DEPARTMENT OF ENERGY, MINES AND RESOURCES
MARINE SCIENCES BRANCH

MINISTÈRE DE L'ÉNERGIE DE MINES ET DES RESSOURCES
DIRECTION DES SCIENCES DE LA MER

ATLANTIC OCEANOGRAPHIC LABORATORY

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INSTITUT de BEDFORD

Dartmouth, Nova Scotia
Canada

WAVE CLIMATE OF THE CANADIAN ATLANTIC COAST
and
CONTINENTAL SHELF – 1970

by

H. A. NEU

AOL REPORT 1971-10

DECEMBER 1971

PROGRAMMED BY

THE CANADIAN COMMITTEE OF OCEANOGRAPHY

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ABSTRACT

Based on the synoptic wave charts issued twice daily by the Maritime Forces Weather Centre, Halifax, the wave climate of the Canadian Atlantic Coast and Continental Shelf was established for the year 1970. The criteria and concepts for developing such a climate are critically reviewed.

The results clearly indicate that the sea state conditions along the coast and over the Continental Shelf vary greatly with season and location. During the winter months, the wave energy was five to six times greater than during the summer, and over Grand Banks it was three to four times that over the Scotian Shelf.

The reason for this lies in the seasonal variation of the wind with respect to its direction and strength. During the winter, strong winds from the northwest are either directed off-shore with regard to the southern coast thereby reducing the sea state by opposing the mid-Atlantic waves, or are parallel to the eastern seaboard where they generate large seas along the coast of Labrador and over the Grand Banks. During the summer, winds are primarily from southwest along the southern coast and away from the eastern seaboard. Since these winds are light, wave action along both coastlines is very low.

In 1970, extreme wave heights over the Scotian Shelf were in the order of 12.5 m, while over the Grand Banks they probably reached 18 to 19 m.

These results are essential for the design of structures and for the planning and operation of off-shore explorations.

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I. INTRODUCTION

Canada has the longest coastline in the world, with a total length of about 50,000 km. A large portion of it is along the Atlantic seaboard, extending from the Gulf of Maine, at the Canada-U.S. border, to the Arctic. Along this coastline stretches the Continental Shelf, which is about 200 km wide off Nova Scotia, reaches out 500 km on the Grand Banks south-east of Newfoundland, and then narrows to less than 100 km along the coast of Labrador. In general, the depths are less than 200 m, with the exception of the Laurentian Channel, which connects with the Gulf of St. Lawrence, and Hudson Strait.

In recent years mineral exploration has increased in this area particularly with respect to oil. Nearly all the available concession rights have been acquired by oil firms, and several oil rigs are drilling in the general vicinity of Sable Island and on the Grand Banks.

This exploration is faced with exceptional technological problems with regard to the aquatic environment, especially the sea state. The planning of the operation, the choice and design of drilling rigs which can survive extreme storms and the knowledge of the occurrence of wave heights which would limit drilling operations or threaten the platform, all require reliable wave information.

It is well known that this type of information is scarce and frequently non-existent. An investigation into the wave climate of the Canadian Atlantic Coast and Continental Shelf thus became imperative to provide systematic sea state information.

2. THE ATLANTIC COAST AND CONTINENTAL SHELF

As shown in Fig. 1, the Atlantic Coast and the Continental Shelf are exposed to waves approaching the southern seaboard from the southwest, south and east, and the eastern seaboard from the north and east. Excluded from the investigation are the Bay of Fundy and the Gulf of St. Lawrence which are partly protected by land. Fully exposed to wave action from the south are Georges Bank at the entrance to the Bay of Fundy, the Scotian Shelf, and the southern portion of the shelf off Newfoundland. The Grand Banks, southeast of Newfoundland, are open to nearly every direction, with the exception of a sector from the northwest, while the east coasts of Newfoundland and Labrador are open to waves from the Labrador Sea and the North Atlantic. The open sea distance, in all these directions, exceeds 3000 km. Storms rarely extend over distances greater than 1000 to 1500 km.

When dealing with the wind-wave relationship, it is well known and has been demonstrated by a number of researchers (Neumann[1], Bretschneider[2], Darbyshire[3] and others) that storm winds blowing over such expanses, referred to as 'fetch', can generate exceptionally high waves. In addition, swell waves, which may have originated outside of the storm area - perhaps as far away as the South Atlantic - may augment these wind-generated waves.

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1. Neumann, G. "On ocean wave spectra and a new method of forecasting wind-generated sea". Tech. Memorandum No. 43, Beach Erosion Board, U.S. Army Corps of Eng., 1952.

2. Bretschneider, C.L. "Revised wave forecasting curves and procedures". Tech. Report No. HE-155047, Inst. of Eng. Research, Univ. of Calif., Berkeley, 1951.

3. Darbyshire, J. "The generation of waves by wind". Proc. Roy Soc. (London), Ser. A, 1952.

FIGURE 1: Canadian Atlantic Coast and Continental Shelf.

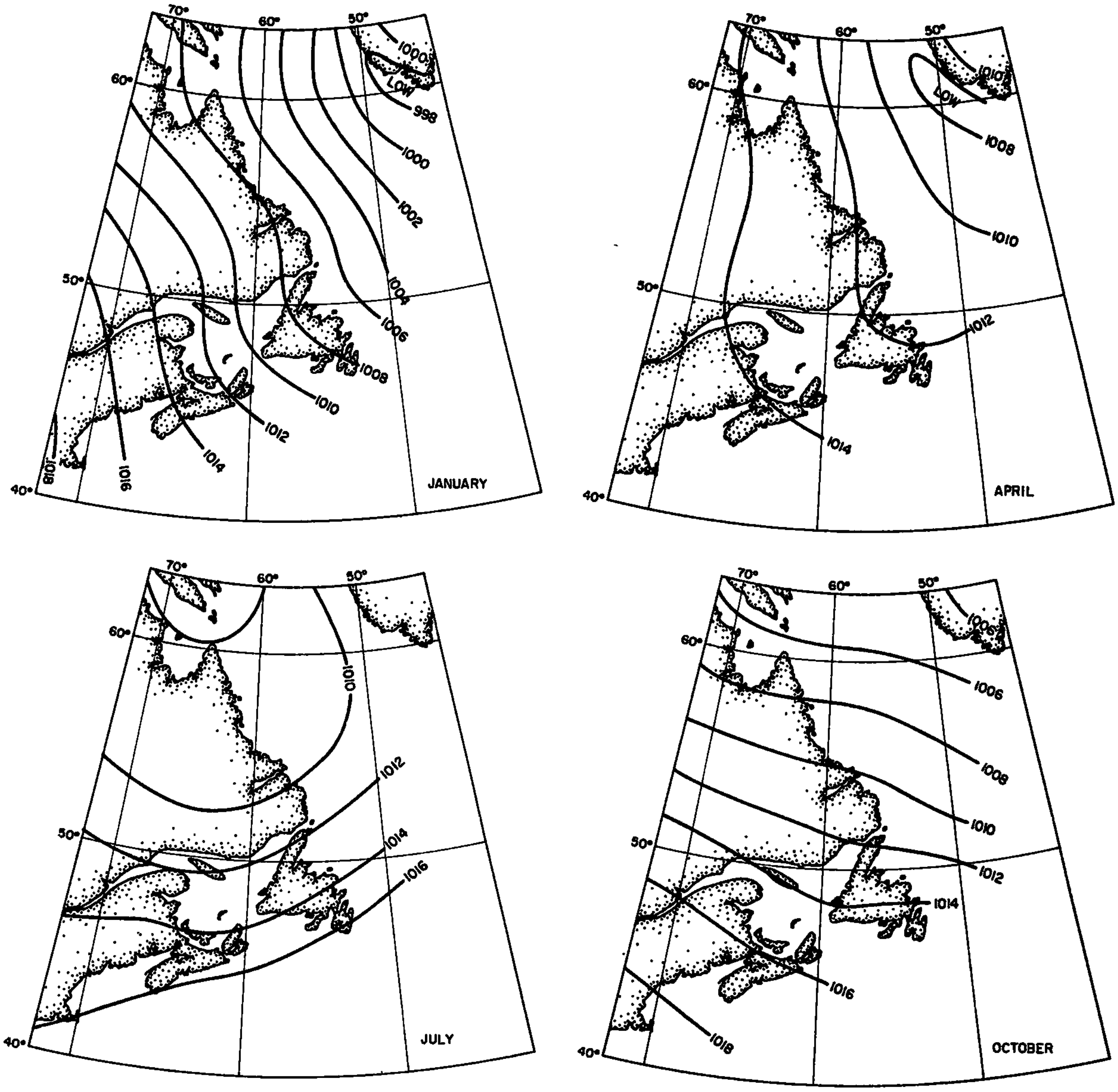
3. WEATHER AND WIND

During the winter months there is a strong outflow of very cold Continental Arctic air into the Canadian Atlantic Region. Over the Gulf Stream this encounters the moist warm air associated with the circulation of the Azores High. The resultant great exchange of energy produces frequent storm developments and these storms reach greatest intensity between South Greenland and Iceland. A strong pressure gradient is normally present, therefore, over the Scotian Shelf and Labrador Sea.

During the summer months, the temperature differential between the Continental Arctic and the Maritimes air is much less pronounced and consequently the polar front is less intense. Depressions forming on this front rarely reach storm dimensions and the area of lowest pressure is displaced northward towards the Davis Straits. Under these conditions, winds over the Canadian Atlantic are generally moderate.

The average barometric pressure distributions, as shown in Fig. 2, demonstrate this changing wind pattern. The geostrophic wind, which is derived from these pressure distributions, is from the northwest in the winter and blows along the coast of Labrador and off the coast of the southern seaboard, while in the summer the opposite occurs. However, the major difference lies in the greater strength of the winter winds.

Clearly these wind conditions have a great effect upon wave generation in both the coastal regions and the Grand Banks area.



NOTE : ATMOSPHERIC PRESSURE IN MILLIBARS
MEAN SEA LEVEL PRESSURE OF PERIOD 1940 TO 1953
FROM ATLAS OF CANADA, DPT. OF MINES AND TECH. SURVEYS, 1957

FIGURE 2: Mean Seasonal Atmospheric Pressure

4. WAVES

4.1 Shoaling of Waves

Waves are modified on moving into shallower water. The speed of a wave depends upon the water depth as well as upon the wave length; the shallower the water, the slower the speed. Thus, wave fronts must be bent when advancing at an angle into shoaling areas because of the reduction of wave speed at the point of contact. This behaviour is known as wave refraction. During the process, wave energy may be concentrated or dispersed and, consequently, the wave height increased or decreased locally. It is readily seen therefore that heights and directions of waves in areas where shoaling occurs are not directly related to the wave conditions in deep water.

According to the first order wave theory, waves shoal when the depth of water is less than half the wave length. A 10-second wave, which occurs frequently, begins to be affected when the depth is less than 75 m, while a 14-second wave, which either results from a large storm or is present as a swell wave, is affected when the depth is less than 150 m. The depths on the Continental Shelf are usually greater than 75 m and less than 200 m. It can be assumed therefore that most waves, with the exception of very long ones, can move freely over most of the Continental Shelf without being noticeably affected. This, however, does not apply to some shallower areas on Georges Bank, around Sable Island, and on the south tip of the Grand Banks, where depths are less than 50 m.

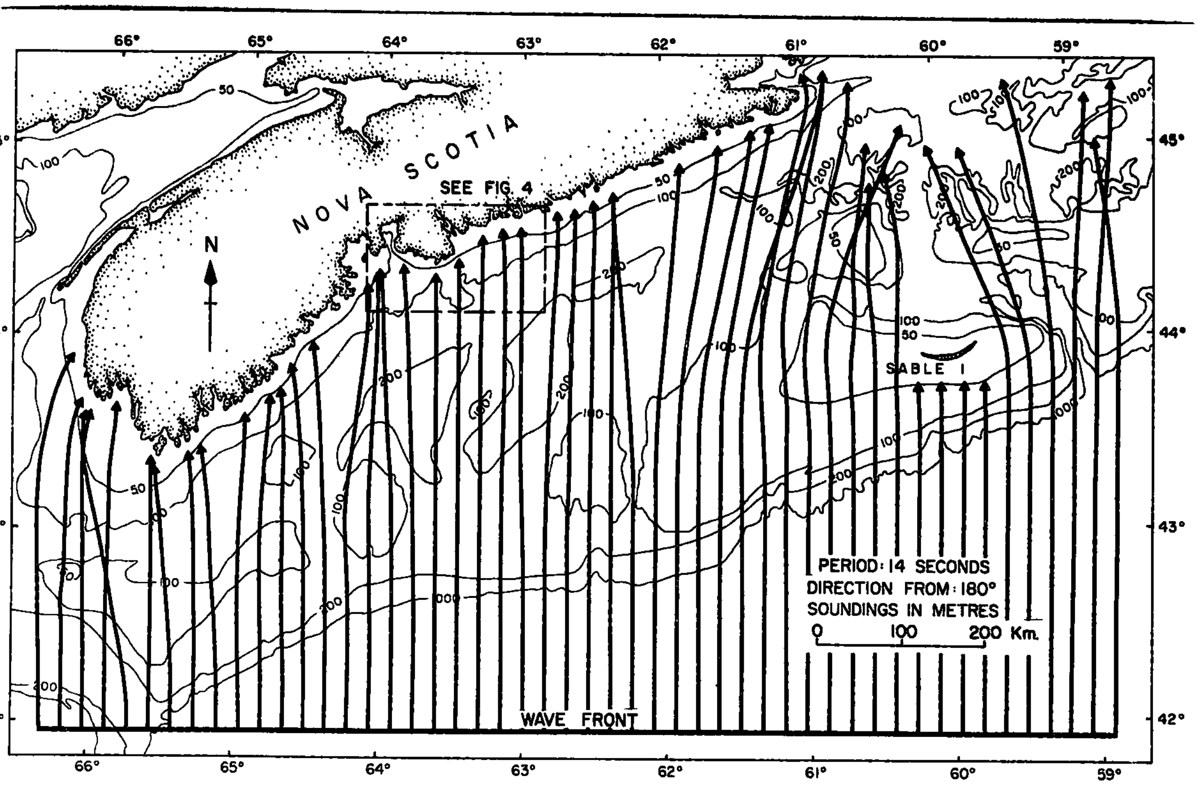


FIGURE 3: Wave Refraction on the Scotian Shelf

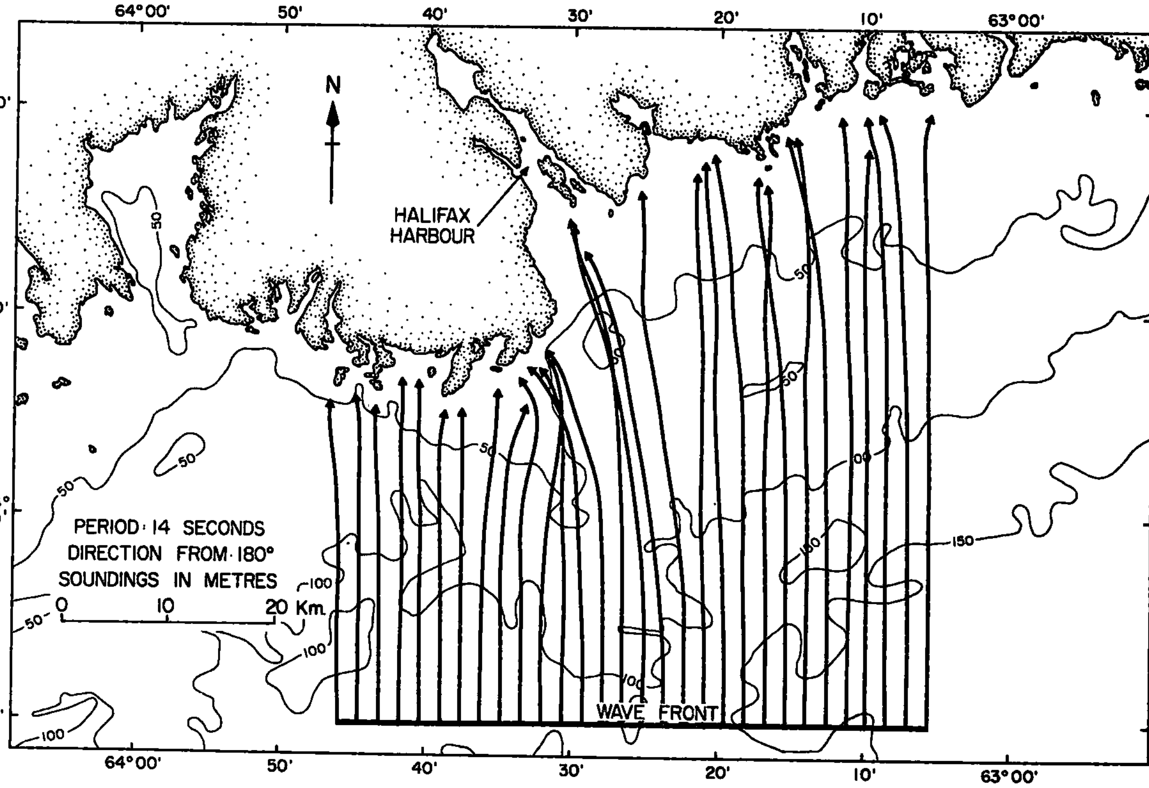


FIGURE 4: Wave Refraction at Halifax Inlet

For a detailed analysis of wave conditions in these areas, the effect of these shoals must be considered. An example of such a study for the Scotian Shelf is shown in Fig. 3, where the Refraction Diagram of a 14-second wave approaching from the south is plotted.

Along the coast the sea bed generally rises landward from a depth of 75 m in the last 10 to 20 km. Since the underwater topography of this region is very irregular, the waves are modified greatly in height and direction by shoaling and refraction. Such a modification occurs at the entrance to Halifax Inlet, and is shown by the Fig. 4.

Thus it is obvious that wave observations performed in the near-shore zone, with respect to wave height and direction of propagation, are not representative of the sea state of the off-shore deep water region.

4.2 Wave Observation Methods

There are two ways of describing the sea state - one in terms of power spectra, and the other with the characteristic physical properties of the waves: their height, length or period, and the direction of propagation. The first is used primarily by scientists studying the physics of waves, their relationship to the atmosphere, etc. It is difficult and, in the opinion of the author, impracticable at present to apply these data to a wave climate investigation. The second type of description is more useful for applied scientists and engineers and also more adaptable to a time series study.

In this investigation, waves are defined by the following properties:

(a) Height - H, in metres

(b) Period - T, in seconds

(c) Direction - in degrees

There are four methods of obtaining these data. They are: hindcasting from wind observations, direct measurement with wave gauges, aerial surveying from satellites and visual observations from ships.

Hindcasting has been applied extensively in the past. Its shortcomings, however, lie primarily in the fact that there are insufficient meteorological observations made over the open ocean particularly with respect to varying winds and moving fetches. Furthermore, the generation of waves and their decay is so complex and so little understood that estimating the sea states from wind conditions can only be performed by applying semi-empirical principles which do not provide reliable or accurate results.

Direct surveying with wave gauges appears to be the most logical method, yet it is confronted with extreme difficulties. Wave gauges, exposed to the hazards of the open sea, have only short operational lives. For time series presentation and probability of occurrence, pairs (or even more) of gauges would have to be placed at each location in an attempt to ensure a continuous yearly record. For direct wave height and energy comparisons along the coast and on the Continental Shelf, hundreds of such groups would have to be operational for years. This would be a monumental task. Furthermore, unless an even greater number were used in special arrays, these gauges would provide no information on wave direction, a property which is most important for coastal and open sea operations.

The third and potentially the most promising method of obtaining wave data is that of surveying from satellites. Although the author is not fully aware of the state of development in this field and has no knowledge of a large-scale application of the method, it appears that it may be available for general use in the late seventies or early eighties.

In this paper, data obtained by the fourth method, visual observations from ships, was used.

4.3 Wave Data

The Maritime Forces Weather Centre of the Canadian Weather Service in Halifax, N.S., issues synoptic wave charts of the North Atlantic twice daily based on observations taken at 0000 and 1200 hours Greenwich time. The wave data for the charts are obtained from weather ships, weather stations, Canadian and U.S. government ships, navies of NATO countries and merchant ships. The majority of the data is obtained visually and includes wave height, wave period and direction of propagation, to be transmitted in code.

On the average, the number of ships involved in reporting the sea state is about 35 (varying from 20 to 60) depending on the season and weather conditions. Occasionally, in areas far from navigation lanes and observation ships, only few data may be available. Under these circumstances wave forecasting methods are applied and the results are fitted into the observed wave environment.

A number of observations from the ships include information on secondary waves, interfering with the primary waves. This is done in order to differentiate between wind waves generated locally and the swell. The wave chosen as being representative of such a sea state is obtained by taking the square root of the sum of the component wave energies. The second, third and ....n^{th} components are added to the first or prime one in the ratio of their respective wave lengths. Since the wave length in deep water condition is a function of the square of the wave period, the composite wave height is derived from the following equation:

$$H = \sqrt{H_1^2 + \frac{T_2^2}{T_1^2} H_2^2 + \frac{T_3^2}{T_1^2} H_3^2 + \ldots + \frac{T_n^2}{T_1^2} H_n^2} \qquad (1)$$

On a 24-hour basis, the data observed from ships and those derived from regional forecasts are constantly reviewed by meteorologically trained personnel who continuously relate them to the past and present wave-field and wind environment. Information which does not fit into this pattern is rigorously checked for errors in observing, reporting or communication and, if found faulty, discarded. In this process, the wave data are subjected to a large measure of quality control.

The data are then plotted on charts and lines of equal wave height are drawn as shown in Figures 5, 6 and 7.

The charts issued twice daily form a time series of 12-hour intervals. From this sequence, the formation of storms, their path and speed as well as their decay can be determined.

Winter storms passing along the coast of Nova Scotia have speeds, on average, between 35 and 40 km per hour. The grid areas for which the sea state is to be reported are approximately 200 by 280 km. Thus, to avoid having storms pass through one of these grids without being detected, the time interval should not be in excess of six hours. This is achieved by estimating the location of the storm at 0600 and 1800 hours, thus providing wave information in the intermediate intervals.

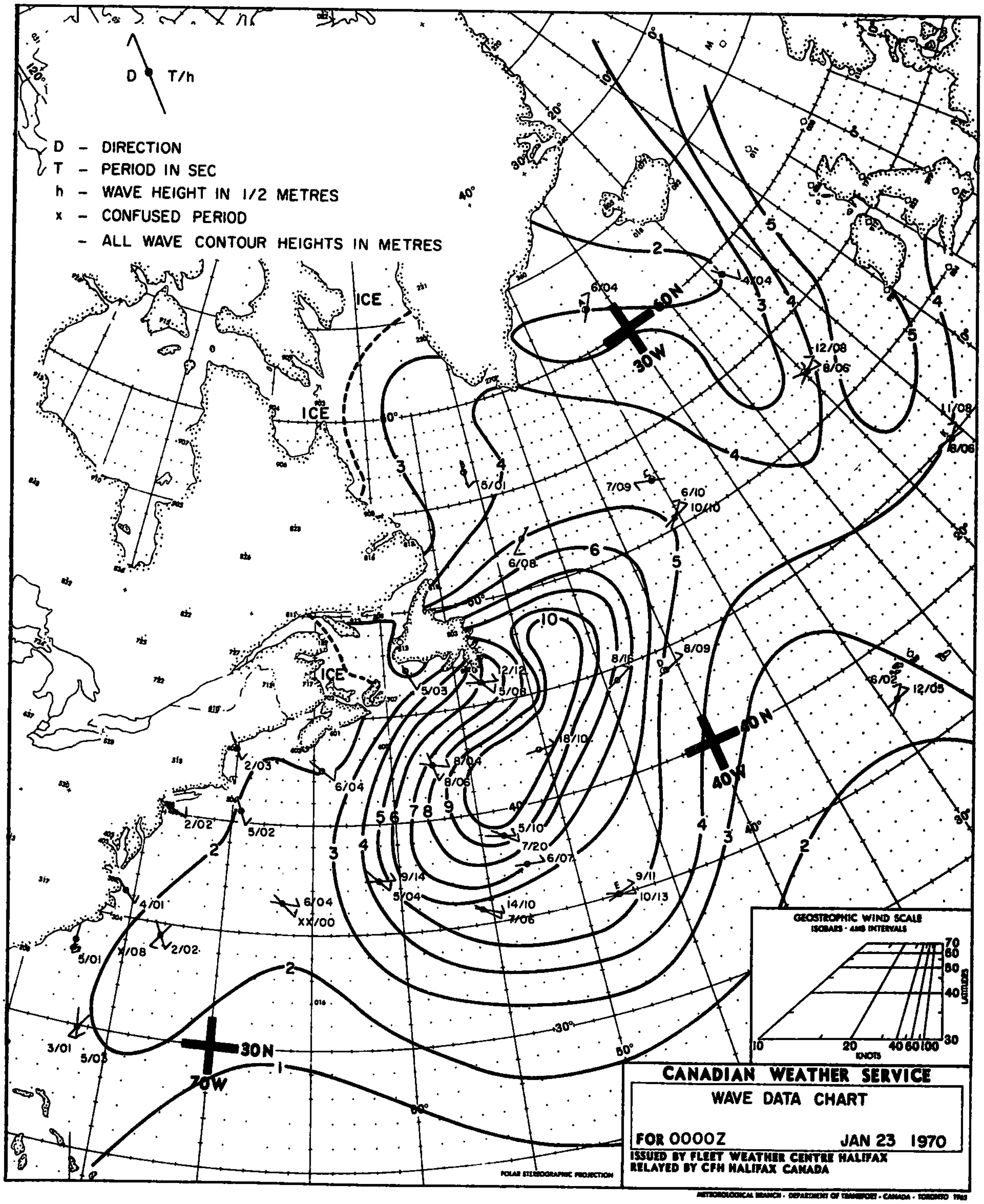


FIGURE 5: Wave Chart of 23 January 1970

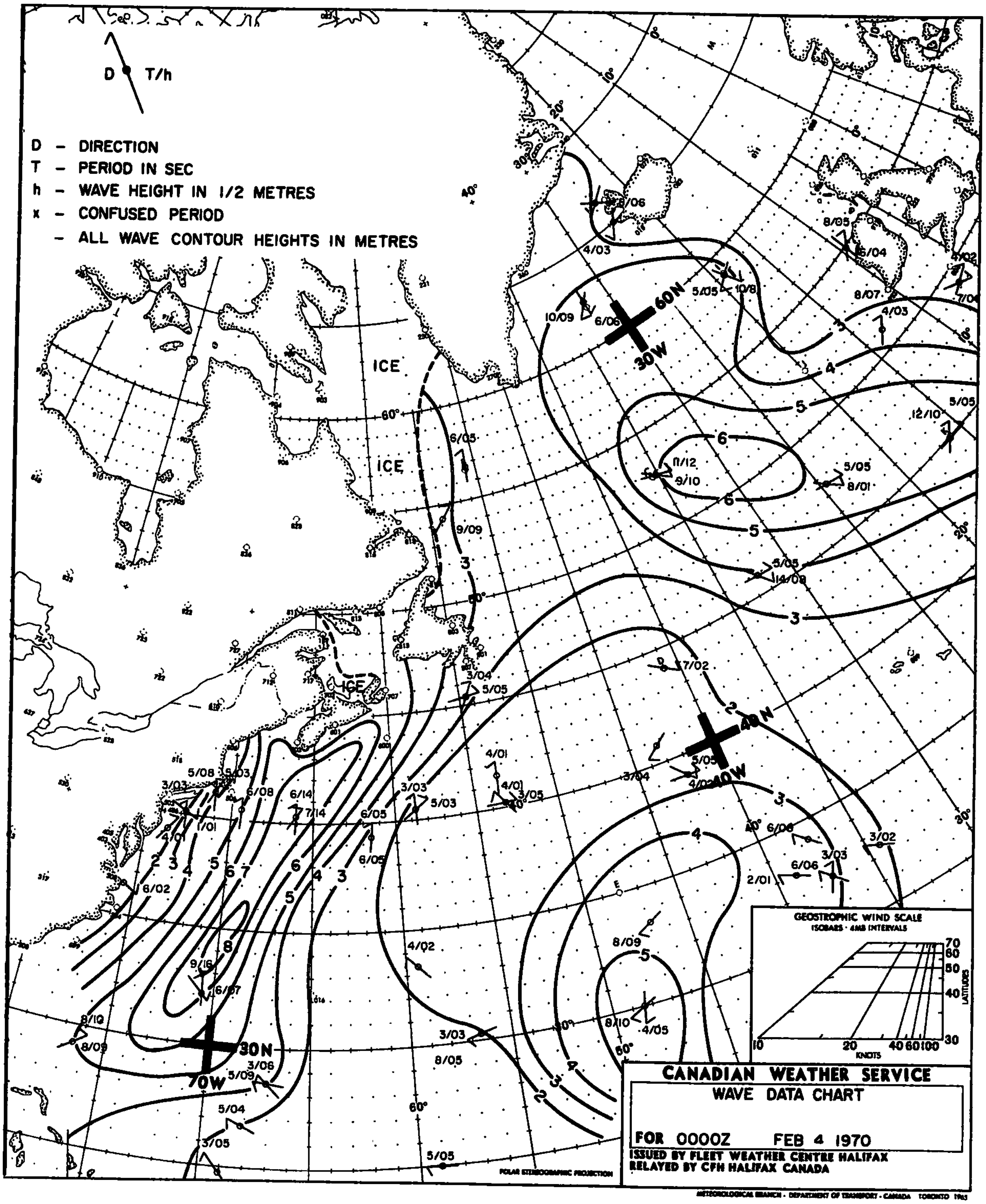


FIGURE 6: Wave Chart of 4 February 1970

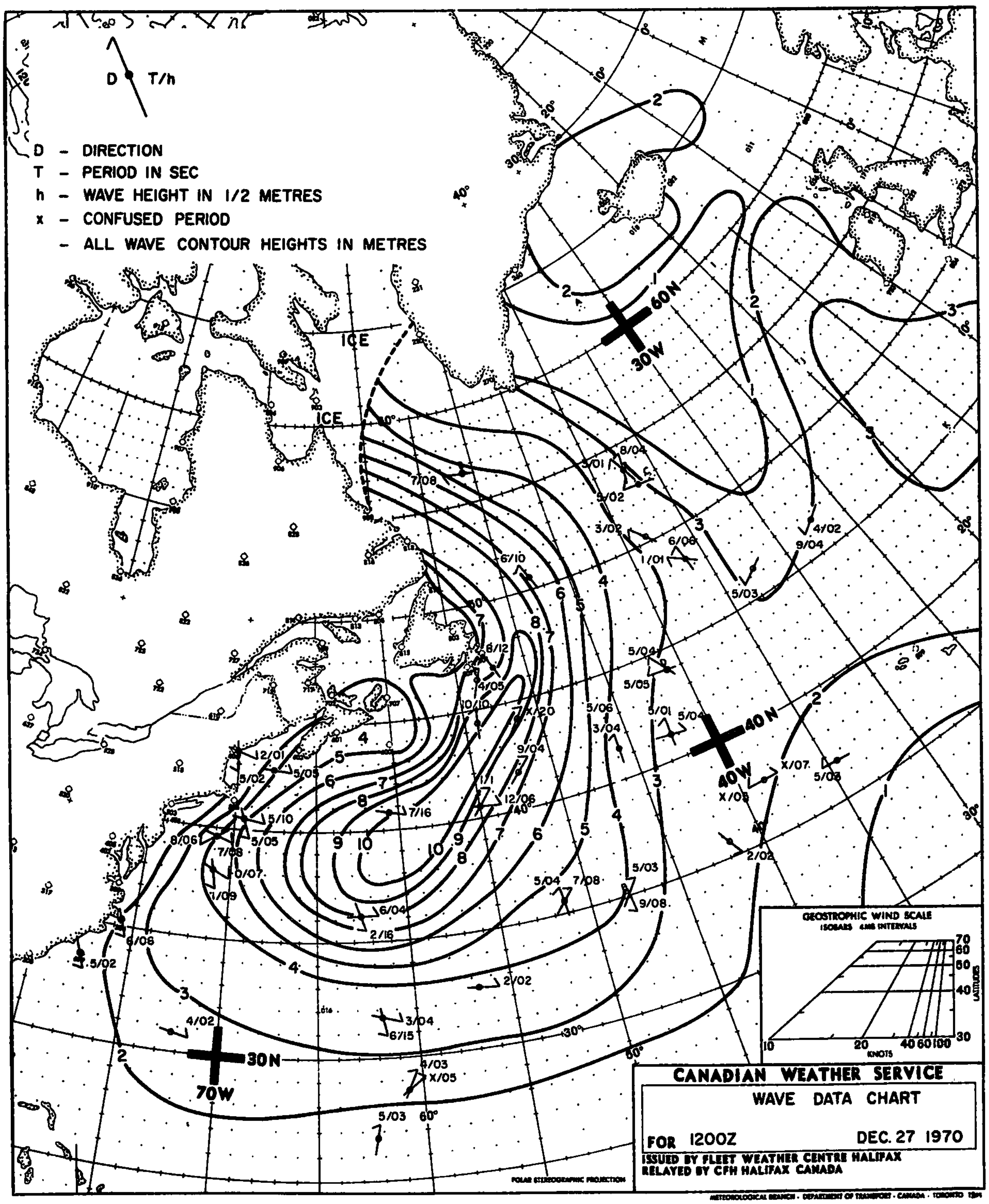


FIGURE 7: Wave Chart of 27 December 1970

4.4 Significant Wave

As mentioned previously, the wave data used in this analysis were generally derived from visual observations. According to Wiegel[4] and Ippen[5] and their analyses of wave records, it has been found that the wave properties obtained by visual observations are equivalent for practical purposes to those of a wave defined as a 'significant wave'; the height (H_{sig}) being the mean height of the highest third of all the waves present in a wave train. Its period is the 'significant period' (T_{sig}).

This wave is considered to be representative of the sea state for the six-hour sampling period. Its relationship to the average (H_{av}) and maximum wave height (H_{max}) can be assumed to follow a Rayleigh distribution as shown graphically in Fig. 8.

4.5 Extreme Wave

Besides the general description of the state of the sea which the significant wave provides, it is of utmost importance to coastal and off-shore operations to be able to estimate the extreme wave height which may occur during the six-hour period. This relationship has been investigated by a number of researchers (Wiegel[4], Ippen[5] and Thom[6]). From their studies it may be concluded that for a recording period of six hours, the ratio between the extreme wave height and the significant wave height is about 1.8:1. This means that the maximum

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4. Wiegel, R.L. "Oceanographical Engineering". Prentice-Hall Series in Fluid Mechanics; Chapter 9; Englewood Cliffs, N.J.; 1964.

5. Ippen, A.T. Editor "Estuary and Coastline Hydrodynamics", Chapter 3 by C.L. Bretschneider; McGraw-Hill Book Company, New York, 1966.

6. Thom, H.C.S. "Asymptatic extreme value distributions of wave heights in the open ocean. Journal of Marine Research, Vol. 29, 1971.

wave height can be obtained by multiplying the observed wave height, which is equivalent to the significant wave height, by this factor.

4.6 Wave Energy

To evaluate the energy distribution and its seasonal and directional variation over the Continental Shelf, the energy of the six-hourly significant wave was calculated and integrated for non-directional and directional presentation.

According to the wave theory, the energy per wave length and per unit width of wave crest in the meter-kilogram-second system is:

$$E = \frac{1}{8} \gamma \, {H_{sig}}^2 \cdot \lambda \cdot \text{[mkg]} \tag{2}$$

where γ is the specific weight of sea water, approximately 1.025, and λ is the wave length. In deep water, the wave length is proportional to the square of the wave period.

$$\lambda = \frac{g}{2\pi} \cdot T^2$$

$$= 1.56 \; T^2 \quad \text{[m]} \tag{3}$$

where g is the gravitational acceleration, i.e. 9.81 m/sec^2. Substituting this term into the energy equation, Eq. (2) provides the following simplification:

$$E = 0.2 \cdot {H_{sig}}^2 \cdot T^2 \; \text{[mkg]}$$

Over a six-hour period, i.e. for 21,600 seconds, the number of waves which occur with a wave period T is:

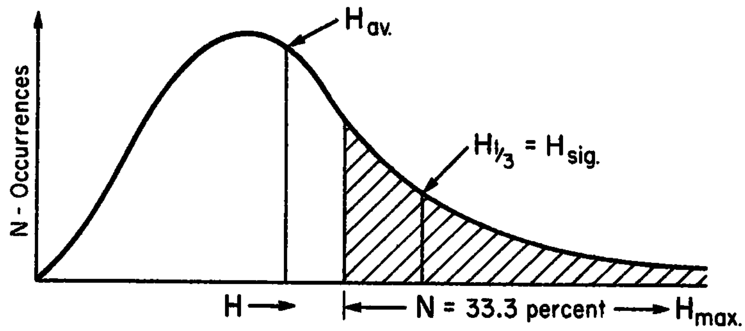


FIGURE 8: Statistical Distribution of Wave Heights

$$n = \frac{6.3600}{T}$$

Therefore the total energy per wave length and metre wave crest for a period of six hours is:

$$E_n = 4.32 \cdot 10^3 \cdot H_{sig}^2 \cdot T \quad [mkg]$$

In the analysis, waves were grouped with respect to periods in intervals of two seconds; that is to say, the significant period T_{sig} represents the period interval from $T_{sig}-1$ (sec) to $T_{sig}+1$ (sec). In Fig. 9, the relationship between the significant wave energy (E_{sig}) and the energy of the entire spectrum (E_{total}) is shown. The ratio is about 1 to 3.

Thus the total energy within a period of six hours can be obtained by multiplying the significant wave energy by a factor of three.

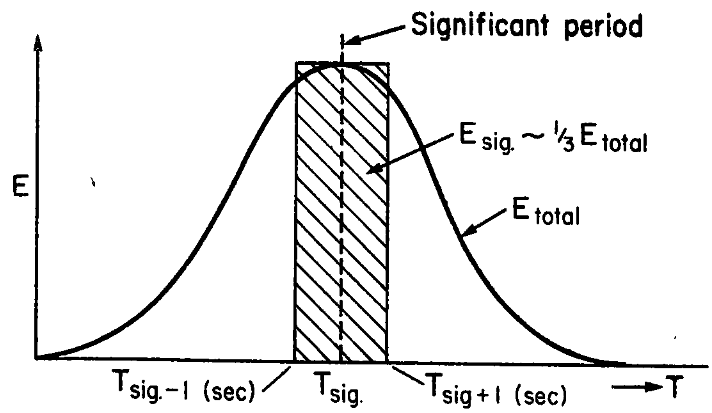


FIGURE 9: Significant Energy vs. Total Energy of a 6-hour Sampling Period

4.7 Grid System

A grid system, consisting of twenty-five 2½ by 2½ degree sectors, was placed over the area of interest. The sectors were grouped in rows and numbered as shown in Fig. 10. They cover the Continental Shelf to the 2000 m depth contour.

For convenience the sectors were named 'blocks'. For each block and each six-hour time interval, the height, period, and direction of the average representative significant wave were determined from the published wave charts and the interpolated conditions. The total number of representative waves for each block was 1460, covering, as a time series, the entire year 1970.

The data were then grouped in their respective monthly intervals, arranged for statistical purposes and the wave energy evaluated for graphical presentation.

5. RESULTS

The results are presented in three ways:

(a) monthly non-directional energy distribution;

(b) monthly directional energy spectra; and

(c) monthly directional wave statistics.

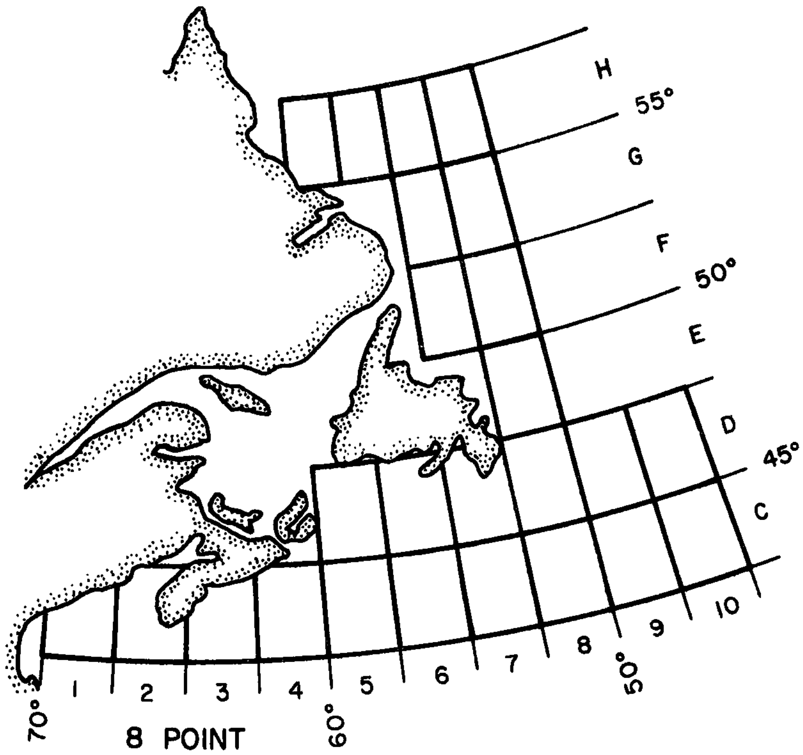
It should be noted again that the energy evaluations are not based upon the power spectra but upon the six-hourly significant wave.

5.1 Monthly Non-Directional Energy Distribution

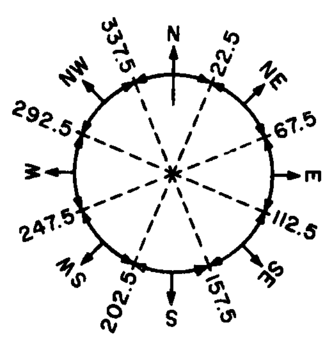
The monthly total significant wave energy per metre of wave crest for each block is shown in Fig. 11 and 12. The shaded areas indicate the energy concentrations. The actual values in mkg/m can be obtained from the scale attached to one of the blocks.

From this presentation, it can be seen immediately that the wave energy along the Canadian Atlantic coast varies greatly with time and location. As expected, the greatest energy concentrations occurred during the winter months, January and December, and were, particularly in the Grand Banks region, five to six times larger than during the summer month of July. Thus, the energy density variation is in good agreement and in phase with the weather and wind pattern.

More significant than the variation with season, however, is the variation with location. With the exception of the summer months, the energy concentration along the coast of Labrador and over the Grand Banks was three to four times greater than over the Scotian Shelf. The lowest energy density occurred in the Gulf of Maine. This is quite surprising since it is known that severe damage has occurred to coastal structures in the Yarmouth region. The reason for this may lie in



8 POINT DIRECTION SYSTEM



WAVE HEIGHT

CODE	HEIGHT-m
0	0 -0.5
1	0.5-1.5
2	1.5-2.5
3	2.5-3.5
4	3.5-4.5
5	4.5-5.5
6	5.5-6.5
7	6.5-7.5
8	7.5-8.5
9	8.5-9.5
10	9.5->10

WAVE PERIOD

CODE	PERIOD-sec.
<5	0-5
6	5-7
8	7-9
10	9-11
12	11-13
14	13-15
>15	>15

FIGURE 10: Grid System and Codes of Wave Properties

shoaling as indicated in Fig. 3. The highest energy concentration occurred in December off the Labrador coast, in Blocks H-7 and H-8. Most of this area is covered with ice from February to mid-summer.

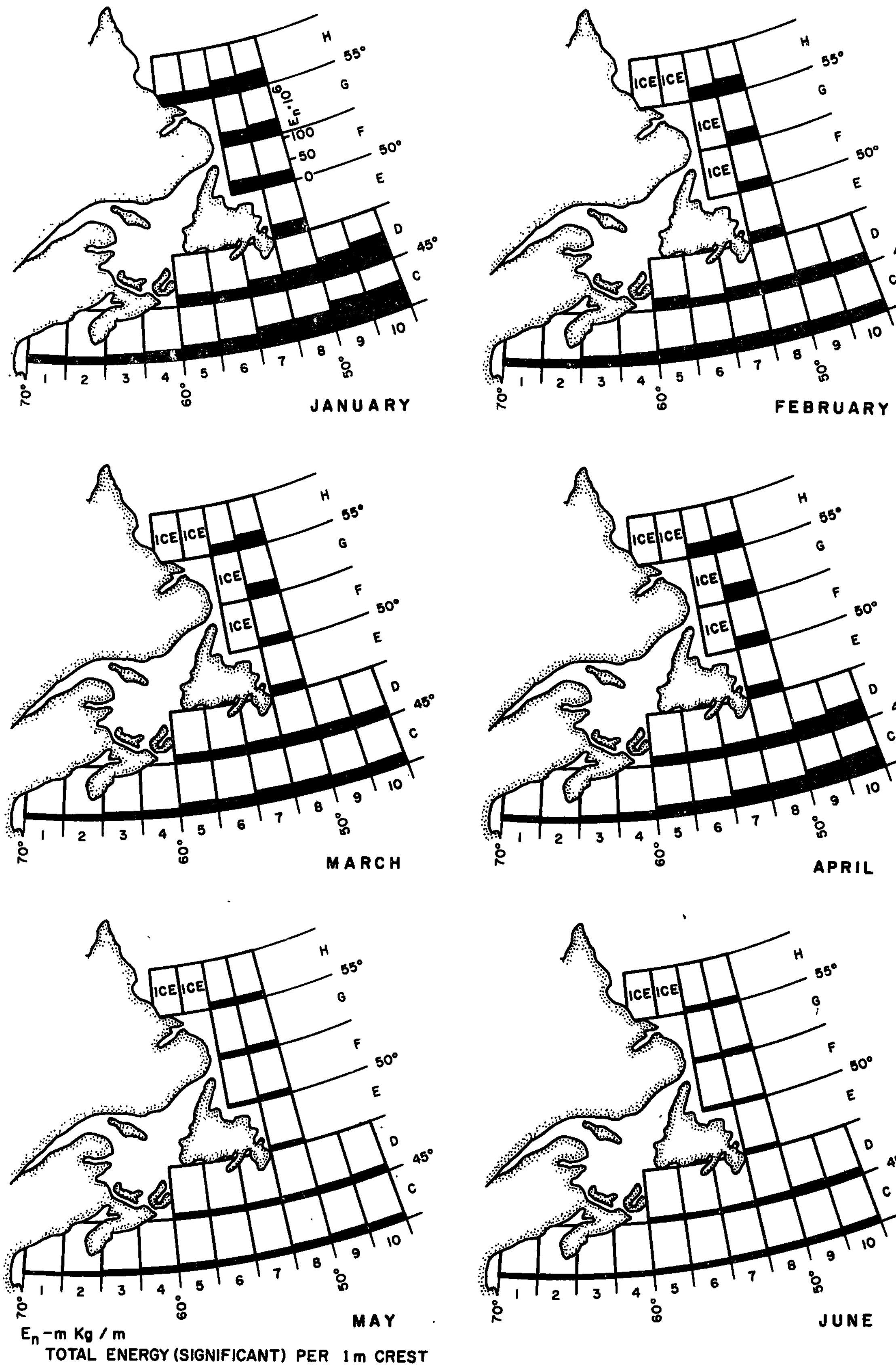


FIGURE 11: Monthly Non-directional Energy Spectra; January to June

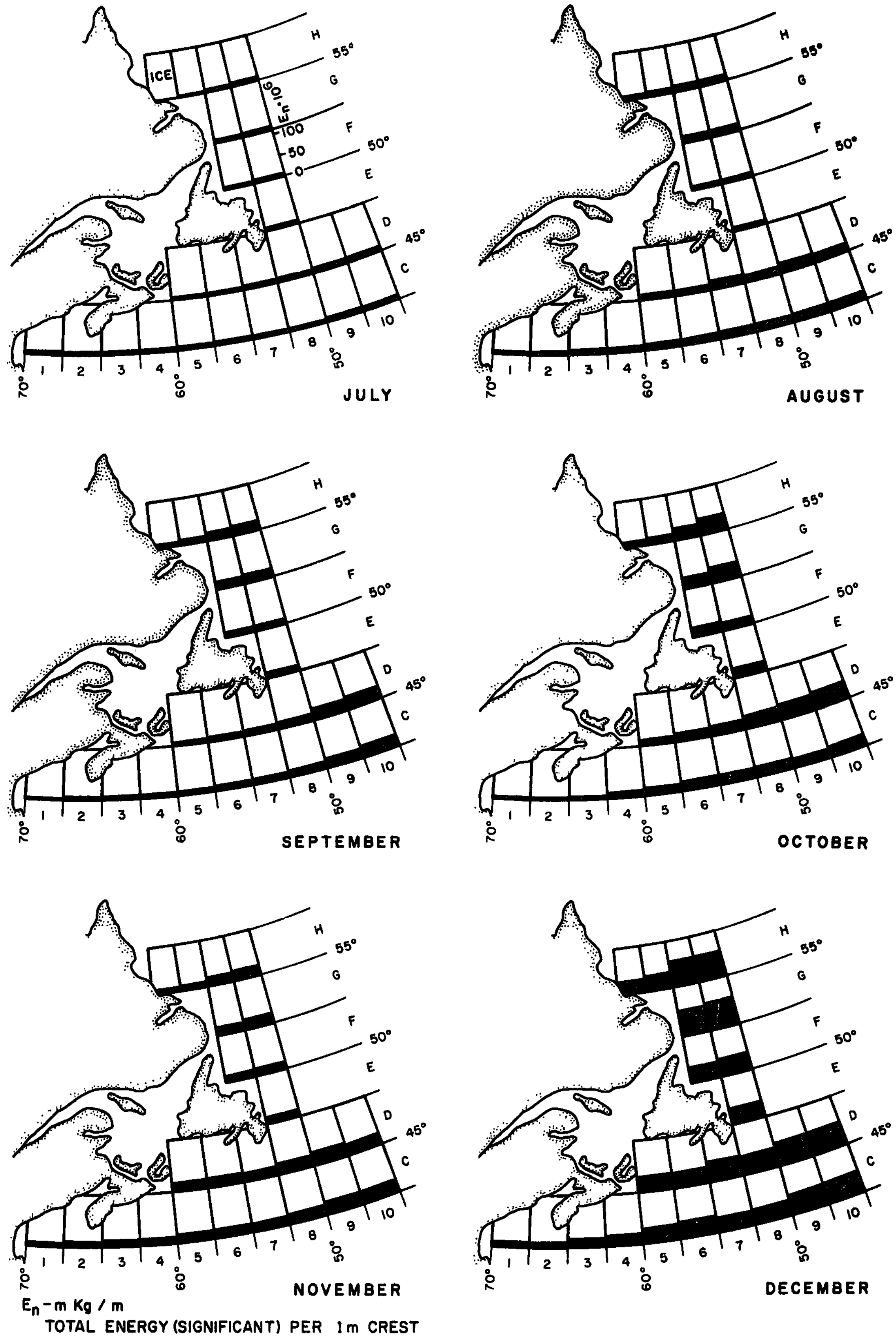


FIGURE 12: Monthly Non-directional Energy Spectra; July to December

5.2 Monthly Directional Energy Spectra

These spectra are presented in the Appendix, in App. Fig. 1 to App. Fig. 12. They are plotted in groups of five blocks per page. The energy of each block is divided into the eight point system, each point representing the energy of the respective 45 degree sector. The energy is plotted along the vertical axis and the wave periods normal to it. The direction of wave propagation is along the E^*_n-axis as indicated by the arrow. The periods (T), to which these energies refer, are grouped in two-second intervals. The shaded area is the integrated significant wave energy for each metre of wave crest. In addition, the occurrence of these energies with respect to percentage of time per month, is included.

The data cannot be discussed in detail because of their volume but must be studied individually in the areas of interest.

A brief review, however, reveals the following general picture for 1970. As already demonstrated by the non-directional energy presentation, the energy level in January was extremely high, with peaks primarily from the north-west and west; an exception being Labrador, where energy came from the north and east. February and March show an appreciable decrease, with more waves from the west and south-west. In contrast, the following month, April, showed an increase in energy level which was experienced during the oil recovery operation from the tanker *Arrow* in Chedabucto Bay (Neu[7]). The wave energy during this

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[7] NEU, H. A. "The hydrodynamics of Chedabucto Bay and its influences on the *Arrow* oil disaster." AOL Report 1970-6, Dartmouth, N.S.

period was primarily from the west and southwest. In the following months, the waves decreased considerably; their direction being more from the southwest. In the fall, the energy level started to increase again, and in December was up to the level of January with waves from the northwest, west and southwest along the southern seaboard and Grand Banks. The energy from the southwesterly direction appears to be generated primarily through short but intense storms associated with rapidly occurring weather disturbances.

In all these results, a remarkable agreement is displayed between the state of the sea, on the one hand, and the wind strength, direction and fetch, on the other. Where the winds are predominantly offshore, it is not surprising that, on the average, relatively little wave energy is transferred from the open Atlantic towards the Canadian seaboard. Only swell with reduced energy and waves of severe weather disturbances are usually able to enter the Continental Shelf region.

5.3 Monthly Directional Wave Statistics

The statistical analysis is also presented in the Appendix and gives the most complete information on the sea state. Each block contains 1460 individual wave data, each representing the 'significant' sea state for a period of six hours. This information is grouped in months, directions, heights, and 2-second period intervals. The number of occurrences of a particular wave type is given numerically at the intersection of the wave height and wave period.

The wave results of the analysis are given in App. Fig. 13 to 24.

5.4 Extreme Wave Heights

As discussed in Chapter 4.5, the ratio between the significant wave height and the maximum wave height which may occur in a 6-hour period is about 1 to 1.8.

The wave charts of three large storms are shown in Figures 4, 5 and 6, representing the wave conditions on 23 January 1970, 4 February 1970 and 27 December 1970, respectively. The first and the last one were the year's most severe storms over the Grand Banks, while the February 4th storm was the most severe one over the Scotian Shelf.

The storm of 23 January 1970 hardly touched the Scotian Shelf. The centre of the wave field was located 600 km offshore and extended over the southern part of the Grand Banks. In the Sable Island area, the significant wave height was 3 to 4 m, while over the Grand Banks it reached 10 m. The extreme wave heights were 5.5 to 7.5 m and 18 m respectively.

The storm which occurred on 4 February 1970, the day the oil tanker *Arrow* grounded, affected primarily the Scotian Shelf. The significant wave height was 7 m, and the extreme wave height in the order of 12.5 m. Hindcasting, for the purpose of investigating the storm during the disaster (Neu[7]), agrees with these figures. The storm had little or no effect on the Grand Banks.

The storm of 27 December 1970 was similar in its wave field pattern to that of 23 January 1970, though the December storm was closer to the continent. The significant wave height at Sable Island was 5 to 6 m and over the Grand Banks, 10 m. The respective extreme wave heights were 9 to 11 m and 18 m. During the height of the storm, an oil exploration platform near Sable Island experienced a maximum wave height of 12 m. This is ten percent higher than reported herein and may be caused by refraction. From these three storms, it can be concluded that in 1970 the maximum wave height over the Scotian Shelf was of the order of 12.5 m, while over the Grand Banks it was 18 m. Shoaling could have caused still higher waves.

6. CONCLUSIONS

All three presentations, the non-directional energy distributions, the directional energy spectra and the wave statistics, clearly demonstrate the variation of the sea state along the Canadian Atlantic coast and over the Continental Shelf with respect to time, location and direction.

The most outstanding features are that during the winter, the wave energy was five to six times greater than during the summer, and the energy concentration on the Grand Banks and along the coast of Labrador was three to four times that over the Scotian Shelf. This latter fact indicates that the wave heights east of Newfoundland and over the Grand Banks were, generally, nearly twice as high as those in the Sable Island area. This ratio is also approximately indicated by the comparision of the extreme wave heights which were 12.5 m and 18 m, respectively.

1970 was not apparently an exceptionally stormy year and it must be assumed that a 100-year wave would be much higher, according to probability statistics, of the order of 1½ while the wave energy would increase by more than 2. The effect of shoaling is not taken into consideration.

From this, it must be concluded that a structure such as an oil drilling rig, which has been built for a design wave of 20 m, may successfully withstand the sea conditions near Sable Island, but would probably fail over the Grand Banks or off the Labrador coast.

Design concepts, safety standards and planning of off-shore operations must therefore be reviewed carefully in the light of the information submitted herewith.

7. ACKNOWLEDGEMENT

The author gratefully acknowledges the contribution of the Maritime Forces Weather Centre and particularly that of M. R. Morgan, the Officer in Charge. Without relinquishing the data and approving their publication, this investigation would not have been possible.

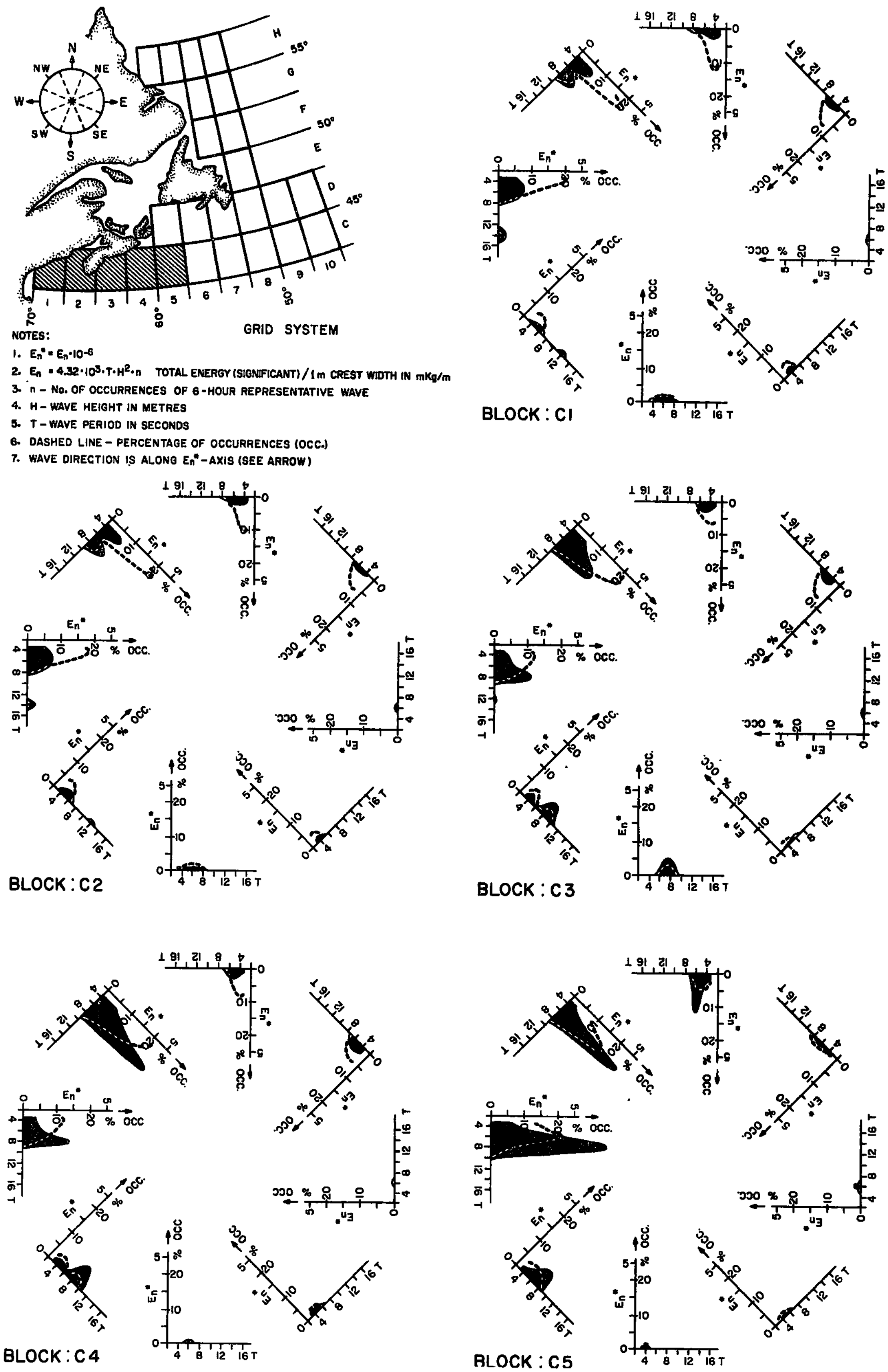
Special mention is made of R. Walker for his untiring effort in processing the data and preparing them for publication. I also thank P. Vandall Jr. and others for their contributions to the project, and E. S. Turner of the National Research Council for reviewing the paper.

8. APPENDIX

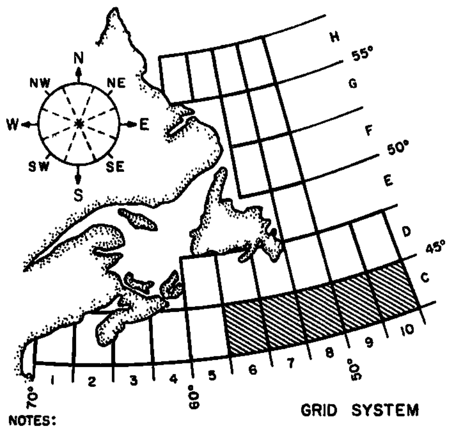
The monthly directional energy spectra and the wave statistics are given in this chapter. They are grouped as follows:

App. Fig. 1 a to e	Directional	Energy	Spectra	for	January
App. Fig. 2 a to e	"	"	"	"	February
App. Fig. 3 a to e	"	"	"	"	March
App. Fig. 4 a to e	"	"	"	"	April
App. Fig. 5 a to e	"	"	"	"	May
App. Fig. 6 a to e	"	"	"	"	June
App. Fig. 7 a to e	"	"	"	"	July
App. Fig. 8 a to e	"	"	"	"	August
App. Fig. 9 a to e	"	"	"	"	September
App. Fig. 10 a to e	"	"	"	"	October
App. Fig. 11 a to e	"	"	"	"	November
App. Fig. 12 a to e	"	"	"	"	December

App. Fig. 13 a to g	Directional	Wave	Statistics	for	January
App. Fig. 14 a to g	"	"	"	"	February
App. Fig. 15 a to g	"	"	"	"	March
App. Fig. 16 a to g	"	"	"	"	April
App. Fig. 17 a to g	"	"	"	"	May
App. Fig. 18 a to g	"	"	"	"	June
App. Fig. 19 a to g	"	"	"	"	July
App. Fig. 20 a to g	"	"	"	"	August
App. Fig. 21 a to g	"	"	"	"	September
App. Fig. 22 a to g	"	"	"	"	October
App. Fig. 23 a to g	"	"	"	"	November
App. Fig. 24 a to g	"	"	"	"	December

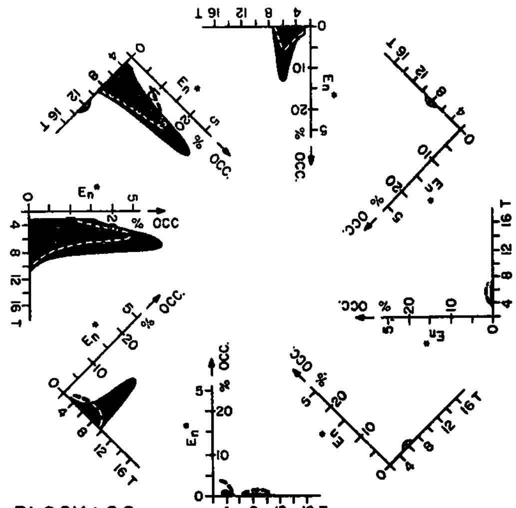


APPENDIX FIGURE 1a: Directional Energy Spectra for January

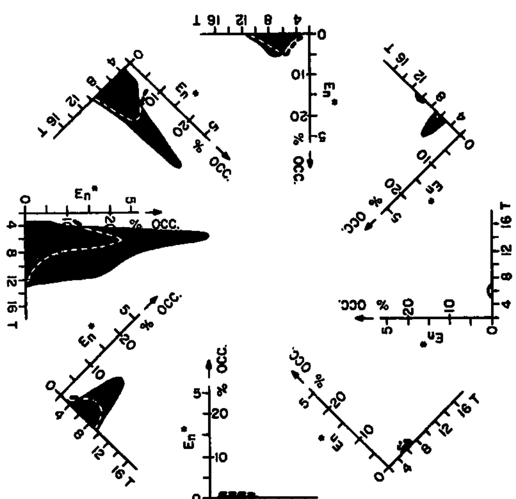


NOTES:

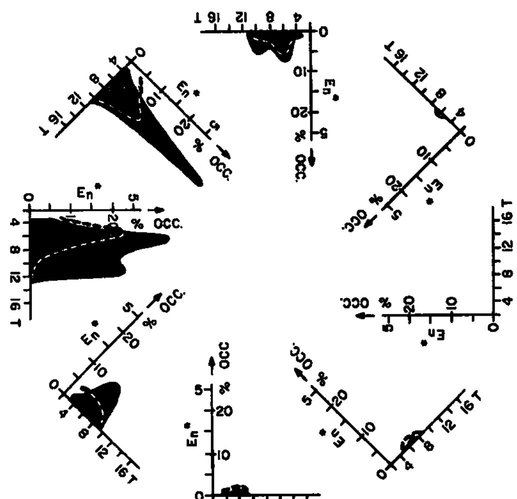
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



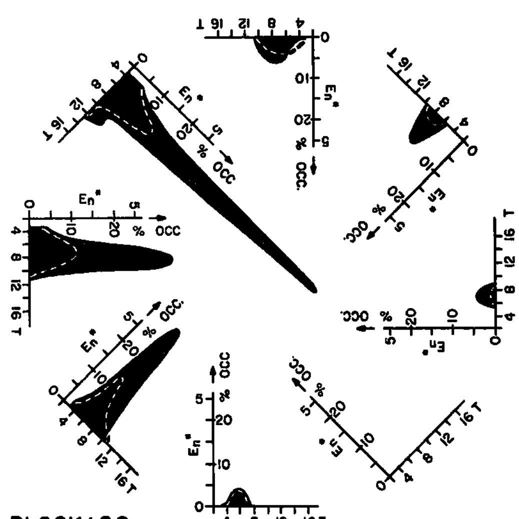
BLOCK : C6



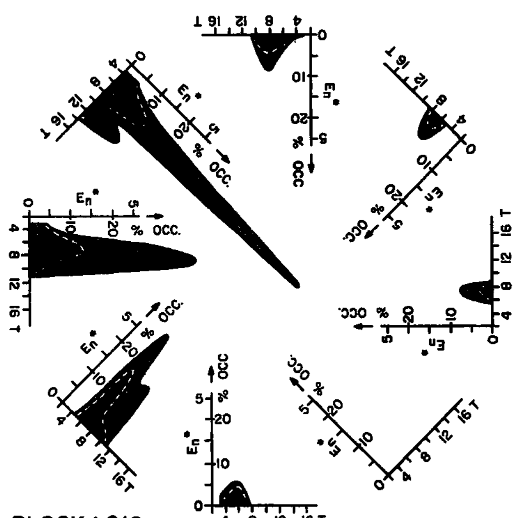
BLOCK : C7



BLOCK : C8

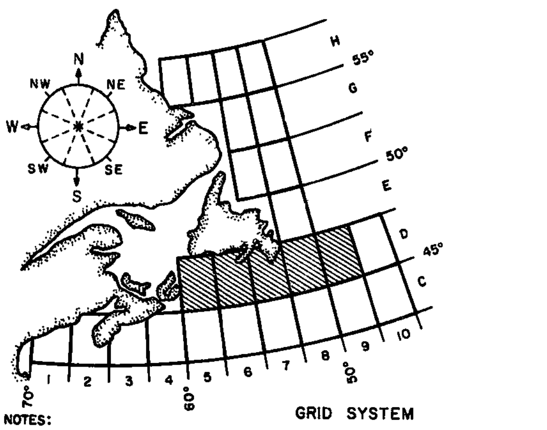


BLOCK : C9



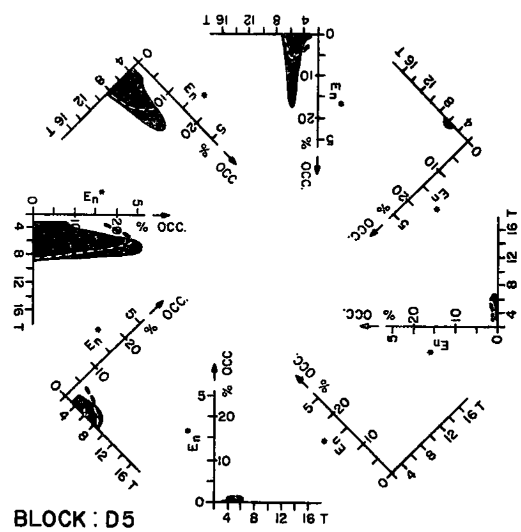
BLOCK : C10

APPENDIX FIGURE 1b: Directional Energy Spectra for January

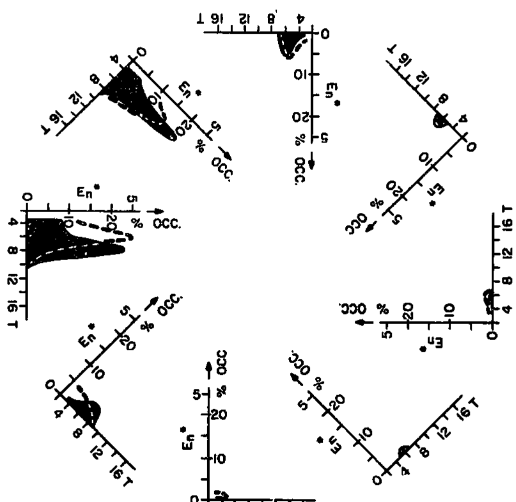


NOTES:

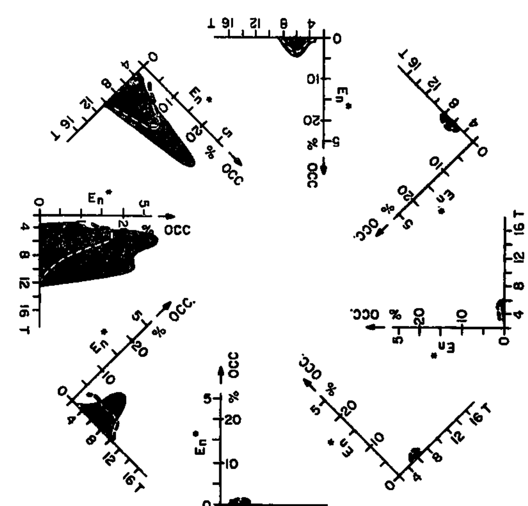
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



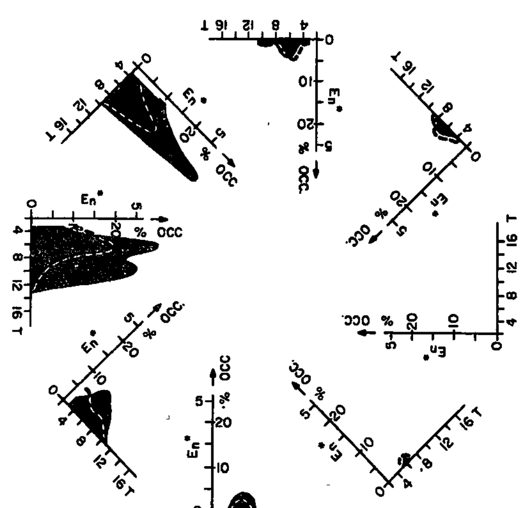
BLOCK : D5



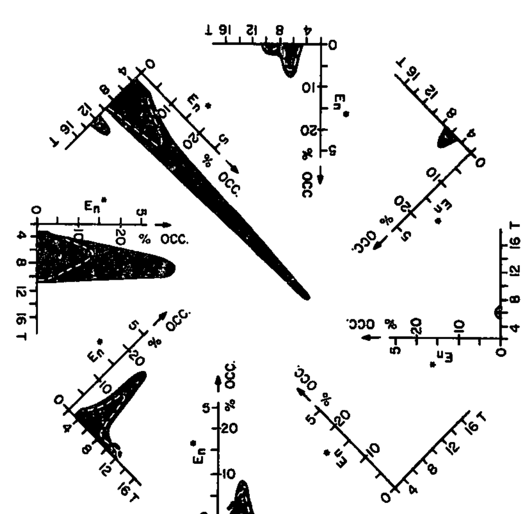
BLOCK : D6



BLOCK : D7

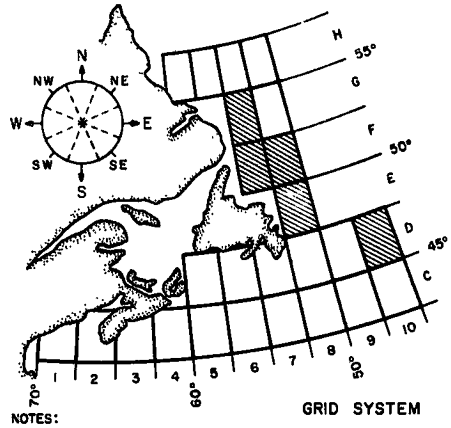


BLOCK : D8



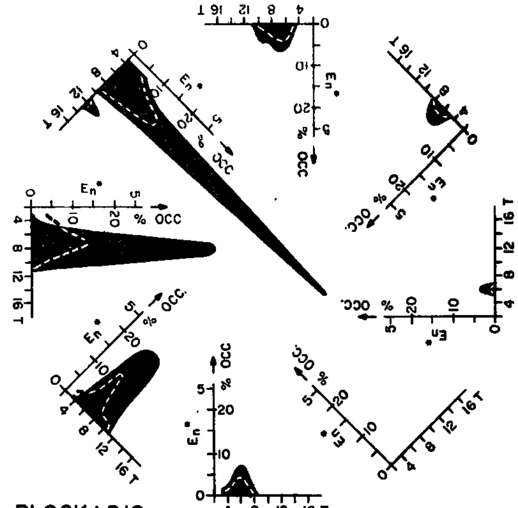
BLOCK : D9

APPENDIX FIGURE 1c: Directional Energy Spectra for January



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^{2} \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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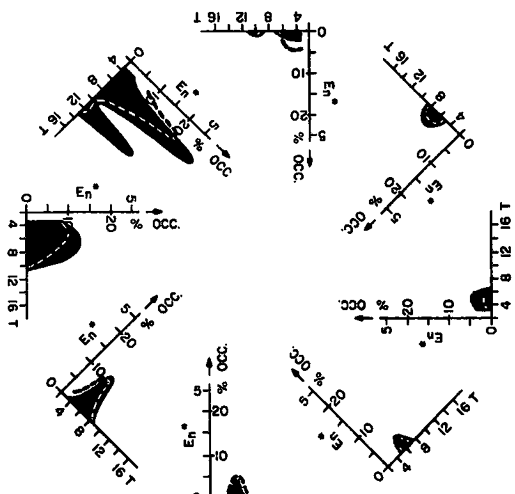

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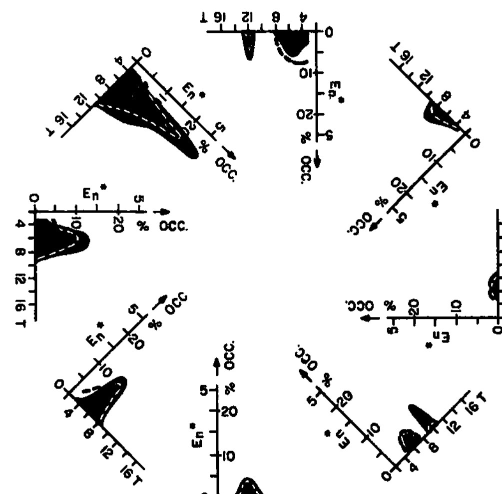

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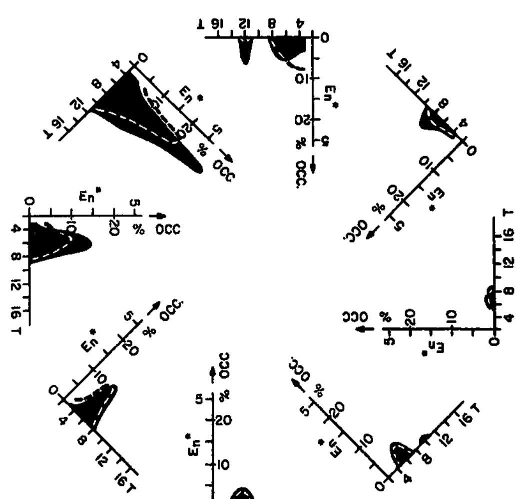

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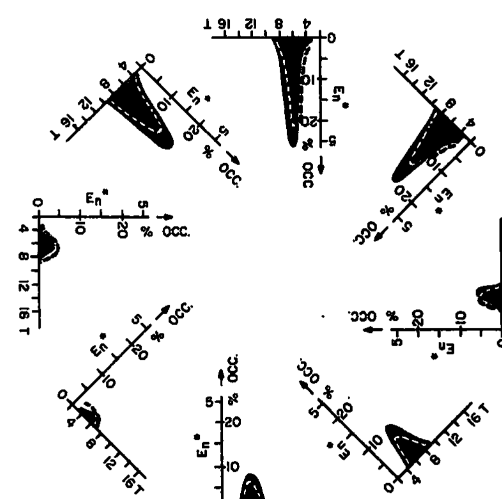
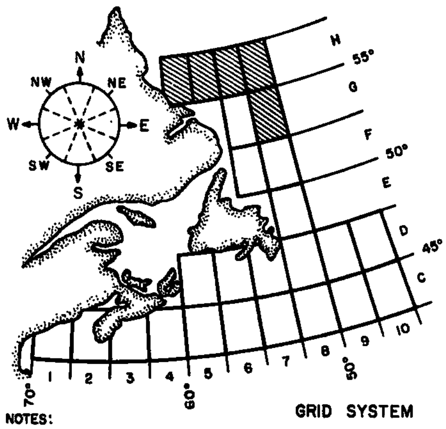
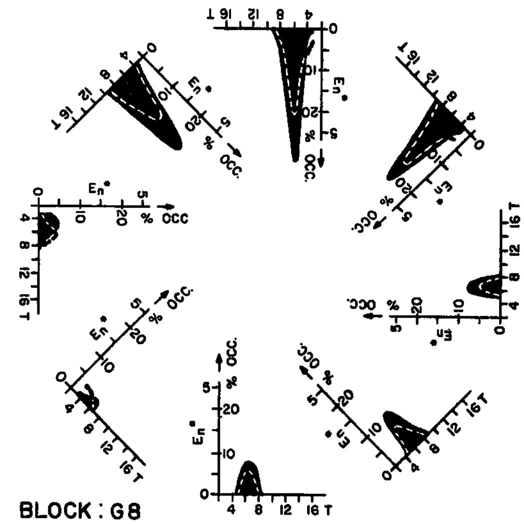


BLOCK : G7

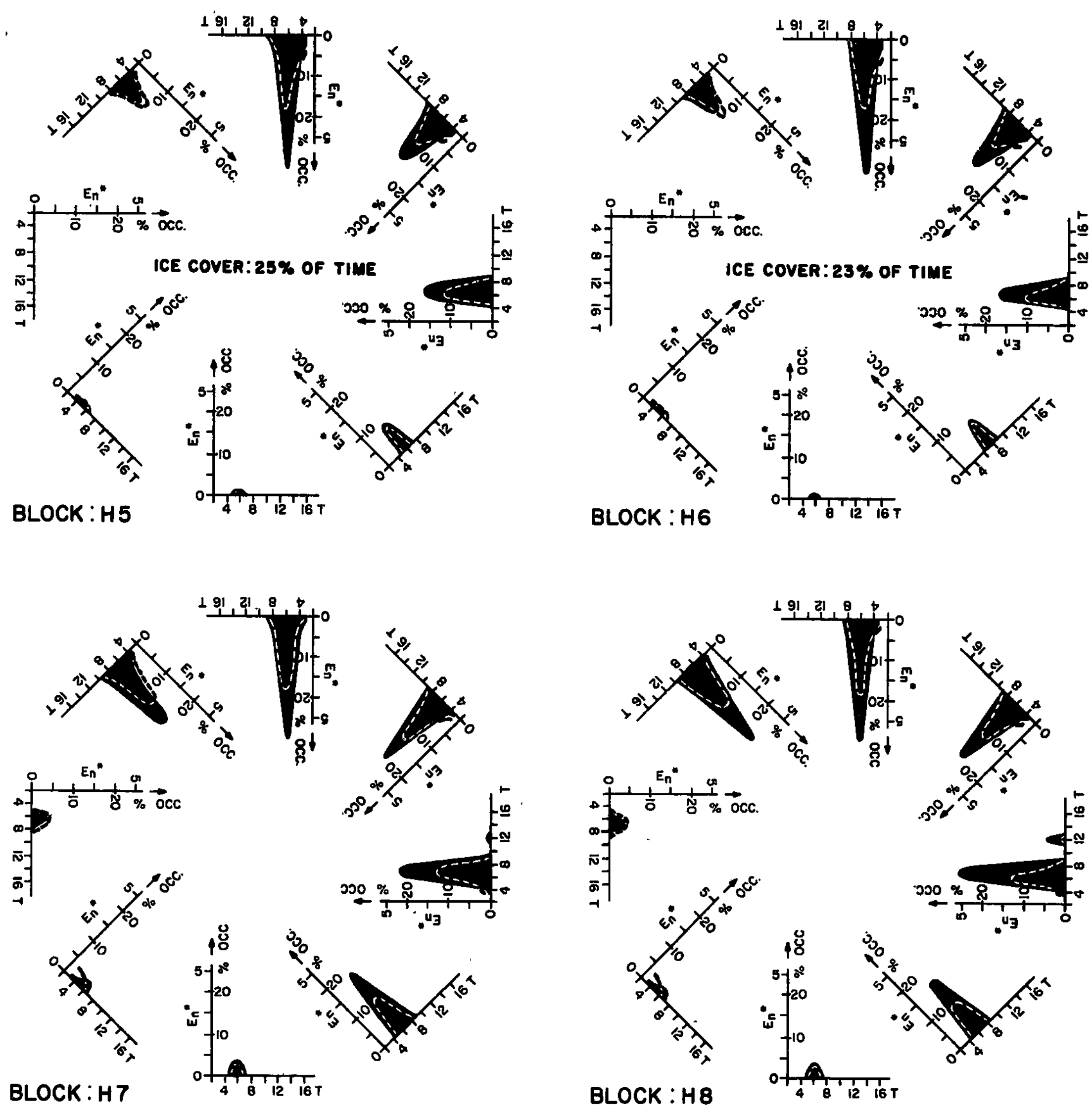
APPENDIX FIGURE 1d: Directional Energy Spectra for January



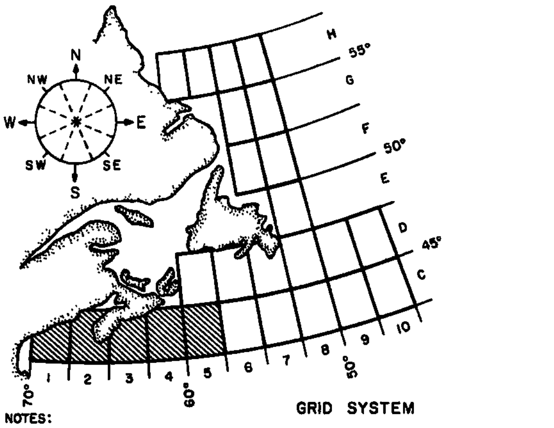


NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)

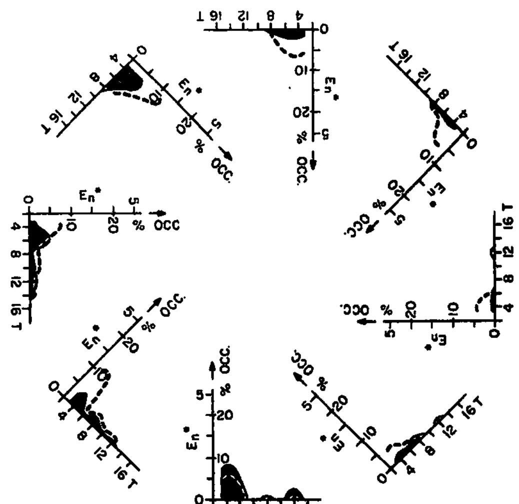


APPENDIX FIGURE 1e: Directional Energy Spectra for January

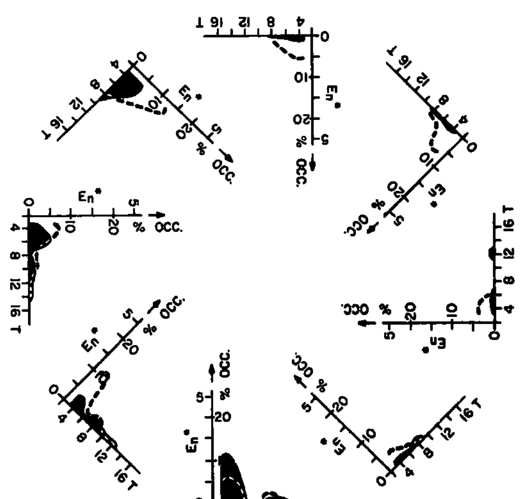


NOTES:

