



**Beach Protection
Authority
Queensland**

WAVE DATA RECORDING PROGRAMME

MACKAY REGION

WAVE DATA RECORDING PROGRAMME

MACKAY REGION

REPORT NO. W02.2

Prepared by the Beach Protection Authority

July 1986

All reasonable care and attention has been exercised in the collection, processing and compilation of the wave data included in this report. However, the accuracy and reliability of this information is not guaranteed in any way by the Beach Protection Authority and the Authority accepts no responsibility for the use of this information in any way whatsoever.

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ABSTRACT:-

This is the second report to provide summaries of primary analysis of raw wave data recorded in 25 metres of water offshore near Mackay in Central Queensland. Data was recorded using a Datawell "Waverider" buoy, and covers the period September 17, 1975 to August 23, 1985. The station was closed from November 5, 1976 to November 24, 1977. The data is divided into seasonal groupings for analysis and no estimations of wave directional data have been provided. This report supersedes Report No. W02.1 Wave Data Recording Programme, Mackay Region.

OTHERS AVAILABLE IN THIS SERIES:-

Wave Data Recording Programme, Cairns Region (Report No. W01.1)
Wave Data Recording Programme, Cairns Region (Report No. W01.2)
Wave Data Recording Programme, Mackay Region (Report No. W02.1)
Wave Data Recording Programme, Townsville Region (Report No. W.03.1)
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Wave Data Recording Program, Burnett Heads Region (Report. No. W05.1)
Wave Data Recording Program, Abbot Point Region (Report No. W06.1)
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Wave Data Recording Programme, Bowen Region (Report No. W10.1)

WAVE DATA RECORDING PROGRAMME

MACKAY REGION

REPORT NO. W02.2

1.0 INTRODUCTION

The Beach Protection Authority as part of its long term programme of investigating erosion problems along Queensland's coastline has been recording wave characteristics through a network of wave recording stations since 1968.

This report summarizes the primary analysis of wave data collected in the Mackay region. In addition brief details of the recording equipment, the method of handling raw data and the type of analysis employed are provided.

2.0 RECORDING EQUIPMENT

All wave recording installations operated by the Authority employ the "Waverider" system developed by Datawell b.v. of the Netherlands.

Initially the installation comprised a Waverider 6000 series buoy transmitting to a shore based WAREP Mark II receiver which in turn is coupled to an ANMA analogue recording unit. From March 11, 1985, the ANMA analogue recording unit was replaced with a DIMA digital recording unit while the remainder of the wave recording equipment for this installation was retained.

This system utilises a buoy mounted accelerometer to follow the water surface movements and transmit a frequency modulated analogue signal of these water level movements to a shore based receiver (WAREP). The WAREP receiver provides a paper chart of the recording and relays the analogue signal to the ANMA recorder or DIMA recorder.

3.0 WAVE RECORDING AND ANALYSIS PROCEDURES

In general between September 17, 1975 and January 24, 1982 two recordings of water levels each of 20 minutes duration were made each day with the timing of the recordings set at 0300 hours and 1500 hours respectively.

During cyclonic events or other periods of severe wave action the recording frequency may be increased to 4 times daily. Twenty minute records are still maintained at such times.

From January 25, 1982 there have been 4 recordings per day each of 20 minutes duration at 0300 hours, 0900 hours, 1500 hours and 2100 hours.

Digitization of the analogue data tapes was carried out at the Brisbane office and the digital records held on 9 track digital tapes compatible with the computing facilities available to the Authority. In this process the analogue tapes produced in the field were sampled electronically at half second intervals and this information together with necessary administration information was transferred to the digital tape by a digitizer which was specifically developed for this purpose.

The DIMA recorder provides digital data on cassette sampled at half second intervals with the necessary administration information included at the beginning of each record. Digital wave data can be transferred directly from the cassette to the Authority's computer facilities by a digital cassette reader.

Routine and spectral analysis of digital wave data was performed by a computer program to obtain the following parameters:

- | | | |
|----|-------------------------------------|--|
| 1. | Energy Density Spectrum | A representation of the distribution of wave energy over the component wave frequencies. |
| 2. | Significant Wave Height (Hsig) | The average of the highest one third of waves in the record. |
| 3. | Root Mean Square Wave Height (Hrms) | The root mean square of the wave heights from the record. |
| 4. | Maximum Wave Height (Hmax) | The highest individual wave in the record (zero upward crossing). |
| 5. | Peak Energy Period (Tp) | The wave period corresponding to the peak of the energy density spectrum. |
| 6. | Significant Period (Tsig) | The average period of the highest one third of waves in the record. |
| 7. | Zero Crossing Period (Tz) | The average period of all waves in the record based on upward zero crossings. |
| 8. | Crest Period (Tc) | The average period of all the waves in the record based on successive crests. |

These parameters are the basis for the summary plots and tables attached to this report.

4.0 DATA LOSSES

Data losses can be divided into three categories - losses due to recording equipment failure, losses during routine processing and losses as a result of spurious data produced by twisted accelerometer cables within the Waverider buoy.

Losses in the first two categories are usually non-recoverable. Data produced when accelerometer cables are twisted, however, are generally recoverable. The twisting of the cables causes a low frequency component to be added to the analogue wave data at the recording stage. When analysis is carried out, the component is easily detected and may be eliminated during data editing following the completion of routine processing and spectral analysis of data.

Details of data losses in the Mackay region are included in Summary Sheet 1, "Details of Wave Recorder Installation".

5.0 WAVE CLIMATE

5.1 General

The wave climate presented in this report is based on statistical analyses of the parameters obtained from the recorded wave data.

Computer programs developed by the Authority provide statistical information on percentage of time occurrence and exceedance for wave heights and periods. The results of these analyses are presented in Tables 1, 2 and 3 and Figures 2, 3 and 4. In addition, similar analyses are carried out on the relationships between the various wave parameters and these are presented in Figure 5.

5.2 Wave Persistence

Wave height persistence is the duration for which any given wave height is exceeded in any single event. Persistence information has been calculated from the recorded data by linearly interpolating the times of exceedance of various wave heights. Wave height persistence data is presented in Figure 6.

5.3 Return Intervals

The percentage of time of exceedance data for various wave heights (Figure 2) are combined with the persistence data (Figure 6) to determine the average wave height recurrence intervals.

The technique used to calculate the return intervals presented in Figure 8 is given below:-

$$\begin{aligned} \text{No. of hours per year of exceedance} & & H &= \frac{P_e \times 8760 \text{ hrs}}{100} \\ \text{of a given wave height} & & &= 87.6 P_e \text{ hrs} \end{aligned}$$

where P_e is the percentage of time of exceedance from Figure 2.

$$\begin{aligned} \text{Average No. of events per year in} & & &= \frac{87.6 P_e}{P} \\ \text{which H is exceeded} & & & \end{aligned}$$

where P is the average persistence (hours) of events of exceedance of the given wave height (H).

However, of this number of events, a certain percentage P_n will persist for at least the specified duration.

$$\begin{aligned} \text{i.e. No. of events per year in which H is exceeded} & & & \\ \text{for at least the specified duration} & & = & \frac{87.6 P_e}{P} \times \frac{P_n}{100} \\ & & & = \frac{0.876 P_e \times P_n}{P} \end{aligned}$$

where P_n may be determined from Figure 6.

By inverting this, the average return interval of the occurrence of an event in which H is exceeded for the given duration is given by -

$$\begin{aligned} \text{Return Interval} & & = & \frac{1}{\text{Ave. No. of occurrences}} \\ & & & \text{per year} \\ & & = & \frac{P}{0.876 P_e \times P_n} \end{aligned}$$

It should be noted that the data presented in Figure 8 are for the average wave height recurrence interval and include all exceedance events of the given wave height without regard for duration of the event. In these calculations P_n was taken as 100 percent.

6.0 DATA PRESENTATION

No attempt has been made to interpret the recorded data for design purposes or to apply corrections for refraction, diffraction and shoaling to obtain equivalent deep water waves. Before any use is made of this data it is therefore necessary to note the exact location of the buoy and the water depth in which the buoy was moored. This data is shown on Summary Sheet 1, "Details of the Wave Recorder Installation". The data herein presented does not include any information on wave directions. The "Waverider" recording system which is utilised by the Authority is designed to record vertical movements of the water surface only and any wave directions must be assigned to the individual wave records by other means.

Wherever major meteorological events such as cyclones have occurred during the recording period, these were noted and are summarized together with the maximum wave height recorded and any other relevant comments in Summary Sheet 2, "Major Meteorological Events".

In addition to the above Summary Sheets the following tables and figures are presented to complete this report.

- Table 1: Wave Statistics; Wave Period/Wave Height Occurrences, All Data, All Directions.
- Table 2: Wave Statistics; Wave Period/Wave Height Occurrences, Summer Data, All Directions.
- Table 3: Wave Statistics; Wave Period/Wave Height Occurrences, Winter Data, All Directions.
- Figure 1: Locality Map.
- Figure 2: Percentage (of time) Exceedance of Wave Heights (H_{sig}) for All Wave Periods.
- Figure 3: Histogram Percentage (of time) Occurrences of Wave Heights (H_{sig}) for All Wave Periods.
- Figure 4: Histogram Percentage (of time) Occurrences of Wave Periods (T_p) for All Wave Heights.
- Figure 5: Wave Parameter Relationships.
- Figure 6: Average Duration of Exceedance of Wave Heights (H_{sig}).
- Figure 7: Daily Wave Recordings.
- Figure 8: Wave Height (H_{sig}) Recurrence Intervals.

The above tables refer to data recorded in Summer and Winter. For the purposes of analysis, Summer has been taken as the period from November 1 to April 30 in the following year. Winter covers the period May 1 to October 31 in any one year.

SUMMARY SHEET 1

DETAILS OF WAVE RECORDER INSTALLATION

Region:- Mackay Region

Buoy Location:-

Co-ordinates:- 149° 31'50" East 21° 06'50" South.
Description:- 30 km east of the Mackay Outer Harbour.
September 17, 1975 - November 5, 1976

Co-ordinates:- 149° 31'48" East 21° 03'54" South.
Description:- 33 km east of Mackay.
November 24, 1977 - August 23, 1985

(See Figure 1)

Water Depth at Buoy:- 25 metres relative to Australian Height Datum
September 17, 1975 - November 5, 1976
28 metres relative to Australian Height Datum
November 24, 1977 - August 23, 1985

Location of Recording Station:- East of Mount Bassett near Mackay
Outer Harbour.

Period of Data Collection:- September 17, 1975 to November 5, 1976
and November 24, 1977 to August 23, 1985.

Normal Recording Interval:-

Two twenty minute records daily at 0300 hours and 1500 hours between
September 17, 1975 and January 24, 1982.

Four twenty minute records daily at 0300 hours and 0900 hours, 1500 hours
and 2100 hours between January 25, 1982 and August 23, 1985.

Total No. of Records Analysed:- 7255

Number of Records Lost Due to:-

Losses during Analysis	255
Damaged Accelerometer Cables	31

Number of Days Lost Due to:-

Field Equipment not Operating	487
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Periods during which four recordings per day were taken:-

January 31 - February 3, 1978
February 23-24, 1980
January 25, 1982 - August 23, 1985

SUMMARY SHEET 2

MAJOR METEOROLOGICAL EVENTS

Meteorological Event	*Central Pressure (mb)	Date	*Estimated Position of Cyclone Relative to Buoy (km)	Maximum Hsig Recorded (metres)	Maximum Hmax Recorded (metres)	Tp (secs)
Cyclone David	965	19.1.76	300 ESE	2.90	3.85	11.92
Cyclone Alan	994	1.2.76	470N	#	#	#
Cyclone Beth	993	16.2.76	600 N	2.47	4.53	7.03
Cyclone Watorea	970	27.4.76	420 NNW	#	#	#
Cyclone Keith	1002	1.2.77	180 NNW	#	#	#
Cyclone Otto	987	9.3.77	200 NNW	#	#	#
High pressure system off Queensland Coast	1028	10.10.78		2.78	5.64	7.12
Cyclone Gordon	1000	12.1.79	100 N	3.56	5.61	8.17
Cyclone Kerry	992	1.3.79	100 NE	4.02	5.91	9.19
Cyclone Ruth	983	14.2.80	670 E	2.44	3.46	7.01
Cyclone Freda	990	27.2.81	450 NNW	2.72	5.33	7.28
Cyclone Abigail	982	28.1.82	860 W	2.41	3.99	6.71
High pressure system over Tasman Sea	1024	7.2.82		2.60	4.25	7.77
Cyclone Dominic	997	10.4.82	640 NNE	2.36	3.65	6.66
High pressure system over Tasman Sea	1036	20.8.82		2.52	4.27	7.37
Cyclone Des	997	17.1.83	400 ENE	2.06	3.43	6.75
Cyclone Elinore	981	17.1.83	120 E	#	#	#
High pressure system off New South Wales Coast	1032	12.5.83		2.76	4.20	7.33

Meteorological Event	*Central Pressure (mb)	Date	*Estimated Position of Cyclone Relative to Buoy (km)	Maximum Hsig Recorded (metres)	Maximum Hmax Recorded (metres)	Tp (secs)
High pressure system off Victorian Coast	1036	17.5.83		2.54	3.67	6.30
Cyclone Ingrid	996	22.2.84	370 NE	1.99	2.89	6.29
Cyclone Lance	996	5.4.84	480 NE	2.43	5.49	7.02
Cyclone Pierre	985	21.2.85	160 N	#	#	#
Cyclone Tanya	982	31.3.85	650 NNE	2.49	4.02	7.97
High pressure system over Tasman Sea	1036	12.5.85		2.67	4.10	6.94

Highest significant Wave Height (Hsig) recorded was 4.02 on March 1, 1979 due to Cyclone Kerry.

Highest Maximum Wave Height (Hmax) recorded was 5.91 on March 1, 1979 due to Cyclone Kerry.

Meteorological information obtained from the 'Monthly Weather Review' published by the Bureau of Meteorology.

*Central pressure and position of cyclone at time of maximum wave conditions.

Field Equipment not operating.

TABLE 1

WAVE STATISTICS

WAVE PERIOD/WAVE HEIGHT OCCURRENCES

ALL DATA, ALL DIRECTIONS

Significant Wave Height (metres)	Peak Energy Wave Period (Seconds)									Totals
	0 - 2.99	3 - 4.99	5 - 6.99	7 - 8.99	9 - 10.99	11 - 12.99	13 - 14.99	> 14.99		
.00 - .20	4.88	2.25	2.50	7.00	13.50	0.88	*	*	*	31.01
.20 - .40	79.88	116.50	31.51	116.12	137.12	26.50		1.50	0.25	509.38
.40 - .60	39.11	328.48	54.38	93.50	86.74	17.50		0.50	*	620.21
.60 - .80	1.75	289.63	67.13	31.87	28.00	7.25		*	*	425.63
.80 - 1.00	*	187.98	101.63	15.88	8.50	3.00		*	*	316.99
1.00 - 1.20	*	80.24	153.99	9.75	7.00	0.75		*	*	251.73
1.20 - 1.40	0.75	22.00	178.12	7.50	2.00	0.50		*	*	210.87
1.40 - 1.60	*	4.87	148.75	5.75	1.75	*		*	*	161.12
1.60 - 1.80	*	*	103.74	5.00	0.50	*		*	*	109.24
1.80 - 2.00	*	0.50	56.39	4.50	*	*		*	*	61.39
2.00 - 2.20	*	*	38.12	6.88	*	*		*	*	45.00
2.20 - 2.40	*	*	14.37	6.38	0.50	*		*	*	21.25
2.40 - 2.60	*	*	4.96	6.25	*	*		*	*	11.21
2.60 - 2.80	*	*	0.25	4.50	*	*		*	*	4.75
2.80 - 3.00	*	*	*	0.75	*	0.50		*	*	1.25
3.00 - 3.20	*	*	*	*	*	*		*	*	0.00
3.20 - 3.40	*	*	*	*	*	*		*	*	0.00
3.40 - 3.60	*	*	*	0.50	*	*		*	*	0.50
3.60 - 3.80	*	*	*	*	*	*		*	*	0.00
3.80 - 4.00	*	*	*	*	*	*		*	*	0.00
4.00 - 4.20	*	*	*	*	0.75	*		*	*	0.75
4.20 - 4.40	*	*	*	*	*	*		*	*	0.00
TOTALS	126.37	1032.45	955.84	322.13	286.36	56.88		2.00	0.25	2782.28

Values in the above table are durations in days and have been rounded to the second decimal place.

TABLE 2

WAVE STATISTICS

WAVE PERIOD/WAVE HEIGHT OCCURRENCES

SUMMER DATA, ALL DIRECTIONS

Significant Wave Height (metres)	Peak Energy Wave Period (Seconds)								Totals
	0 - 2.99	3 - 4.99	5 - 6.99	7 - 8.99	9 - 10.99	11 - 12.99	13 - 14.99	> 14.99	
.00 - .20	1.75	1.75	0.50	1.75	1.75	0.38	*	*	7.88
.20 - .40	34.13	54.25	12.75	64.88	54.87	10.75	0.50	*	232.13
.40 - .60	18.88	162.25	20.50	59.00	44.50	3.50	*	*	308.63
.60 - .80	0.50	132.13	26.38	18.62	17.50	2.50	*	*	197.63
.80 - 1.00	*	90.00	49.25	9.38	6.00	1.00	*	*	155.63
1.00 - 1.20	*	35.12	82.00	5.25	5.00	*	*	*	127.37
1.20 - 1.40	*	7.25	99.12	3.63	1.25	*	*	*	111.25
1.40 - 1.60	*	1.62	78.87	3.75	1.75	*	*	*	86.00
1.60 - 1.80	*	*	51.50	2.50	0.50	*	*	*	54.50
1.80 - 2.00	*	*	31.39	2.13	*	*	*	*	33.52
2.00 - 2.20	*	*	25.00	3.62	*	*	*	*	28.62
2.20 - 2.40	*	*	10.13	5.50	0.50	*	*	*	16.13
2.40 - 2.60	*	*	4.21	5.00	*	*	*	*	9.21
2.60 - 2.80	*	*	*	3.75	*	*	*	*	3.75
2.80 - 3.00	*	*	*	0.75	*	0.50	*	*	1.25
3.00 - 3.20	*	*	*	*	*	*	*	*	0.00
3.20 - 3.40	*	*	*	*	*	*	*	*	0.00
3.40 - 3.60	*	*	0.50	*	*	*	*	*	0.50
3.60 - 3.80	*	*	*	*	*	*	*	*	0.00
3.80 - 4.00	*	*	*	*	*	*	*	*	0.00
4.00 - 4.20	*	*	*	*	0.75	*	*	*	0.75
4.20 - 4.40	*	*	*	*	*	*	*	*	0.00
TOTALS	55.26	484.37	491.60	190.01	134.37	18.63	0.50	0.00	1374.75

Values in the above table are durations in days and have been rounded to the second decimal place.

