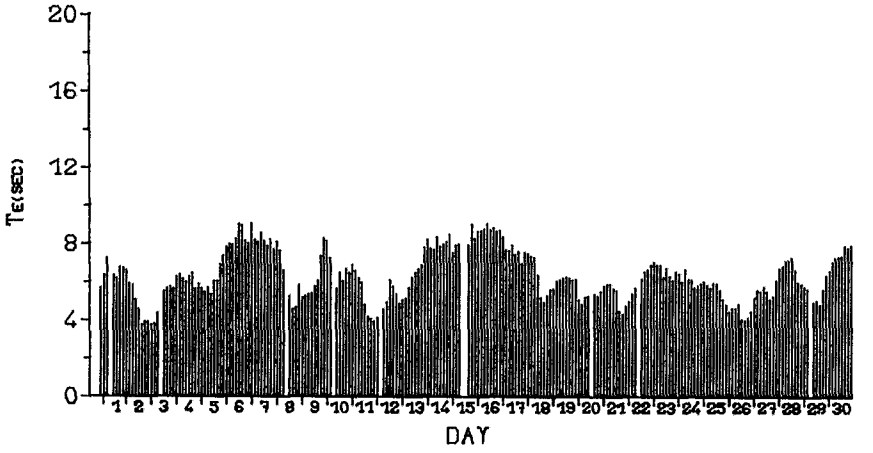
TIME SERIES OF T_E

S.UIST NEARSHORE 2 & 3 WAVERIDER

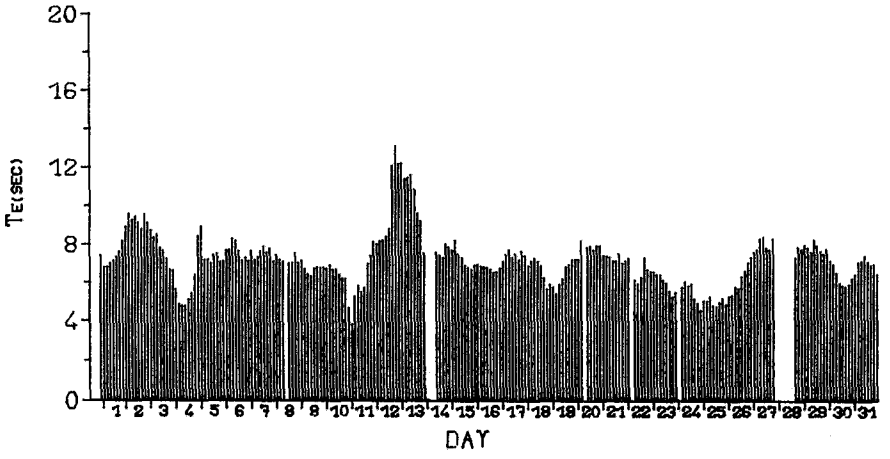
Fig. 3.11



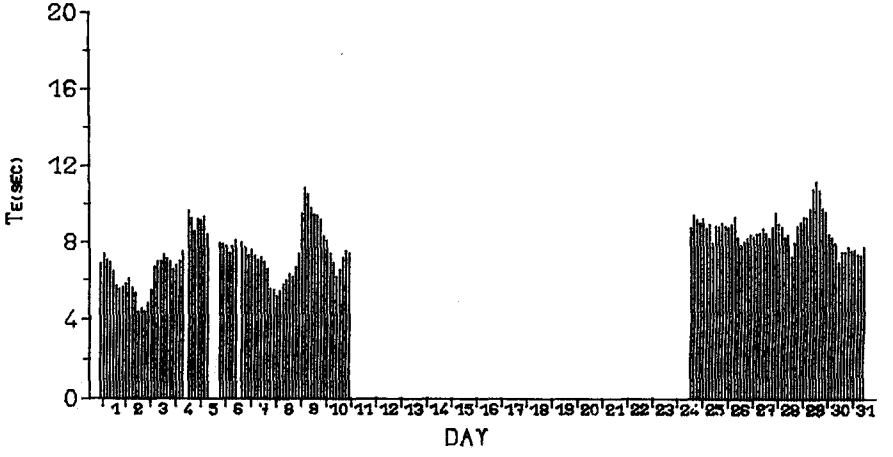
MAY 1981



JUN 1981



JUL 1981

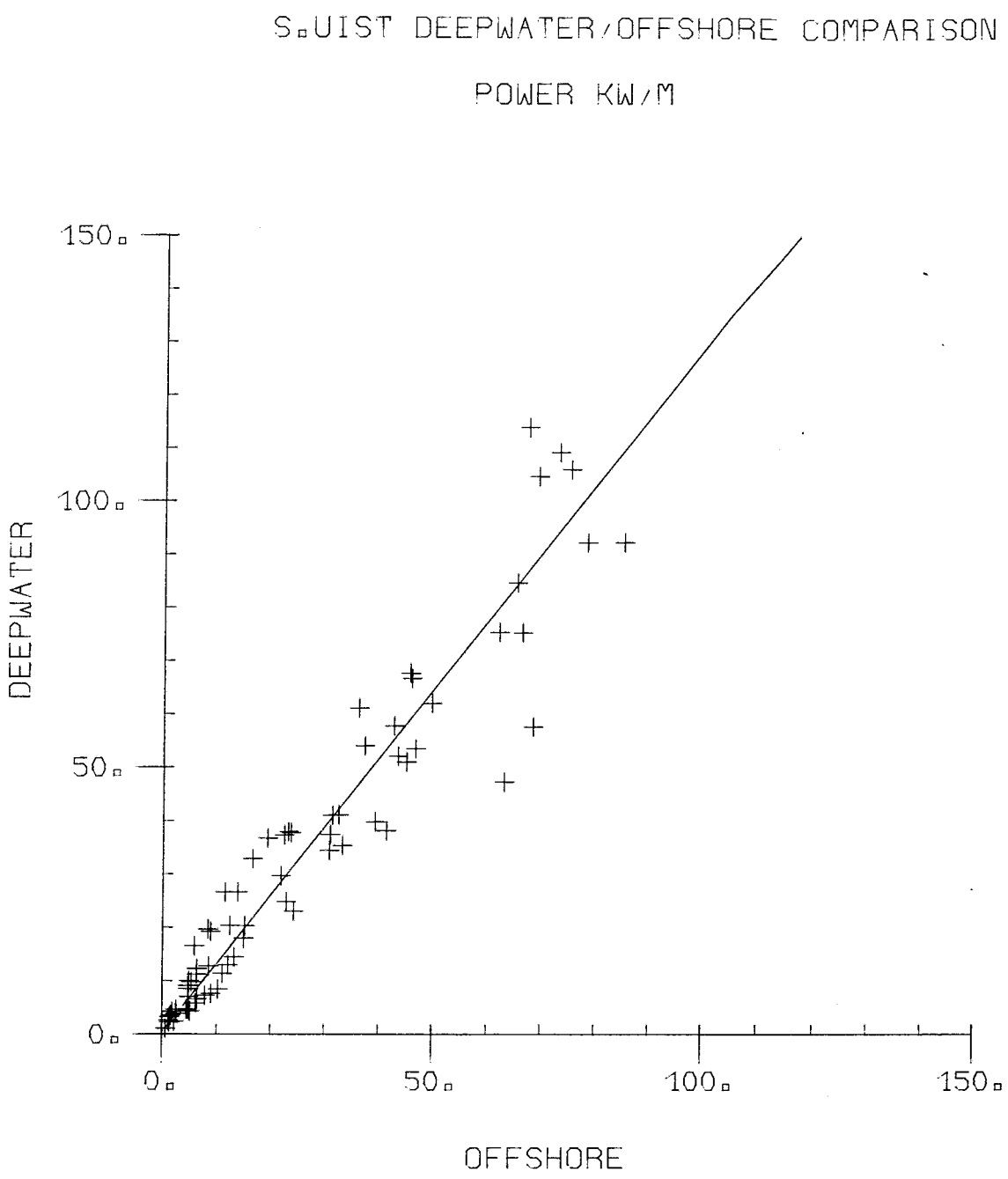


AUG 1981