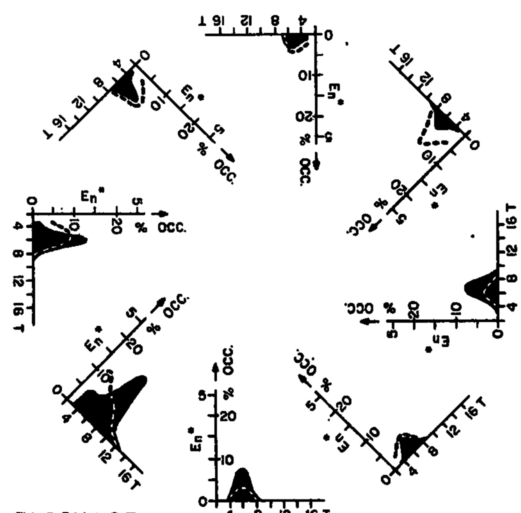
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



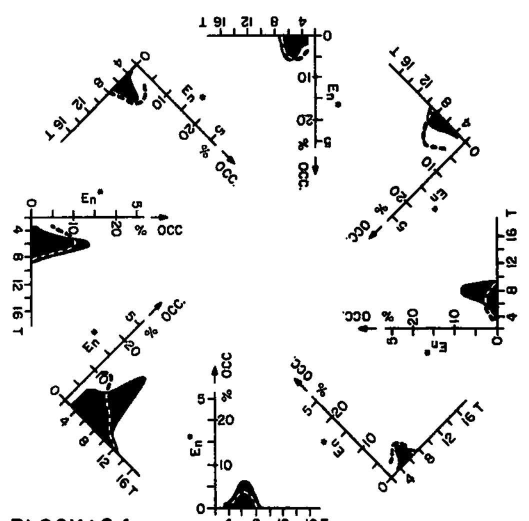
BLOCK : C1



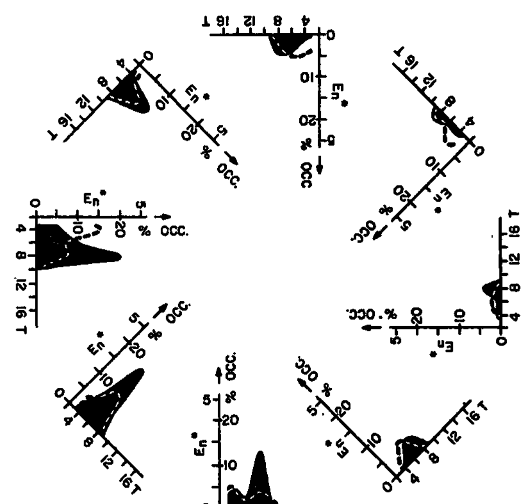
BLOCK : C2



BLOCK : C3

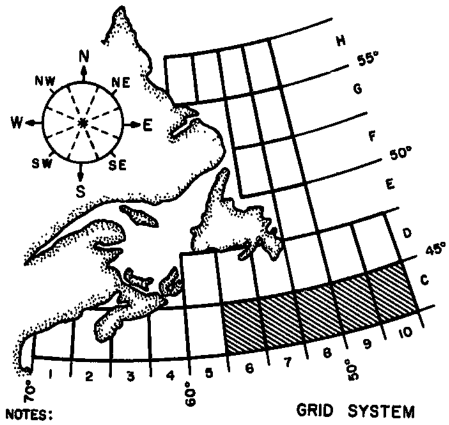


BLOCK : C4



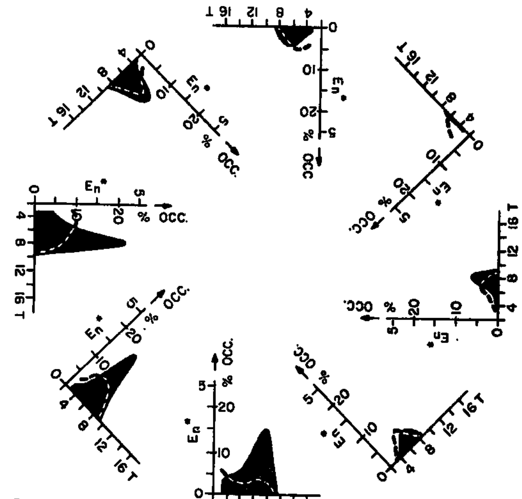
BLOCK : C5

APPENDIX FIGURE 2a: Directional Energy Spectra for February

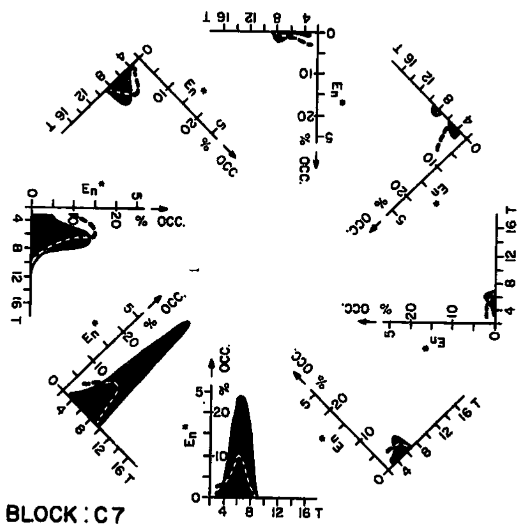


NOTES:

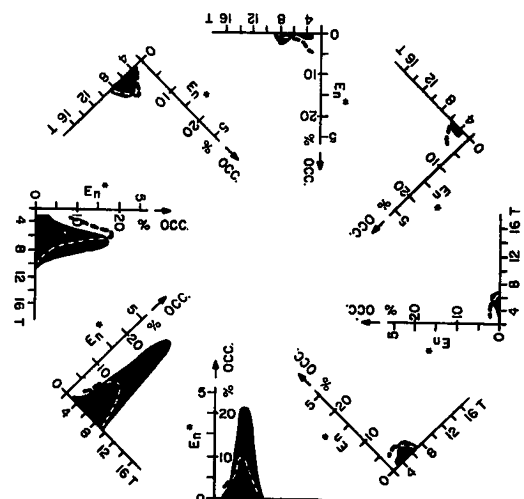
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



BLOCK : C6



BLOCK : C7



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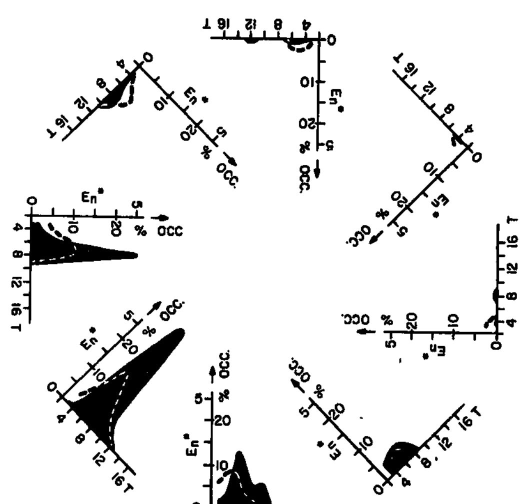

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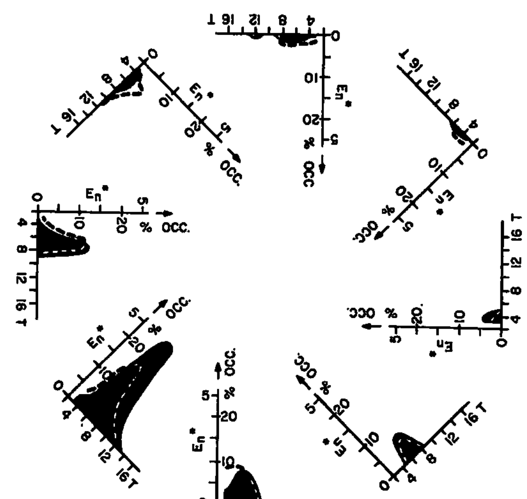
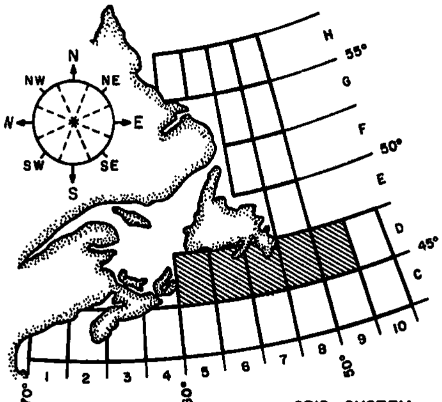


BLOCK : C10

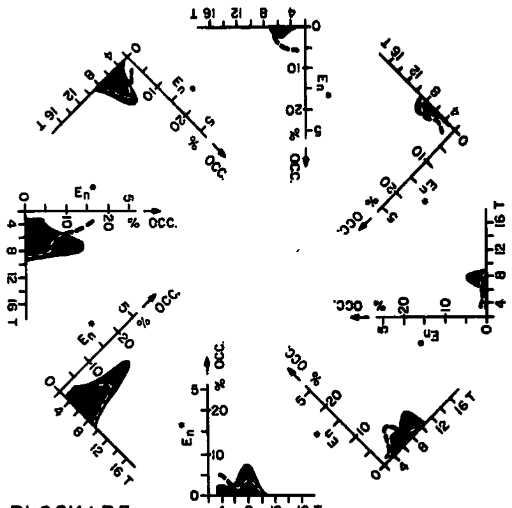
APPENDIX FIGURE 2b: Directional Energy Spectra for February



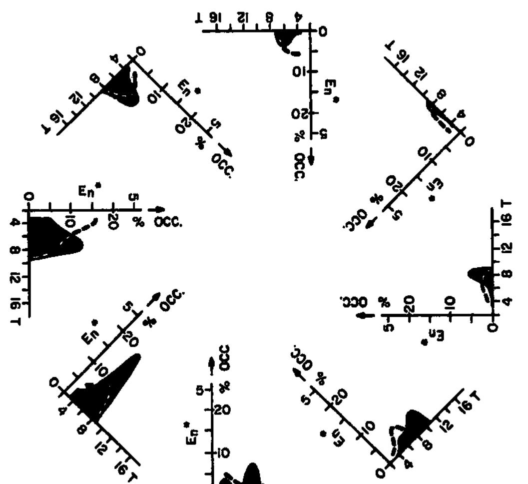
GRID SYSTEM

NOTES:

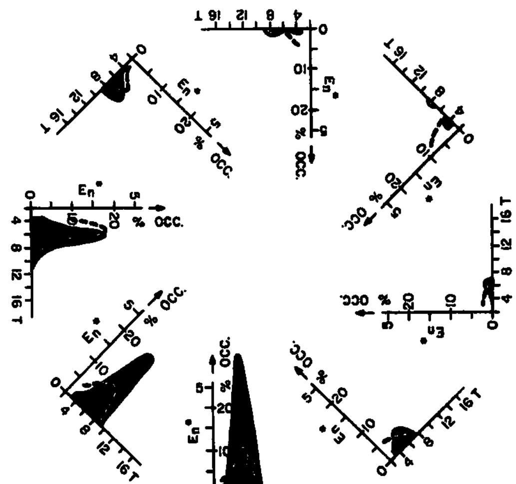
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



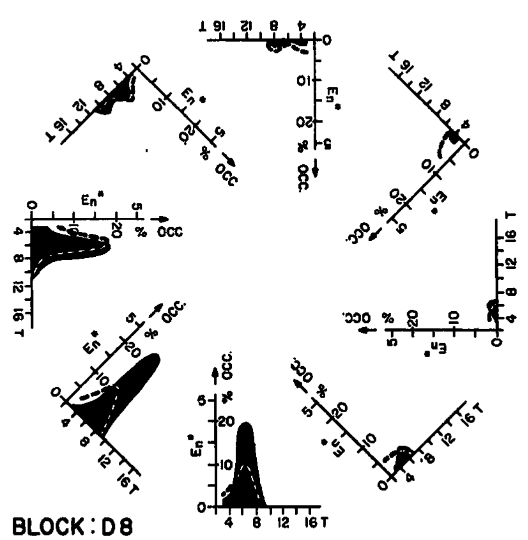
BLOCK : D5



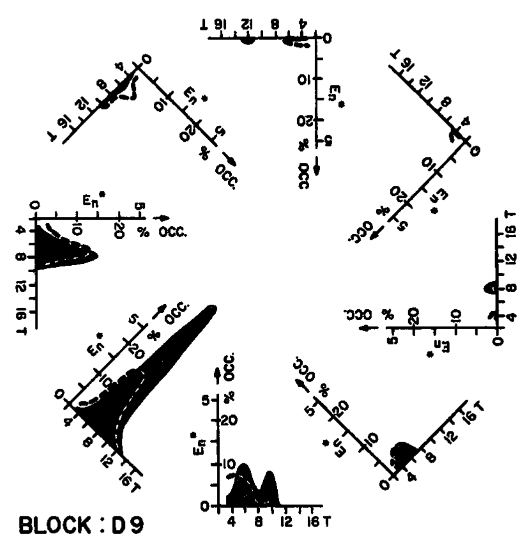
BLOCK : D6



BLOCK : D7

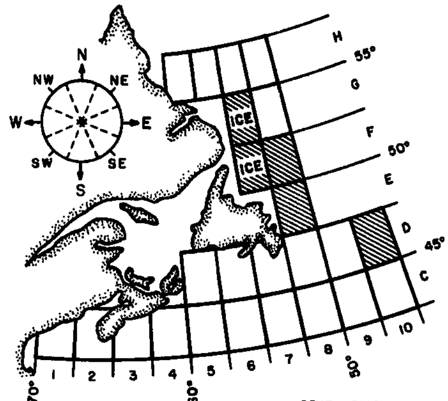


BLOCK : D8



BLOCK : D9

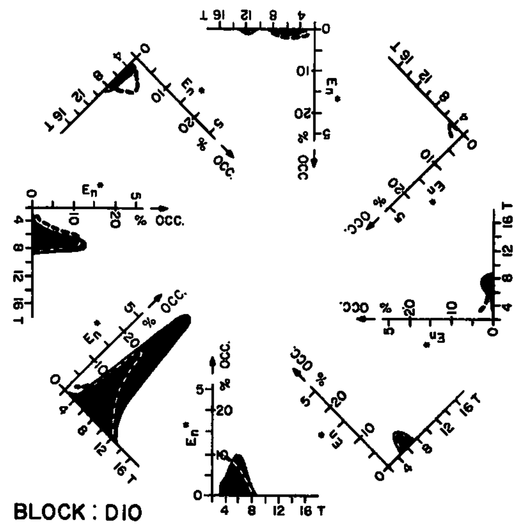
APPENDIX FIGURE 2c: Directional Energy Spectra for February

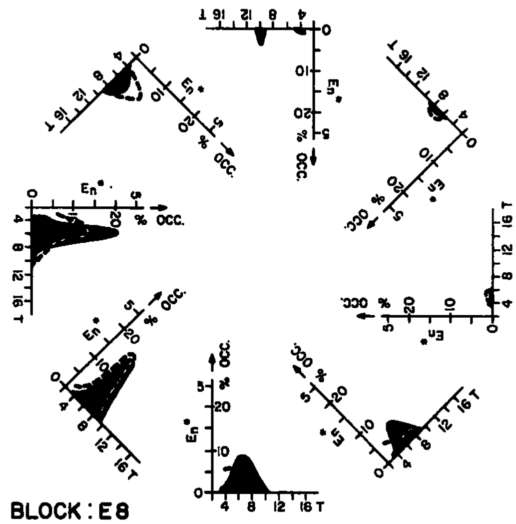


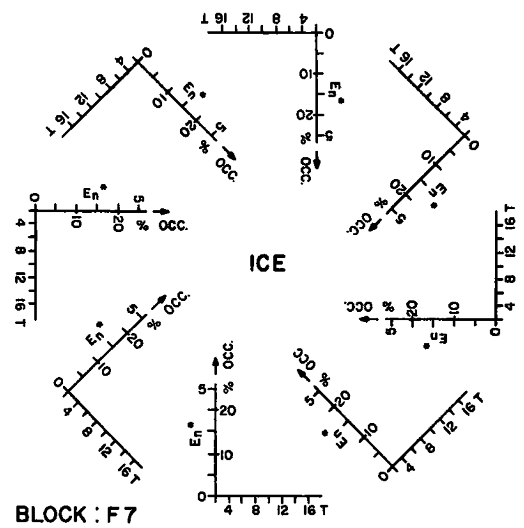
GRID SYSTEM

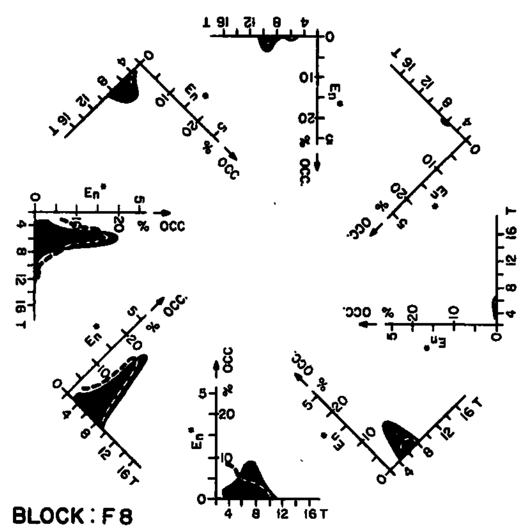
NOTES:

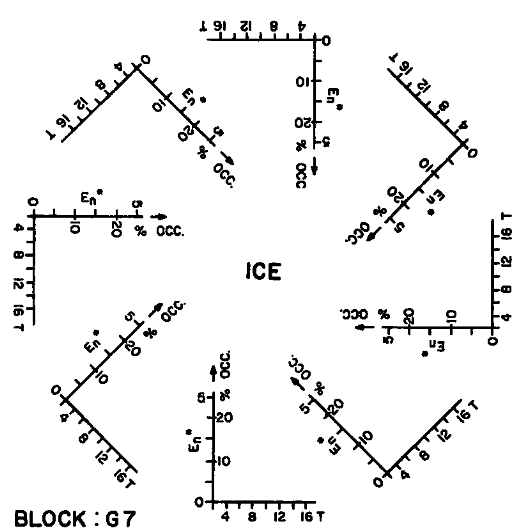
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



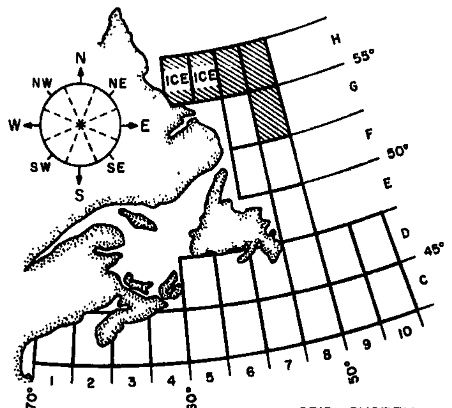








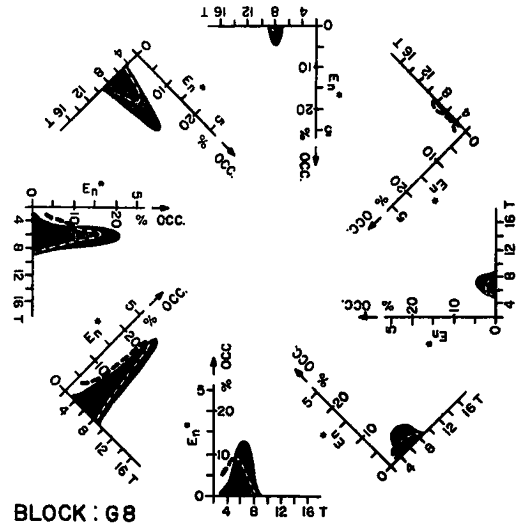
APPENDIX FIGURE 2d: Directional Energy Spectra for February



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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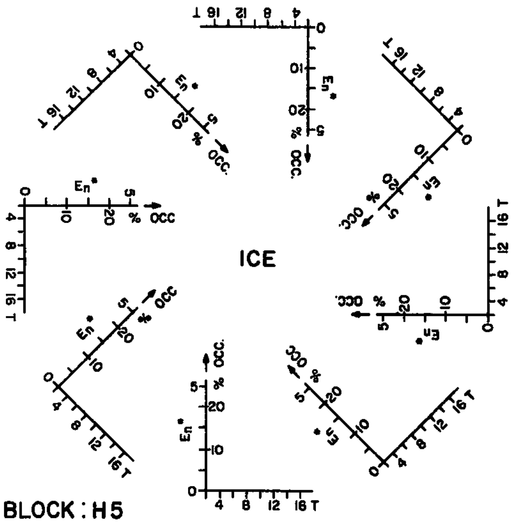
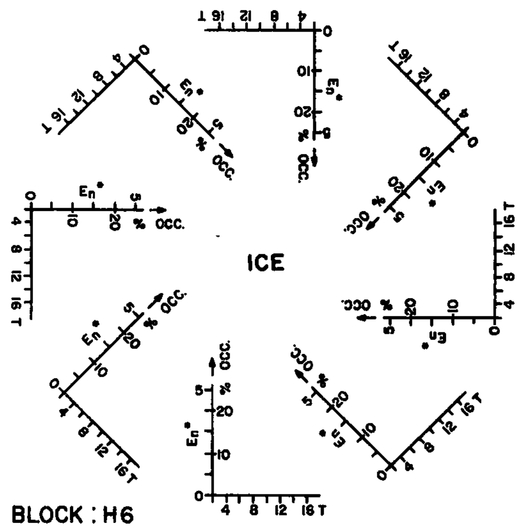
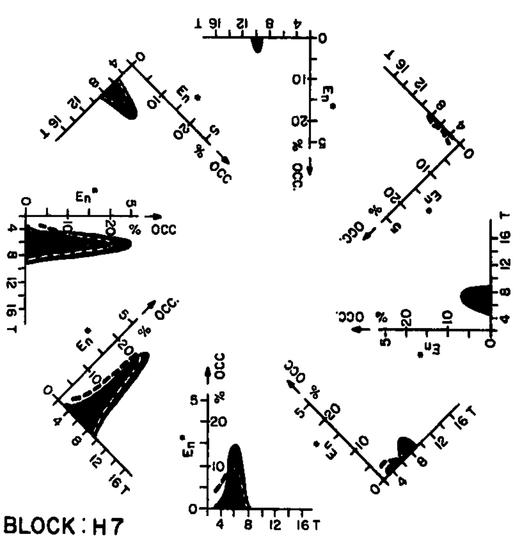


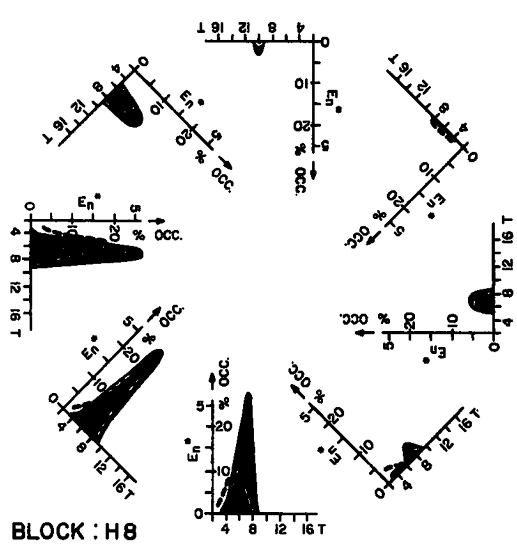
BLOCK : H5



BLOCK : H6

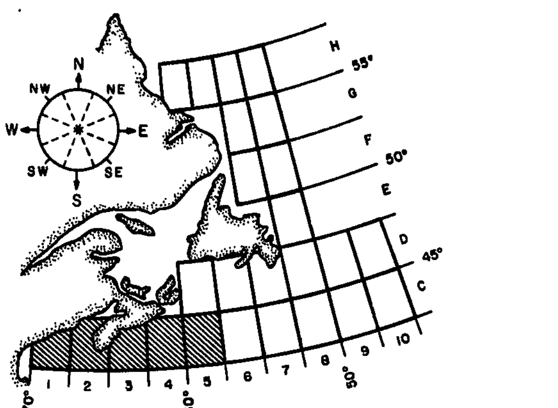


BLOCK : H7



BLOCK : H8

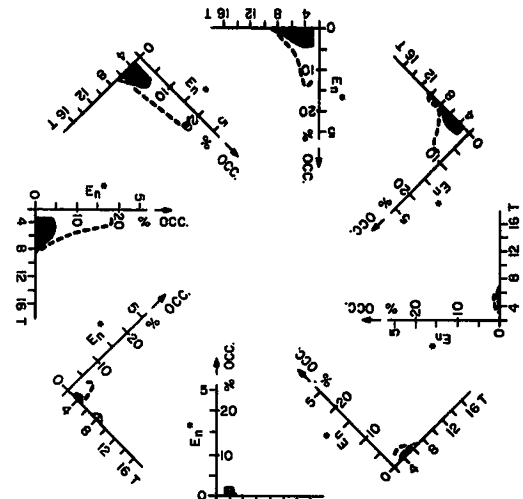
APPENDIX FIGURE 2e: Directional Energy Spectra for February



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



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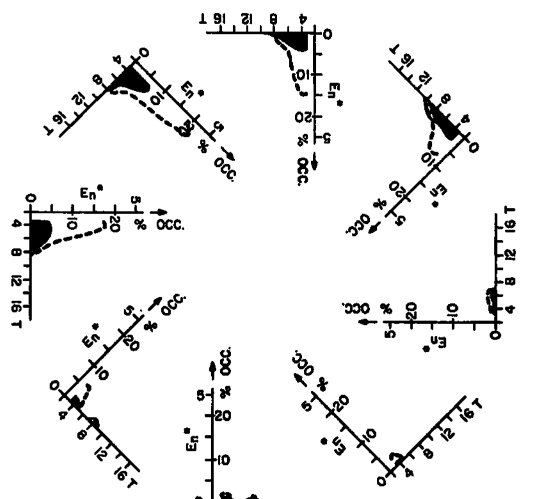

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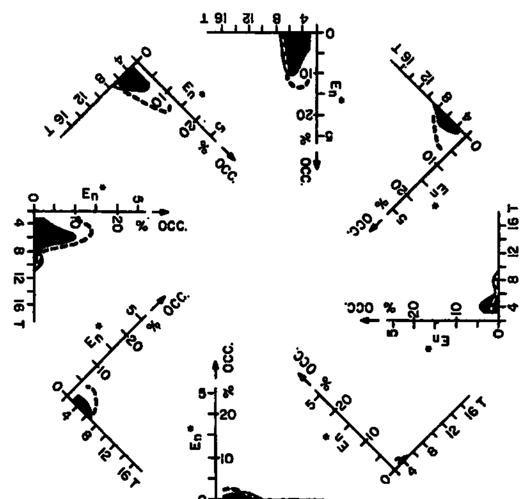

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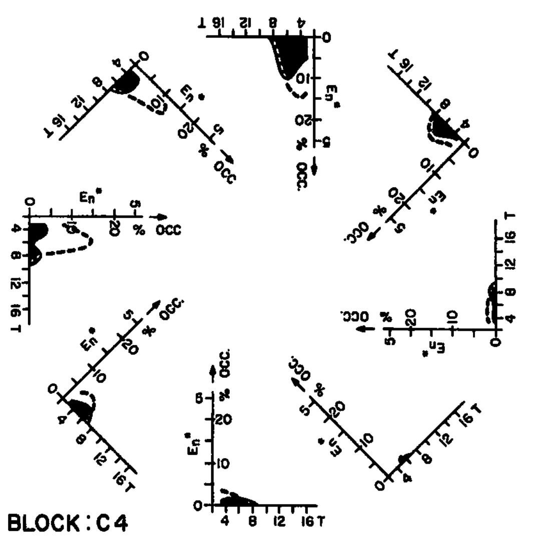

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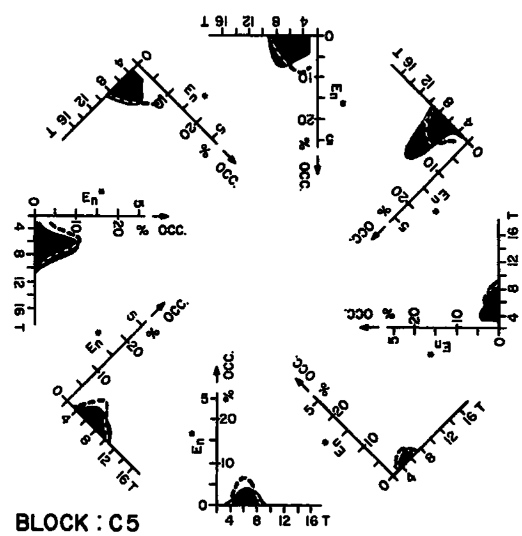

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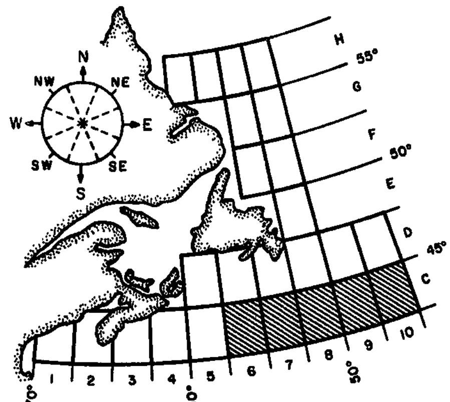
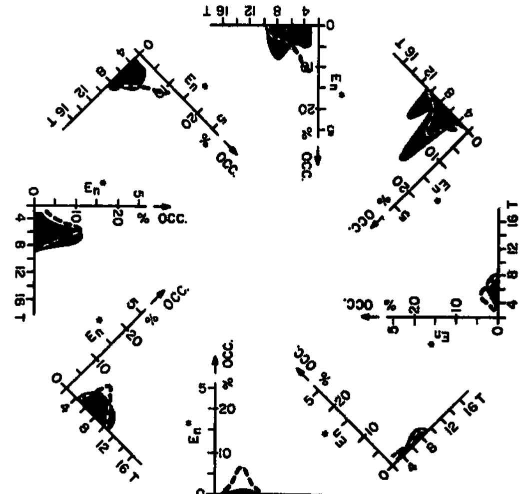
APPENDIX FIGURE 3a: Directional Energy Spectra for March



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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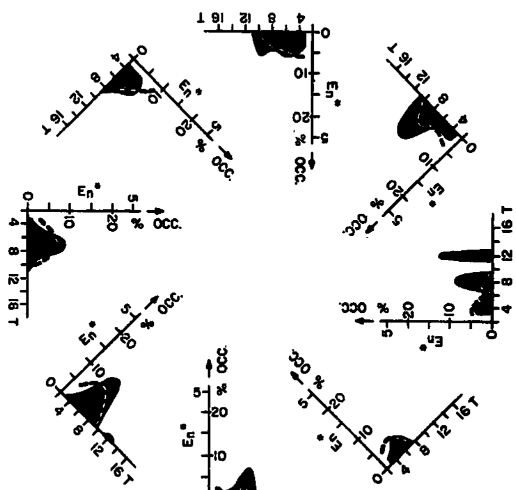

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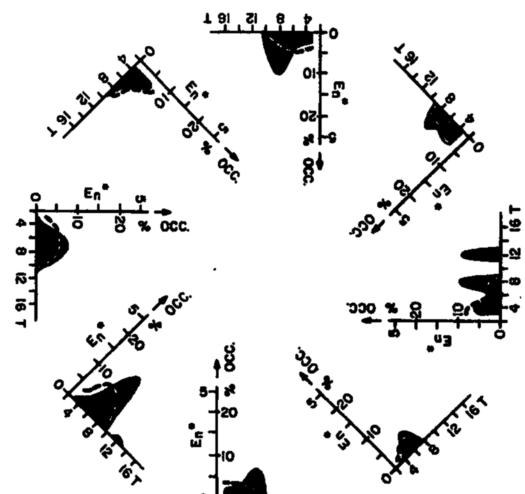

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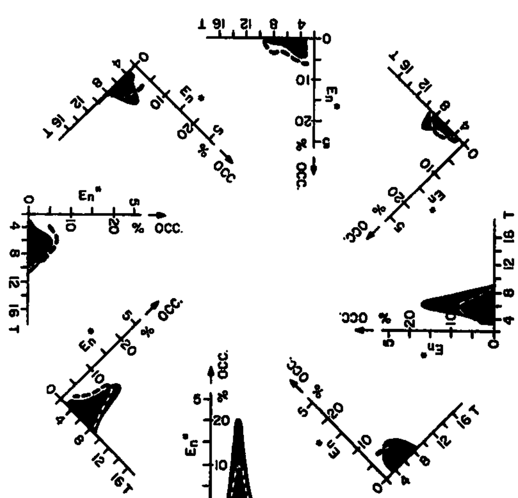

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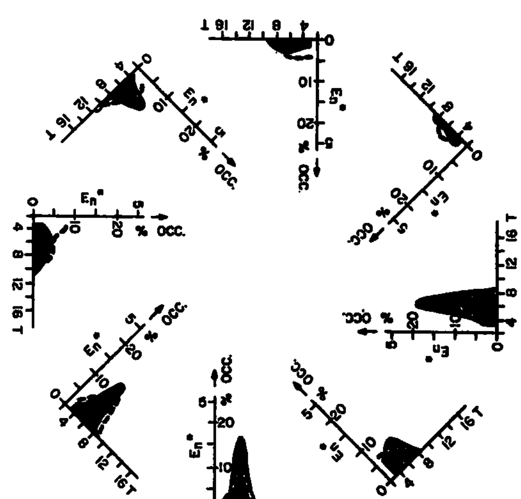

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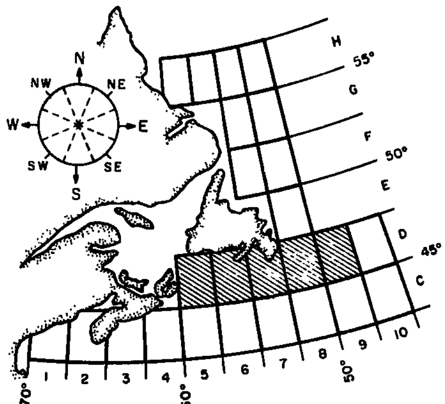
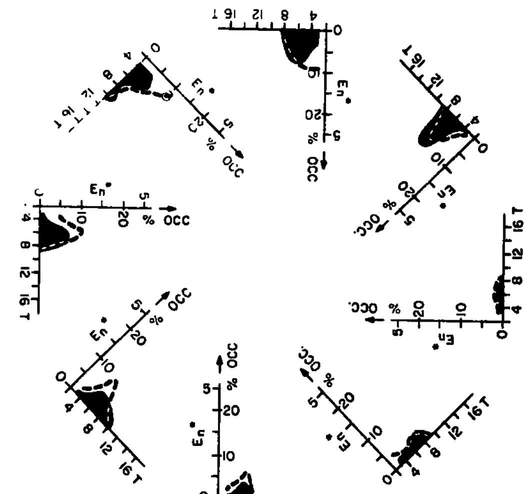
APPENDIX FIGURE 3b: Directional Energy Spectra for March



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n - No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H - WAVE HEIGHT IN METRES
5. T - WAVE PERIOD IN SECONDS
6. DASHED LINE - PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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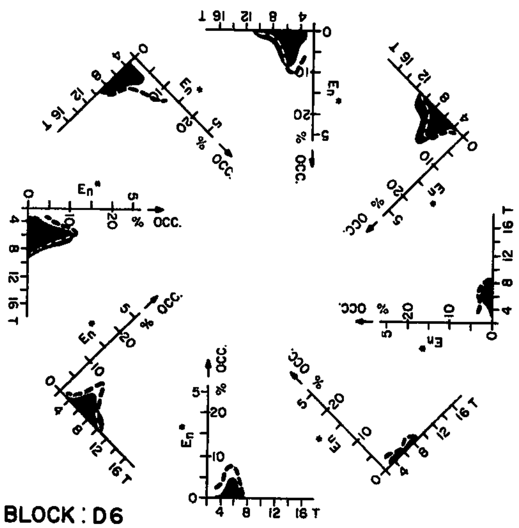

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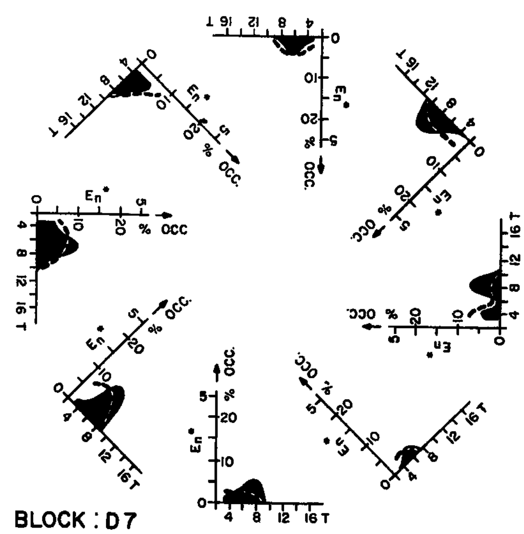

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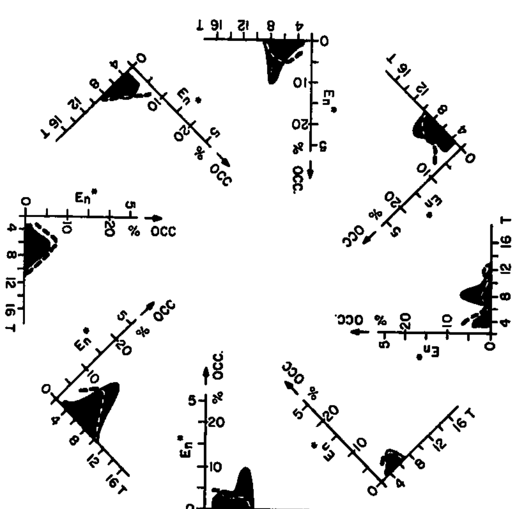

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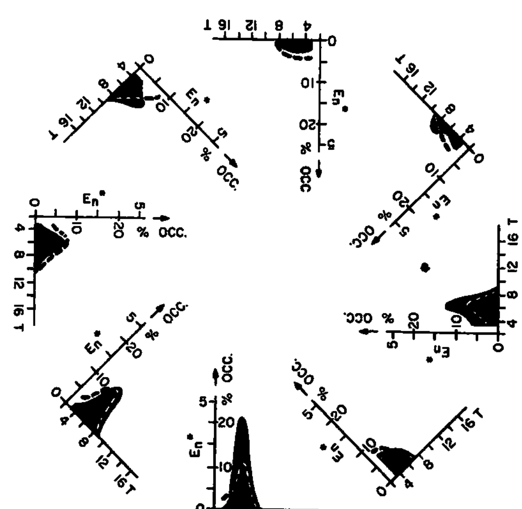
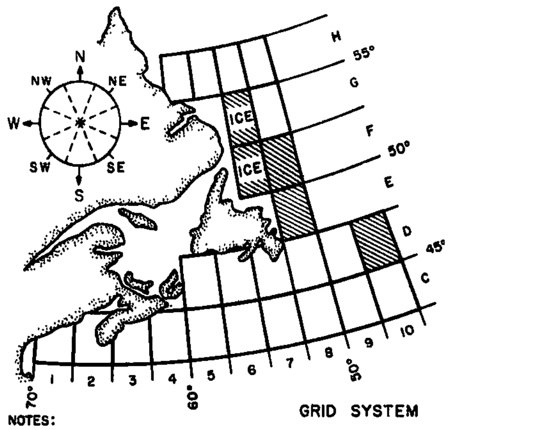


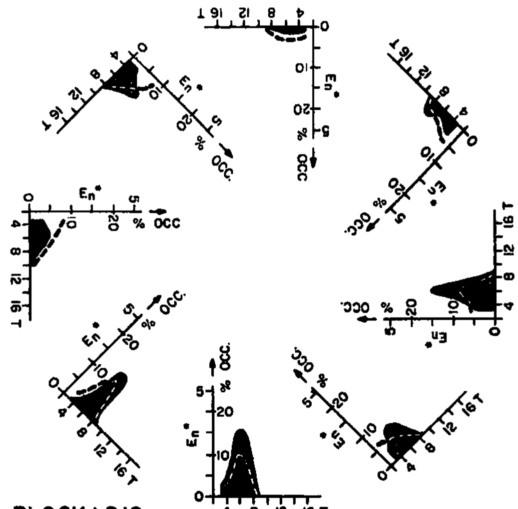
BLOCK : D9

APPENDIX FIGURE 3c: Directional Energy Spectra for March



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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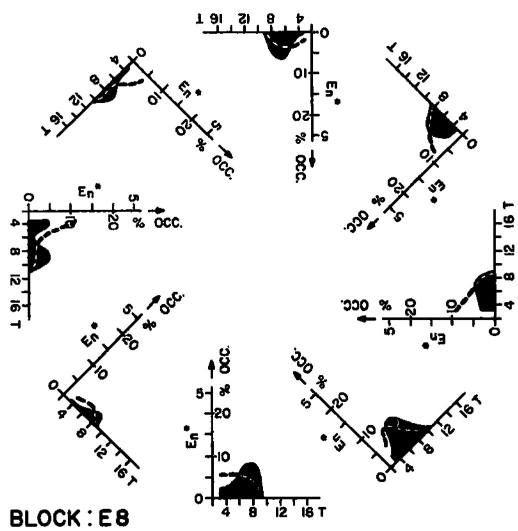

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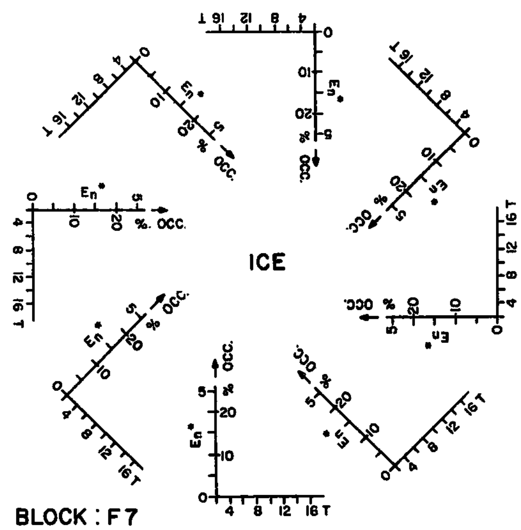

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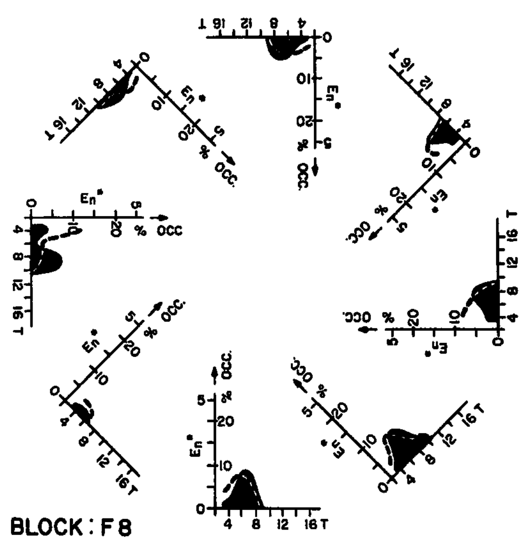

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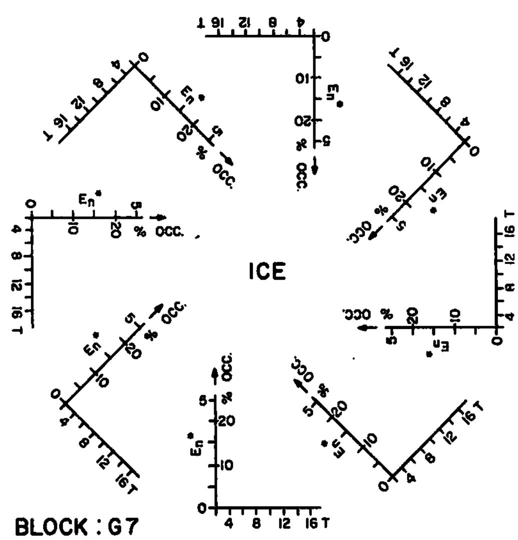

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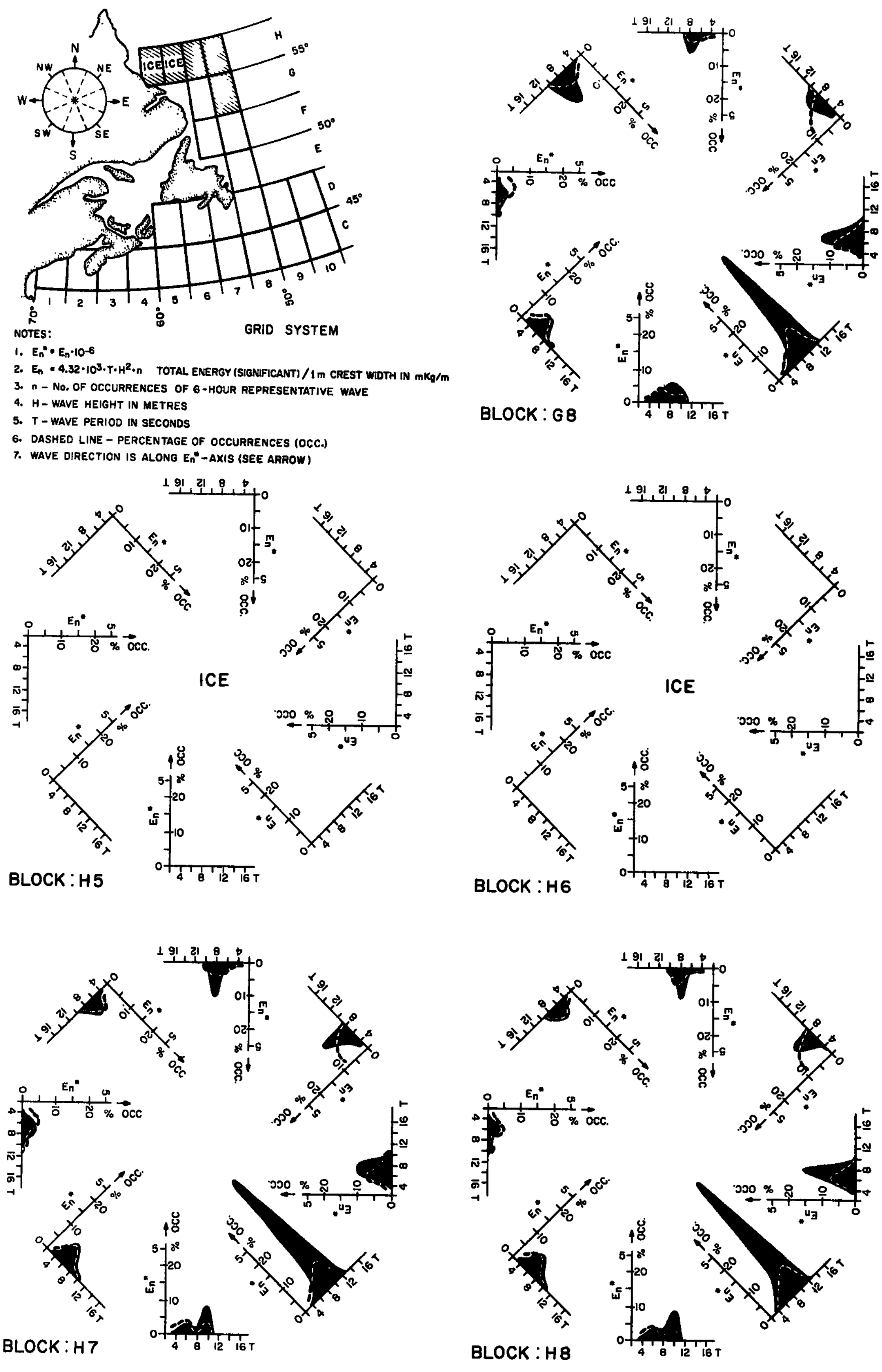
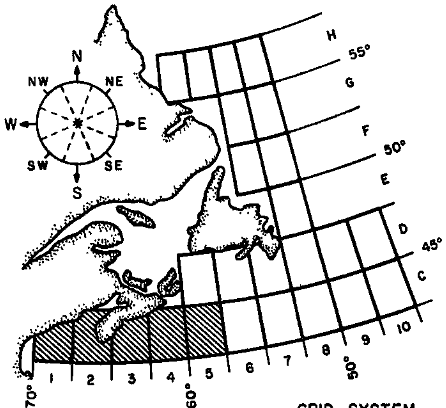
APPENDIX FIGURE 3d: Directional Energy Spectra for March

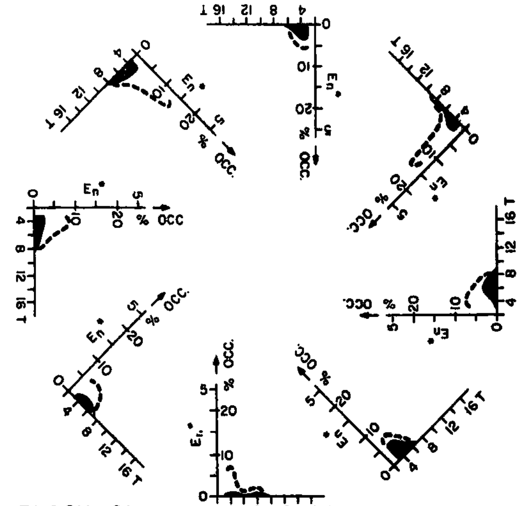


APPENDIX FIGURE 3e: Directional Energy Spectra for March

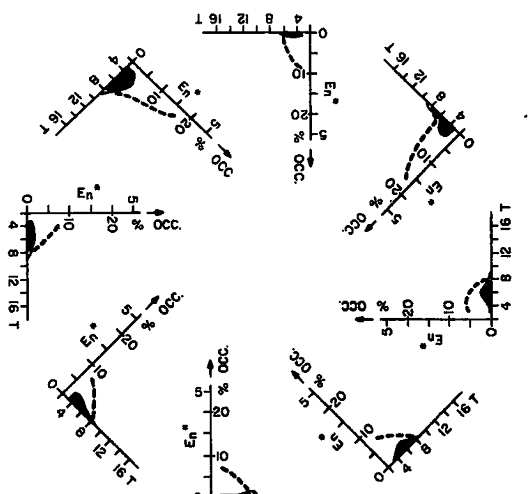


NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



BLOCK : C1



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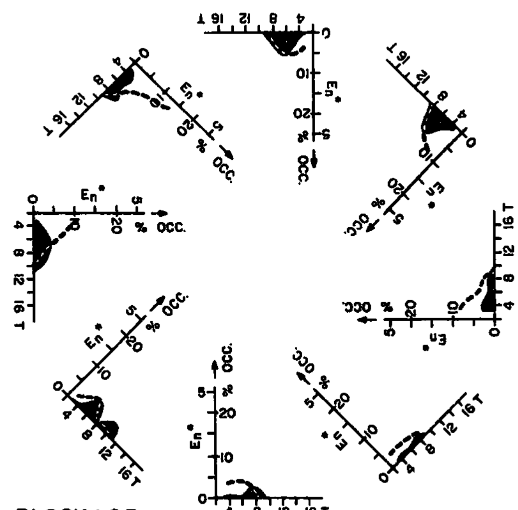

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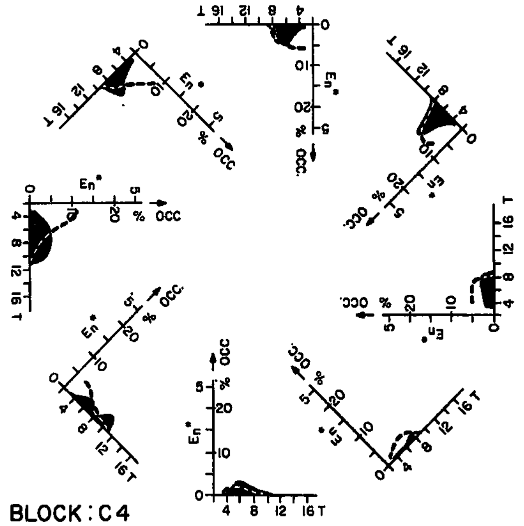

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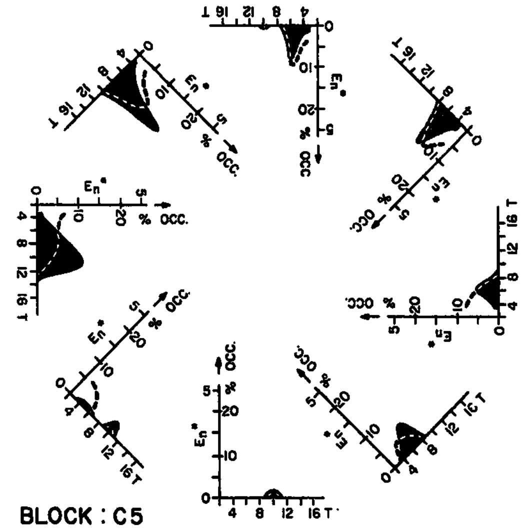
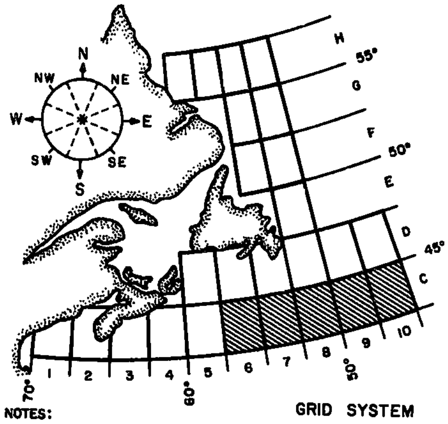


BLOCK : C5

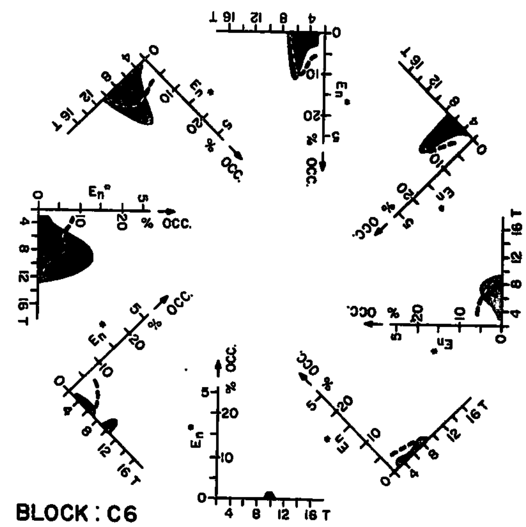
APPENDIX FIGURE 4a: Directional Energy Spectra for April



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



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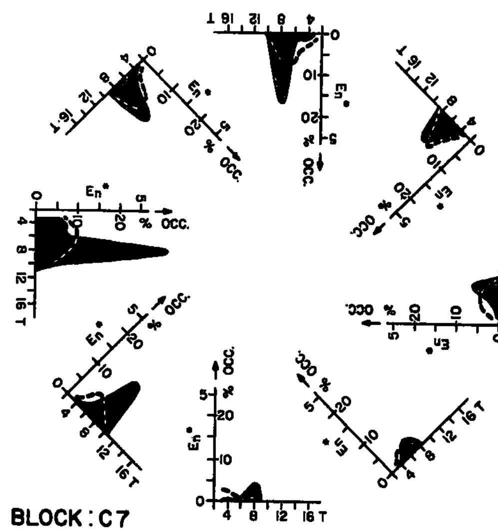

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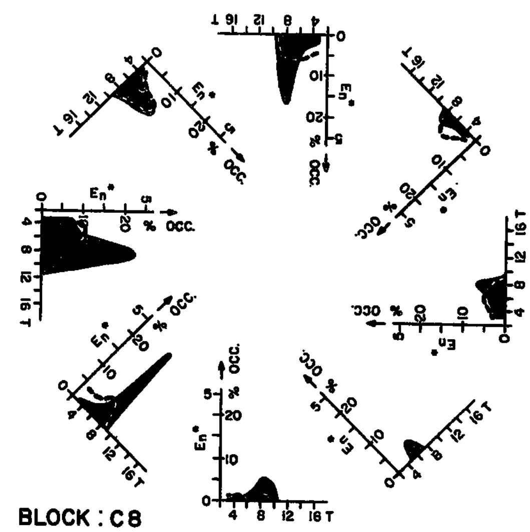

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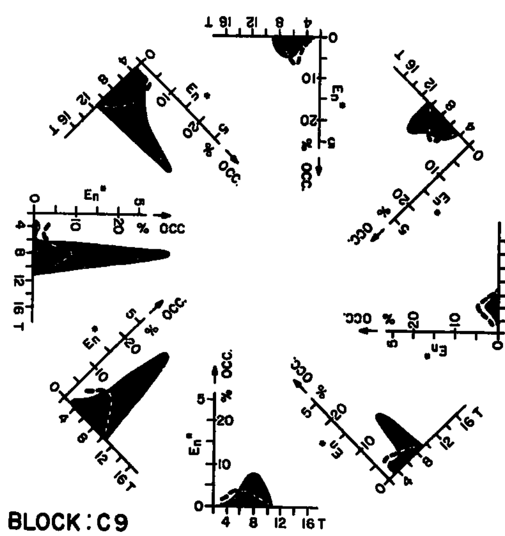

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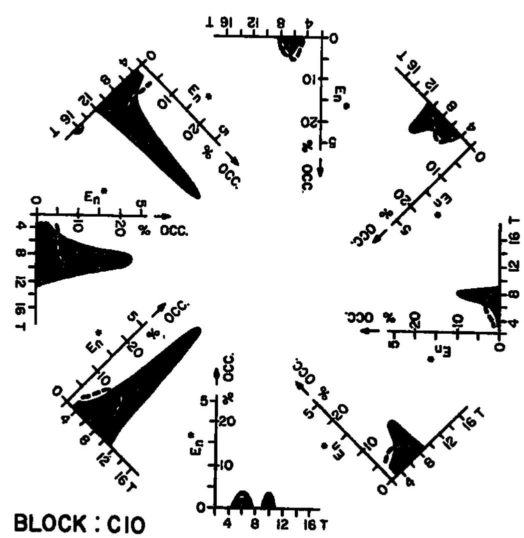
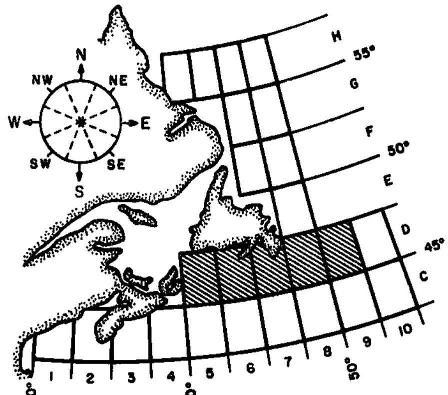


BLOCK : C10

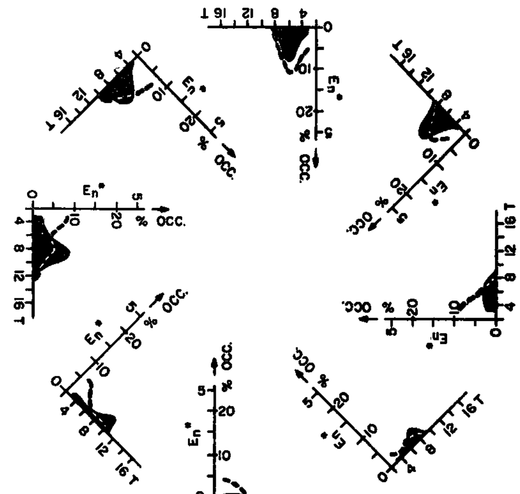
APPENDIX FIGURE 4b: Directional Energy Spectra for April



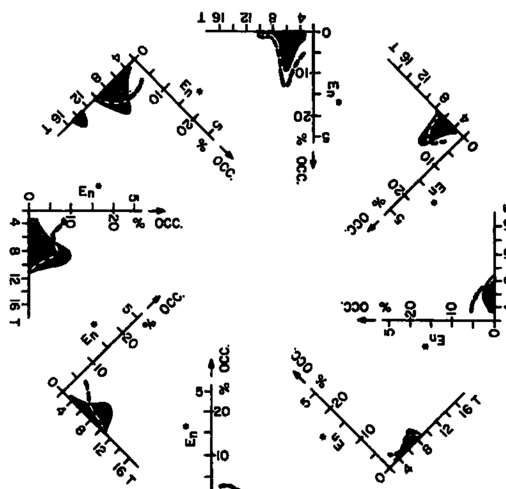
GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



BLOCK : D5



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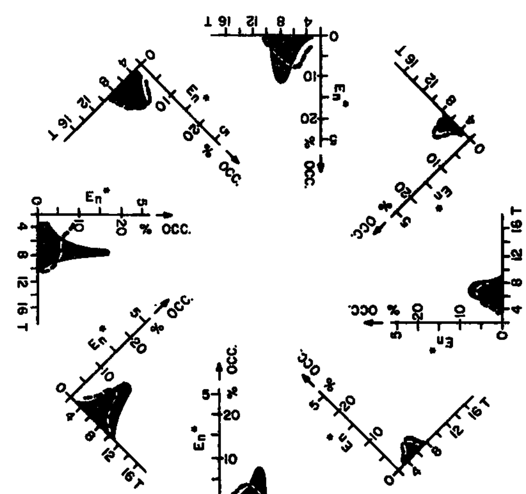

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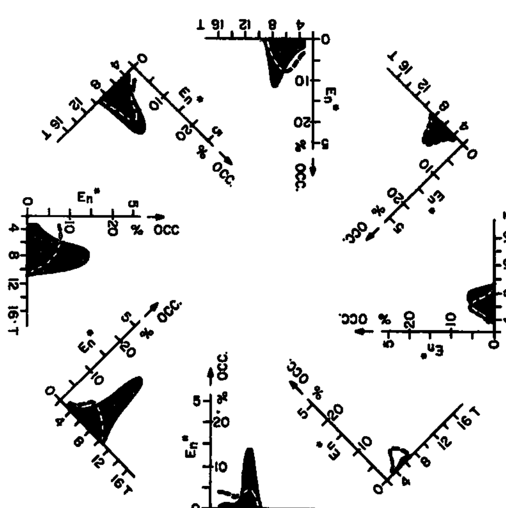

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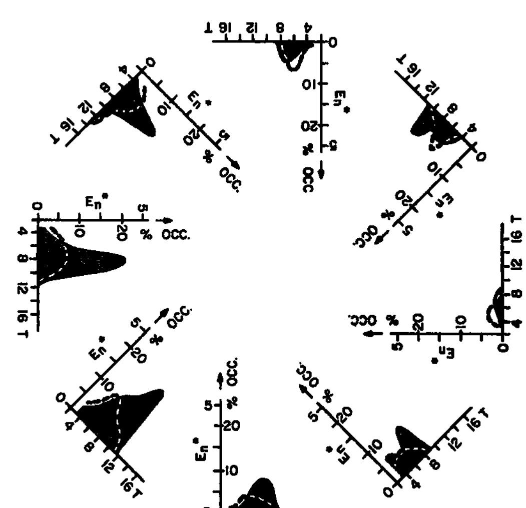
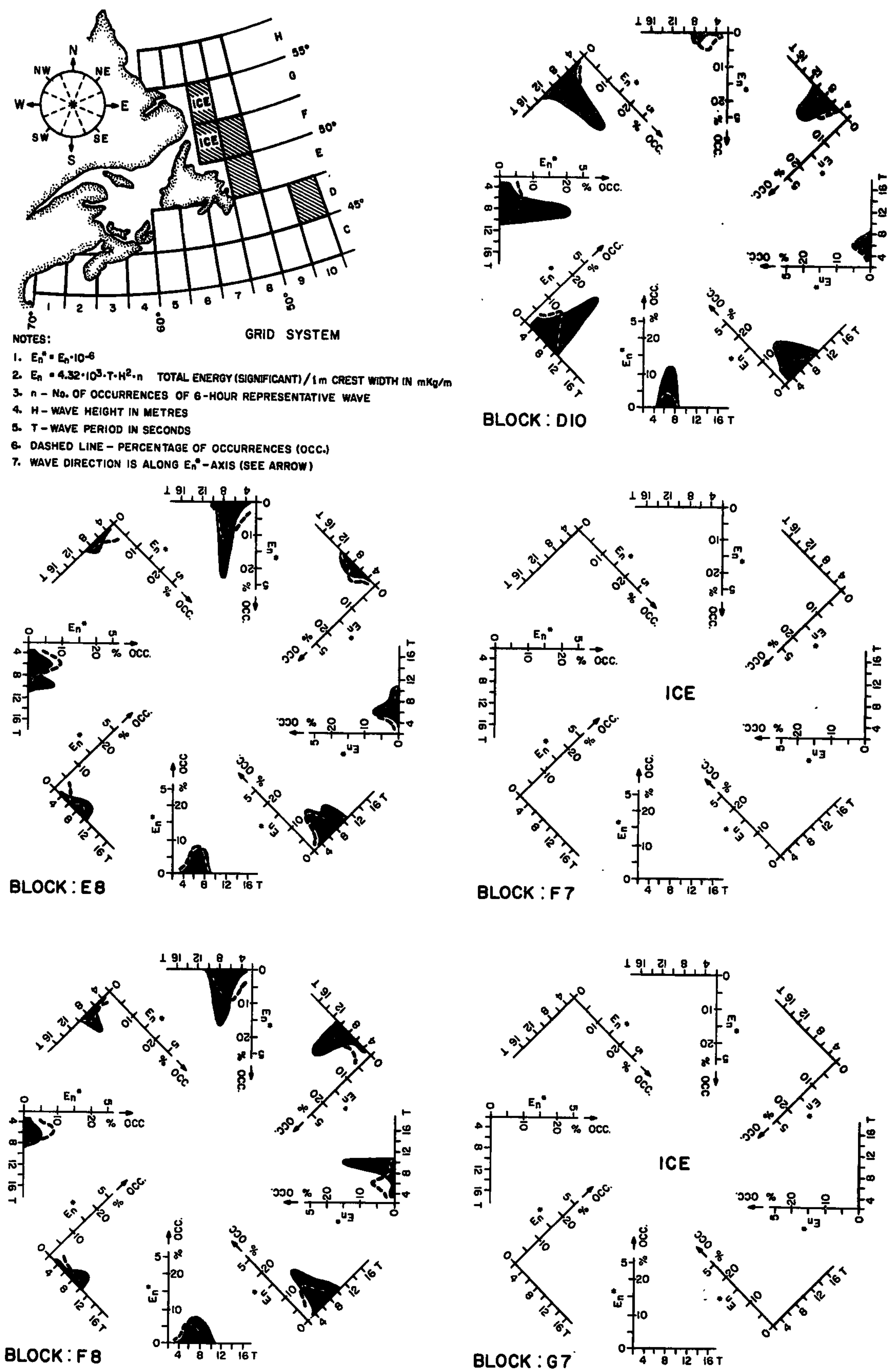
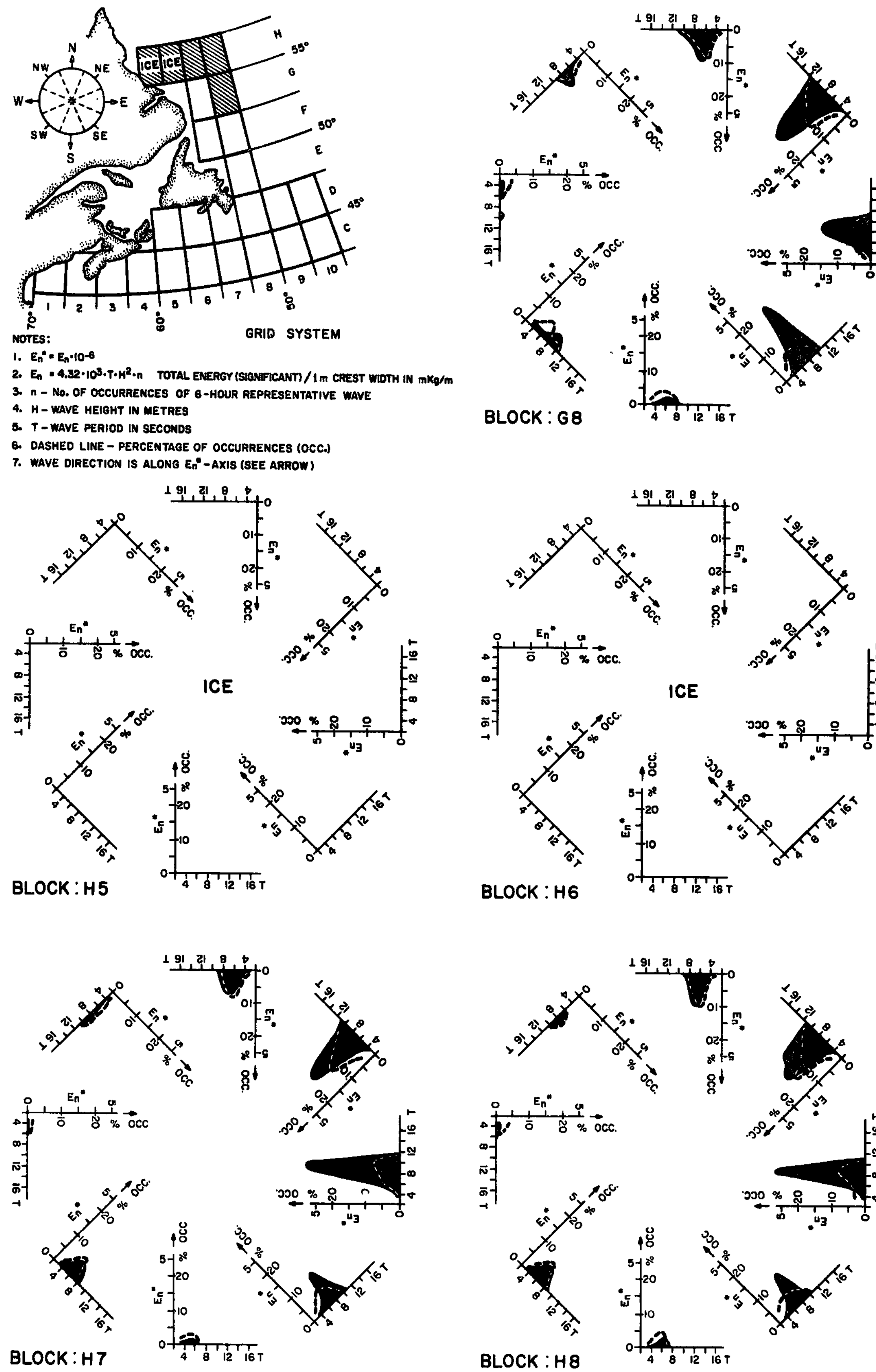


BLOCK : D9

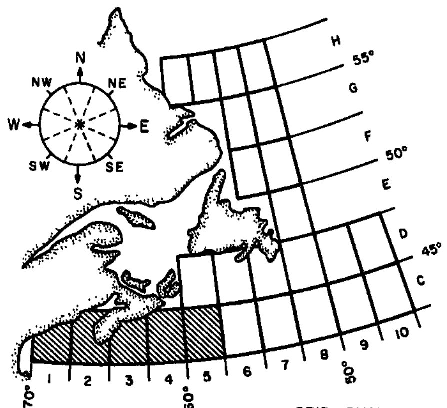
APPENDIX FIGURE 4c: Directional Energy Spectra for April



APPENDIX FIGURE 4d: Directional Energy Spectra for April

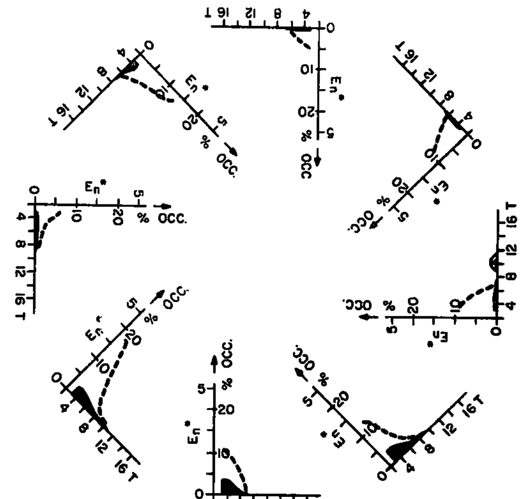


APPENDIX FIGURE 4e: Directional Energy Spectra for April

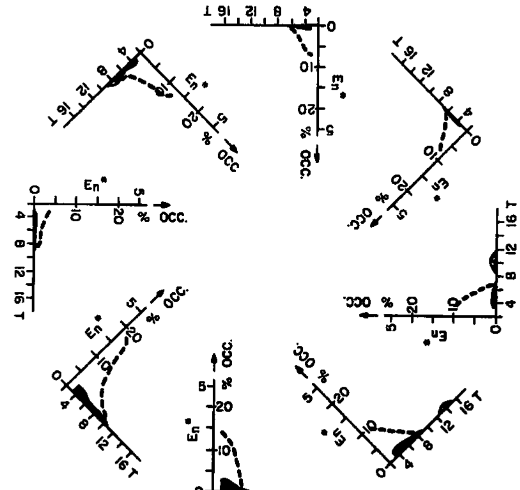


NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



BLOCK : C1



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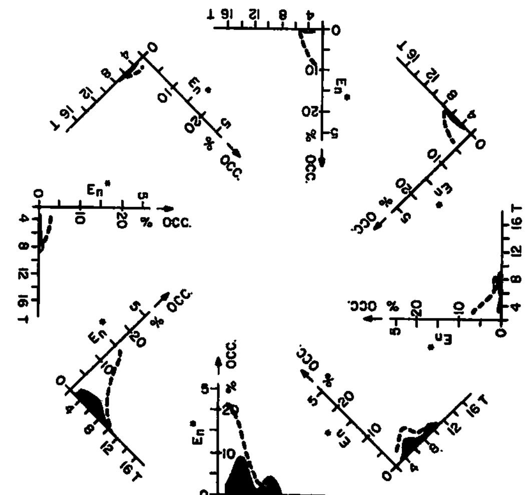
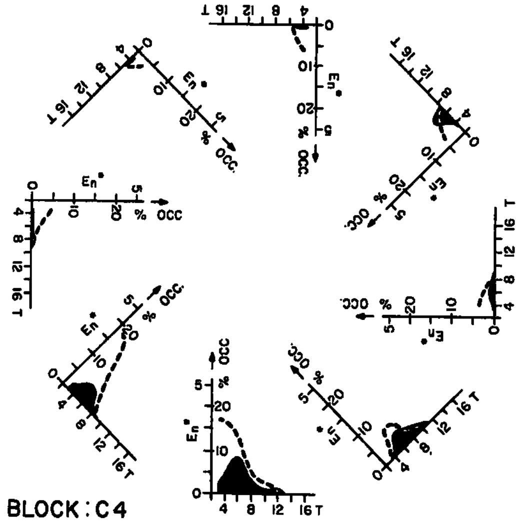


BLOCK : C3



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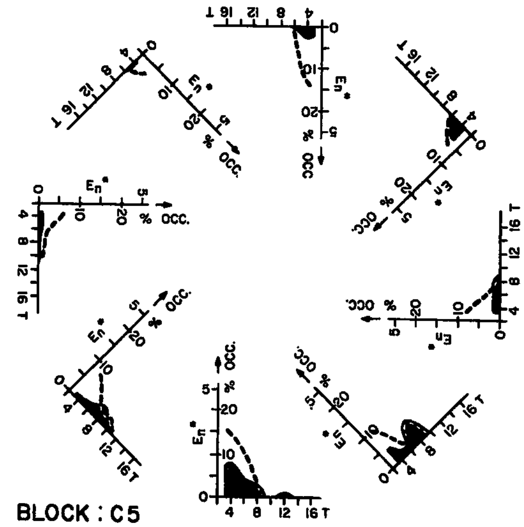
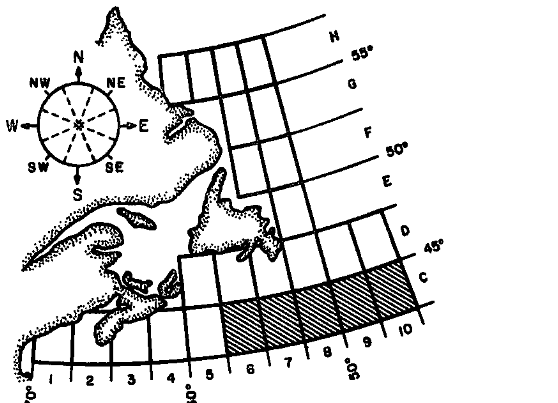


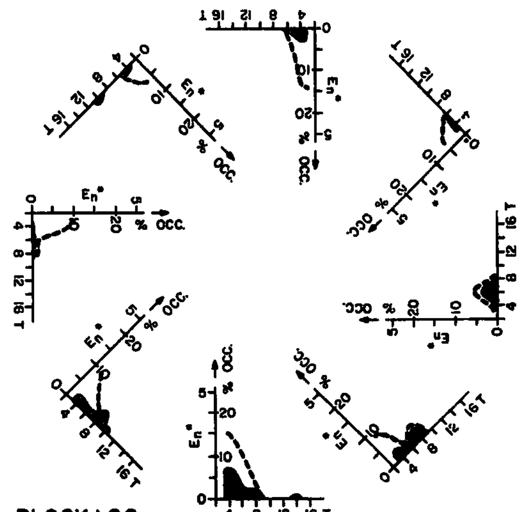
BLOCK : C5

APPENDIX FIGURE 5a: Directional Energy Spectra for May



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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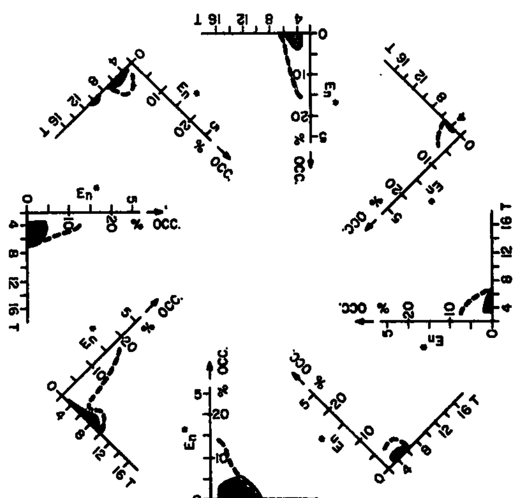

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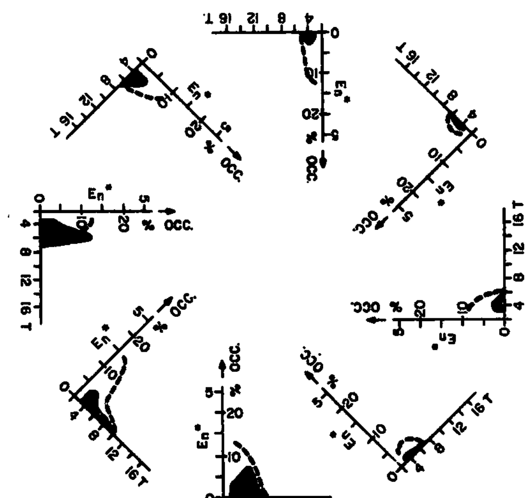
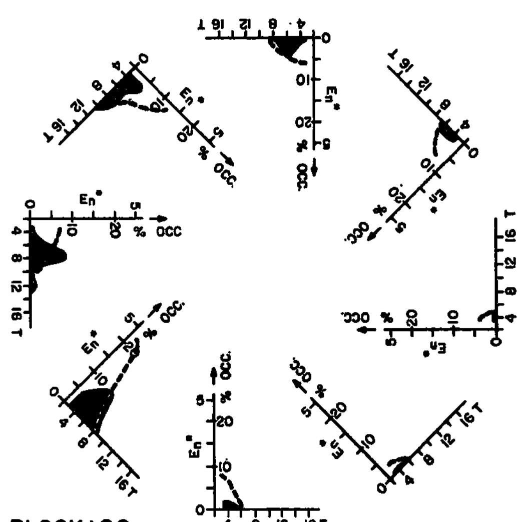


BLOCK : C8



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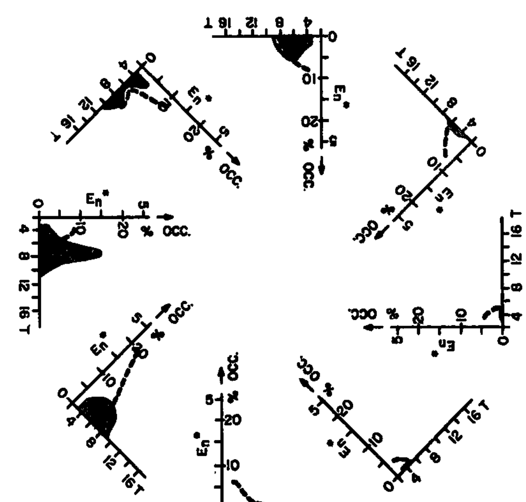
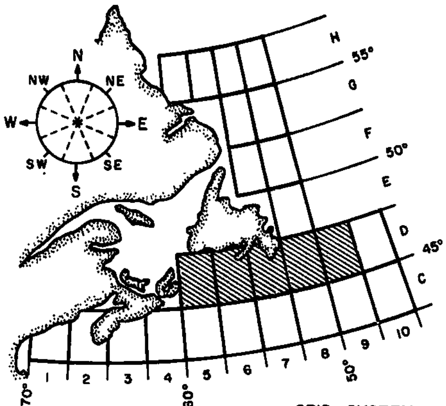
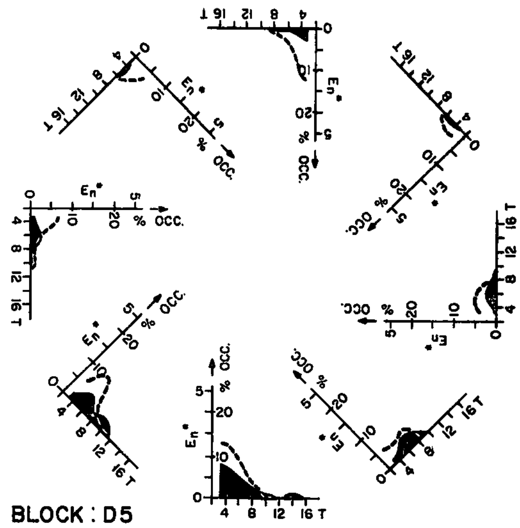


BLOCK : C10

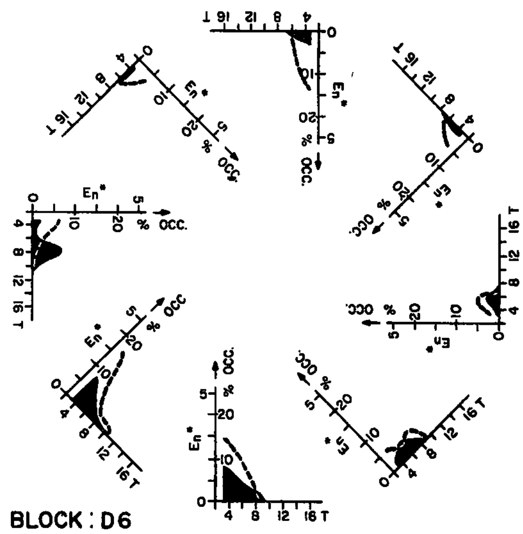
APPENDIX FIGURE 5b: Directional Energy Spectra for May



NOTES:
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



BLOCK : D5



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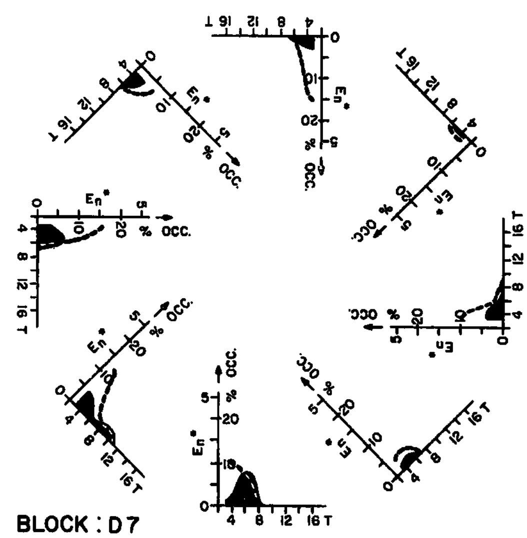
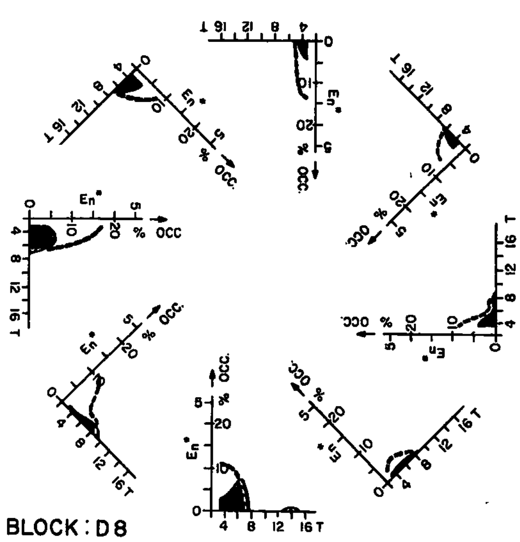
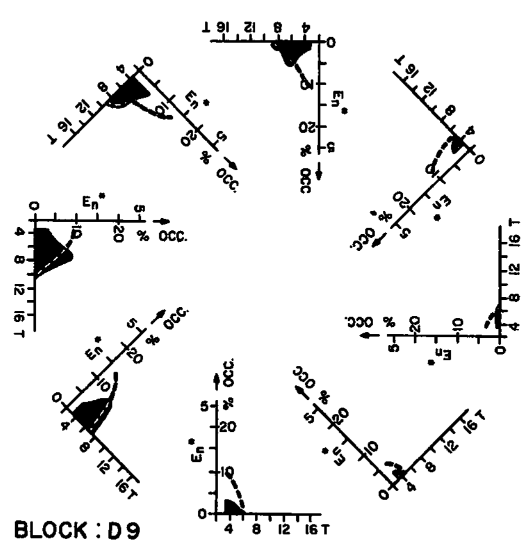