TABLE 3

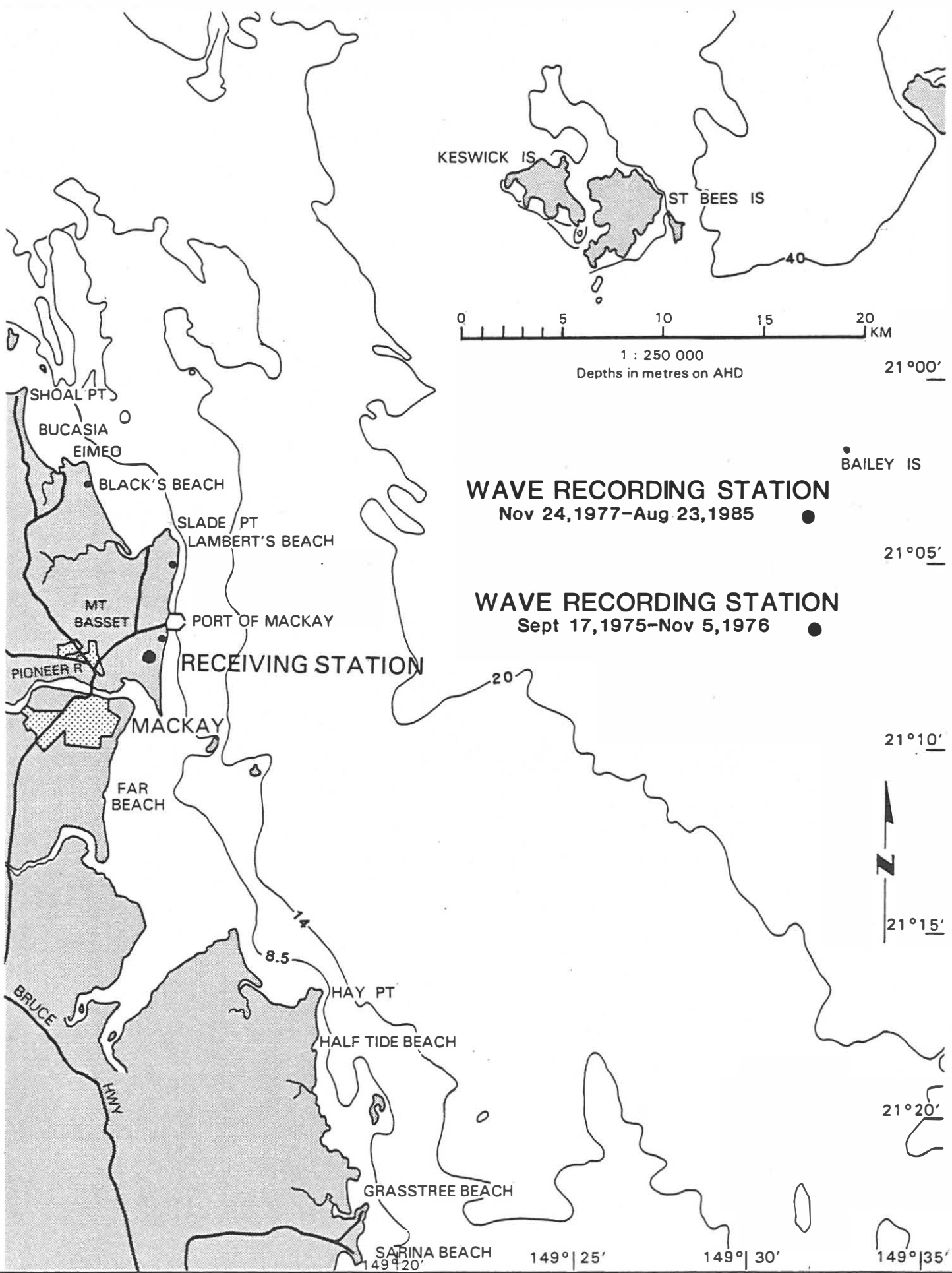
WAVE STATISTICS

WAVE PERIOD/WAVE HEIGHT OCCURRENCES

WINTER DATA, ALL DIRECTIONS

Significant Wave Height (metres)	Peak Energy Wave Period (Seconds)										Totals
	0 - 2.99	3 - 4.99	5 - 6.99	7 - 8.99	9 - 10.99	11 - 12.99	13 - 14.99	> 14.99			
.00 - .20	3.13	0.50	2.00	5.25	11.75	0.50	*	*	*	23.13	
.20 - .40	45.75	62.25	18.76	51.25	82.25	15.76	1.00	0.25	0.25	277.27	
.40 - .60	20.24	166.23	33.88	34.50	42.24	14.00	0.50	*	*	311.59	
.60 - .80	1.25	157.50	40.75	13.25	10.50	4.75	*	*	*	228.00	
.80 - 1.00	*	97.98	52.38	6.50	2.50	2.00	*	*	*	161.36	
1.00 - 1.20	*	45.12	71.99	4.50	2.00	0.75	*	*	*	124.36	
1.20 - 1.40	0.75	14.75	78.99	3.87	0.75	0.50	*	*	*	99.61	
1.40 - 1.60	*	3.25	69.87	2.00	*	*	*	*	*	75.12	
1.60 - 1.80	*	*	52.24	2.50	*	*	*	*	*	54.74	
1.80 - 2.00	*	0.50	25.00	2.37	*	*	*	*	*	27.87	
2.00 - 2.20	*	*	13.12	3.25	*	*	*	*	*	16.37	
2.20 - 2.40	*	*	4.25	0.88	*	*	*	*	*	5.13	
2.40 - 2.60	*	*	0.75	1.25	*	*	*	*	*	2.00	
2.60 - 2.80	*	*	0.25	0.75	*	*	*	*	*	1.00	
2.80 - 3.00	*	*	*	*	*	*	*	*	*	0.00	
TOTALS	71.12	548.08	464.23	132.12	151.99	38.26	1.50	0.25	0.25	1407.55	

Values in the above table are durations in days and have been rounded to the second decimal place.

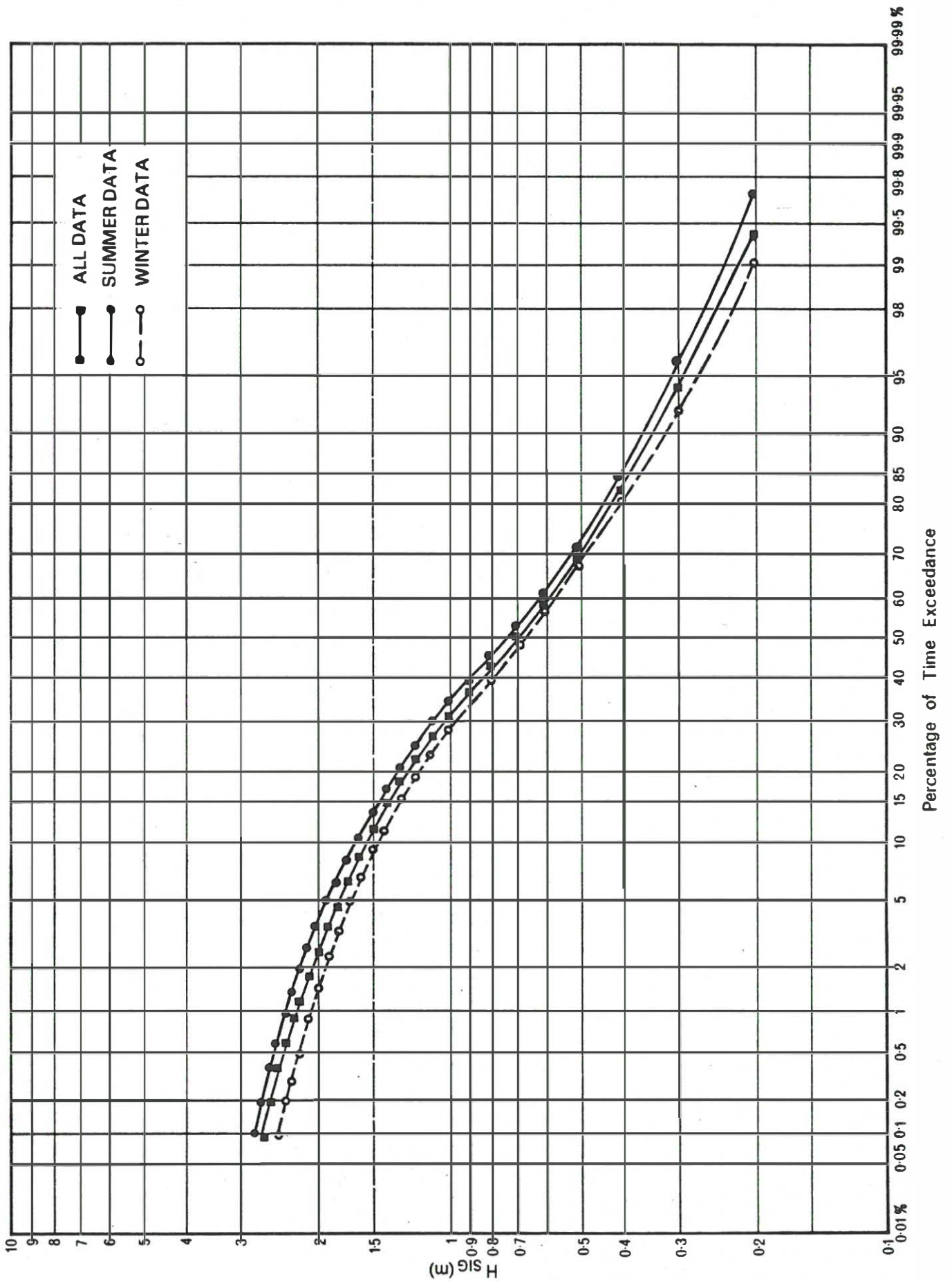


Wave Data Recording Programme
Mackay Region

LOCALITY MAP

Figure 1
WO2.2





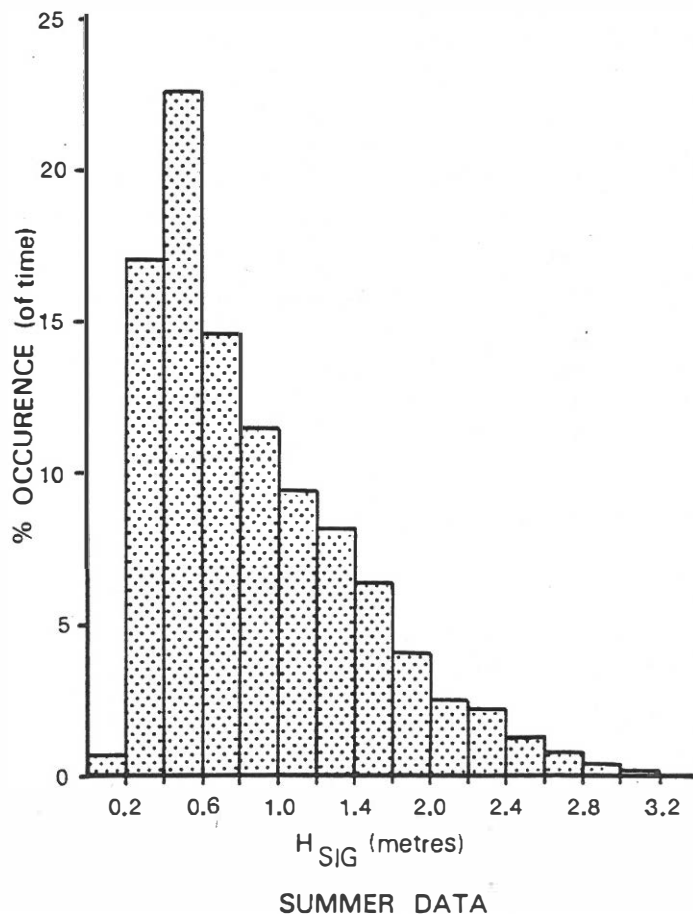
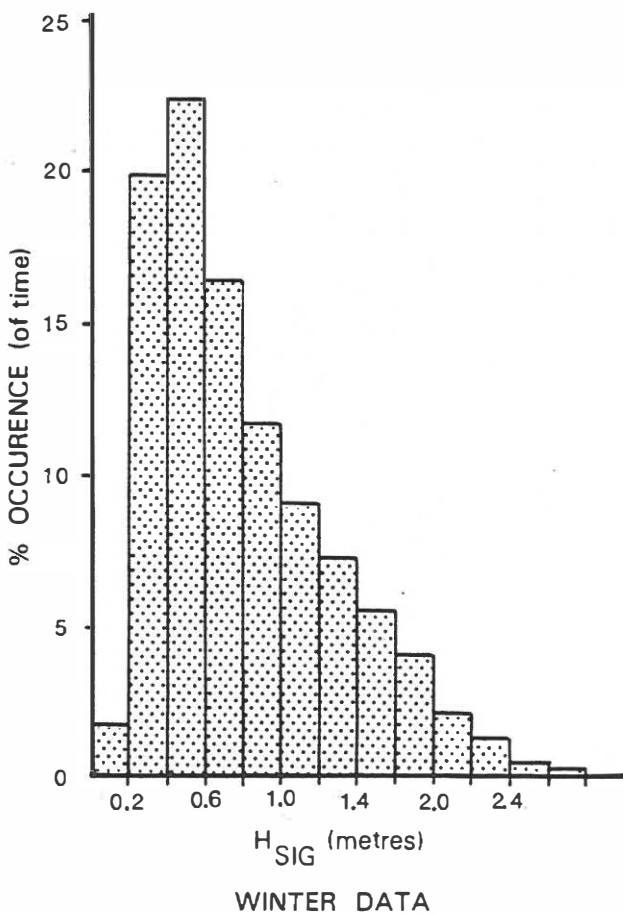
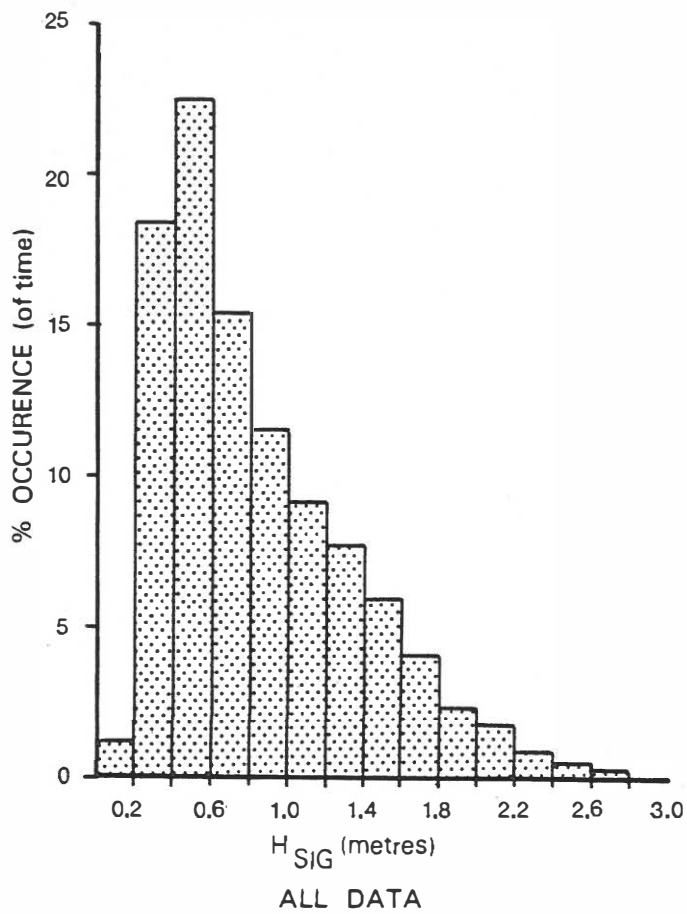
**PERCENTAGE (OF TIME) EXCEEDANCE
OF WAVE HEIGHTS (H_{sig}) FOR ALL
WAVE PERIODS**

17th September 1975 to 23rd August 1985

Wave Data Recording Programme
Mackay Region

Figure 2
WO2.2

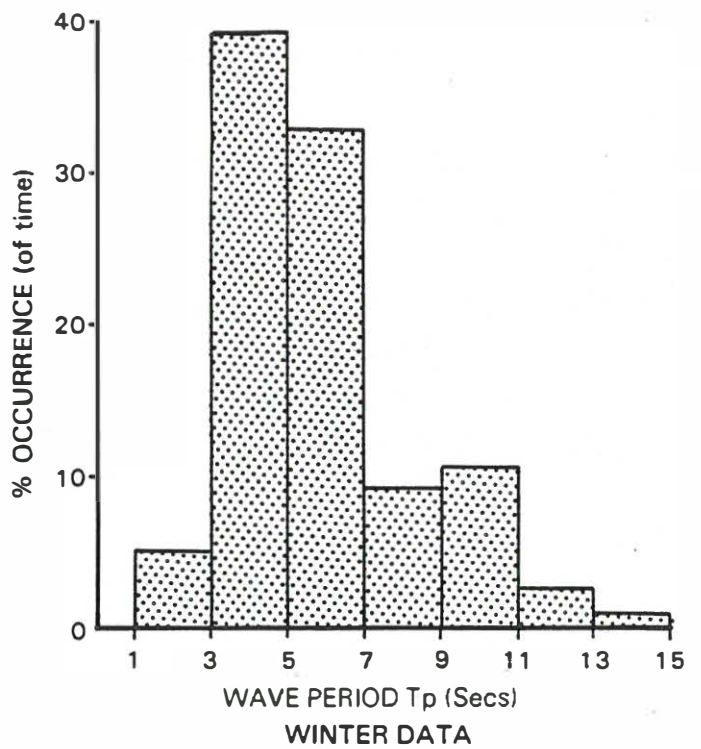
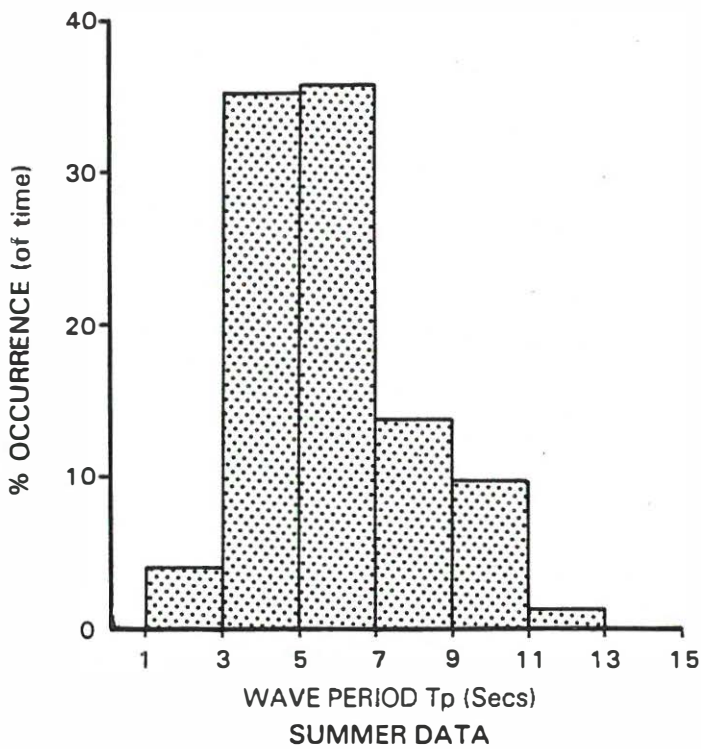
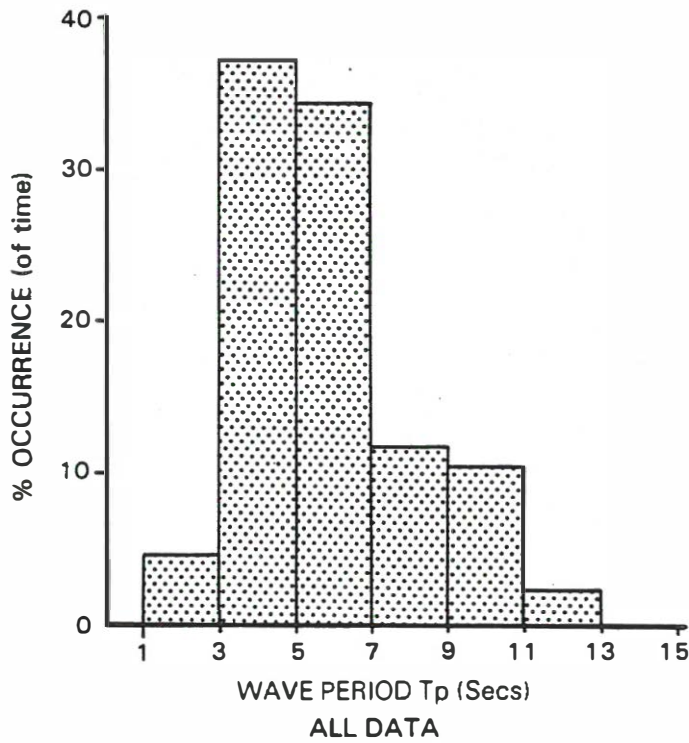




**HISTOGRAM PERCENTAGE (OF TIME)
OCCURENCE OF WAVE HEIGHTS (H_{sig})
FOR ALL WAVE PERIODS (T_p)
17th September 1975 to 23rd August 1985**

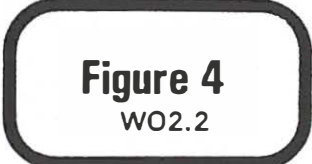
Wave Data Recording Programme
Mackay Region