TIME SERIES OF T_E

S.UIST NEARSHORE 3 WAVERIDER

Fig. 3.12



SLOPE =1.282

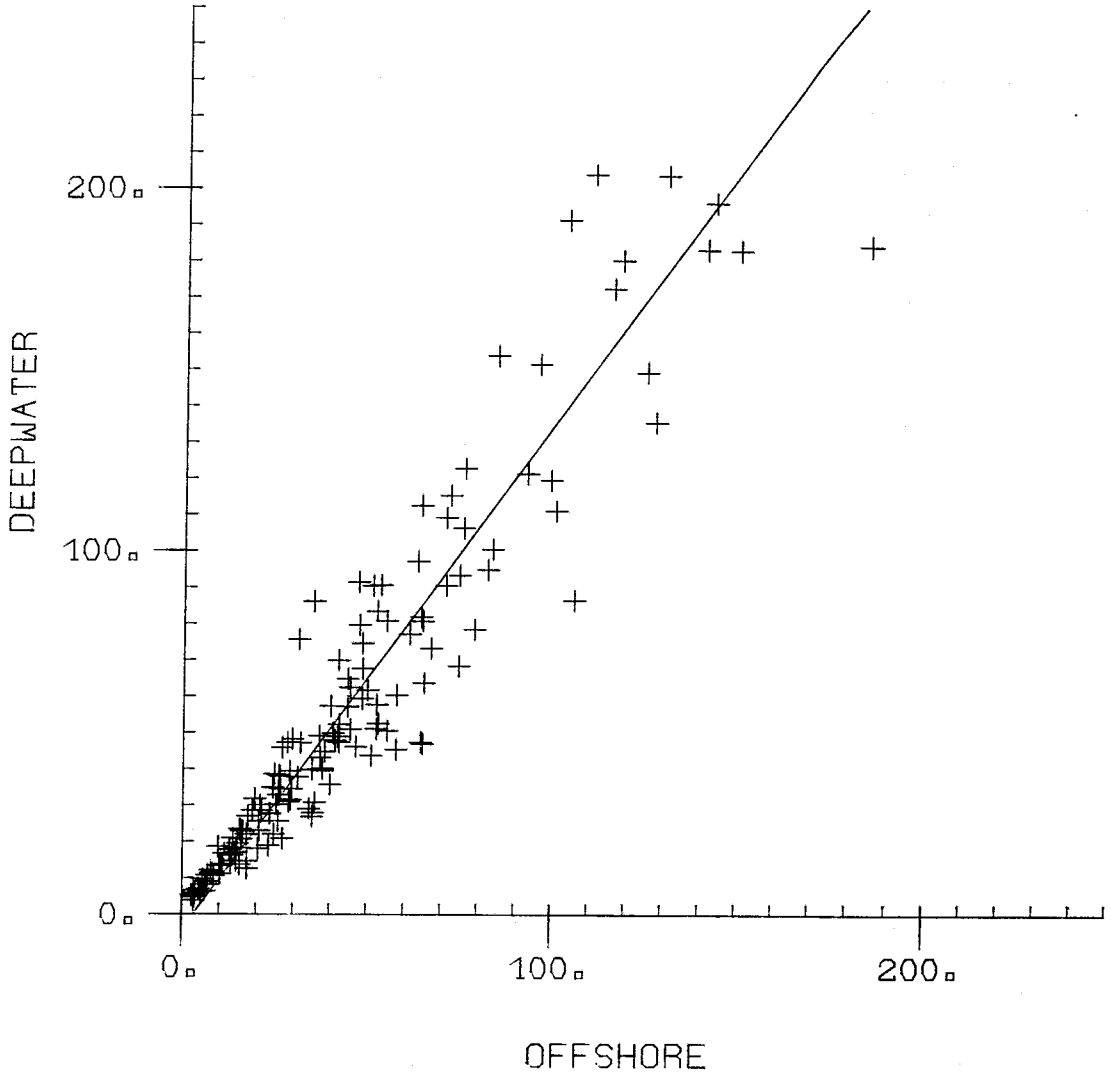
INTERCEPT =0.46

STANDARD ERROR =5.480

Fig. 4.1

S.UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M



SEPTEMBER 1980

SLOPE =1.387