BLOCK : D7

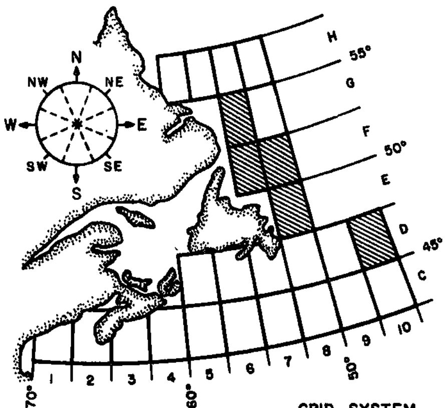


BLOCK : D8

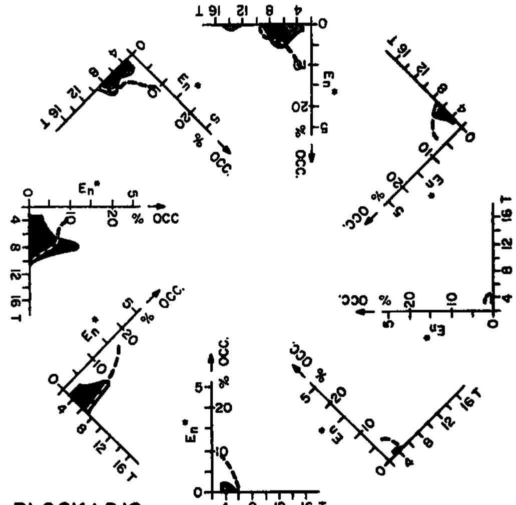


BLOCK : D9

APPENDIX FIGURE 5c: Directional Energy Spectra for May



NOTES:
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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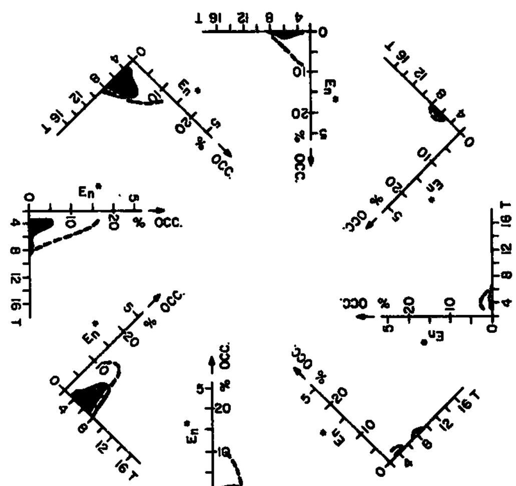

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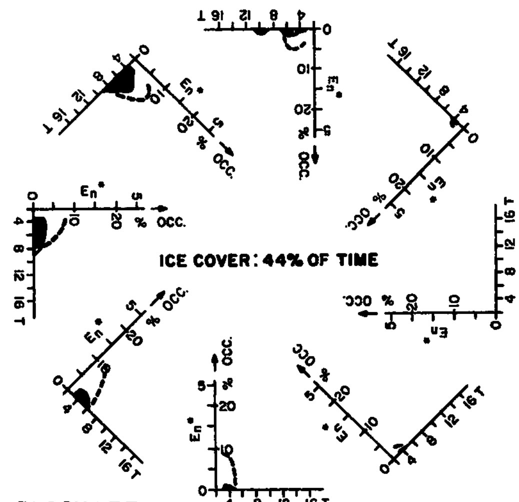

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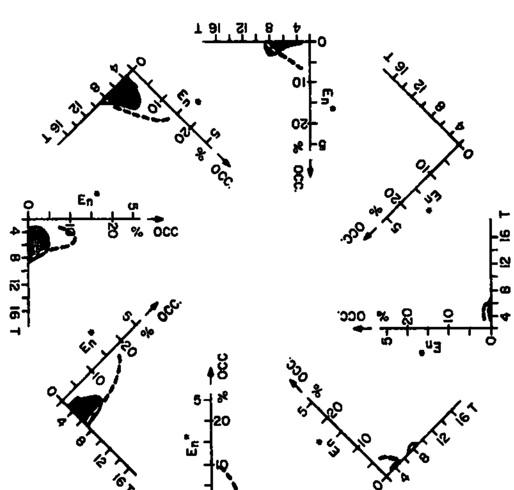

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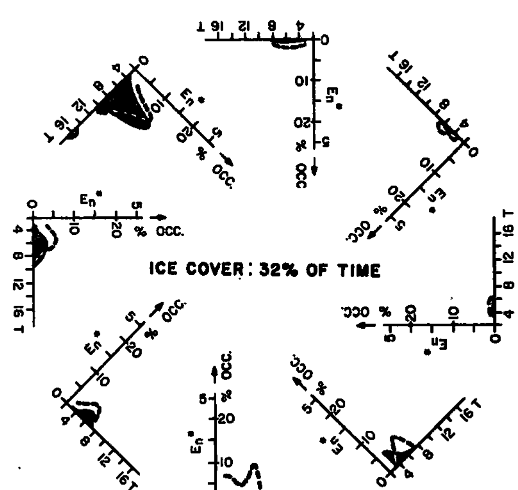
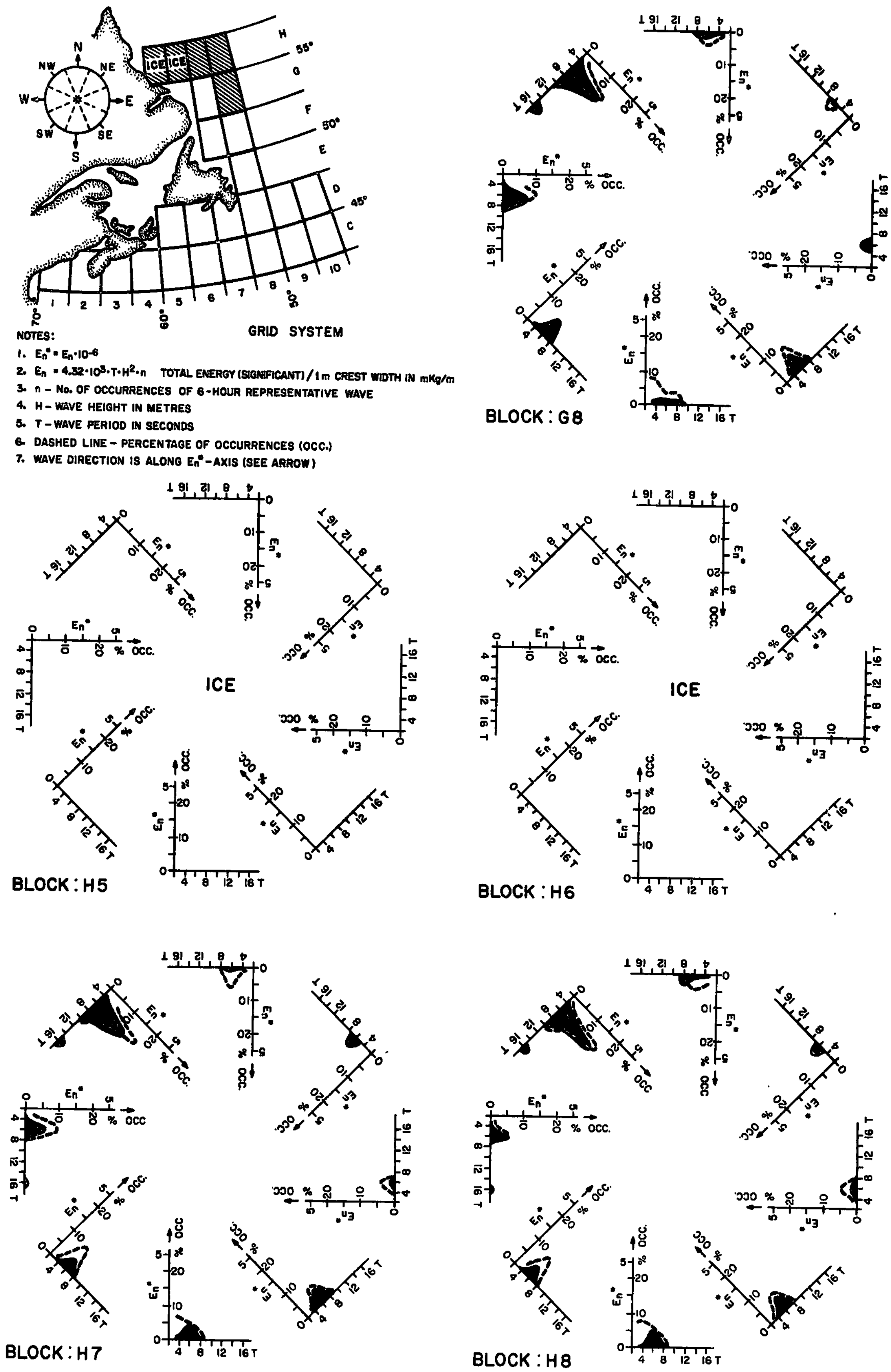
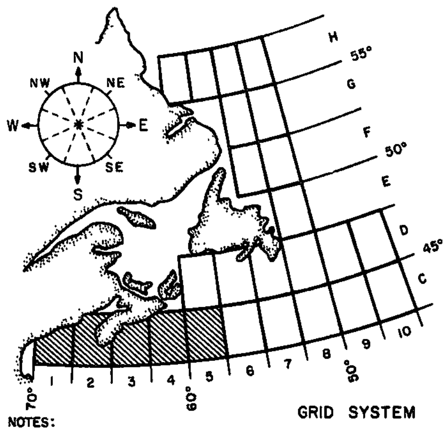


BLOCK : G7

APPENDIX FIGURE 5d: Directional Energy Spectra for May

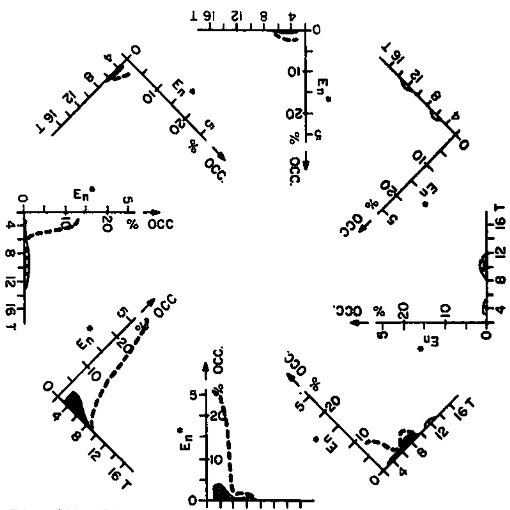


APPENDIX FIGURE 5e: Directional Energy Spectra for May



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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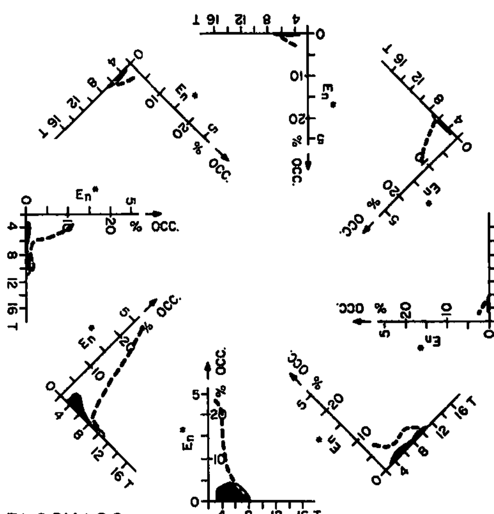

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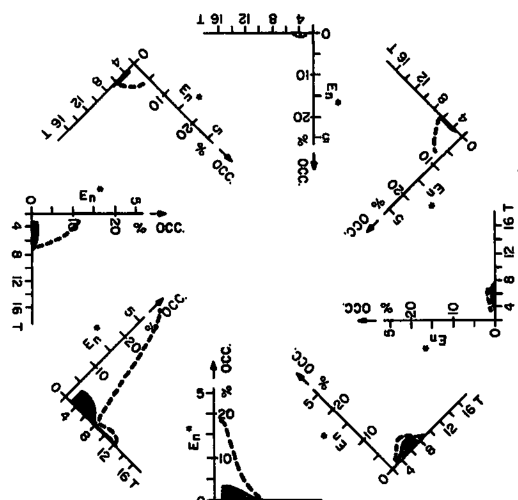

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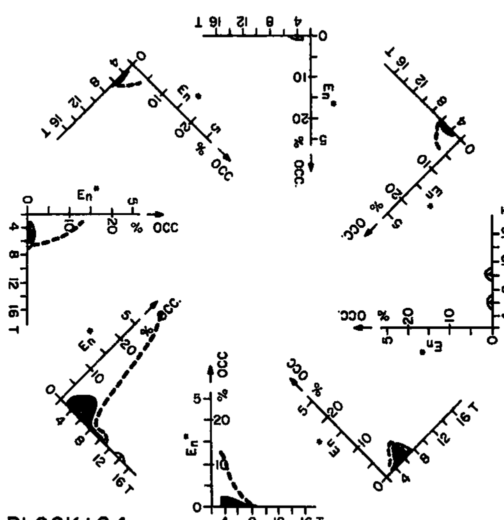

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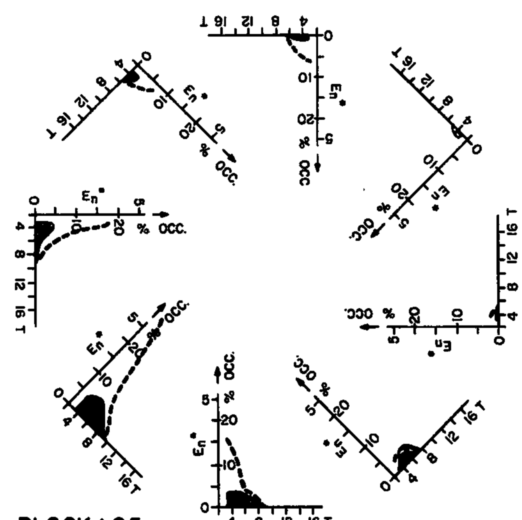
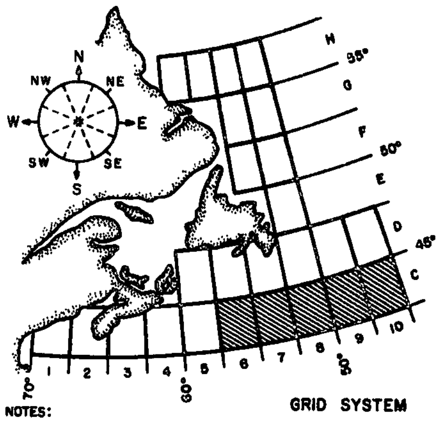
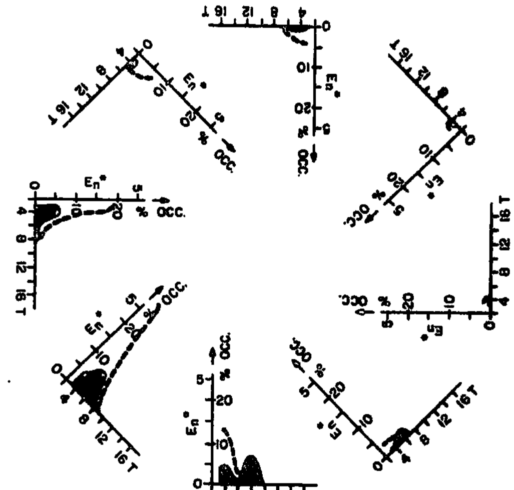


BLOCK : C5

APPENDIX FIGURE 6a: Directional Energy Spectra for June



NOTES:
1. $E_n^o = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^o-AXIS (SEE ARROW)



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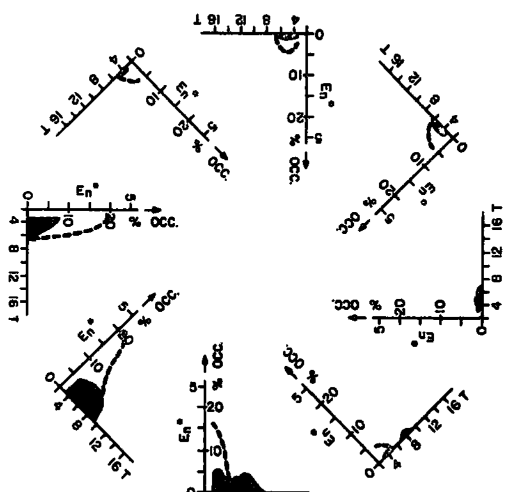

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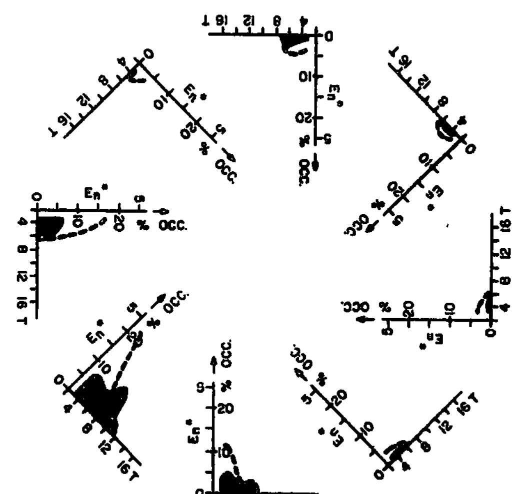

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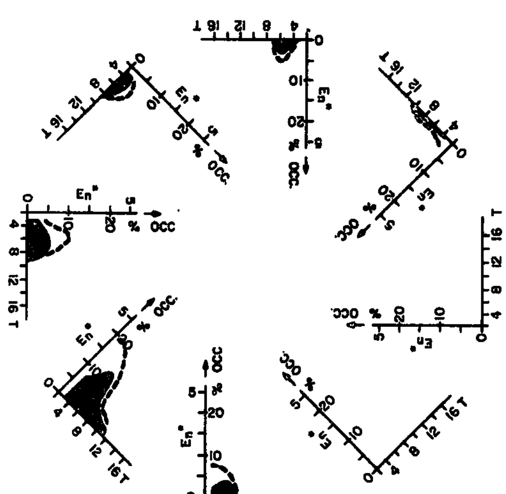
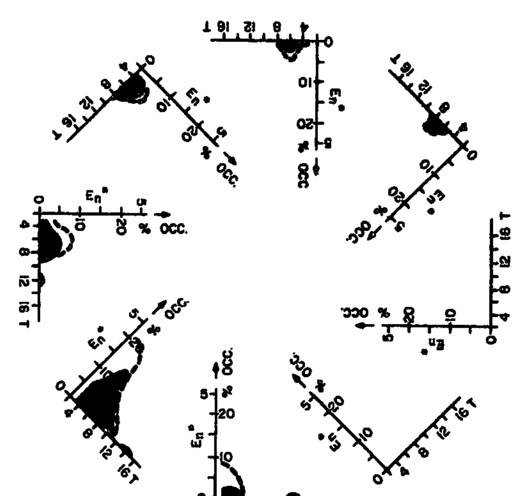
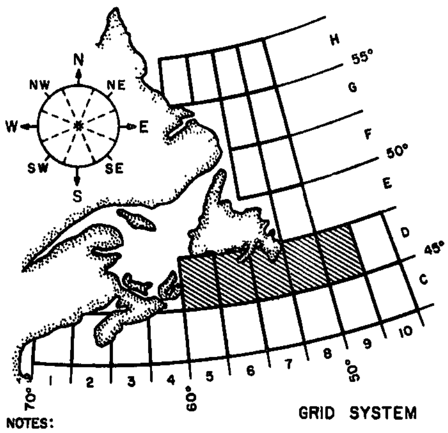


BLOCK : C9



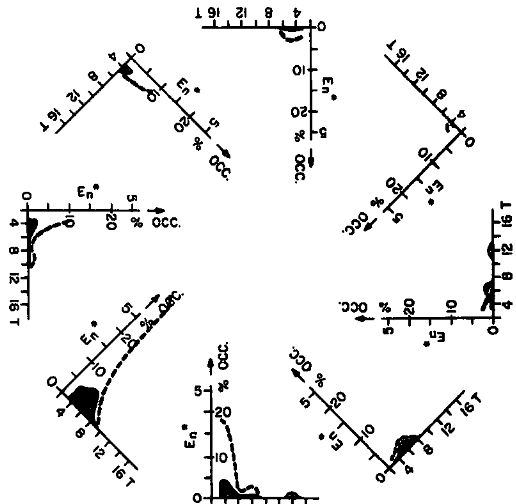
BLOCK : C10

APPENDIX FIGURE 6b: Directional Energy Spectra for June

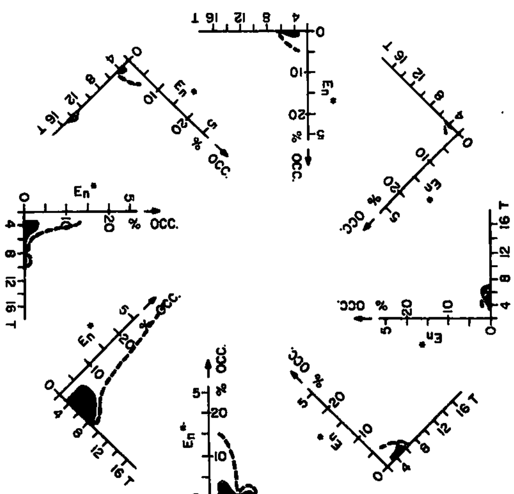


NOTES:

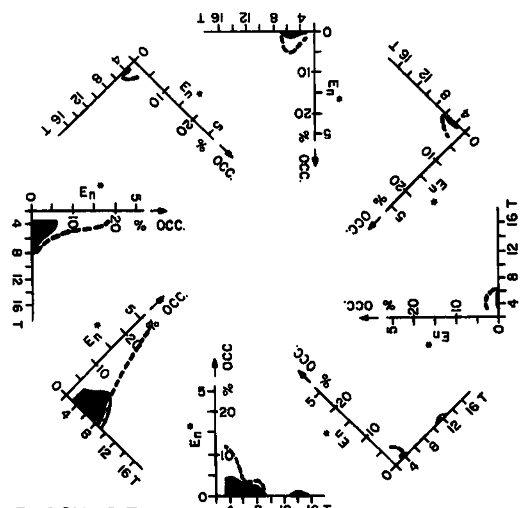
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



BLOCK : D5



BLOCK : D6



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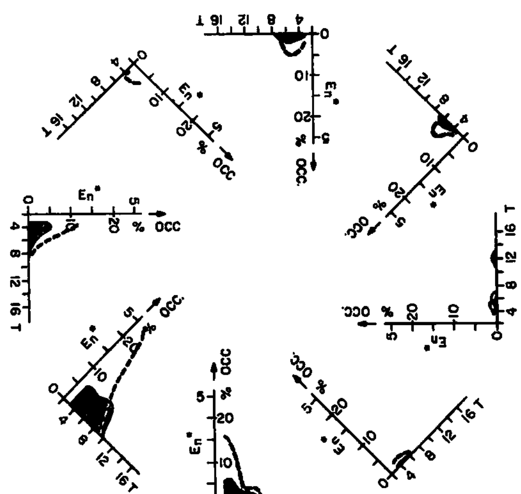

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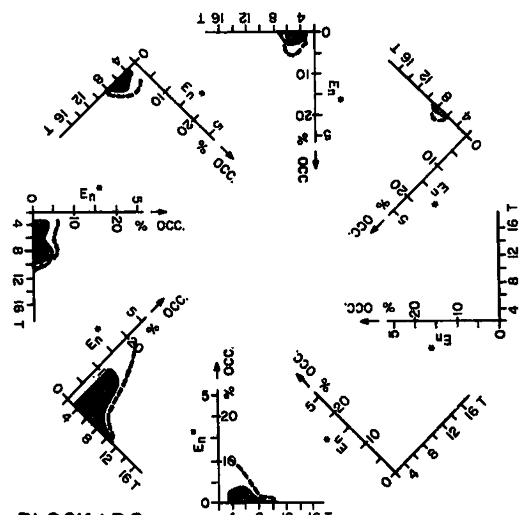
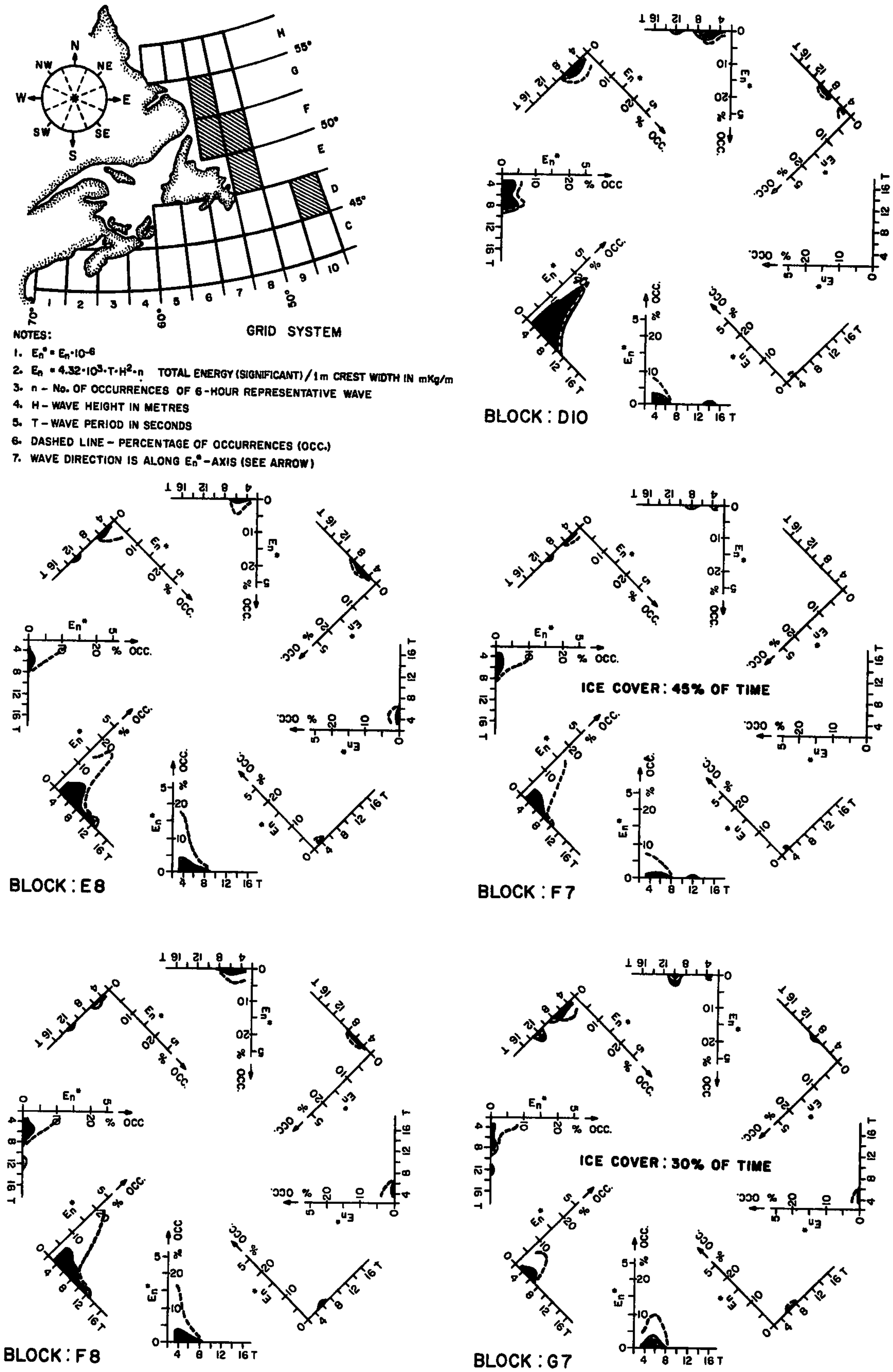
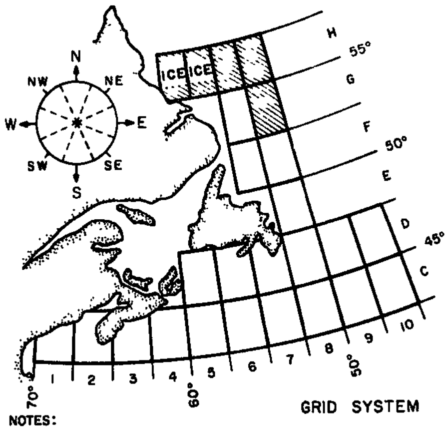


BLOCK : D9

APPENDIX FIGURE 6c: Directional Energy Spectra for June

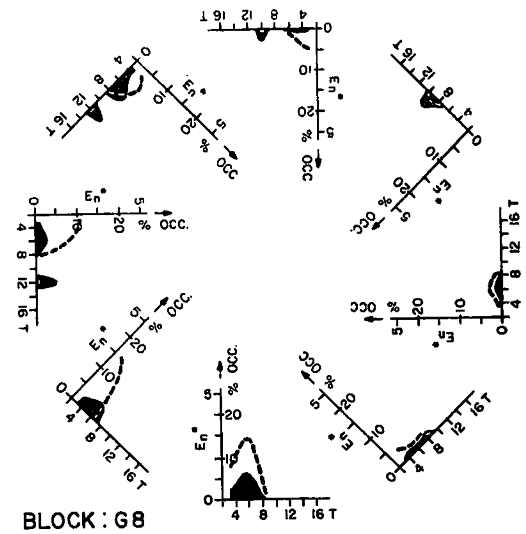


APPENDIX FIGURE 6d: Directional Energy Spectra for June



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^{2} \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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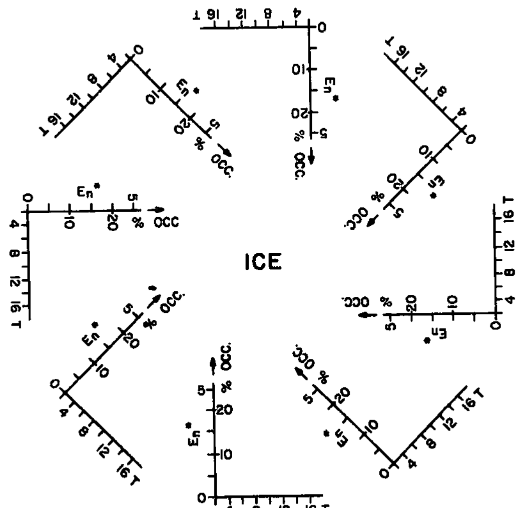

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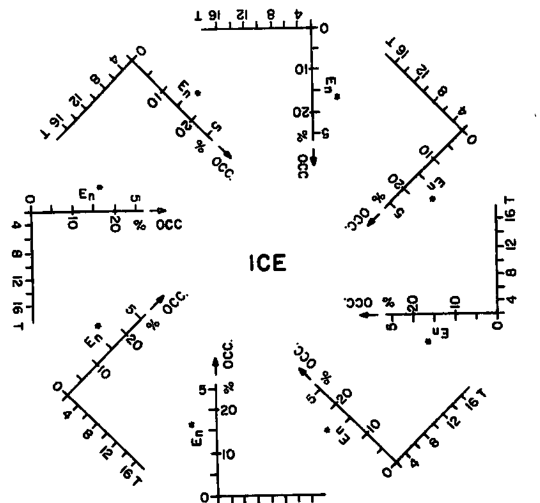
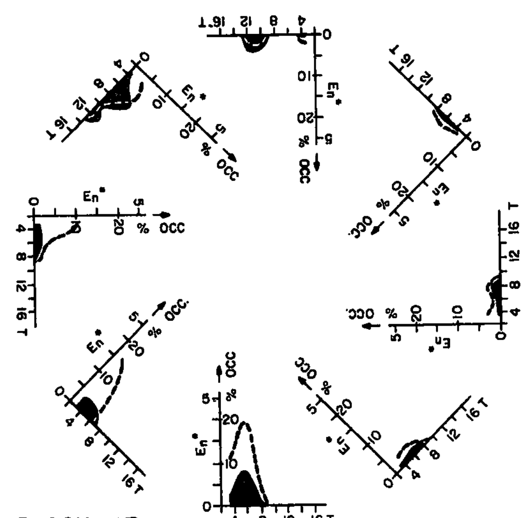
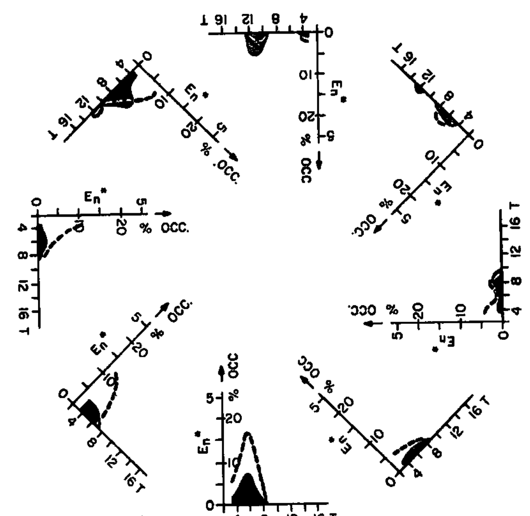


BLOCK : H6

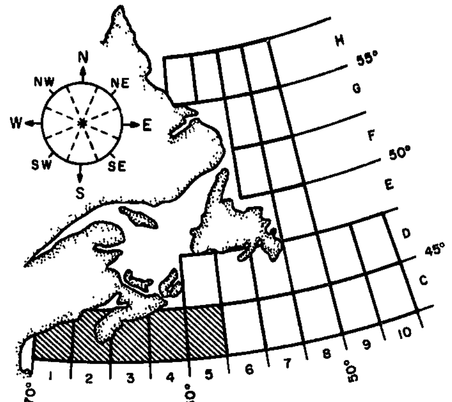


BLOCK : H7



BLOCK : H8

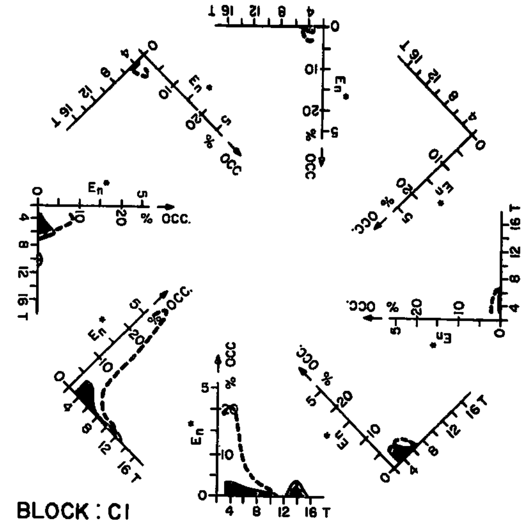
APPENDIX FIGURE 6e: Directional Energy Spectra for June



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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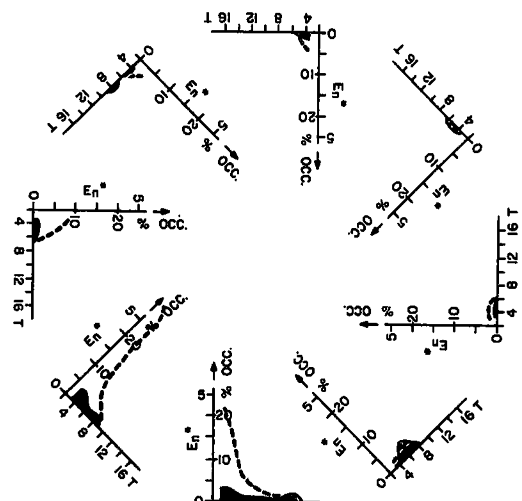
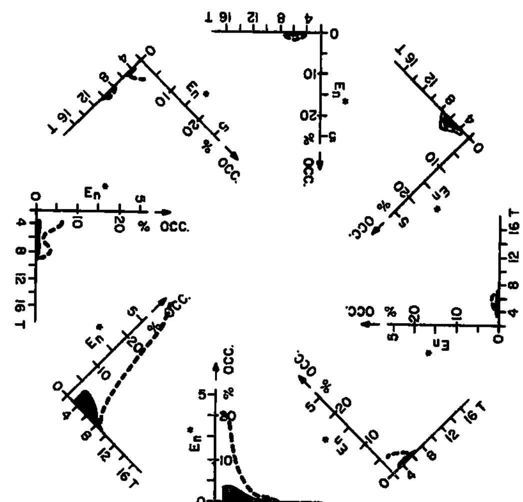


BLOCK : C2



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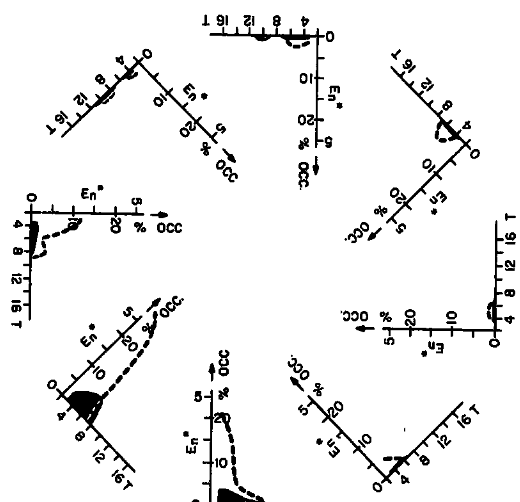

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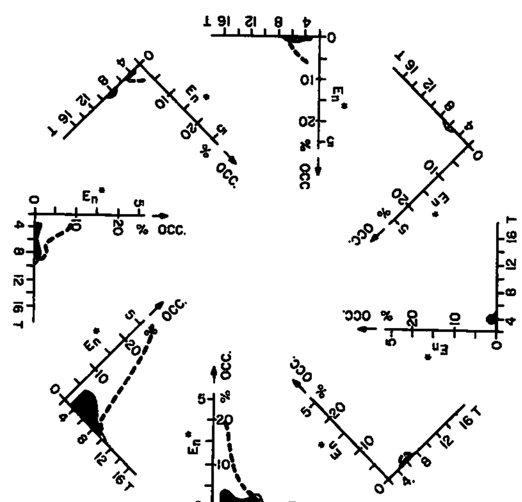
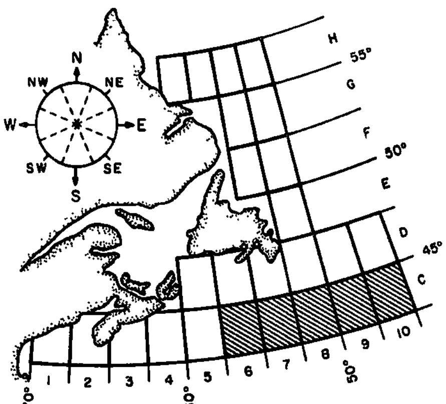


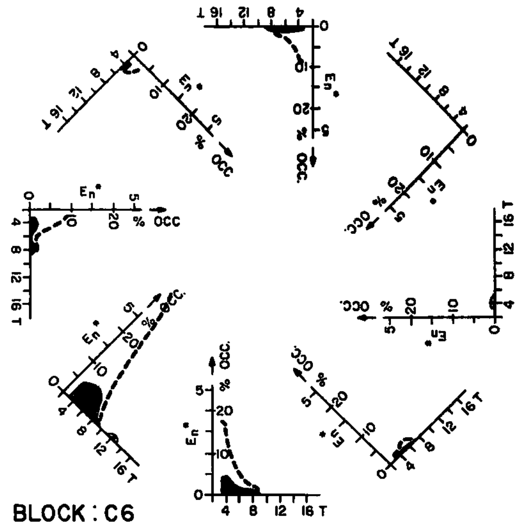
BLOCK : C5

APPENDIX FIGURE 7a: Directional Energy Spectra for July

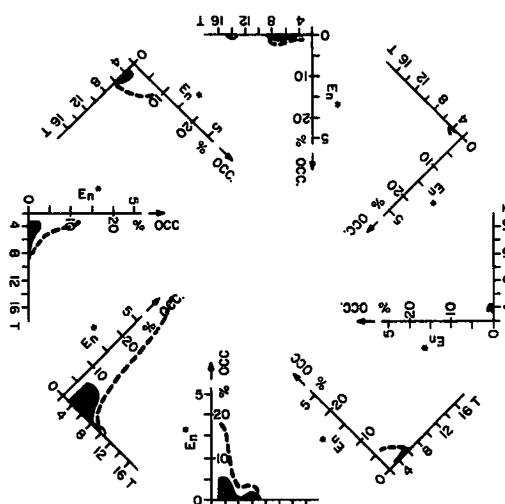


GRID SYSTEM

NOTES:
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^{2} \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



BLOCK : C6



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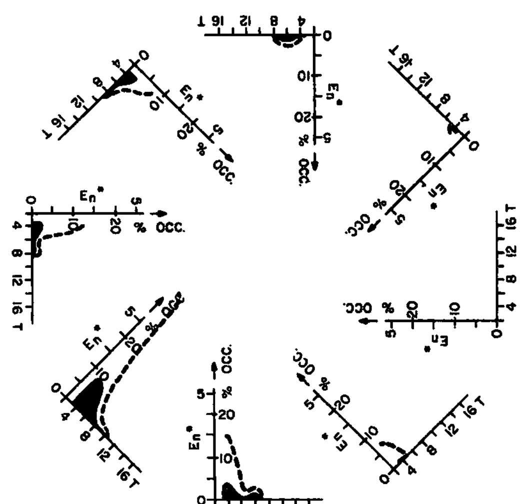

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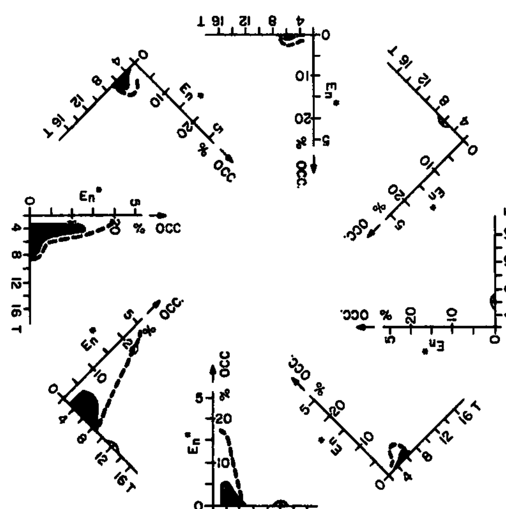
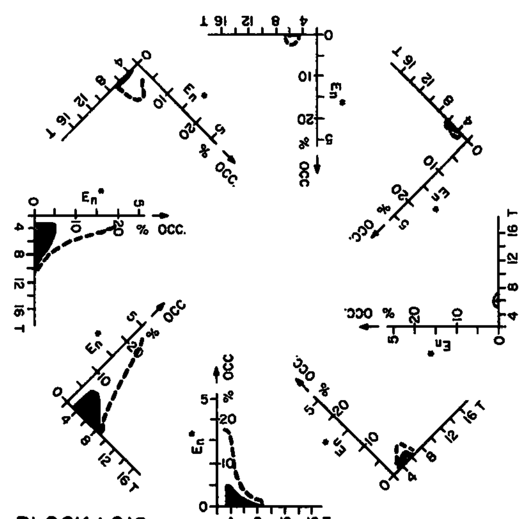
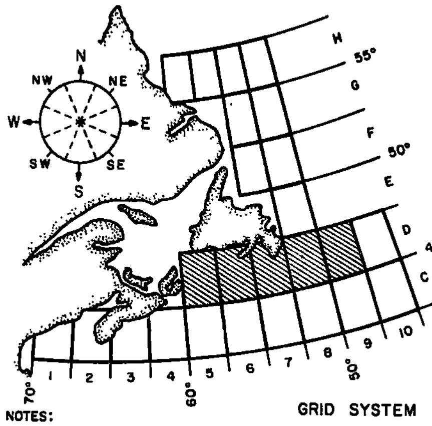


BLOCK : C9



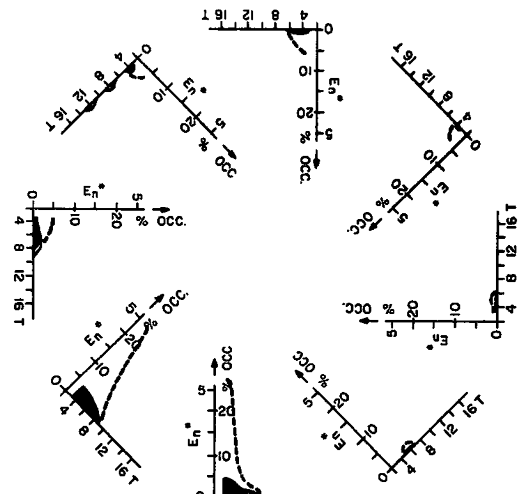
BLOCK : C10

APPENDIX FIGURE 7b: Directional Energy Spectra for July

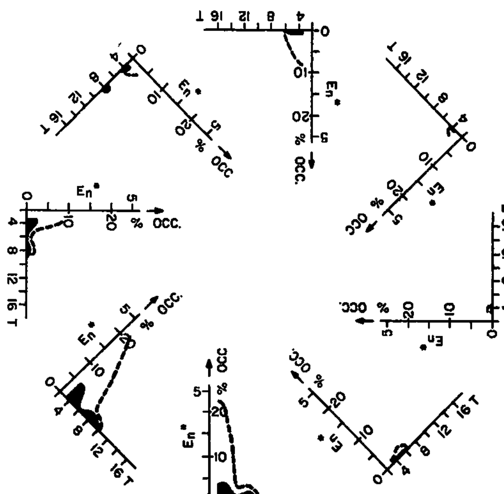


NOTES:

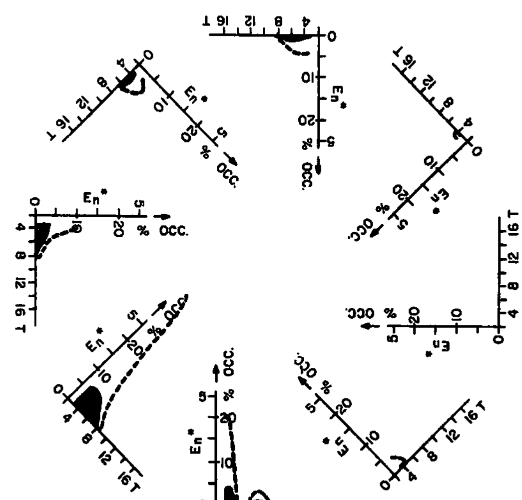
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



BLOCK : D5



BLOCK : D6



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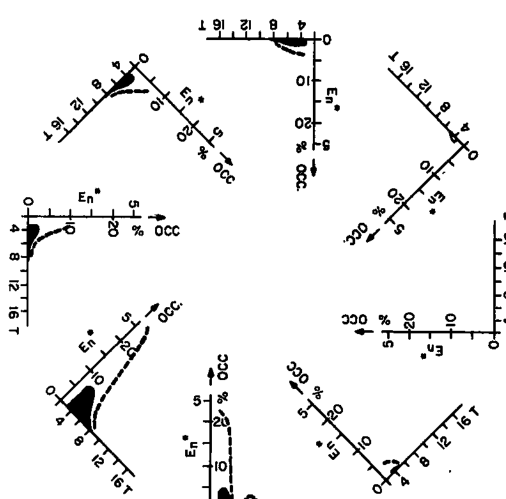

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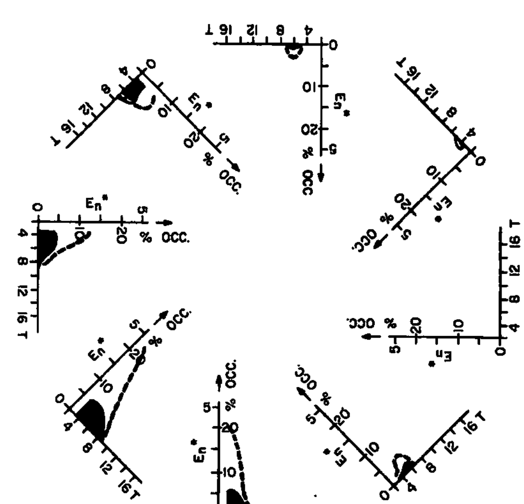
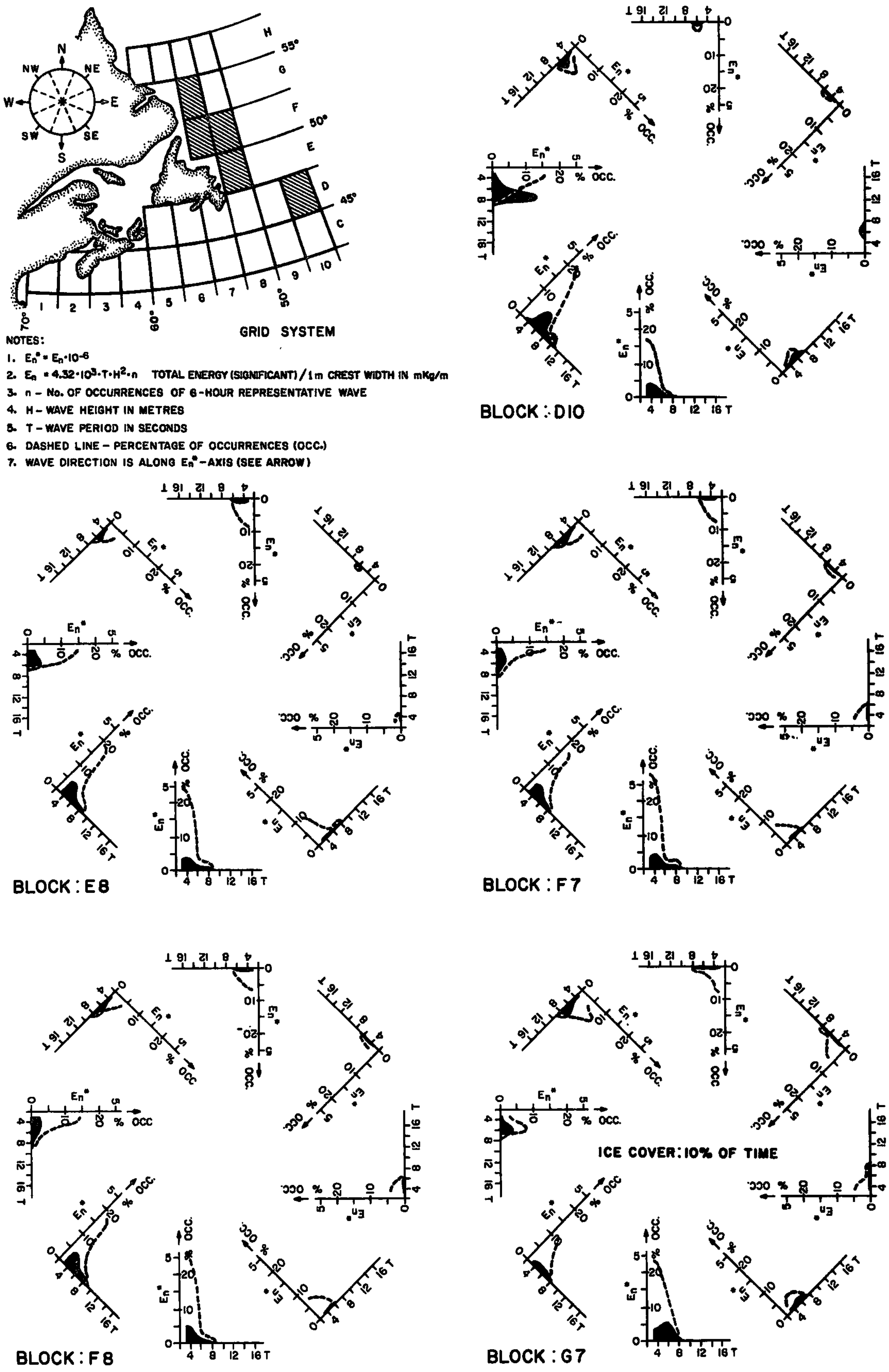
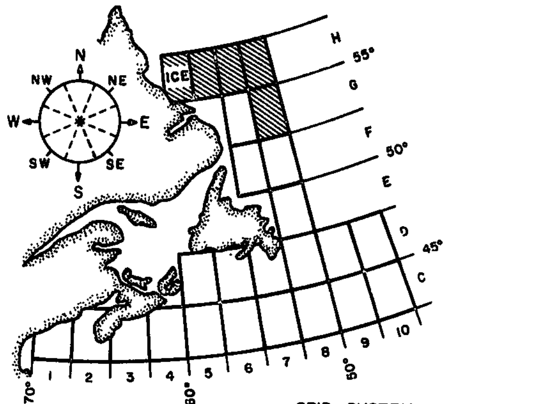


BLOCK : D9

APPENDIX FIGURE 7c: Directional Energy Spectra for July



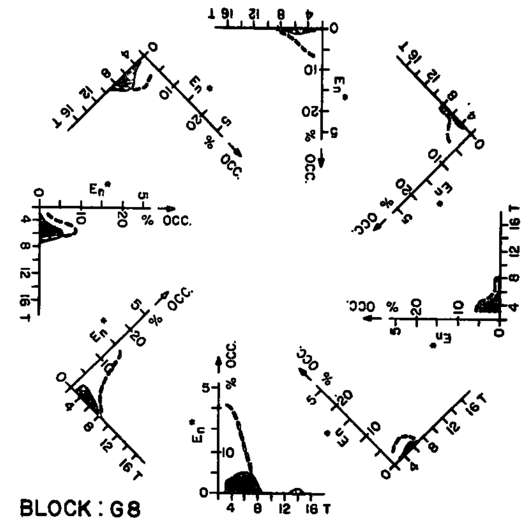
APPENDIX FIGURE 7d: Directional Energy Spectra for July



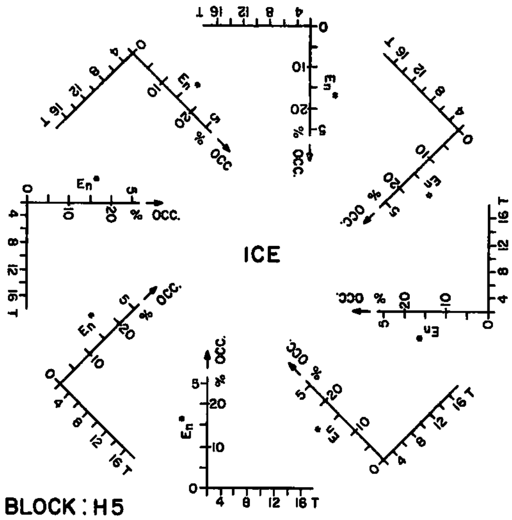
GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^{3} \cdot T \cdot H^{2} \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



BLOCK : G8



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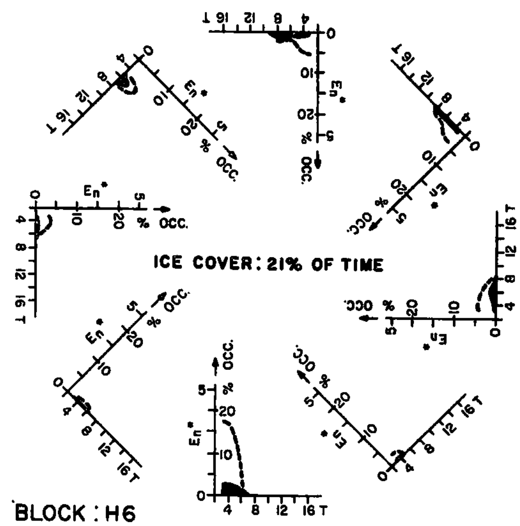

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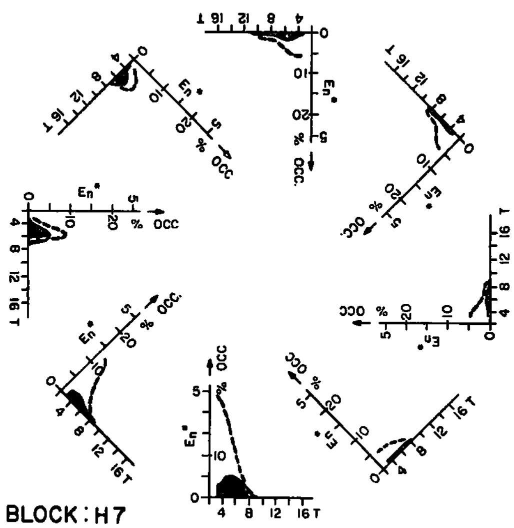
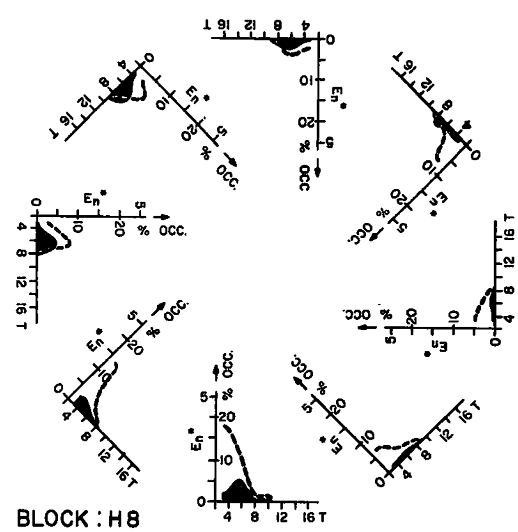
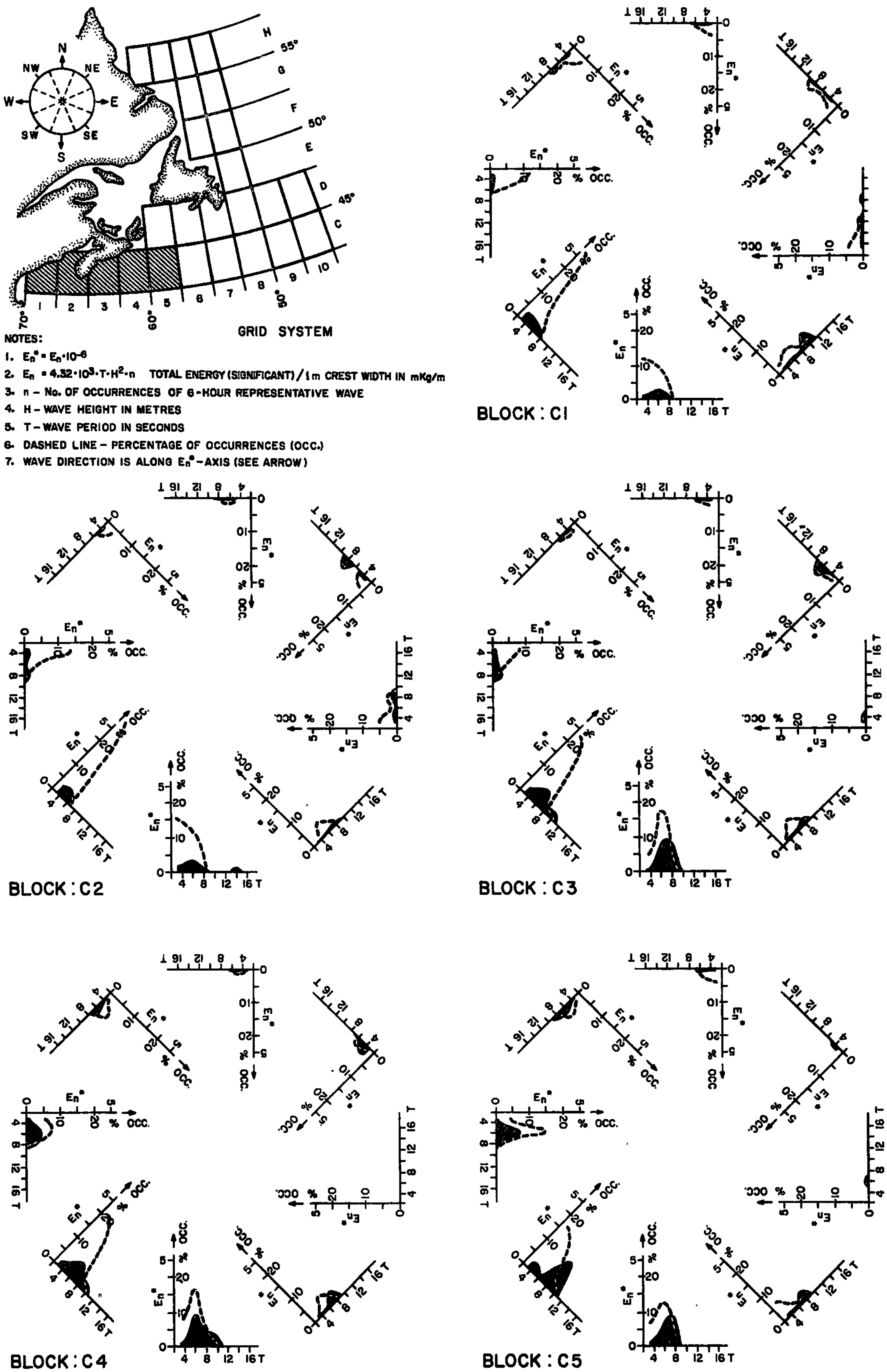


BLOCK : H7

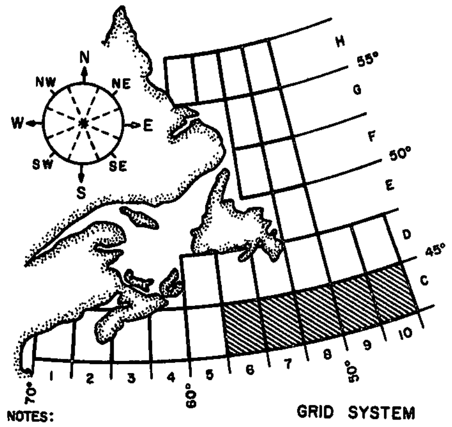


BLOCK : H8

APPENDIX FIGURE 7e: Directional Energy Spectra for July



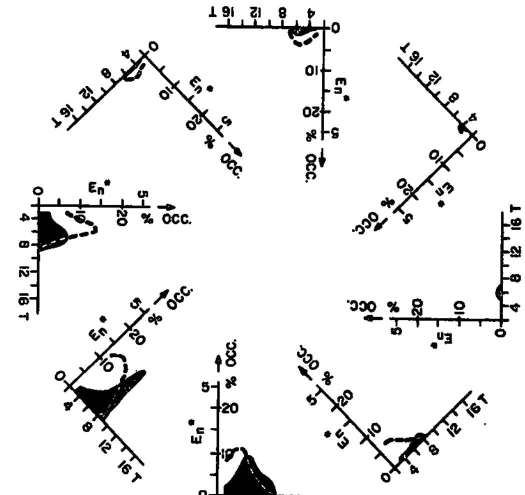
APPENDIX FIGURE 8a: Directional Energy Spectra for August



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)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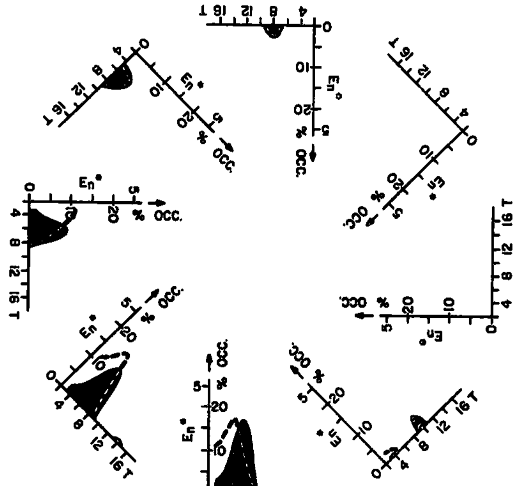
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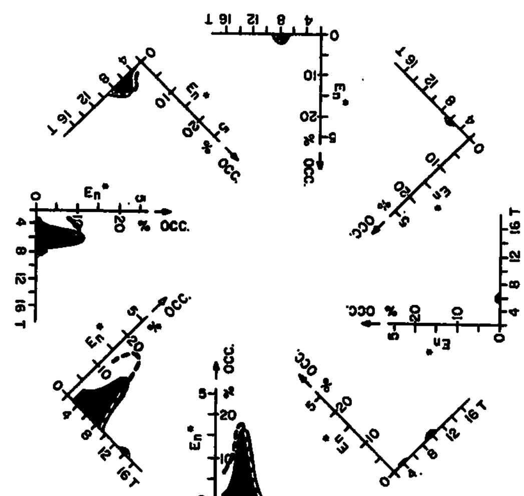
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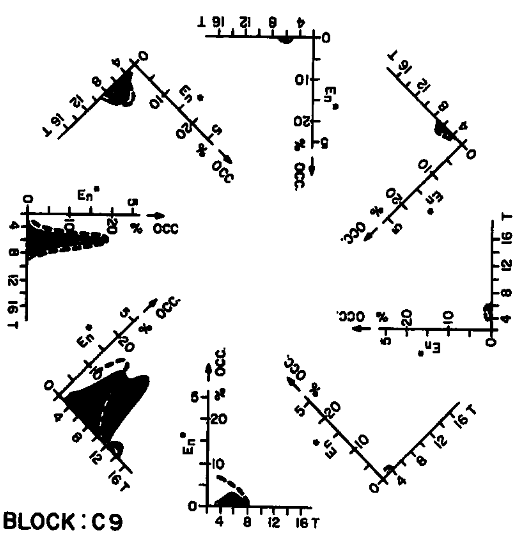
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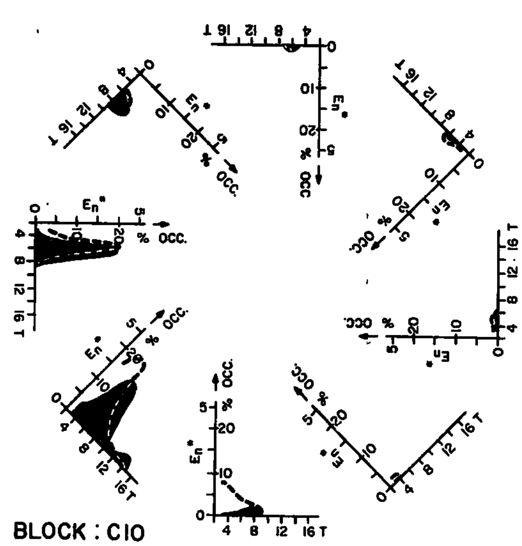
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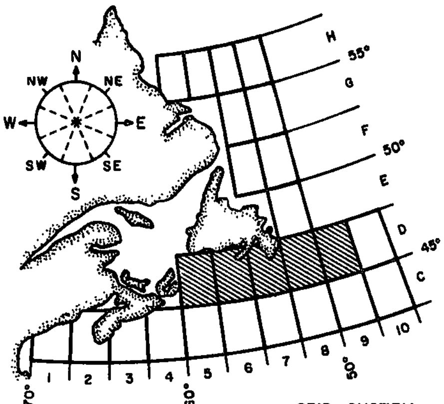
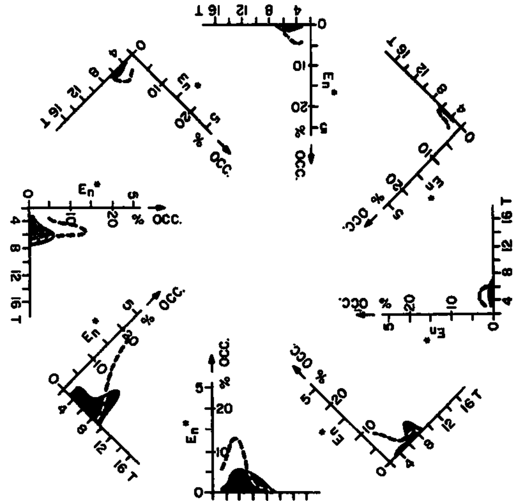
APPENDIX FIGURE 8b: Directional Energy Spectra for August



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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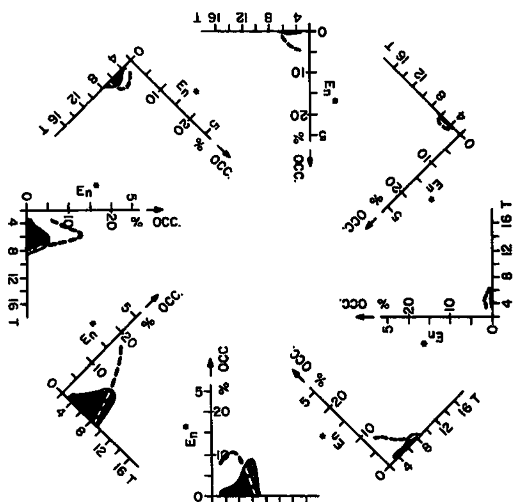

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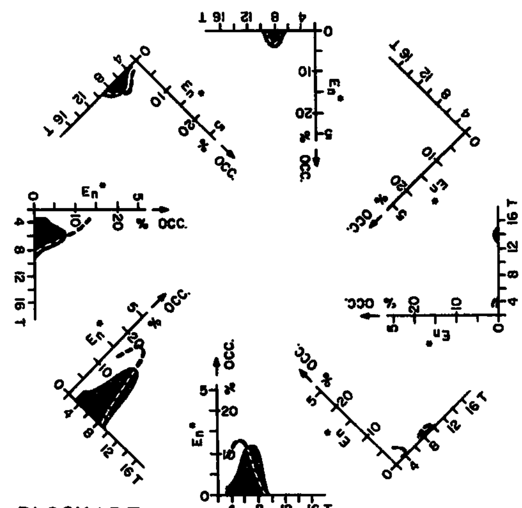
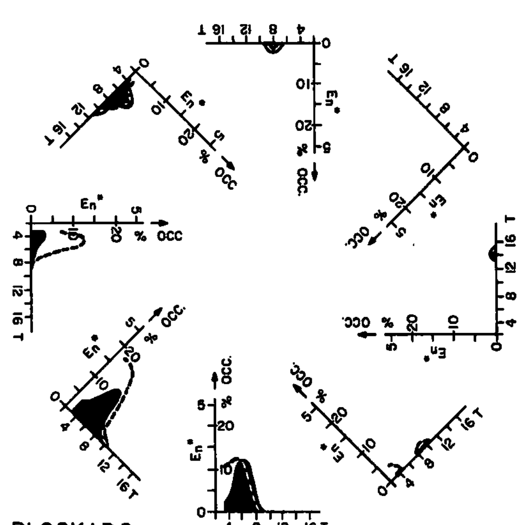


BLOCK : D7



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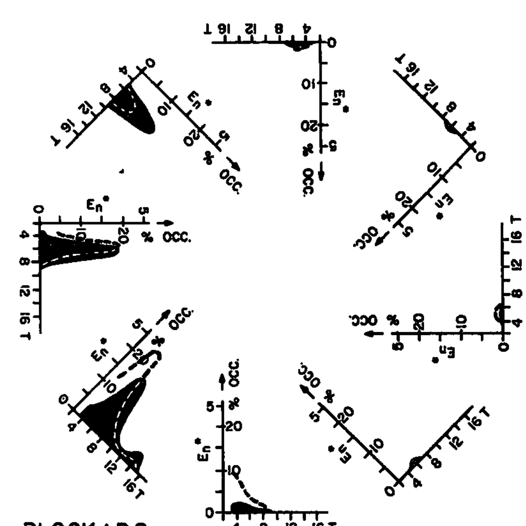
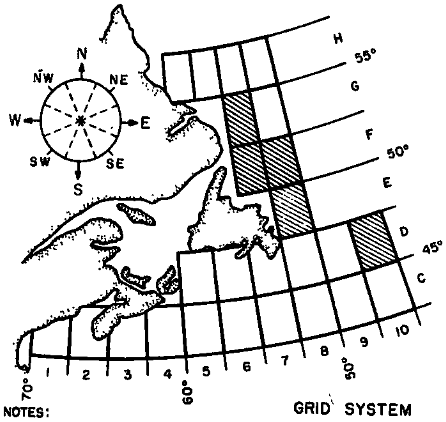


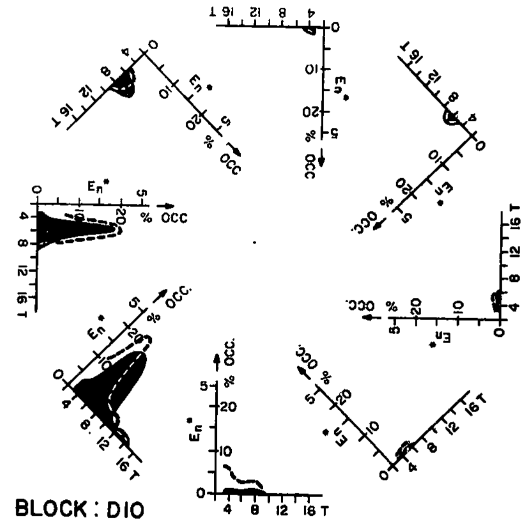
BLOCK : D9

APPENDIX FIGURE 8c: Directional Energy Spectra for August



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n - No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H - WAVE HEIGHT IN METRES
5. T - WAVE PERIOD IN SECONDS
6. DASHED LINE - PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



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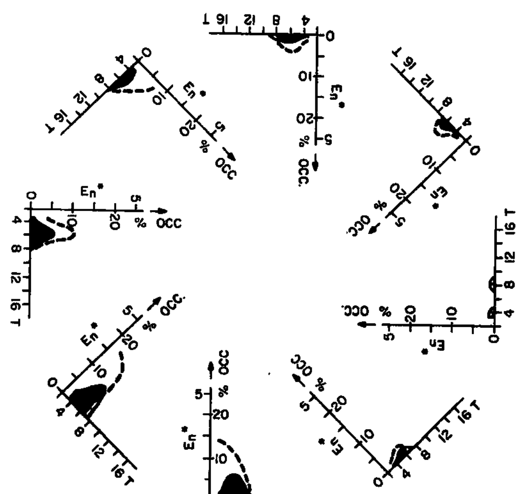
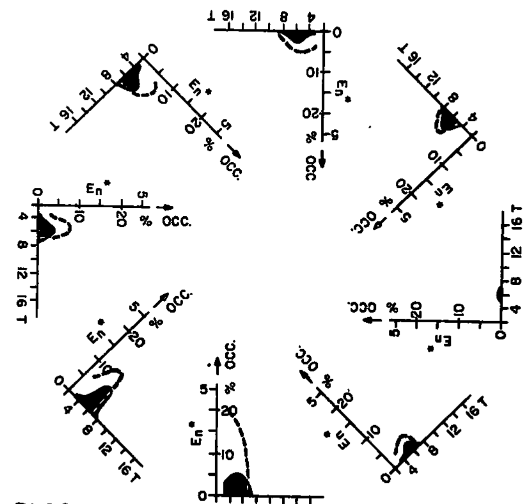


BLOCK : E8



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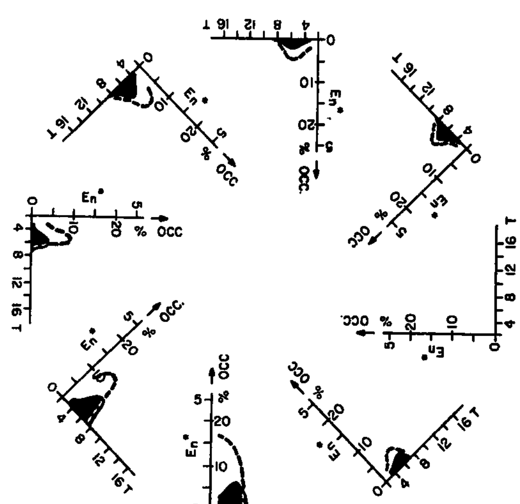

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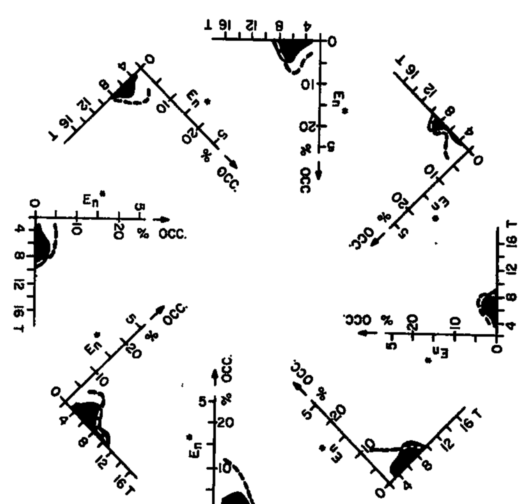
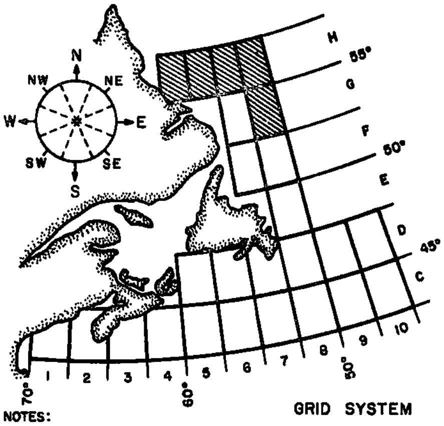


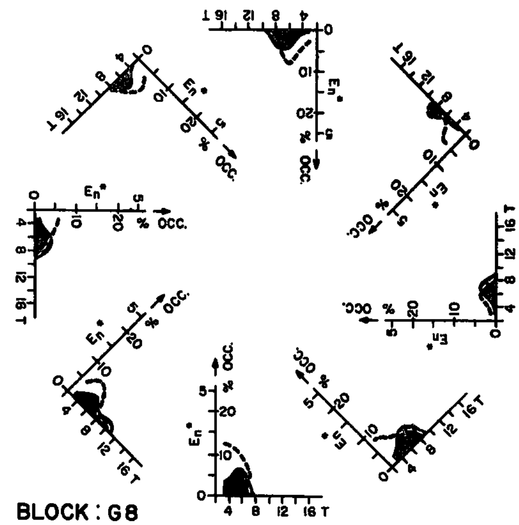
BLOCK : G7

APPENDIX FIGURE 8d: Directional Energy Spectra for August



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



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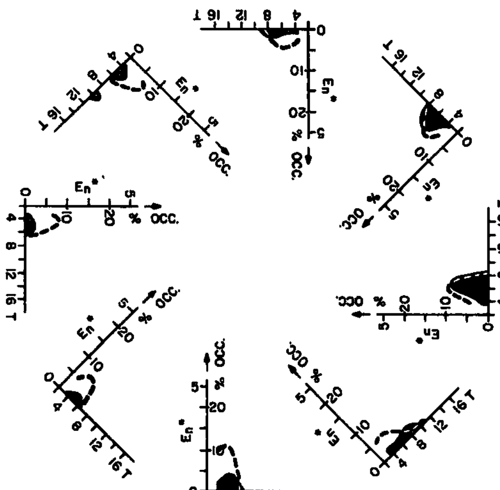

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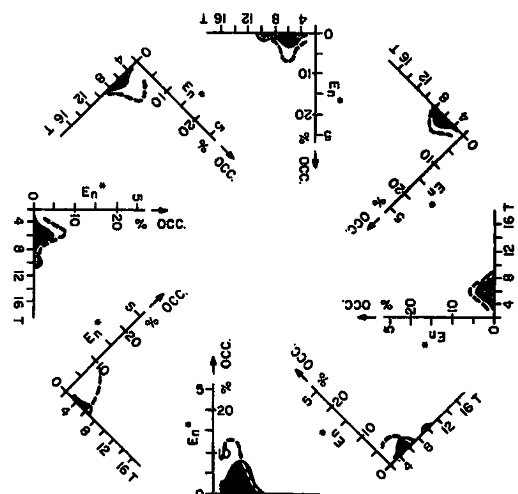
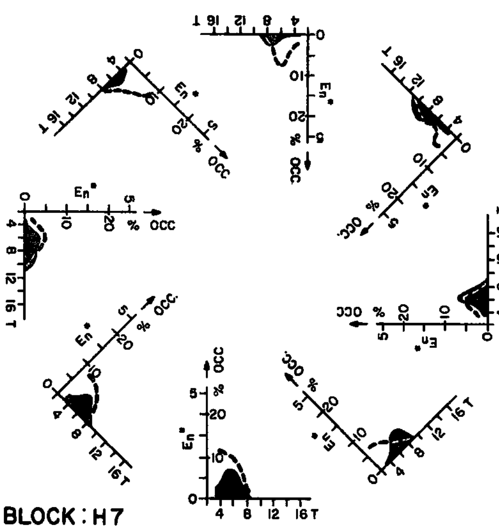
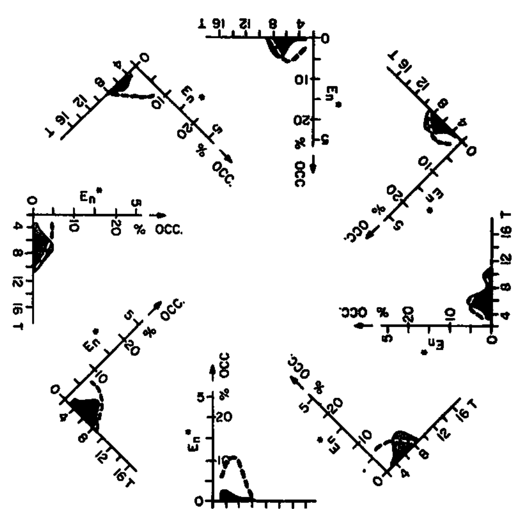


BLOCK : H6

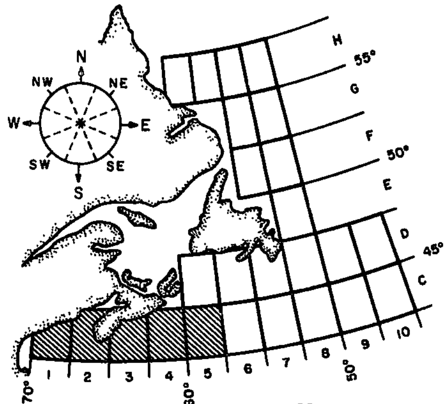


BLOCK : H7



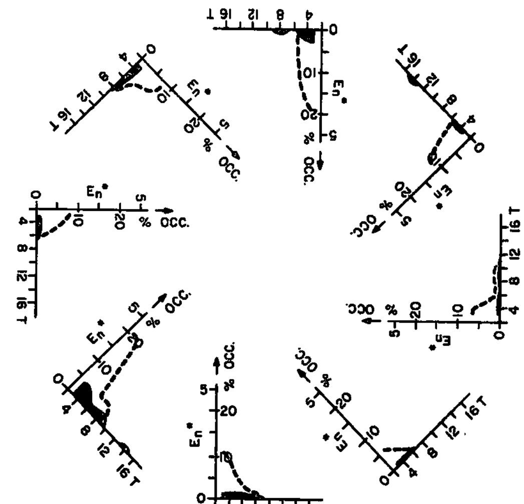
BLOCK : H8

APPENDIX FIGURE 8e: Directional Energy Spectra for August

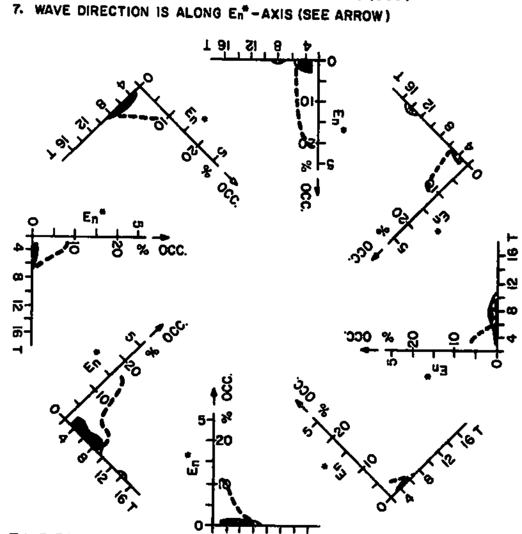


NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



BLOCK : C1



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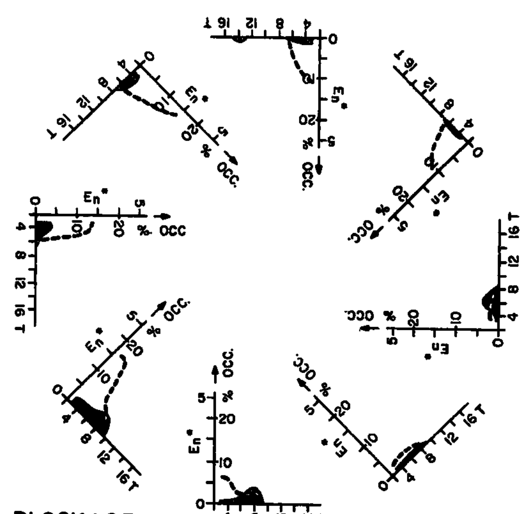