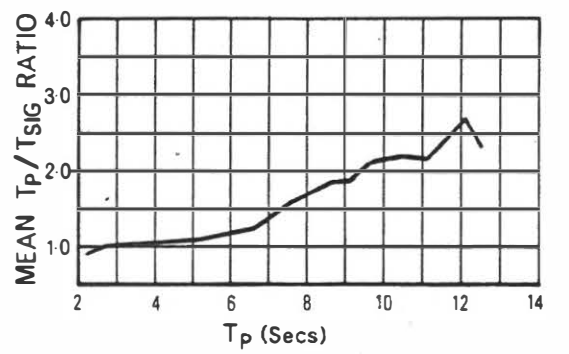
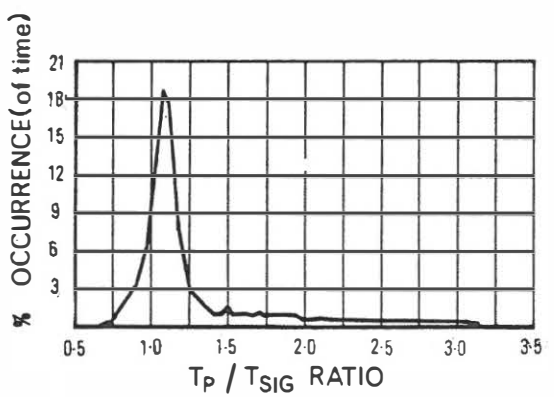
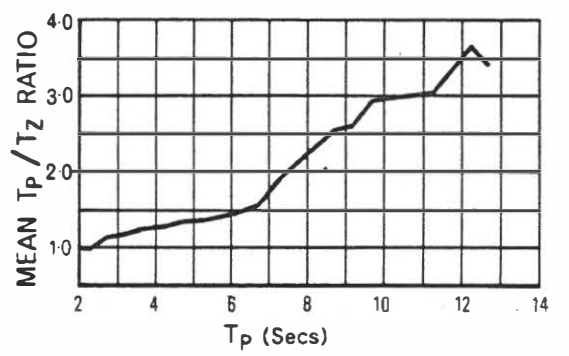
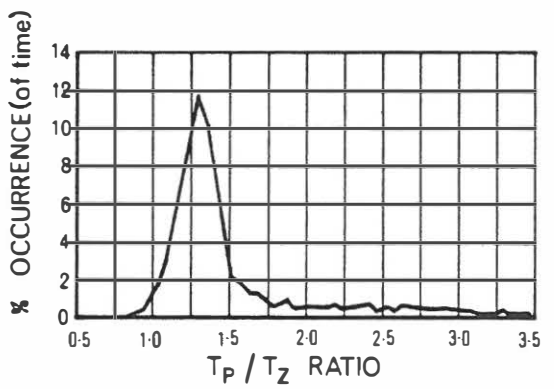
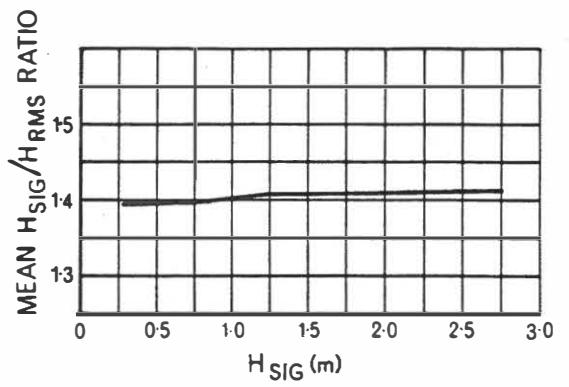
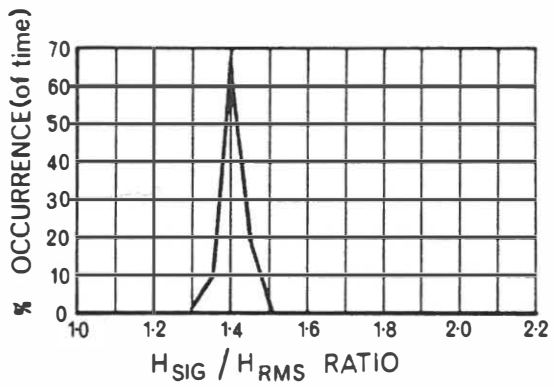
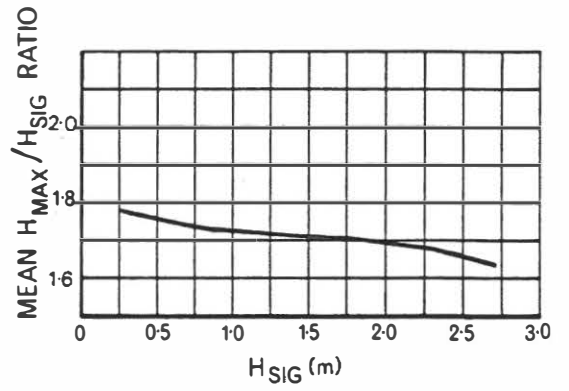
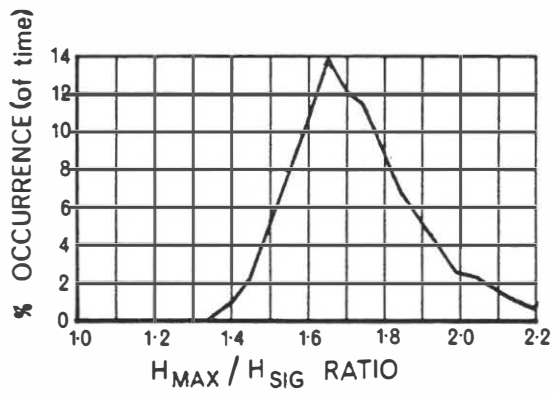
Figure 3
WO2.2



**HISTOGRAM PERCENTAGE (OF TIME)
OCCURRENCE OF WAVE PERIODS (T_p) FOR
ALL WAVE HEIGHTS (H_{sig})**

17th September 1975 to 23rd August 1985





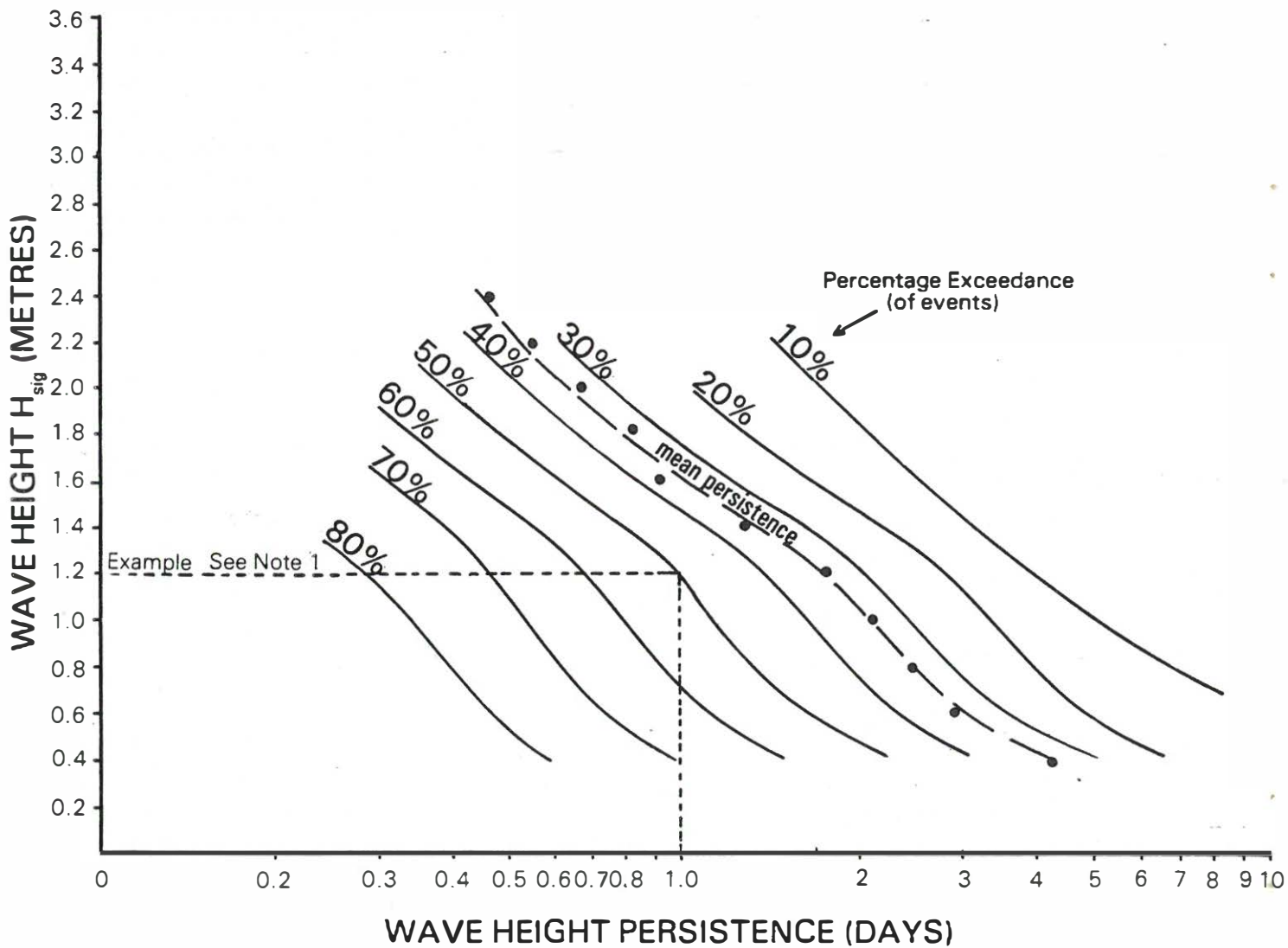
Beach Protection Authority

WAVE PARAMETER RELATIONSHIPS

17th September 1975 to 23rd August 1985

Wave Data Recording Programme
Mackay Region

Figure 5
W02.2



Note:

1. Wave height persistence is the duration for which a given significant wave height is continuously exceeded. As an example, given a 1.2 metre significant wave height, there is a 50% probability that this wave height or greater will persist for more than one day.
2. The mean persistence line plotted represents the average persistence of all events having a given significant wave height or greater.



**AVERAGE DURATION OF
EXCEEDANCE OF WAVE HEIGHTS (H_{sig})**
17th September 1975 to 23rd August 1985



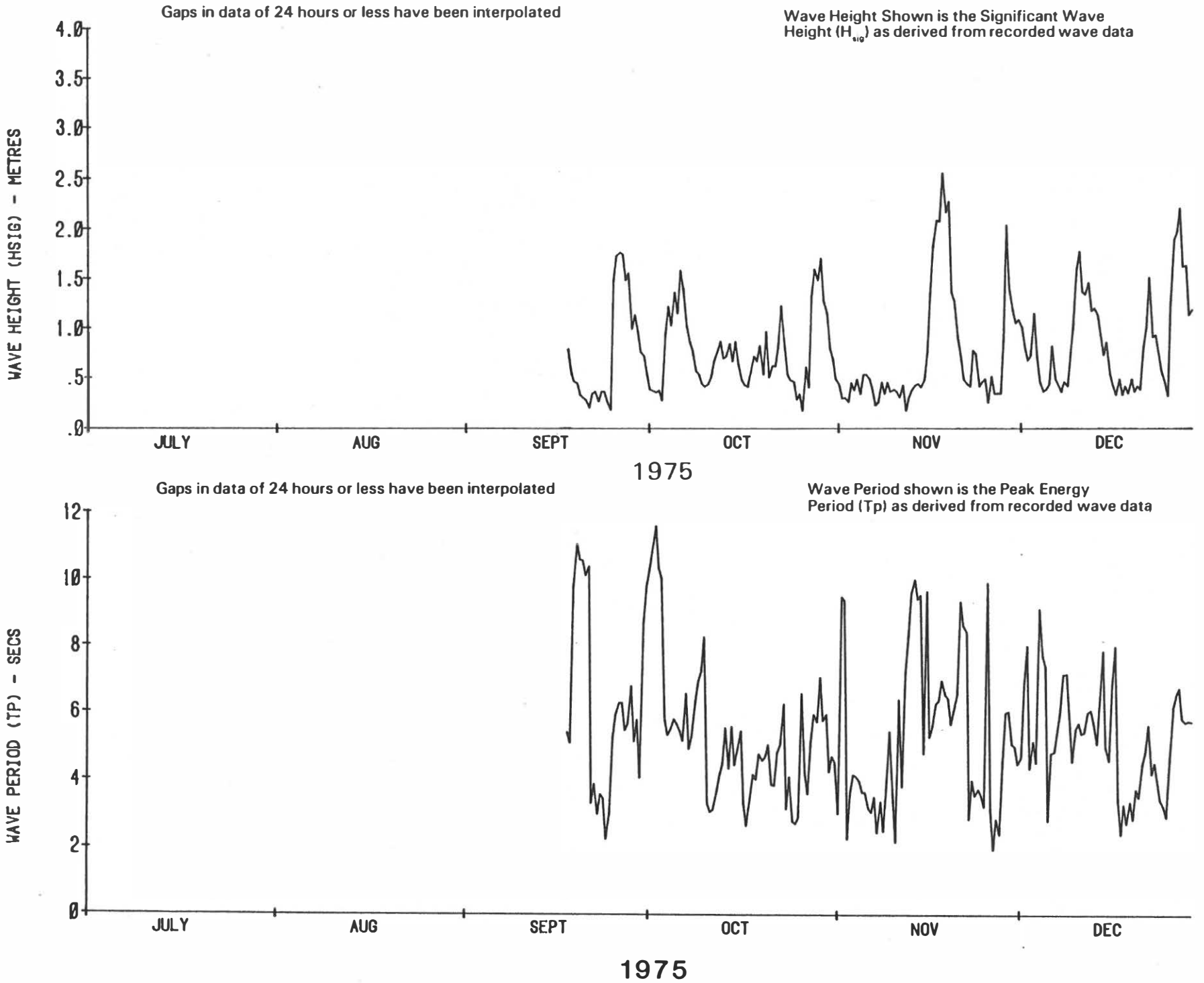
17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

Figure 7

WO2.2





17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

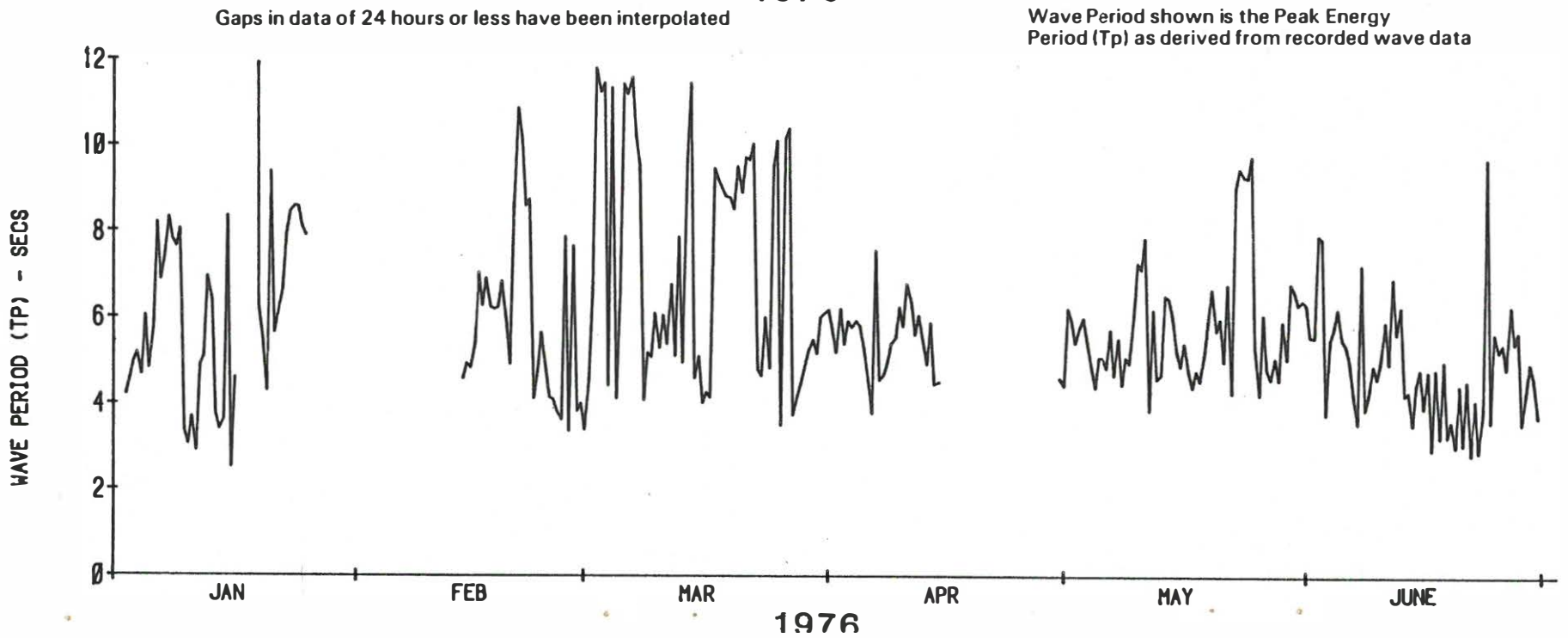
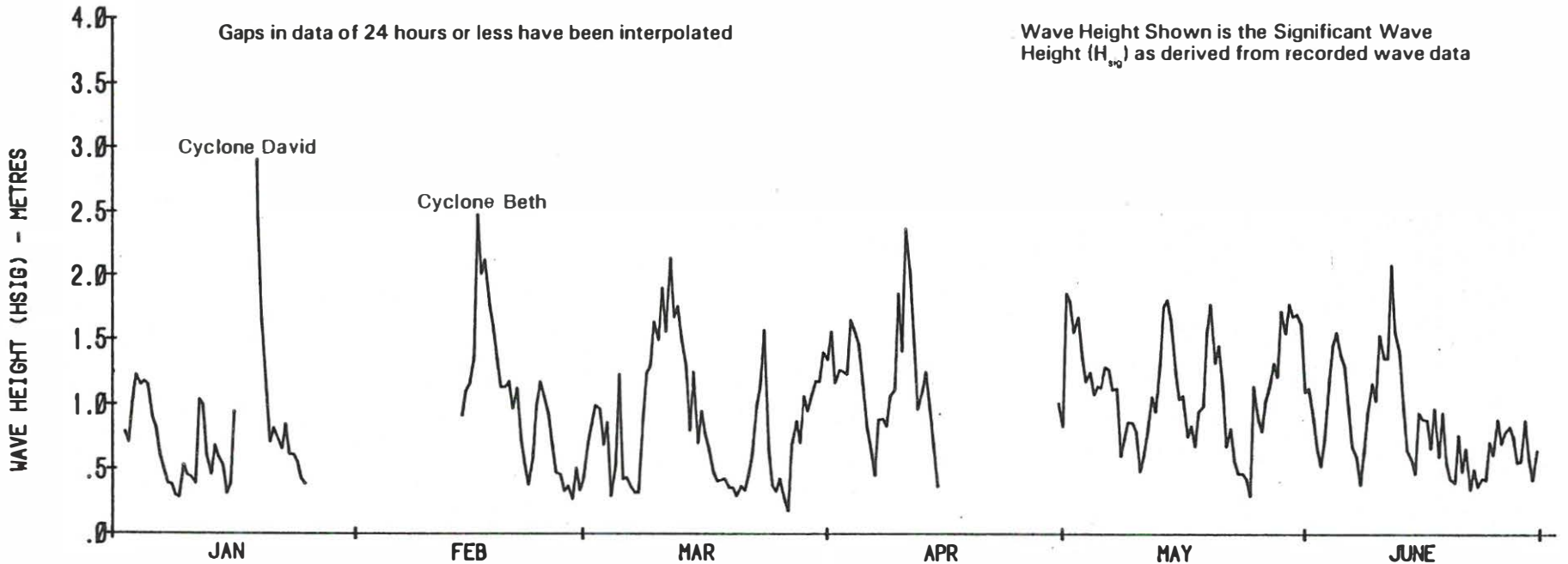


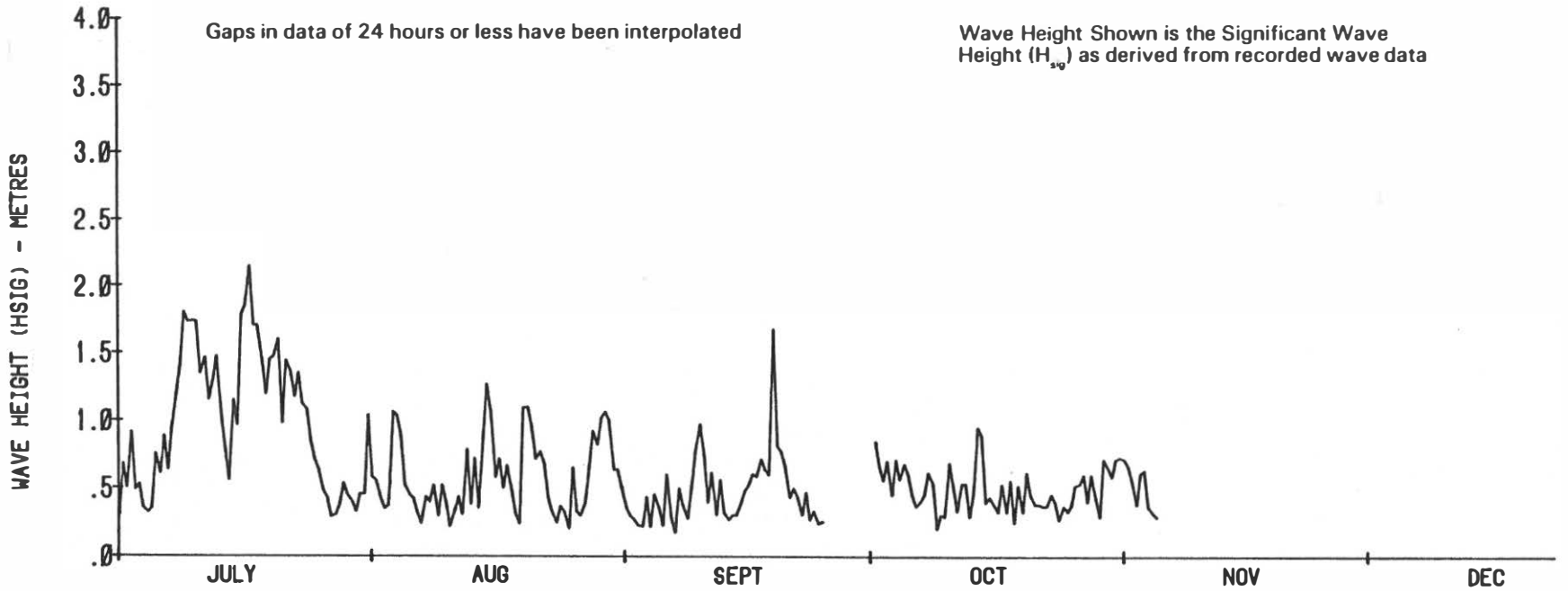
Figure 7
WO2.2



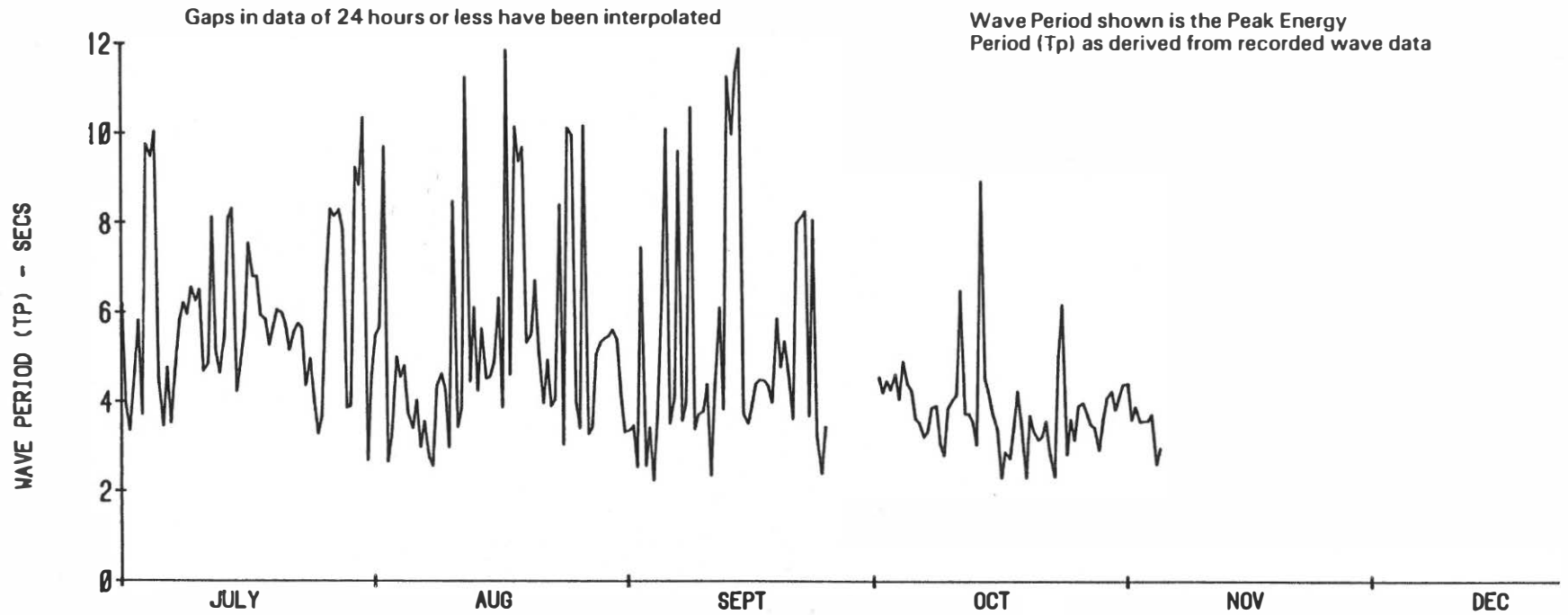
17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region



