WAVES AT SOUTH UIST -
AUGUST 1980 to AUGUST 1981

Some results of relevance to the
Wave Energy Programme

R GLEASON and J A CRABB

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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:

<table>
<thead>
<tr>
<th>Fig</th>
<th>Description</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Scatter diagram of $H_g$ v $T_e$</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>1.2</td>
<td>Scatter diagram showing distribution of total energy with $H_g$ and $T_e$</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>1.3-1.6</td>
<td>Time series of power</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>1.7-1.10</td>
<td>Time series of $H_g$</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>1.11-1.14</td>
<td>Time series of $T_e$</td>
<td>Aug 80-Aug 81</td>
</tr>
</tbody>
</table>

2. Waves at the offshore buoy

<table>
<thead>
<tr>
<th>Fig</th>
<th>Description</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1-2.3</td>
<td>Time series of power</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>2.4-2.6</td>
<td>Time series of $H_g$</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>2.7-2.9</td>
<td>Time series of $T_e$</td>
<td>Aug 80-Aug 81</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fig</th>
<th>Description</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1-3.4</td>
<td>Time series of power</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>3.5-3.8</td>
<td>Time series of $H_g$</td>
<td>Aug 80-Aug 81</td>
</tr>
<tr>
<td>3.9-3.12</td>
<td>Time series of $T_e$</td>
<td>Aug 80-Aug 81</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Slope of regression line</th>
<th>1.23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.29</td>
</tr>
<tr>
<td>Standard error of slope</td>
<td>0.01</td>
</tr>
<tr>
<td>Standard error of intercept</td>
<td>0.34</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.958</td>
</tr>
<tr>
<td>Slope of regression line constrained to pass through (0,0)</td>
<td>1.24</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Slope of regression line</th>
<th>0.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.37</td>
</tr>
<tr>
<td>Standard error of slope</td>
<td>0.01</td>
</tr>
<tr>
<td>Standard error of intercept</td>
<td>0.20</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.937</td>
</tr>
<tr>
<td>Slope of regression line constrained to pass through (0,0)</td>
<td>0.762</td>
</tr>
</tbody>
</table>
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
SCATTER PLOT OF HS AND TE

SOUTH UIST DEEPWATER WAVERIDER AUGUST 1980 - AUGUST 1981

Fig. 1.1

2409 VALID OBSERVATIONS

KEY
1. PARTS PER THOUSAND (PPT)
2. NO. OF OCCURRENCES (<1 PPT)

SOUTH UIST DEEPWATER WAVERIDER (NO. 6851)
DISTRIBUTION OF TOTAL MEASURED WAVE ENERGY WITH Hs AND Te (PPT)

SUUST DEEPWATER WAVERIDER AUG 80/AUG 81

Fig. 1.2
TIME SERIES OF POWER
SUIST DEEPWATER WAVERIDER

Fig. 1.3
TIME SERIES OF POWER
S. UIST DEEPWATER WAVERIDER
Fig. 1.4
TIME SERIES OF POWER
S. UIST DEEPWATER WAVERIDER
Fig. 1.6
TIME SERIES OF Hs