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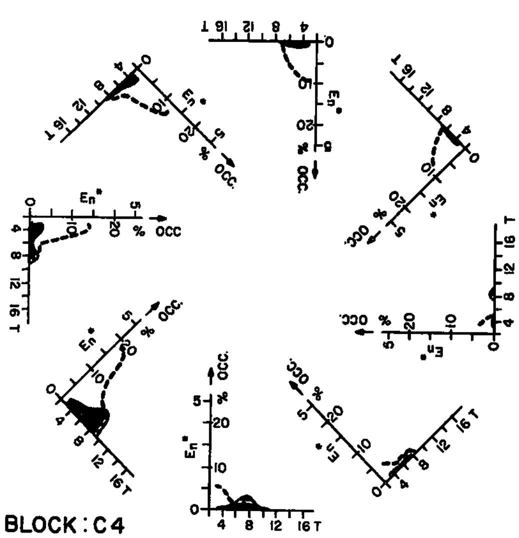

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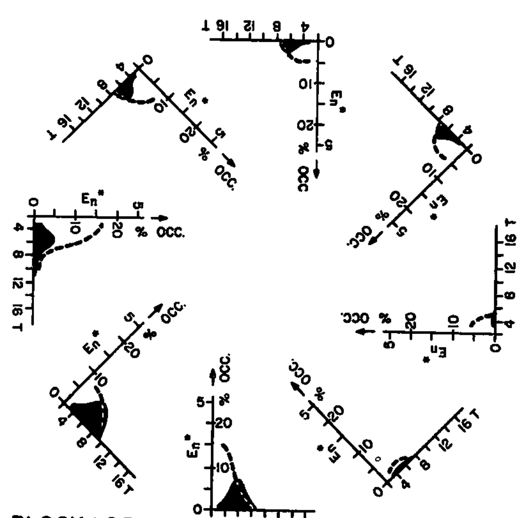
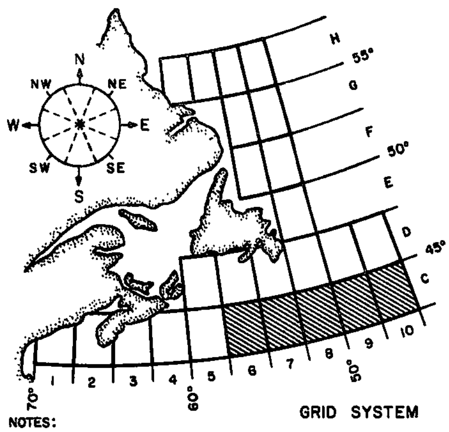


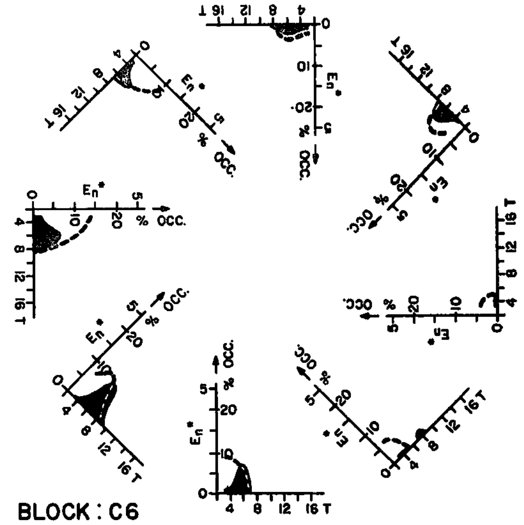
BLOCK : C5

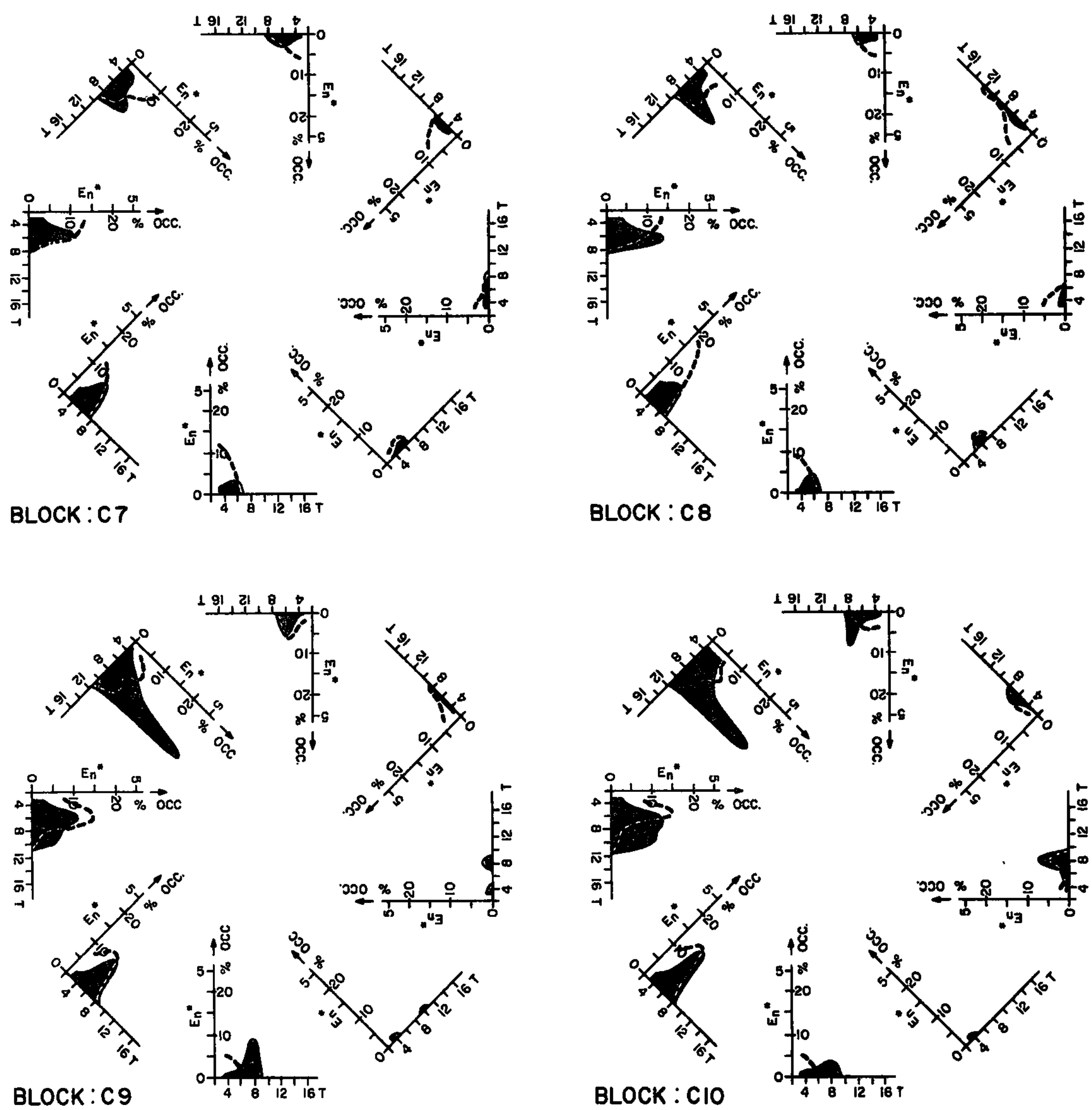
APPENDIX FIGURE 9a: Directional Energy Spectra for September



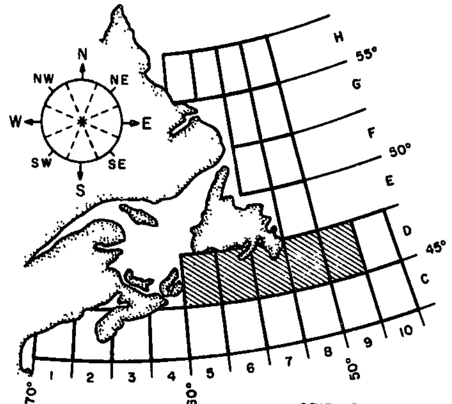
NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



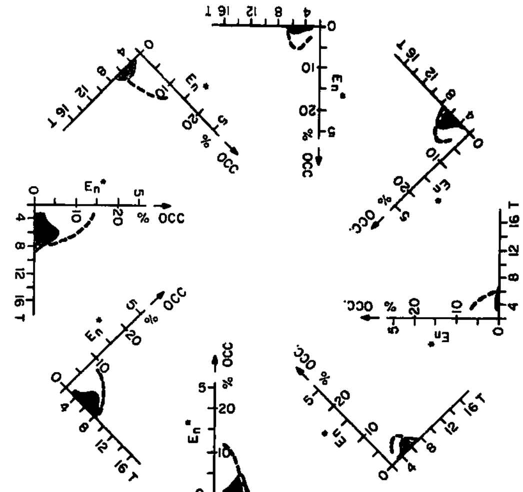


APPENDIX FIGURE 9b: Directional Energy Spectra for September

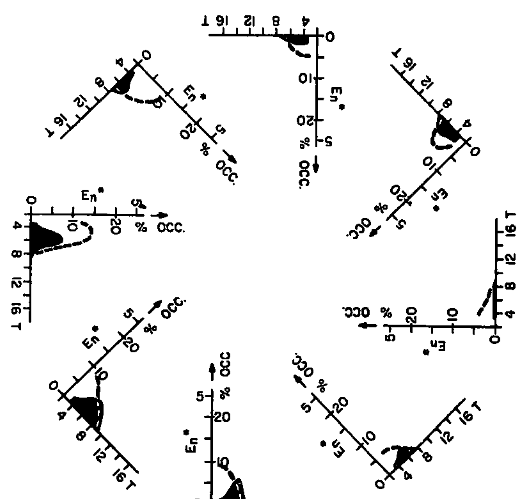


NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



BLOCK : D5



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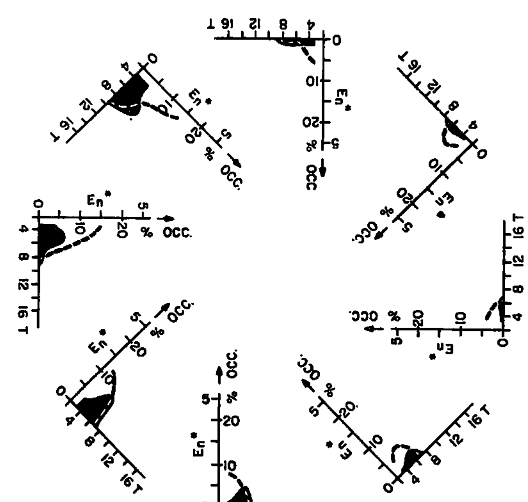

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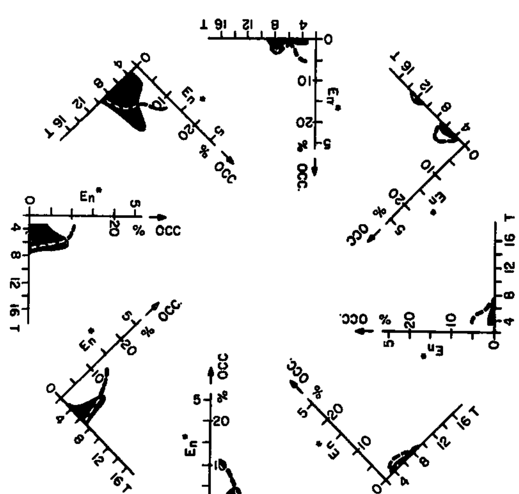

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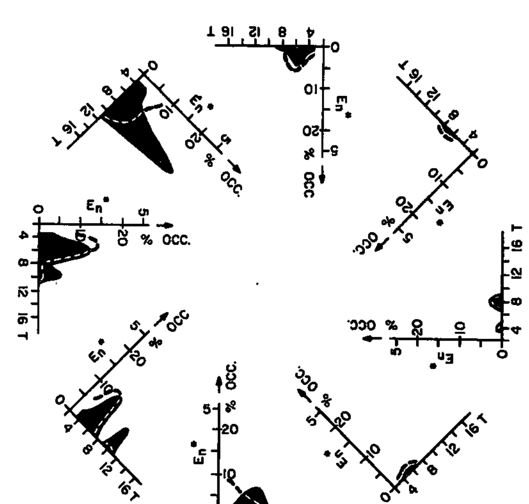
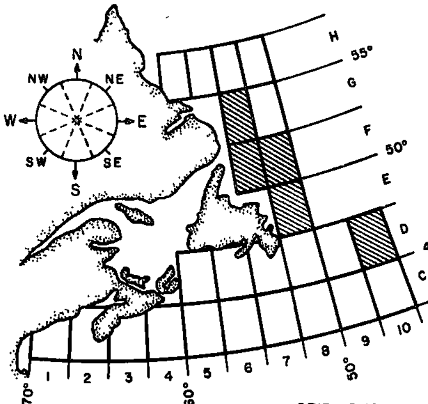


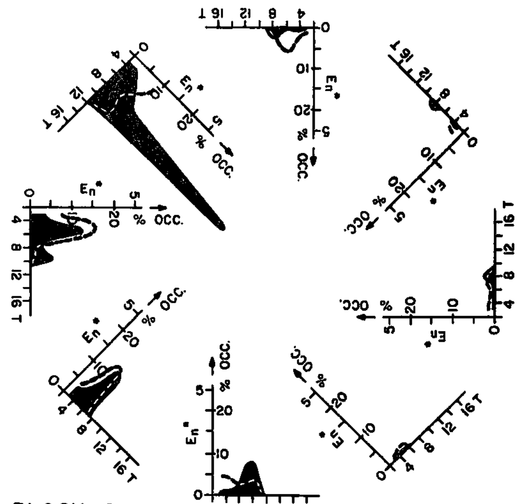
BLOCK : D9

APPENDIX FIGURE 9c: Directional Energy Spectra for September



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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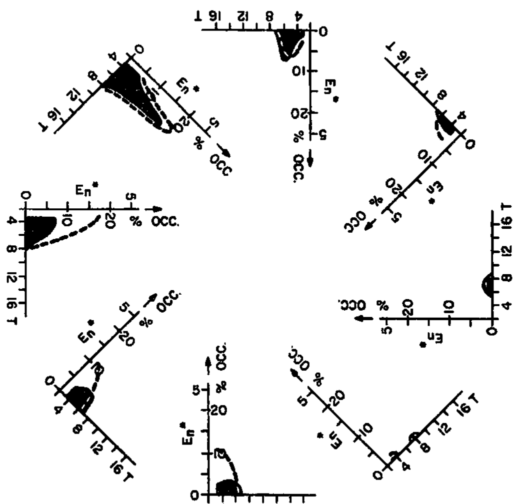
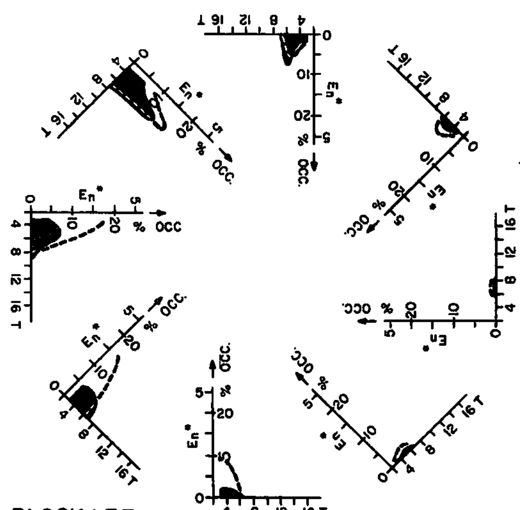


BLOCK : E8



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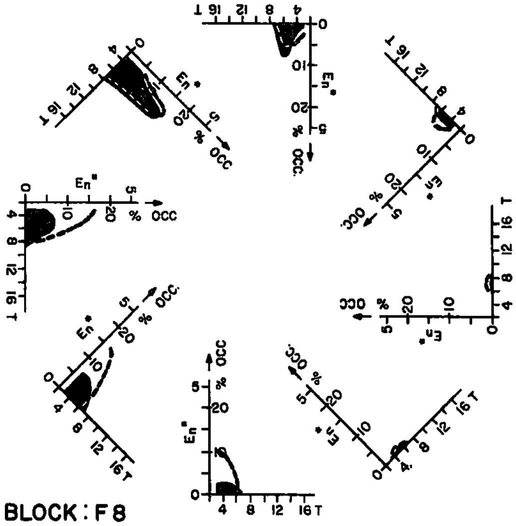

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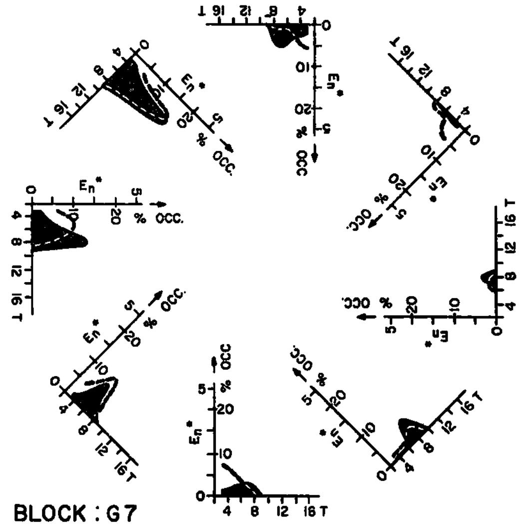
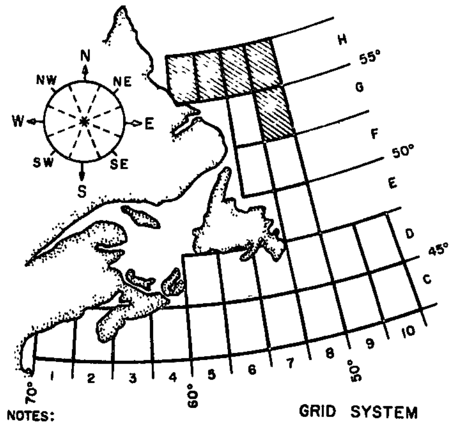


BLOCK : G7

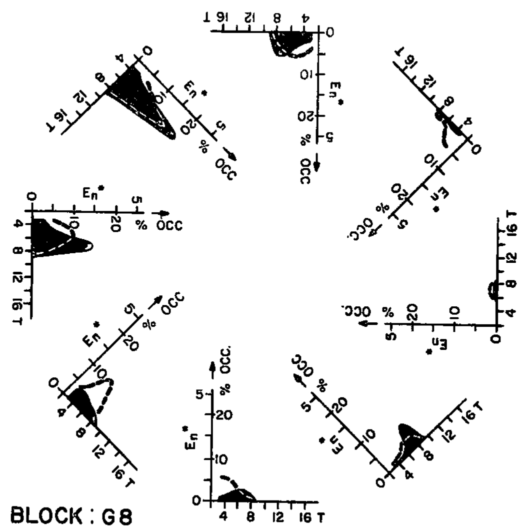
APPENDIX FIGURE 9d: Directional Energy Spectra for September



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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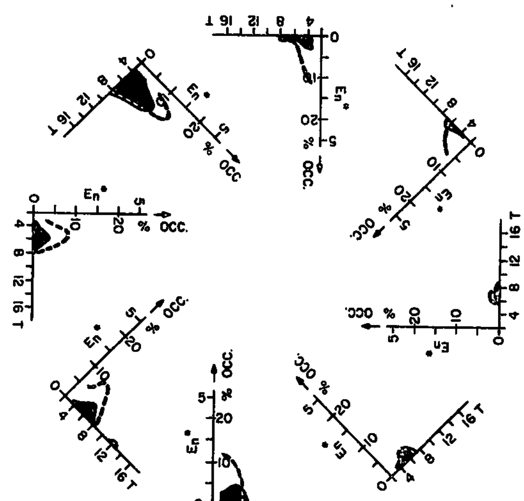
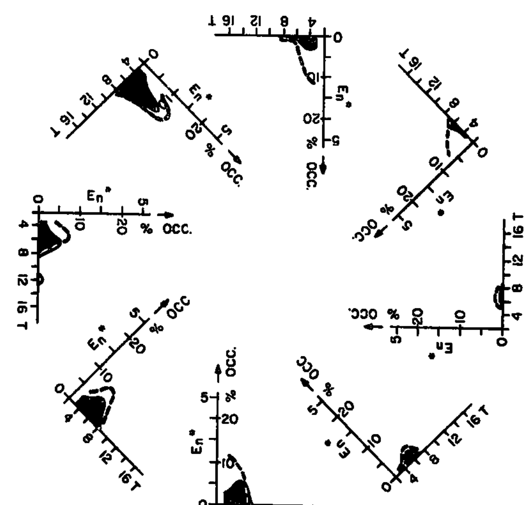
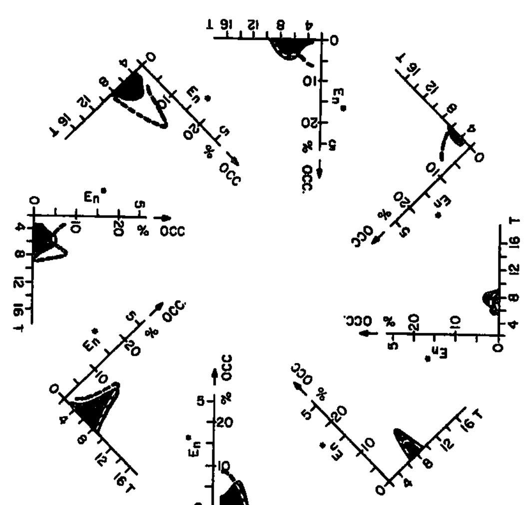


BLOCK : H5



BLOCK : H6



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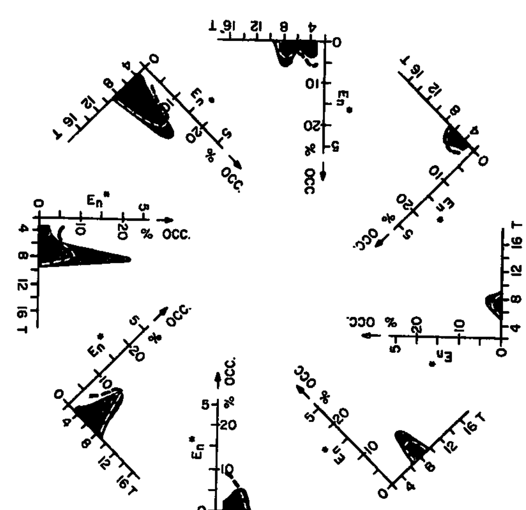
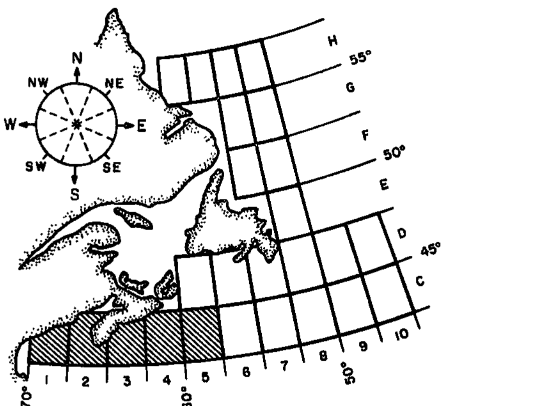


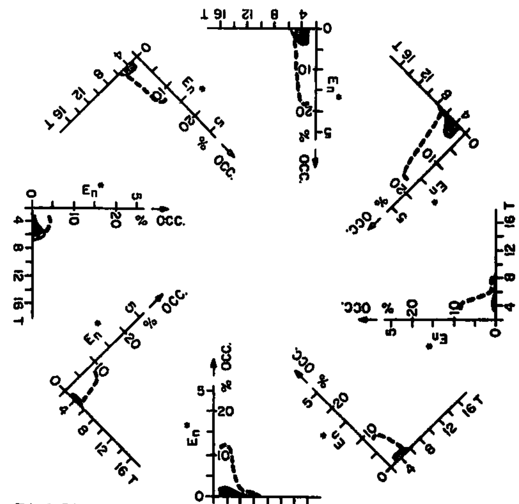
BLOCK : H8

APPENDIX FIGURE 9e: Directional Energy Spectra for September

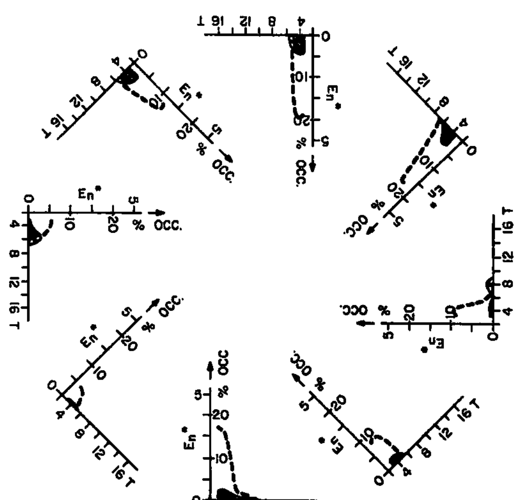


NOTES:

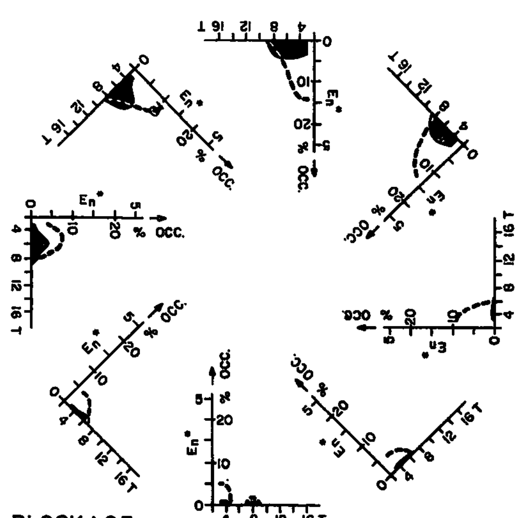
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



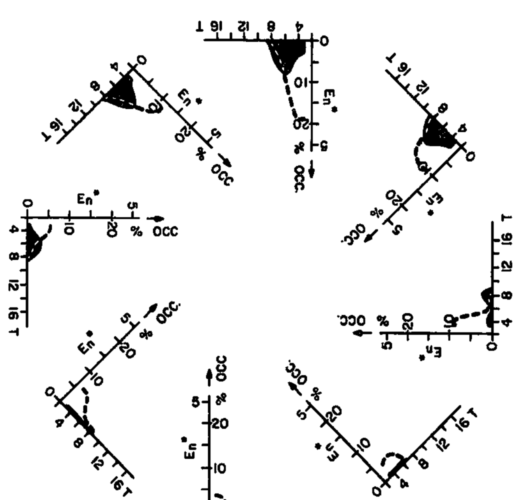
BLOCK : C1



BLOCK : C2



BLOCK : C3



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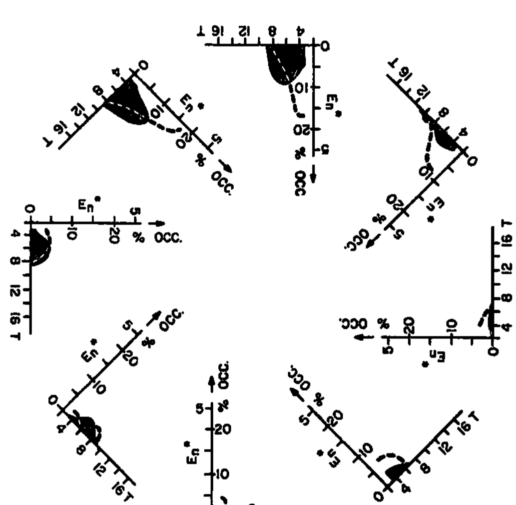
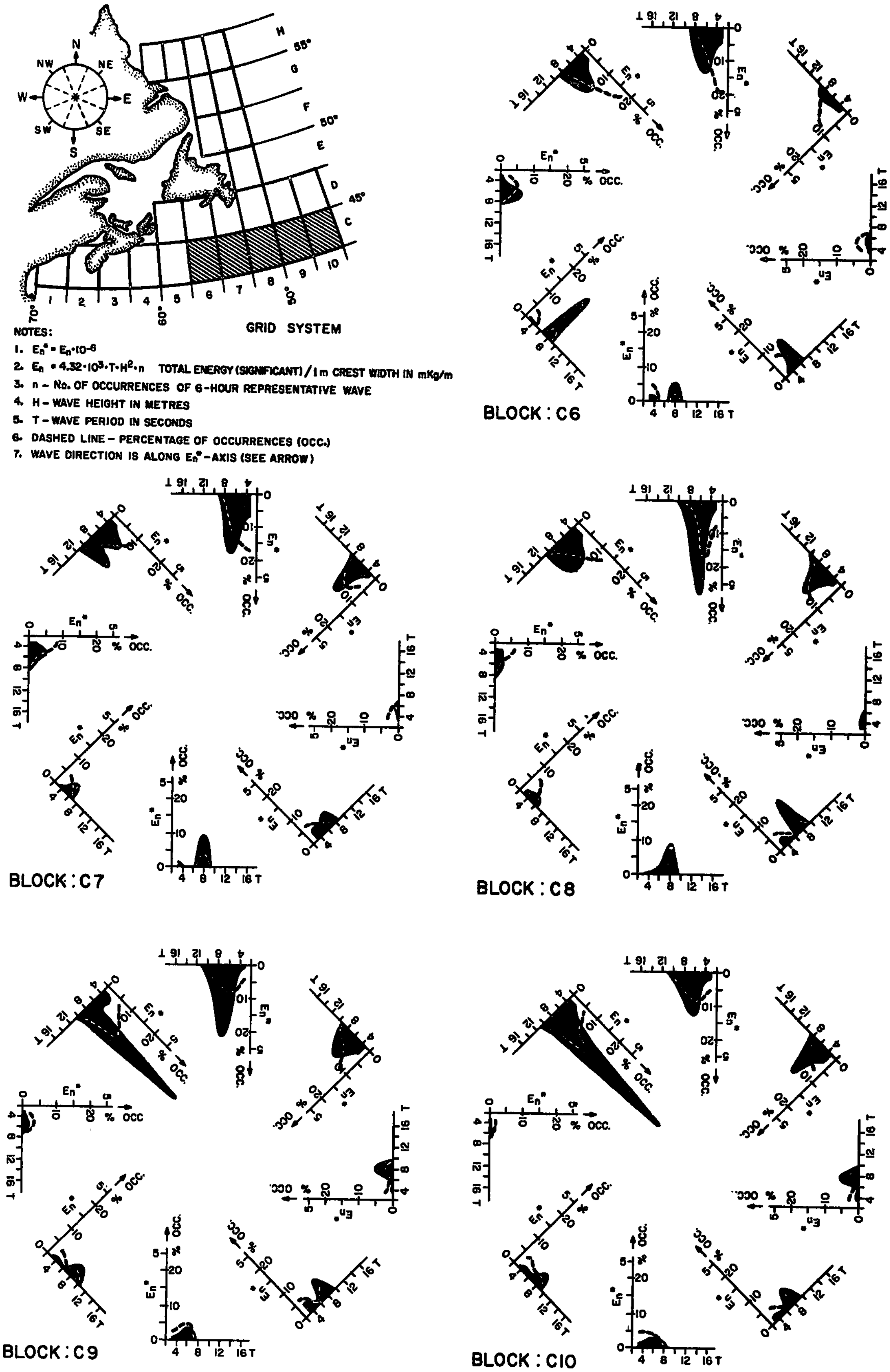
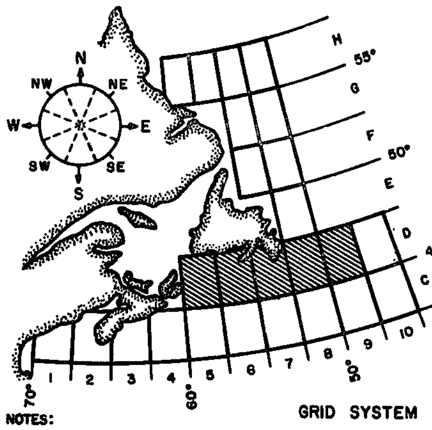


BLOCK : C5

APPENDIX FIGURE 10a: Directional Energy Spectra for October

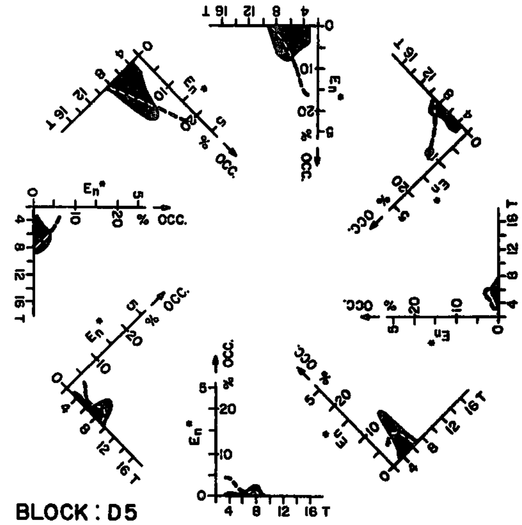


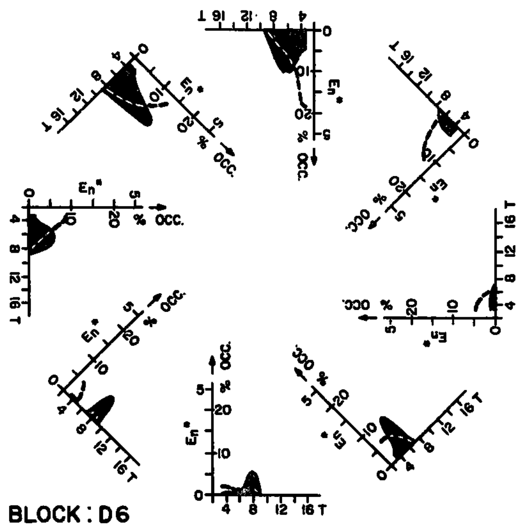
APPENDIX FIGURE 10b: Directional Energy Spectra for October

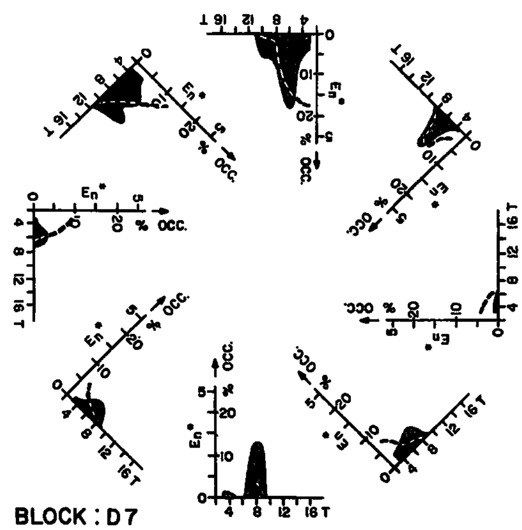


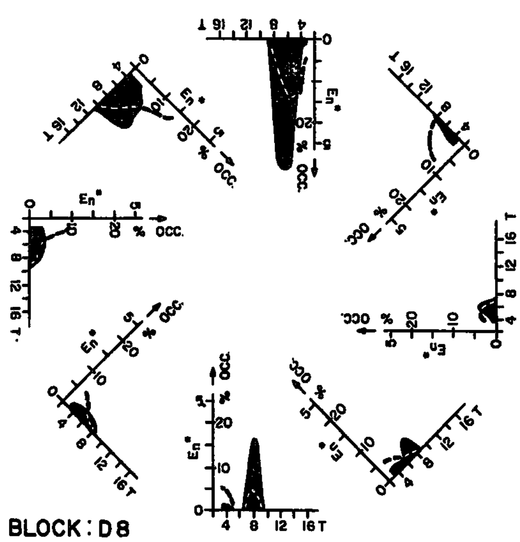
NOTES:

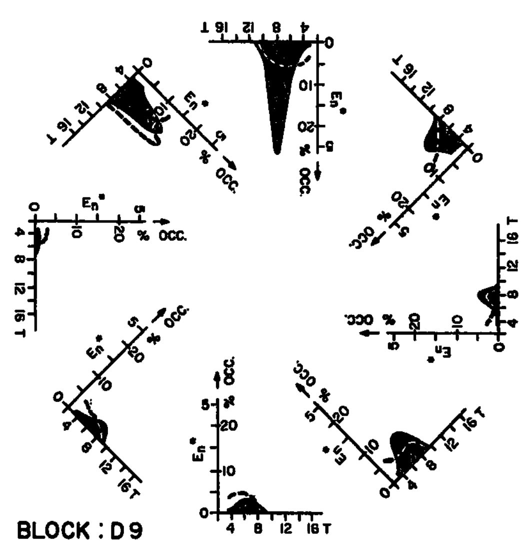
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



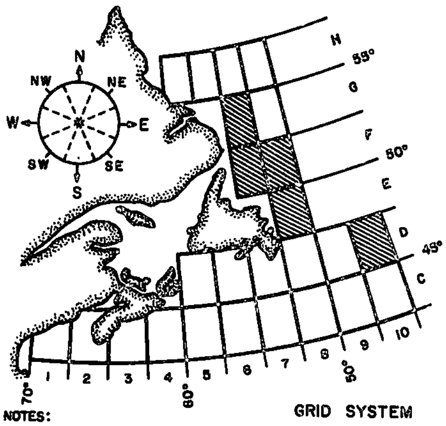






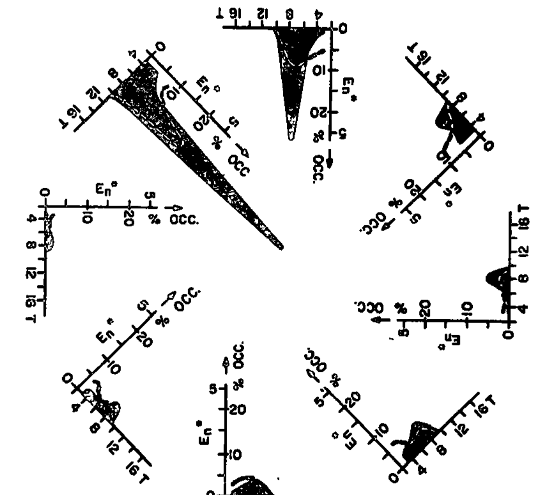


APPENDIX FIGURE 10c: Directional Energy Spectra for October

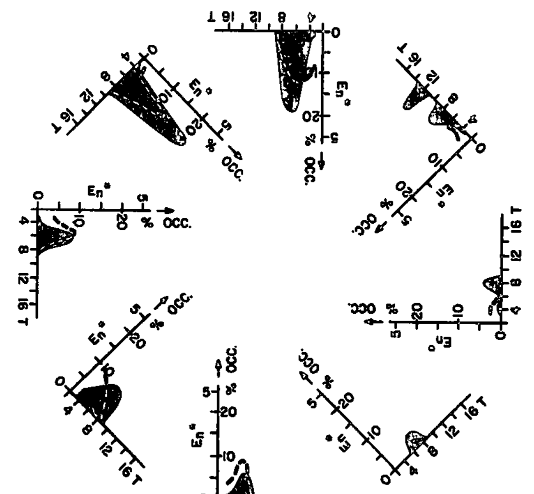


NOTES:

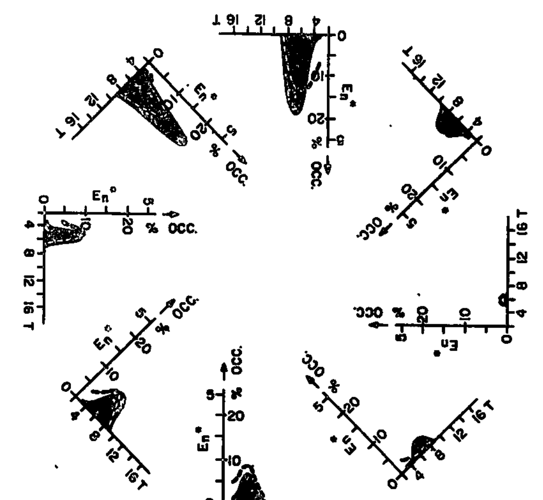
1. $E_n^\circ = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n°-AXIS (SEE ARROW)



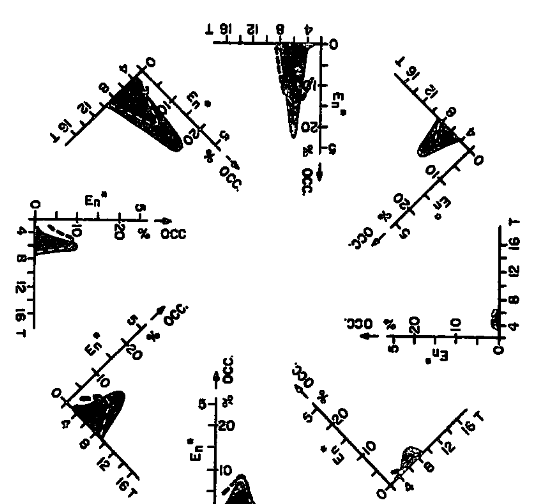
BLOCK : D10



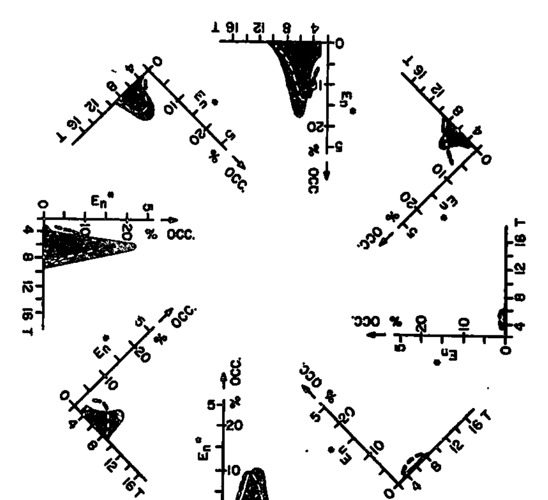
BLOCK : E8



BLOCK : F7

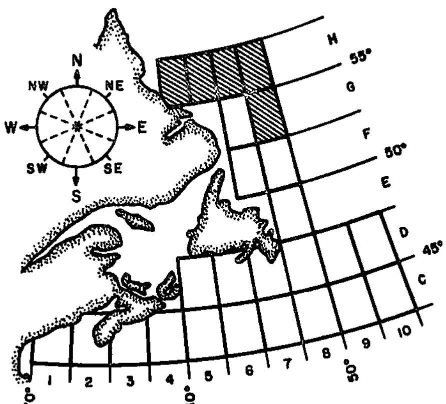


BLOCK : F8



BLOCK : G7

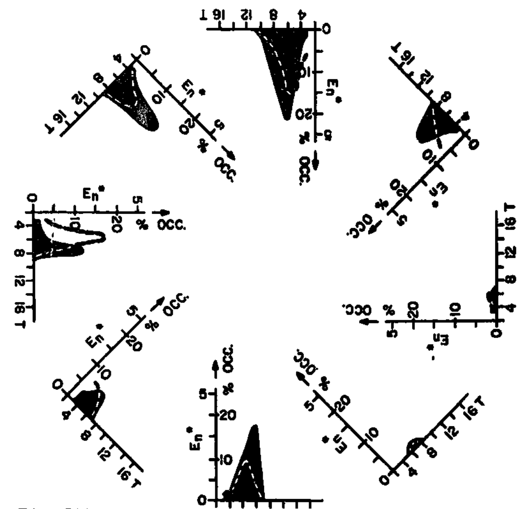
APPENDIX FIGURE 10d: Directional Energy Spectra for October



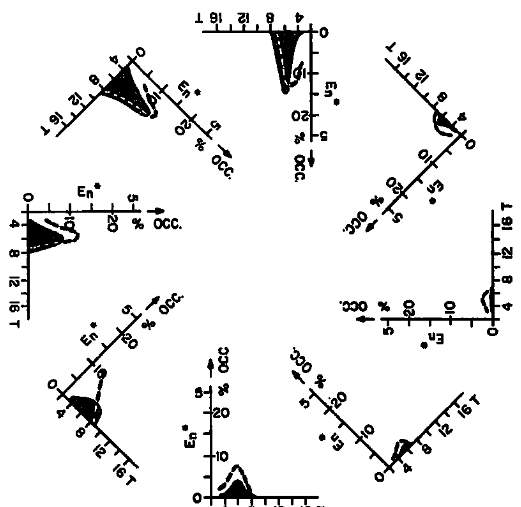
GRID SYSTEM

NOTES:

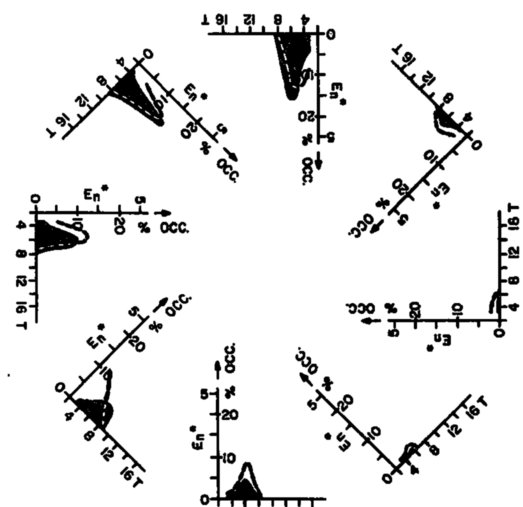
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



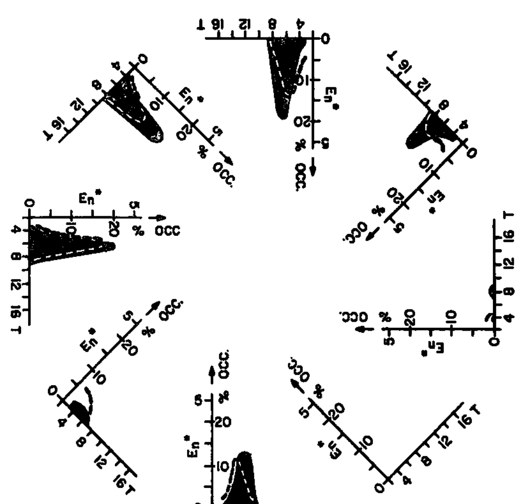
BLOCK : G8



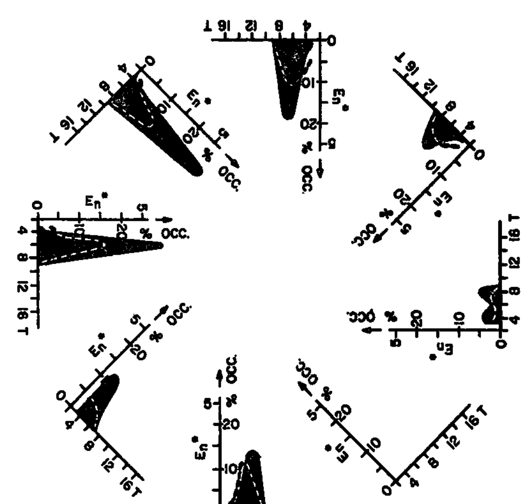
BLOCK : H5



BLOCK : H6

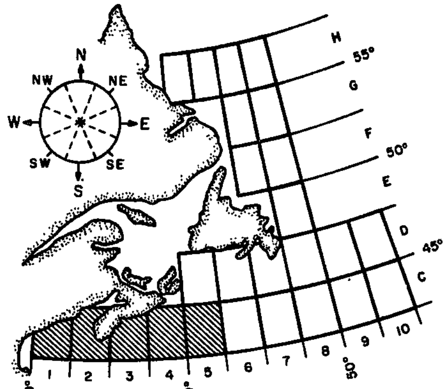


BLOCK : H7



BLOCK : H8

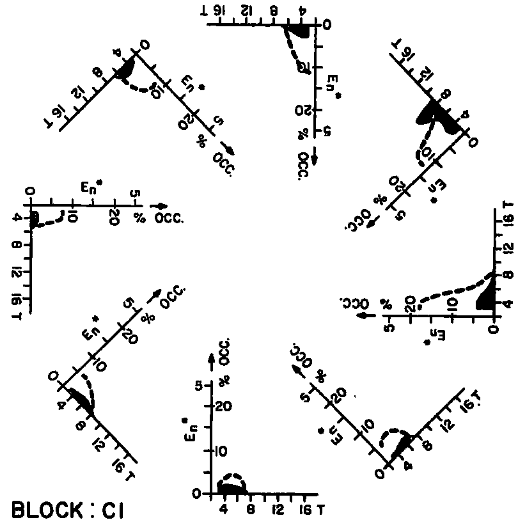
APPENDIX FIGURE 10e: Directional Energy Spectra for October



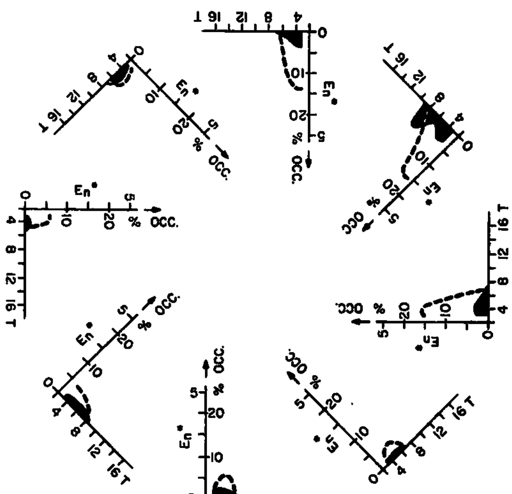
GRID SYSTEM

NOTES:

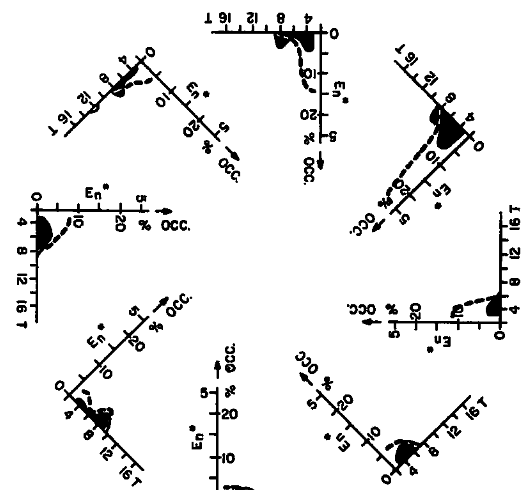
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



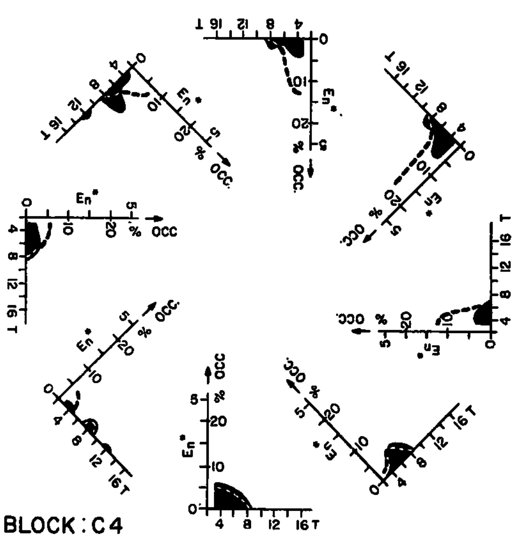
BLOCK : C1



BLOCK : C2



BLOCK : C3



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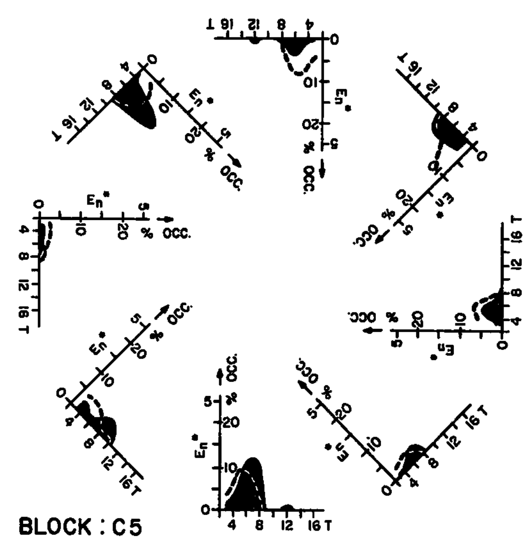
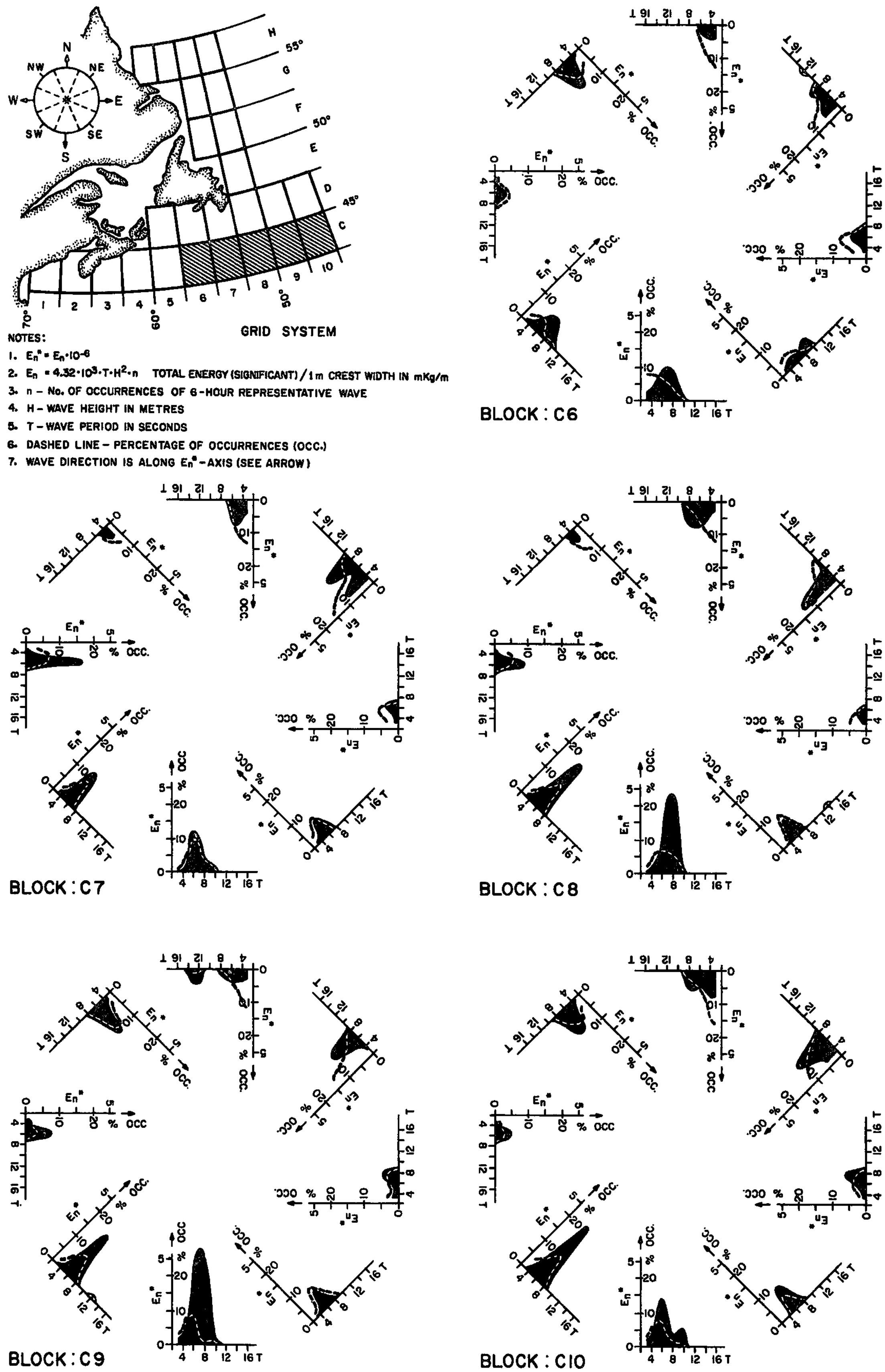
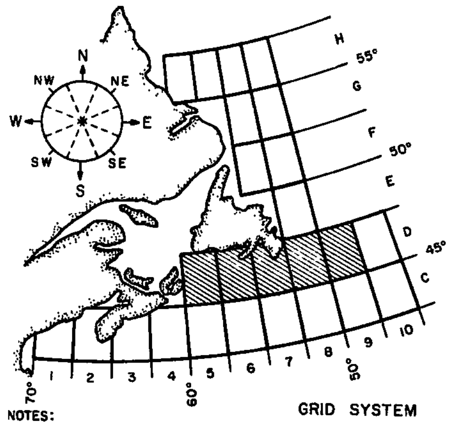


BLOCK : C5

APPENDIX FIGURE 11a: Directional Energy Spectra for November

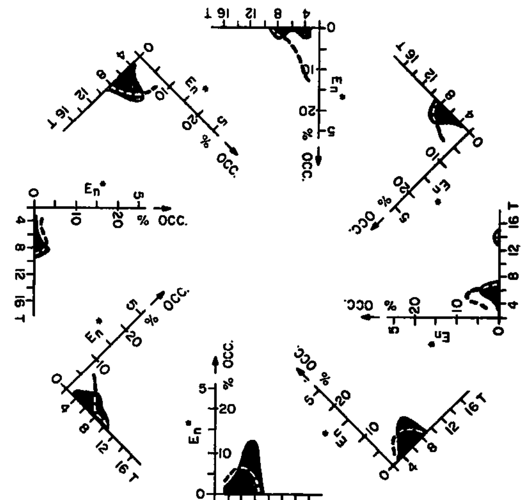


APPENDIX FIGURE 11b: Directional Energy Spectra for November

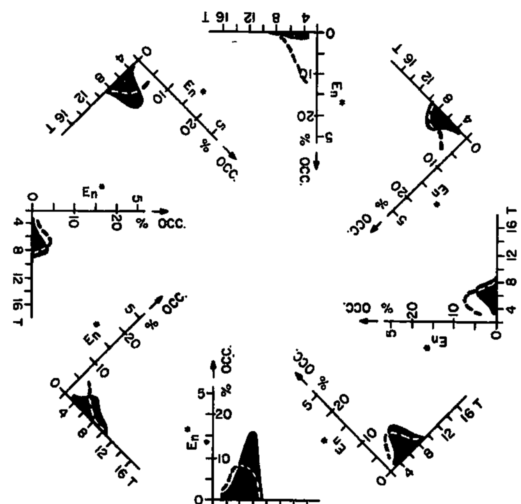


NOTES:

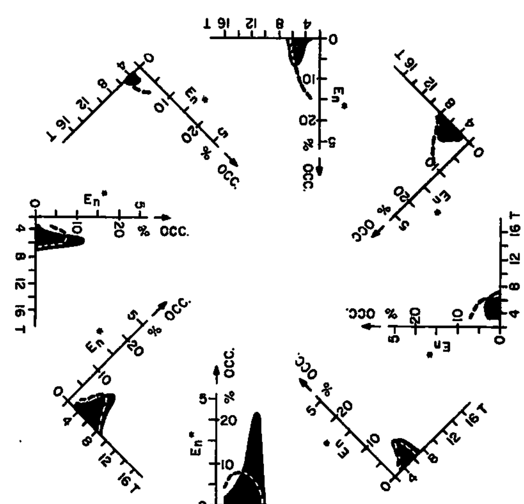
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



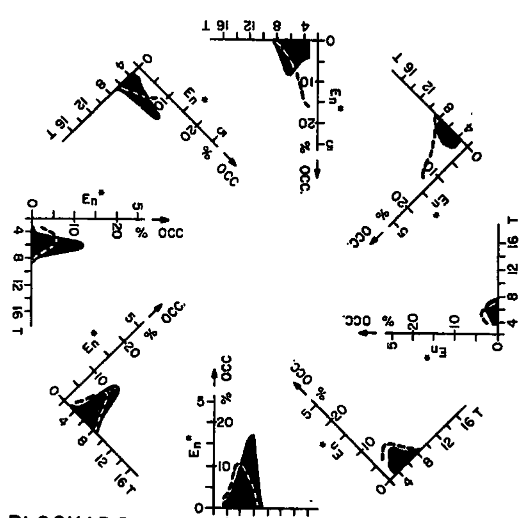
BLOCK : D5



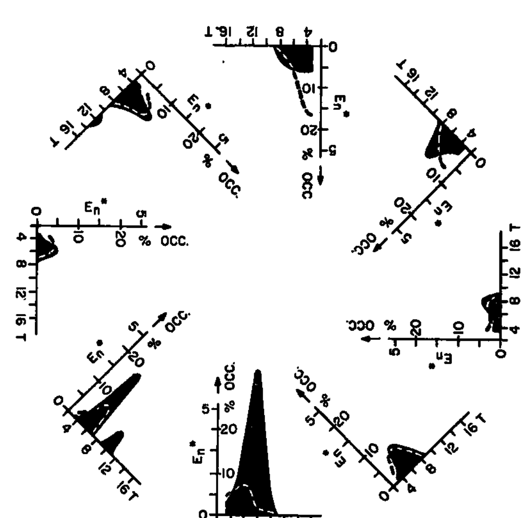
BLOCK : D6



BLOCK : D7

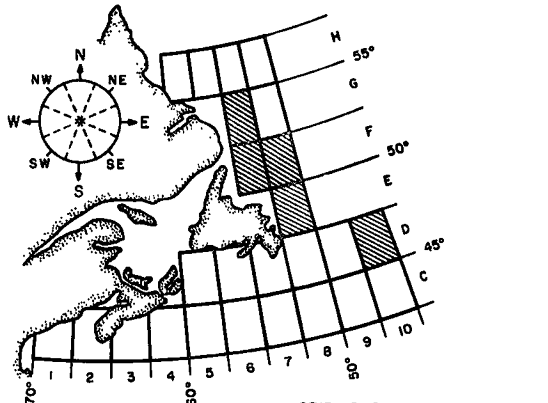


BLOCK : D8



BLOCK : D9

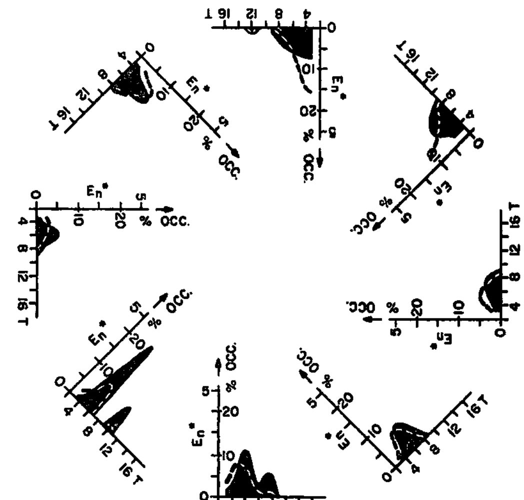
APPENDIX FIGURE 11c: Directional Energy Spectra for November



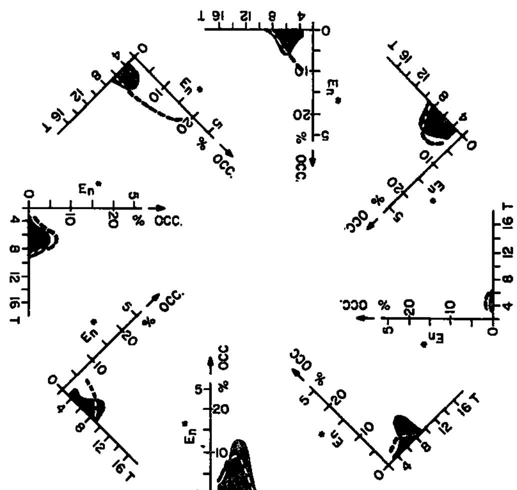
GRID SYSTEM

NOTES:

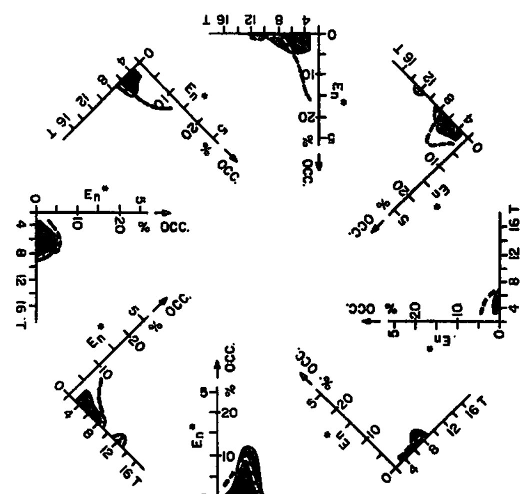
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



BLOCK : D10



BLOCK : E8



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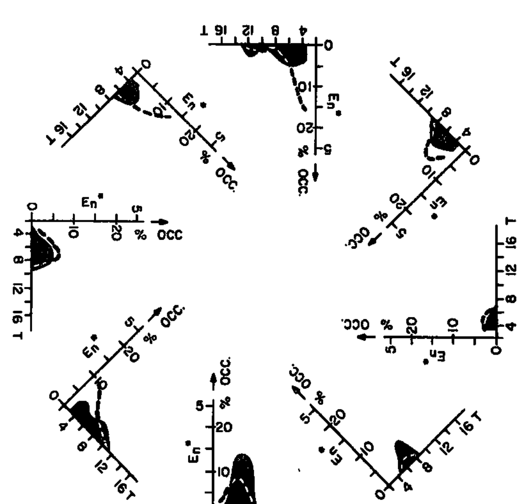

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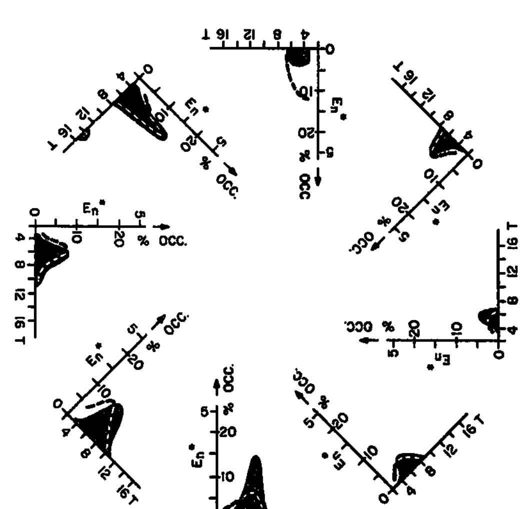
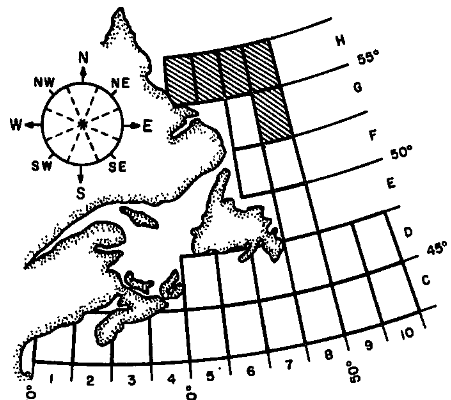


BLOCK : G7

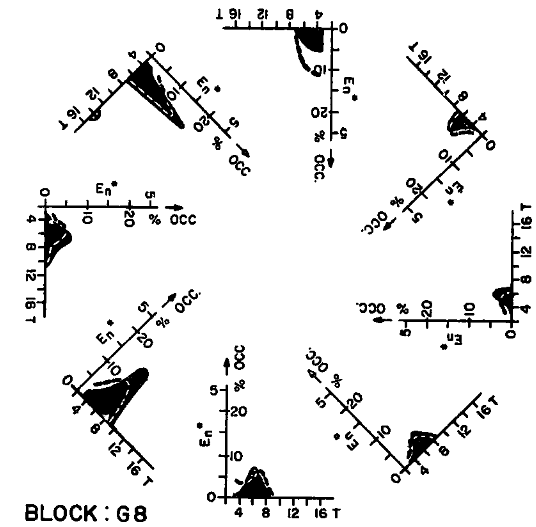
APPENDIX FIGURE 11d: Directional Energy Spectra for November



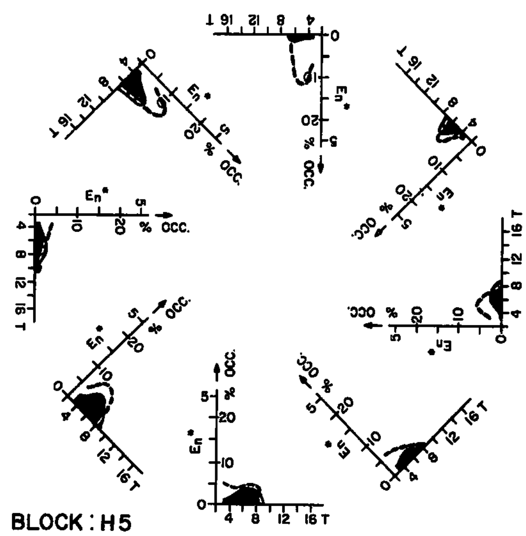
GRID SYSTEM

NOTES:

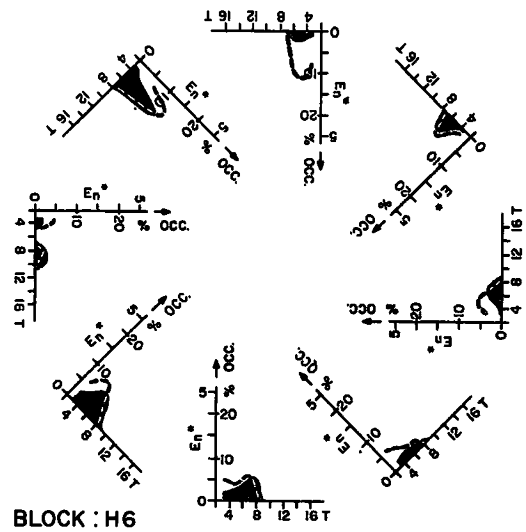
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*-AXIS (SEE ARROW)



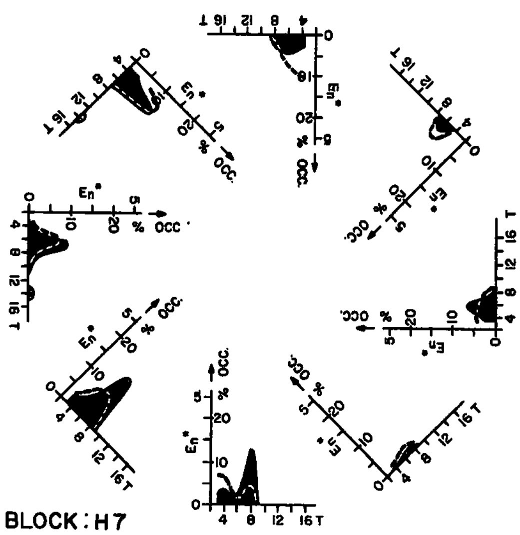
BLOCK : G8



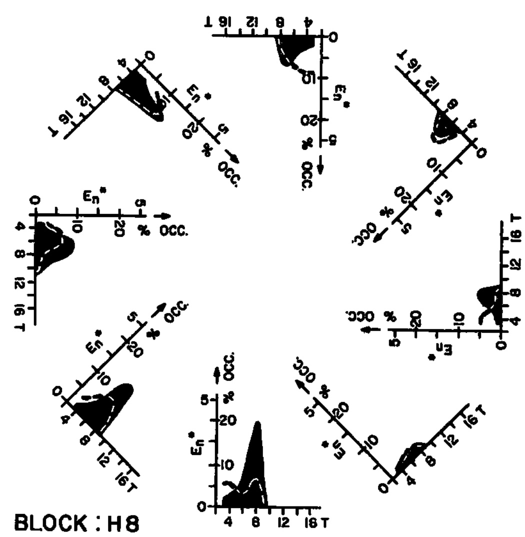
BLOCK : H5



BLOCK : H6

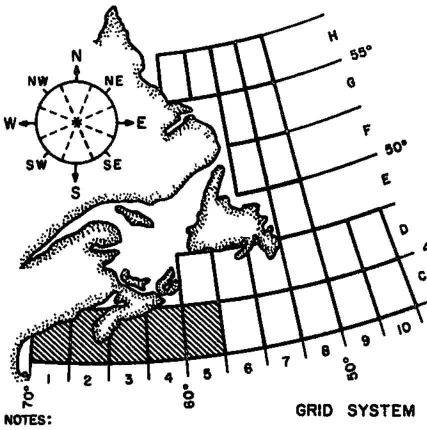


BLOCK : H7



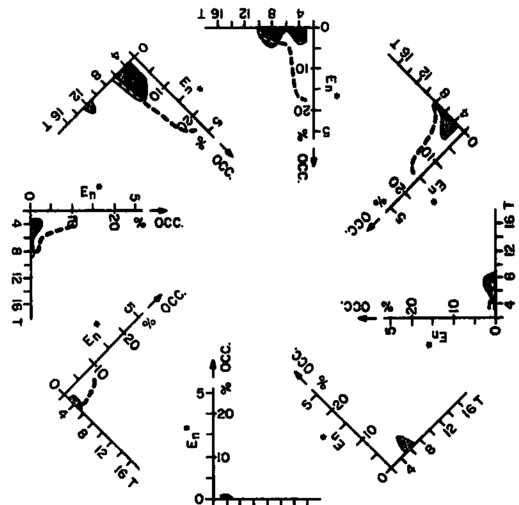
BLOCK : H8

APPENDIX FIGURE 11e: Directional Energy Spectra for November

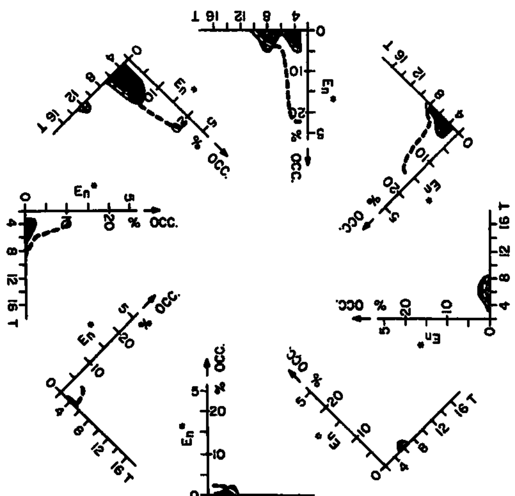


NOTES:

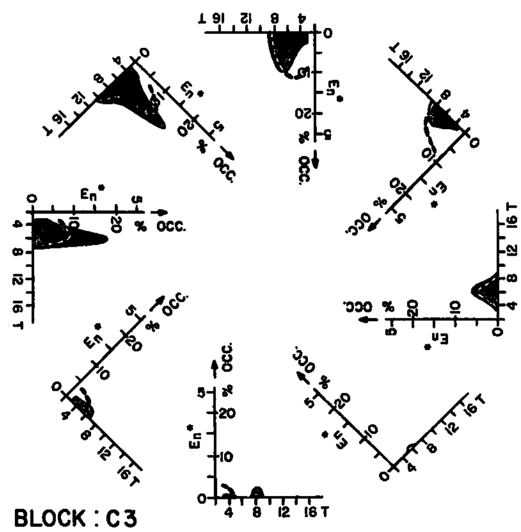
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



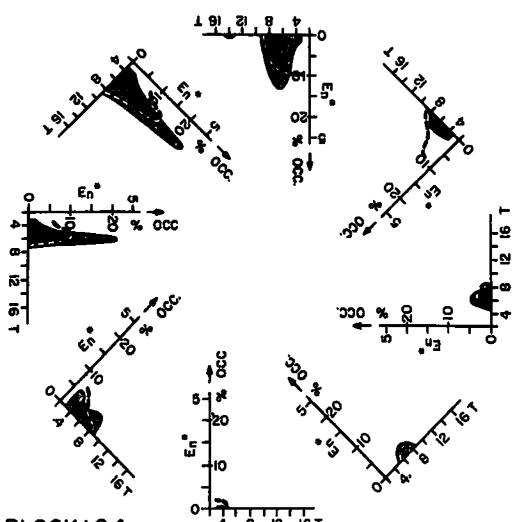
BLOCK : C1



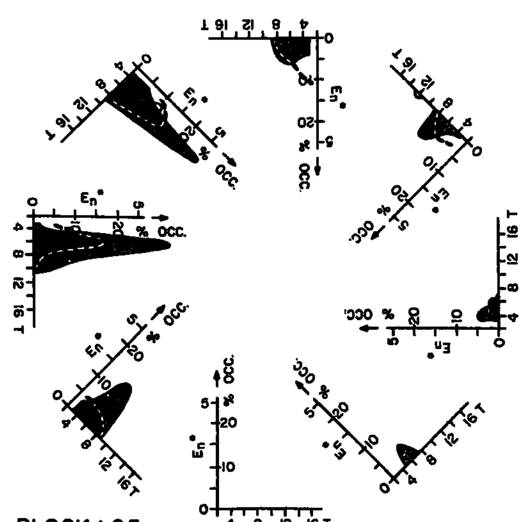
BLOCK : C2



BLOCK : C3

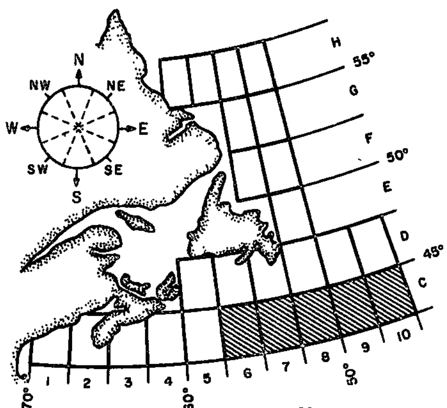


BLOCK : C4



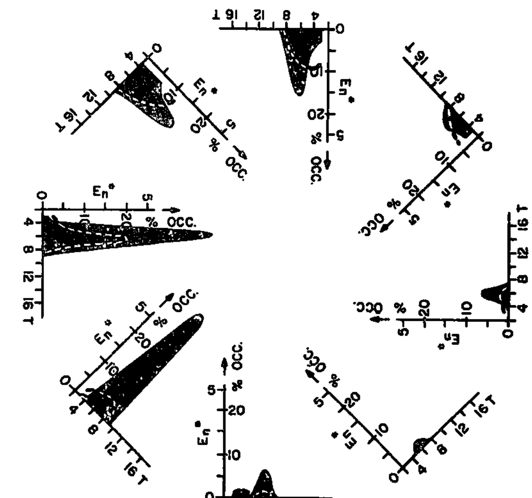
BLOCK : C5

APPENDIX FIGURE 12a: Directional Energy Spectra for December

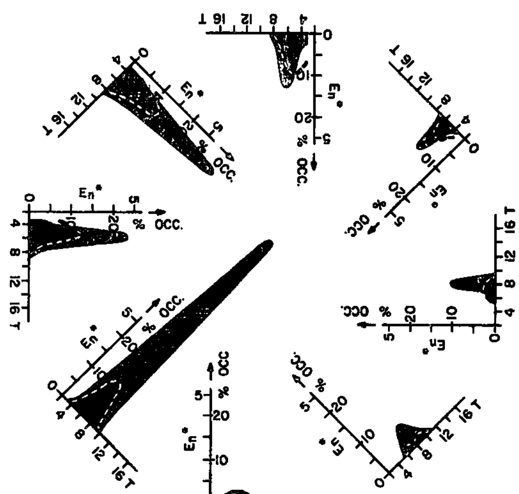


NOTES:

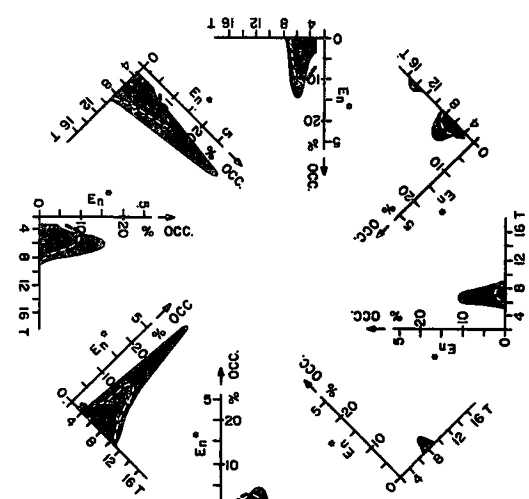
1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^*–AXIS (SEE ARROW)



BLOCK : C6



BLOCK : C7



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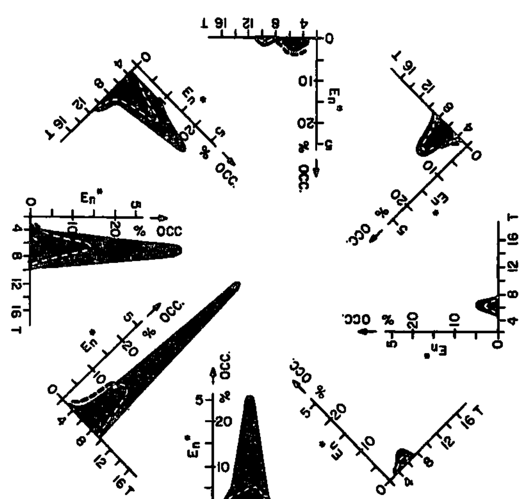

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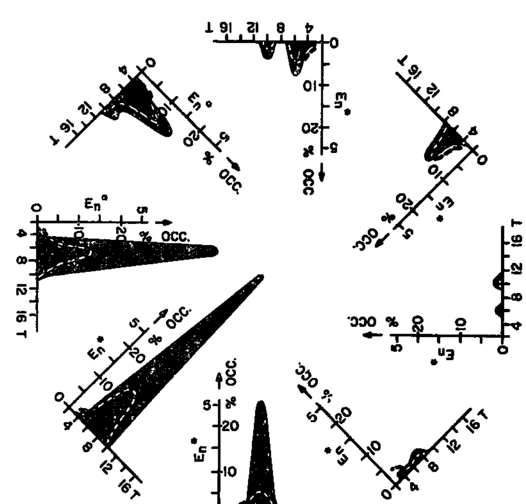

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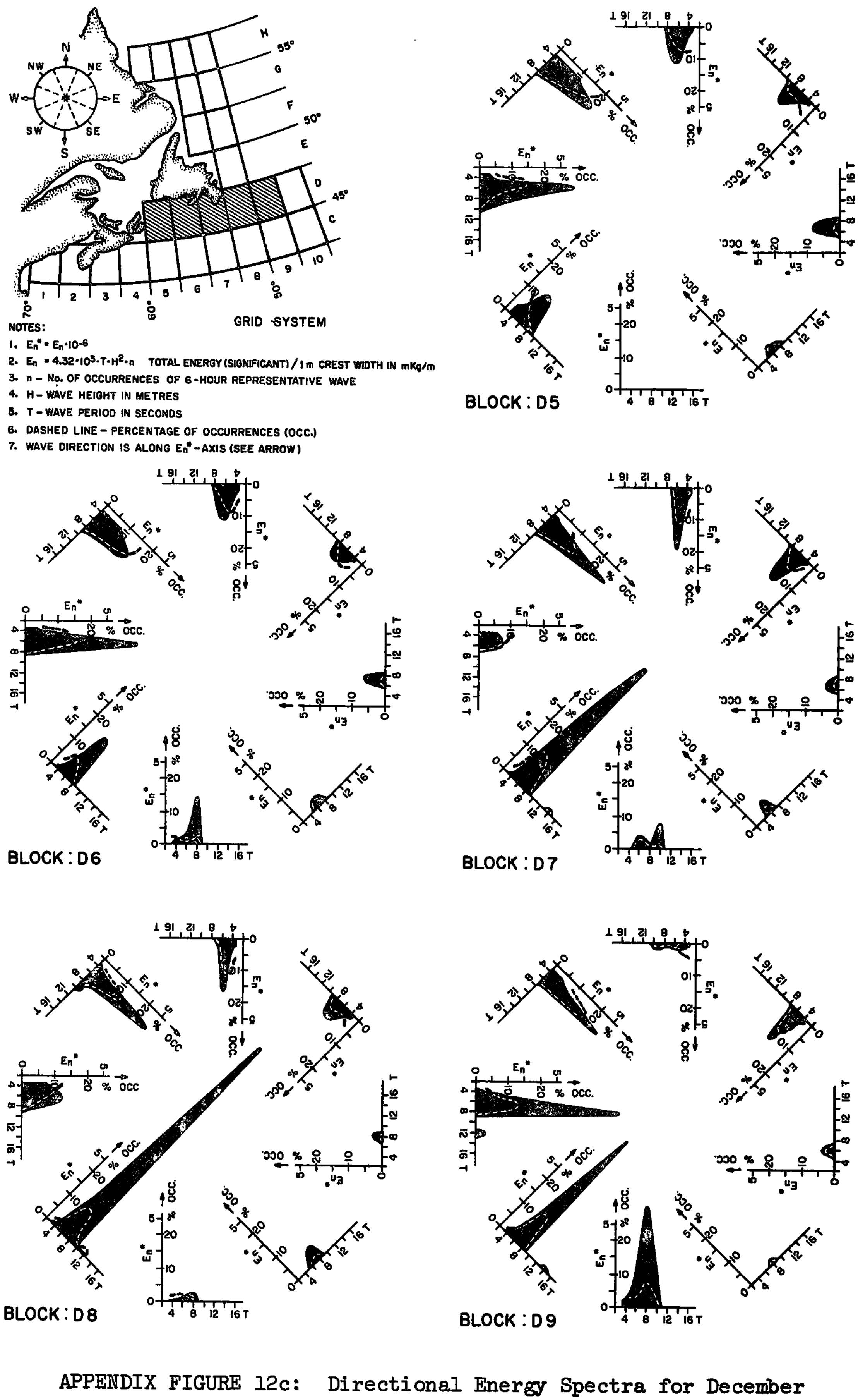
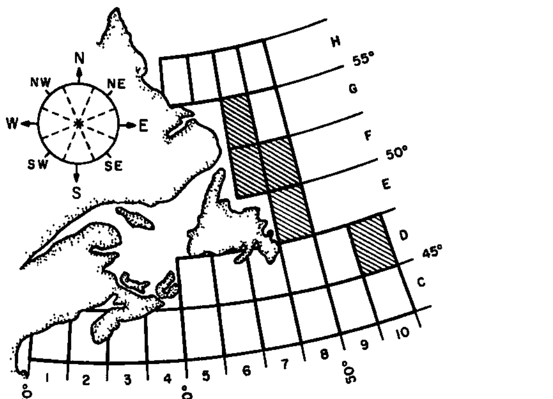
APPENDIX FIGURE 12b: Directional Energy Spectra for December