1976



1976

Figure 7
WO2.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

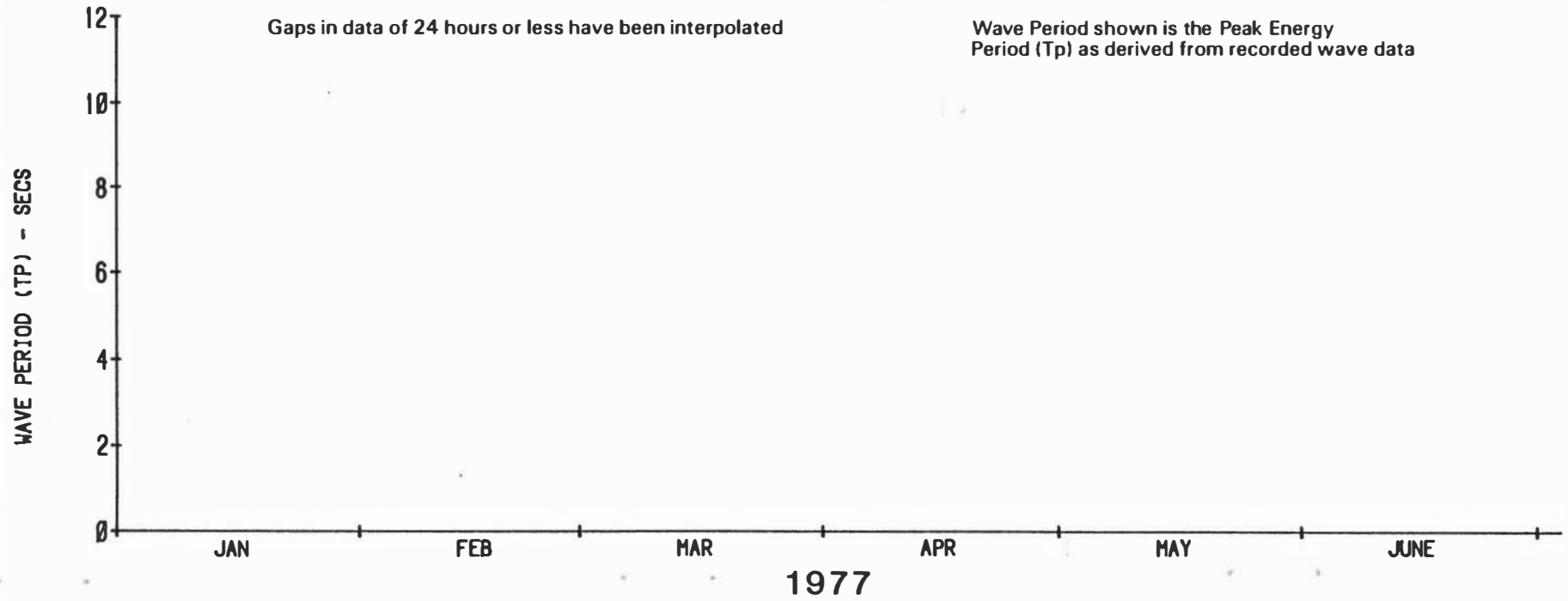
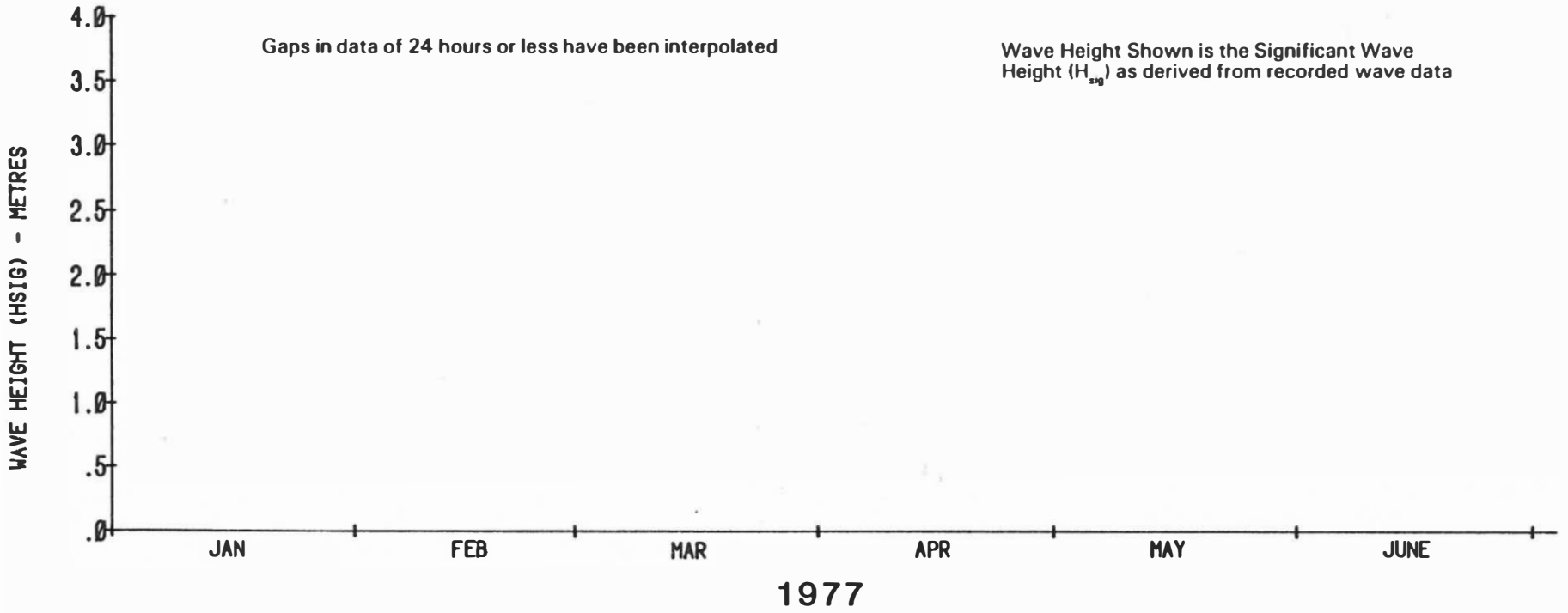


Figure 7

WO2.2

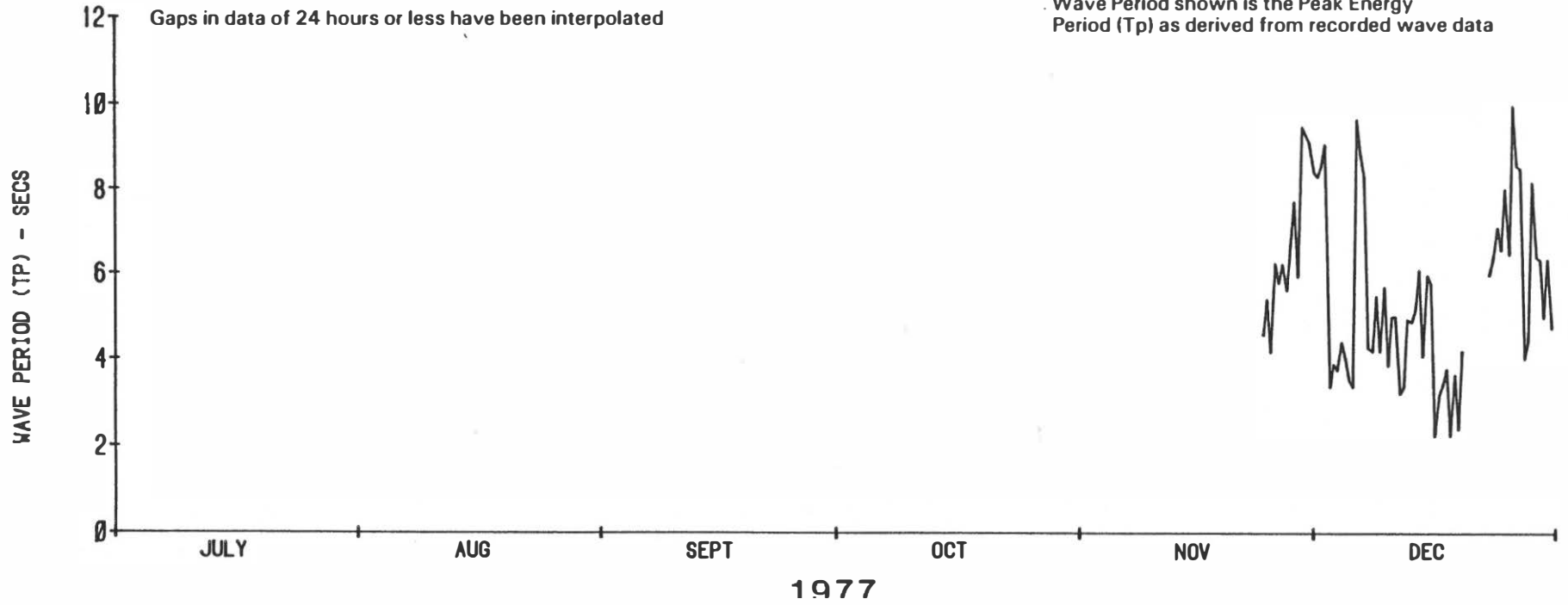
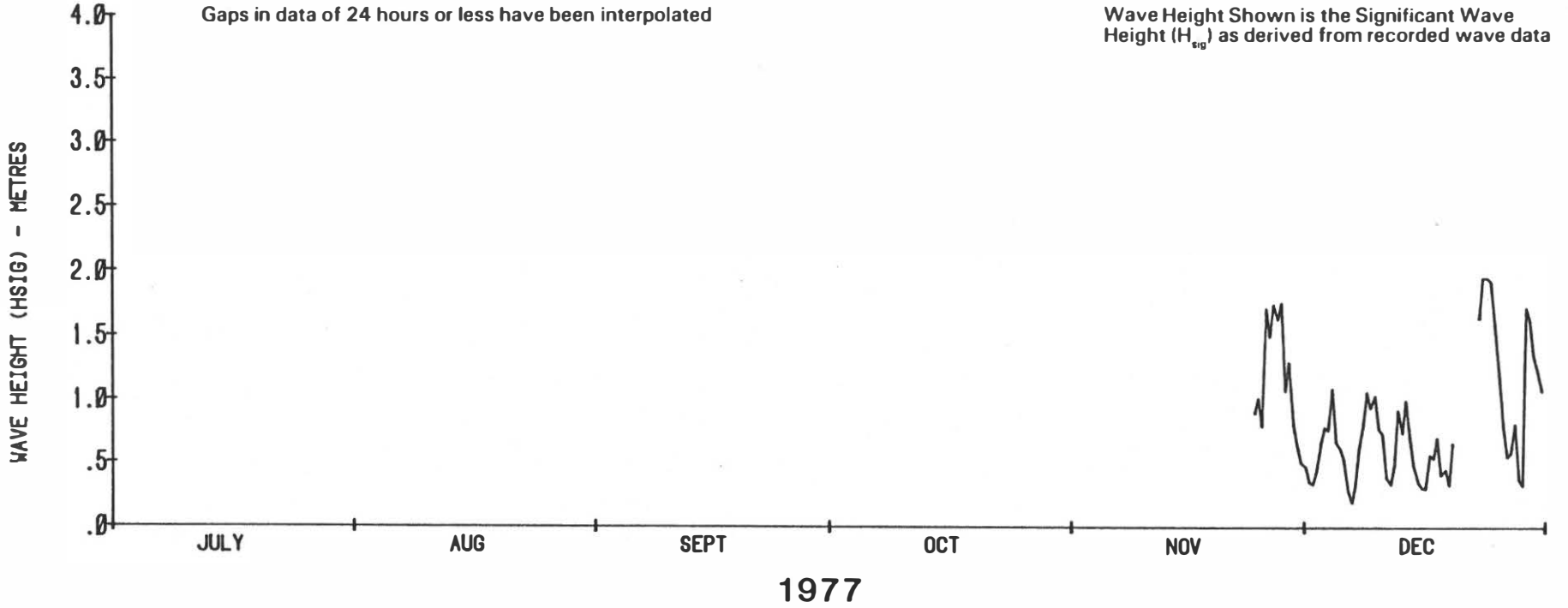


17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

Figure 7
WO2.2





17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

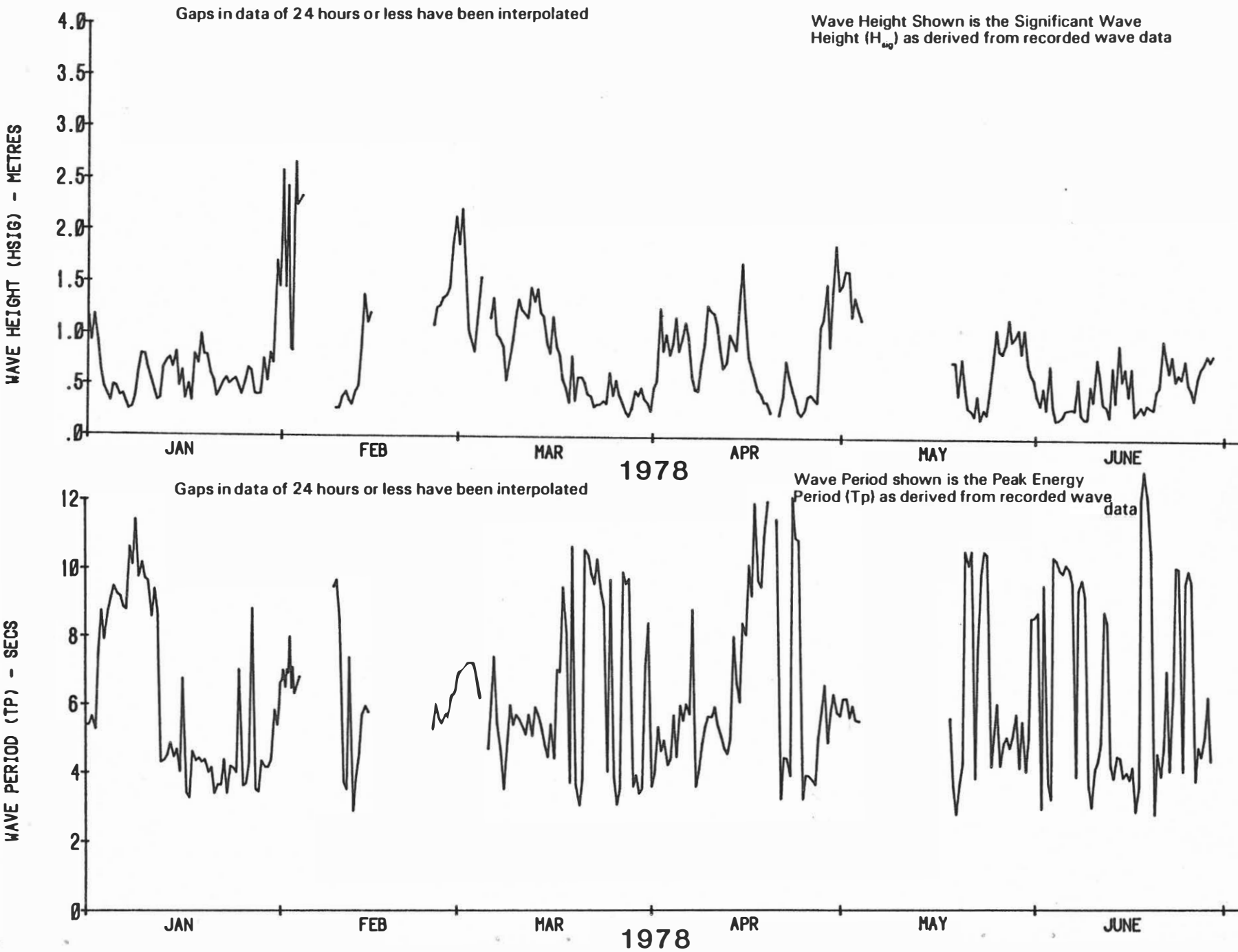


Figure 7
WO2.2



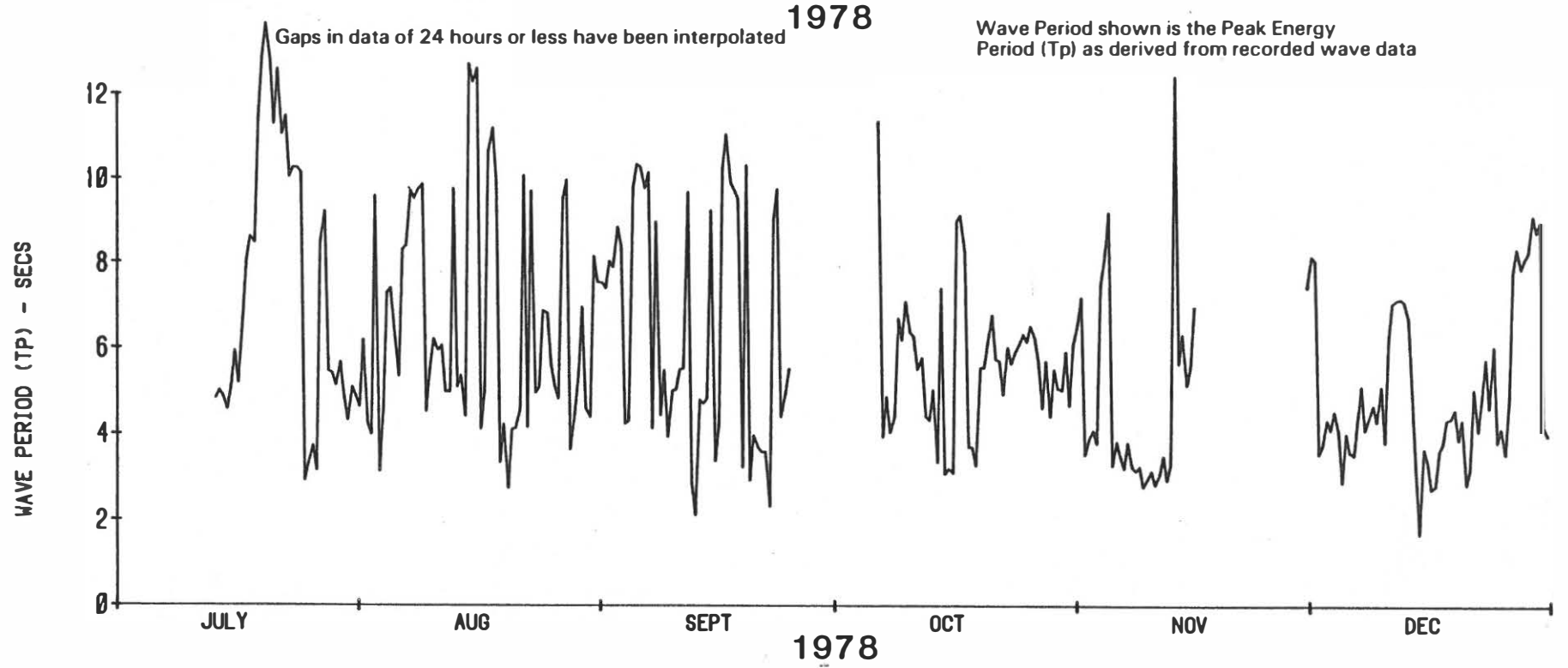
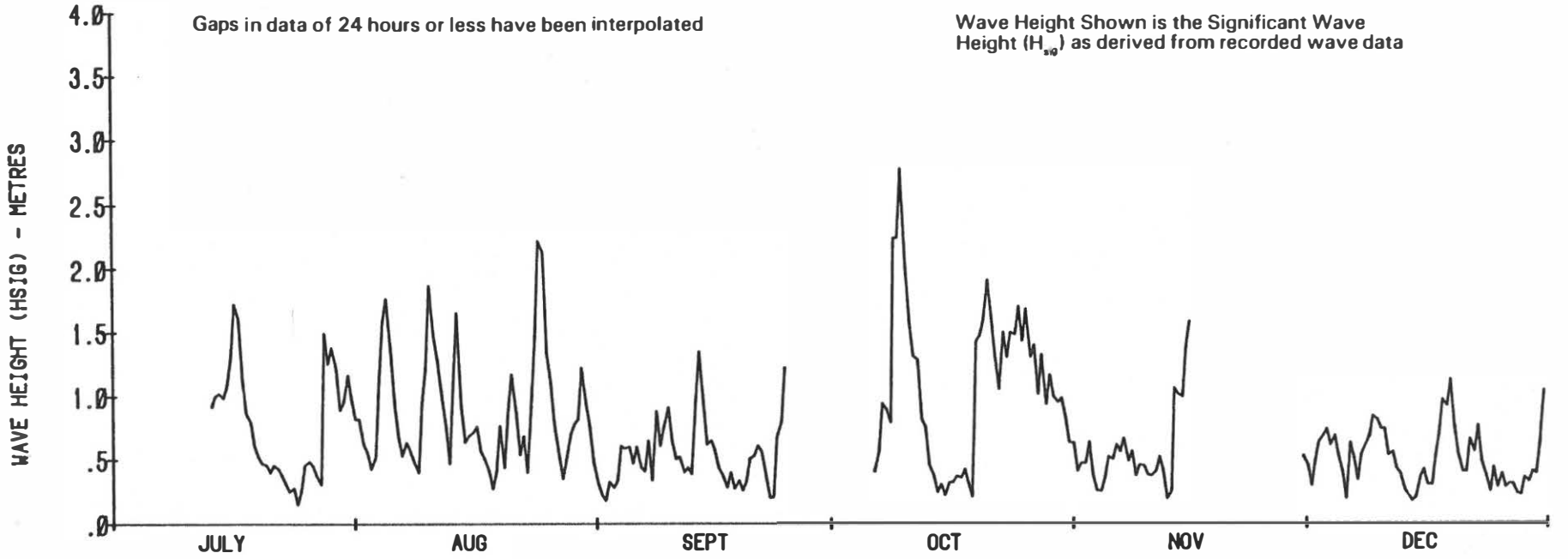
17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