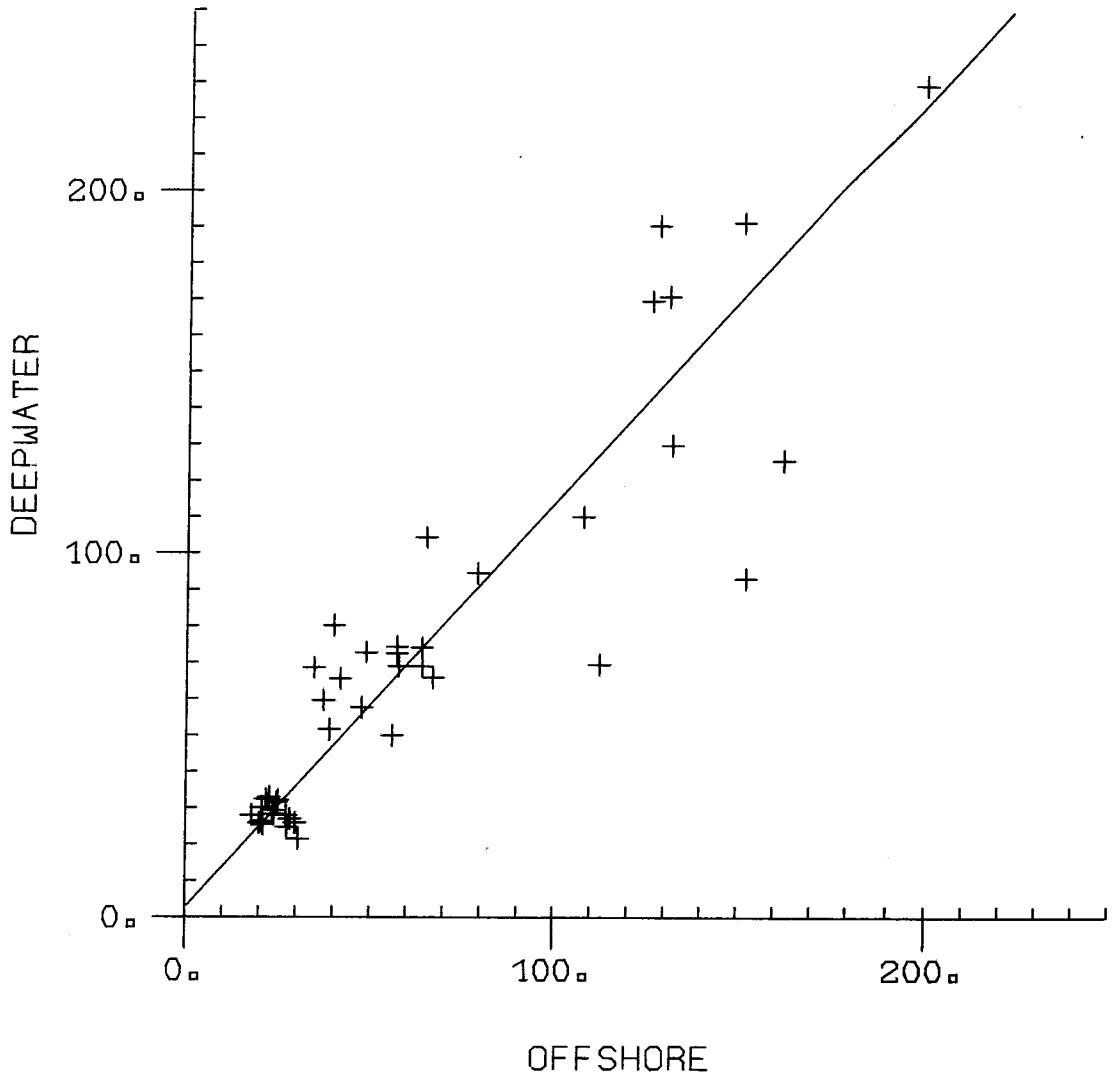
INTERCEPT =-4.11

STANDARD ERROR =9.544

Fig. 4.2

S.UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M



JANUARY 1981

SLOPE =1.115

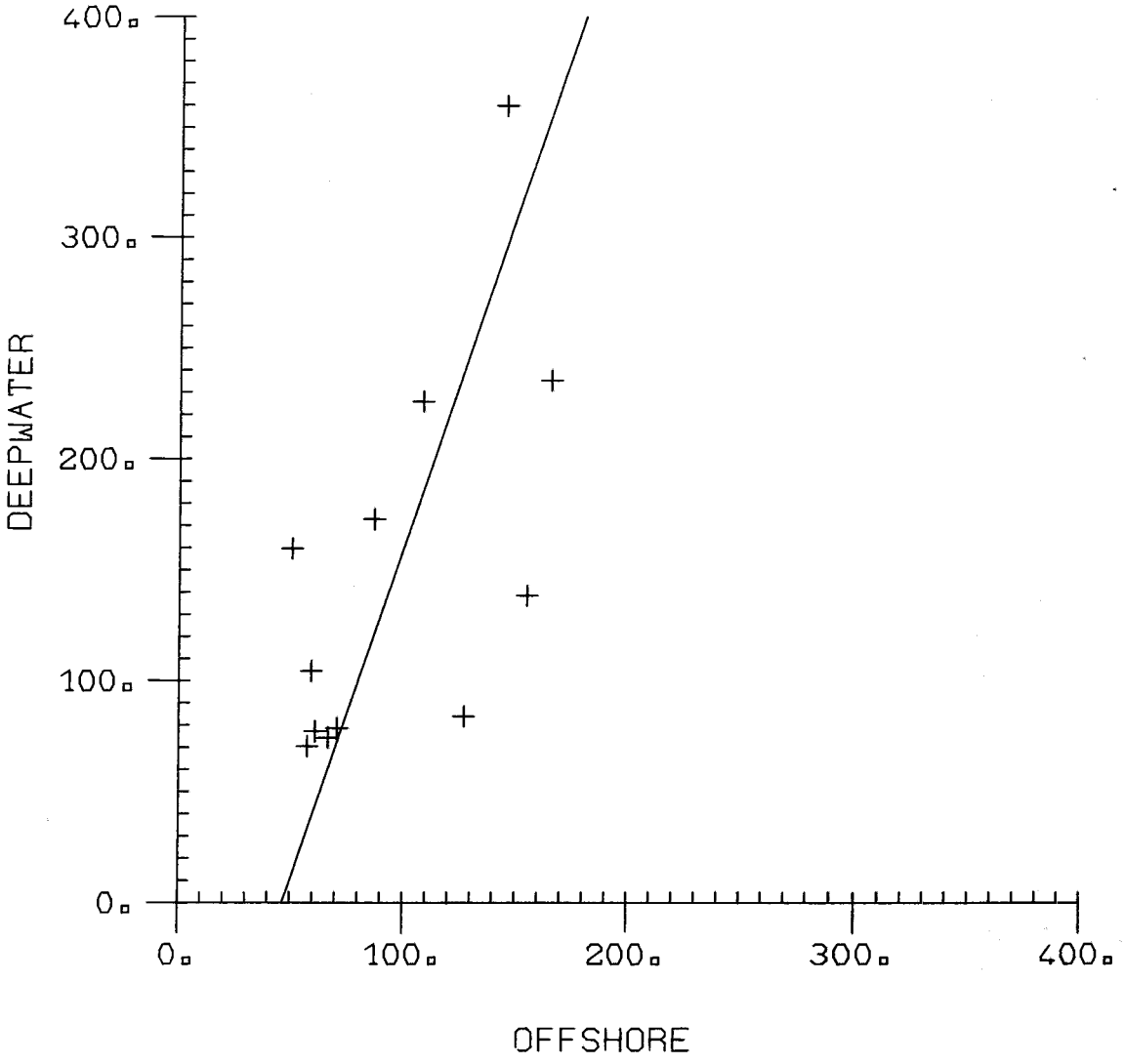
INTERCEPT =2.62

STANDARD ERROR =15.226

Fig. 4.3