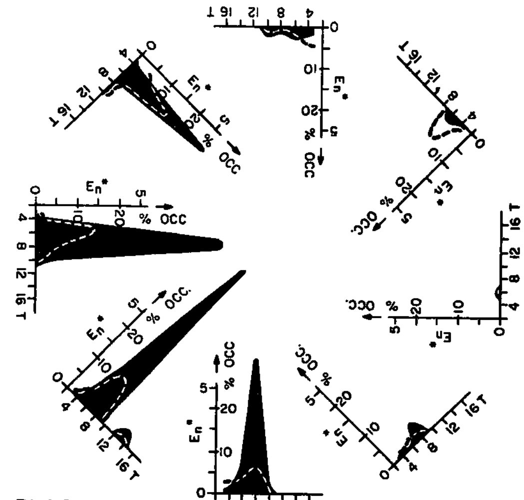
APPENDIX FIGURE 12c: Directional Energy Spectra for December



GRID SYSTEM

NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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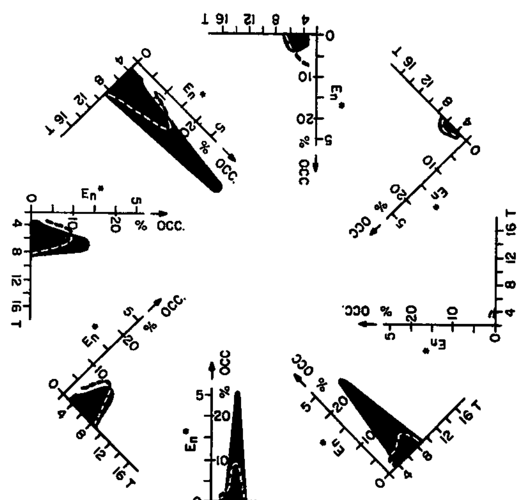

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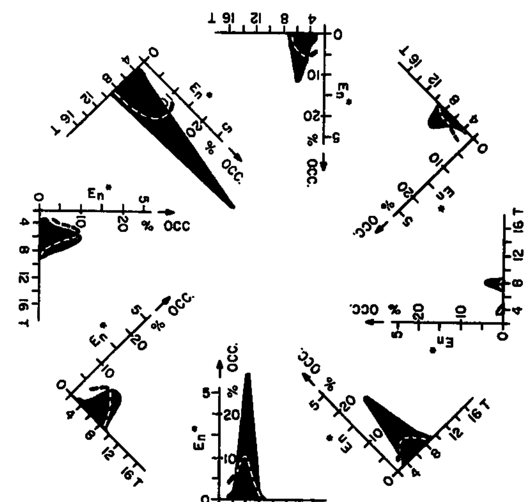

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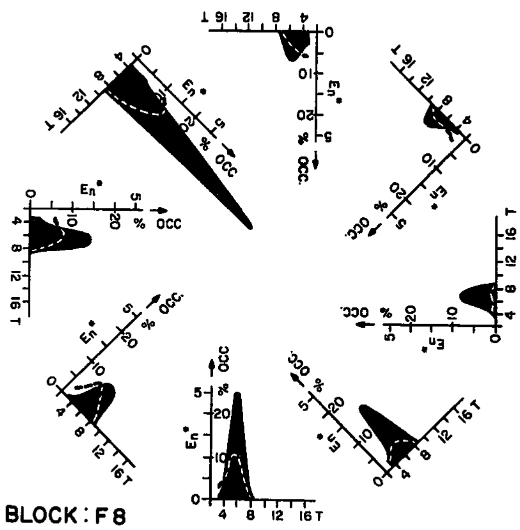

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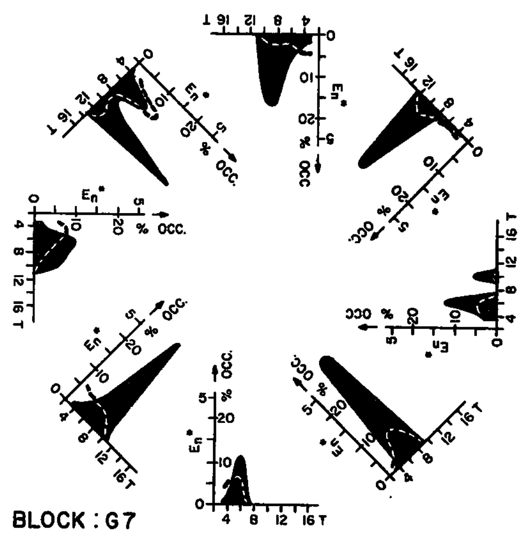

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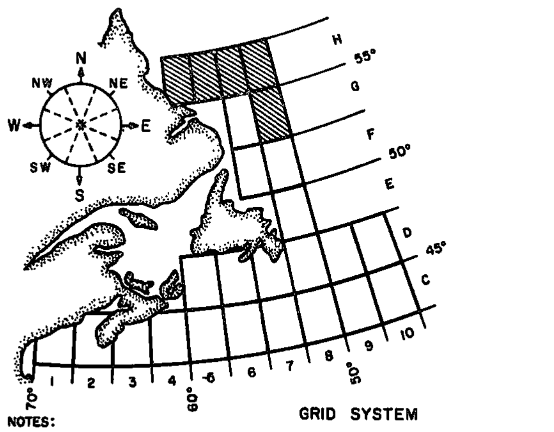
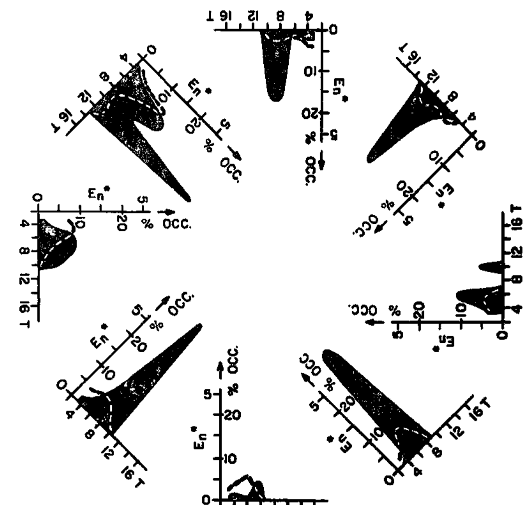
APPENDIX FIGURE 12d: Directional Energy Spectra for December



NOTES:

1. $E_n^* = E_n \cdot 10^{-6}$
2. $E_n = 4.32 \cdot 10^3 \cdot T \cdot H^2 \cdot n$ TOTAL ENERGY (SIGNIFICANT) / 1 m CREST WIDTH IN mKg/m
3. n – No. OF OCCURRENCES OF 6-HOUR REPRESENTATIVE WAVE
4. H – WAVE HEIGHT IN METRES
5. T – WAVE PERIOD IN SECONDS
6. DASHED LINE – PERCENTAGE OF OCCURRENCES (OCC.)
7. WAVE DIRECTION IS ALONG E_n^* – AXIS (SEE ARROW)



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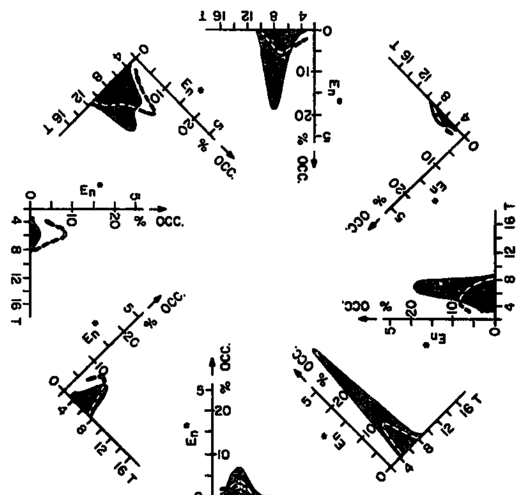

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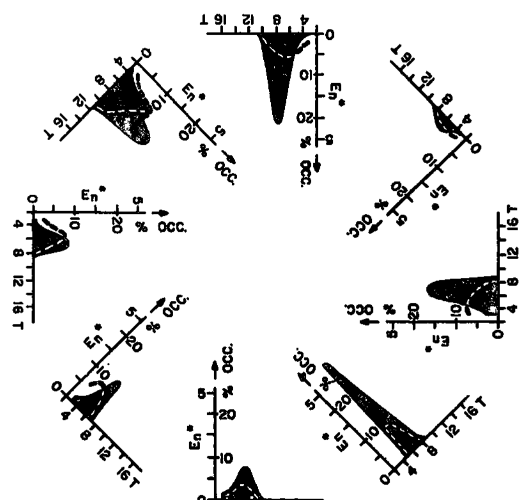

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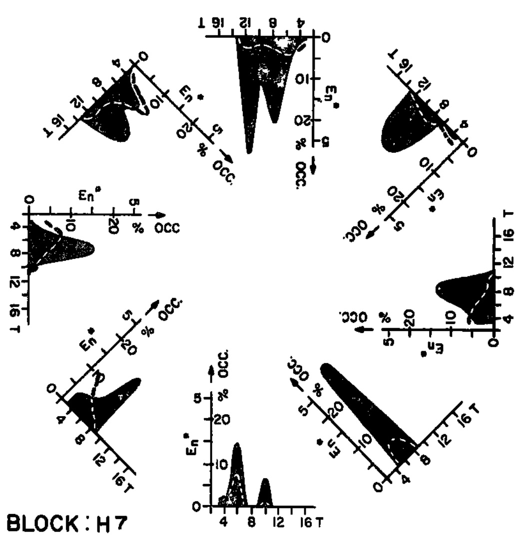

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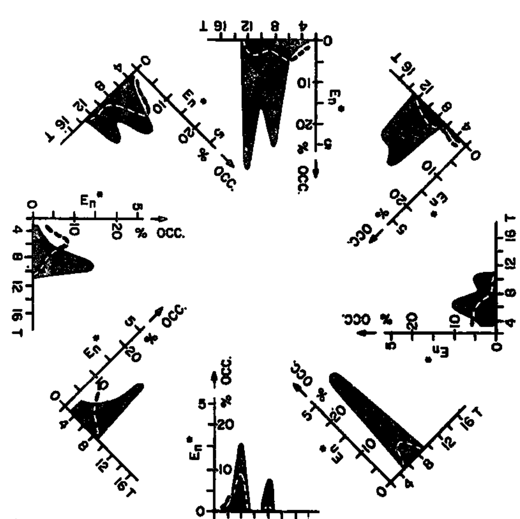

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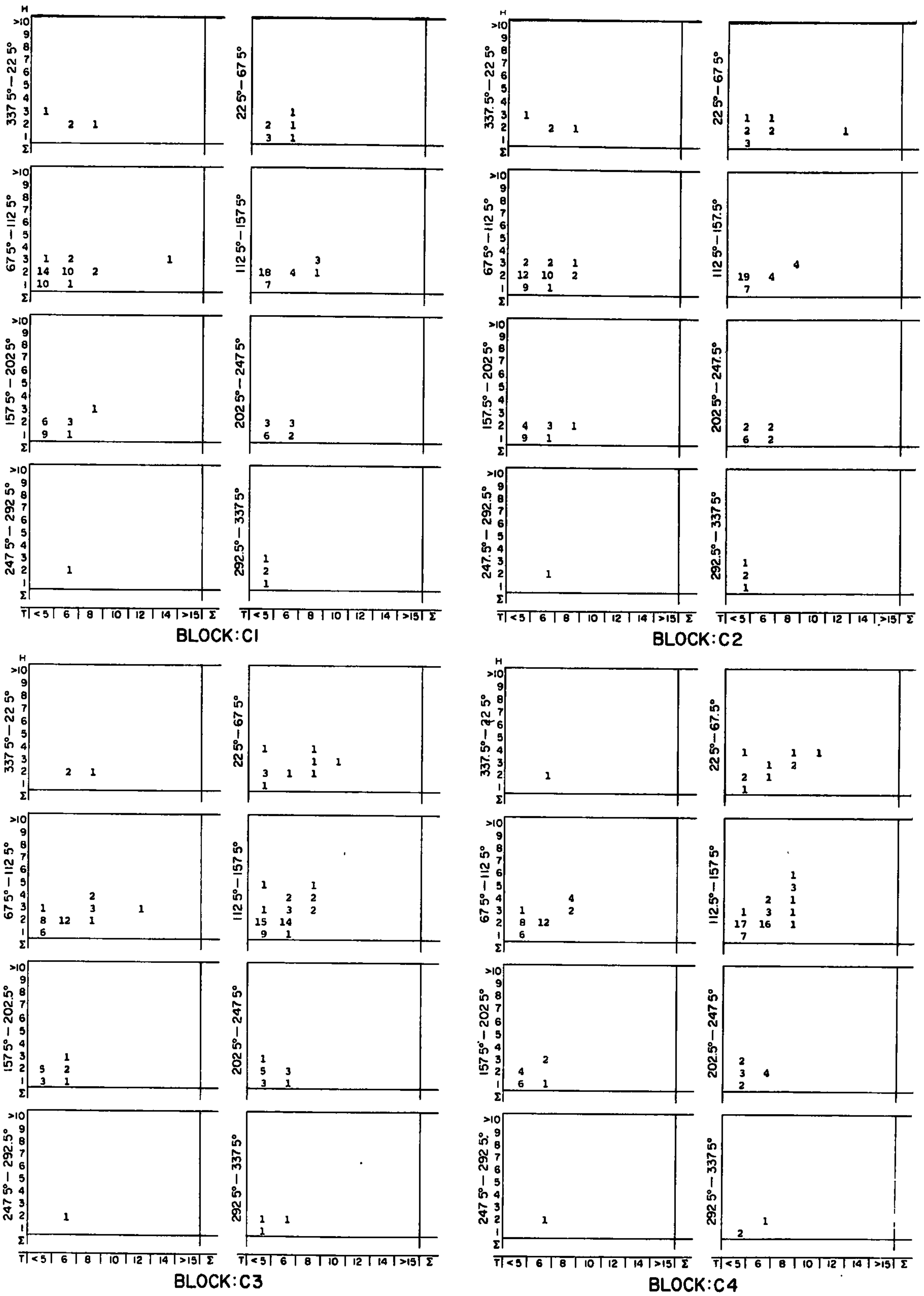
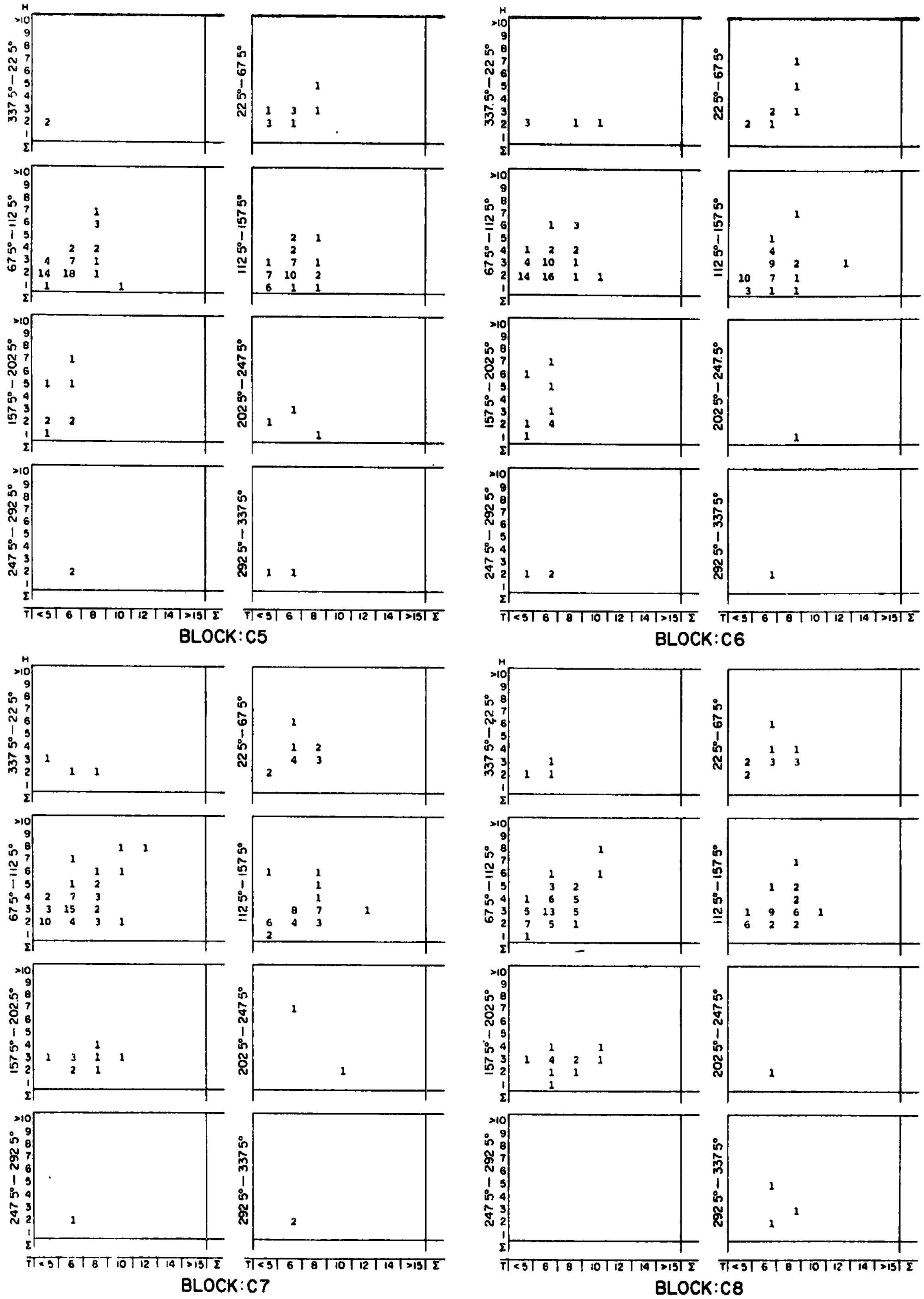
APPENDIX FIGURE 12e: Directional Energy Spectra for December



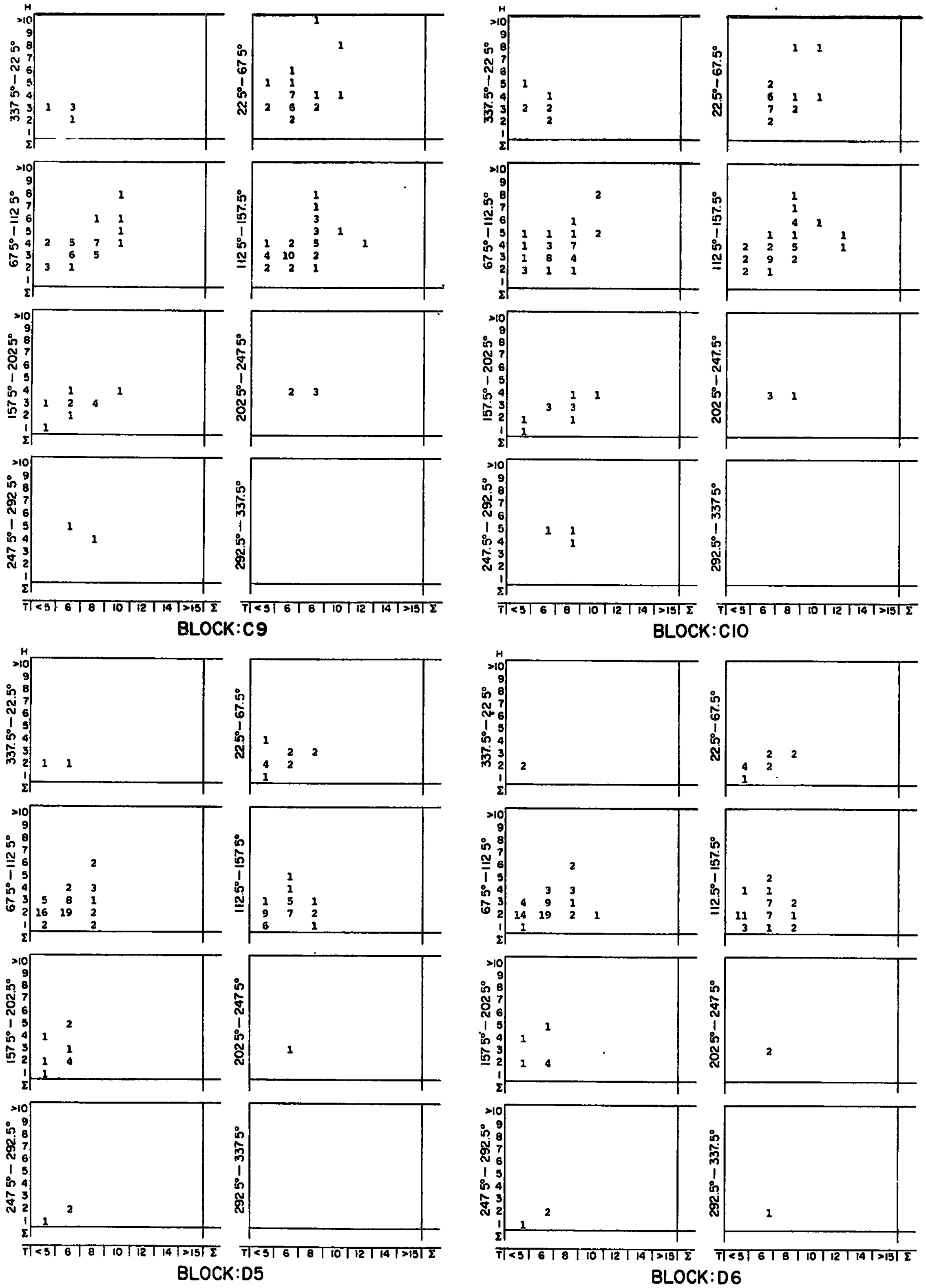
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 13a: Directional Wave Statistics for January



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 13b: Directional Wave Statistics for January



NOTES:

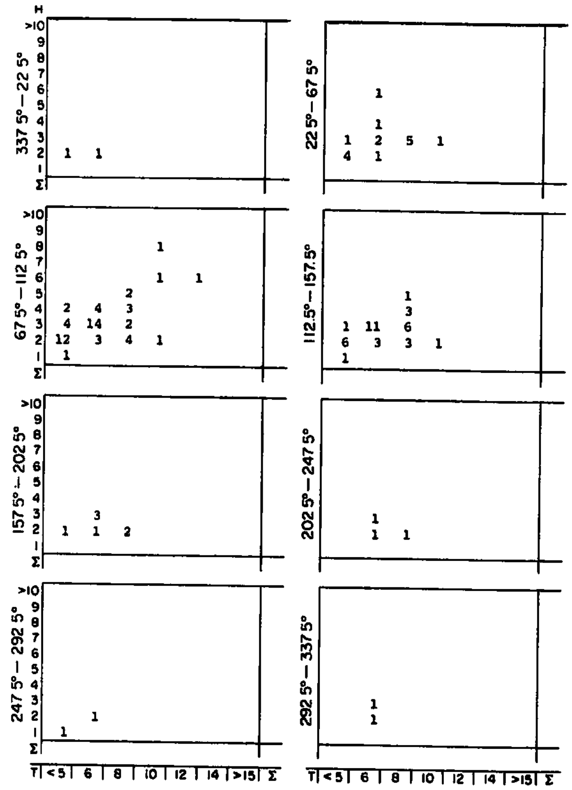
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 13c: Directional Wave Statistics for January



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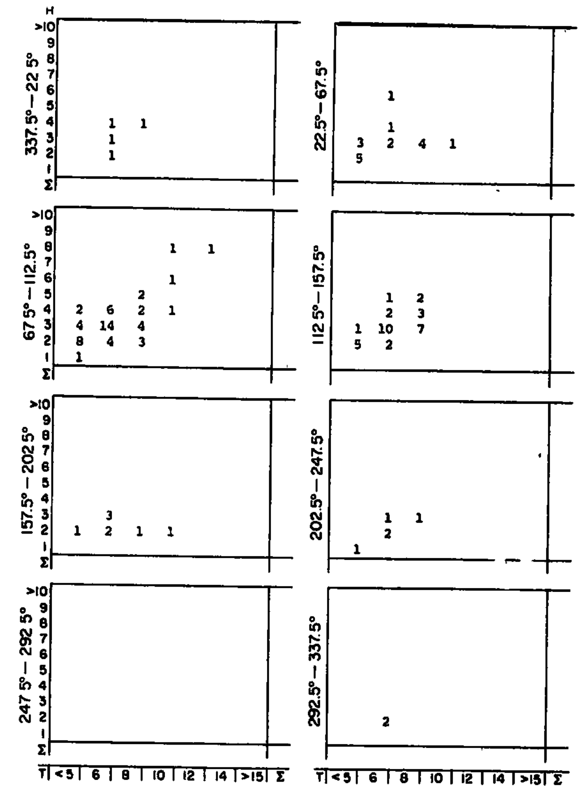

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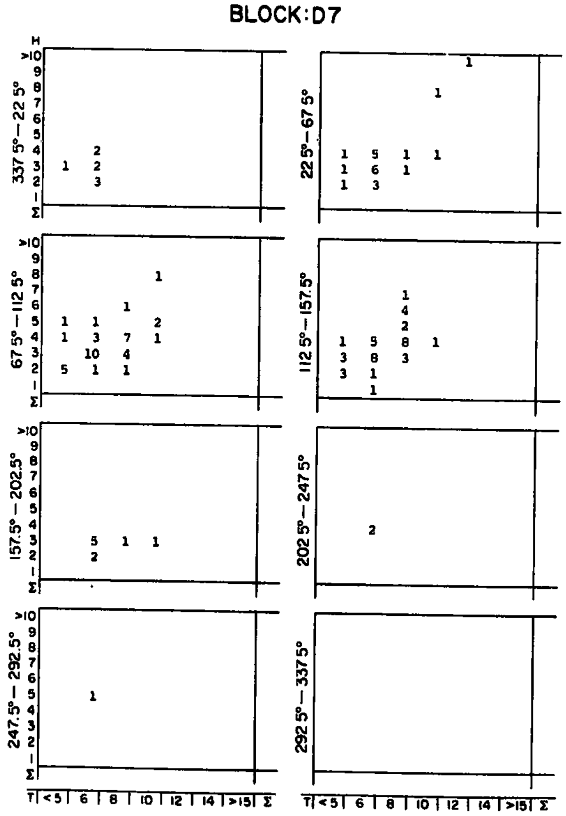

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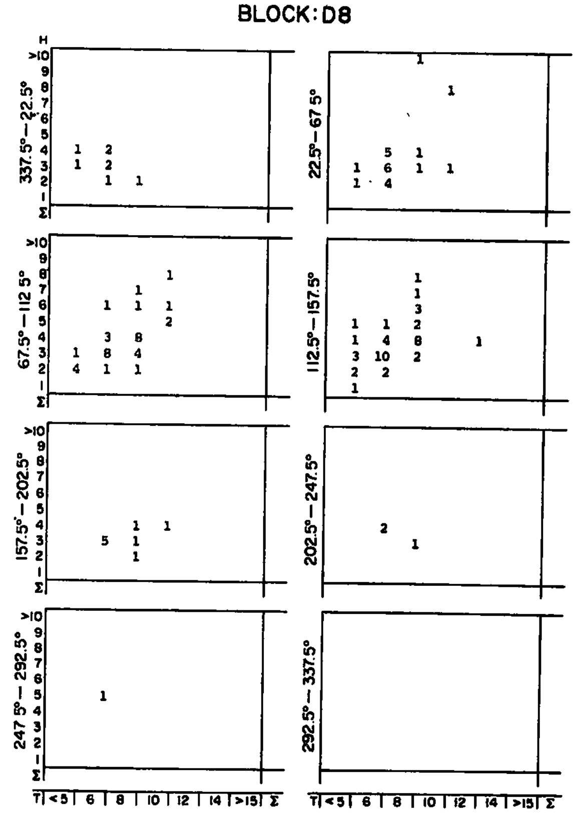

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NOTES:

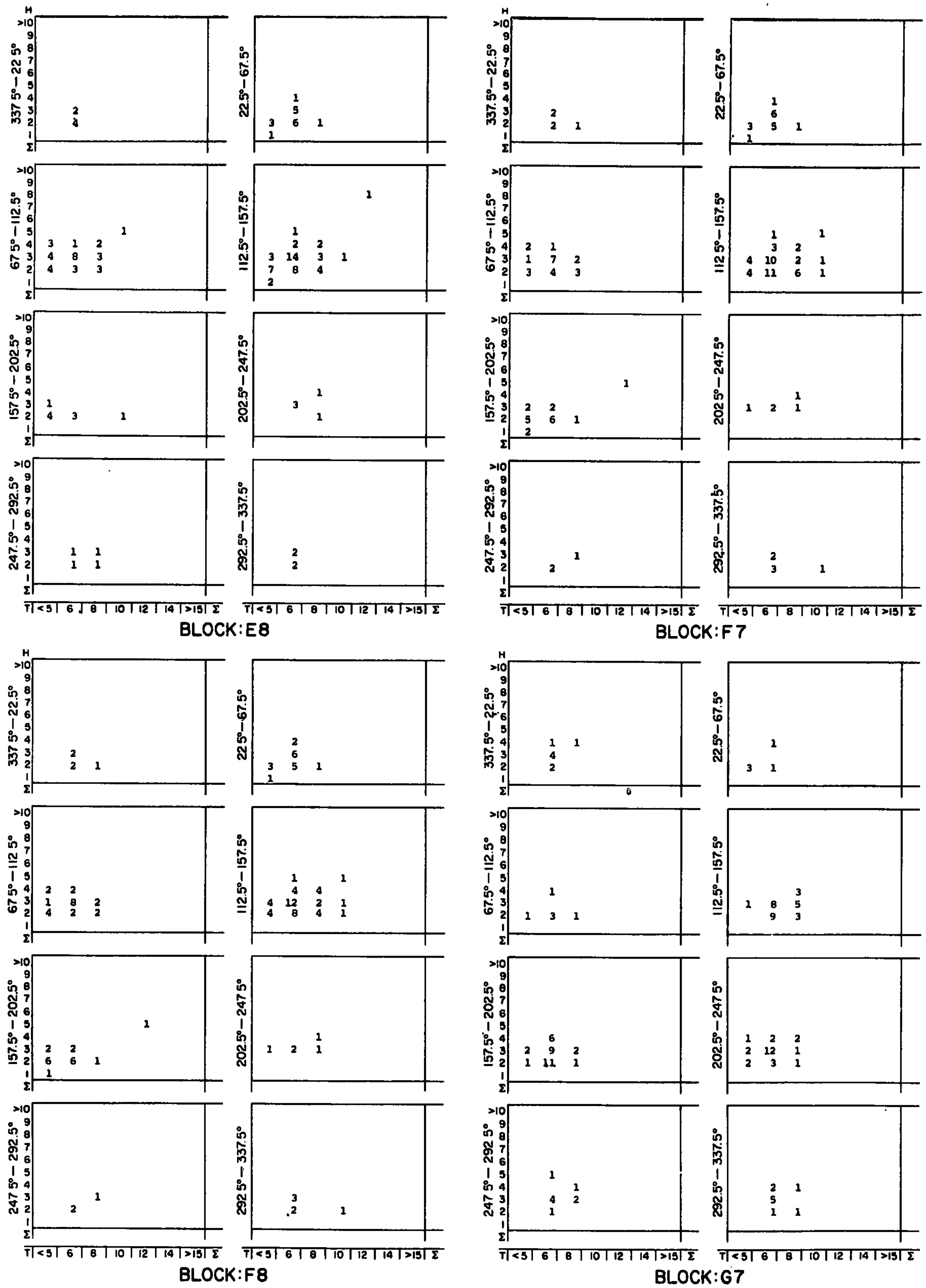
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

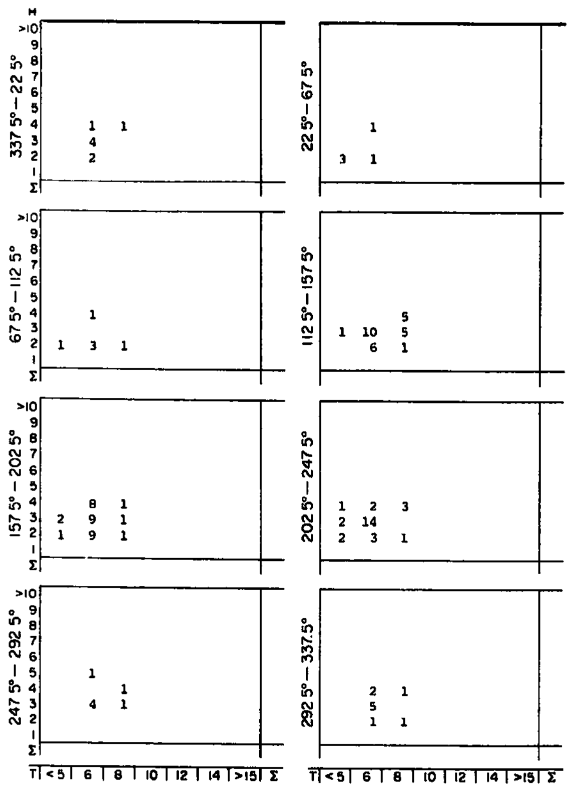
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 13d: Directional Wave Statistics for January



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 13e: Directional Wave Statistics for January



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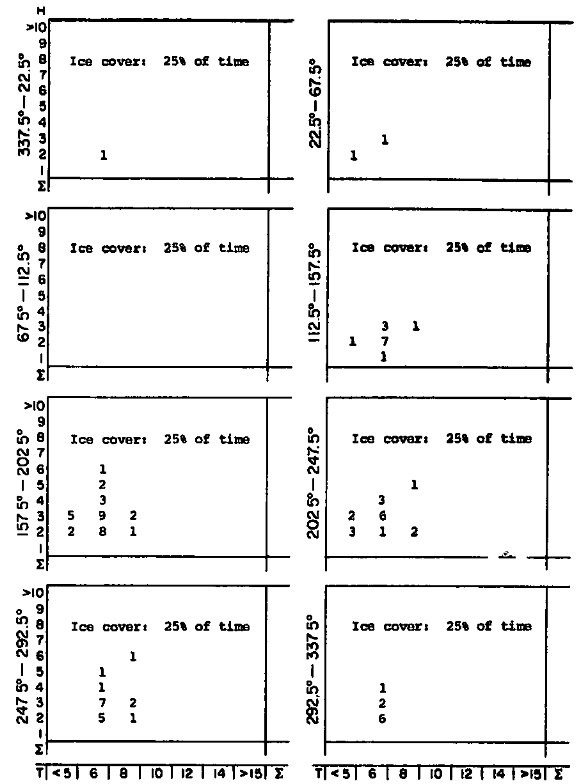

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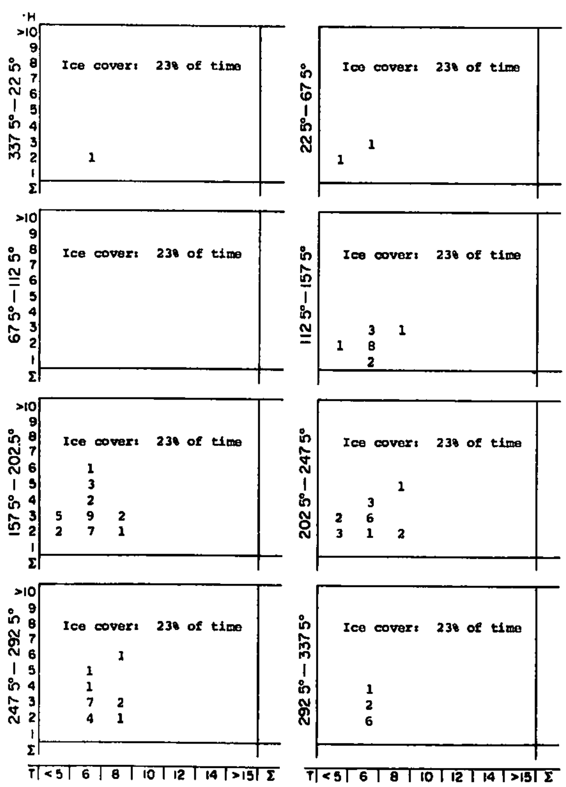

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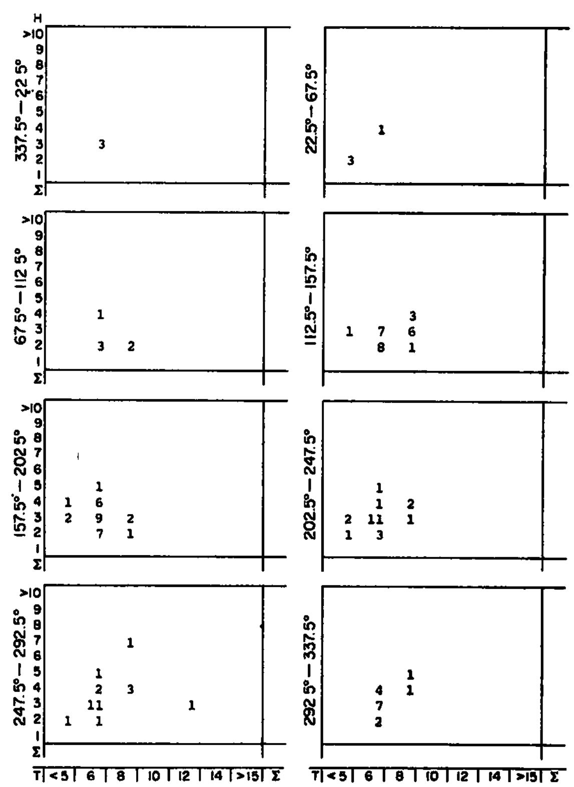
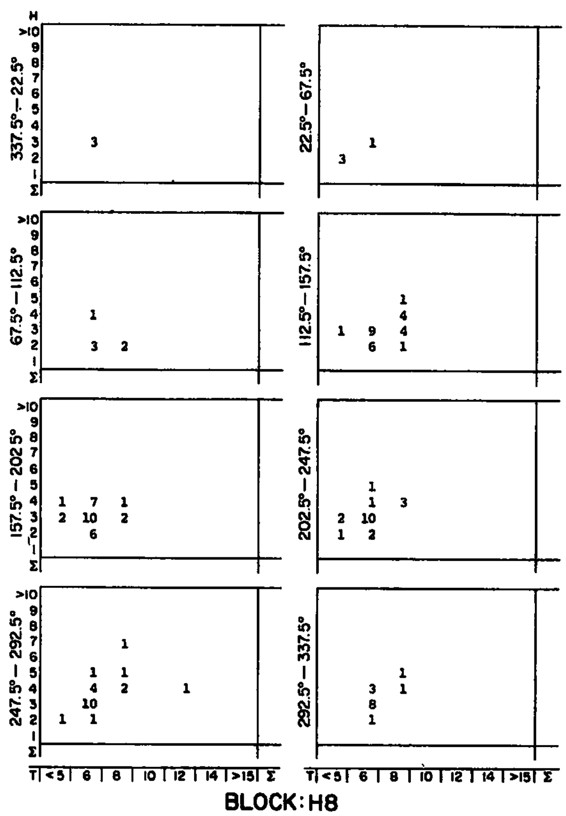


BLOCK: H7

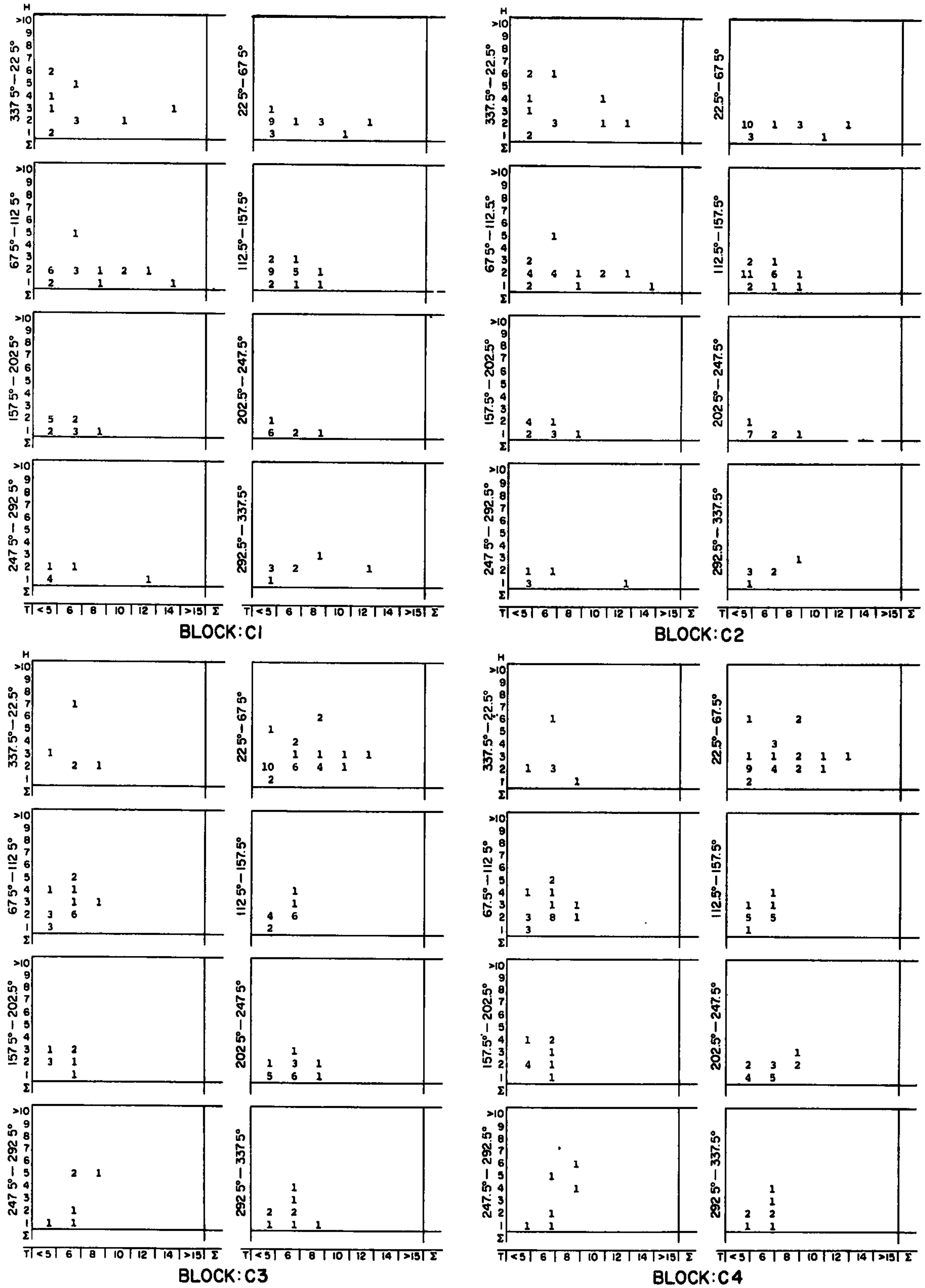
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 13f: Directional Wave Statistics for January



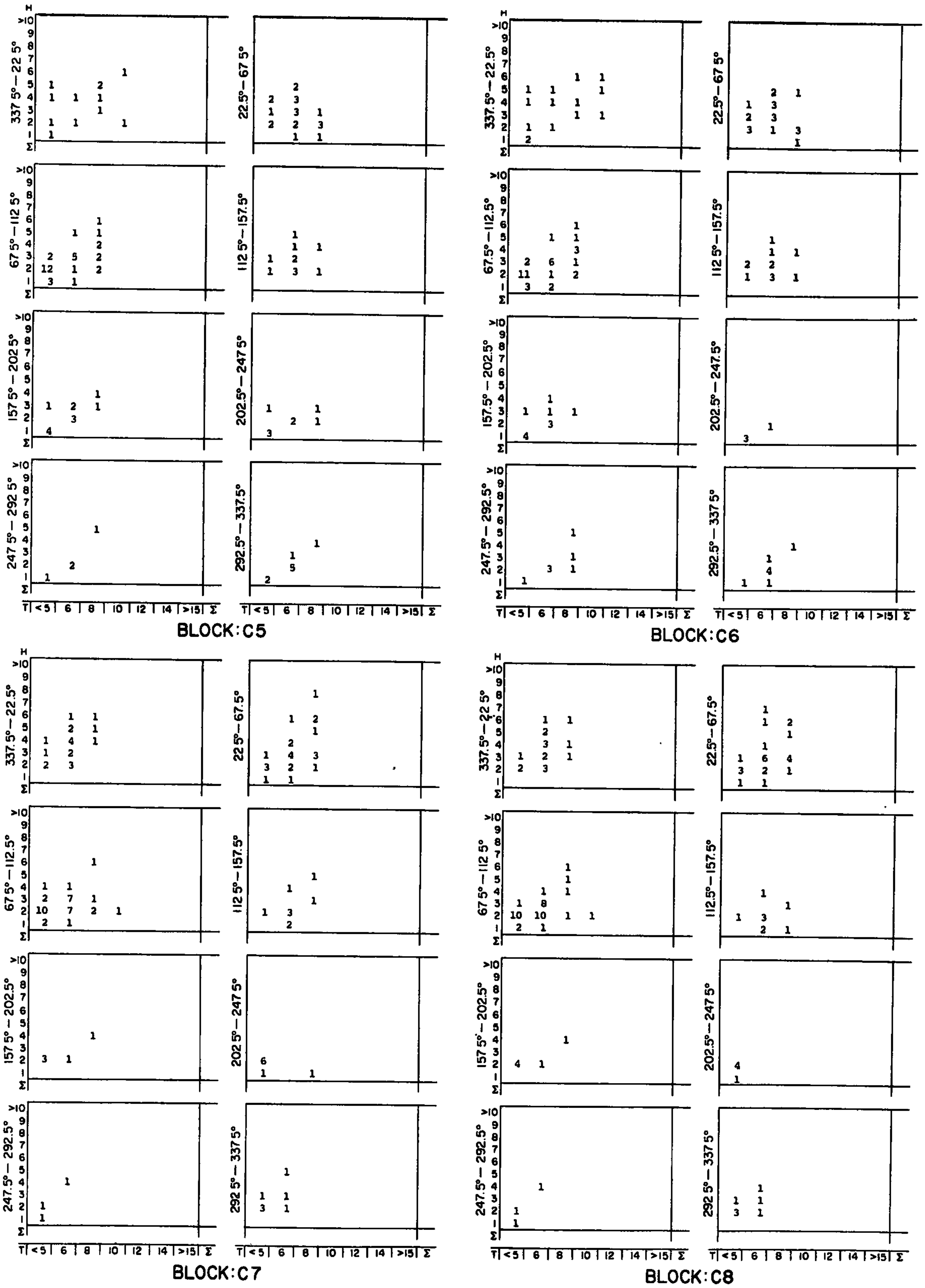
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 13g: Directional Wave Statistics for January



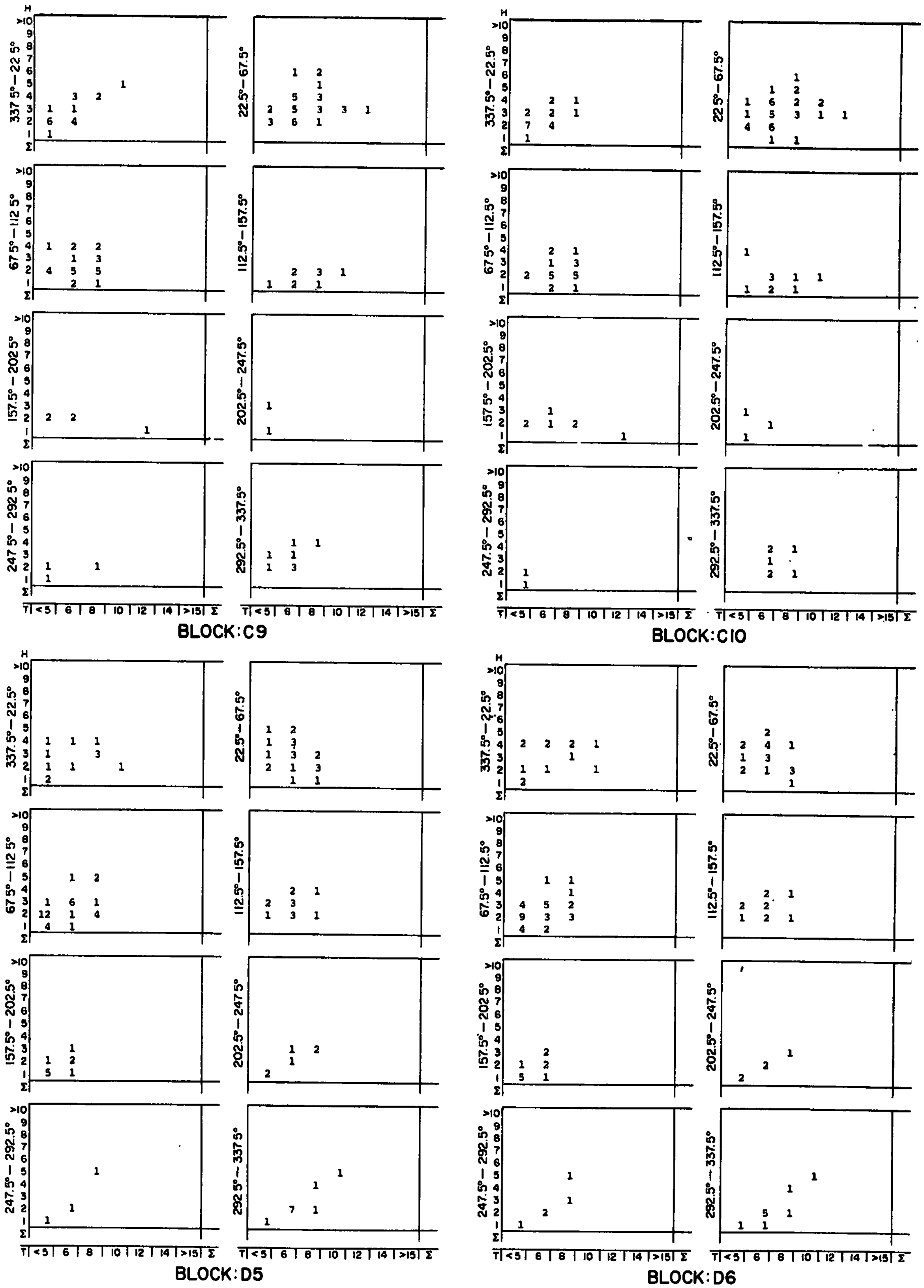
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 14a: Directional Wave Statistics for February



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 14b: Directional Wave statistics for February



NOTES:

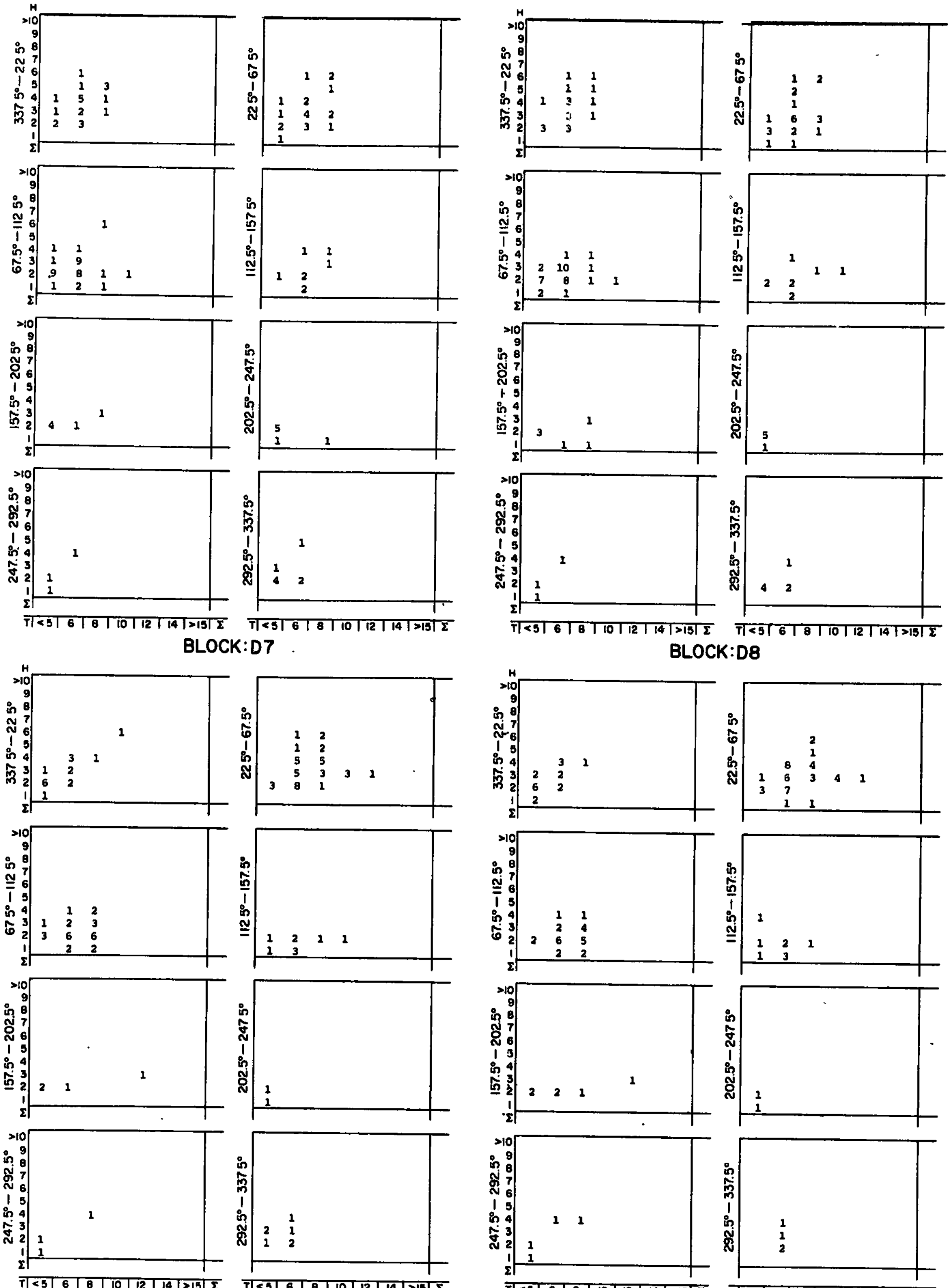
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 14c: Directional Wave Statistics for February



BLOCK: D7

BLOCK: D8

BLOCK: D9

BLOCK: D10

NOTES:

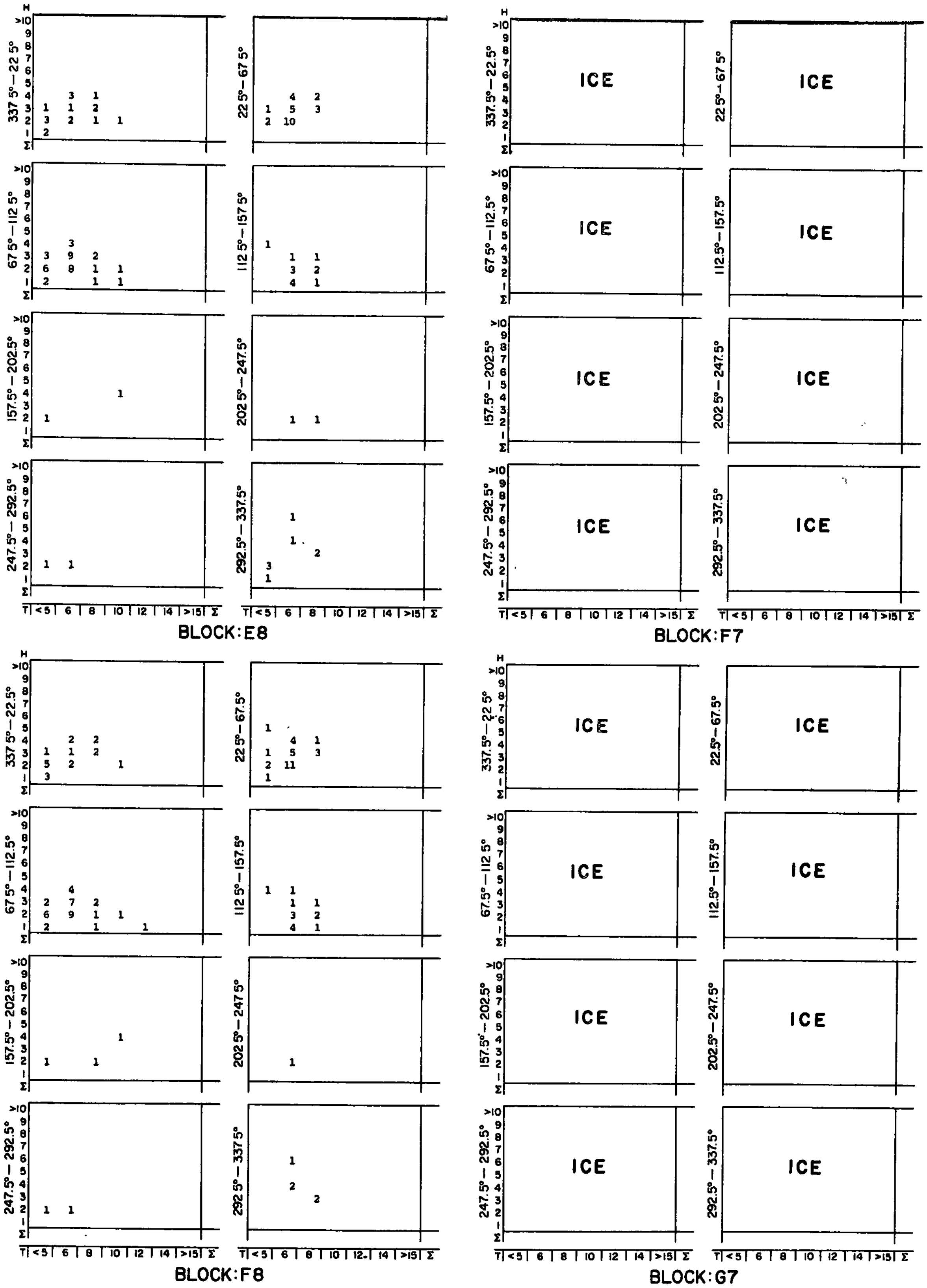
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

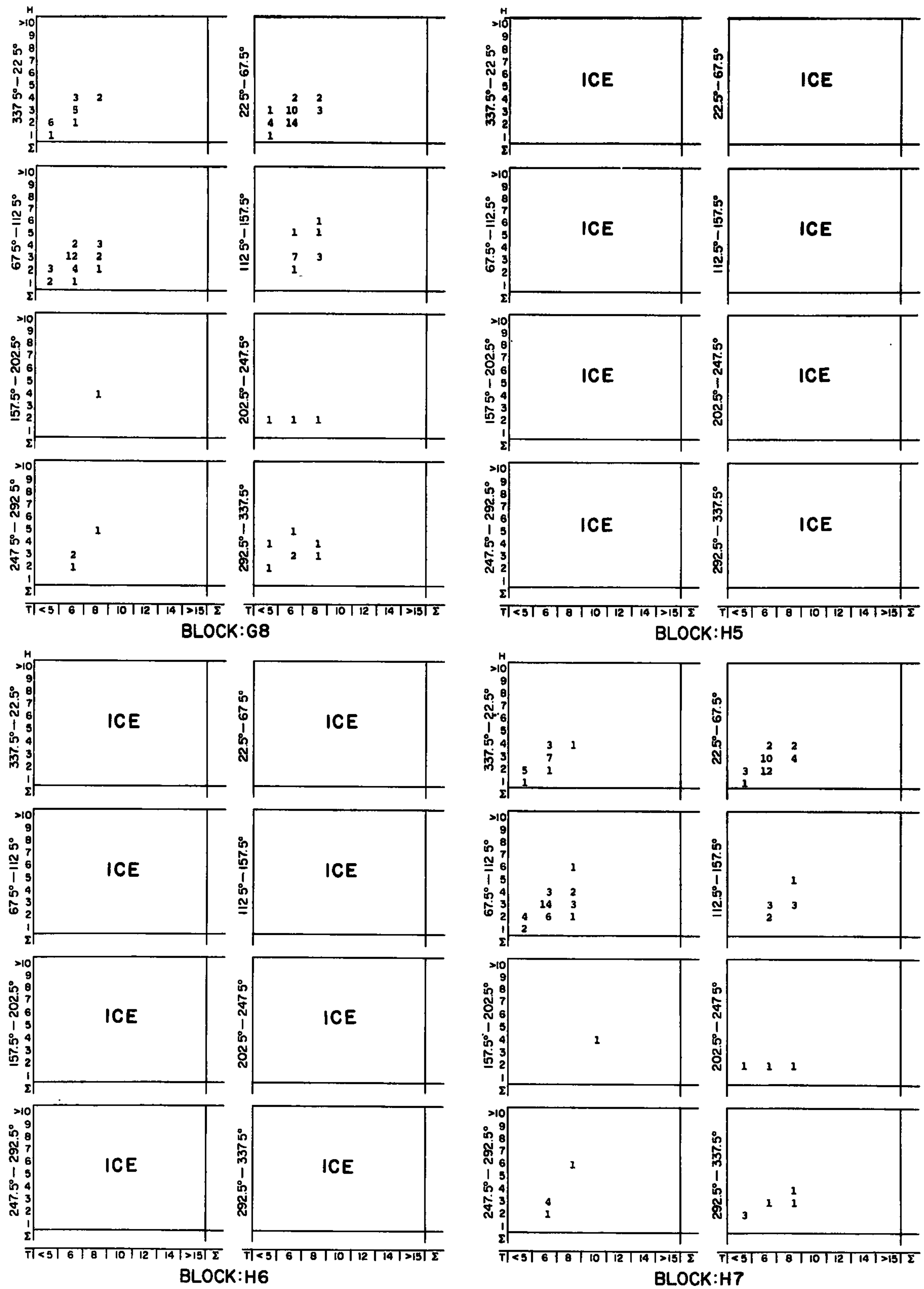
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 14d: Directional Wave Statistics for February



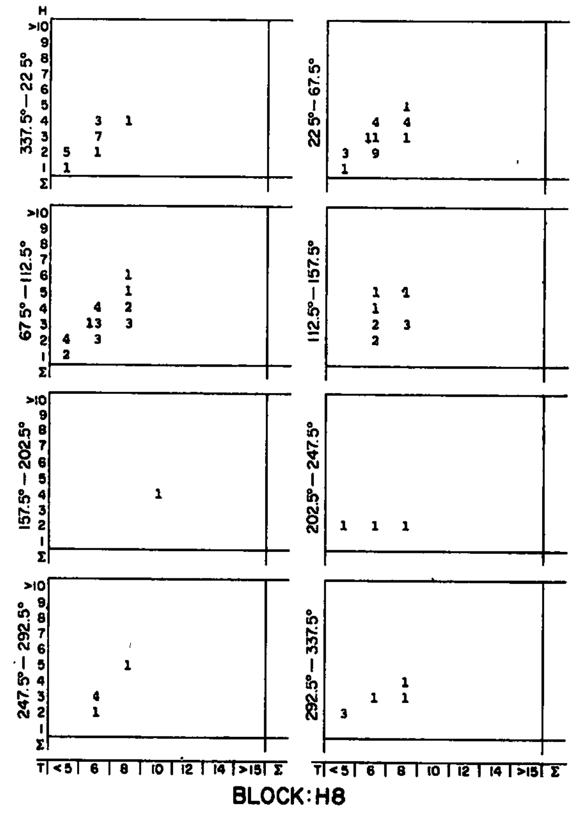
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 14e: Directional Wave Statistics for February



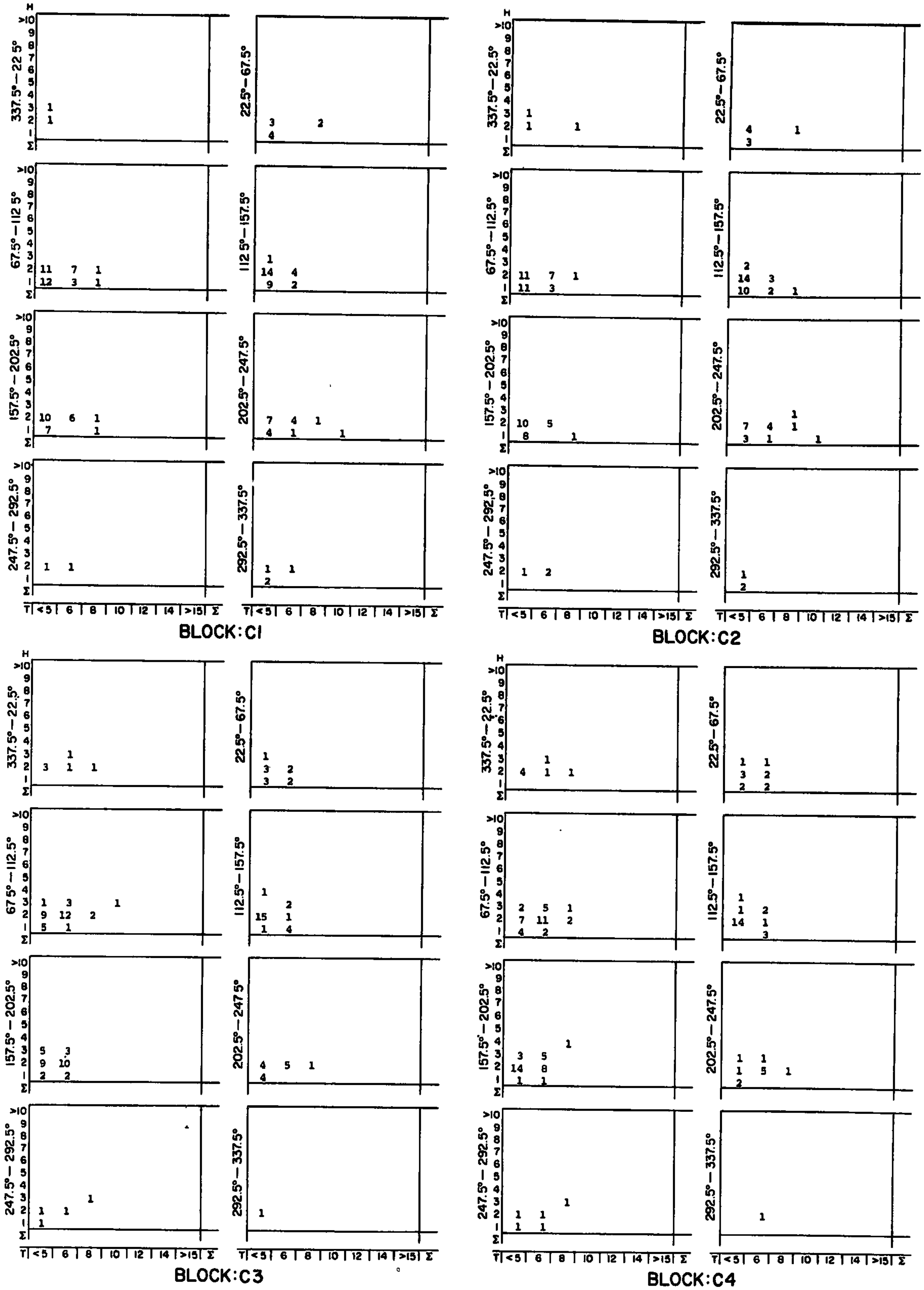
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 14f: Directional Wave Statistics for February



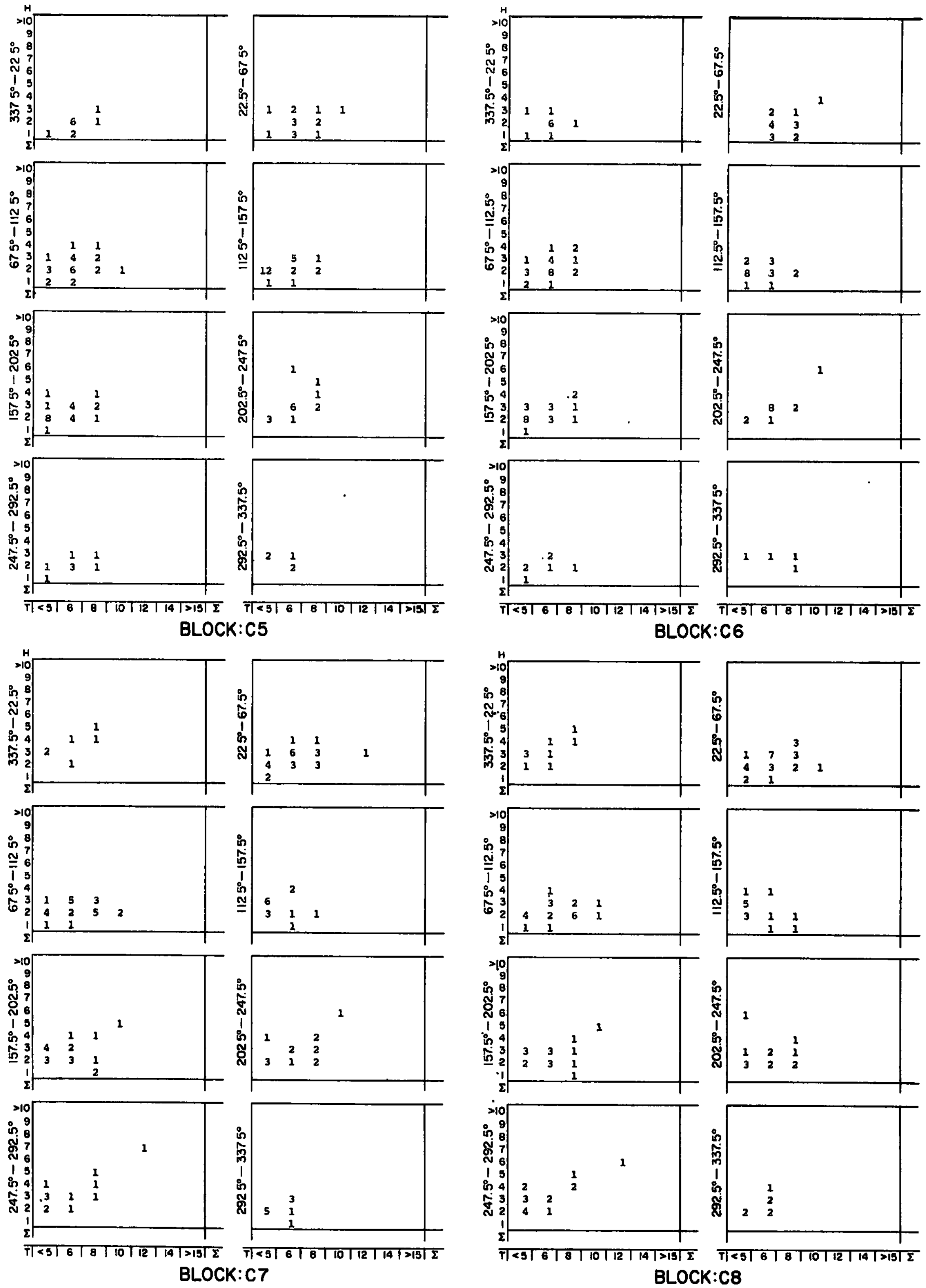
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 14g: Directional Wave Statistics for February



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 15a: Directional Wave Statistics for March



NOTES:

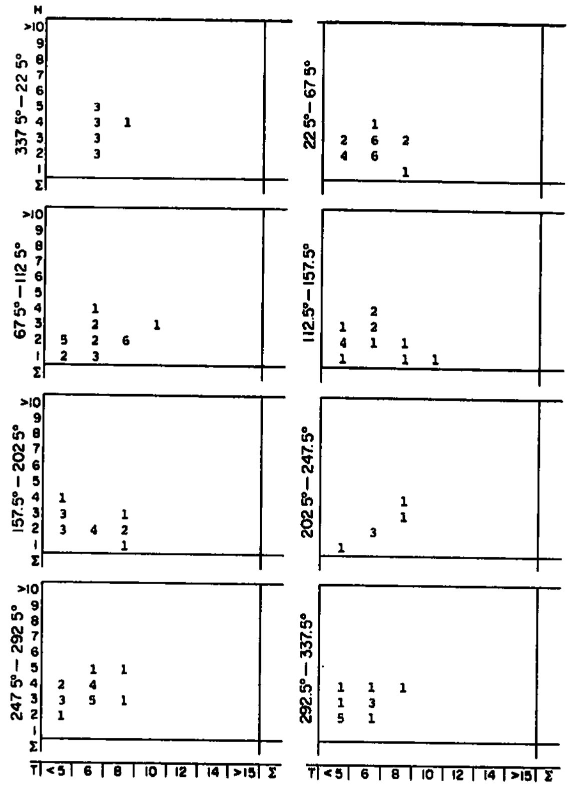
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 15b: Directional Wave Statistics for March



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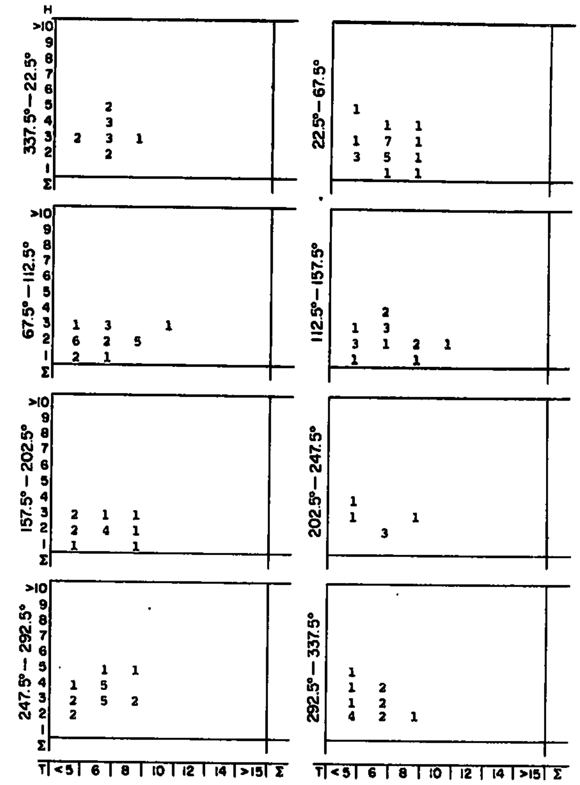

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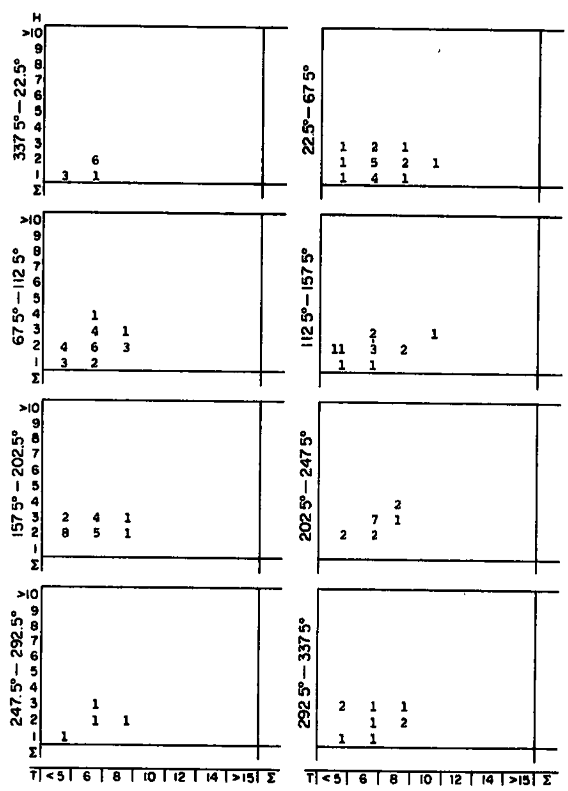

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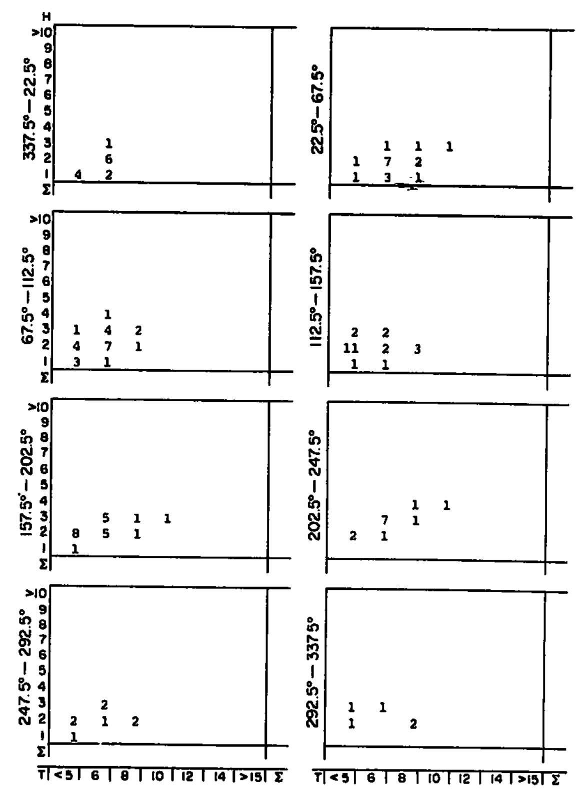
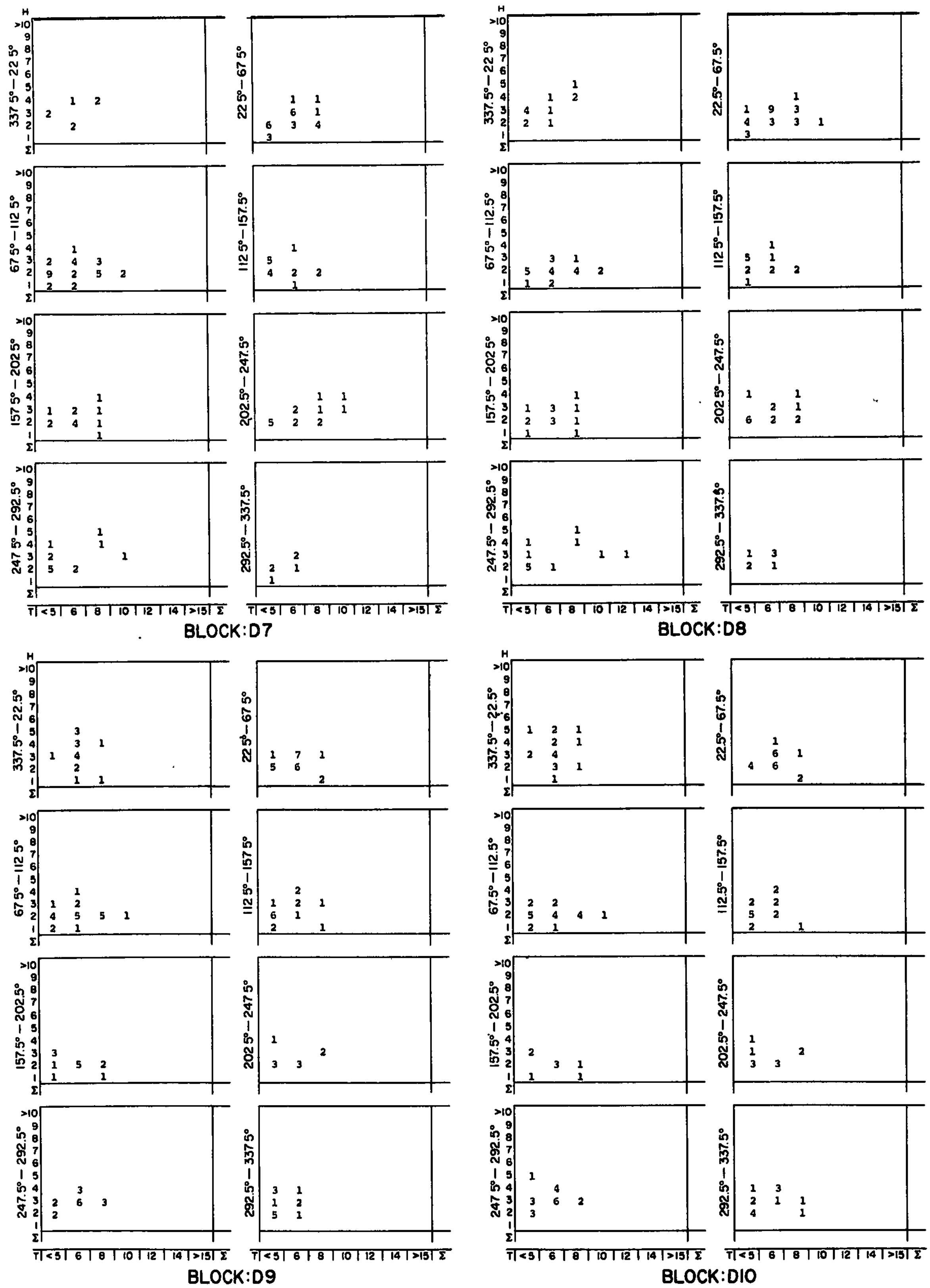


BLOCK: D6

NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 15c: Directional Wave Statistics for March



NOTES:

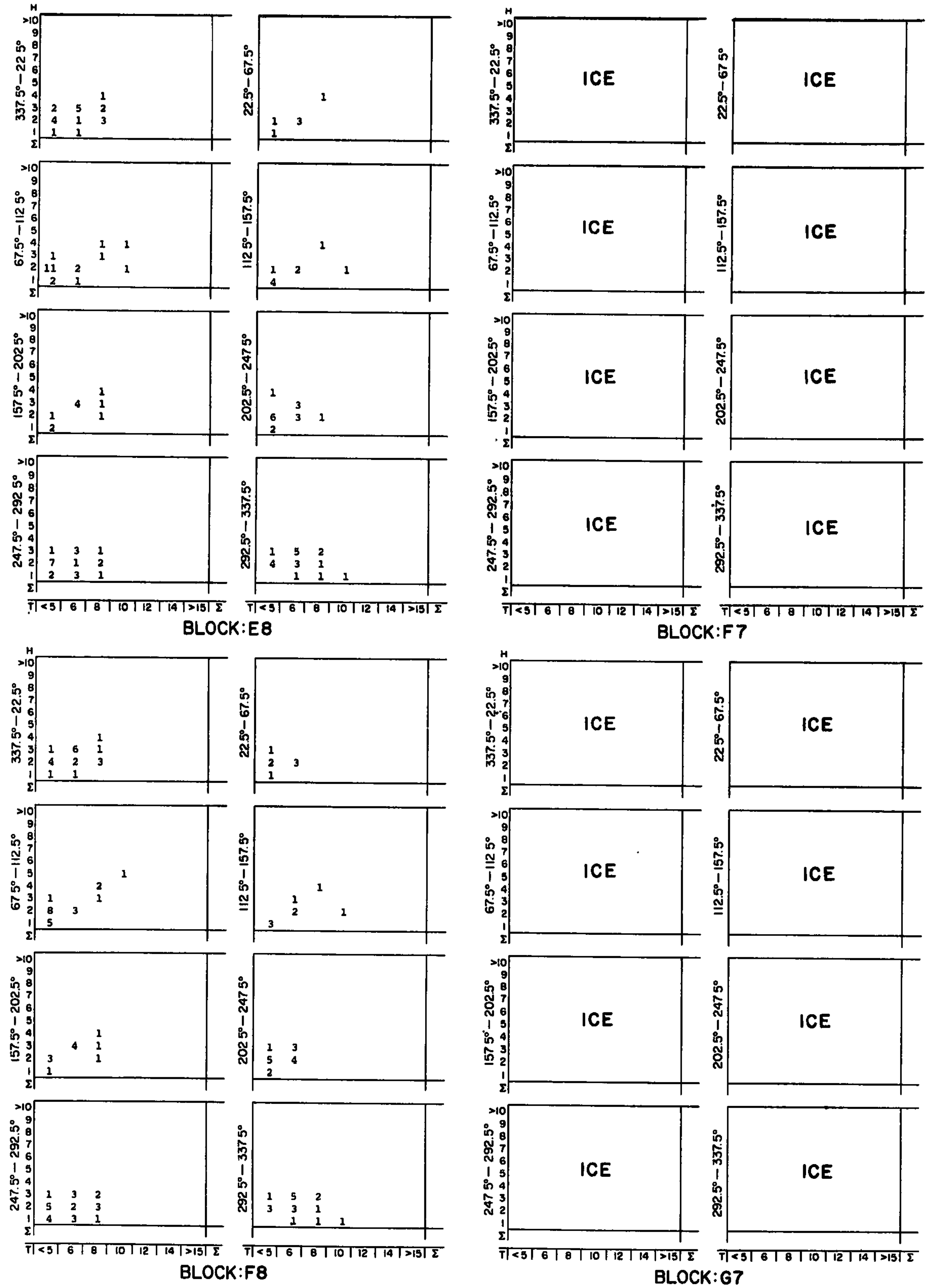
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