Figure 7

WO2.2





17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

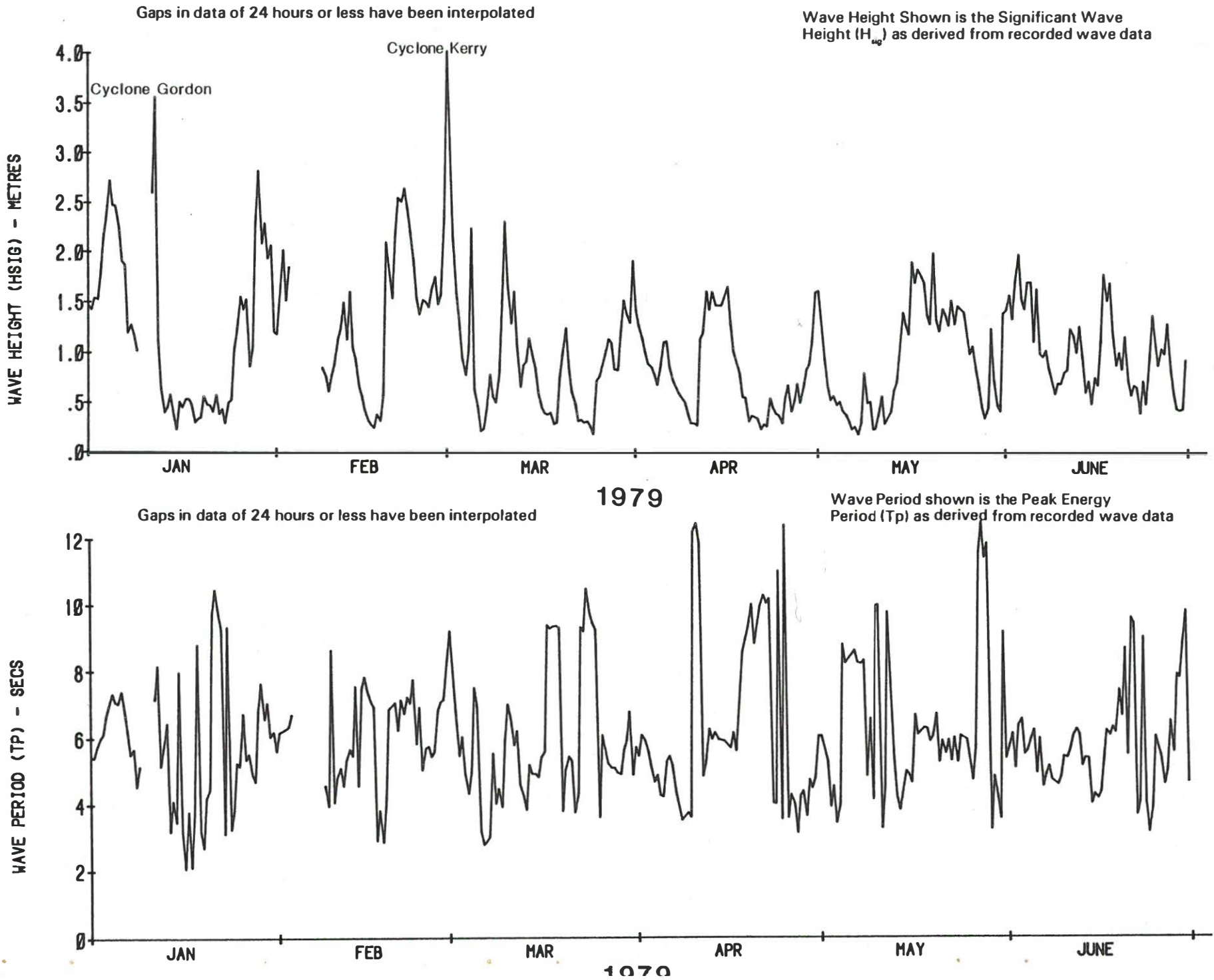


Figure 7
W02.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

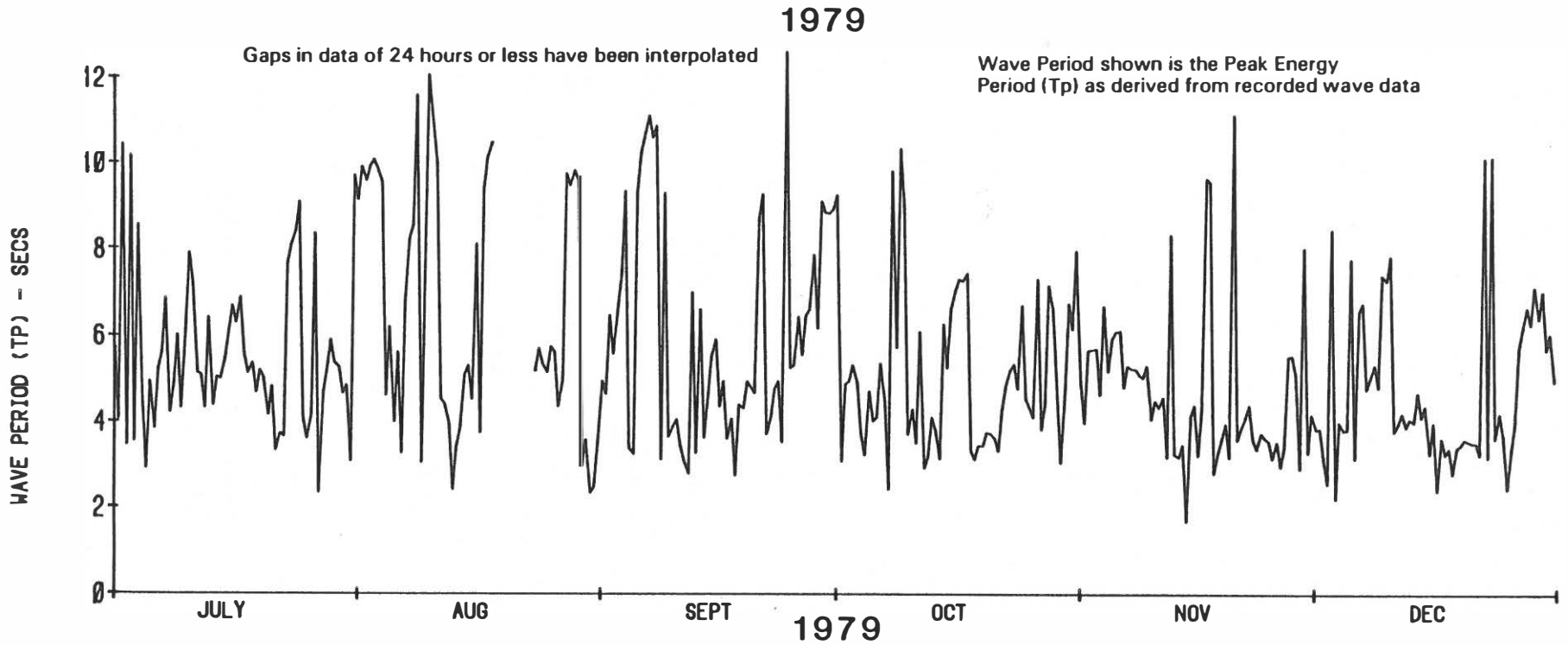
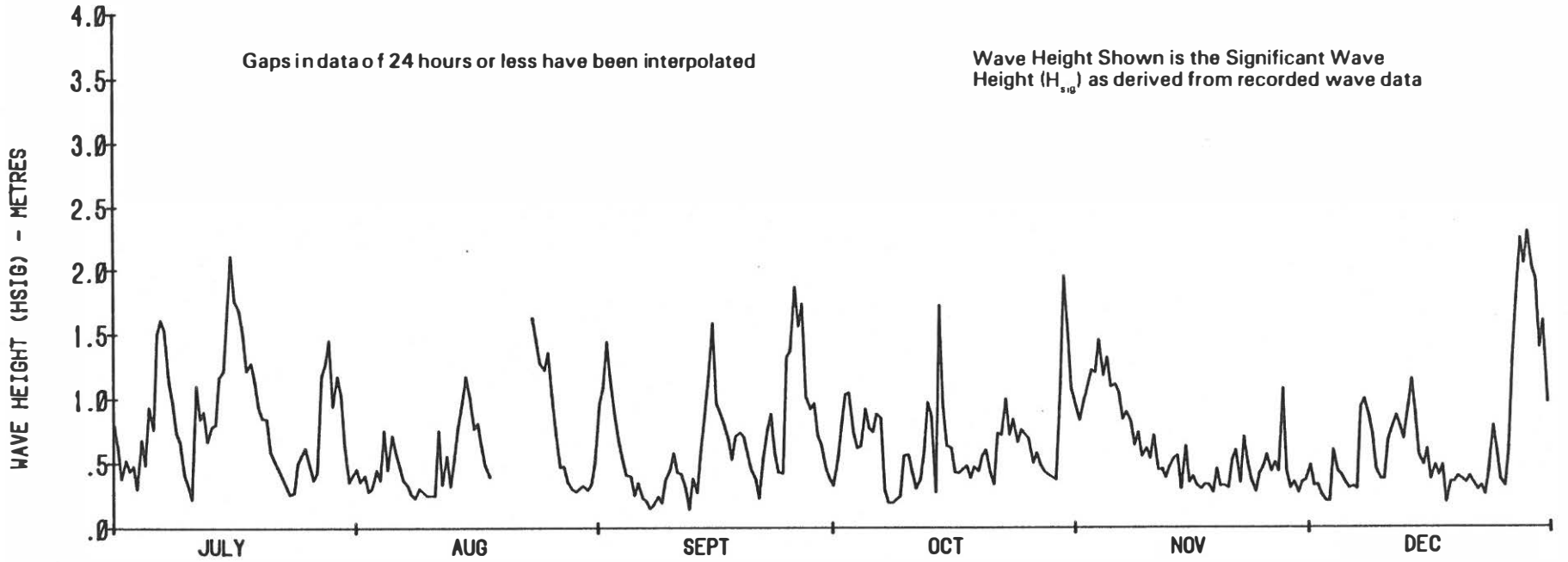


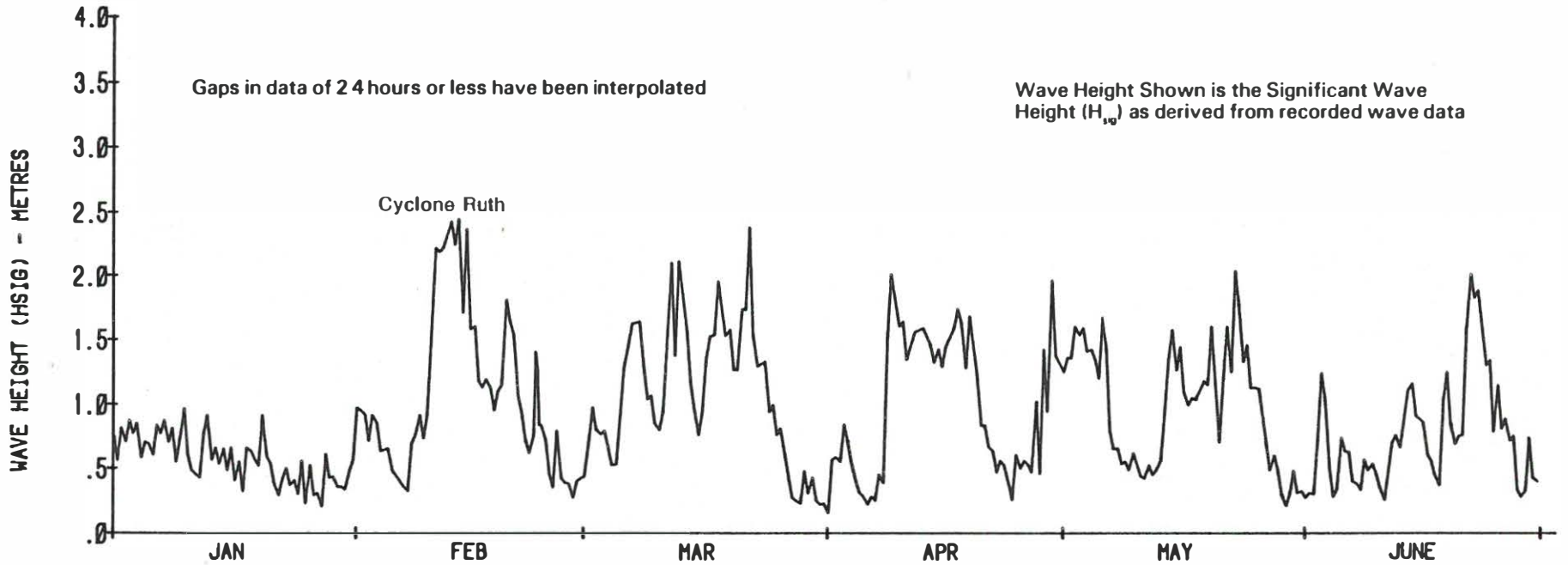
Figure 7
WO2.2



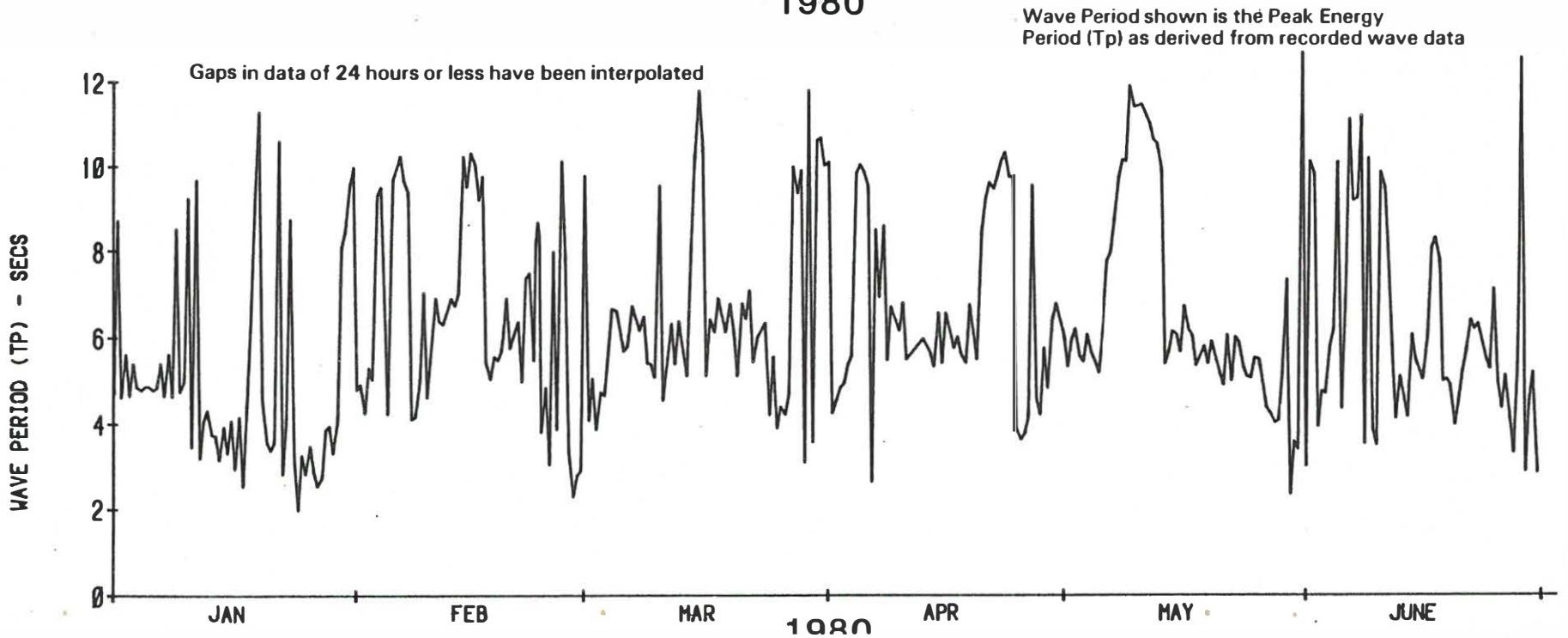
17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region



1980



1980

Figure 7

W02.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackey Region

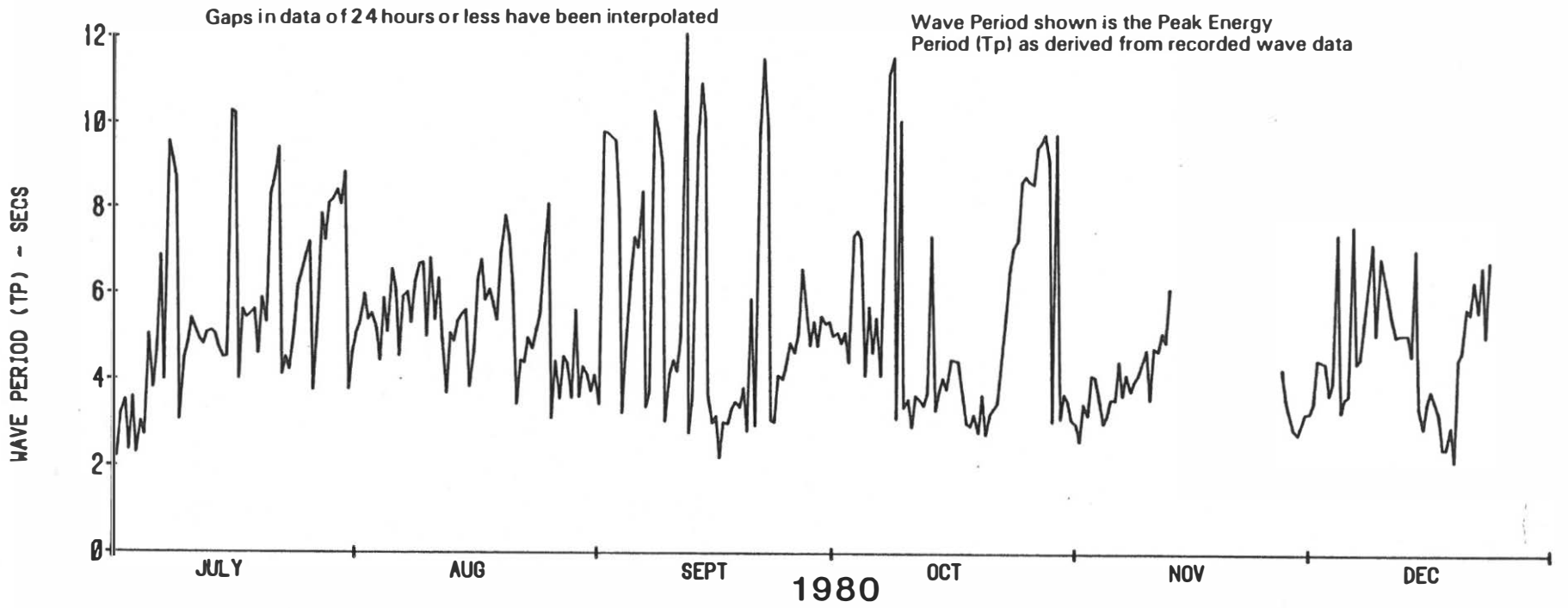
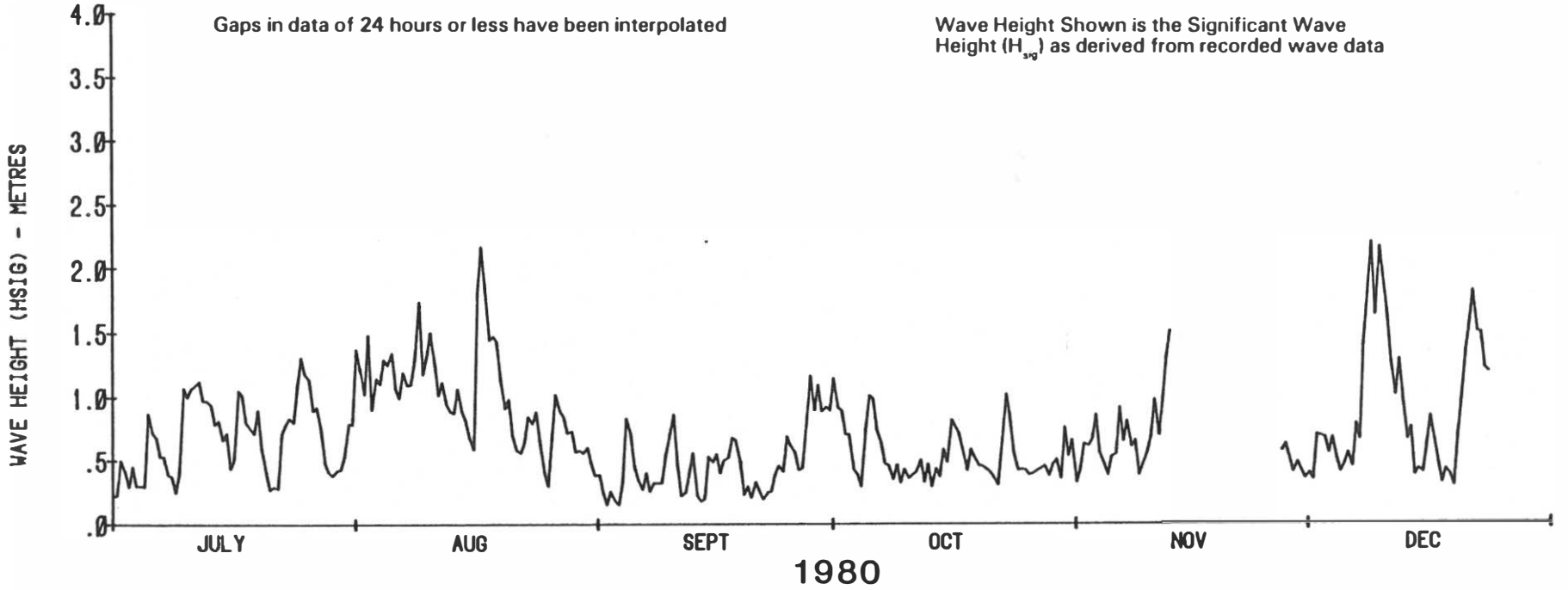