S.UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M



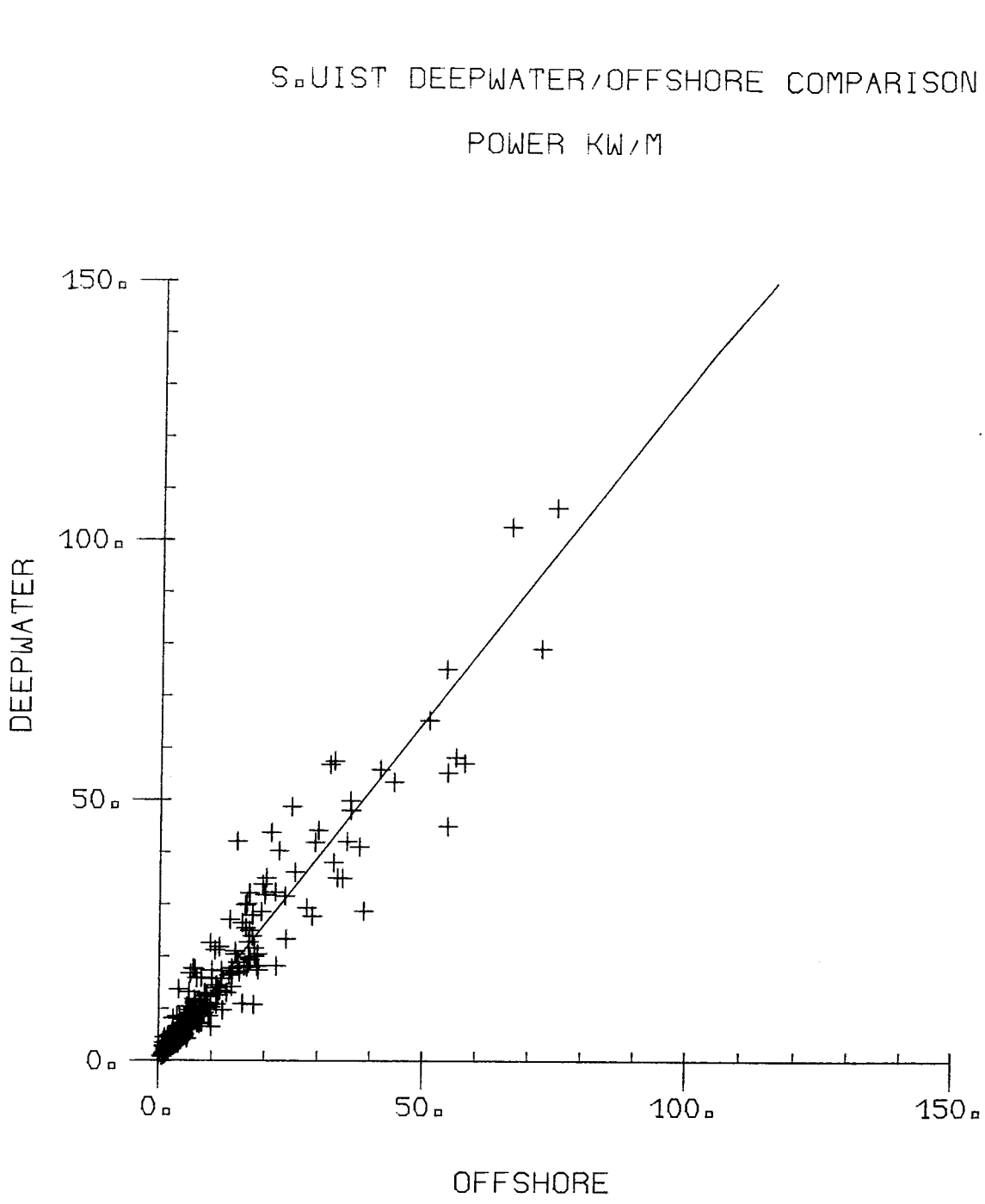
FEBRUARY 1981

SLOPE =3.002

INTERCEPT =******

STANDARD ERROR =30.578

Fig. 4.4



SLOPE =1.298

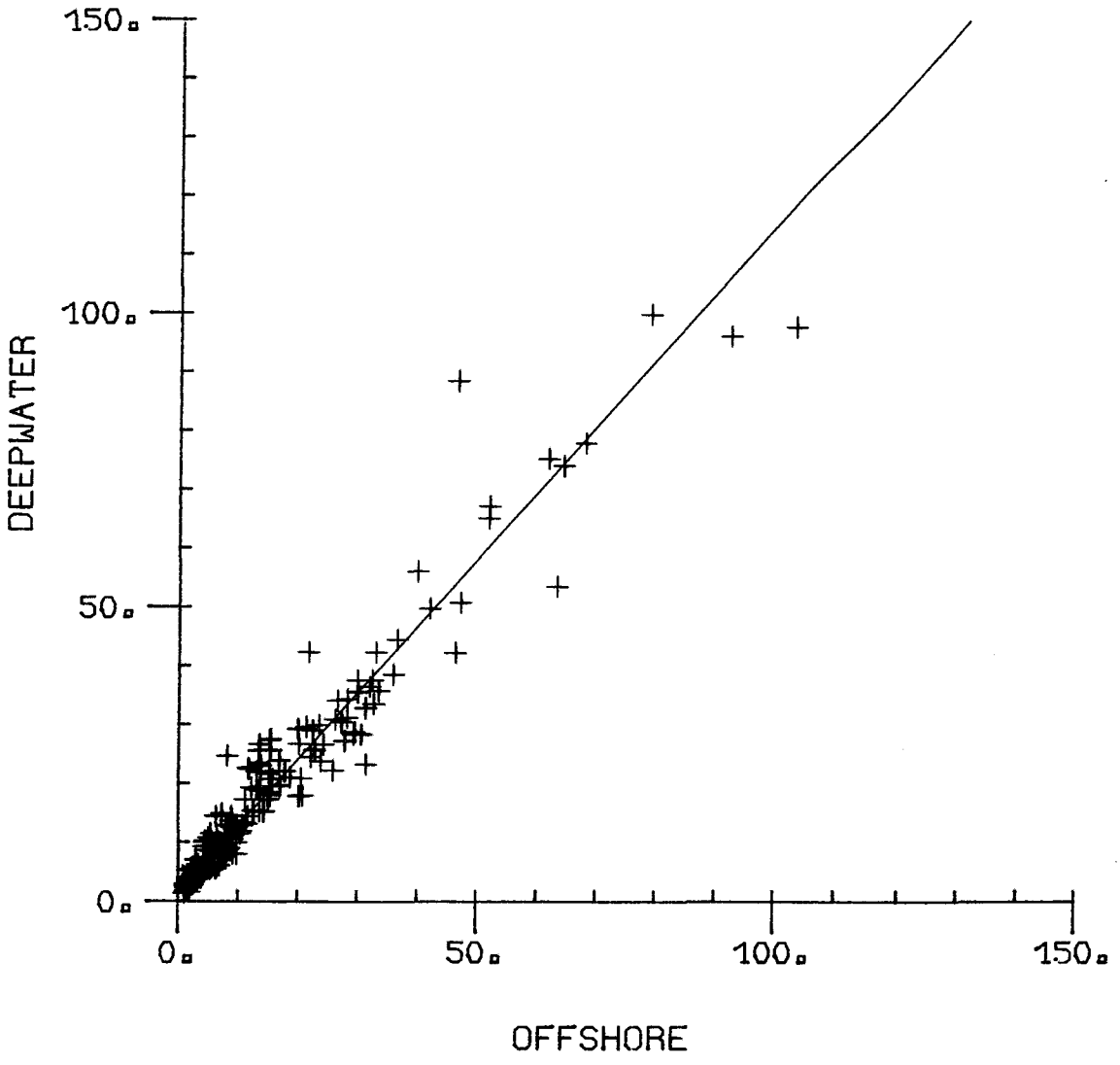
INTERCEPT =0.34

STANDARD ERROR =3.325

Fig. 4.5