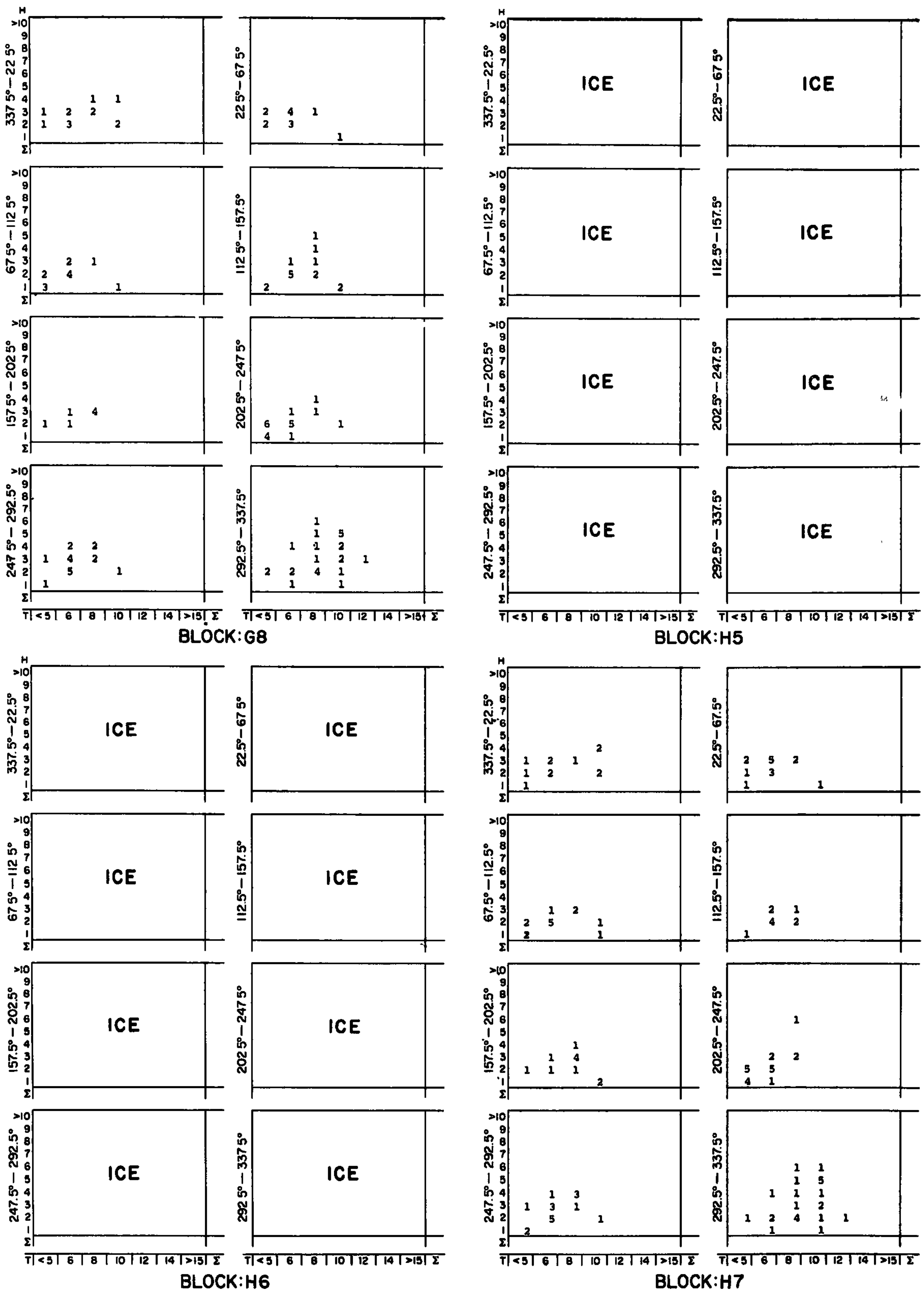
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 15d: Directional Wave Statistics for March



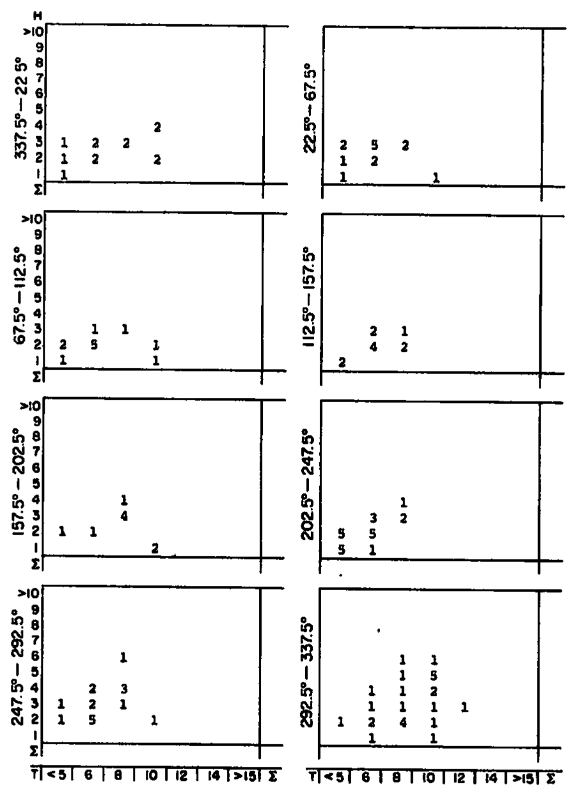
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 15e: Directional Wave Statistics for March



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

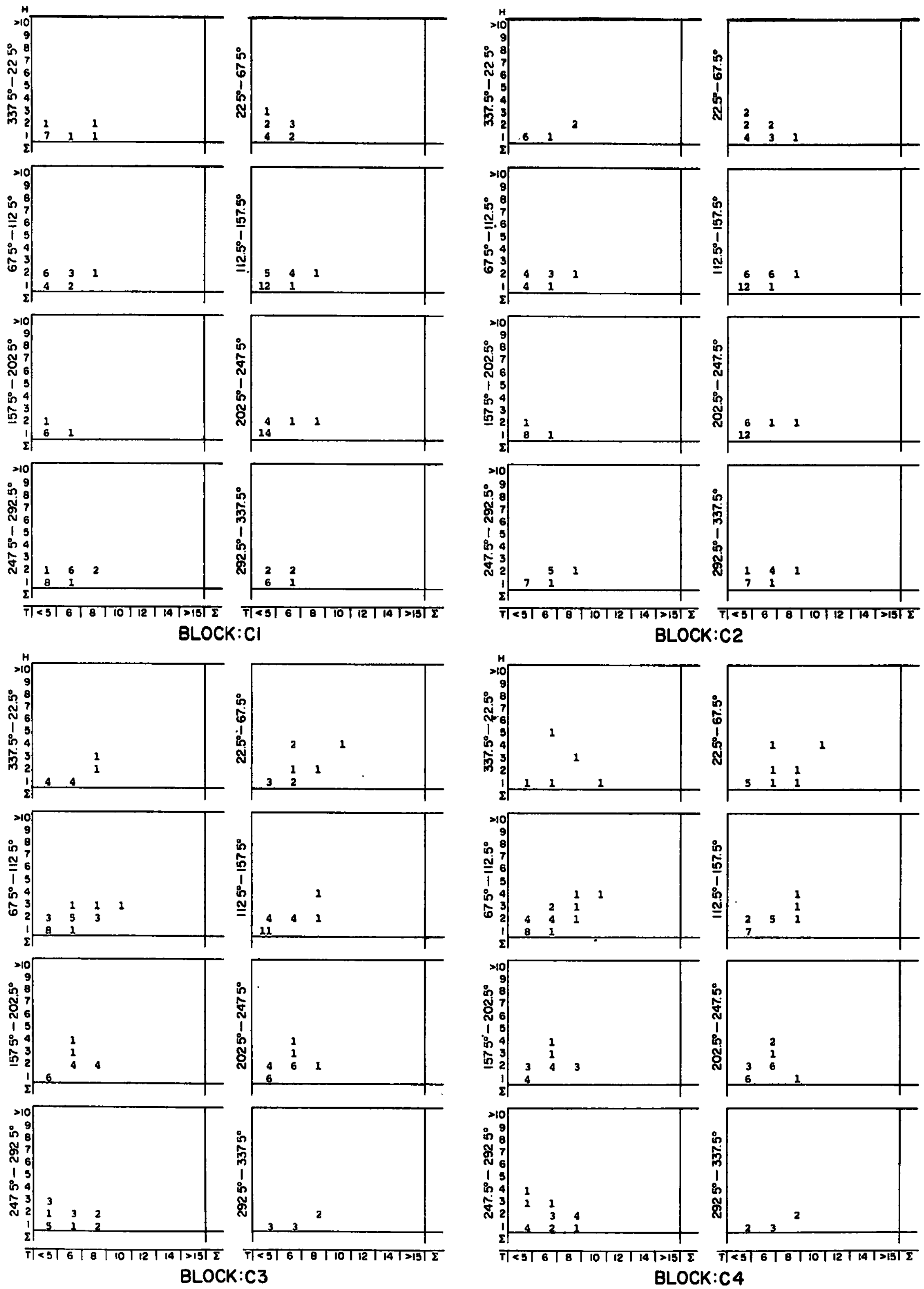
APPENDIX FIGURE 15f: Directional Wave Statistics for March



BLOCK:H8

NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 15g: Directional Wave Statistics for March



NOTES:

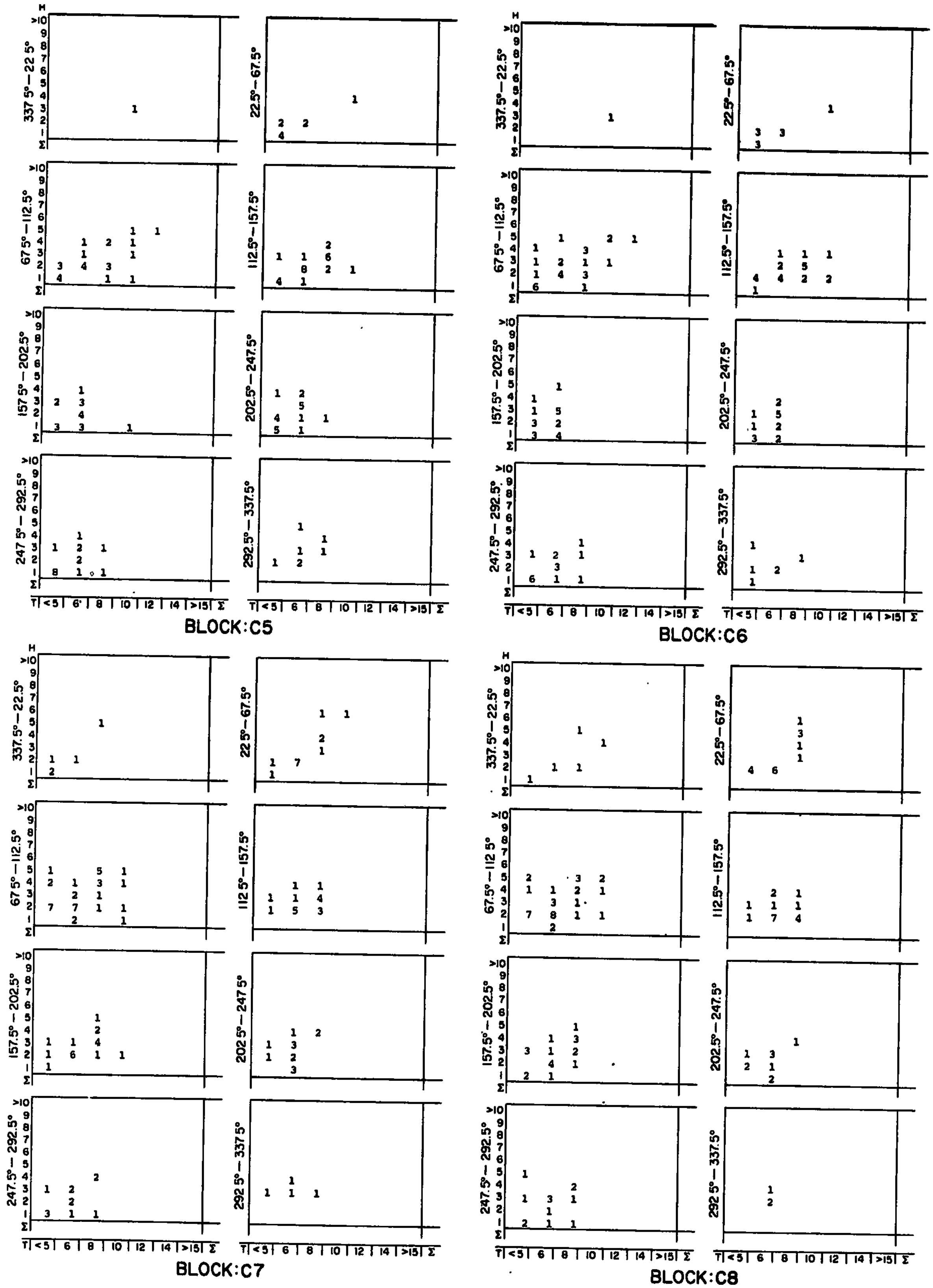
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES

T — WAVE PERIOD IN SECONDS.

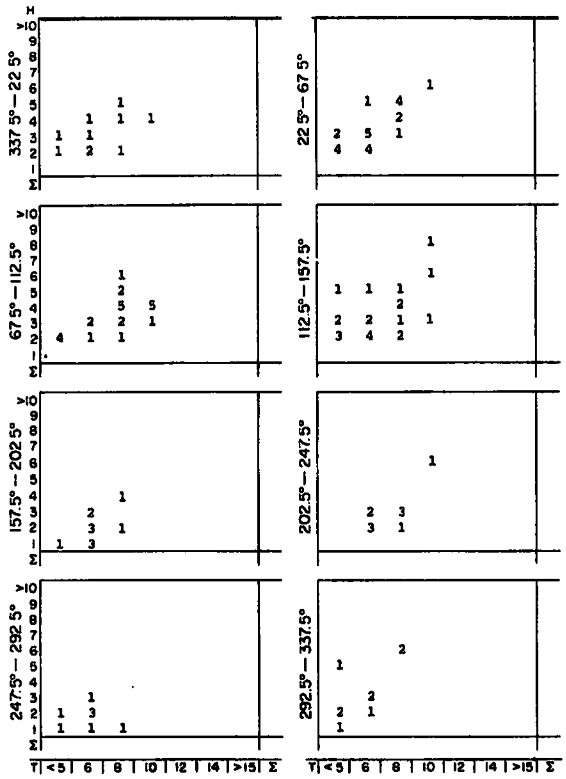
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 16a: Directional Wave Statistics for April



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE—IN DEGREES
H— WAVE HEIGHT IN METRES.
T— WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 16b: Directional Wave Statistics for April



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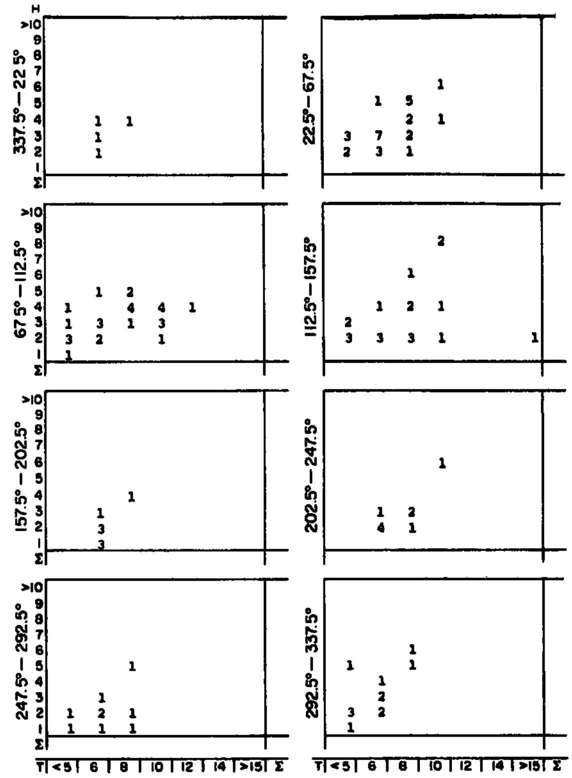

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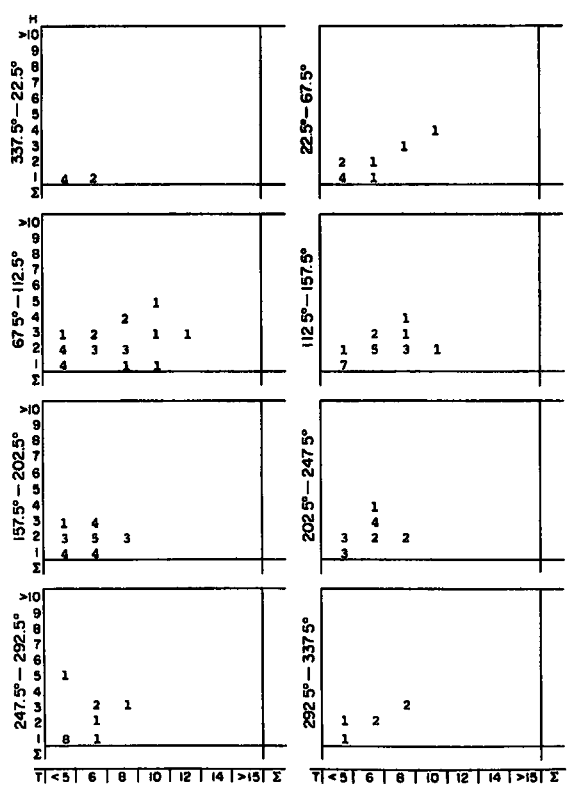

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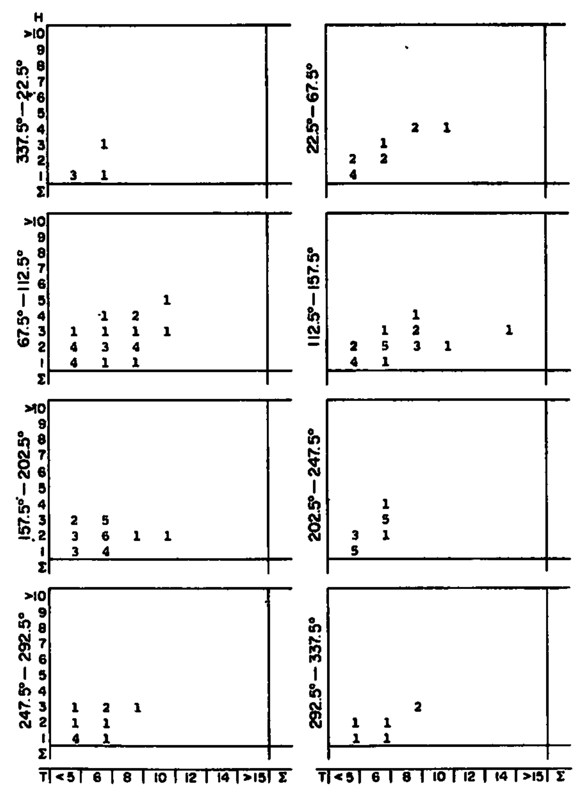
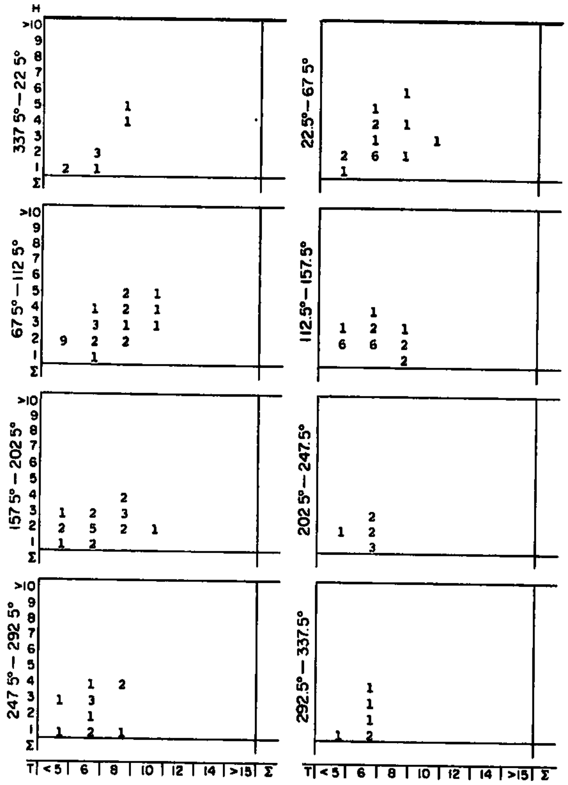


BLOCK: D6

NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 16c: Directional Wave Statistics for April



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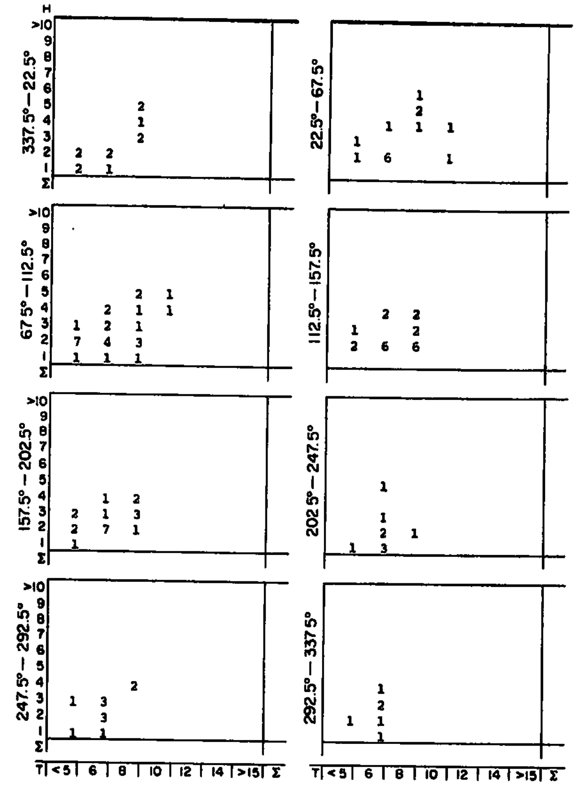

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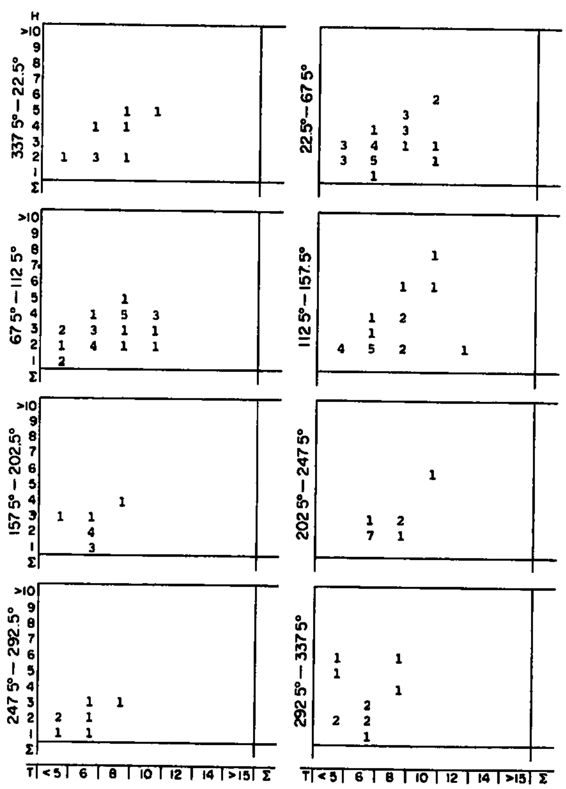

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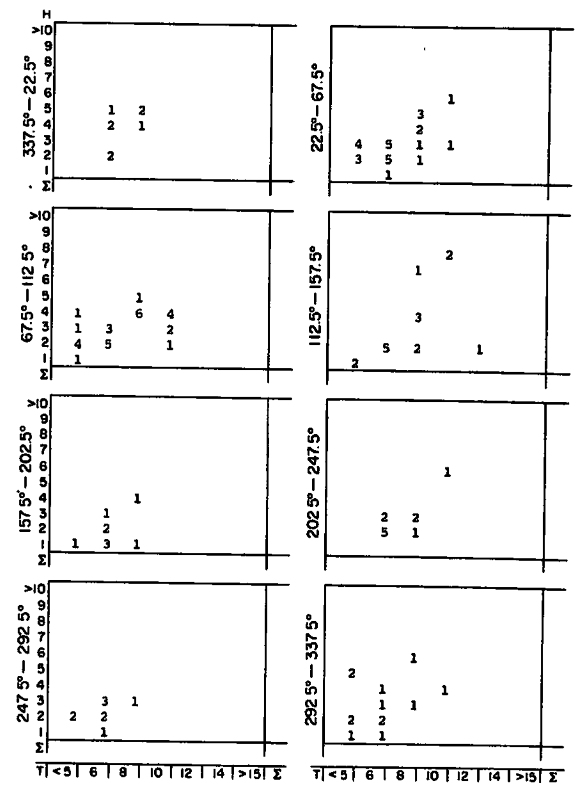

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NOTES:

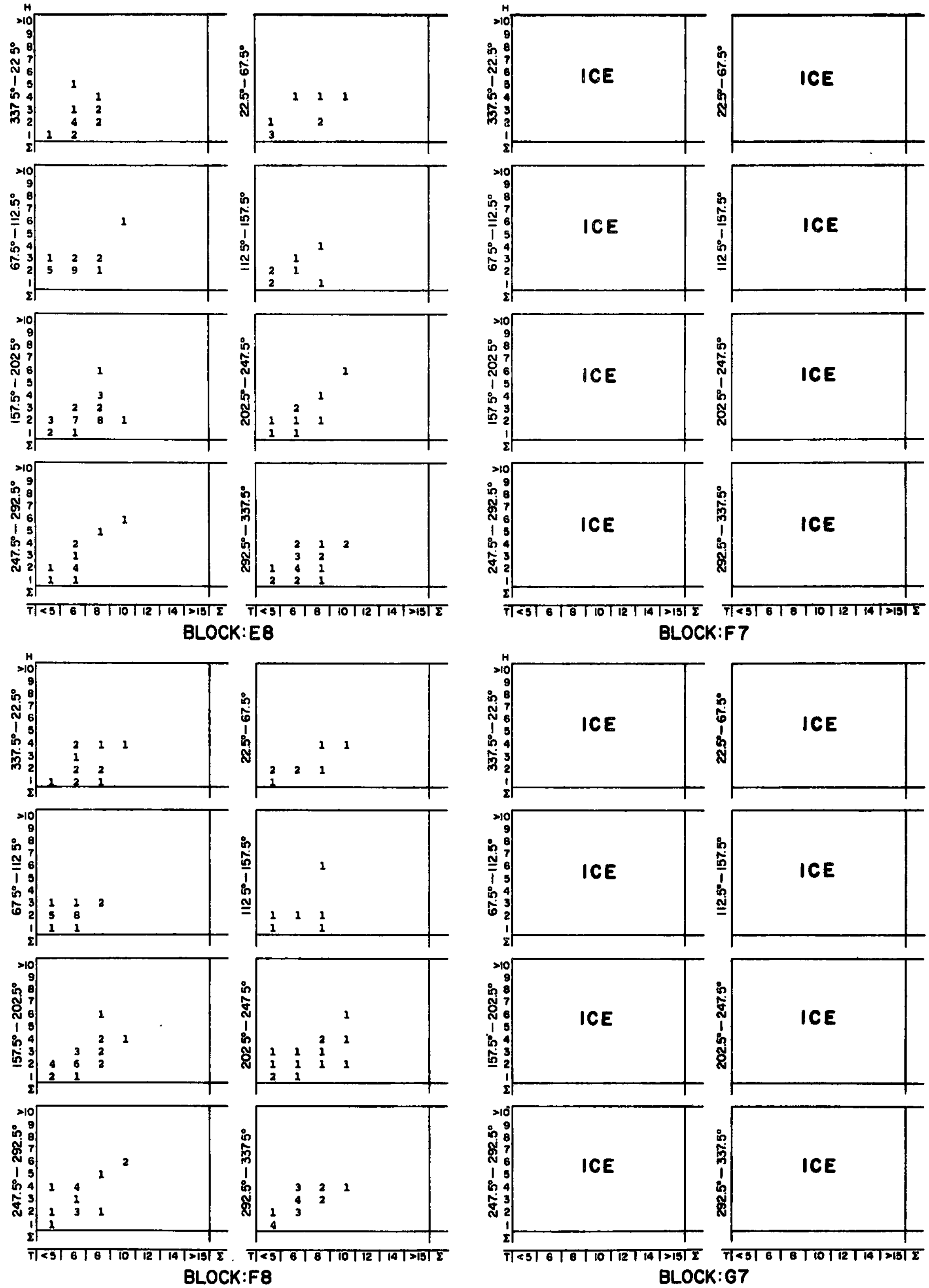
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

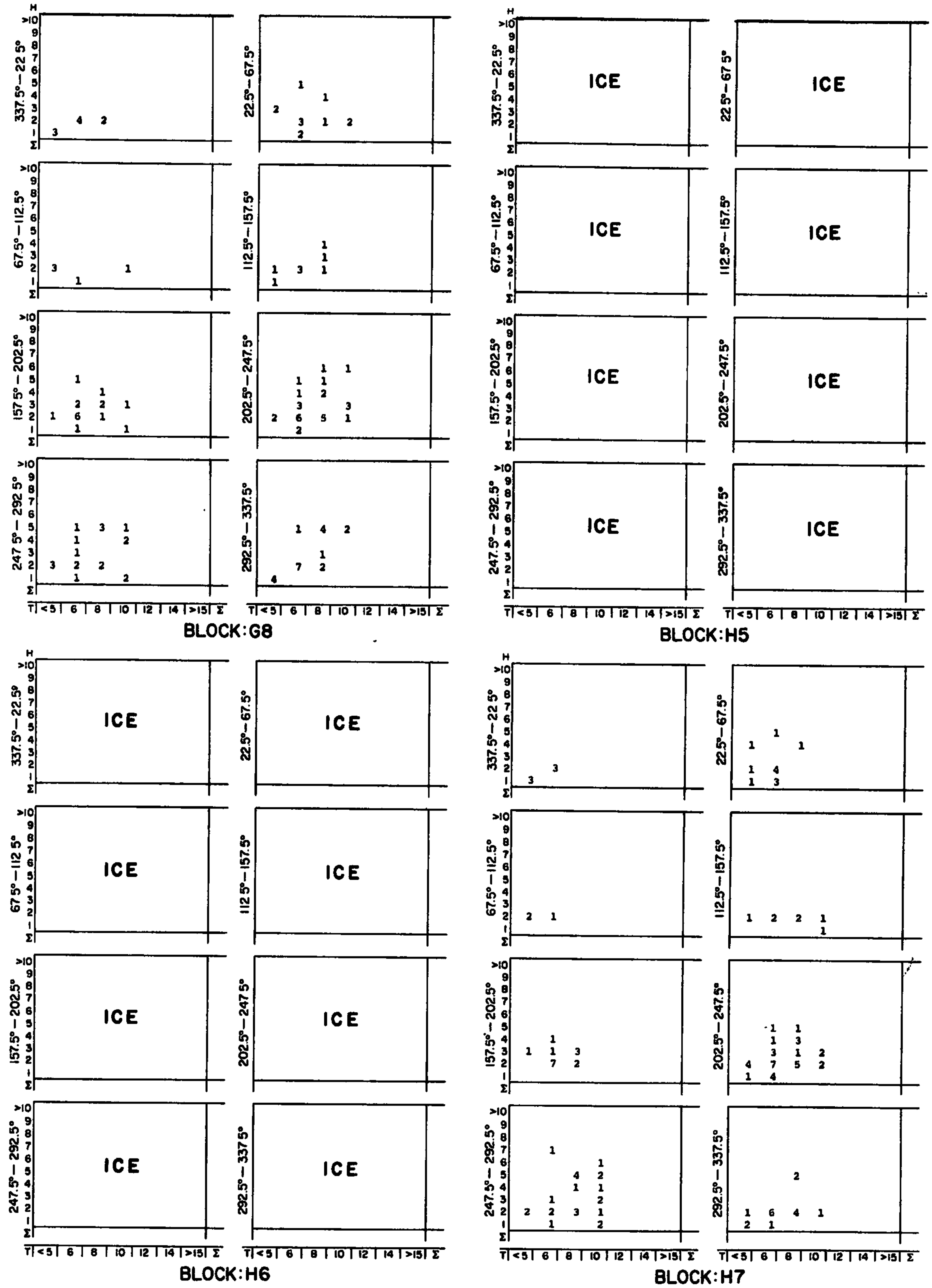
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 16d: Directional Wave Statistics for April



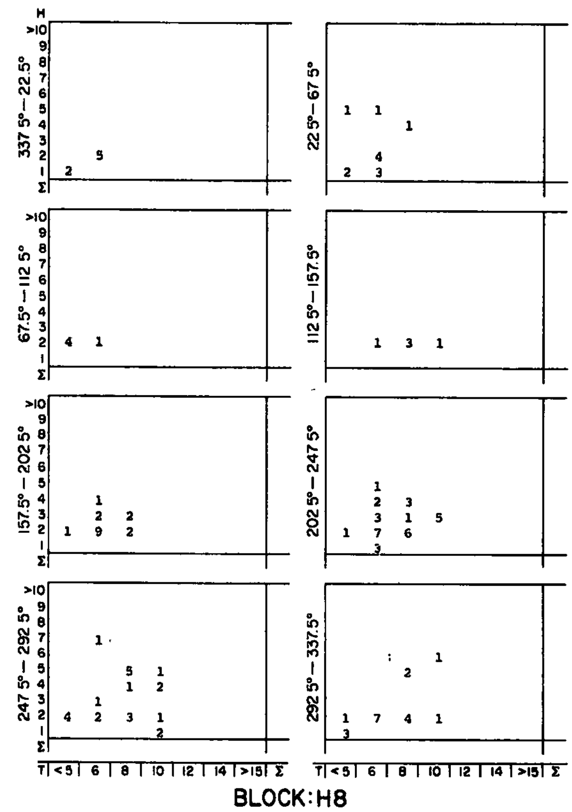
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 16e: Directional Wave Statistics for April



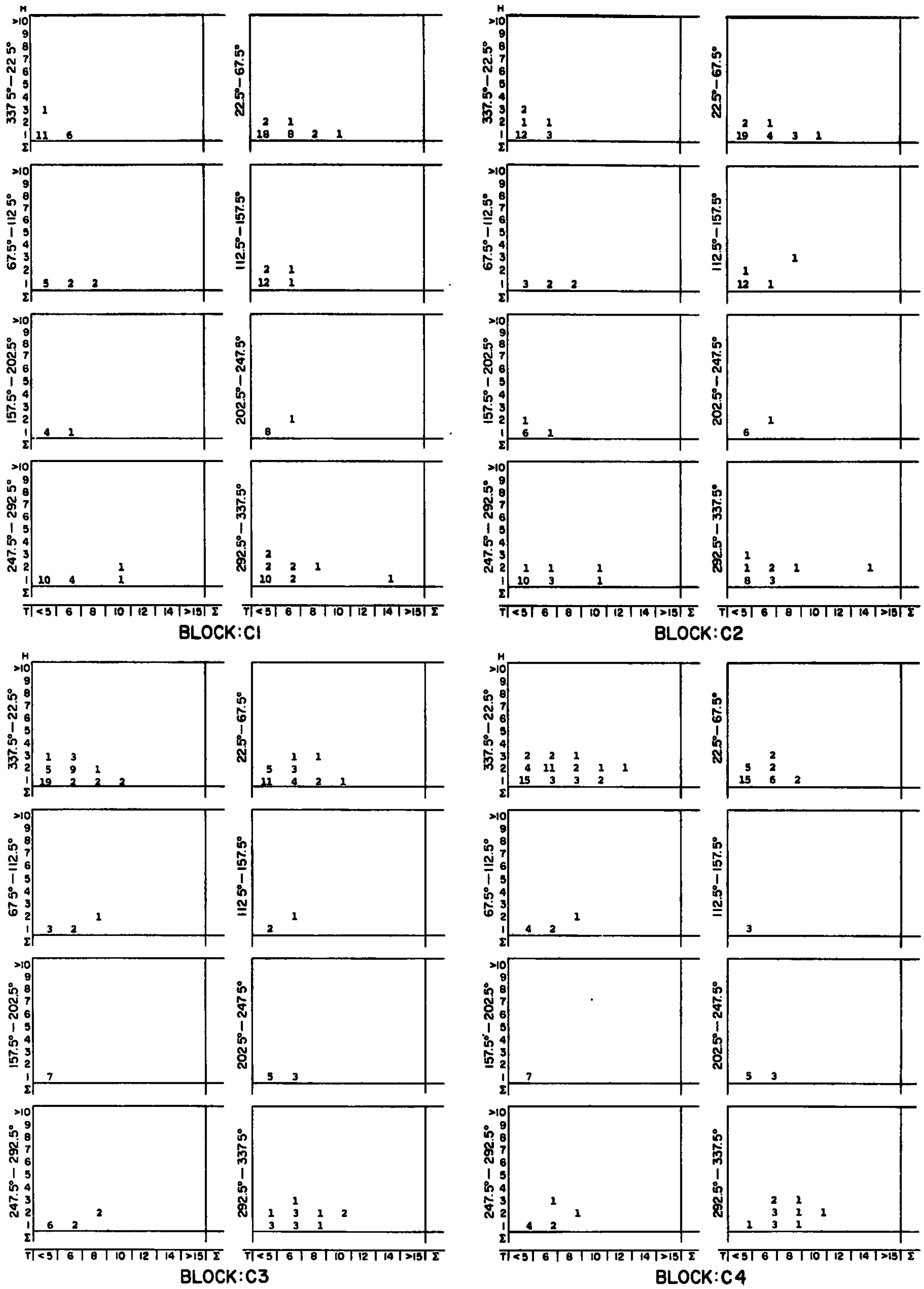
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 16f: Directional Wave Statistics for April



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 16g: Directional Wave Statistics for April



NOTES:

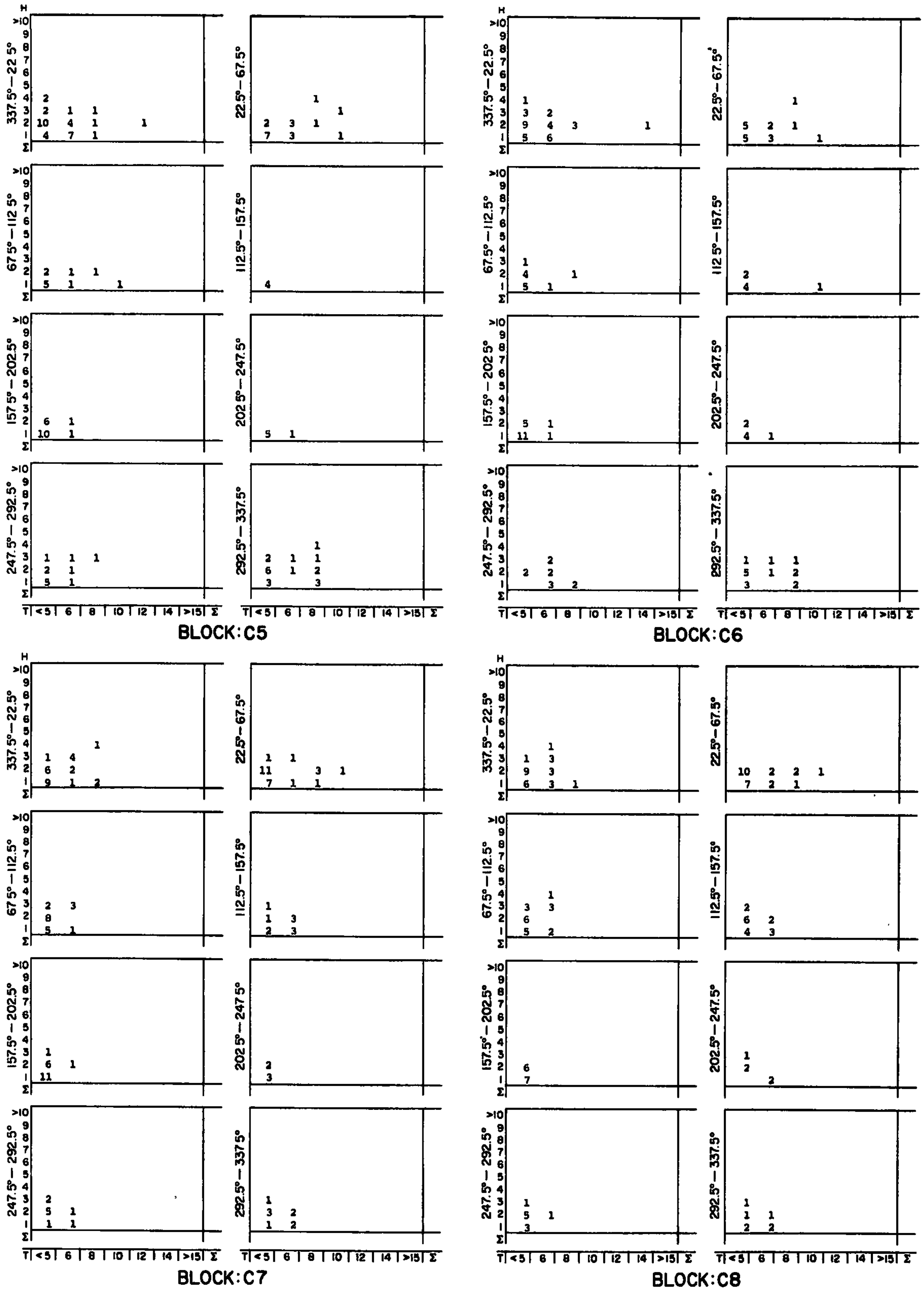
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

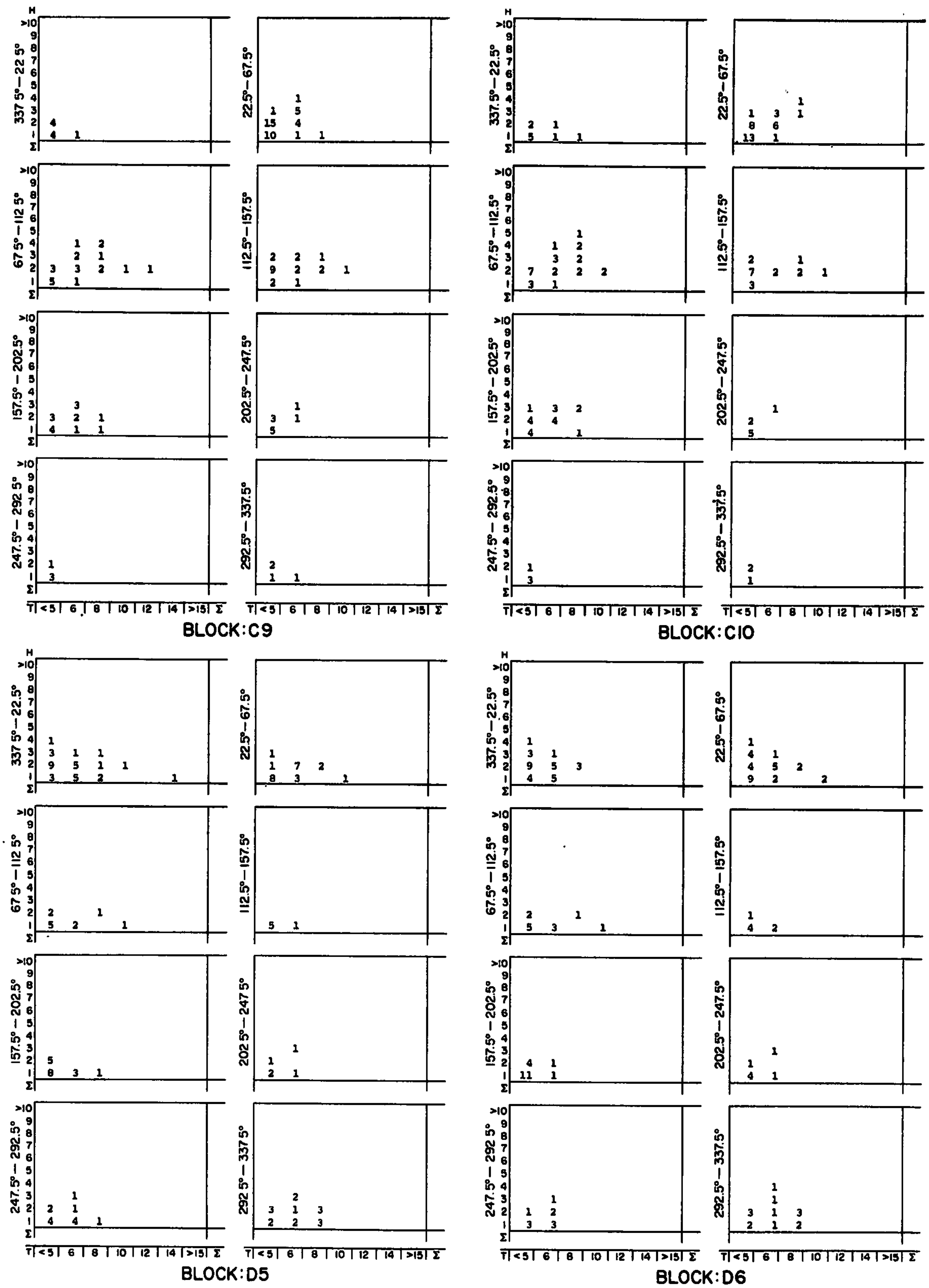
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 17a: Directional Wave Statistics for May



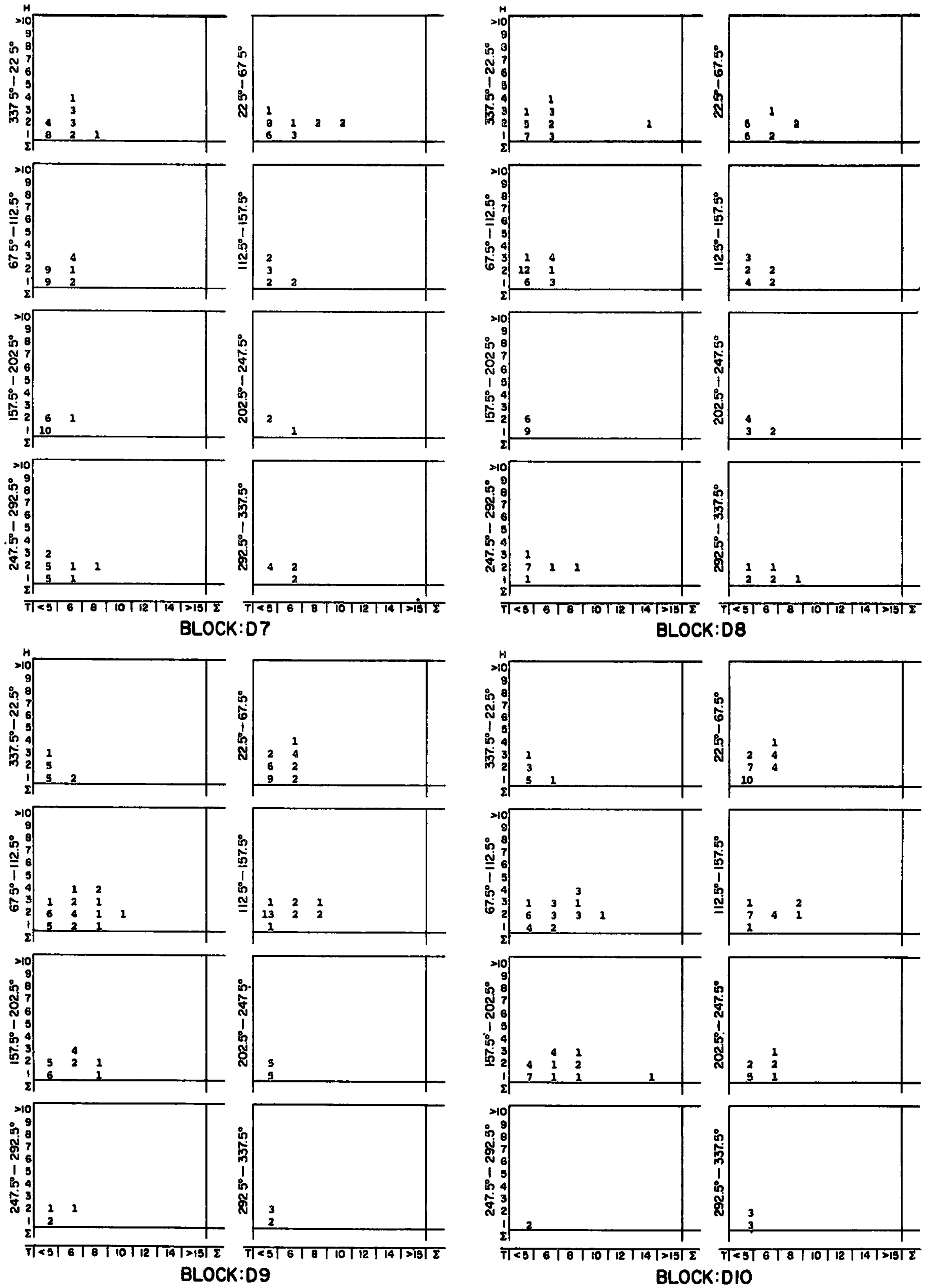
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 17b: Directional Wave Statistics for May



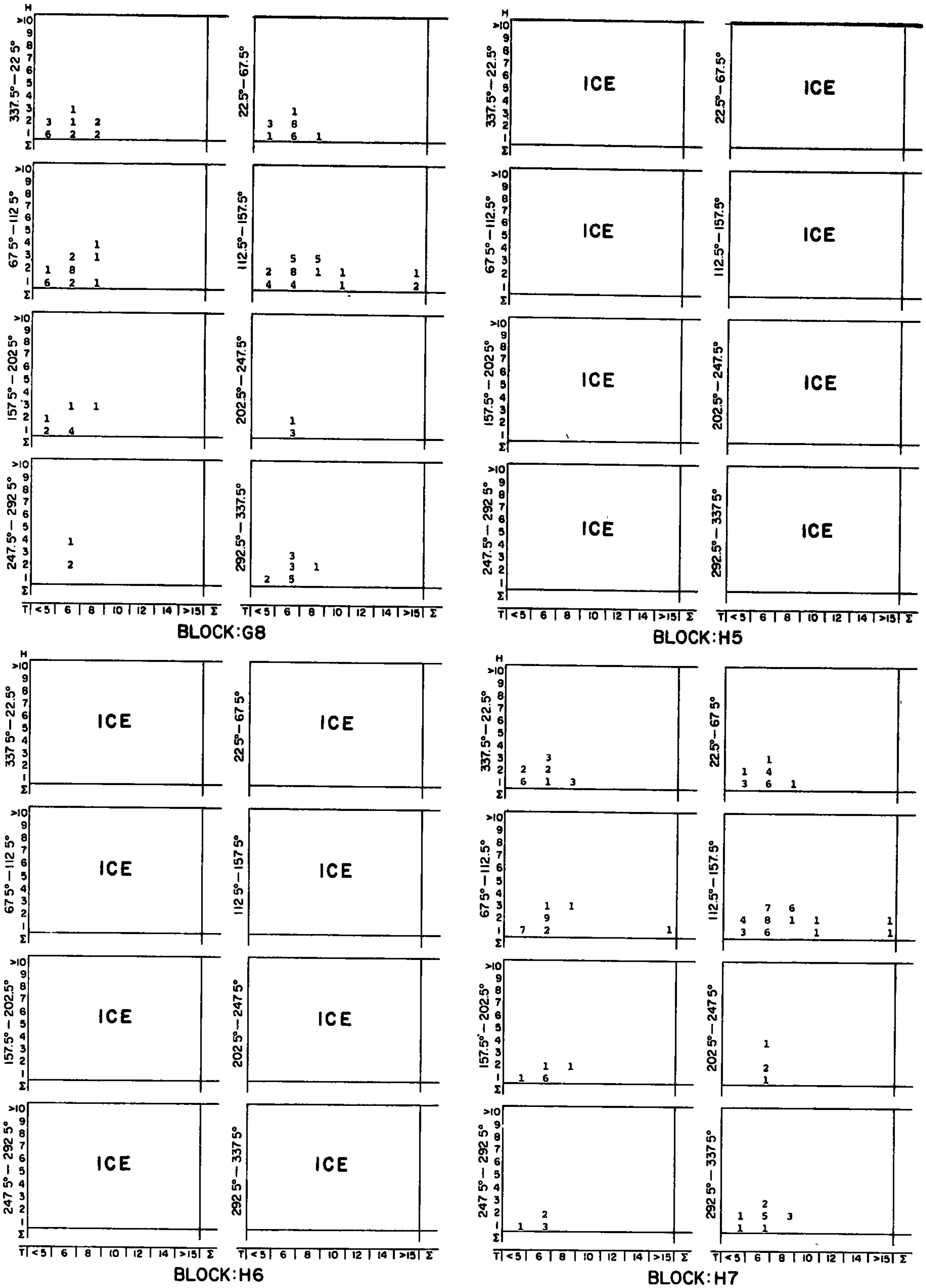
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 17c: Directional Wave Statistics for May



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 17d: Directional Wave Statistics for May



NOTES:

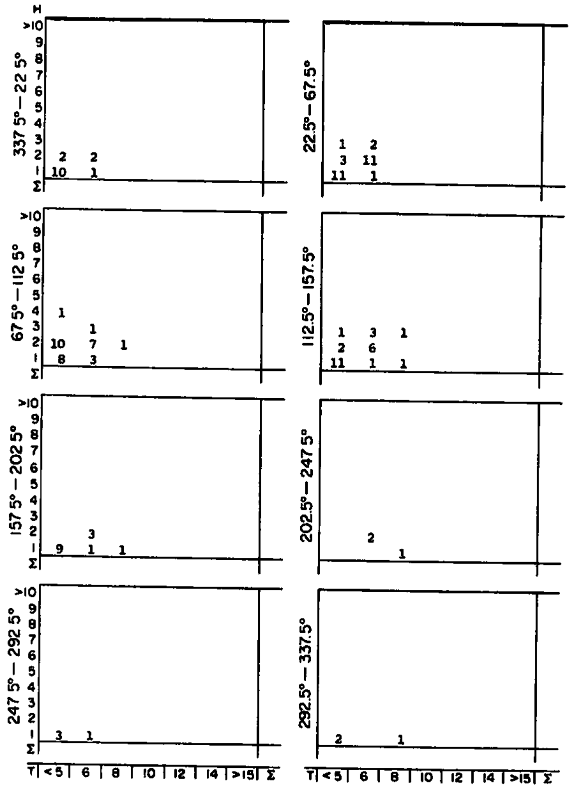
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 17f: Directional Wave Statistics for May



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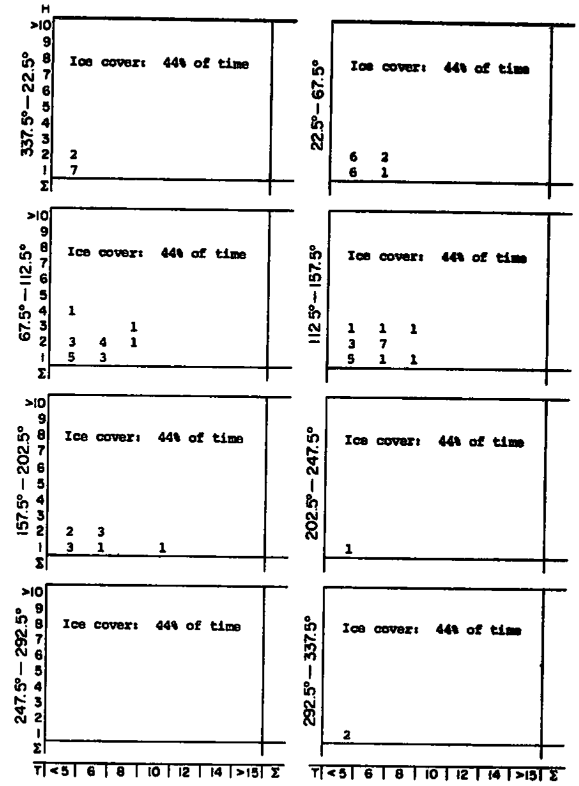

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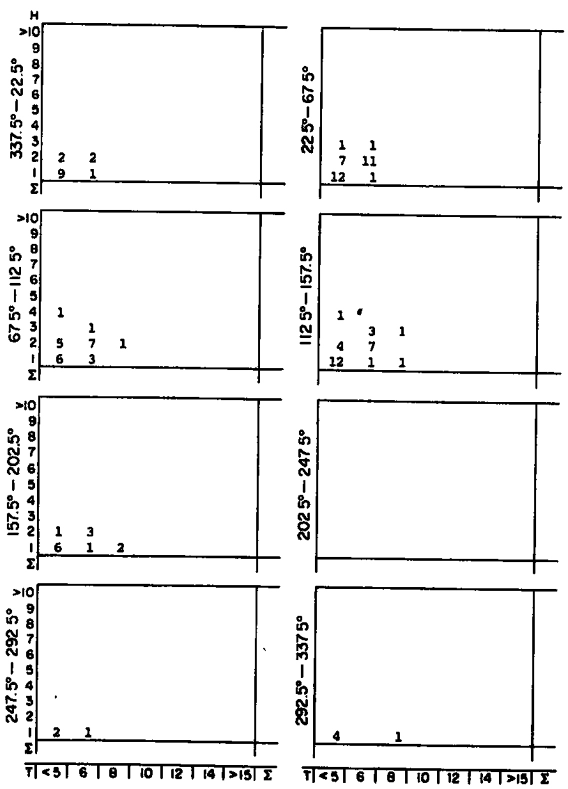

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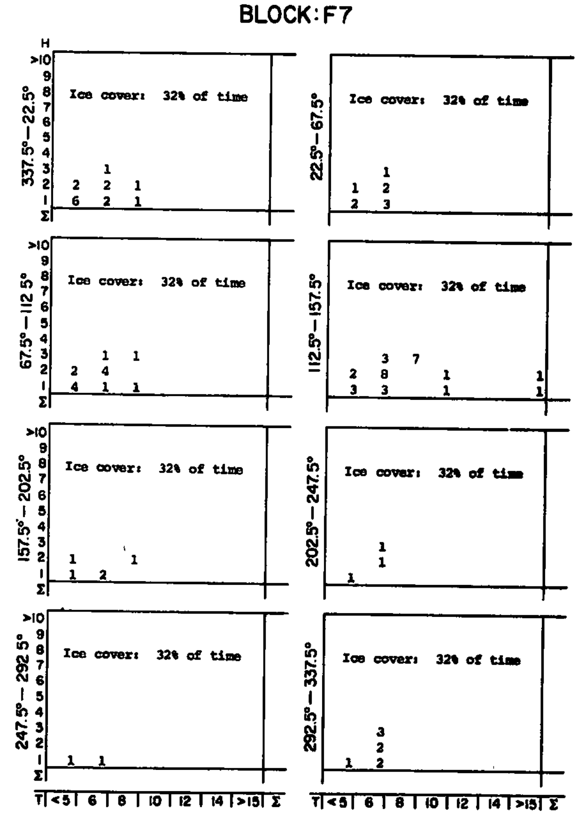

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NOTES:

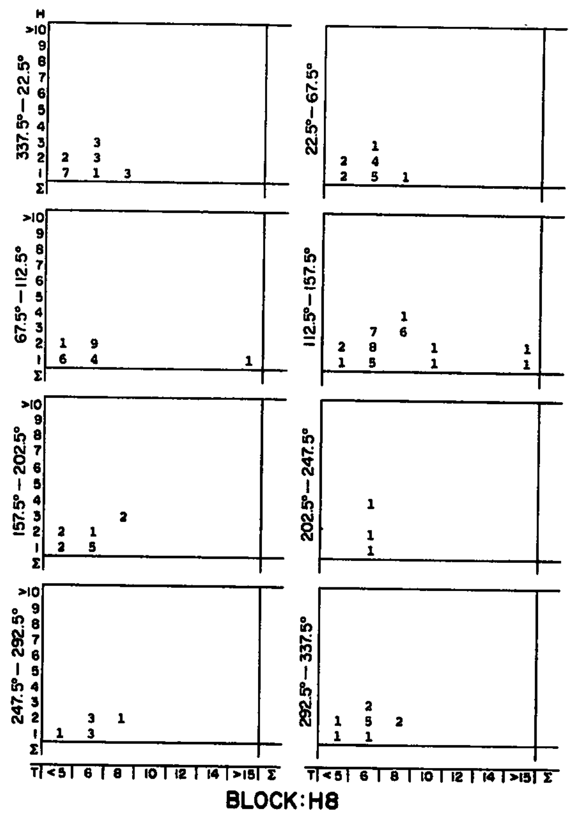
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

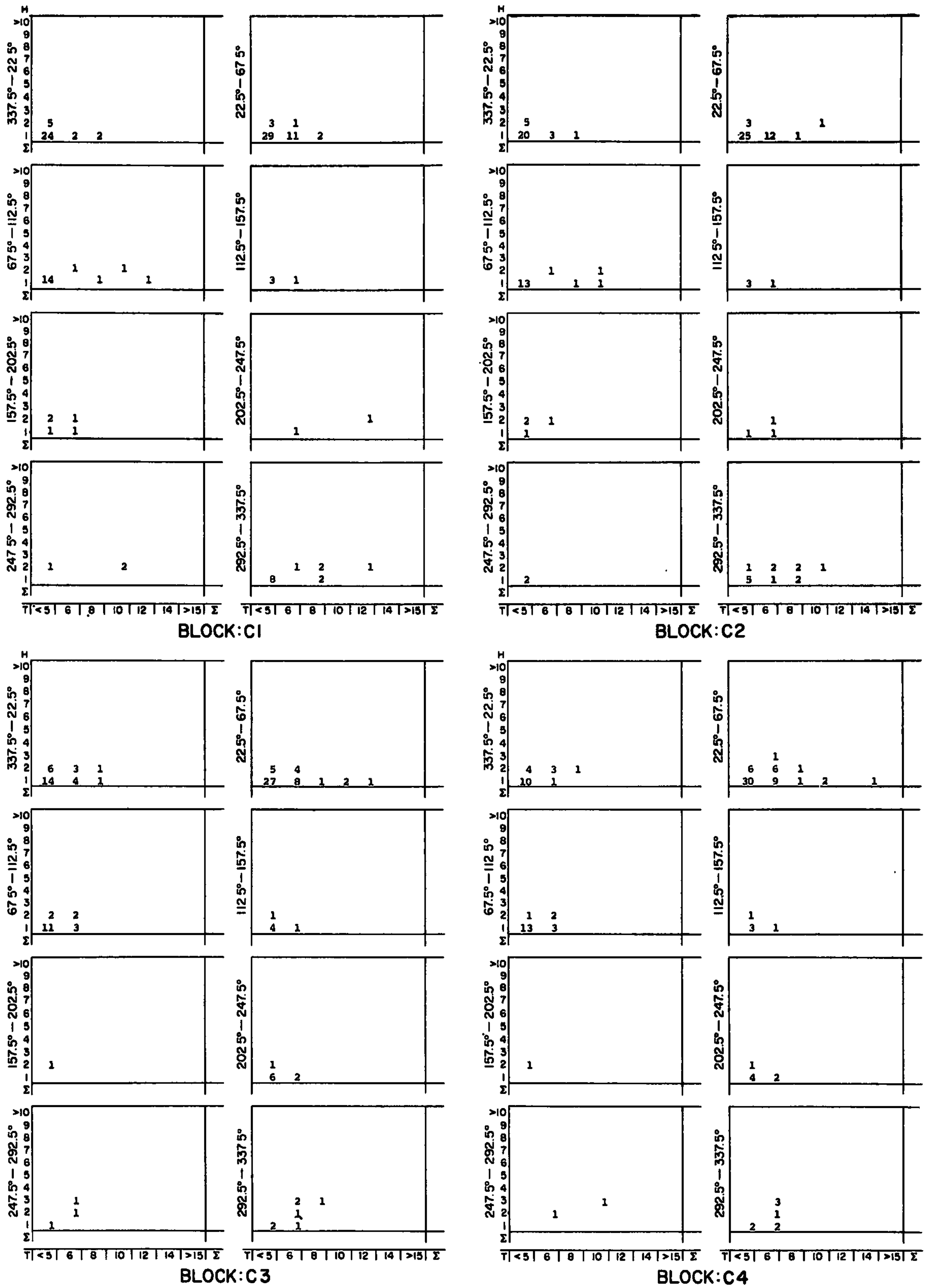
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 17e: Directional Wave Statistics for May



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 17g: Directional Wave Statistics for May



NOTES:

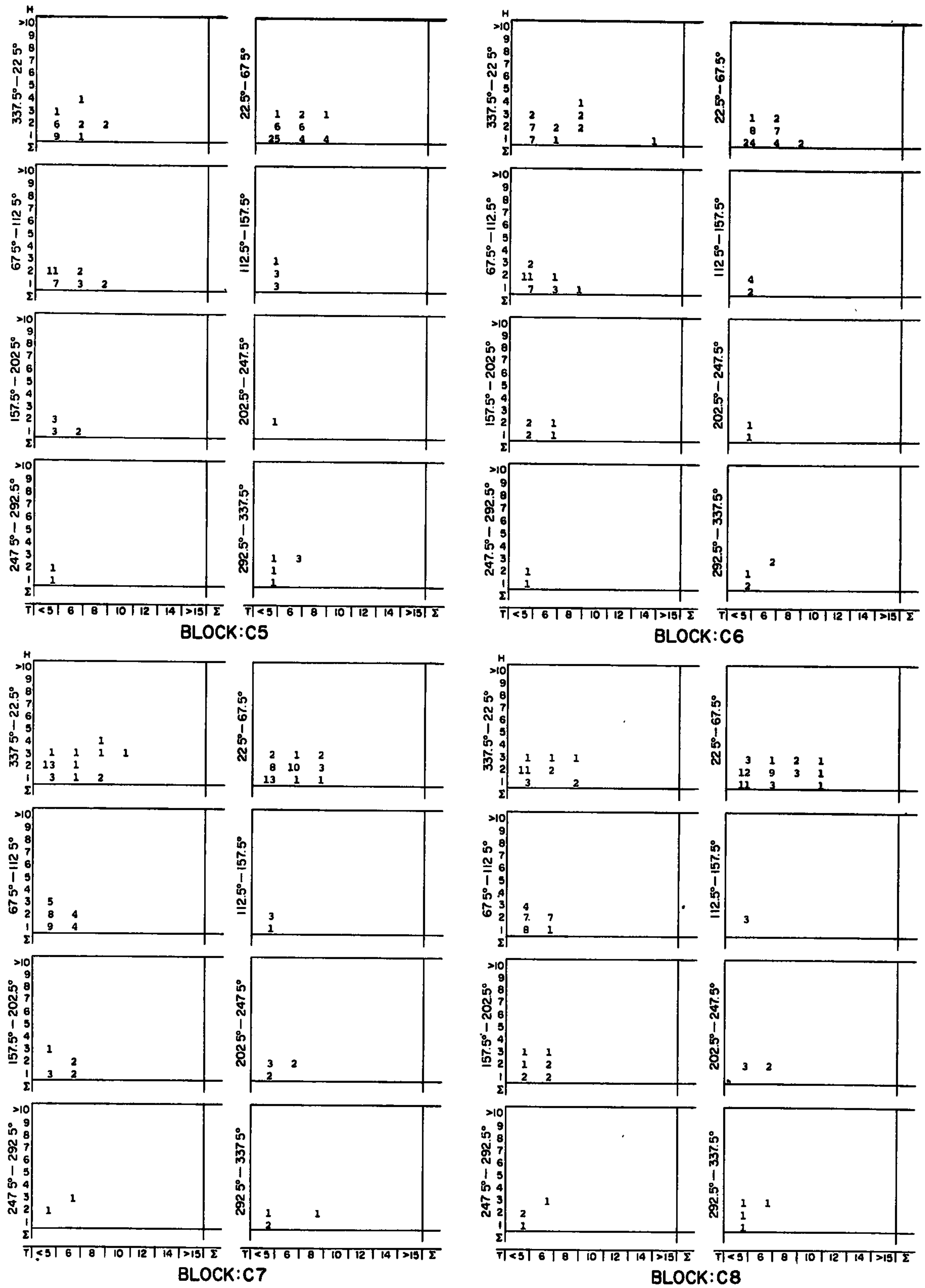
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

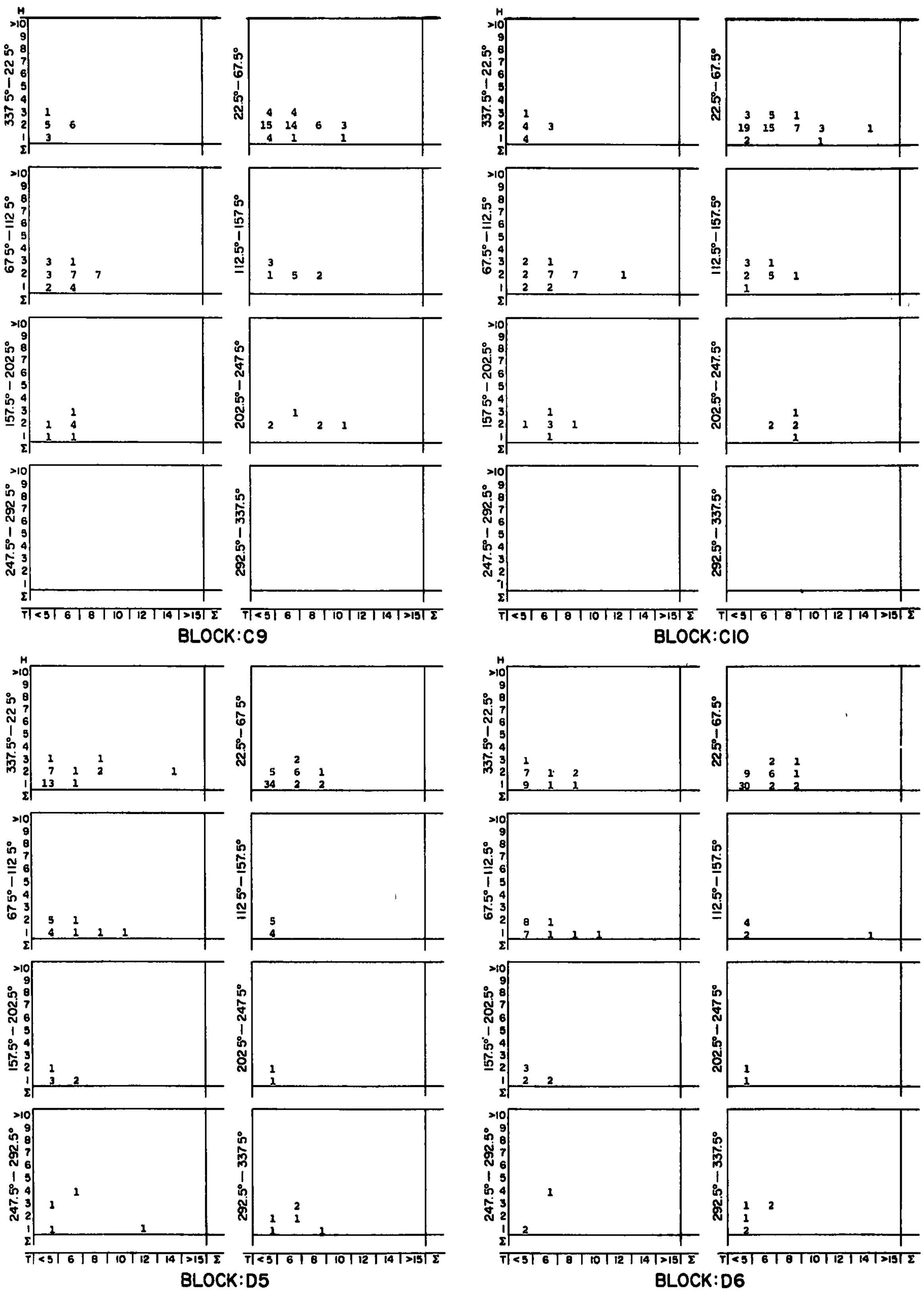
APPENDIX FIGURE 18a: Directional Wave Statistics for June



NOTES:

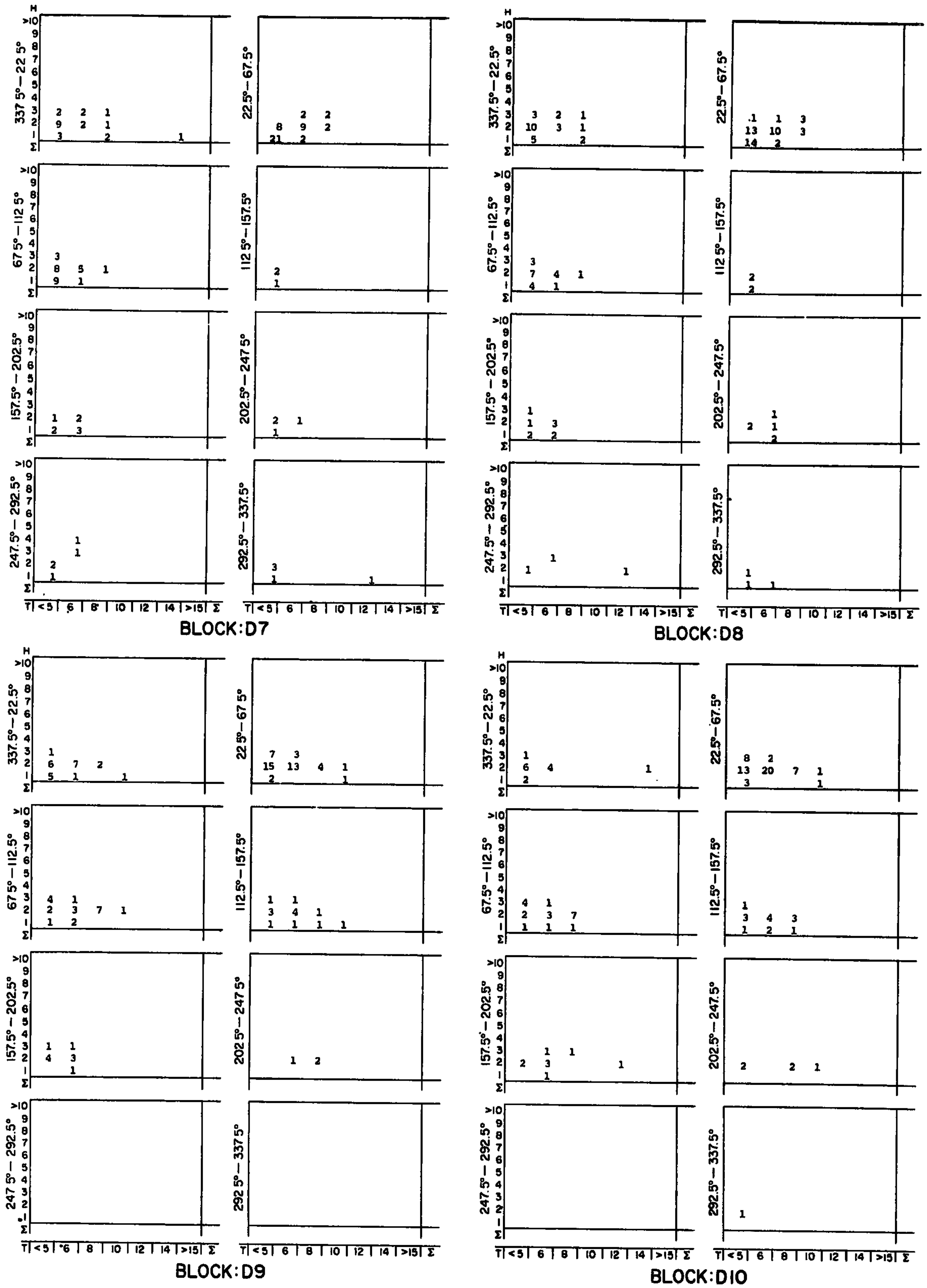
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 18b: Directional Wave Statistics for June



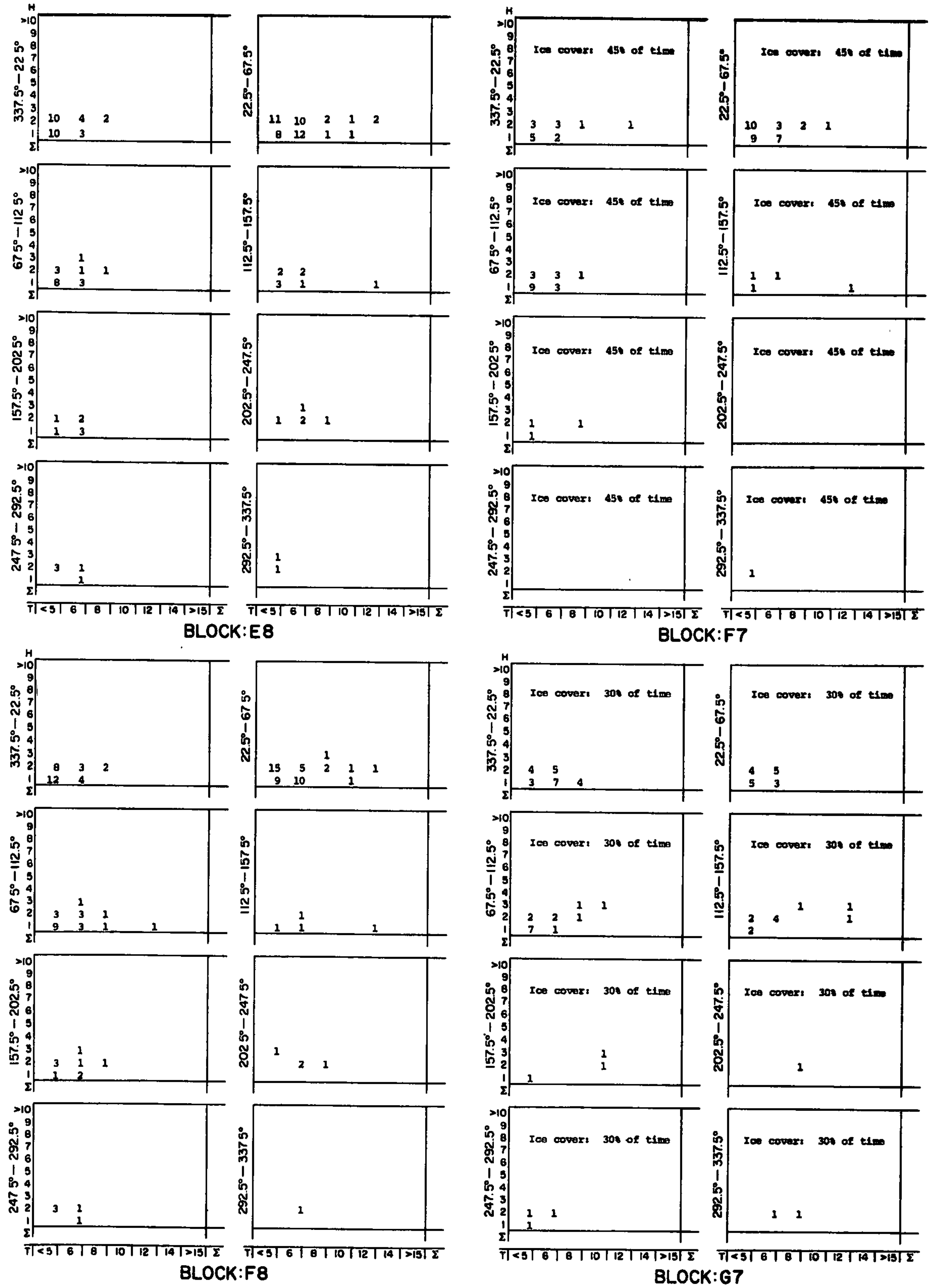
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 18c: Directional Wave Statistics for June



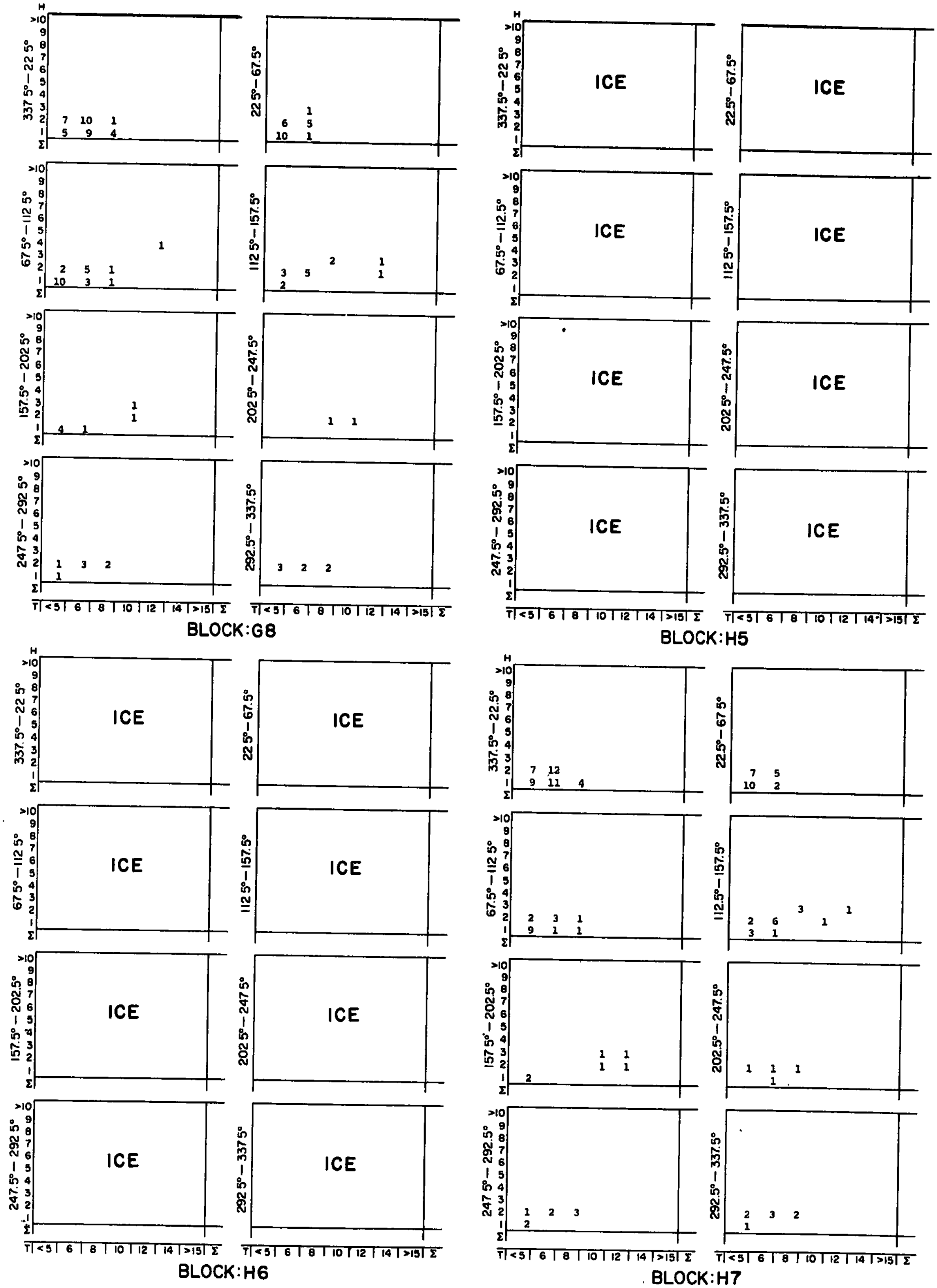
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 18d: Directional Wave Statistics for June