Figure 7
WO2.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

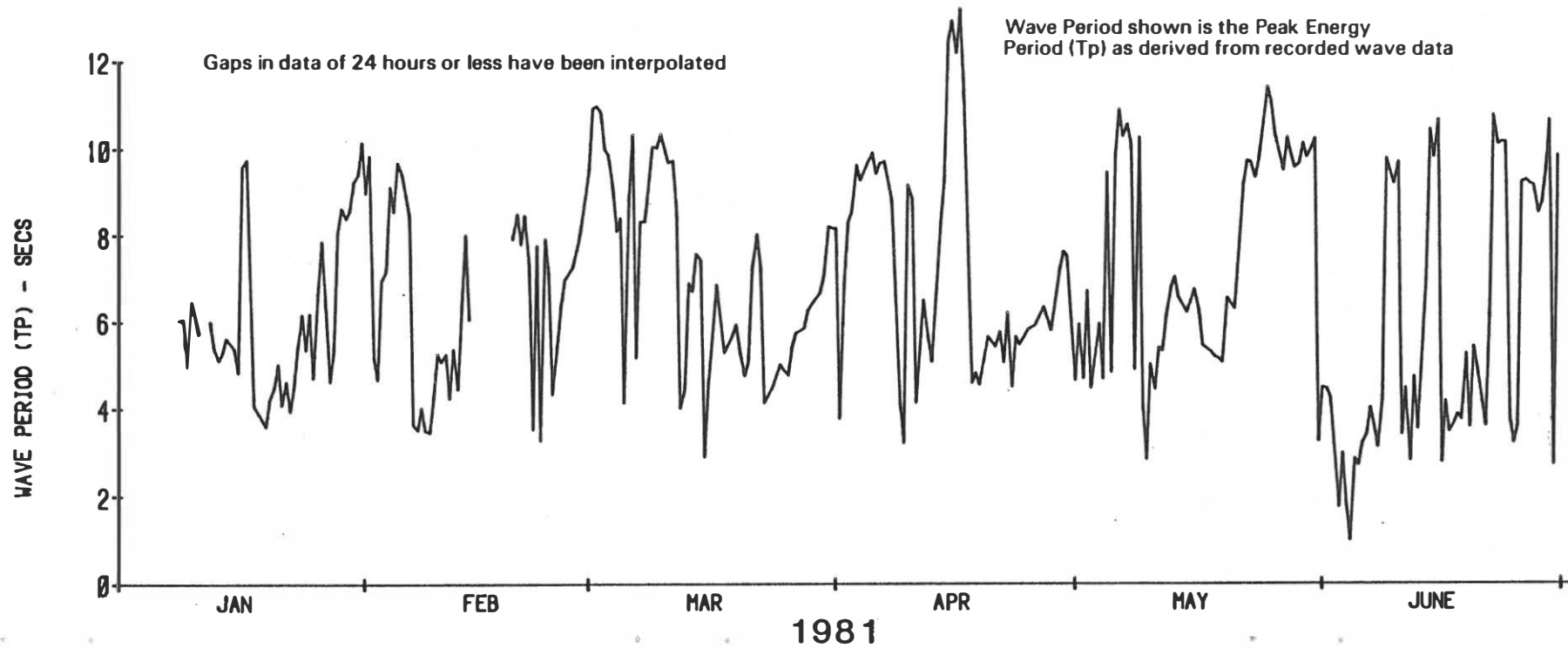
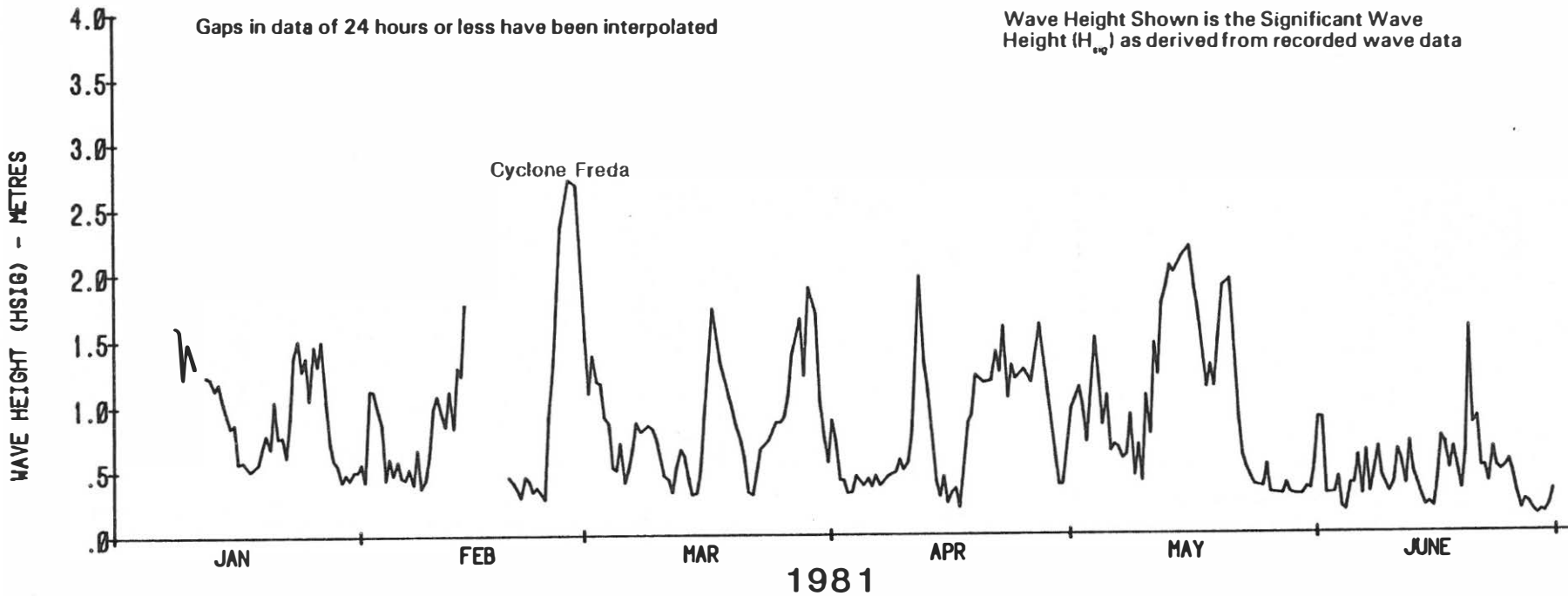


Figure 7
W02.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

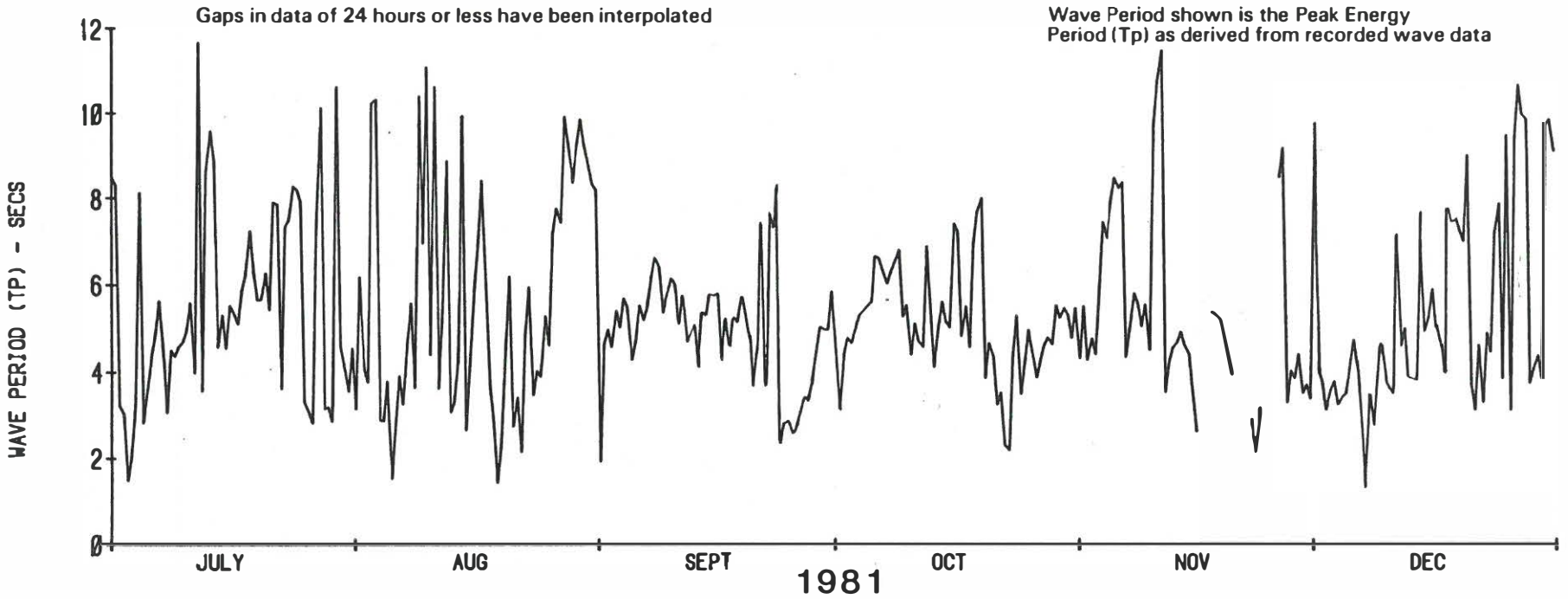
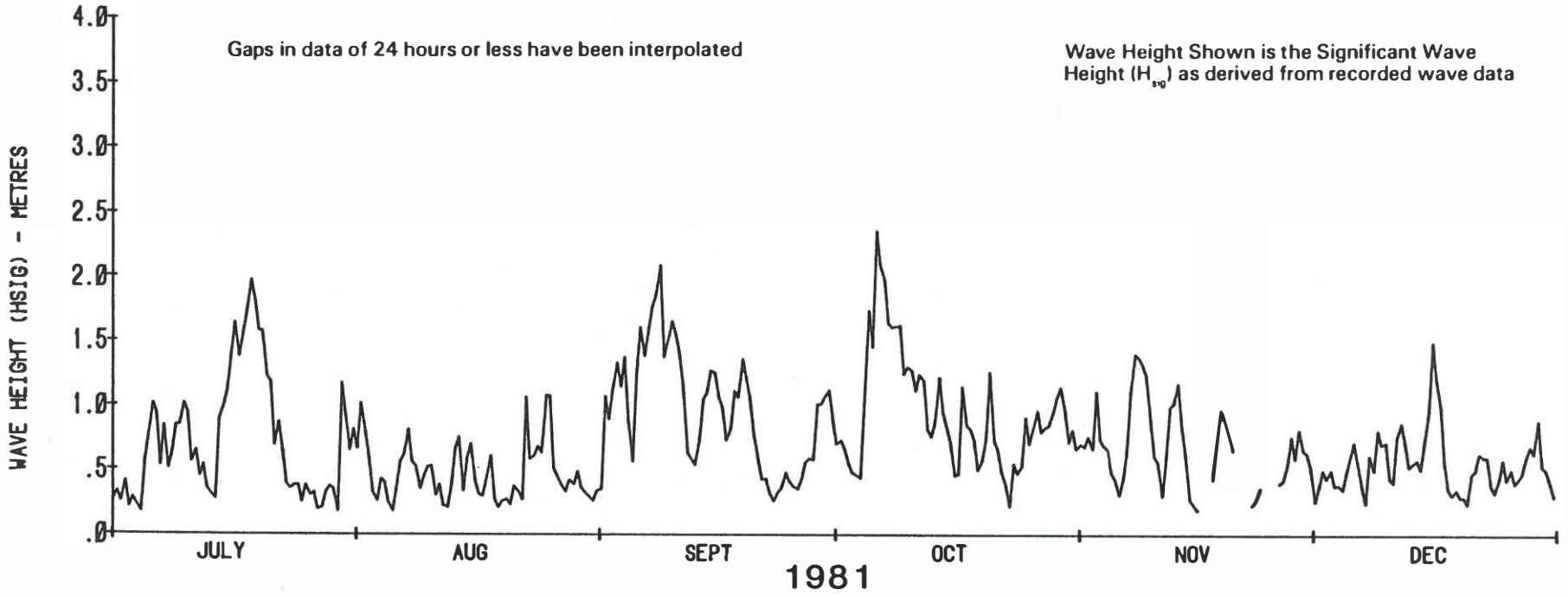


Figure 7
WO2.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

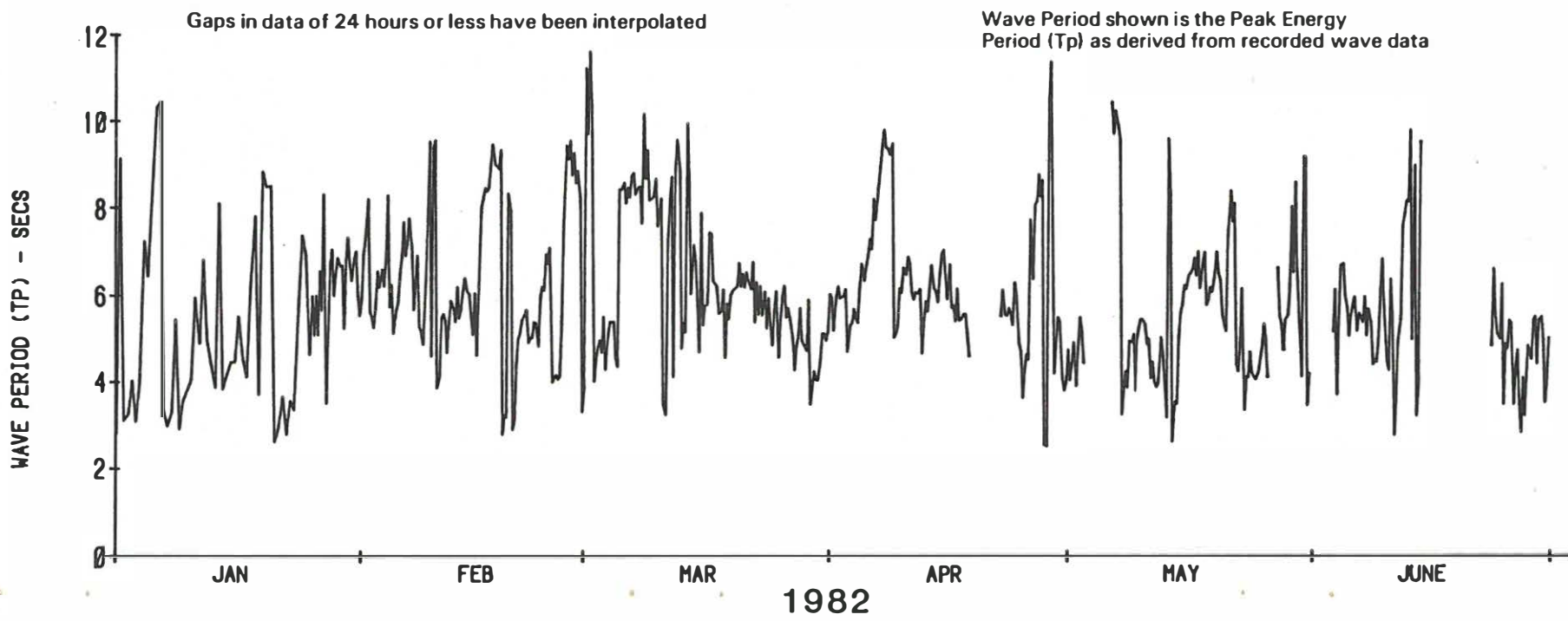
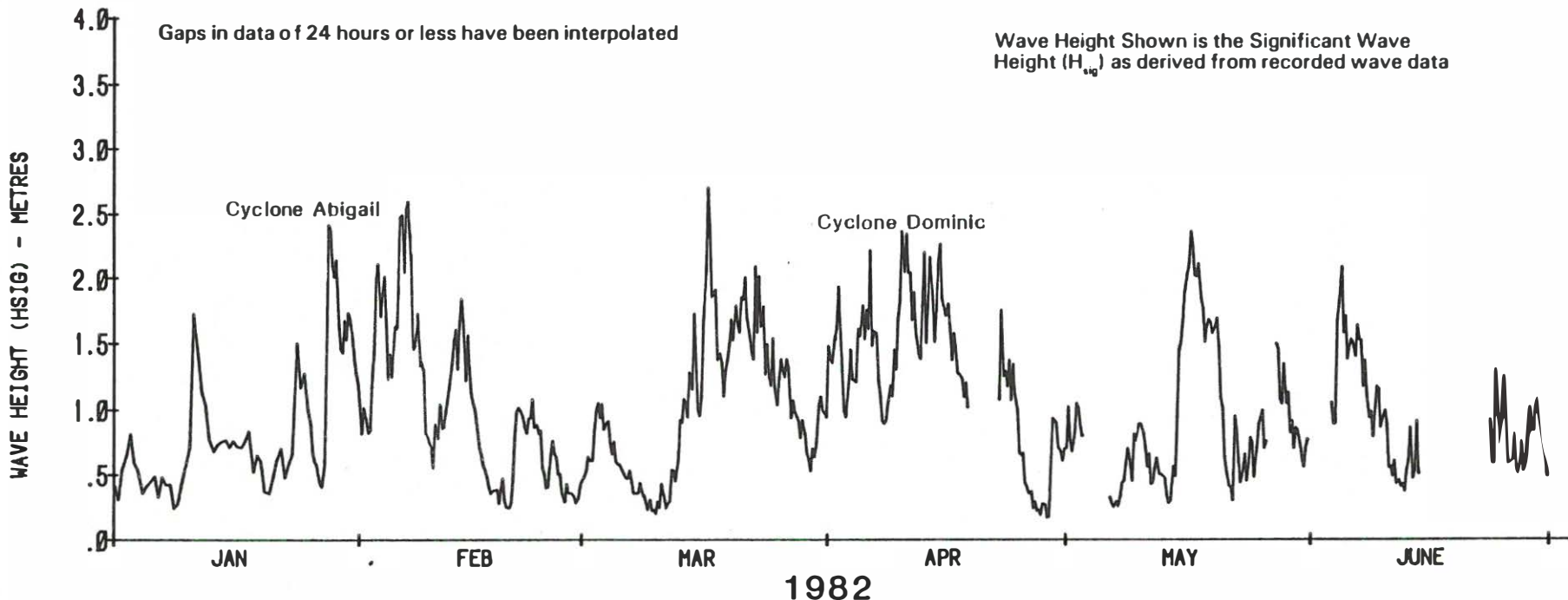


Figure 7

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17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