S.UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M



JUNE 1981

SLOPE =1.131

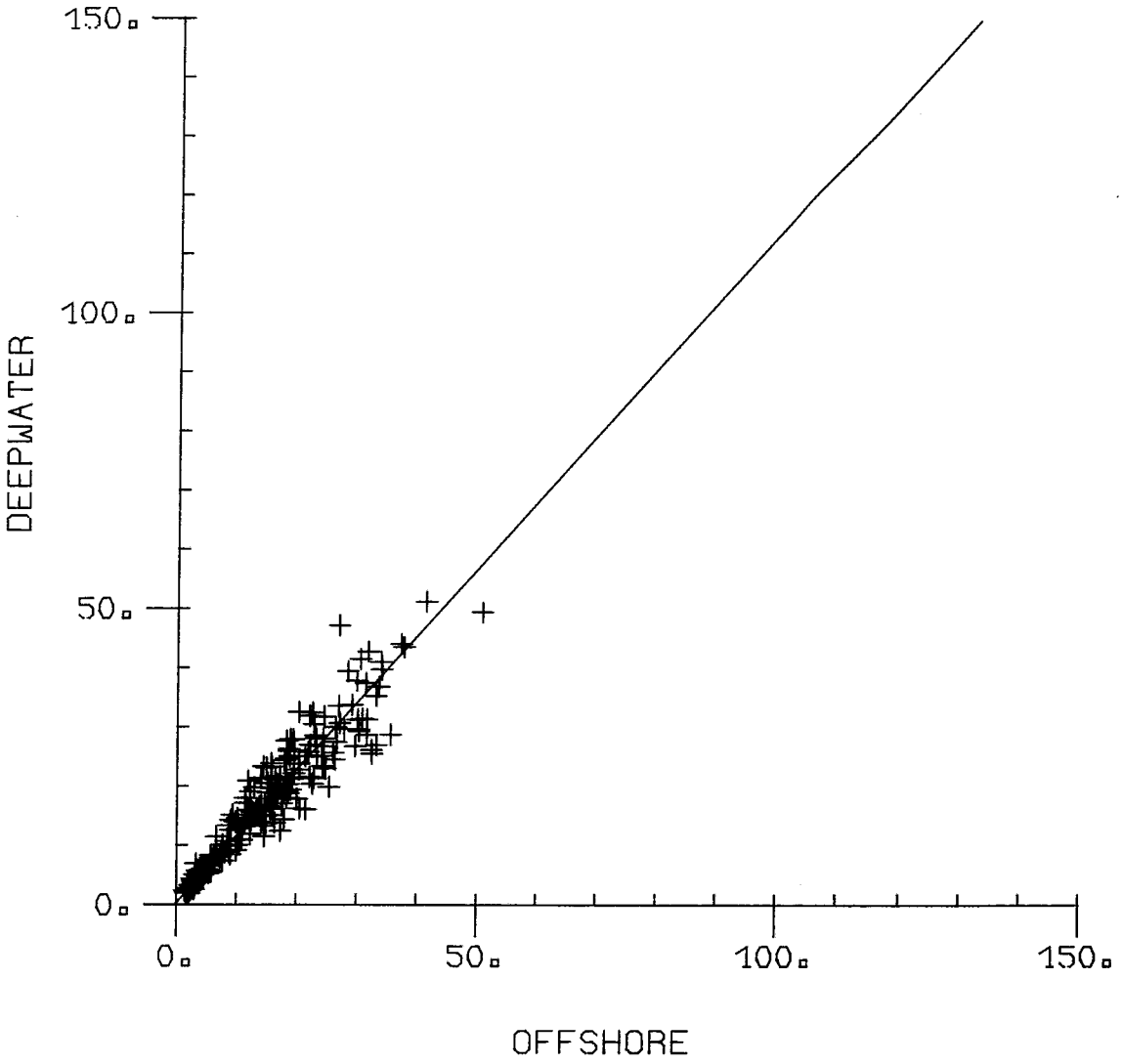
INTERCEPT =1.45

STANDARD ERROR =3.086

Fig. 4.6

S.UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M



JULY 1981

SLOPE =1.128

INTERCEPT =0.30