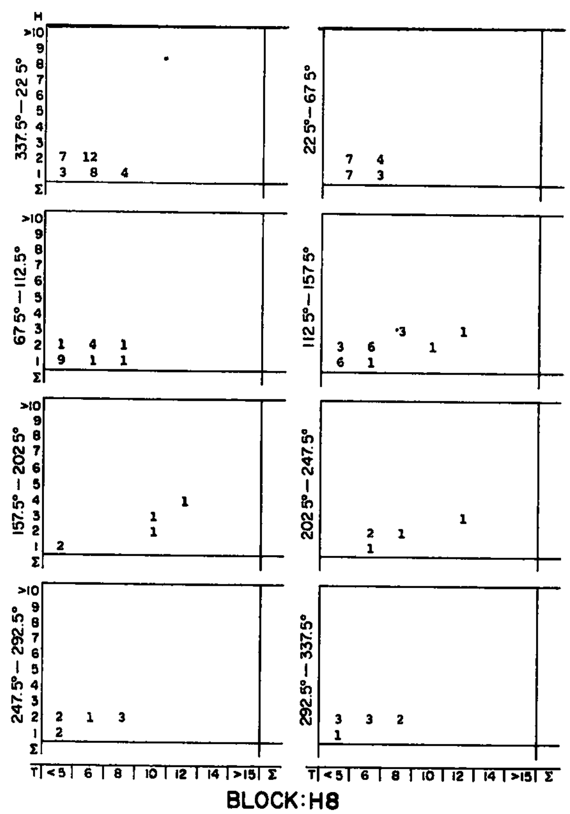
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 18e: Directional Wave Statistics for June



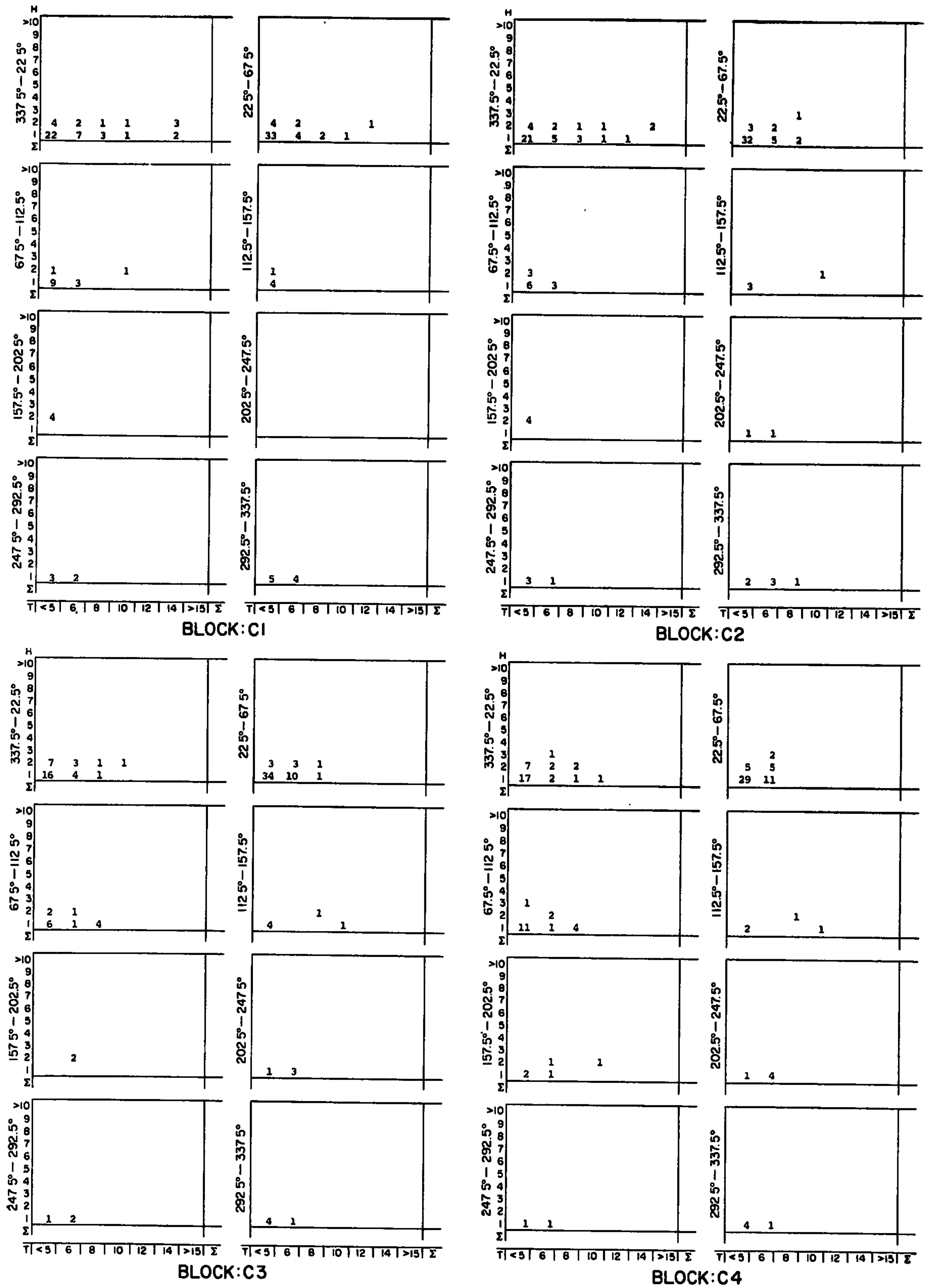
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 18f: Directional Wave Statistics for June



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 18g: Directional Wave Statistics for June



NOTES:

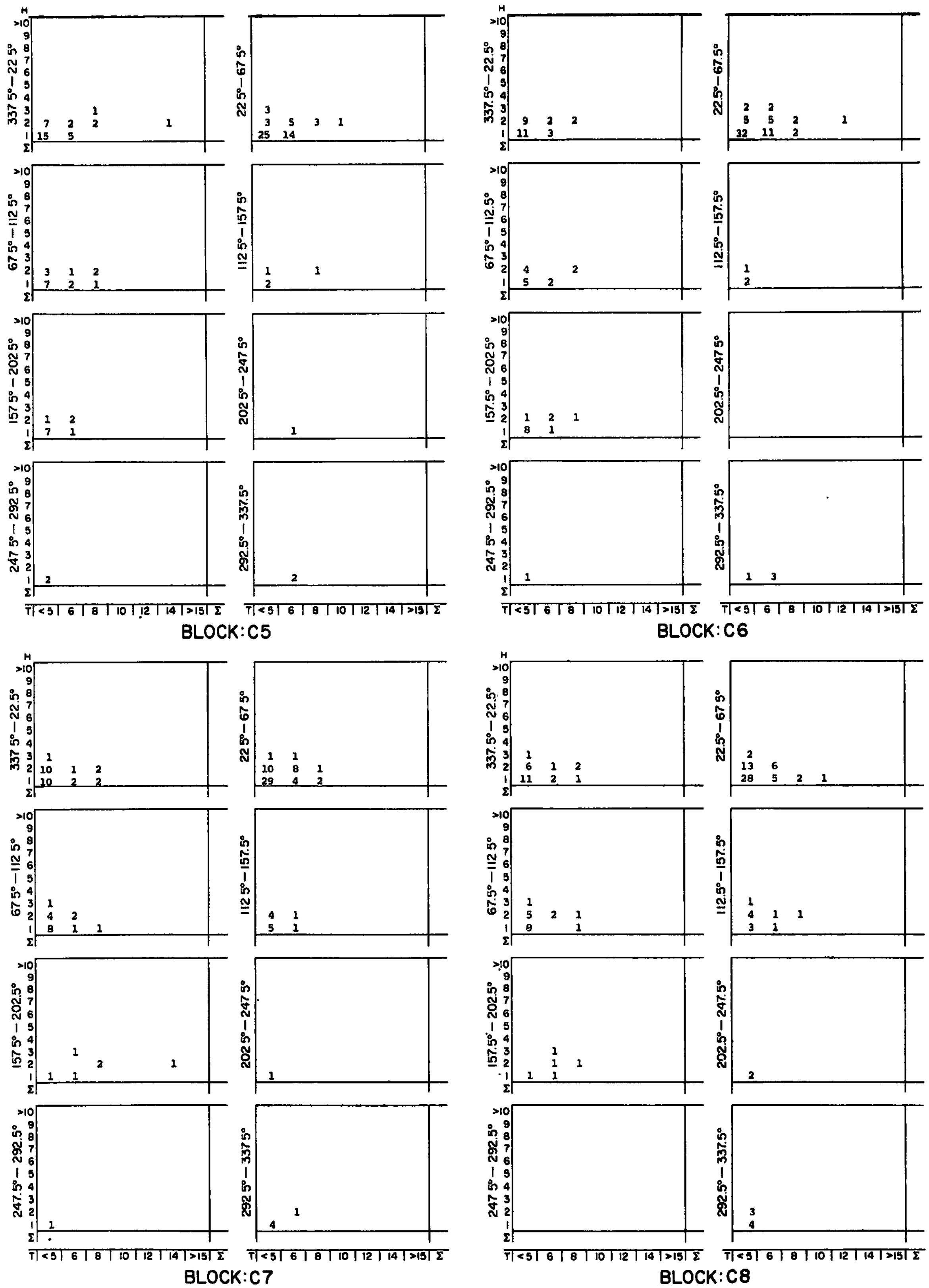
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

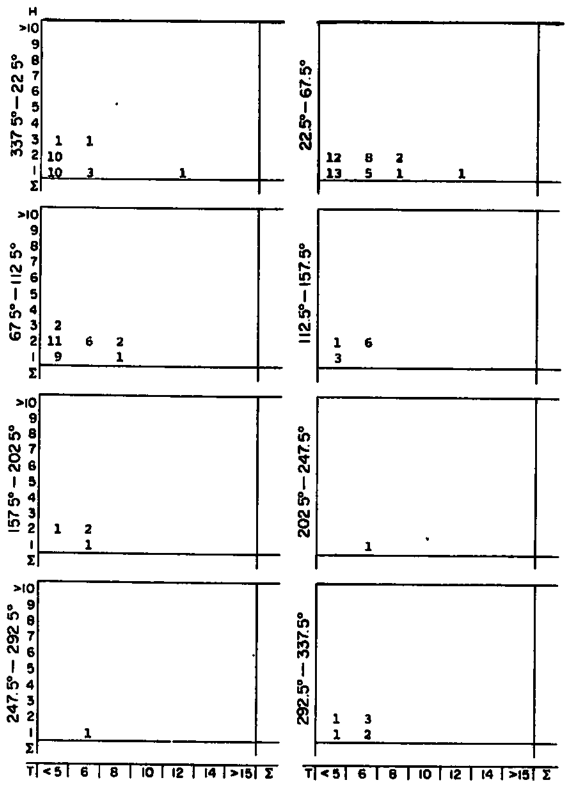
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 19a: Directional Wave Statistics for July



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 19b: Directional Wave Statistics for July



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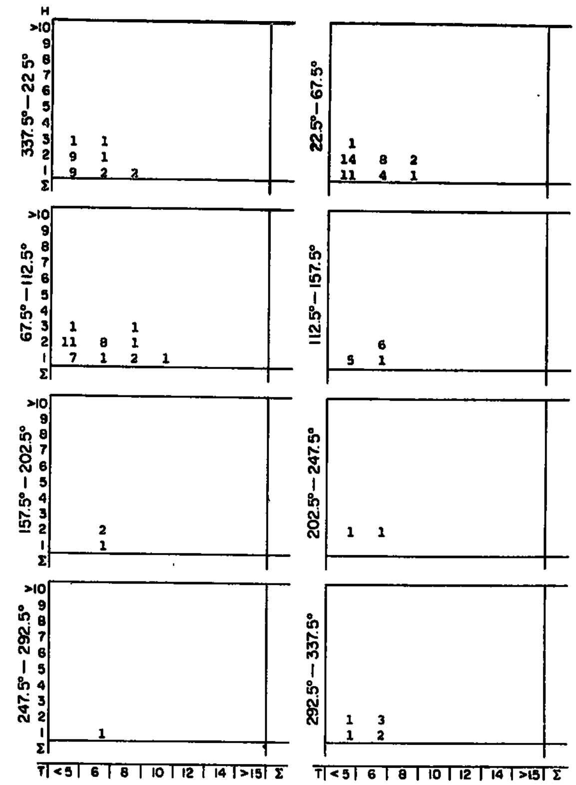

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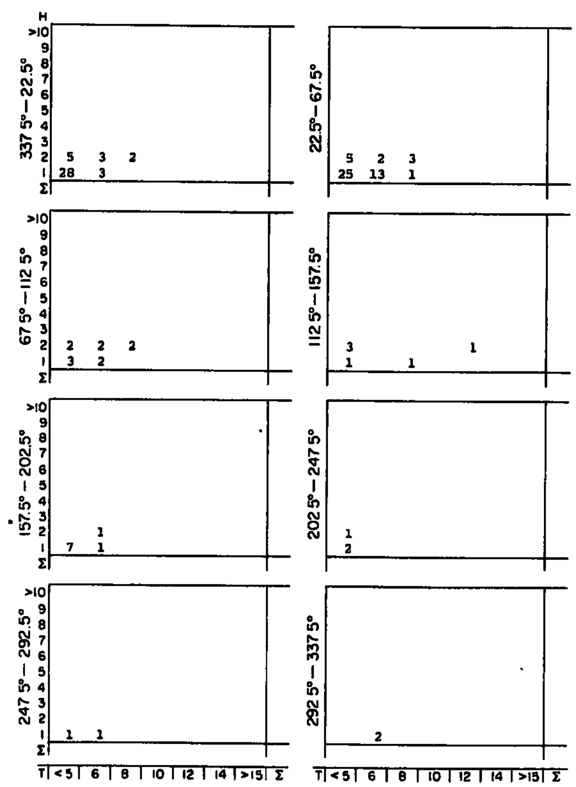

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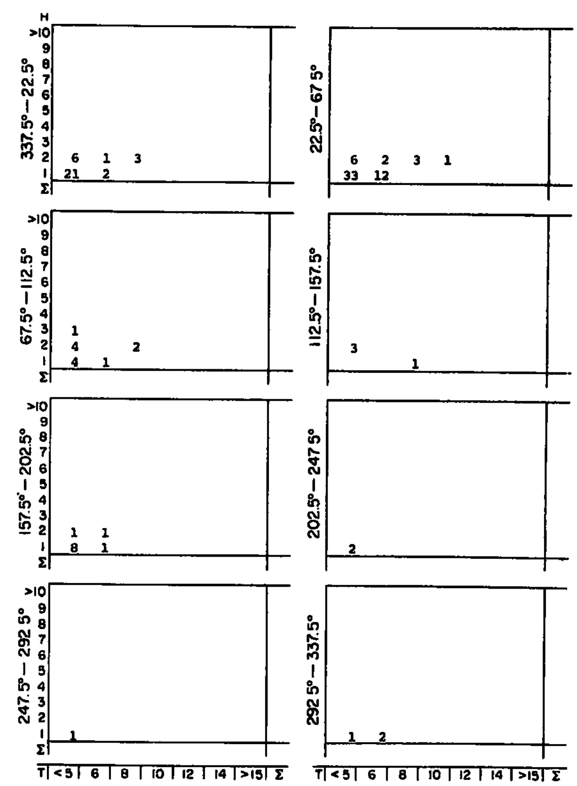

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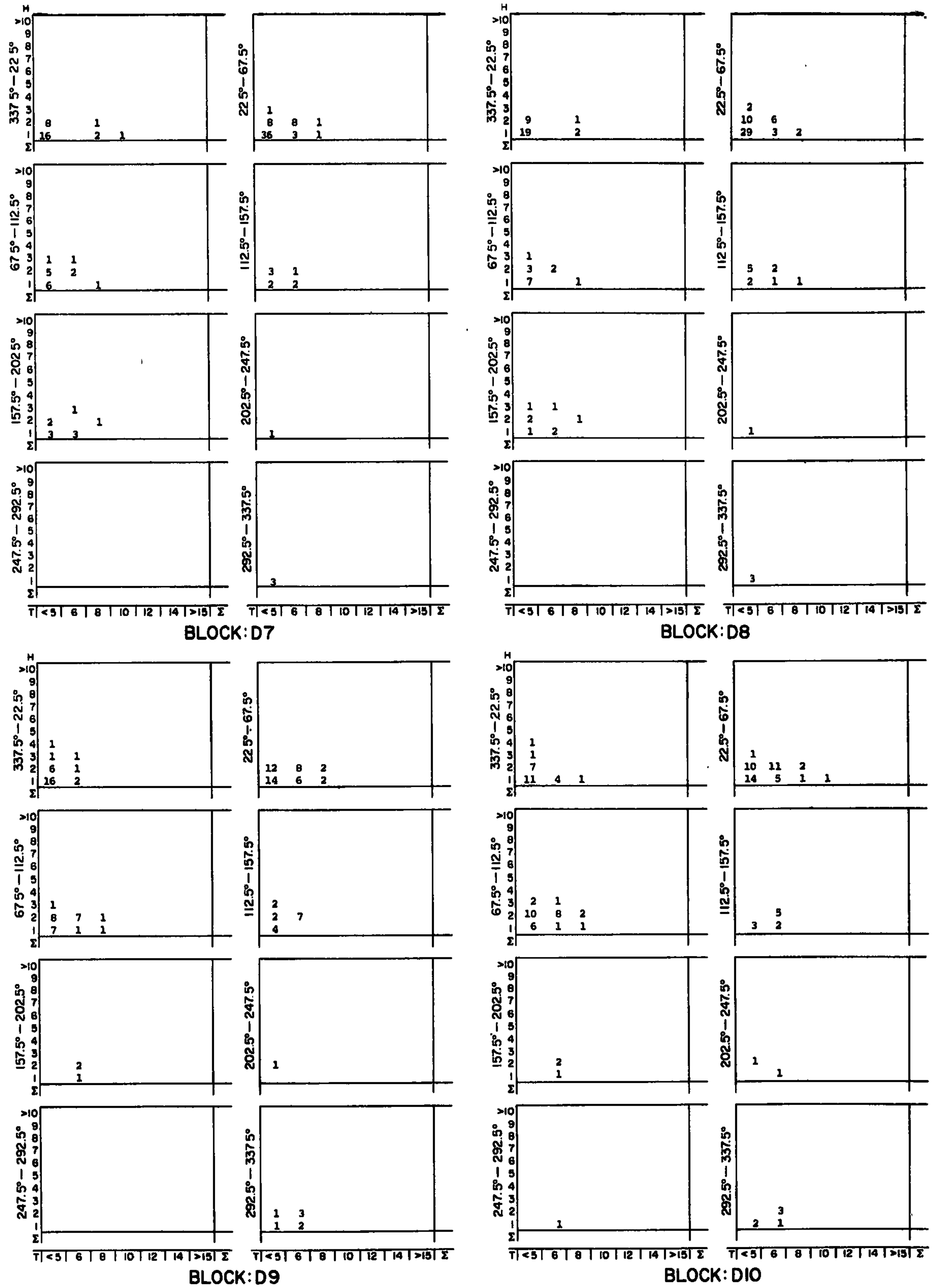
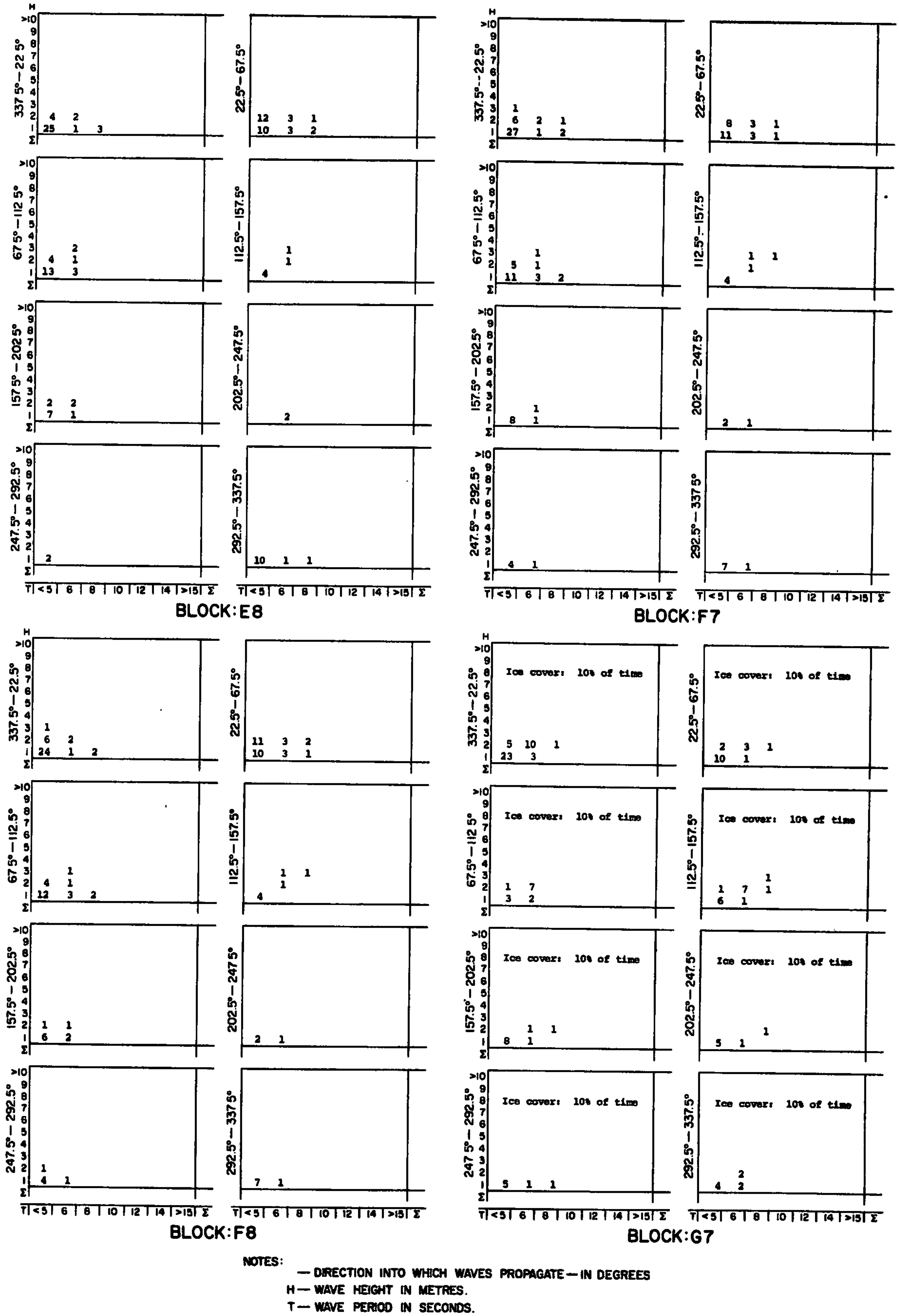
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 19c: Directional Wave Statistics for July



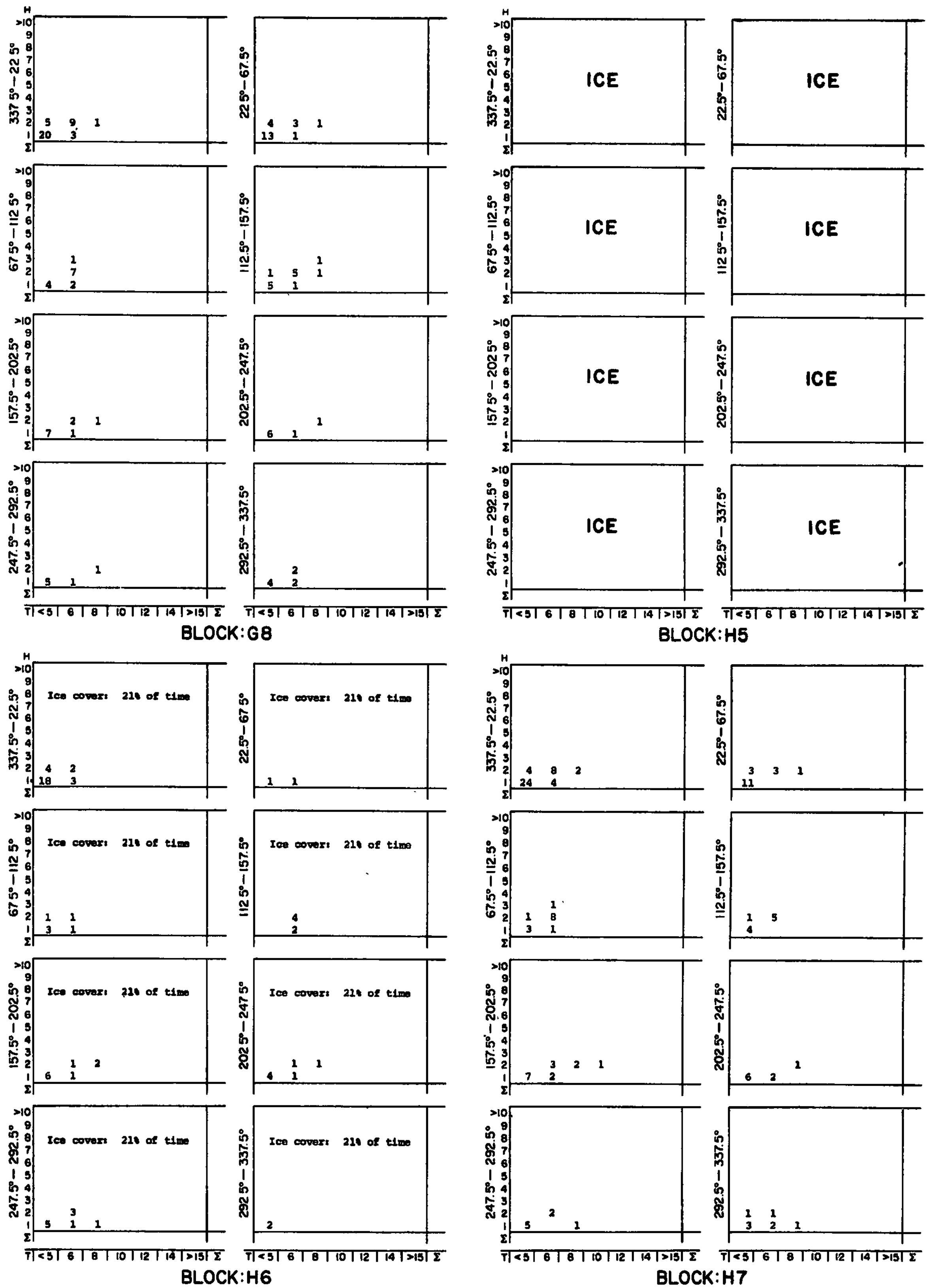
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 19d: Directional Wave Statistics for July



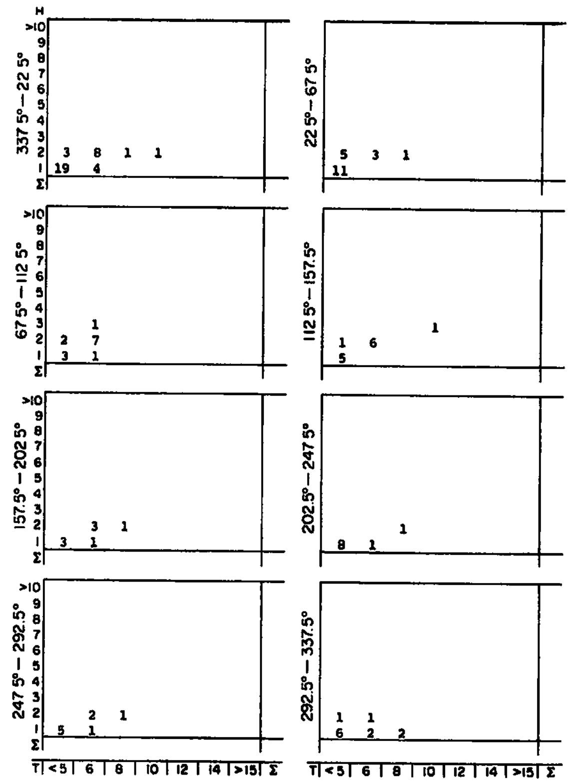
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 19e: Directional Wave Statistics for July



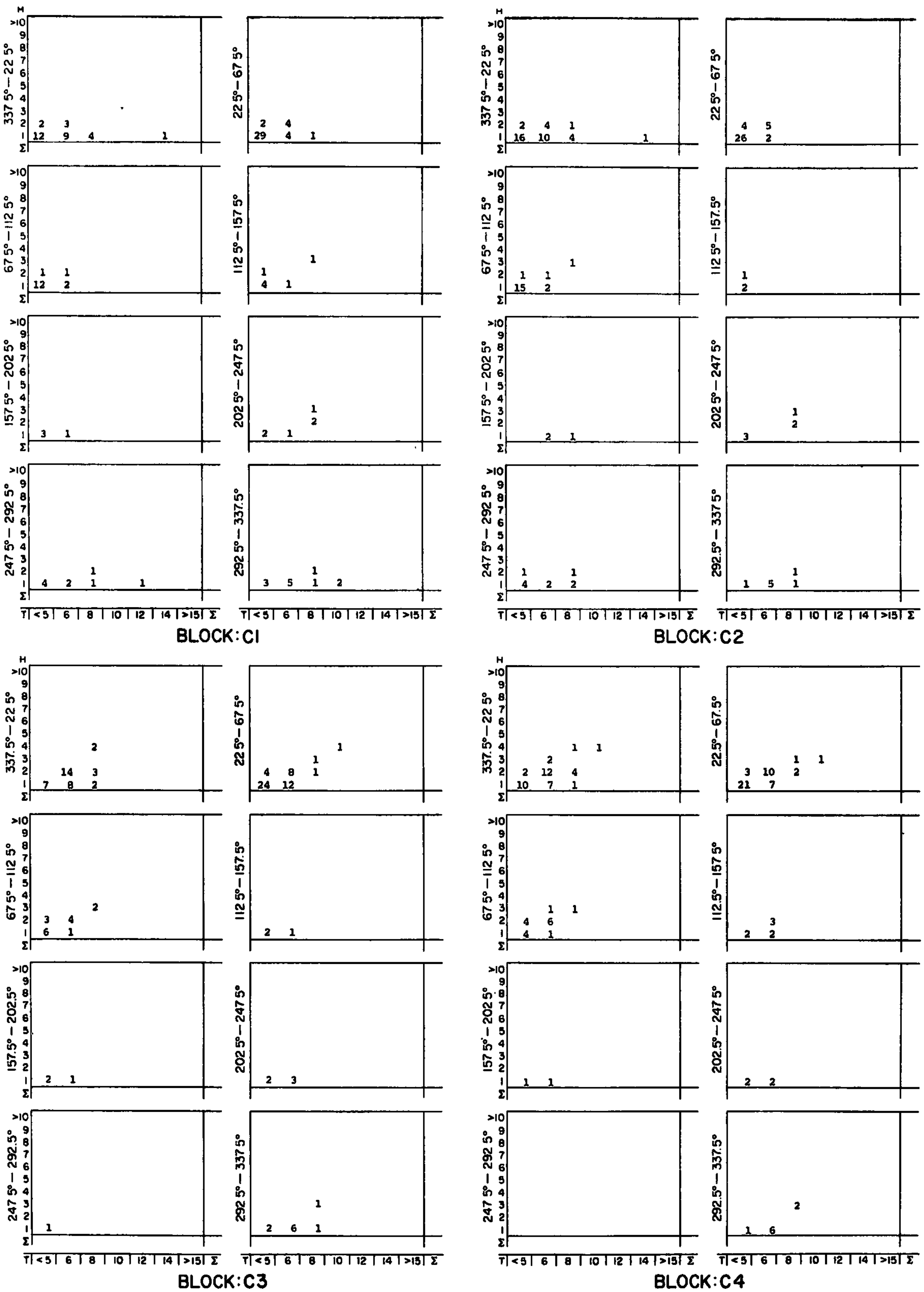
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 19f: Directional Wave Statistics for July



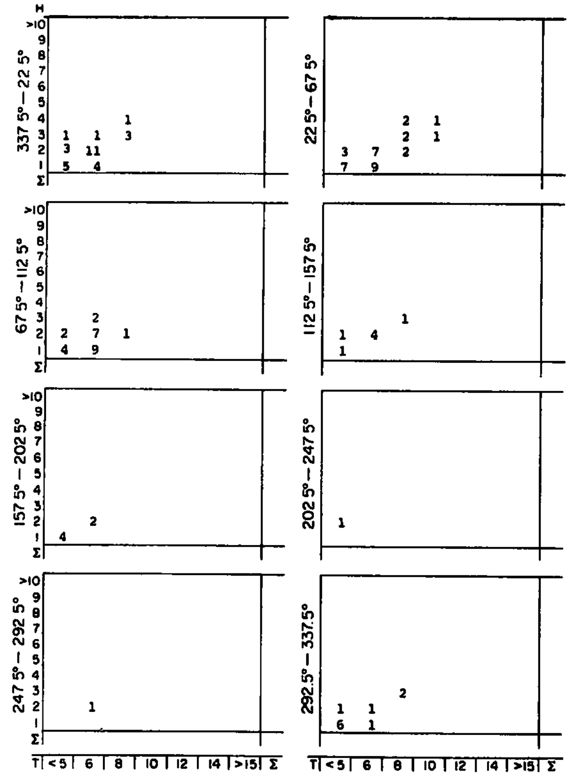
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 19g: Directional Wave Statistics for July



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 20a: Directional Wave Statistics for August



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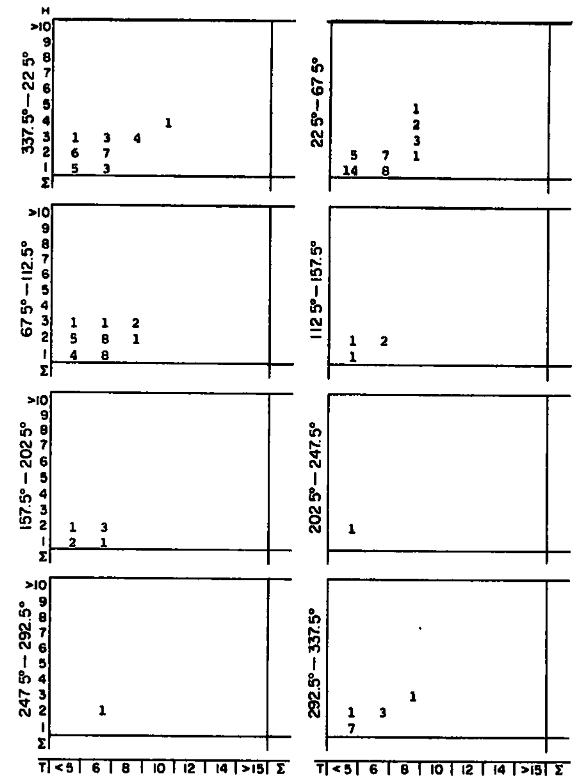

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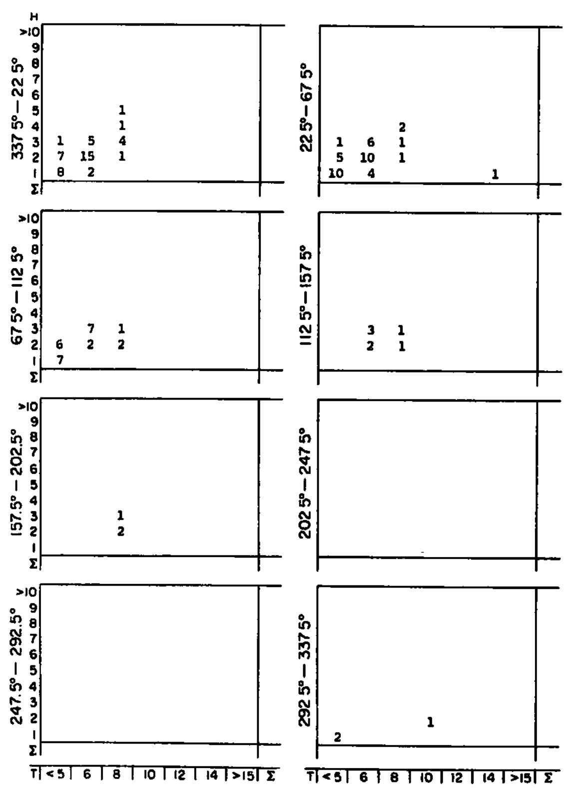

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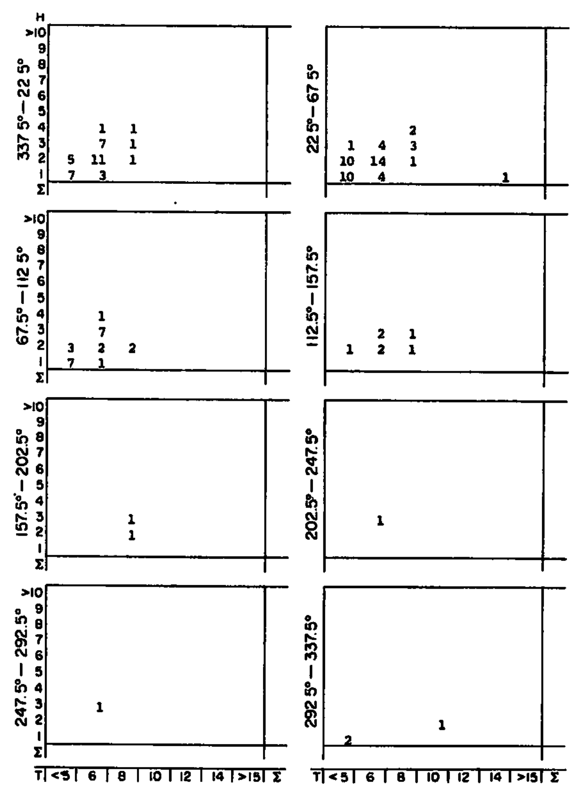

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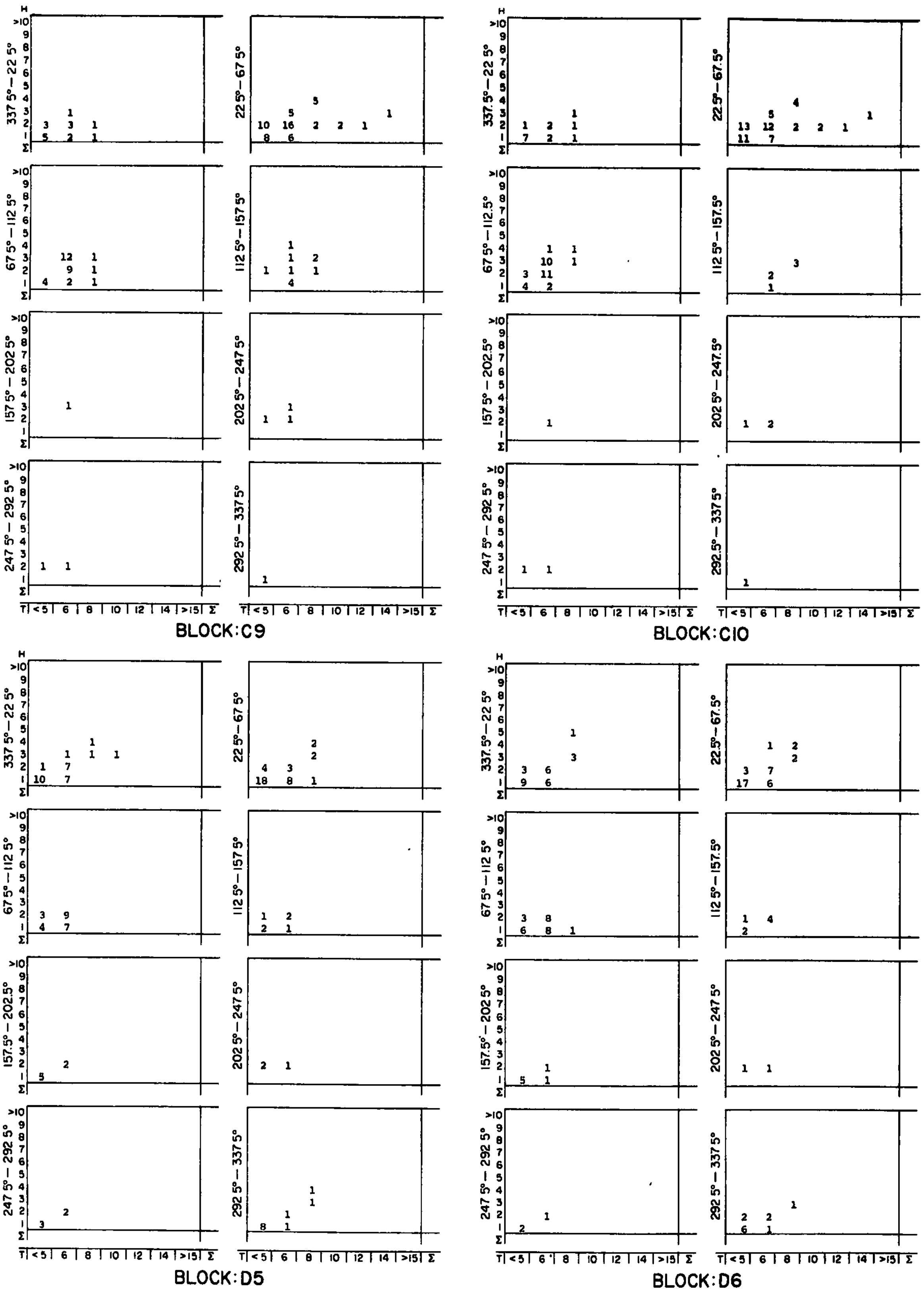
NOTES:

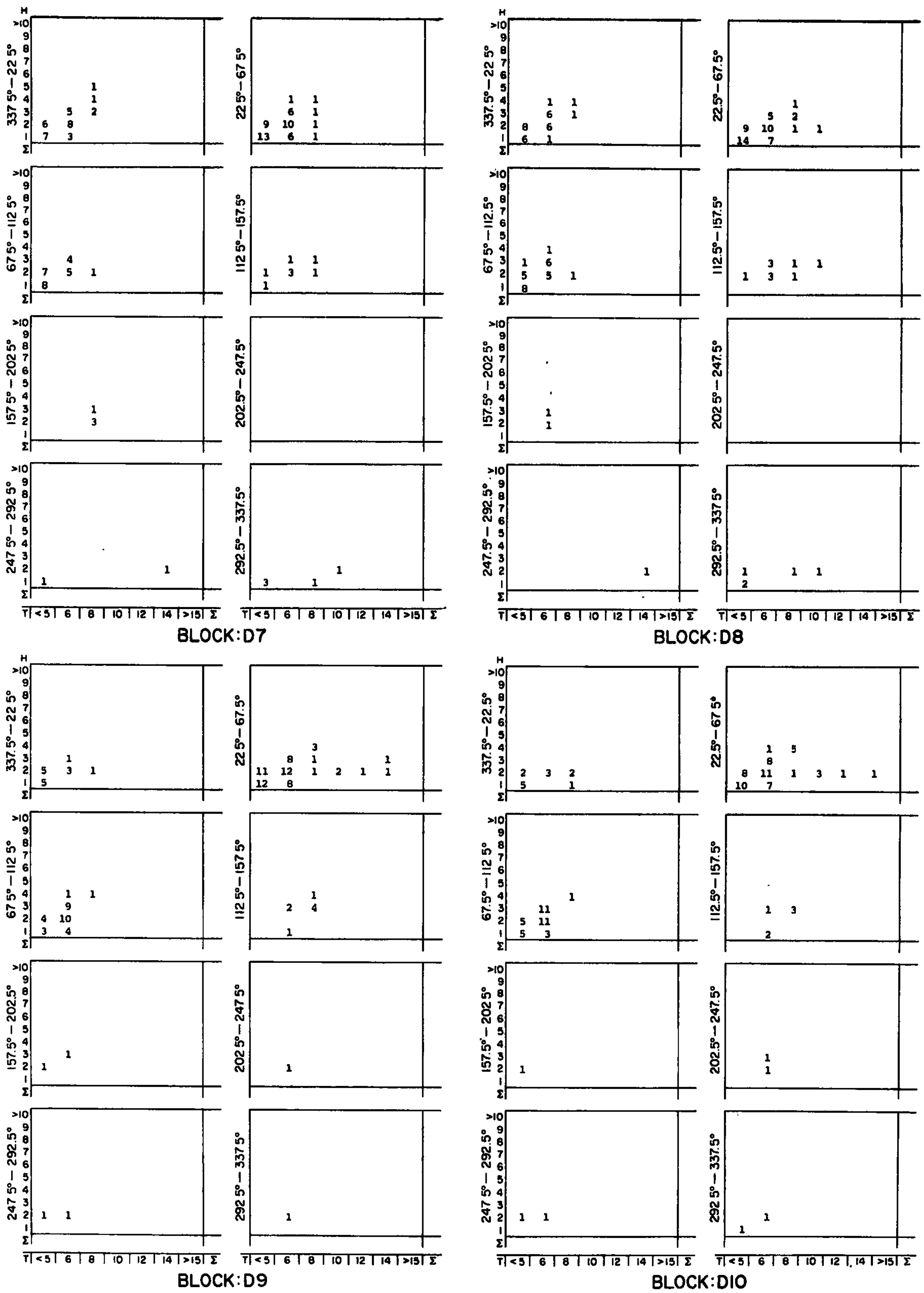
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 20b: Directional Wave Statistics for August



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 20c: Directional Wave Statistics for August



NOTES:

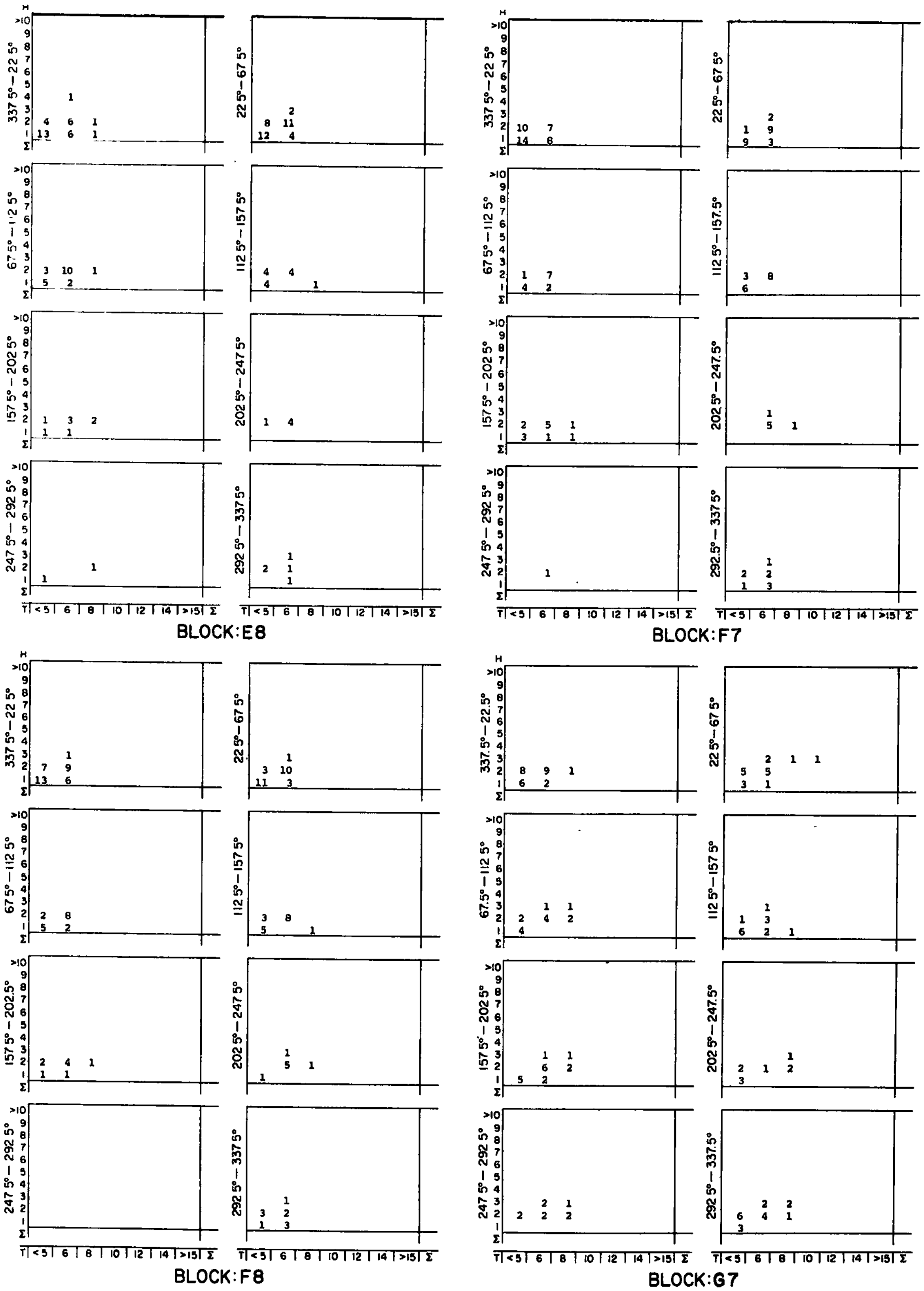
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 20d: Directional Wave Statistics for August



NOTES:

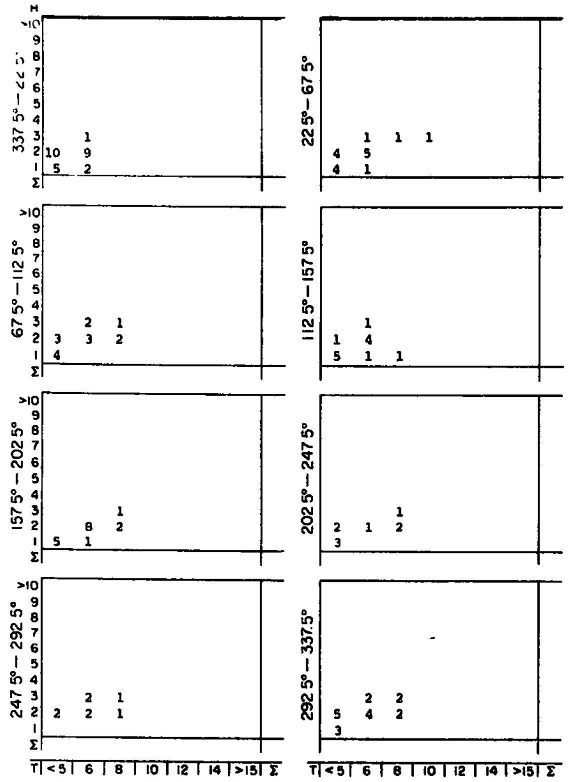
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES

T — WAVE PERIOD IN SECONDS

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 20e: Directional Wave Statistics for August



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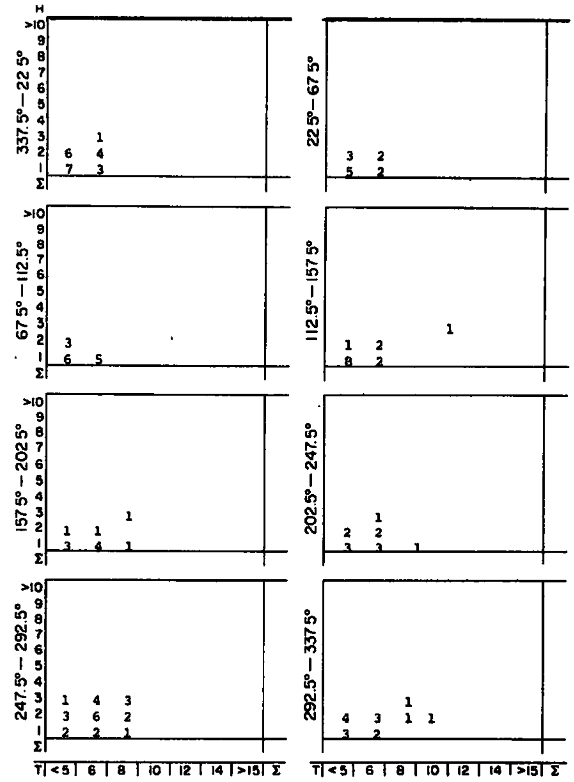

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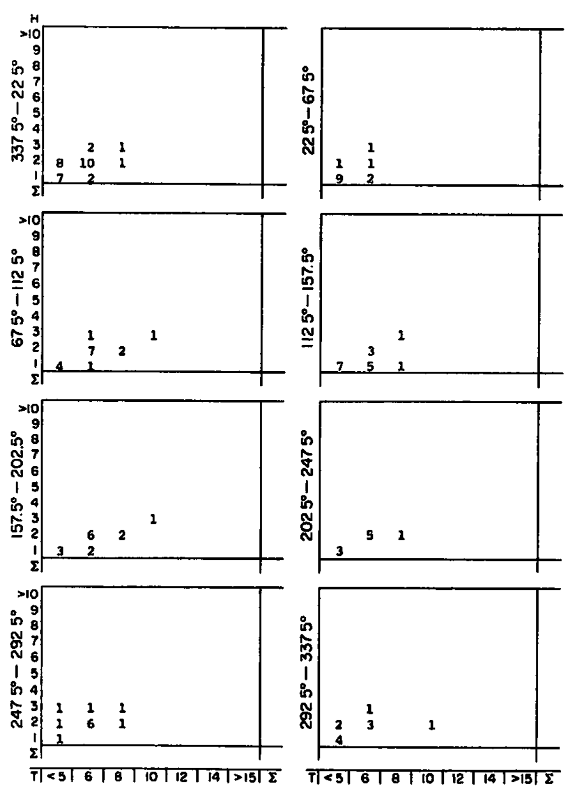

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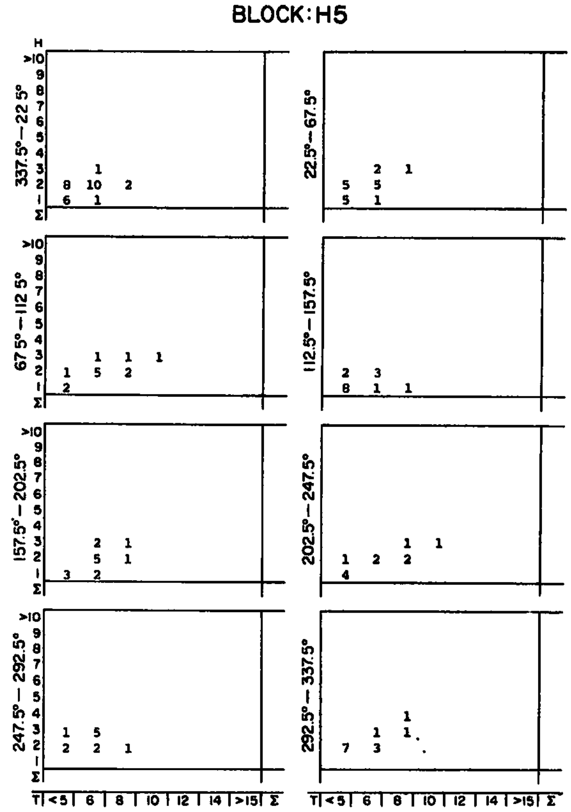


BLOCK:H7

NOTES:

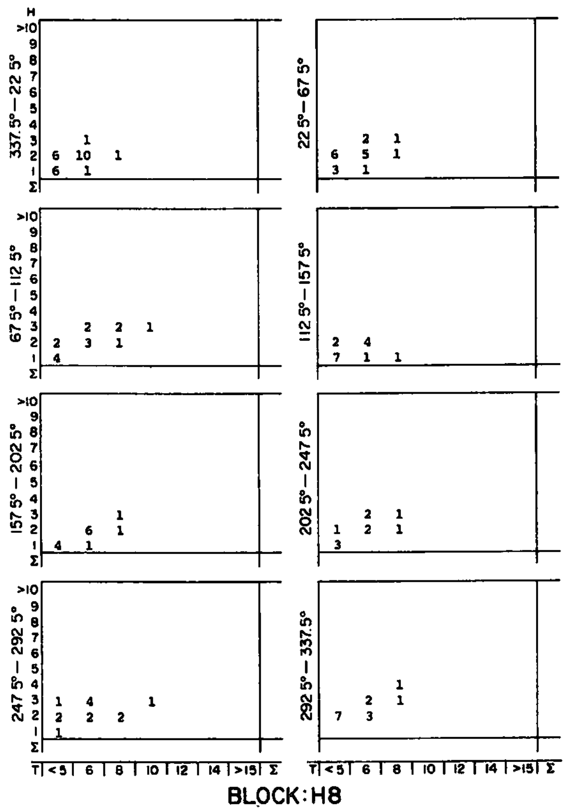
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

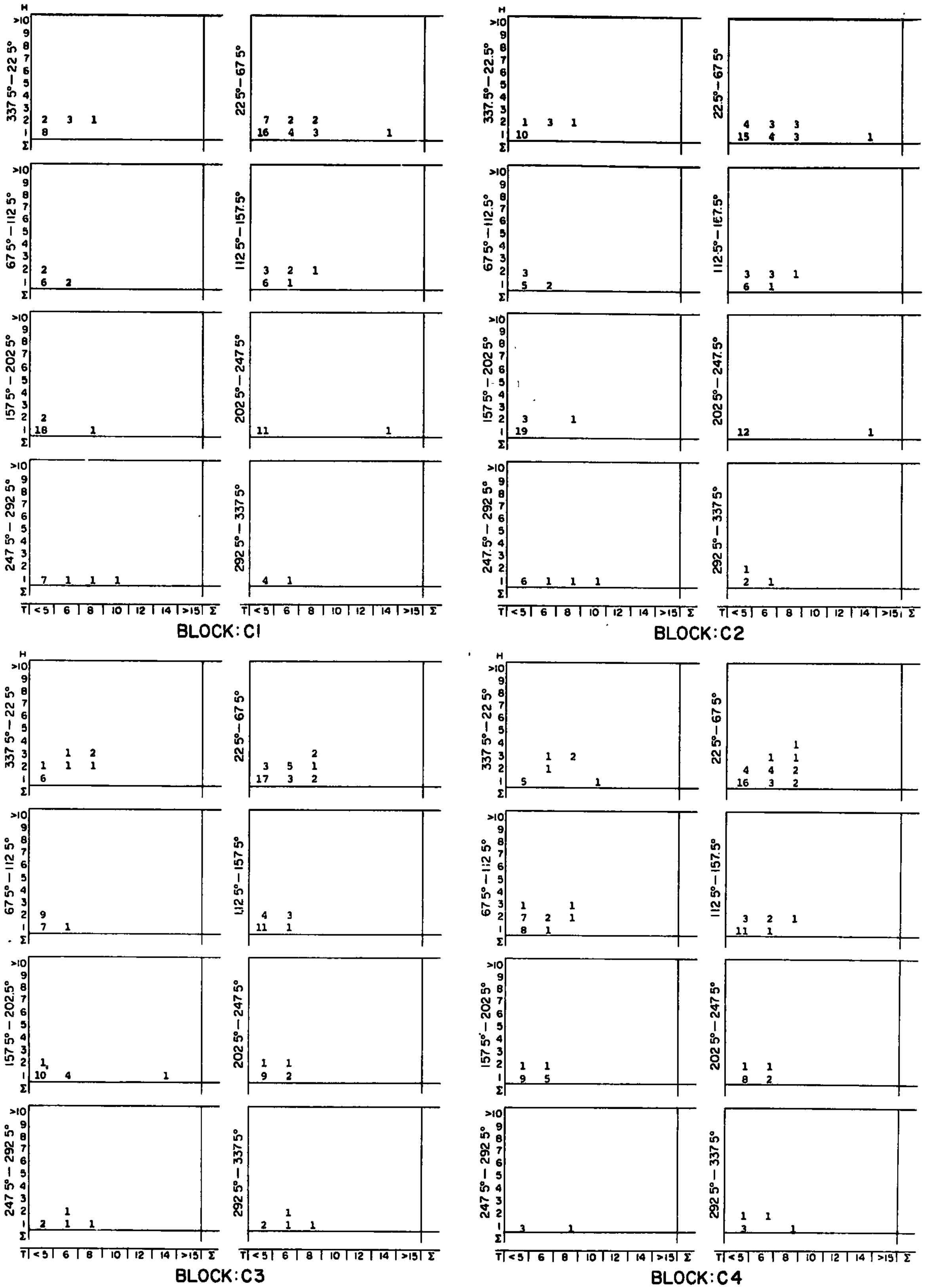
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 20f: Directional Wave Statistics for August



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

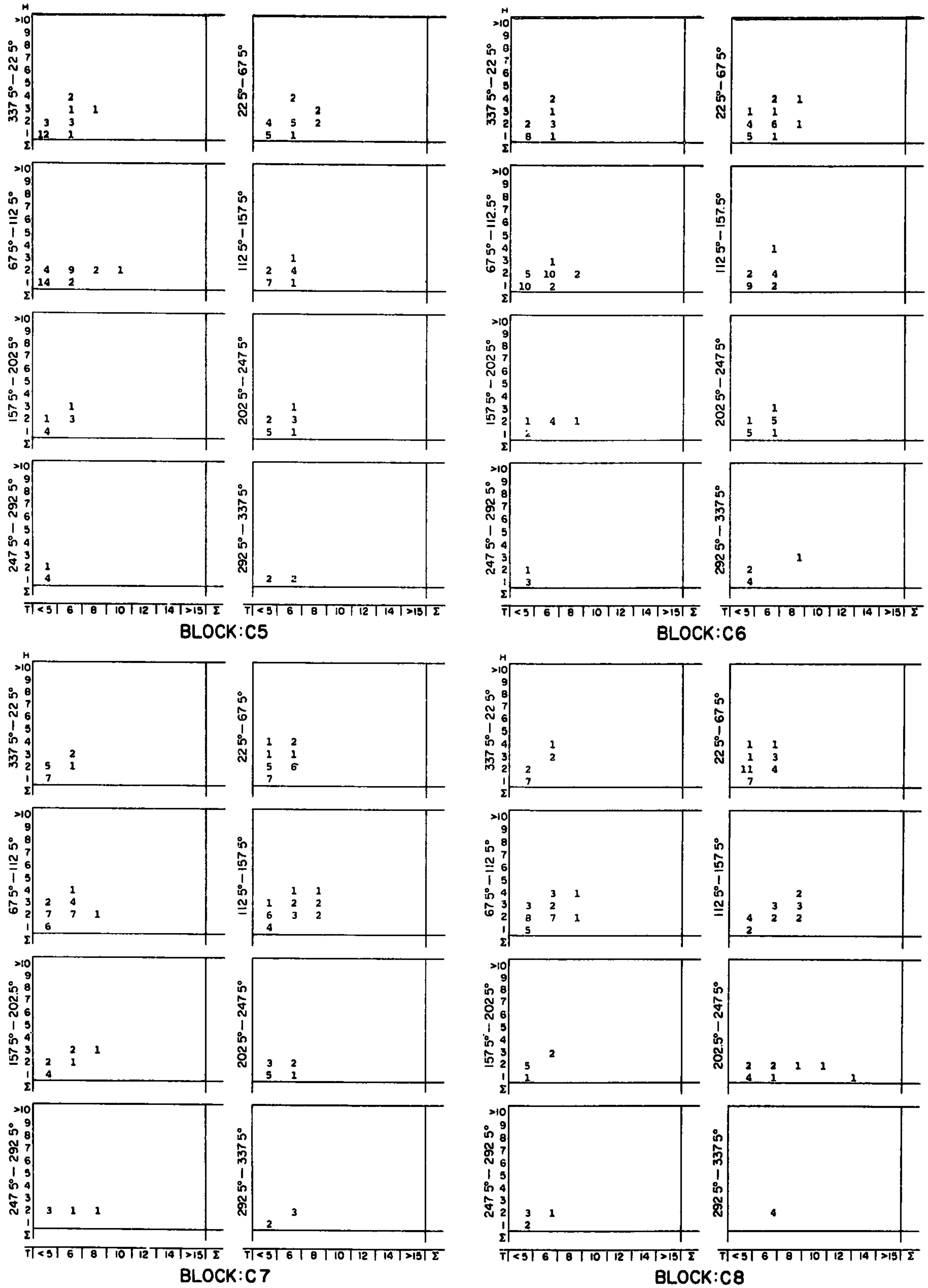
APPENDIX FIGURE 20g: Directional Wave Statistics for August



NOTES:

— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 21a: Directional Wave Statistics for September



NOTES:

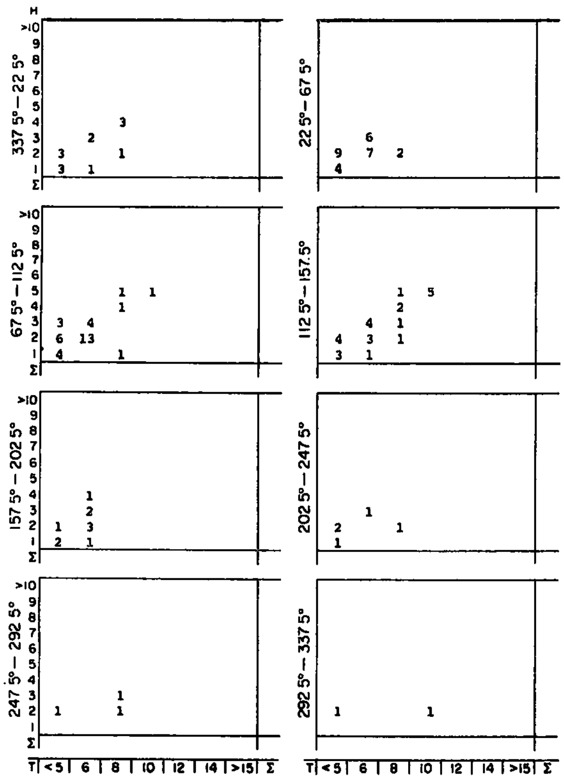
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 21b: Directional Wave Statistics for September



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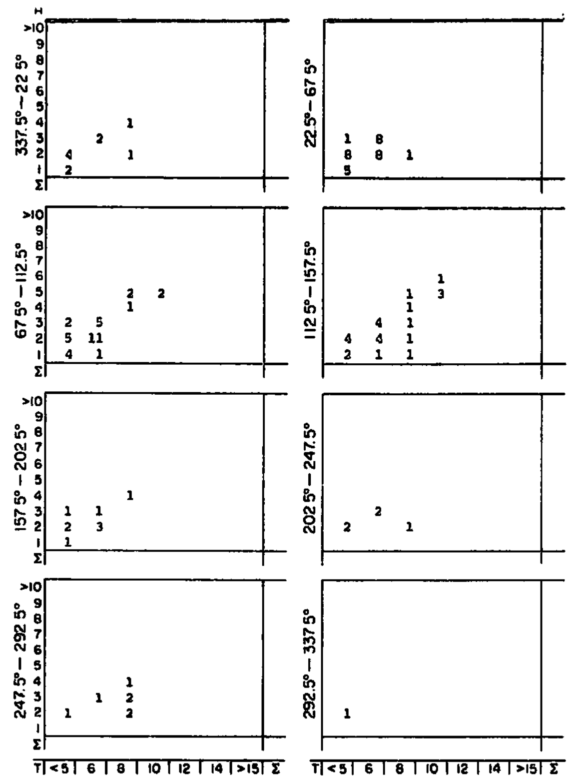

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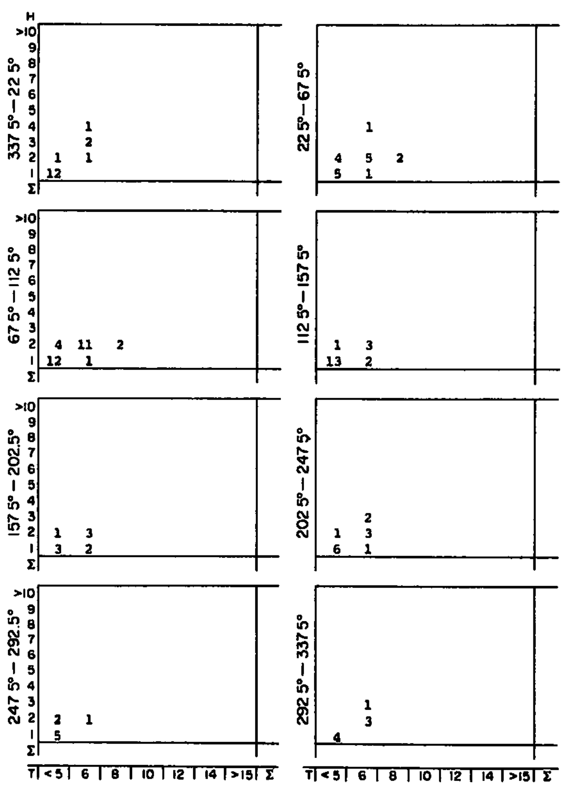

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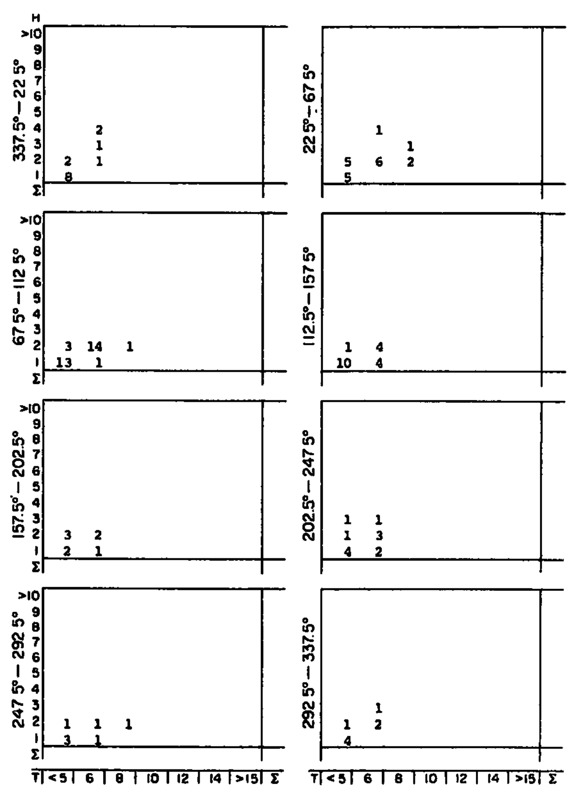

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NOTES:

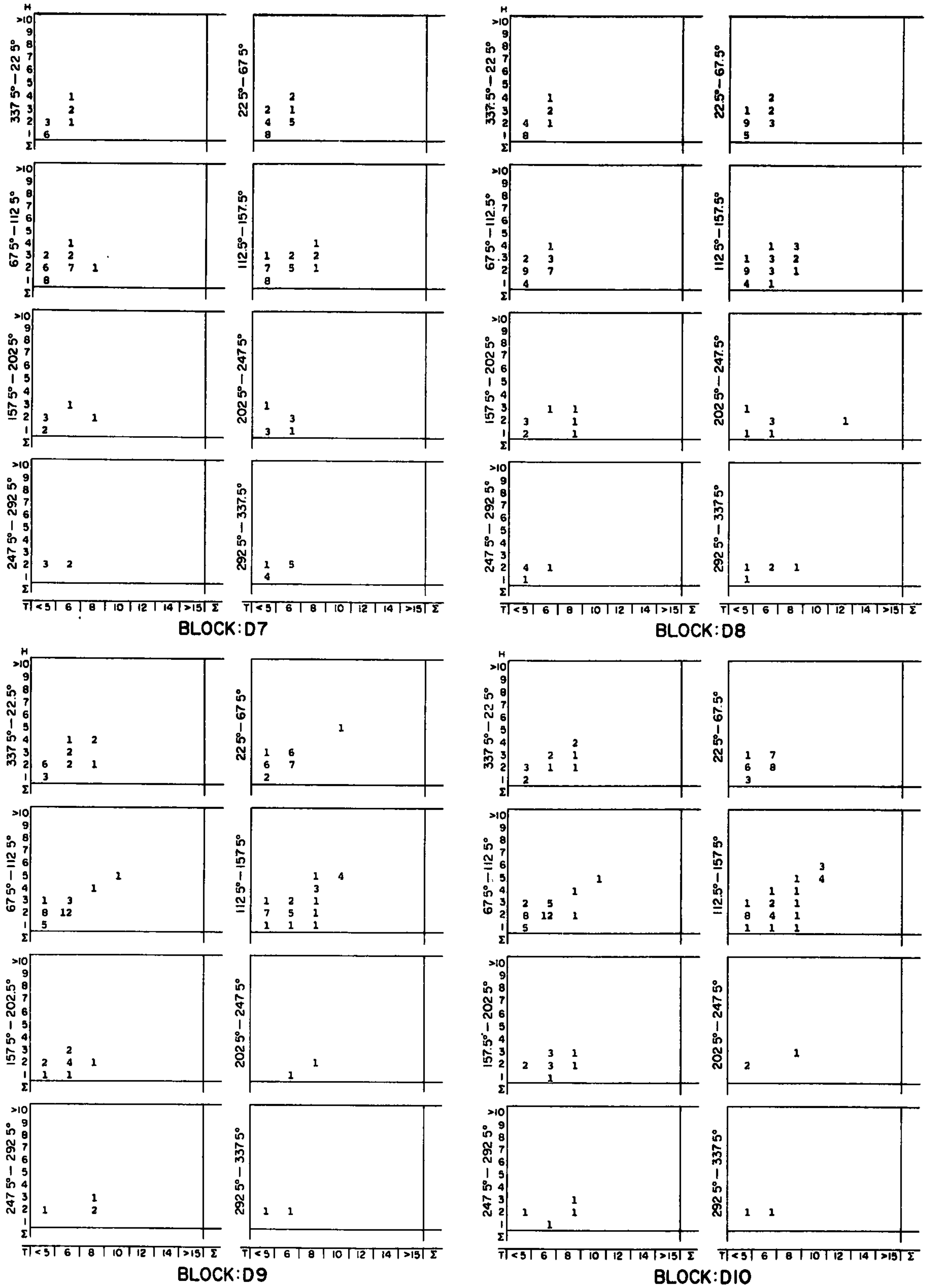
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

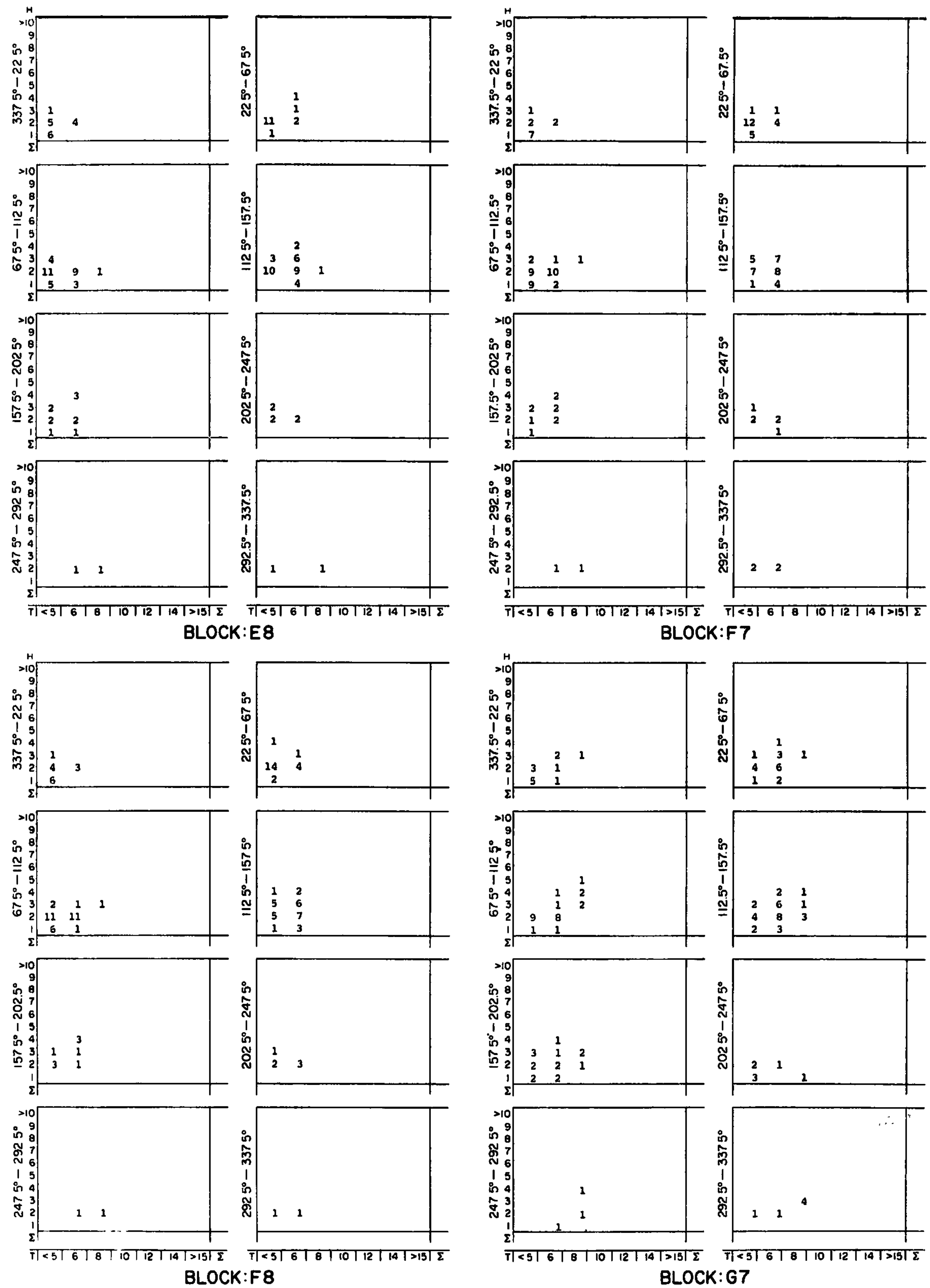
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 21c: Directional Wave Statistics for September



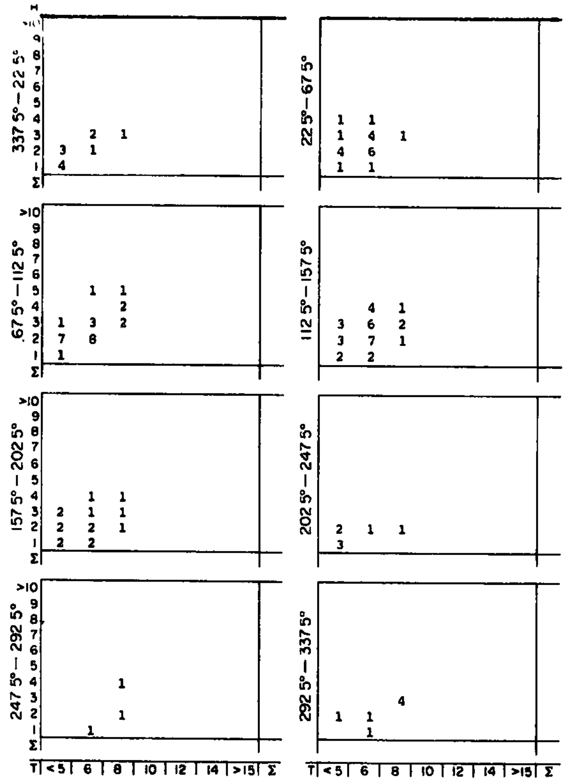
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 21d: Directional Wave Statistics for September



NOTES.
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 21e: Directional Wave Statistics for September



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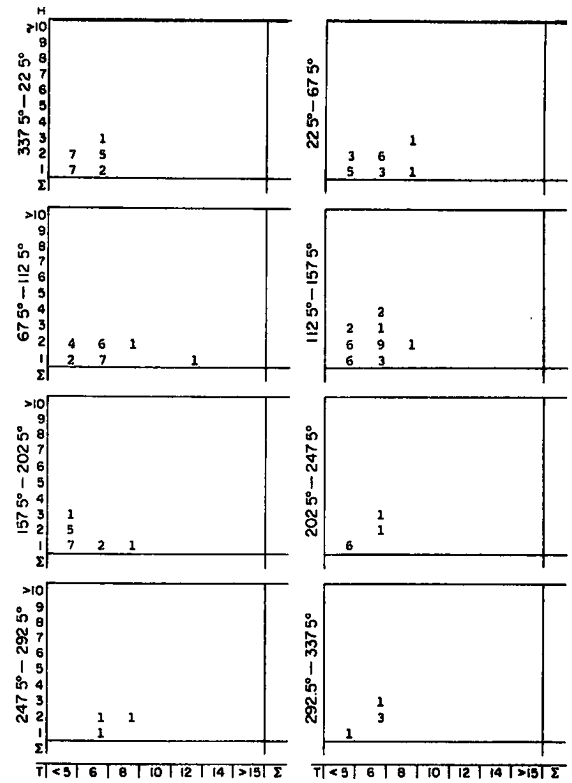

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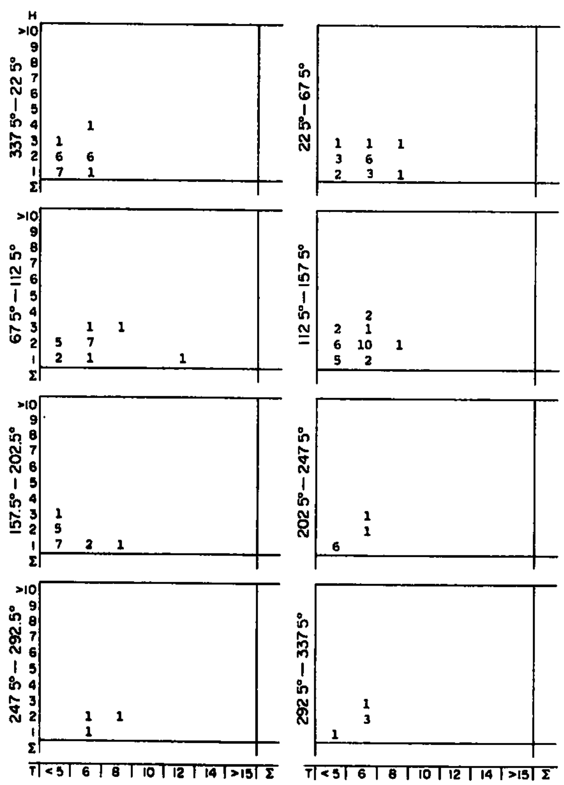

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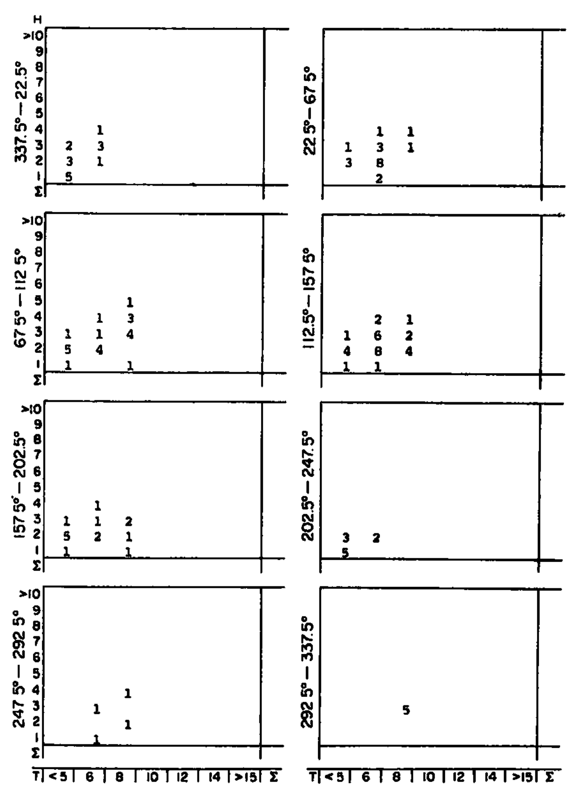