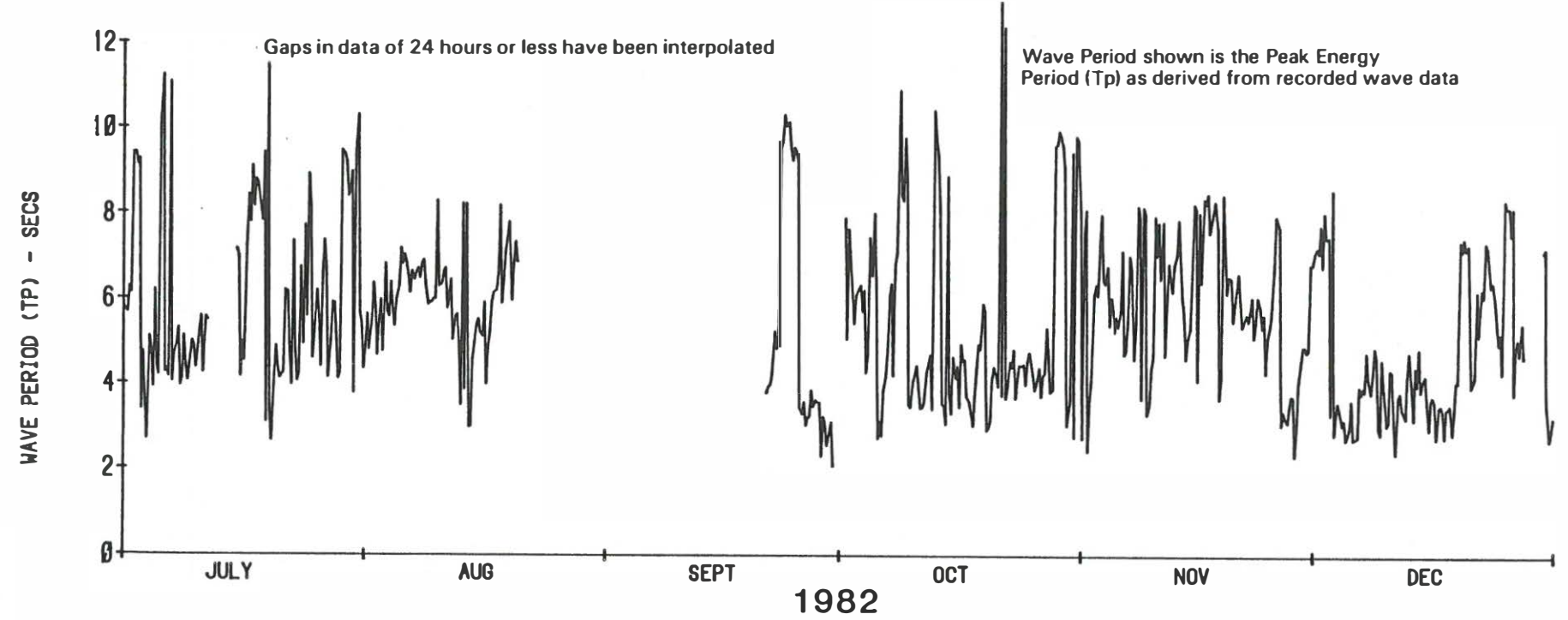
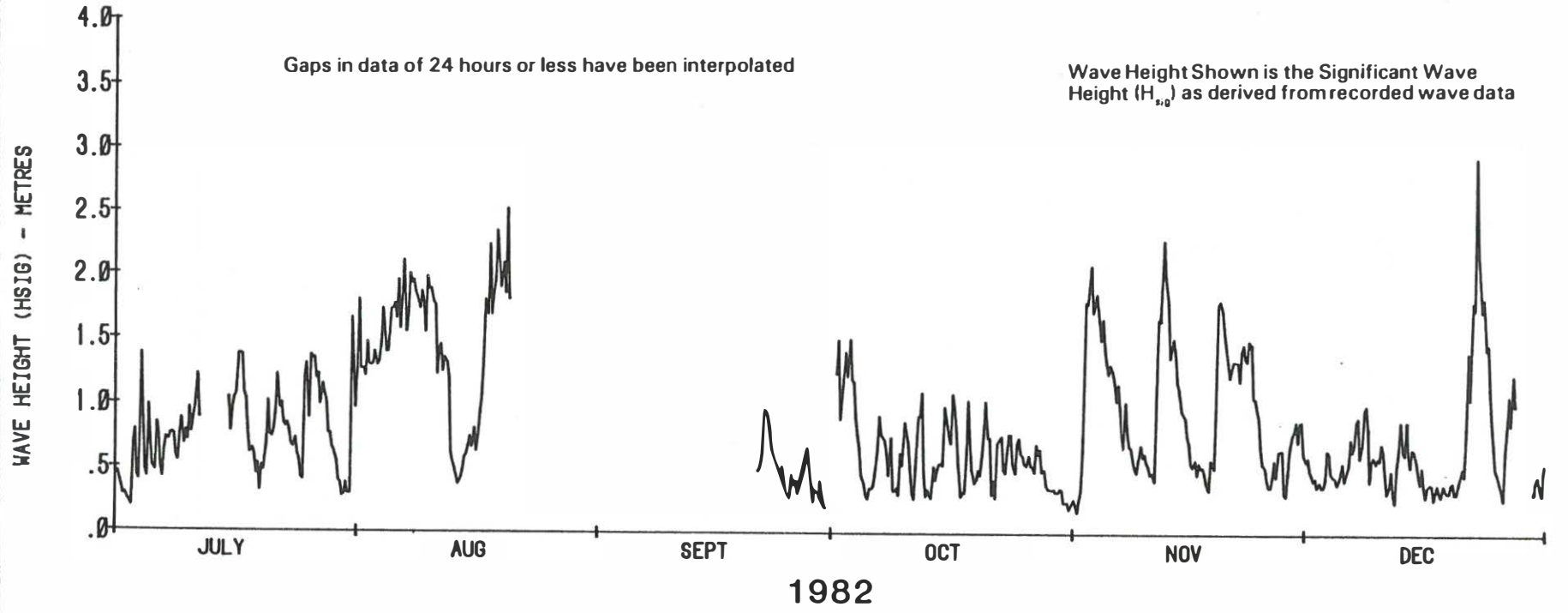


Figure 7
W02.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

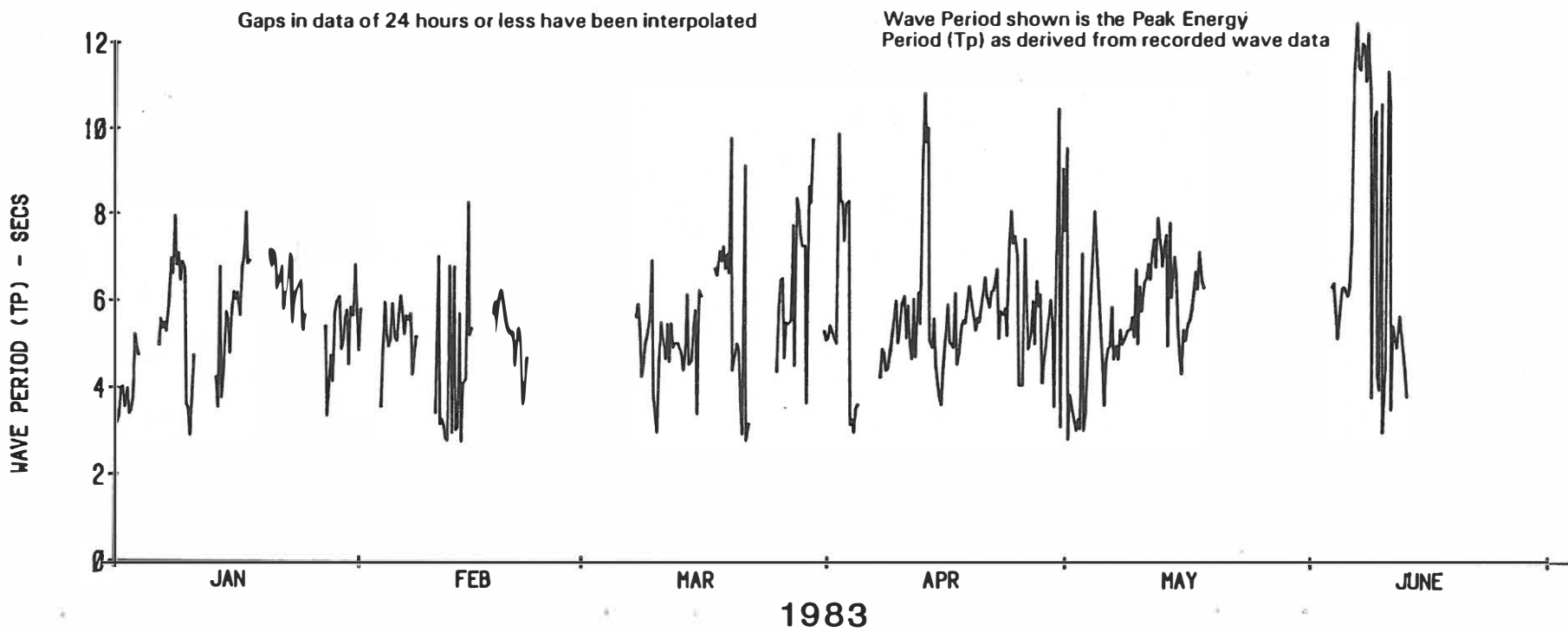
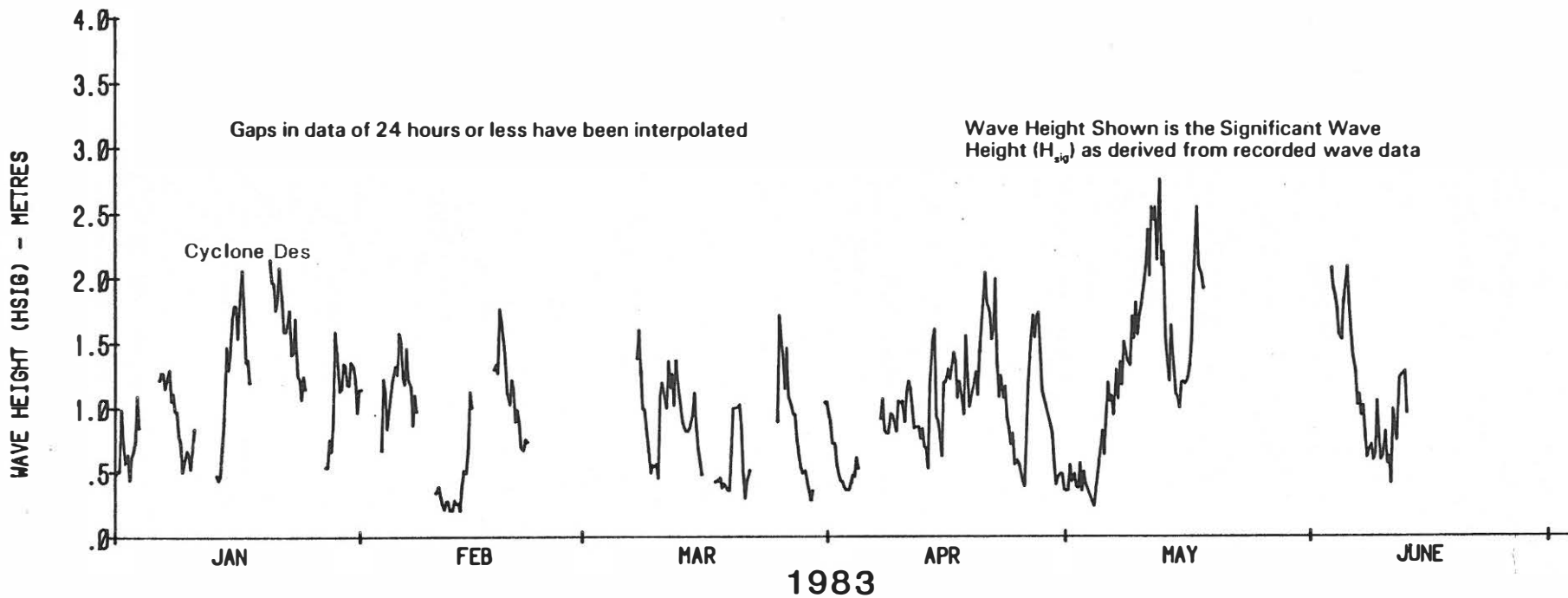
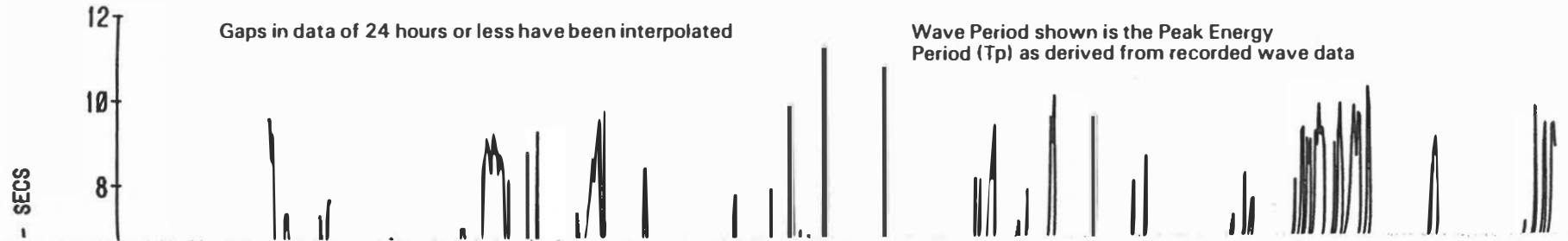
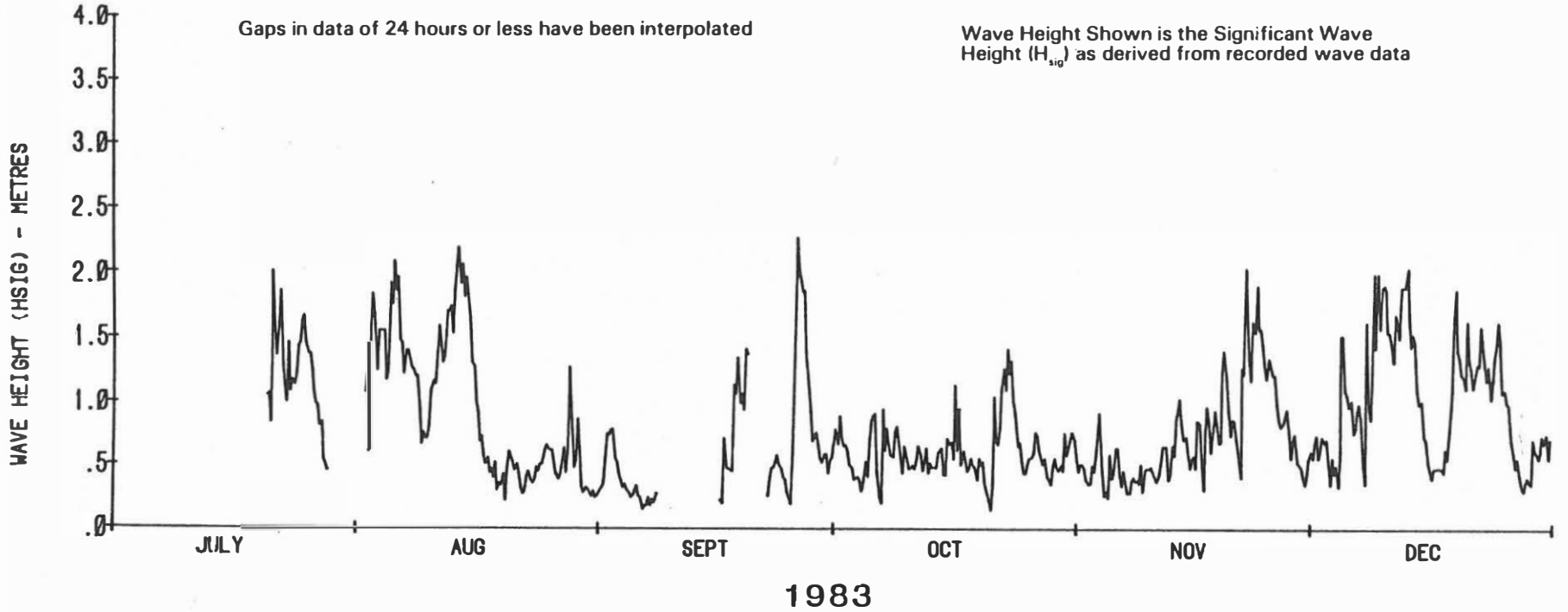