STANDARD ERROR =2.409

Fig. 4.7

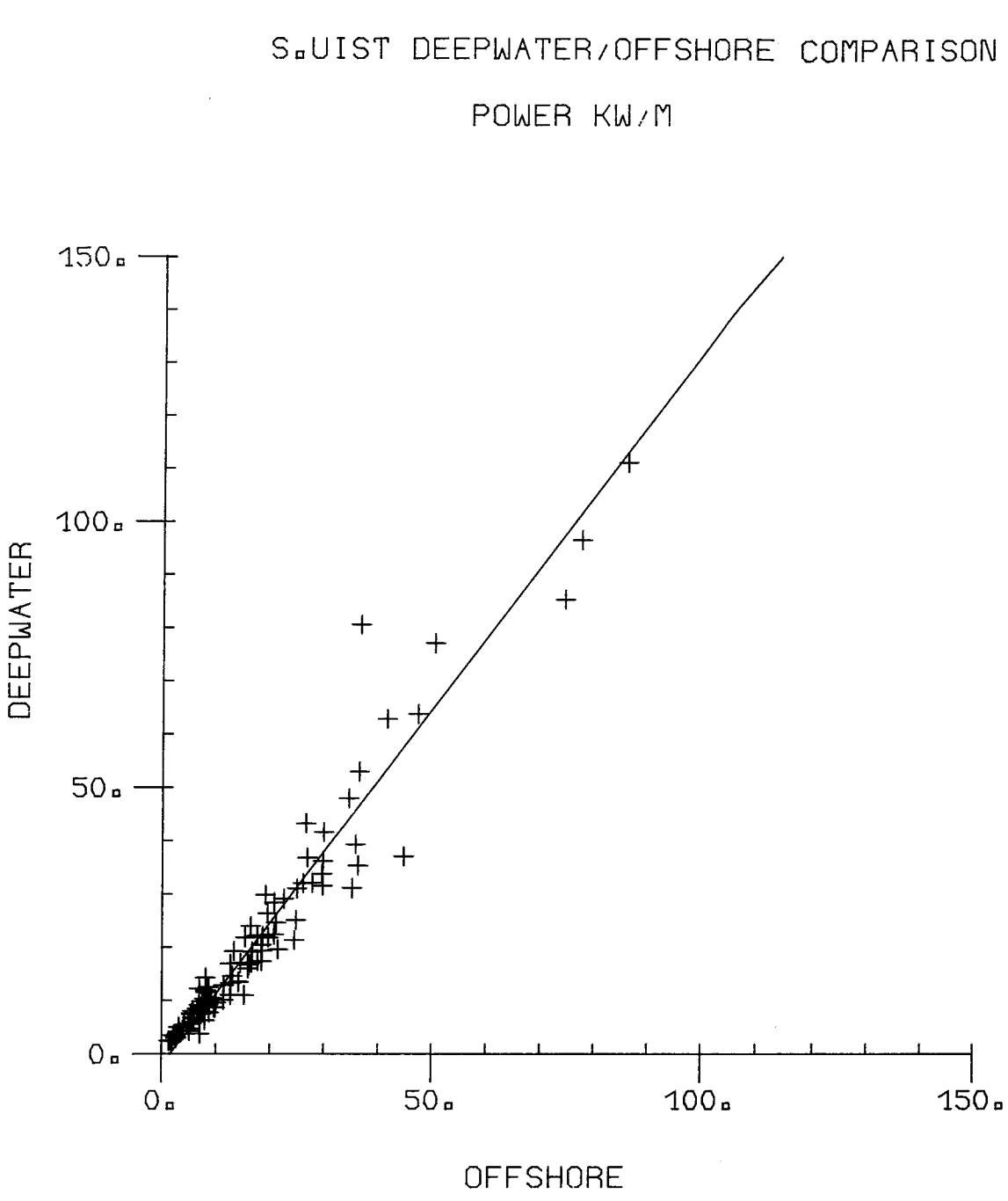
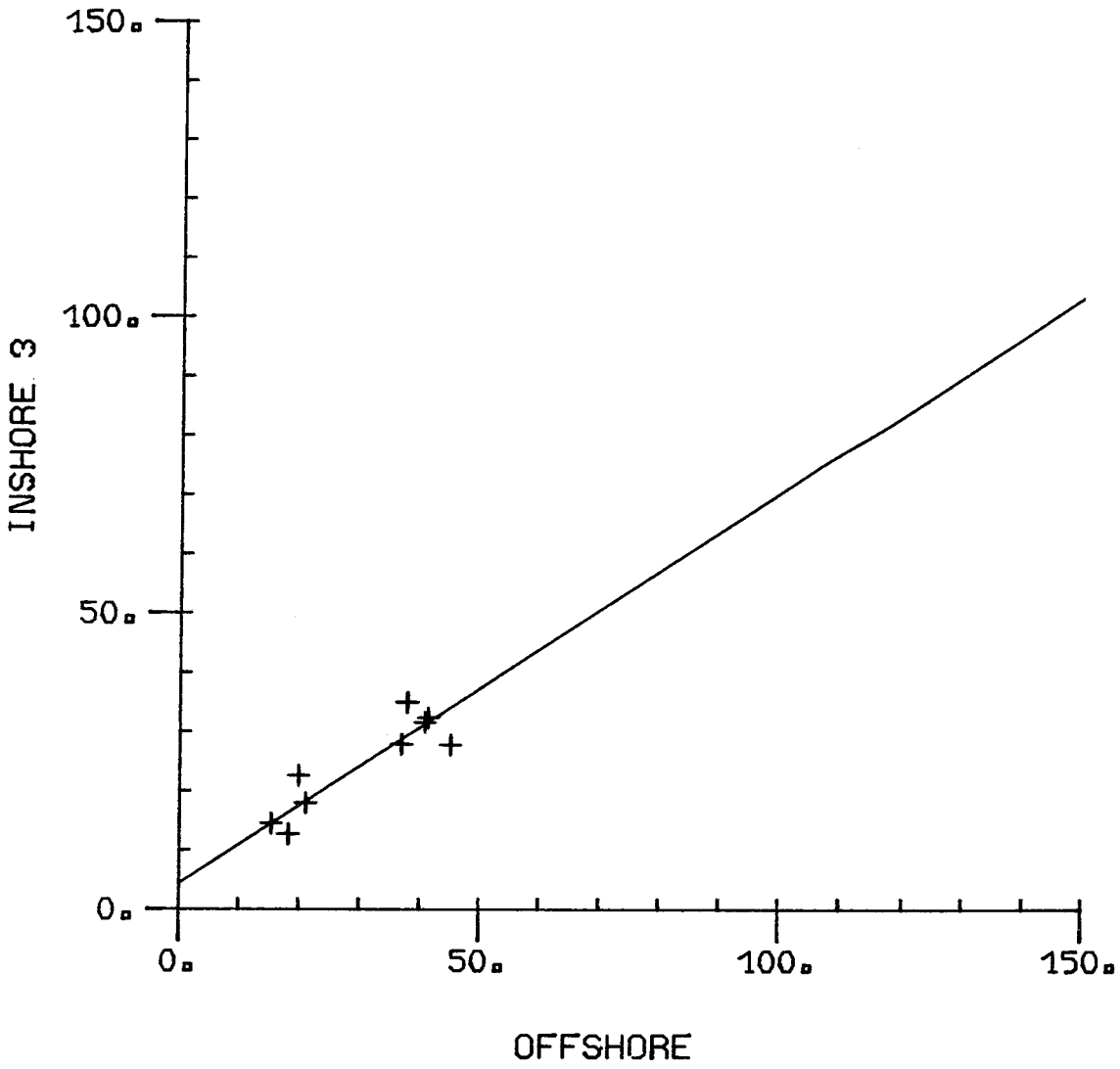

S.UIST DEEPWATER/OFFSHORE COMPARISON
POWER KW/M
150.
100.
50.
0.
DEEPWATER
0.
50.
100.
150.
OFFSHORE
AUGUST 1981
SLOPE =1.337
INTERCEPT =-2.11
STANDARD ERROR =3.361