STUDEBAKER DEEPWATER WAVE RIDER

Fig. 1.7
TIME SERIES OF $H_s$
SOUIST DEEPWATER WAVE RIDER

Fig. 1.8
FIG. 1.9
SOUTH DEEPWATER WAVE RIDER
TIME SERIES OF HS
TIME SERIES OF Hs
S. UIST DEEPWATER WAVERIDER

Fig. 1.10
TIME SERIES OF $T_e$

S.OIST DEEPWATER WAVERIDER

Fig. 1.11
FIG. 1.4
SOUTH DEEPWATER WAVERIDER
TIME SERIES OF TE

AUG 1981

JUL 1981

JUN 1981

MAY 1981
TIME SERIES OF POWER
S. UIST OFFSHORE WAVERIDER

Fig. 2.1
TIME SERIES OF POWER
SUIST OFFSHORE WAVERIDER

Fig. 2.2
TIME SERIES OF POWER
S.ULIST OFFSHORE WAVERIDER
Fig. 2.3
TIME SERIES OF Hs
S. UIST OFFSHORE WAGERIDER

Fig. 2.4
TIME SERIES OF Hs
S. UIST OFFSHORE WAVE RIDER

Fig. 2.5
TIME SERIES OF $T_{e}$
S. UIST OFFSHORE WAVERIDER

Fig. 2.7
TIME SERIES OF $T_e$

S. UIST OFFSHORE WAVERIDER

Fig. 2.8
Fig. 2.9
SOUTH OFFSHORE WAVE RIDER
TIME SERIES OF TE

Aug 1981

Jul 1981

Jun 1981

Mar 1981
TIME SERIES OF POWER
S. UIST NEARSHORE 2 WAVERIDER

Fig. 3.1
TIME SERIES OF POWER
S. UIST NEARSHORE 2 WAVERIDER
Fig. 3.2
TIME SERIES OF POWER
S. UIST NEARSHORE 2 & 3 WAVE RIDER
Fig. 3.3
TIME SERIES OF POWER
S. UIST NEARSHORE 3 WAVERIDER

Fig. 3.4
TIME SERIES OF Hs
S. UIST NEARSHORE 2 WAVERIDER
Fig. 3.5
TIME SERIES OF Hs
S. UIST NEARSHORE 2 WAVERIDER
Fig. 3.6
TIME SERIES OF Hs

SQUIST NEARSHORE 2 & 3 WAvERIDER

Fig. 3.7
FIG. 3.8
S. NIST NEARSHORE 3 WAVE RIDER
TIME SERIES OF HS

AUG 1981

JUL 1981

JUN 1981

MAR 1981
TIME SERIES OF $T_e$

S. Quist Nearshore 2 Waverider

Fig. 3.9
TIME SERIES OF $T_e$

SQUIST NEARSHORE 2 WAVERIDER

Fig 3.10
TIME SERIES OF $T_e$

SQUIST NEARSHORE 2 & 3 WAVERIDER

Fig. 3.11
Fig. 3.12
SÜST NEARSHORE 3 WAVE RIDER
TIME SERIES OF TE

AUG 1981

JUL 1981

JUN 1981

MAR 1981
S. U. I. S. T. DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

Fig. 4.1

SLOPE = 1.282
INTERCEPT = 0.46
STANDARD ERROR = 5.480

AUGUST 1980
S. UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

SEPTEMBER 1980

SLOPE = 1.387
INTERCEPT = -4.11
STANDARD ERROR = 9.544

Fig. 4.2
S.OIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

SLOPE = 1.115
INTERCEPT = 2.62
STANDARD ERROR = 15.226

Fig. 4.3
SUIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

Fig. 4.4
S. UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

Fig. 4.5

MAY 1981

SLOPE = 1.298
INTERCEPT = 0.34
STANDARD ERROR = 3.325
S. UIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

SLOPE = 1.131
INTERCEPT = 1.45
STANDARD ERROR = 3.086

Fig. 4.6
S. UIST DEEPWATER/OFFSHORE COMPARISON
POWER KW/M

Fig. 4.7

SLOPE = 1.128
INTERCEPT = 0.30
STANDARD ERROR = 2.409

JULY 1981
SUIST DEEPWATER/OFFSHORE COMPARISON

POWER KW/M

AUGUST 1981

SLOPE = 1.337
INTERCEPT = -2.11
STANDARD ERROR = 3.361

Fig. 4.8
SUIST 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
SUIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M

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
SUIST INSHORE 3/OFFSHORE COMPARISON

POWER KW/M

AUGUST 1981

SLOPE = 0.807
INTERCEPT = 0.17
STANDARD ERROR = 3.661

Fig. 5.5