Figure 7
WO2.2



17th September 1975 to 23rd August 1984

DAILY WAVE RECORDINGS





17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

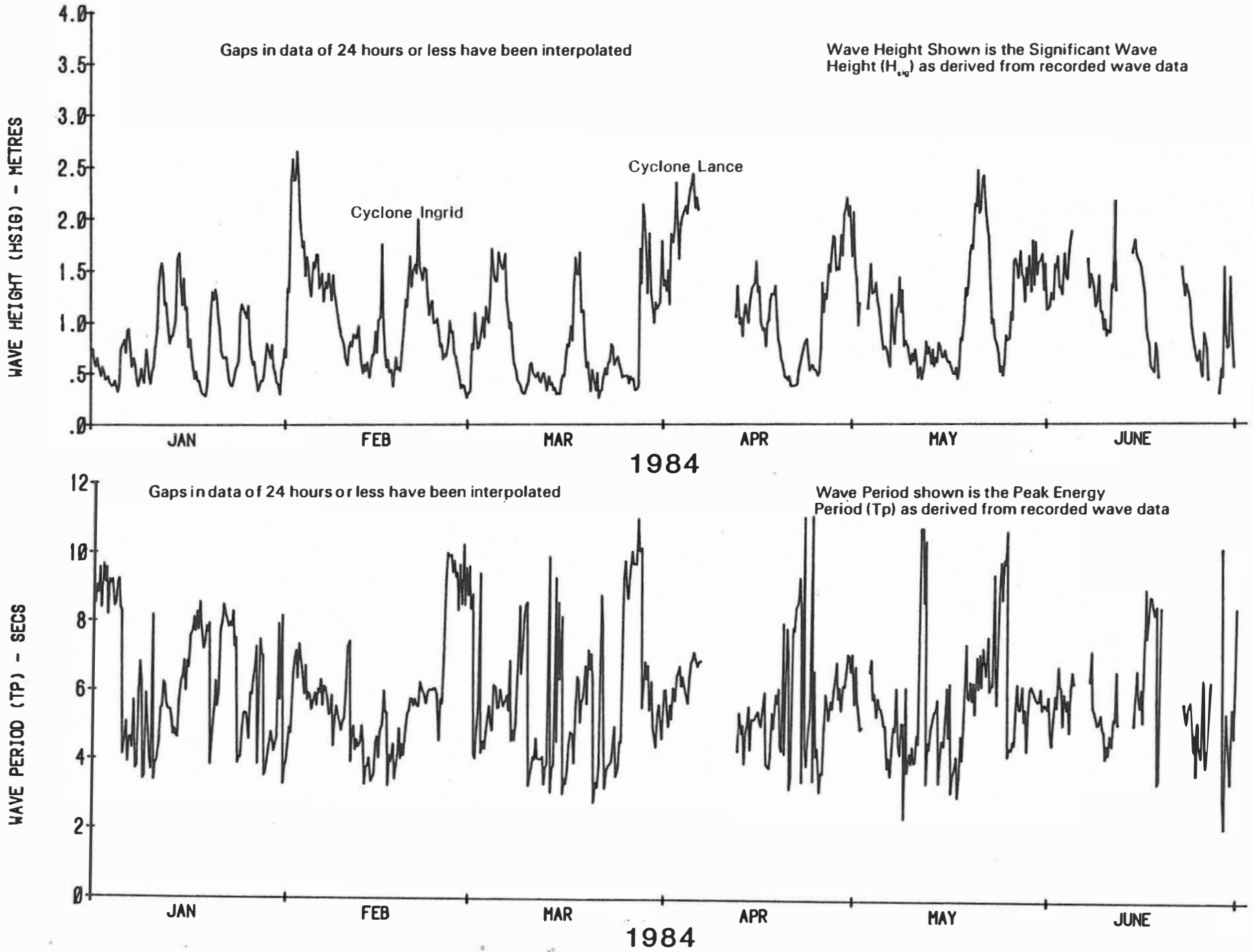


Figure 7
WO2.2



17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

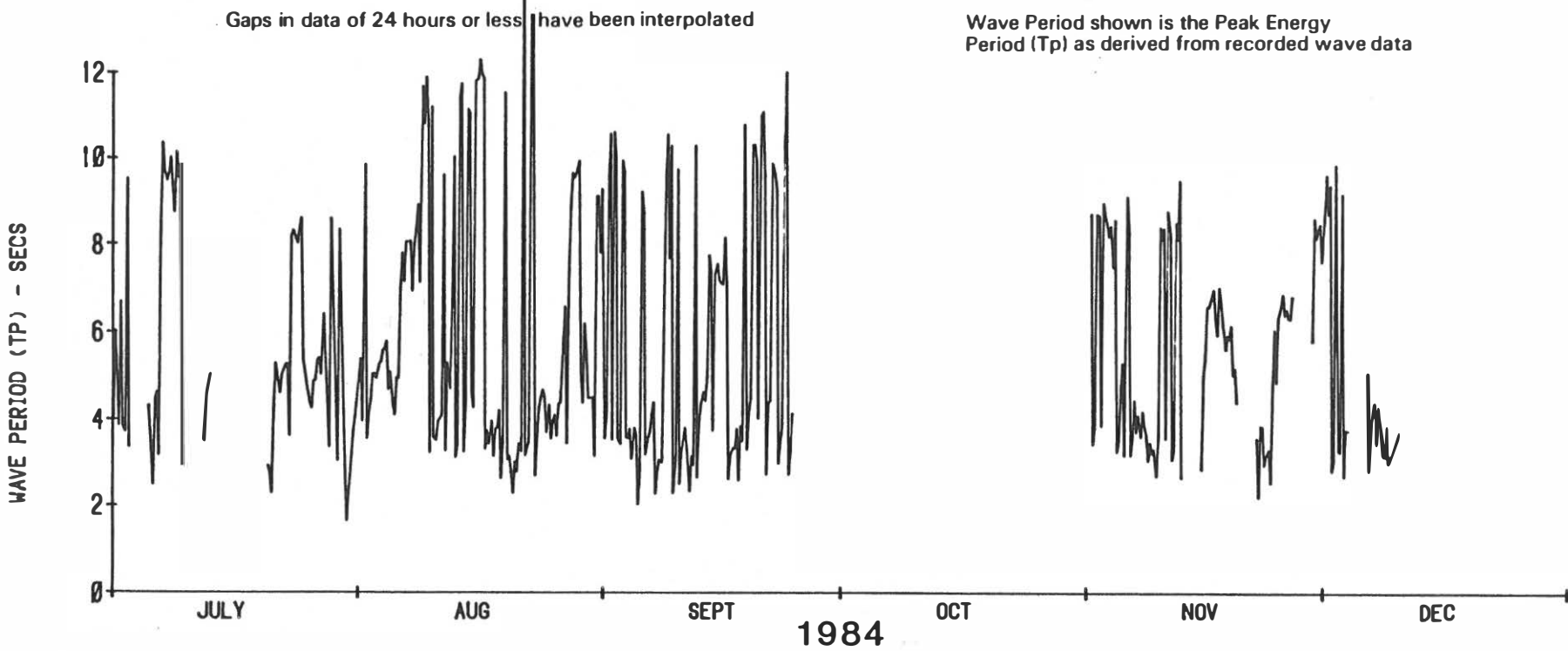
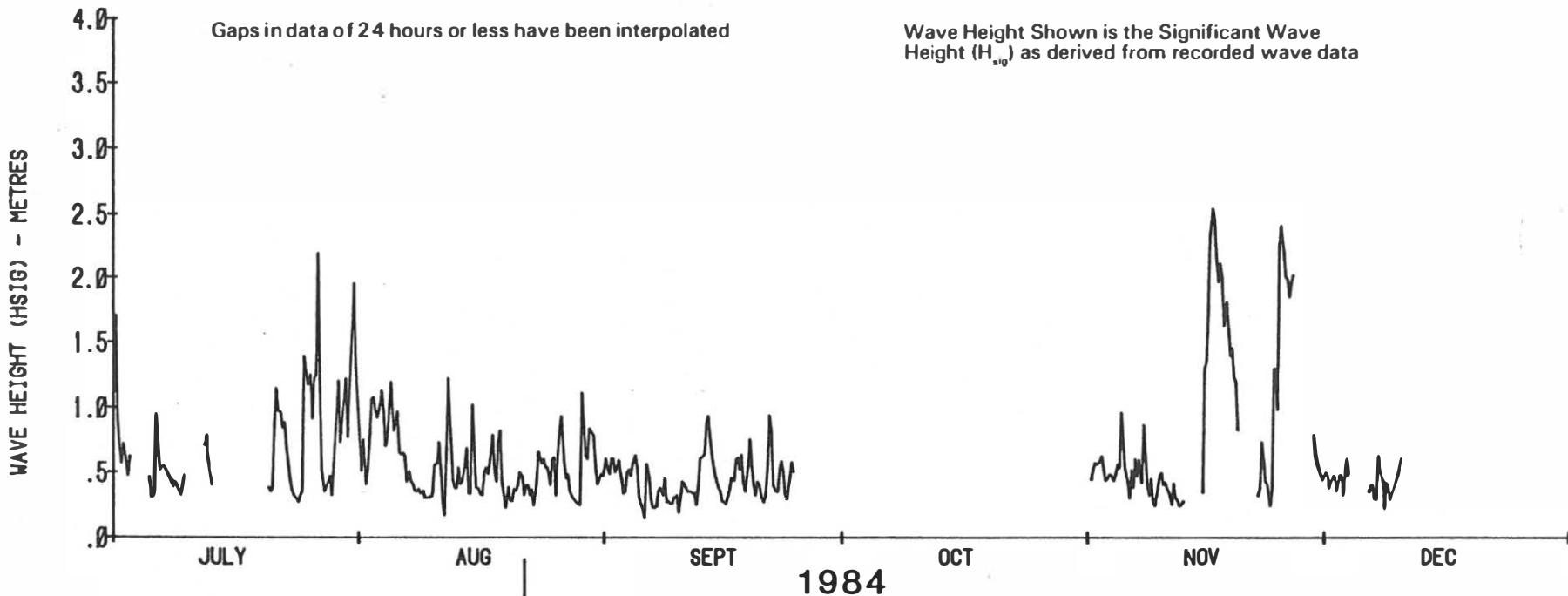


Figure 7
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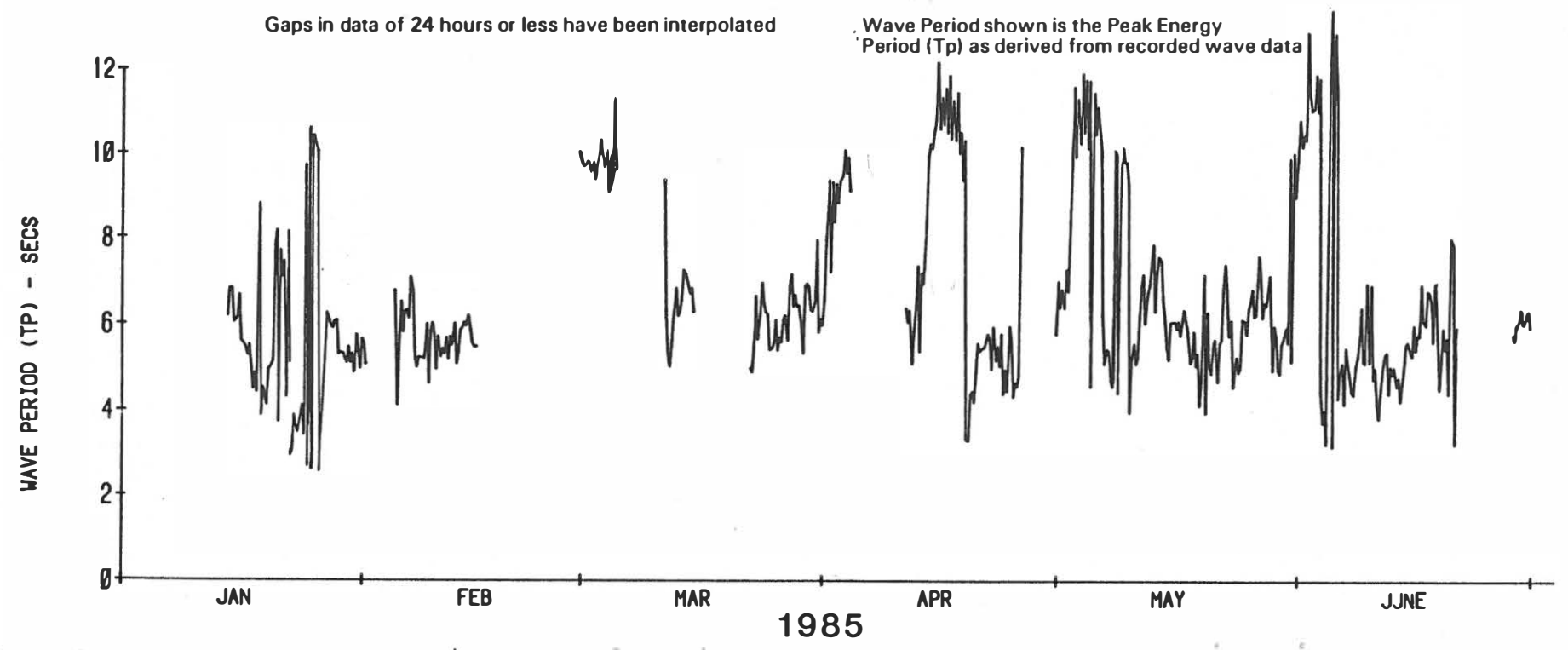
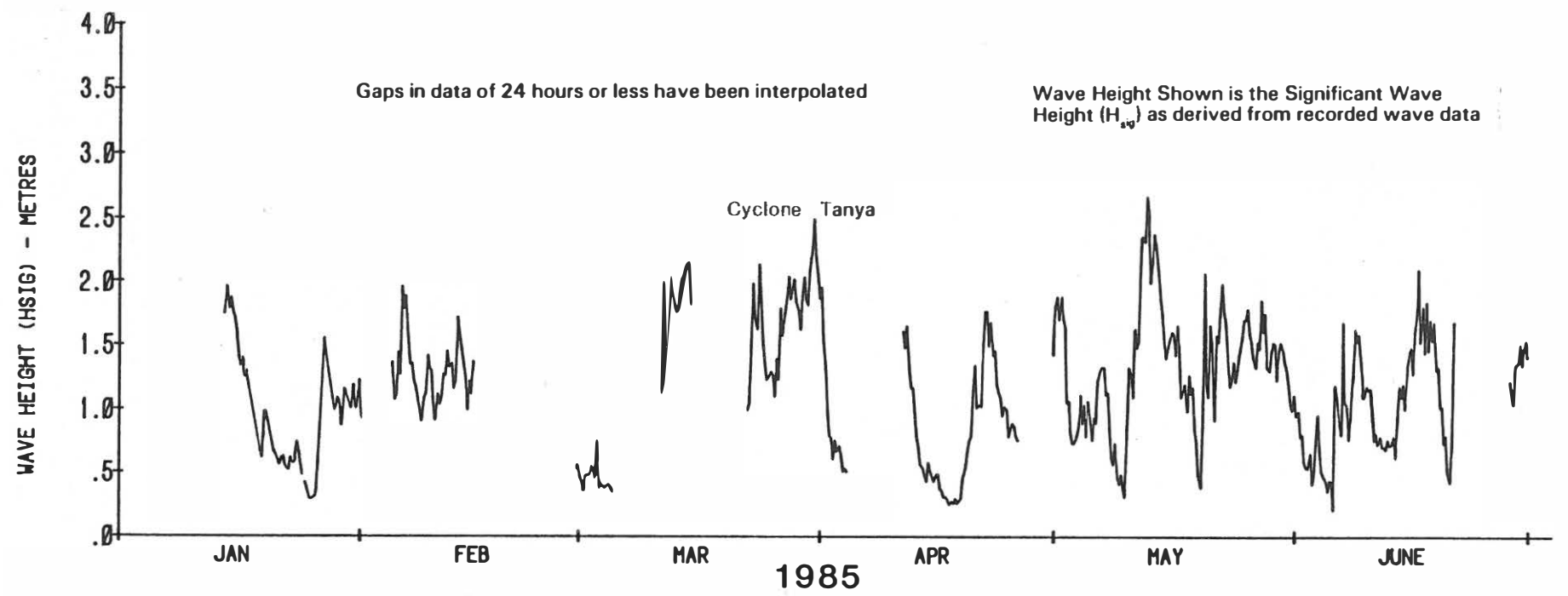


17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Figure 7
WO2.2

Wave Data Recording Programme
Mackay Region





17th September 1975 to 23rd August 1985

DAILY WAVE RECORDINGS

Wave Data Recording Programme
Mackay Region

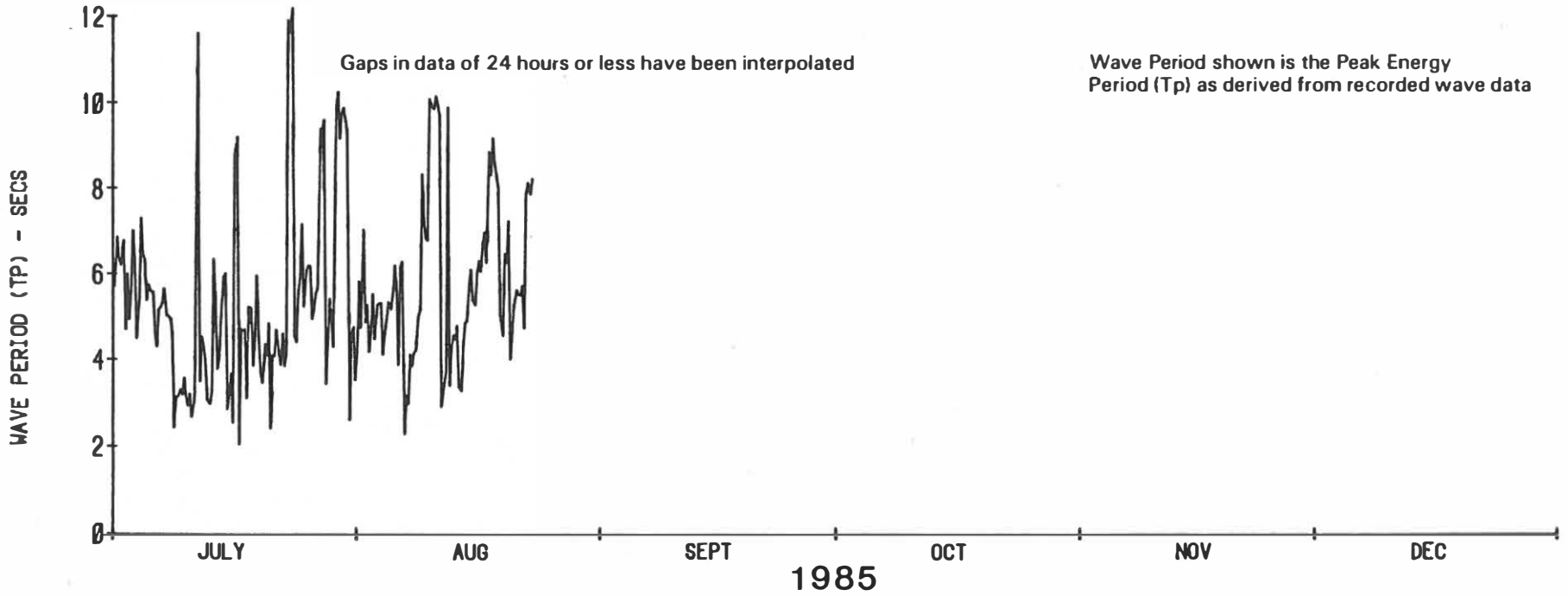
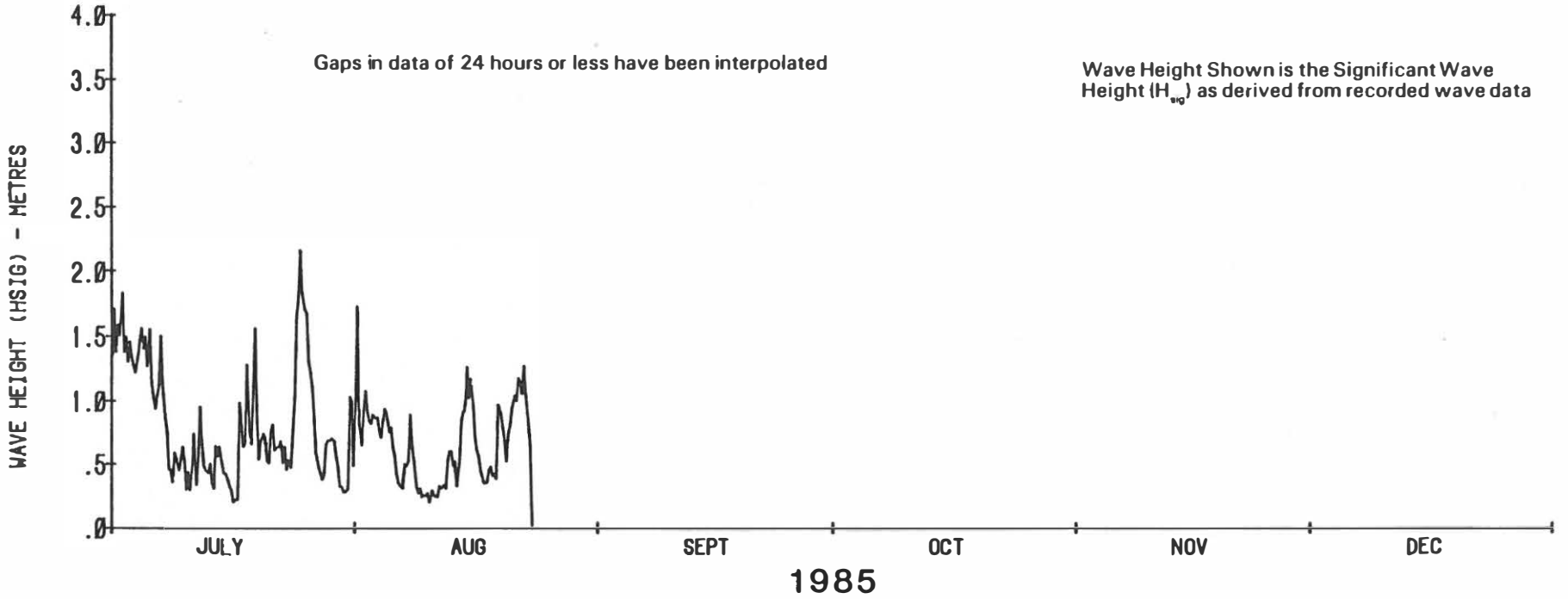
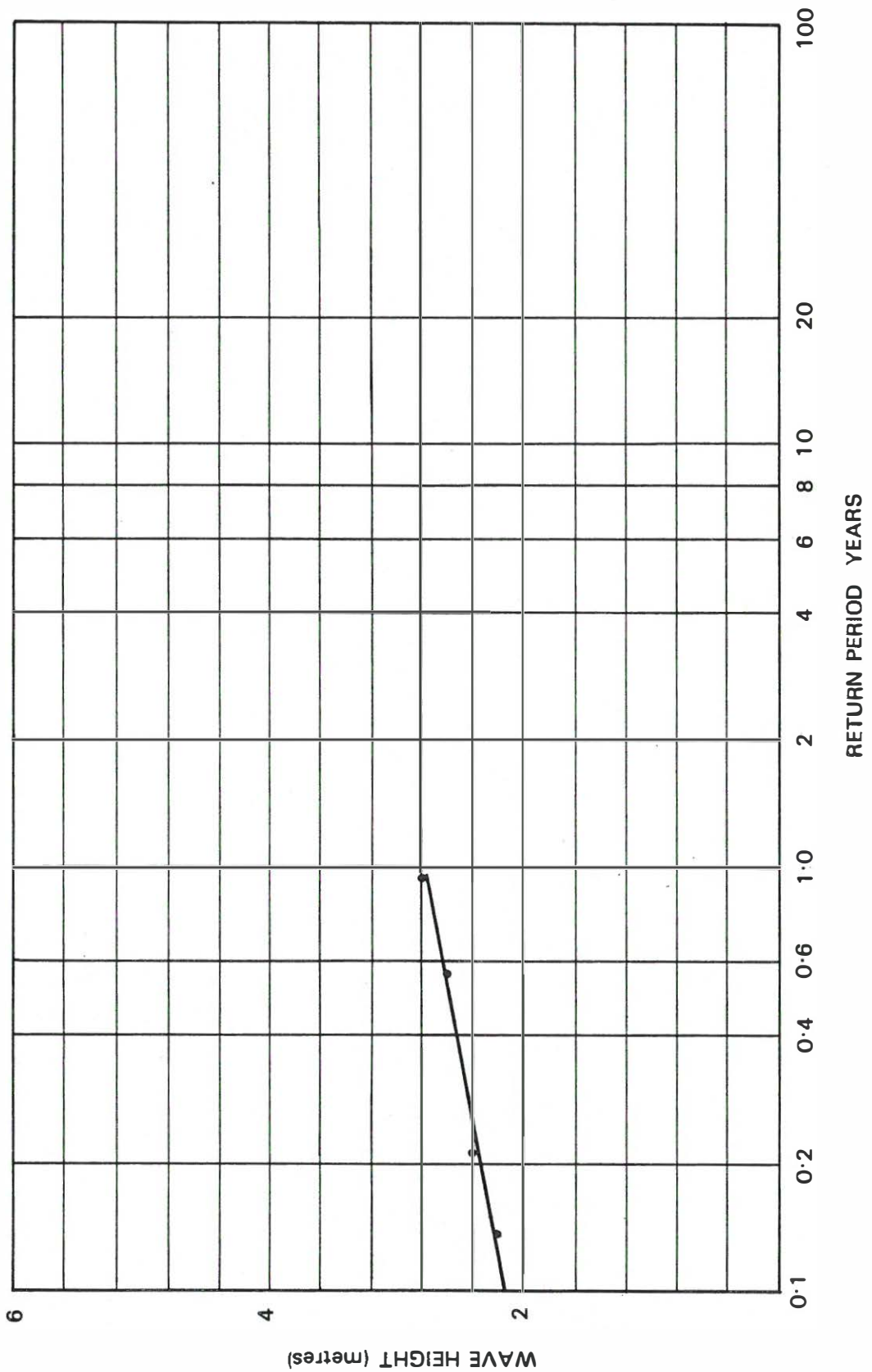


Figure 7
WO2.2



Beach Protection Authority

**WAVE HEIGHT (H_{sig})
RECURRENCE INTERVALS**

17th September 1975 to 23rd August 1985

Wave Data Recording Programme
Mackay Region

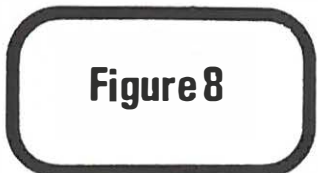


Figure 8

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