Fig. 4.8

S.UIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M



APRIL. 1981

SLOPE =0.661

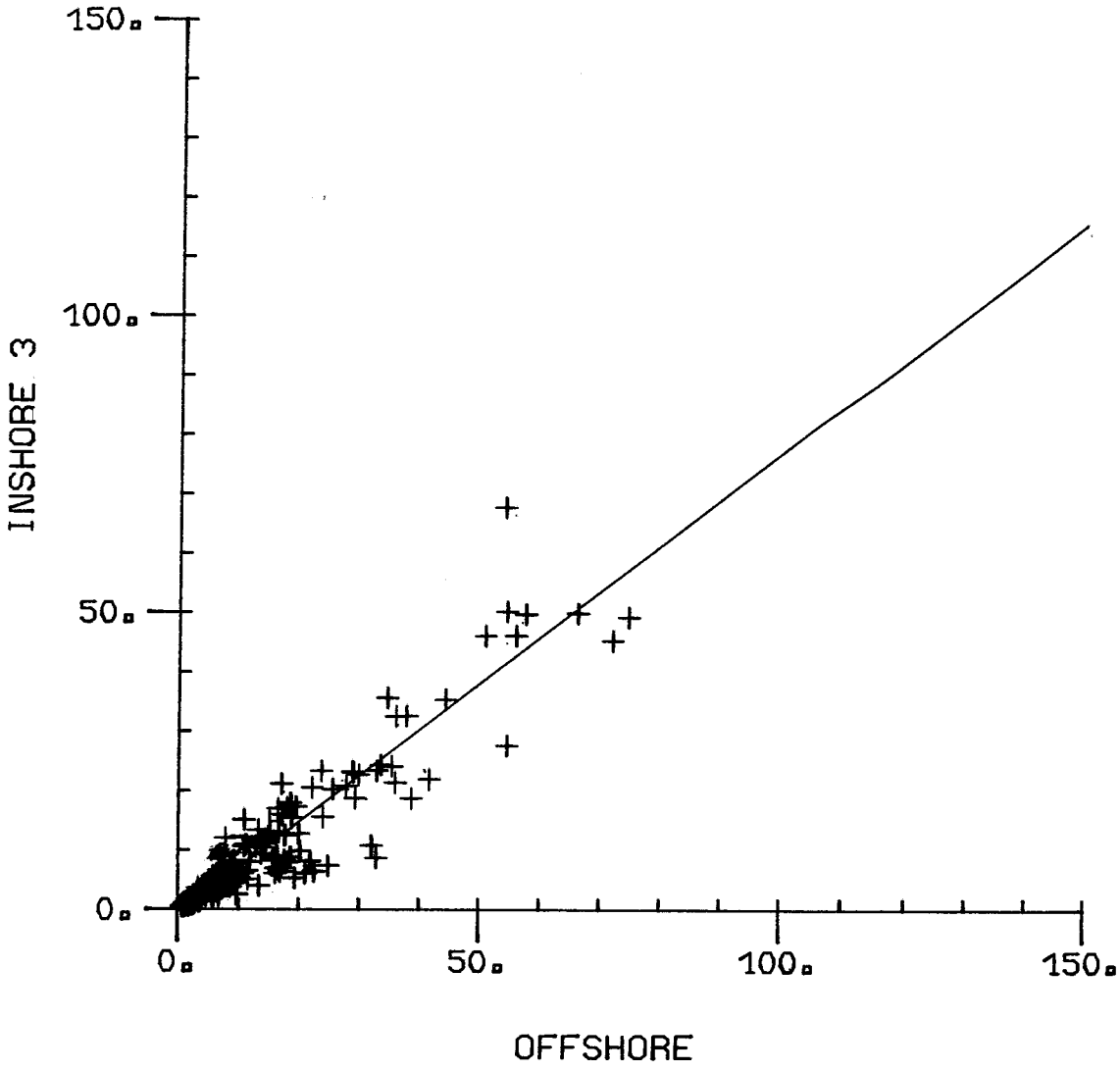
INTERCEPT =4.35

STANDARD ERROR =2.963

Fig. 5.1

S.UIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M



MAY 1981

SLOPE =0.777

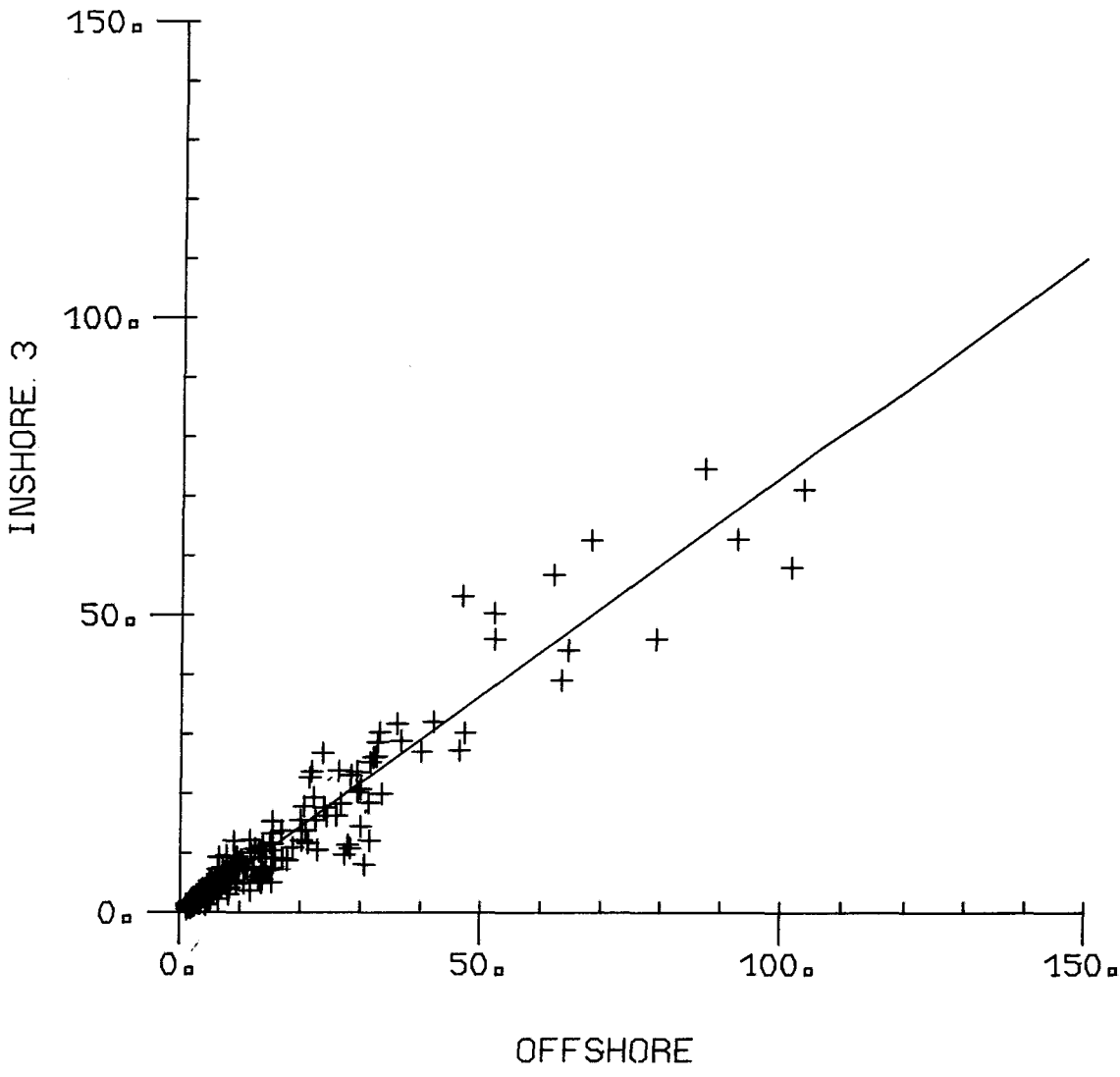
INTERCEPT =-0.67

STANDARD ERROR =3.039

Fig. 5.2

S.UIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M