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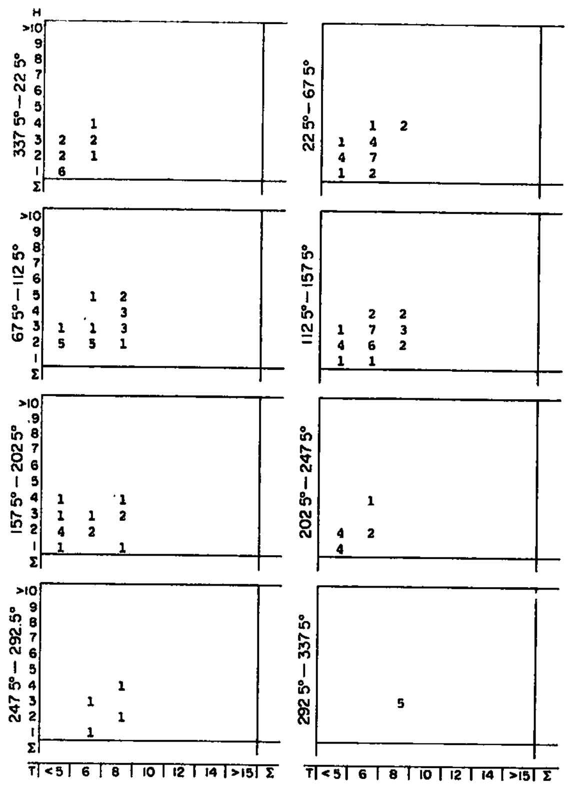
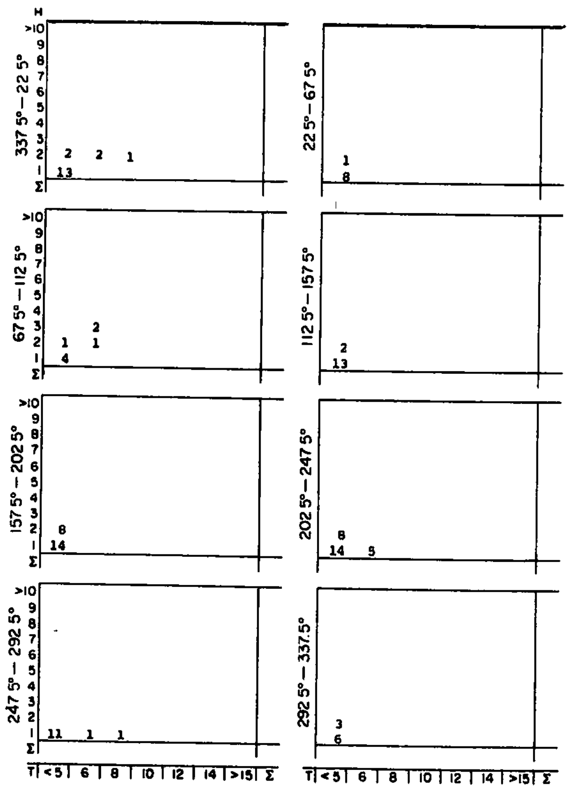
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 21f: Directional Wave Statistics for September



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 21g: Directional Wave Statistics for September



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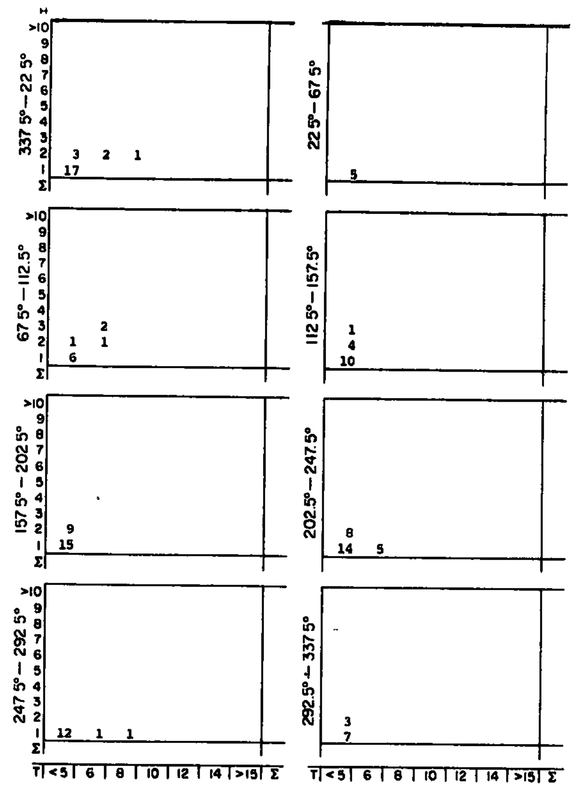

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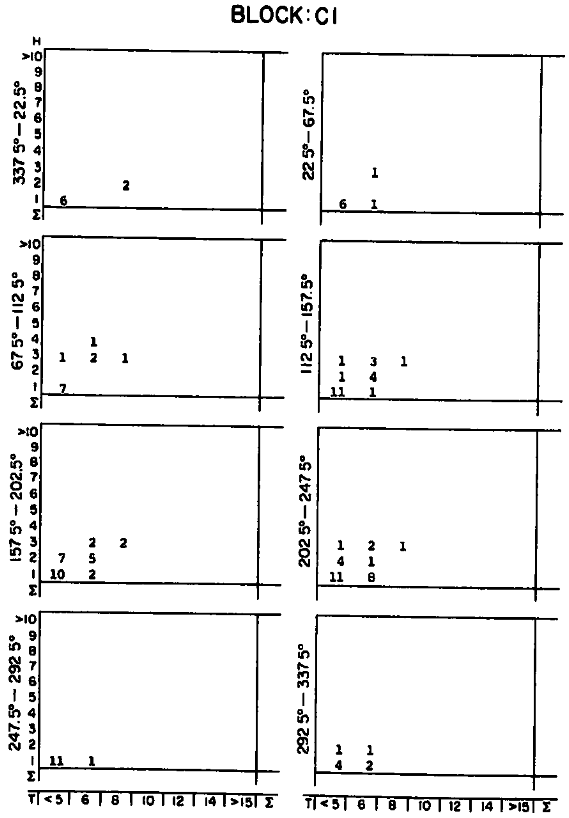

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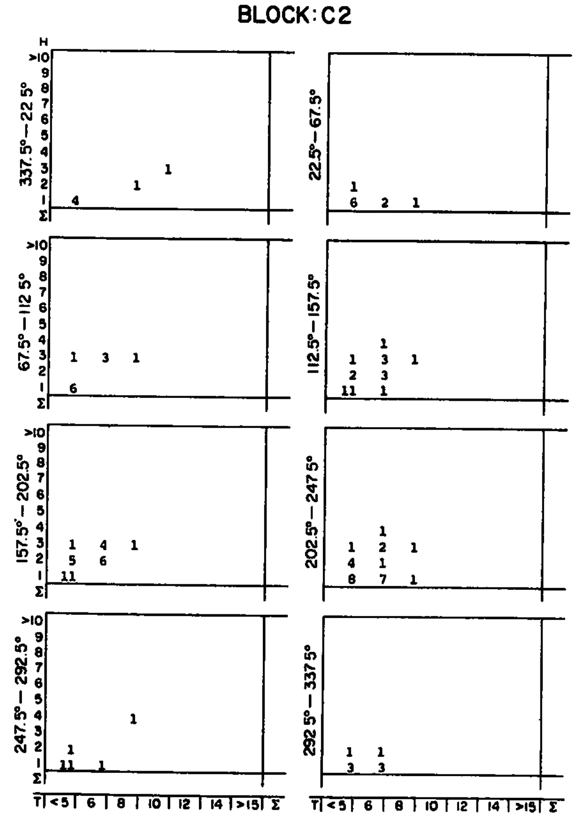

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NOTES:

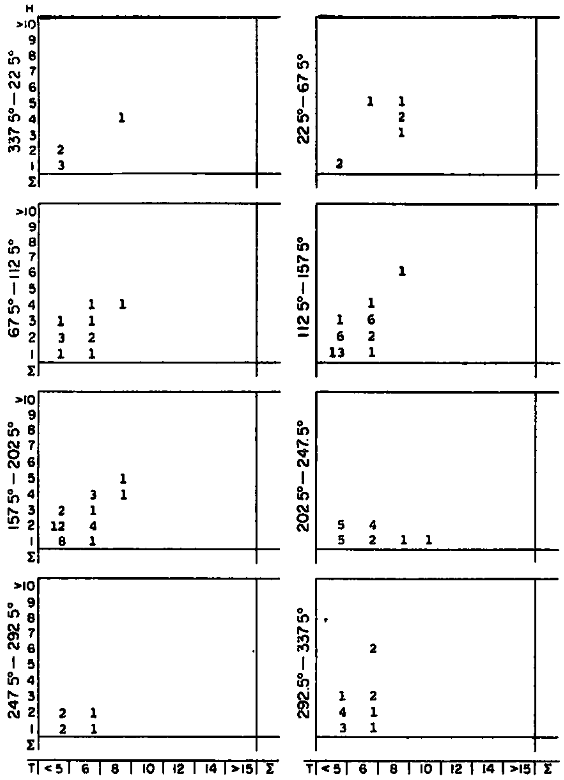
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 22a: Directional Wave Statistics for October



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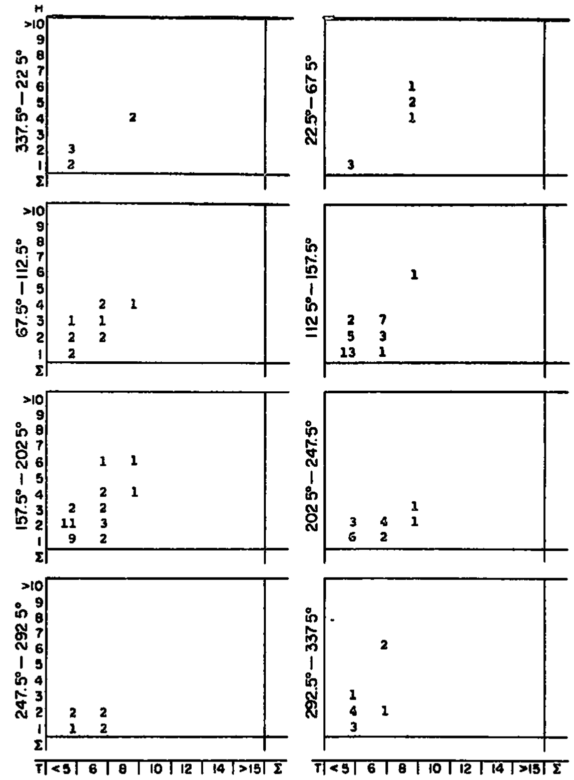

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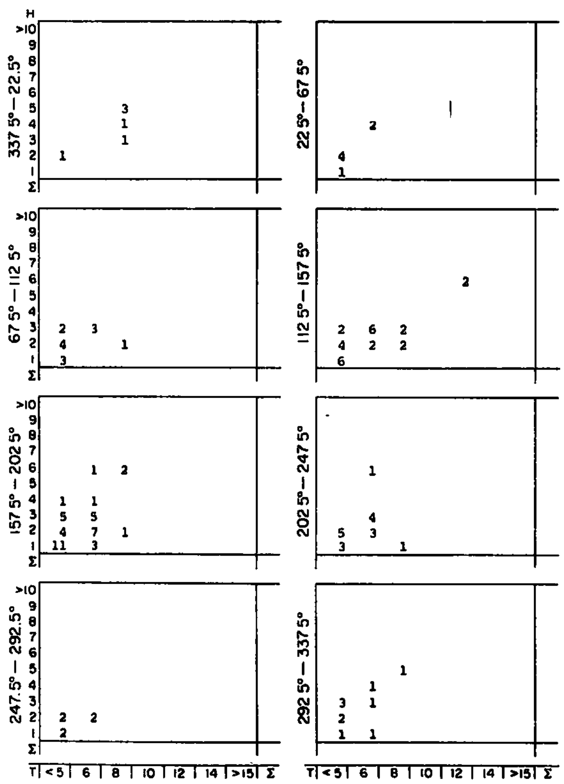

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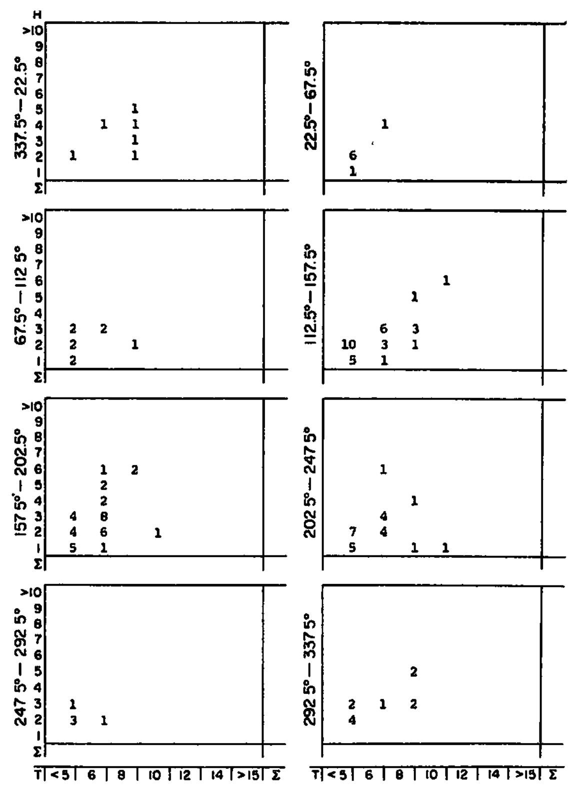

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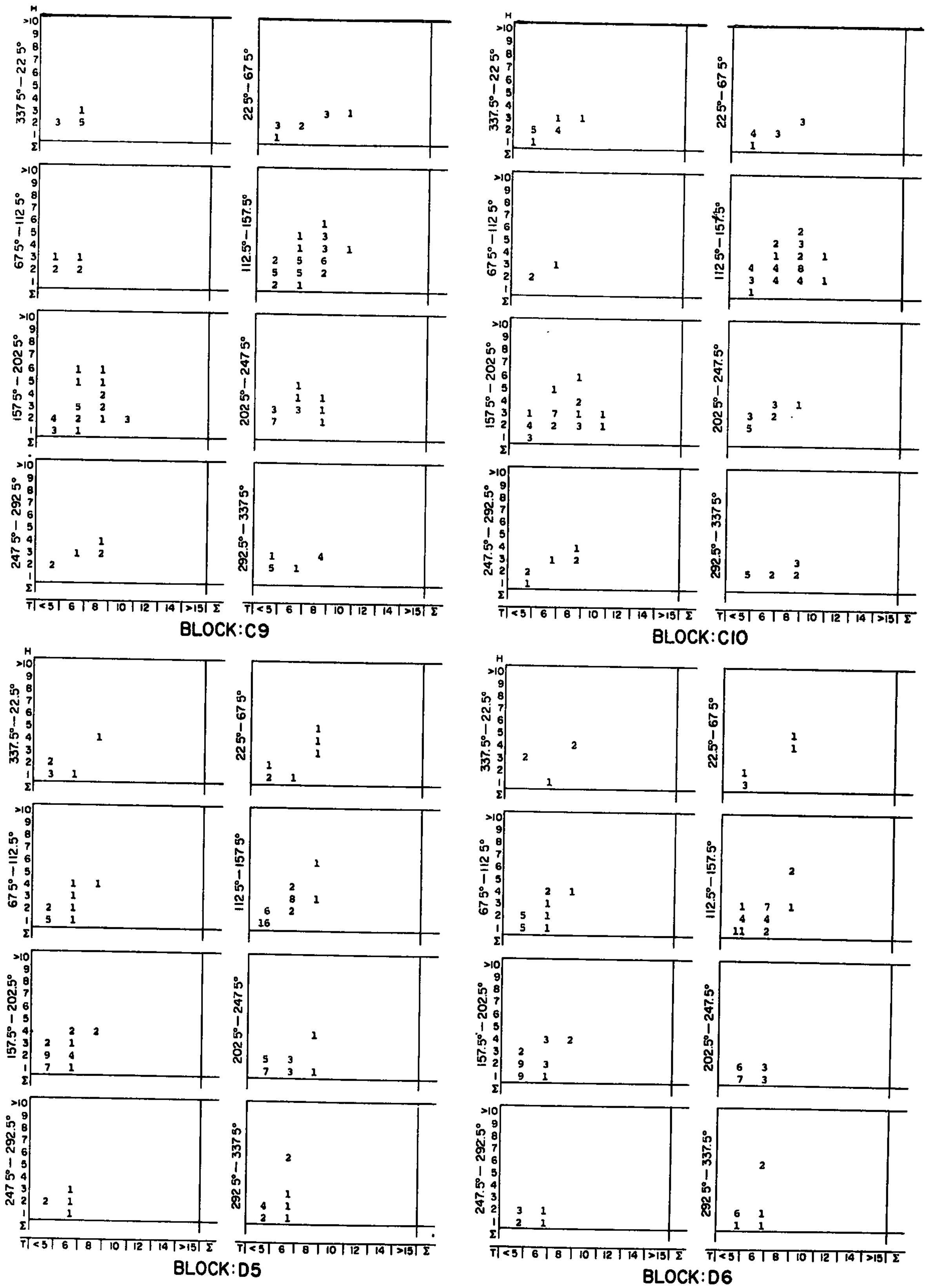
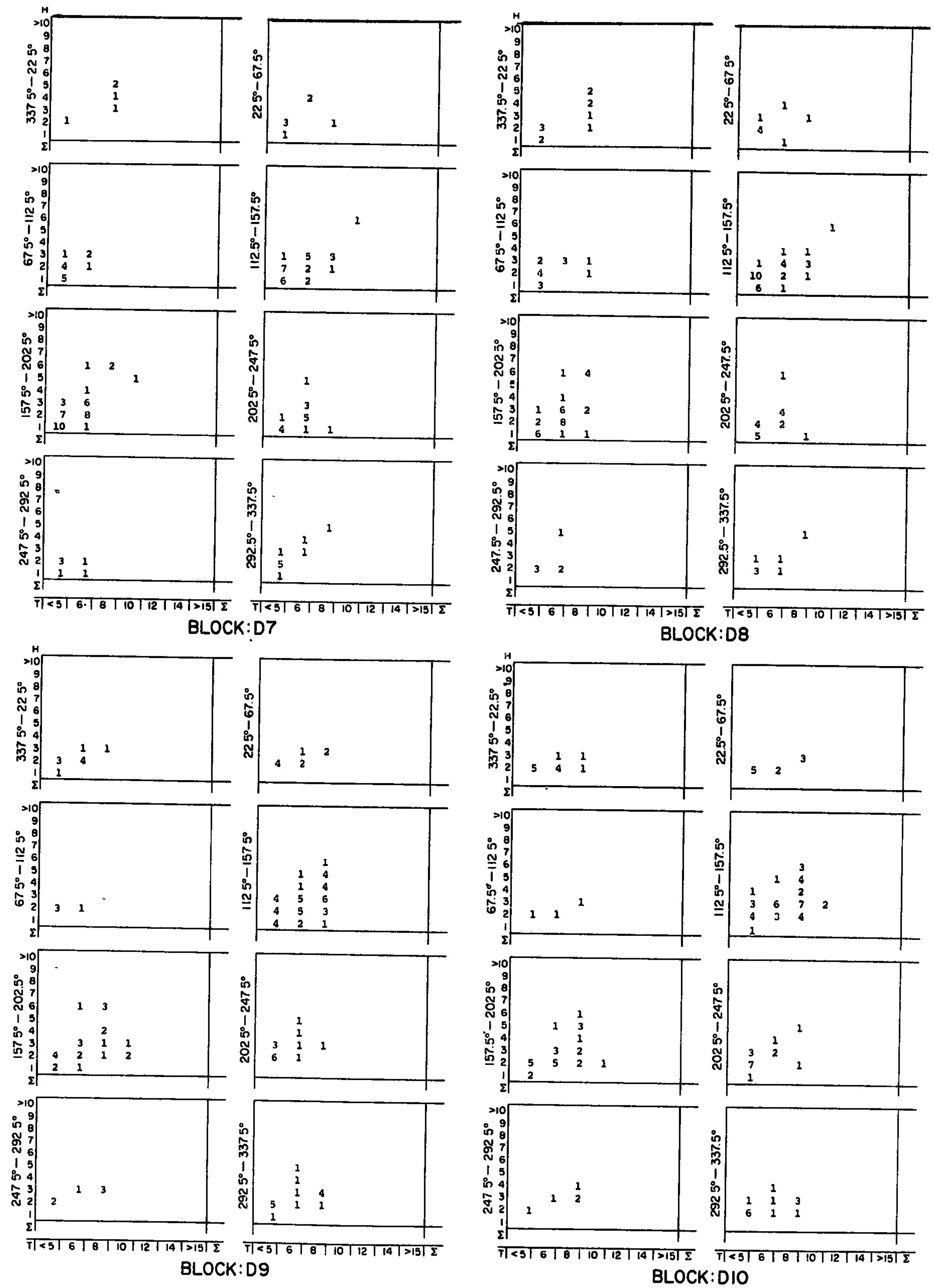
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 22b: Directional Wave Statistics for October



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

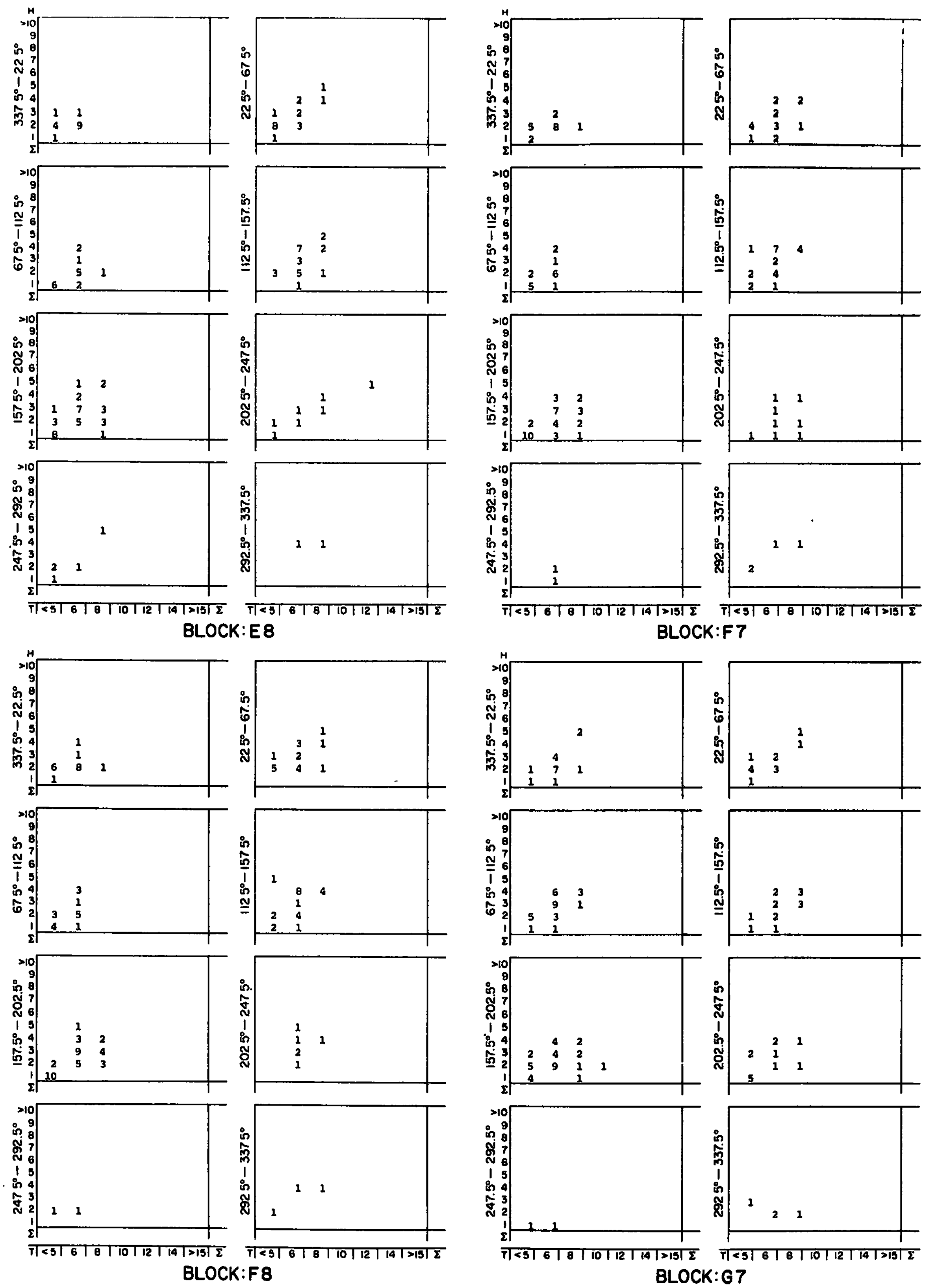
APPENDIX FIGURE 22c: Directional Wave Statistics for October



NOTES:

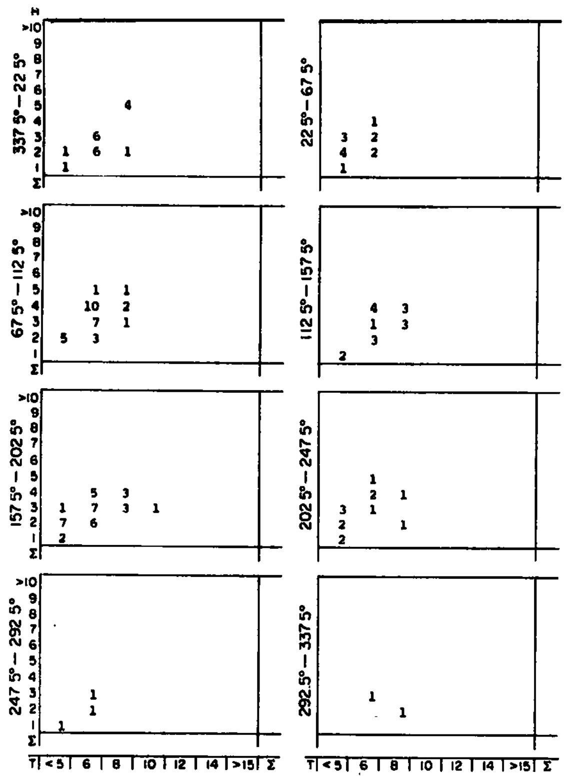
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 22d: Directional Wave Statistics for October



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 22e: Directional Wave Statistics for October



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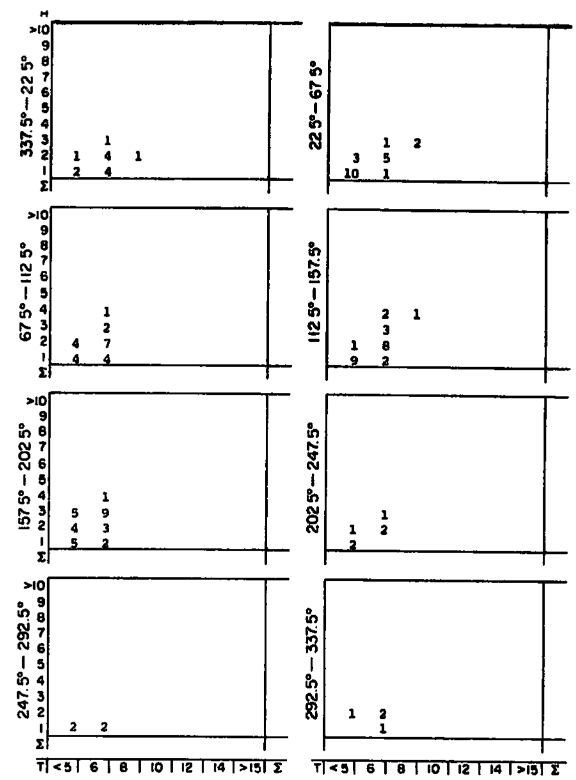

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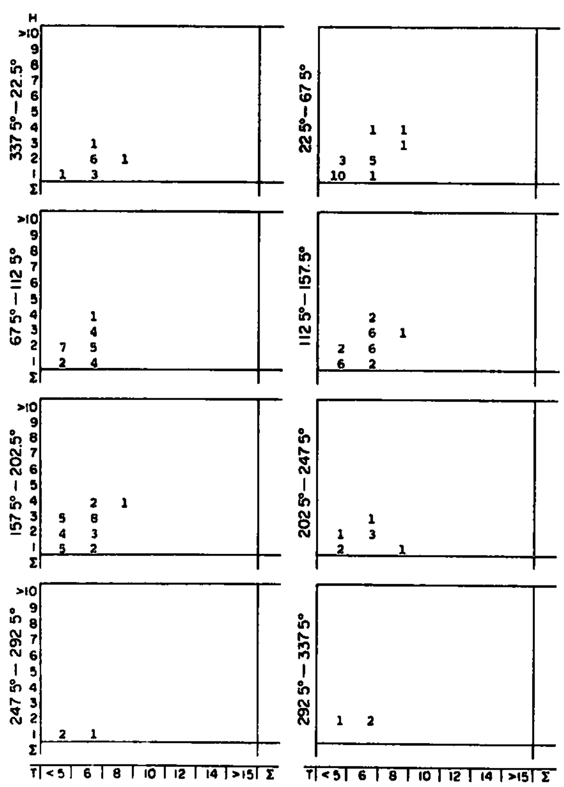

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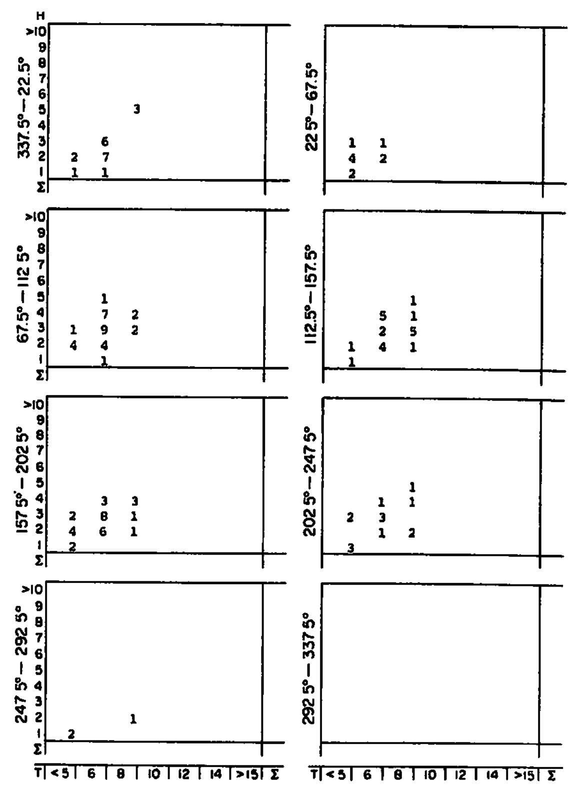

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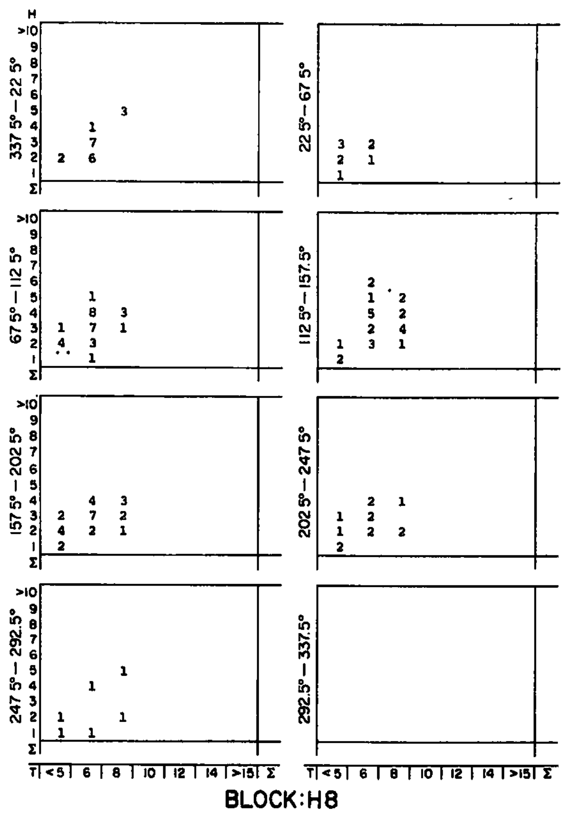
NOTES:

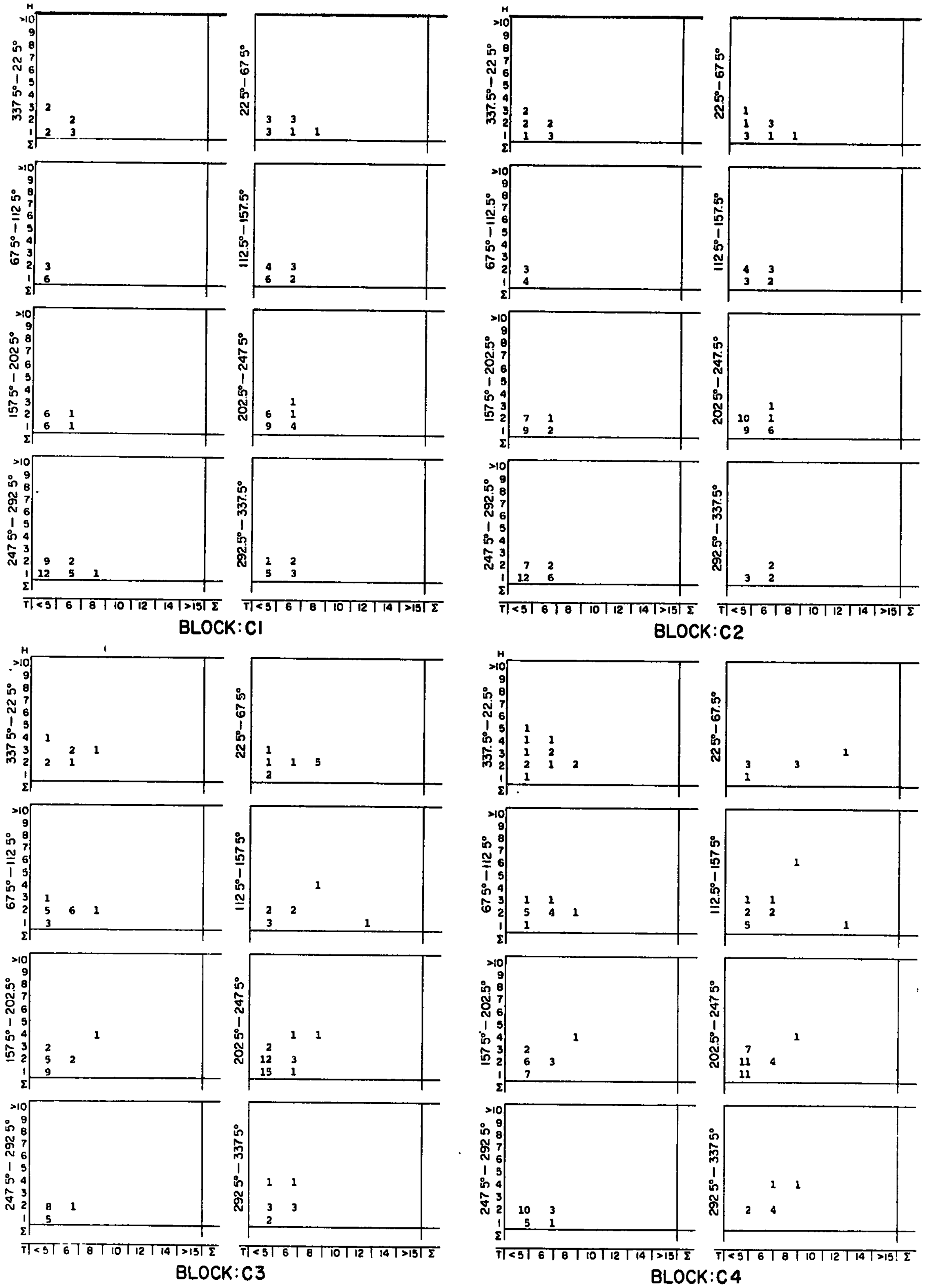
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 22f: Directional Wave Statistics for October



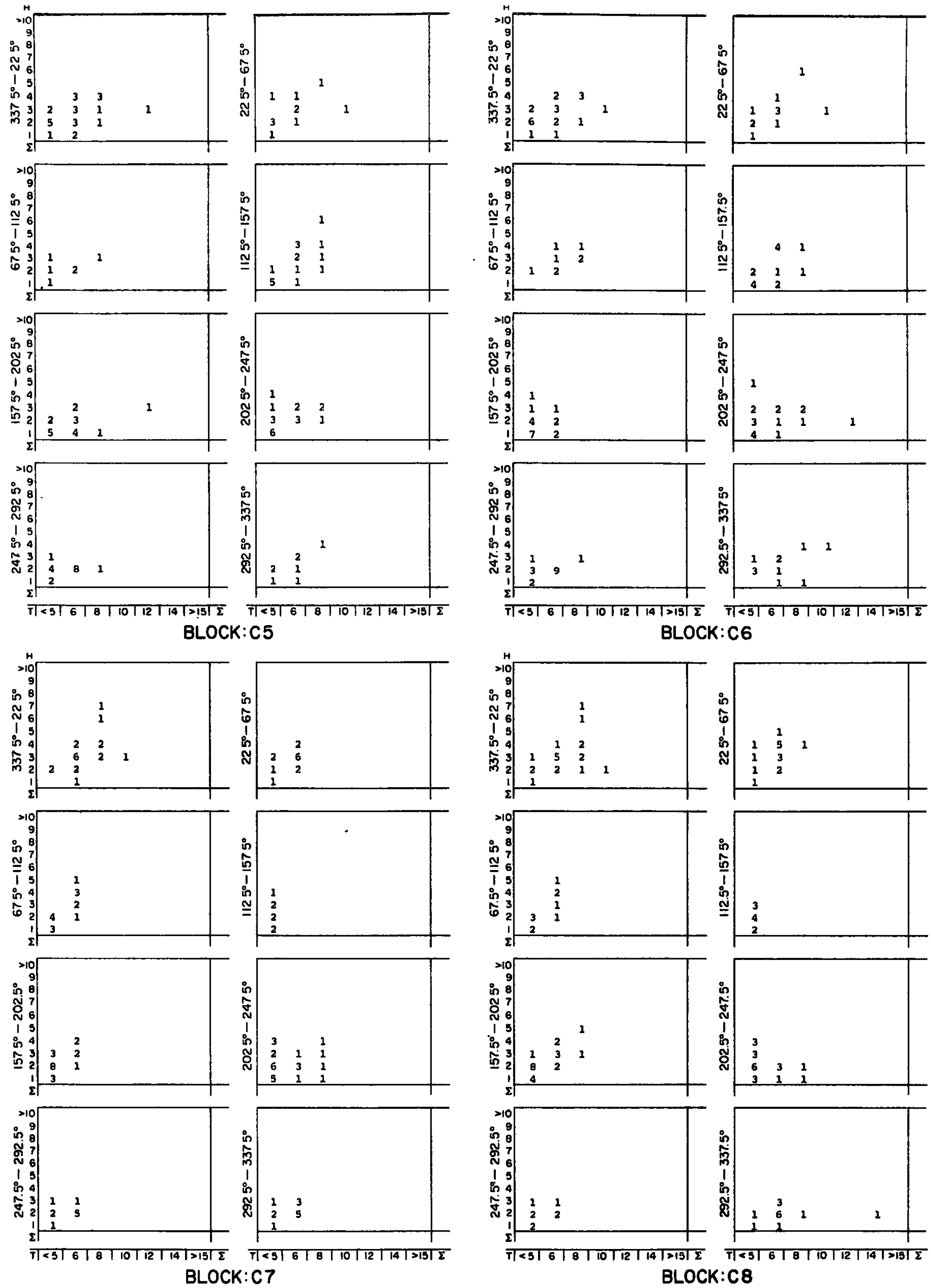
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 22g: Directional Wave Statistics for October



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 23a: Directional Wave Statistics for November



NOTES:

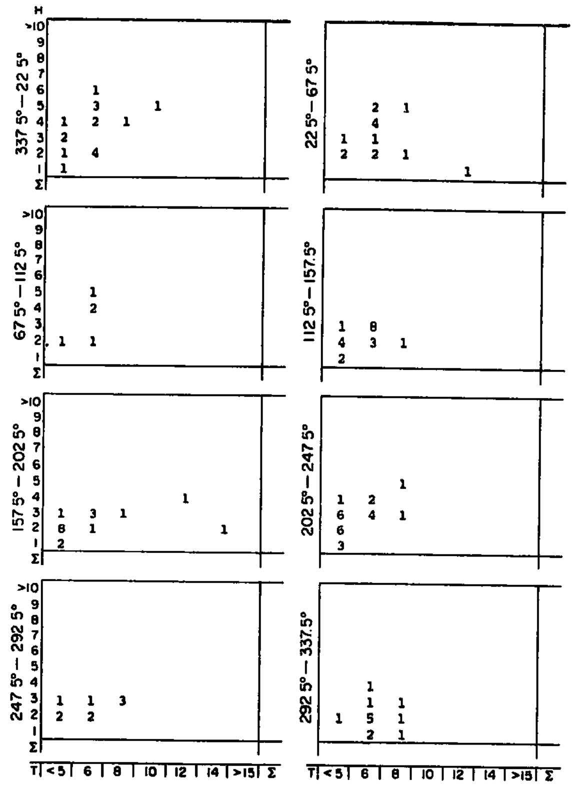
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 23b: Directional Wave Statistics for November



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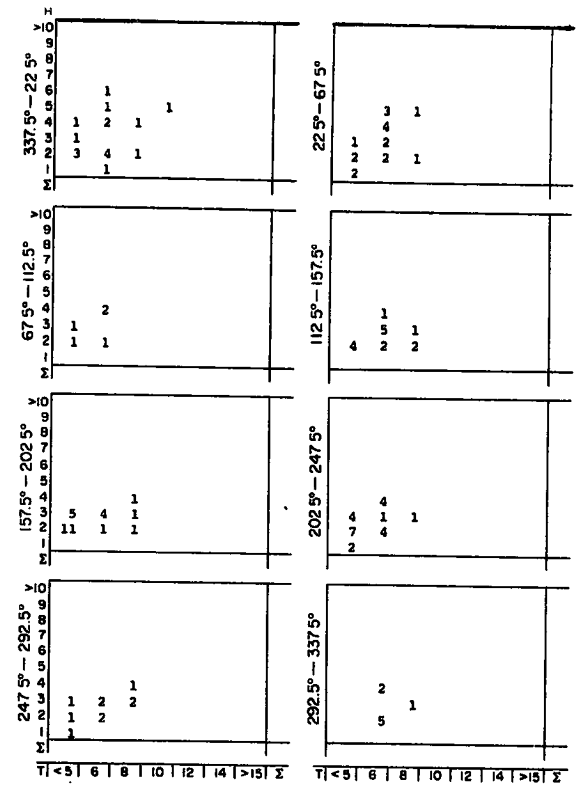

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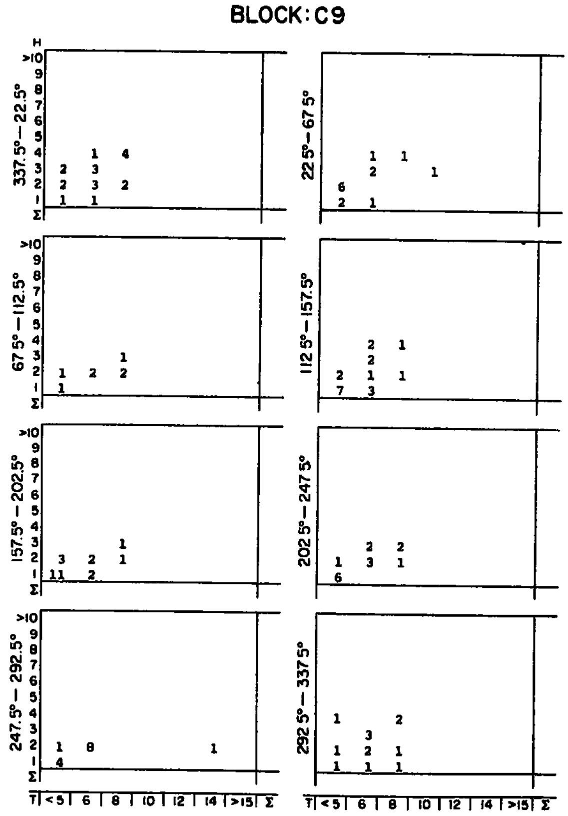

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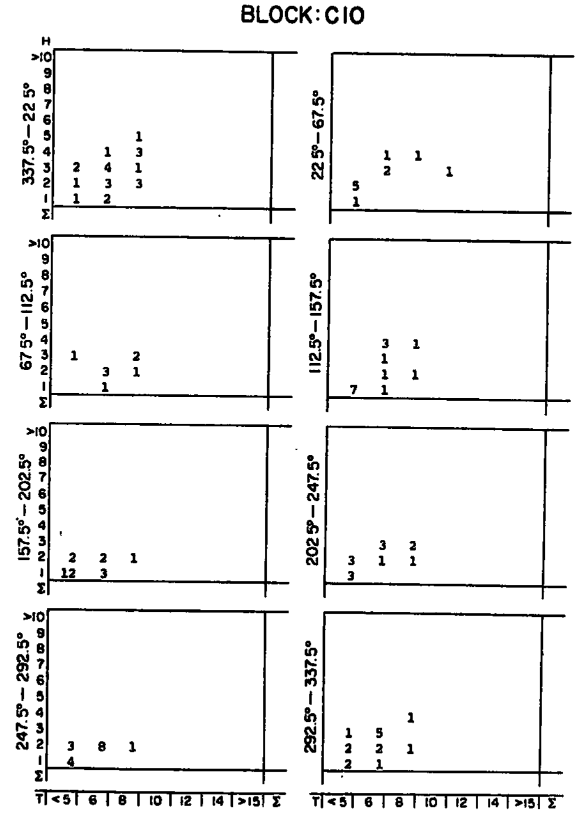
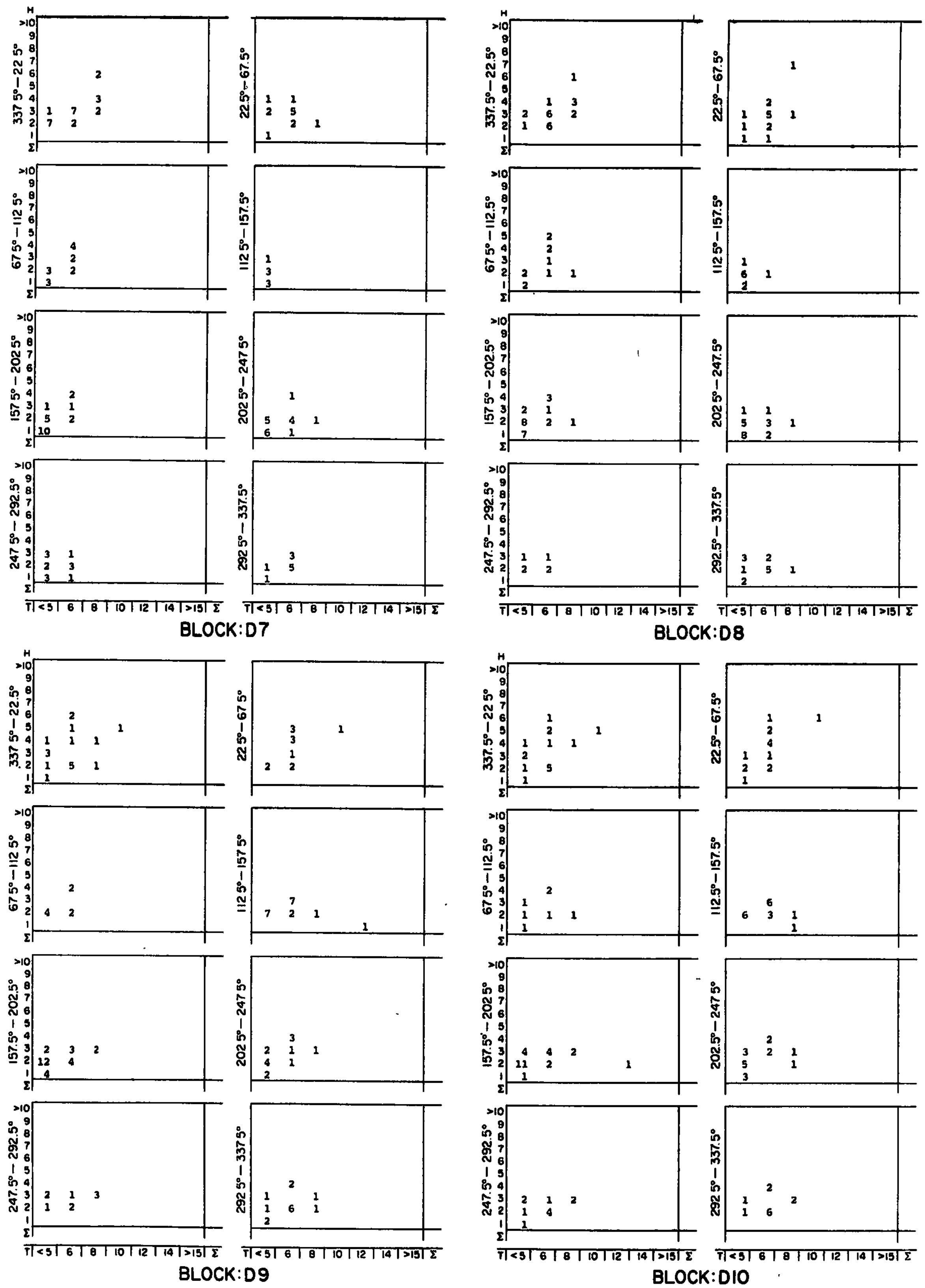


BLOCK: D6

NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 23c: Directional Wave Statistics for November



NOTES:

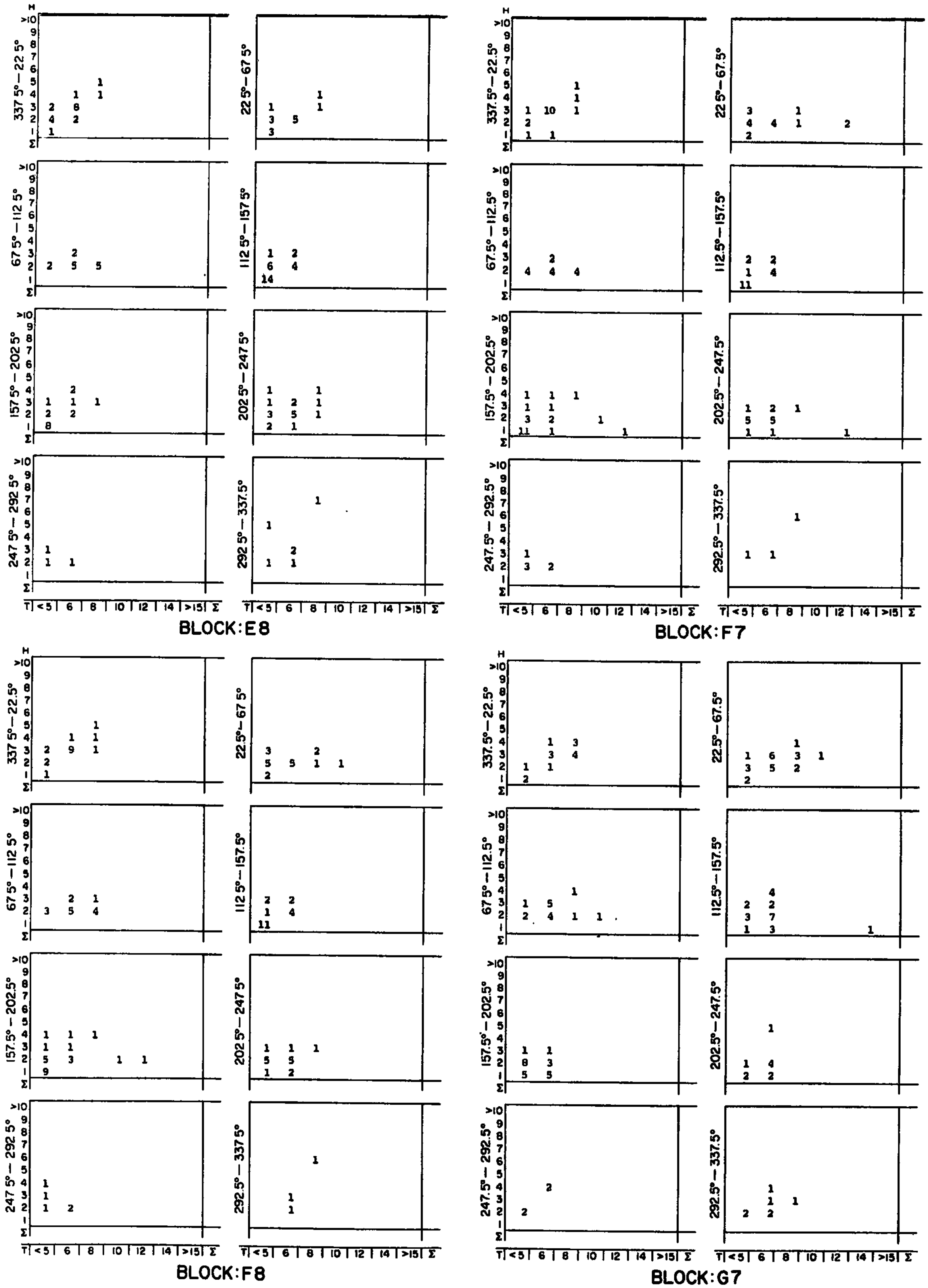
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES

H — WAVE HEIGHT IN METRES.

T — WAVE PERIOD IN SECONDS.

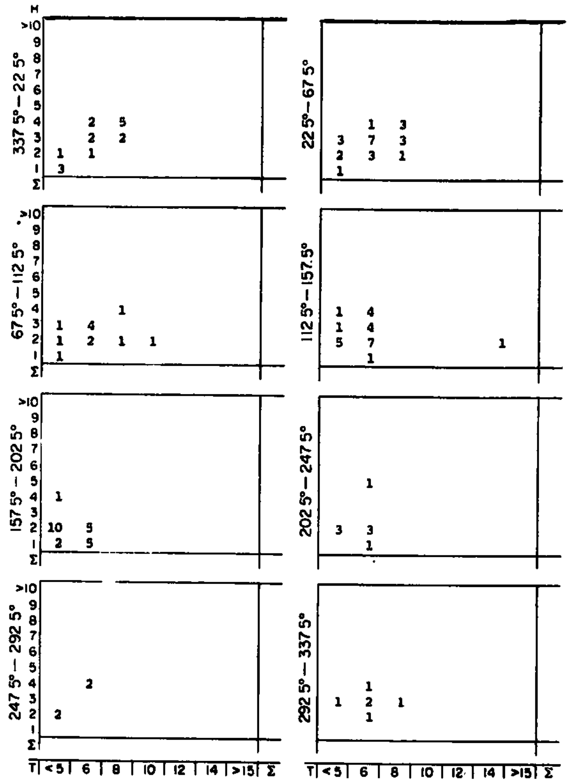
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 23d: Directional Wave Statistics for November



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 23e: Directional Wave Statistics for November



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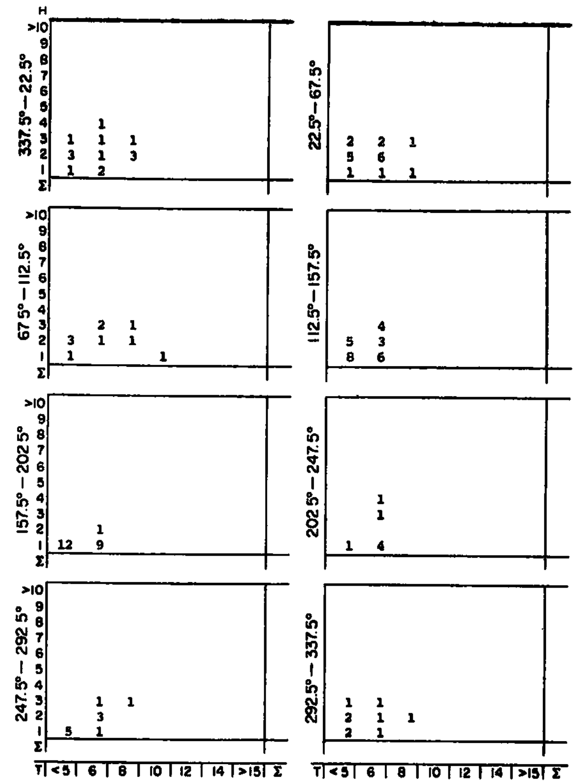

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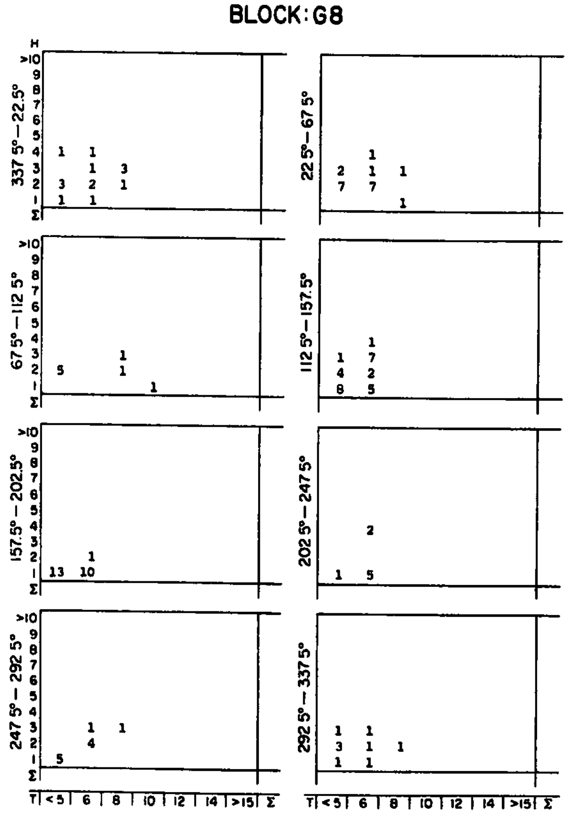

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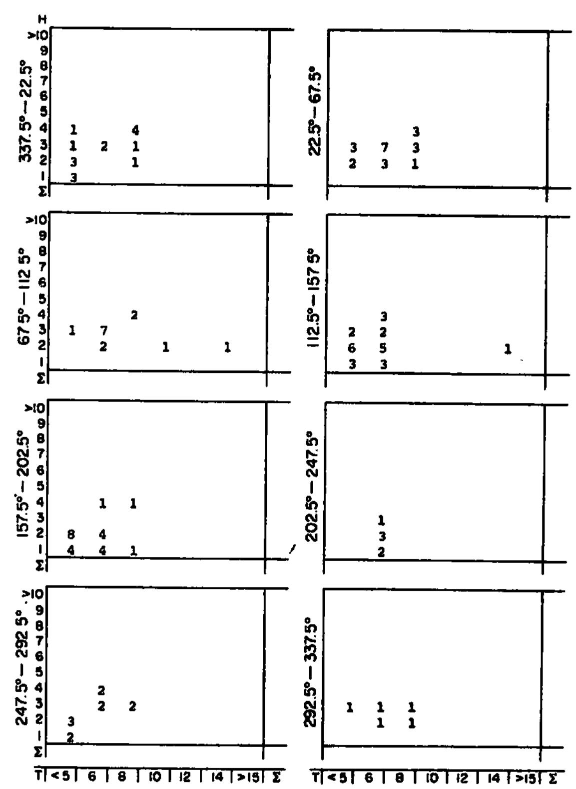

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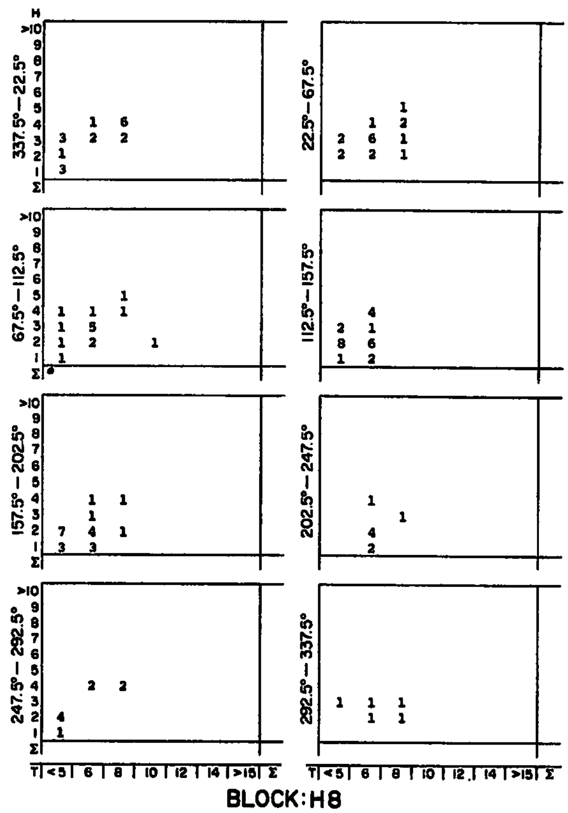
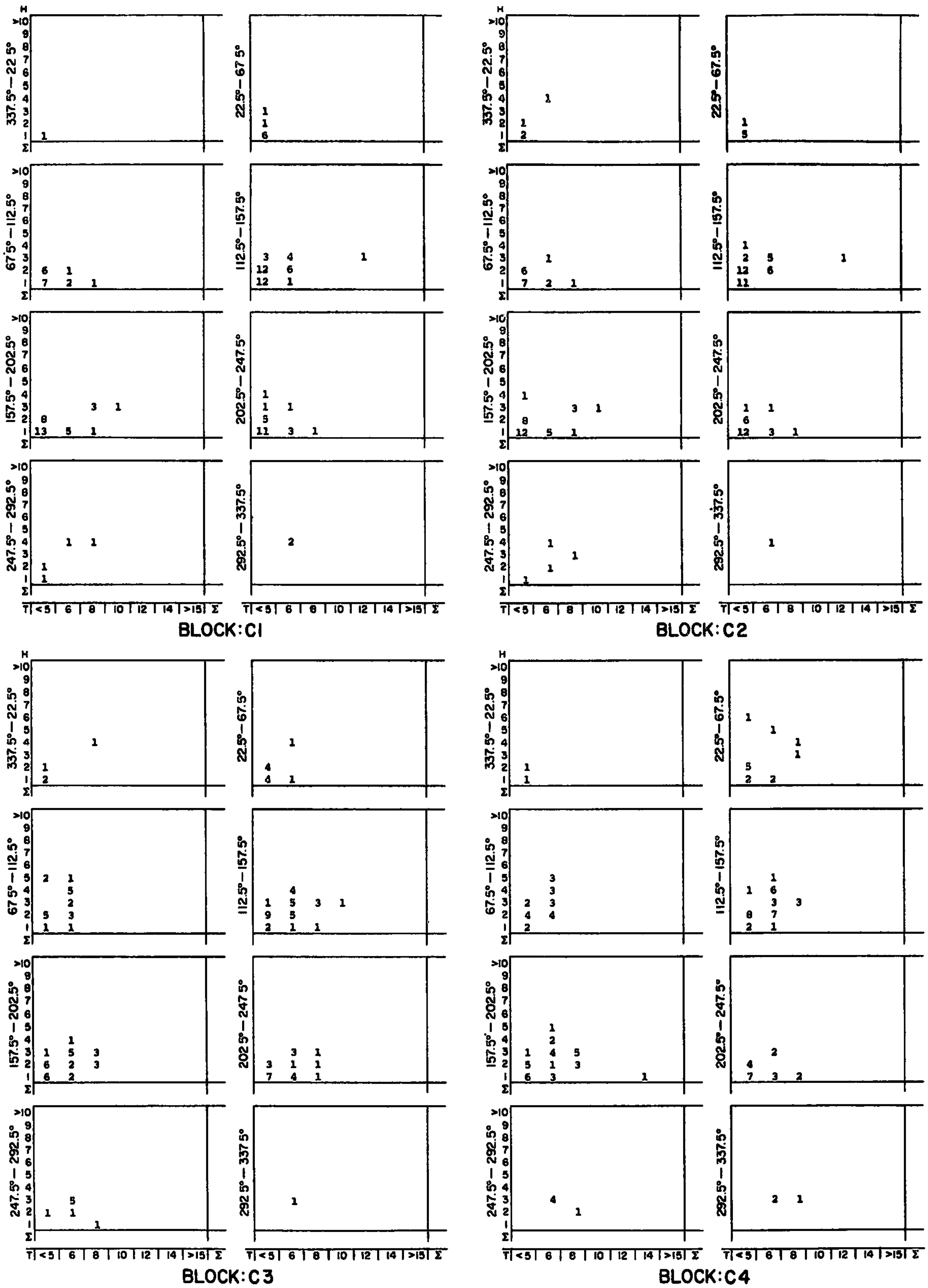
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 23f: Directional Wave Statistics for November



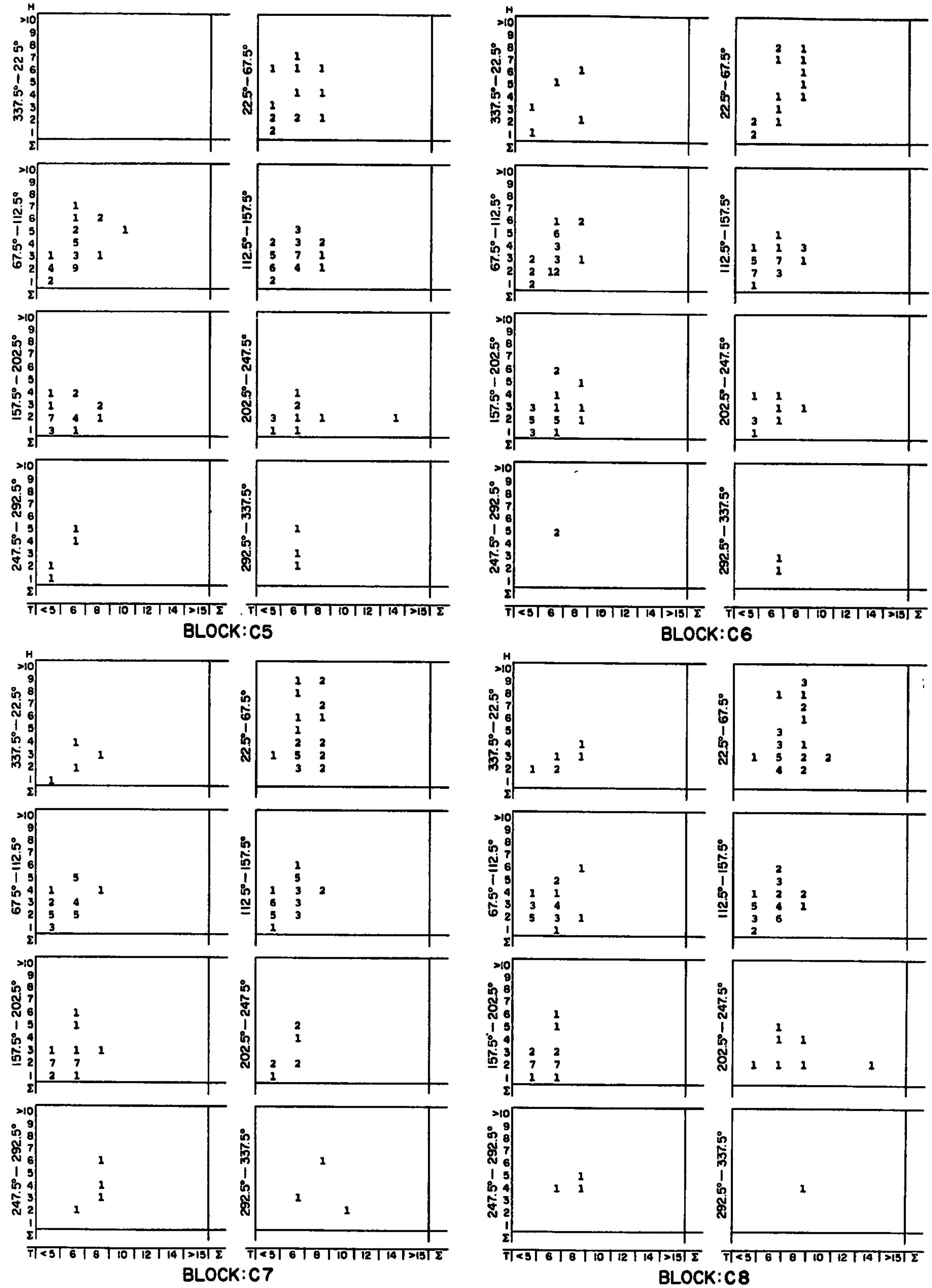
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 23g: Directional Wave Statistics for November



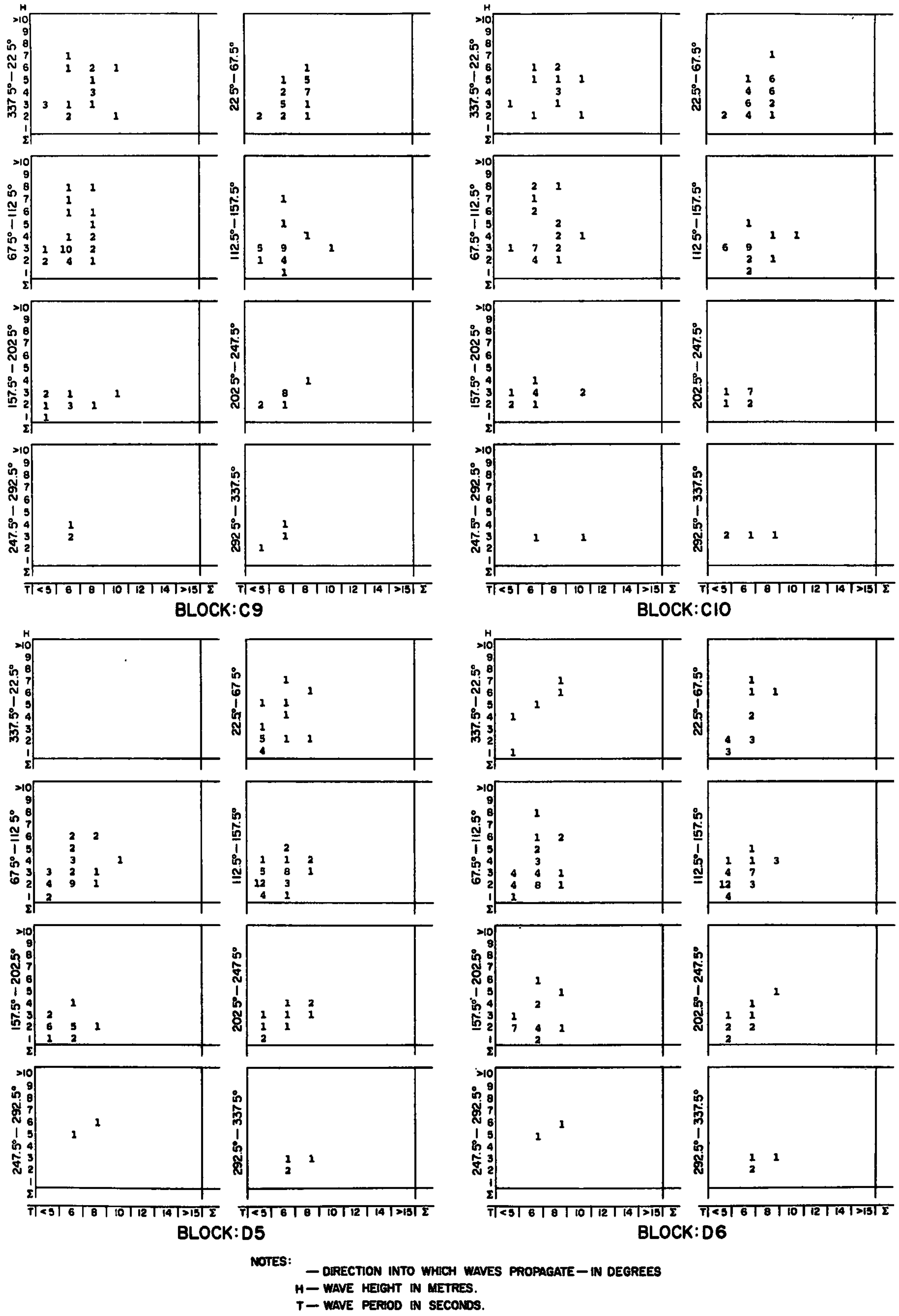
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 24a: Directional Wave Statistics for December

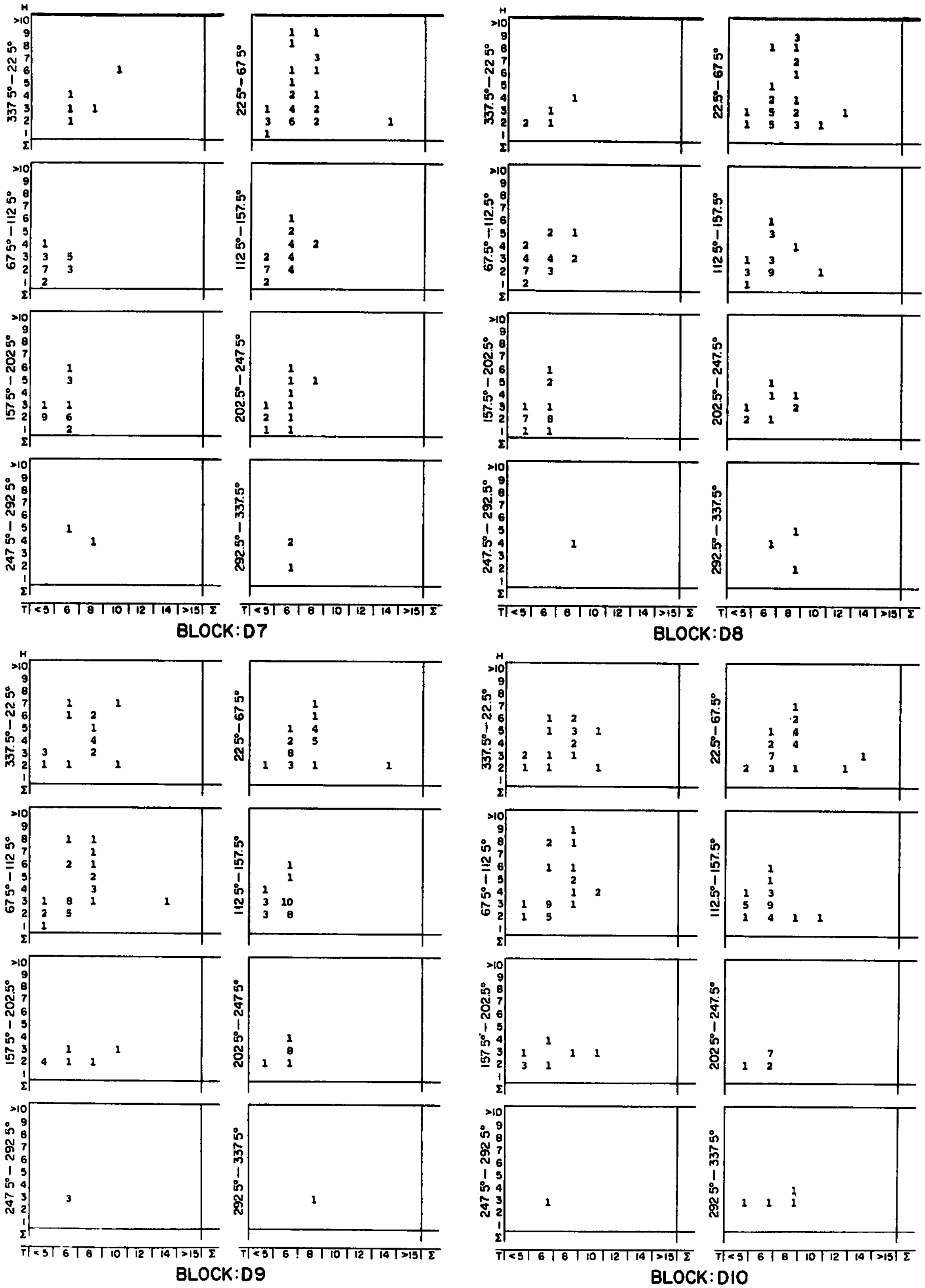


NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 24b: Directional Wave Statistics for December

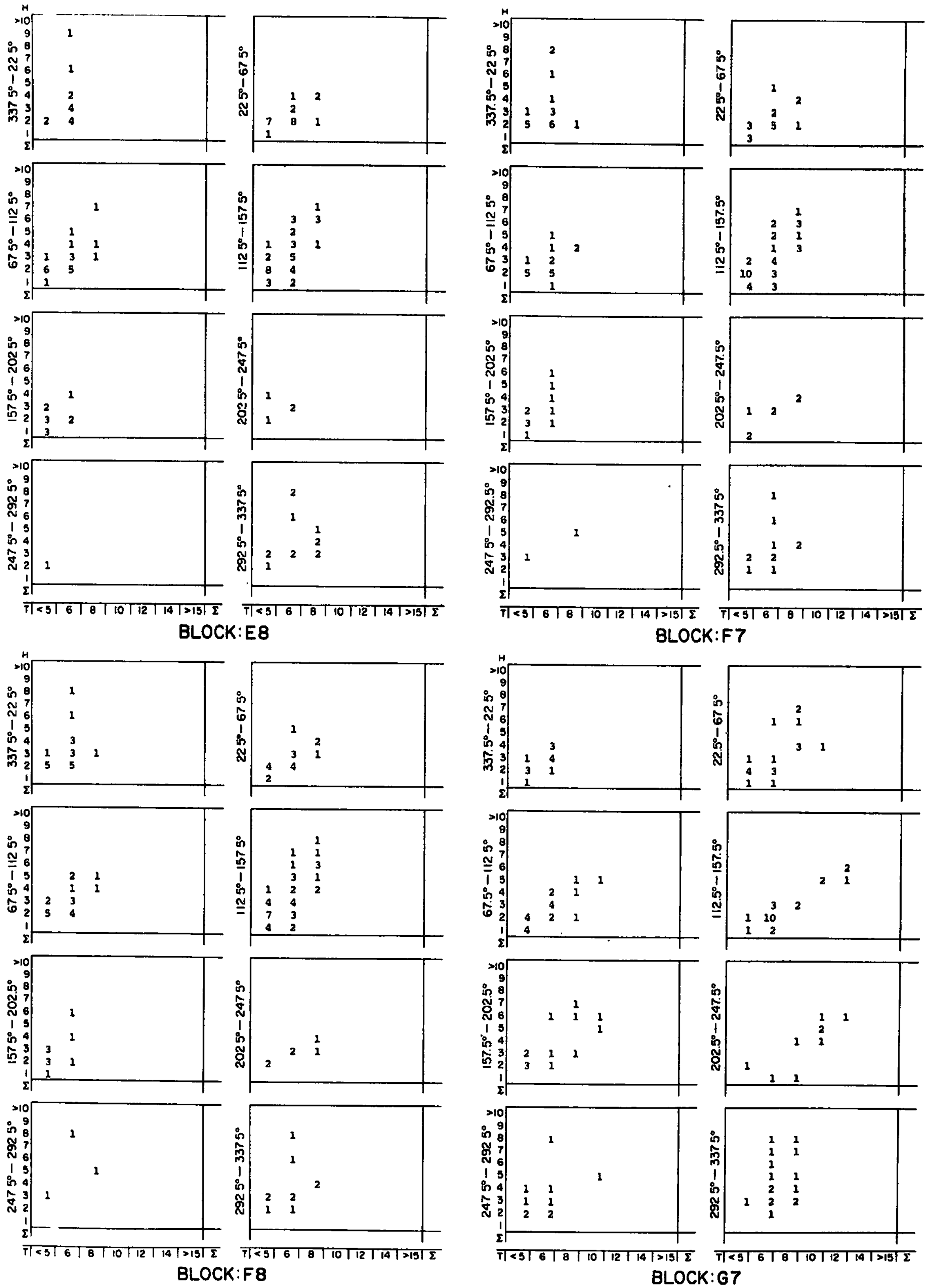


APPENDIX FIGURE 24c: Directional Wave Statistics for December



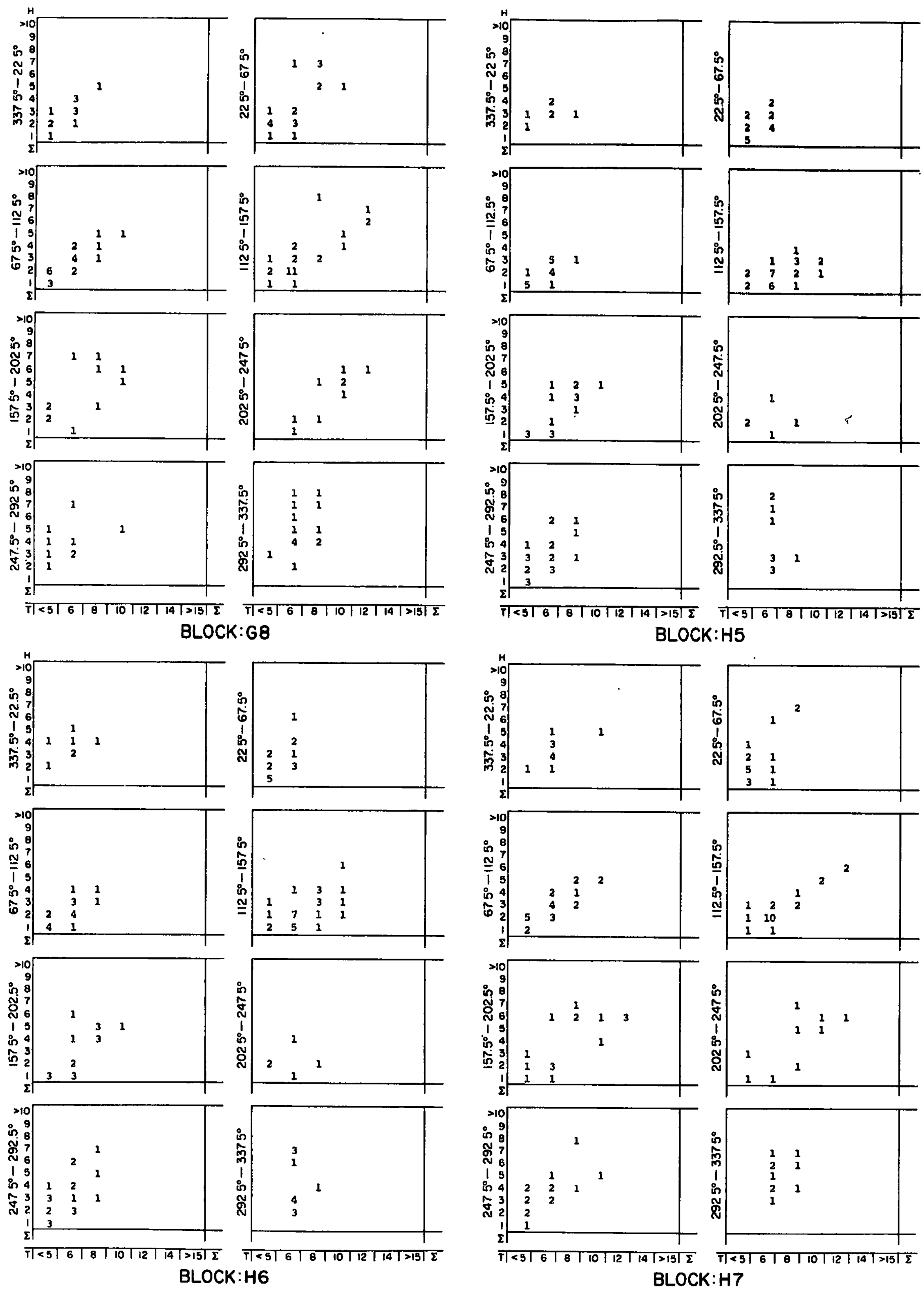
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 24d: Directional Wave Statistics for December



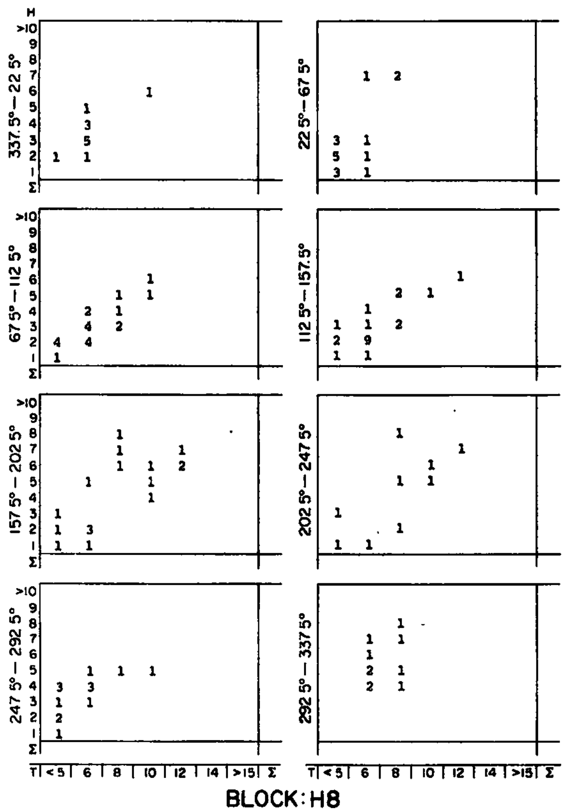
NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN.

APPENDIX FIGURE 24e: Directional Wave Statistics for December



NOTES:
— DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES.
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 24f: Directional Wave Statistics for December



NOTES: — DIRECTION INTO WHICH WAVES PROPAGATE — IN DEGREES
H — WAVE HEIGHT IN METRES
T — WAVE PERIOD IN SECONDS.
— ONE OCCURRENCE REFERS TO A SIX HOUR MEAN

APPENDIX FIGURE 24g: Directional Wave Statistics for December