JUNE 1981

SLOPE =0.738

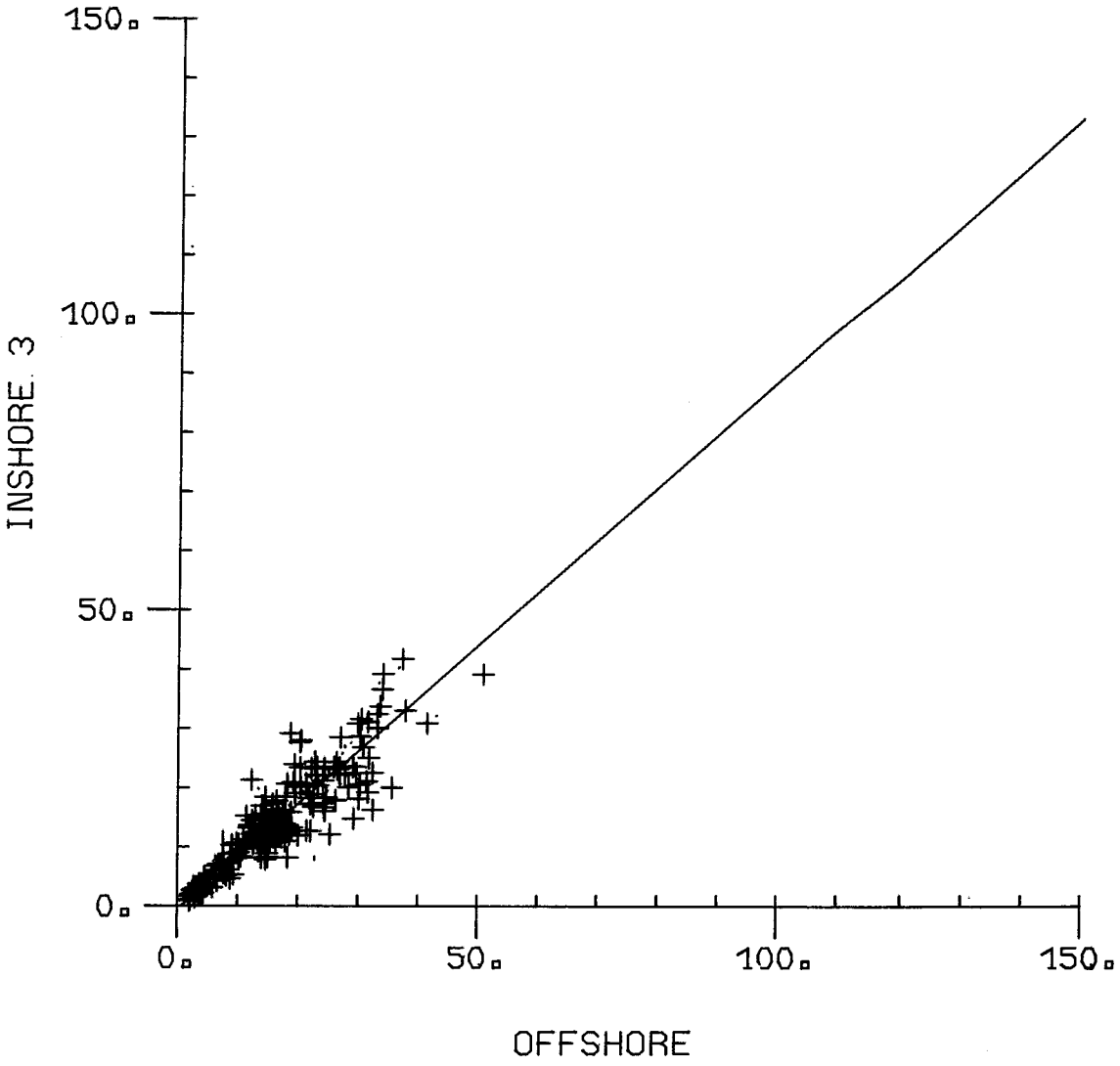
INTERCEPT =-0.25

STANDARD ERROR =3.021

Fig. 5.3

S.UIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M



JULY 1981

SLOPE =0.894

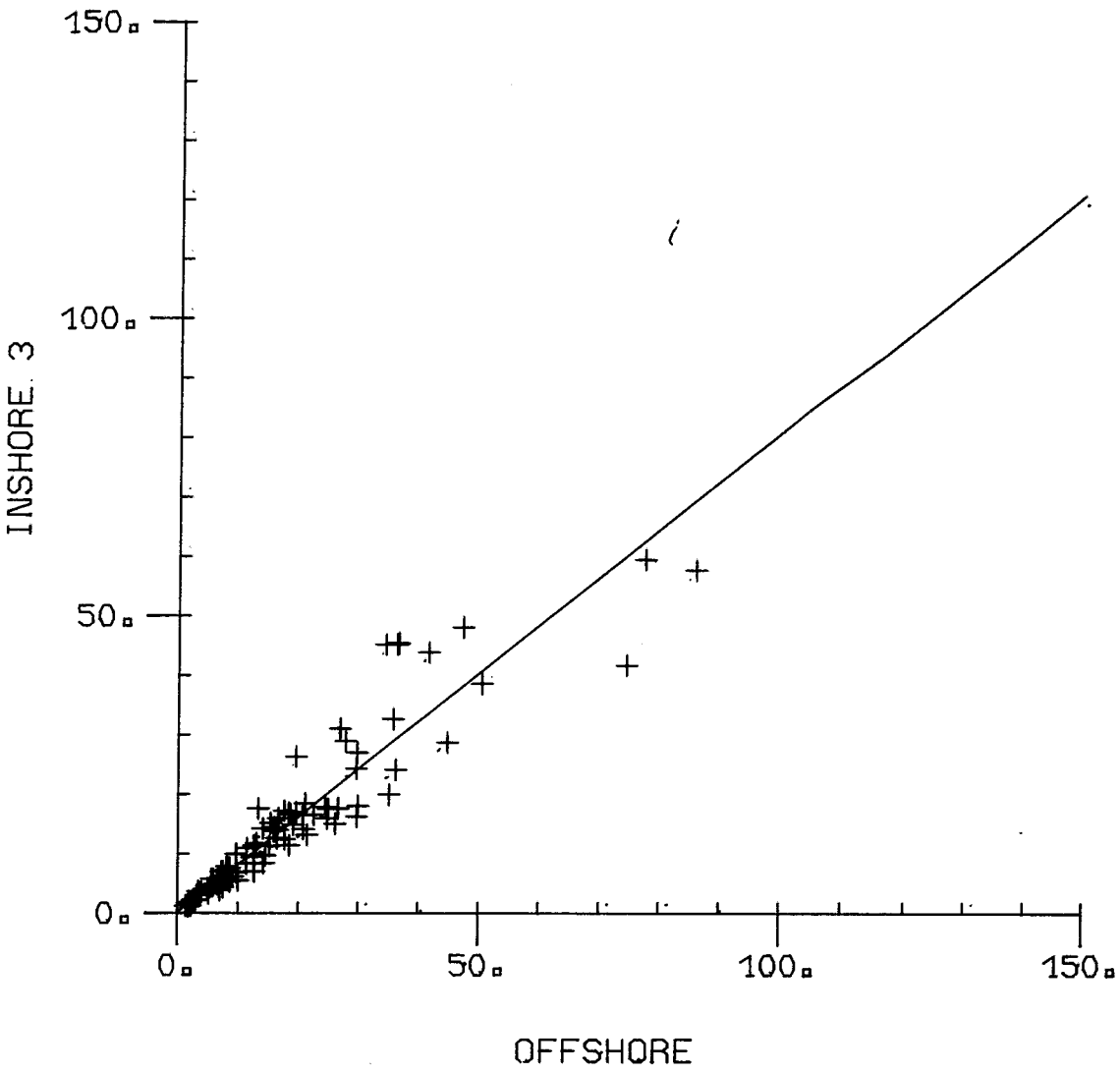
INTERCEPT =-0.60

STANDARD ERROR =2.777

Fig. 5.4

S.UIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M



AUGUST 1981

SLOPE =0.807

INTERCEPT =0.17

STANDARD ERROR =3.661

Fig. 5.5