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ATLAS OF FOURIER COEFFICIENTS OF DIURNAL VARIATION OF foF2 PART II. DISTRIBUTION OF AMPLITUDE AND PHASE

William B. Jones and Roger M. Gallet

U. S. DEPARTMENT OF COMMERCE
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NATIONAL BUREAU OF STANDARDS

Technical Note 305

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PART II.

DISTRIBUTION OF AMPLITUDE AND PHASE

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ATLAS OF FOURIER COEFFICIENTS OF DIURNAL VARIATION OF foF2
PART II. DISTRIBUTION OF AMPLITUDE AND PHASE

William B. Jones and Roger M. Gallet

This atlas is devoted to the study of amplitude and phase from the diurnal analysis of foF2 monthly median. It is concerned with their variations - both systematic and random - as functions of latitude, season and solar activity. The atlas contains a series of graphs of the distribution of amplitude and phase and tables of phase distribution for four seasonal months of high and low years of solar activity. Emphasis is placed on the study of the phase distributions for determining the optimum separation of harmonics produced mainly by noise from those representing mostly real physical variation.

1. INTRODUCTION

Extensive efforts have been made in recent years to solve the problems of representing ionospheric characteristics on a world-wide scale, including their diurnal variation, by objective analysis of ionospheric data using high speed computers [Jones and Gallet, 1960, 1962a, b, 1965; Jones, 1962; Hinds and Jones, 1963]. In this work, the analysis is made in two main parts. (1) For the diurnal variation, the 24 hourly measurements from each available station are Fourier analyzed. (2) The geographic variation of each Fourier coefficient is analyzed and represented by series of orthonormal functions in latitude and longitude, equivalent, in a sense, to surface spherical harmonics.

In the work cited above, major emphasis is placed on obtaining optimum separation of noise (i.e., random fluctuation of ionospheric data) from real physical variation. From studies of Fourier power spectra in the diurnal analysis of foF2 monthly median [Jones and Gallet, 1962a, Section 4], it is shown that certain harmonics are produced mainly by noise, whereas other harmonics represent mostly real physical variation. The proper separation of these harmonics and resulting truncation of the Fourier series give the optimum smoothing as well as the desired diurnal representation. A number of additional investigations have been made to determine the proper separation of harmonics, including that of the distribution of amplitude and phase. That investigation is the object of the present atlas.

The first Atlas of Fourier Coefficients of Diurnal Variation of foF2 [Jones, 1962] (hereinafter referred to as Part I) is devoted to studying the variations (both systematic and random) of the sine and cosine components. The present atlas (Part II) deals with the variations of amplitude and phase as functions of latitude, season and solar activity. These are studied by means of a series of graphs of amplitude and phase distribution and tables of phase distribution for four seasonal months of high and low years of solar activity.

The form of presentation used here has two main advantages over that employed in Part I. (1) Physical properties are more easily interpreted in terms of amplitude and phase than in sine and cosine components. (2) The effect of noise on the various harmonics is more clearly distinguishable in the distribution of phase than in the distribution of the other three Fourier components. This latter advantage is exploited, in Section 4, for determining the optimum separation of harmonics.

The regular and systematic behavior found in this series of graphs and tables has been instrumental in solving the problems of ionospheric mapping by numerical methods. Although more objective methods have been used to study the physical variations and effects of noise in ionospheric data, the graphical representations presented here have guided the development of mapping methods and have added insight to understanding the complex properties of the ionosphere.

The ionospheric characteristic chosen for this study is the monthly median of the F2-layer critical frequency (foF2), because of its physical significance as well as practical importance in radio propagation. Similar investigations have been made for other characteristics of the ionosphere, such as the 3000 km maximum usable frequency factor (F2-M3000). For that quantity the main variations are weaker than for foF2, but again they are found to be regular and systematic.

2. THE BASIC INPUT DATA

The basic data used for this Atlas (Part II) are the same as for Part I. They consist of 24 hourly medians of foF2 from all available ionospheric stations for the four seasonal months, March, June, September, and December, for each of the last minimum and maximum years of solar activity (1954 and 1958). Table 1 gives the total number of stations available at the time this study was made and the Zurich sunspot numbers for each month. The data were punched on cards as they had been tabulated in ionospheric booklets (or in some cases on microfilm) without prior smoothing. In a few cases it was necessary to reject data from certain stations if, for example, so many consecutive hourly values were missing that the diurnal curve could not be defined, or if the data were grossly inconsistent with those from closely neighboring stations. For the IGY year (1958) there were about twice as many stations as for 1954, and so the world-wide coverage was considerably better, particularly in the southern hemisphere.

TABLE 1

Number of Stations and Zurich Sunspot Numbers (ZSN):
(A) Monthly Mean and (B) 12 Month Running Average

	1954				1958			
	Mar.	Jun.	Sep.	Dec.	Mar.	Jun.	Sep.	Dec.
Stations	66	68	63	64	118	118	113	118
ZSN (A)	10.9	0.2	1.5	7.6	190.7	171.5	201.2	187.6
ZSN (B)	4.2	4.2	7.8	12.0	201.3	186.8	183.8	180.5

3. Fourier Analysis

3.1 Fourier Components

The 24 hourly medians of foF2 have been Fourier analyzed for each available station, each in its own zone time. As a result, the diurnal variation at each station is decomposed into 11 harmonics,

$$a_j \cos jt + b_j \sin jt = c_j \cos (jt - \psi_j), \qquad j = 1, 2, \ldots, 11, \tag{1}$$

and a constant term a_o, which is the arithmetic mean of the 24 medians[1]. Each harmonic is defined by an amplitude c_j and a phase angle ψ_j or, equivalently, by cosine and sine coefficients a_j and b_j, respectively. The Fourier components have been corrected to local mean time (LMT) by means of a shift in the phase angles determined by the difference in the station longitude and reference longitude of the time zone. The variable t denotes local mean hour angle related to LMT (in hours) by

$$t = 15^\circ \text{ (LMT)} - 180^\circ. \tag{2}$$

Thus, for example, $t = 0^\circ$ at noon LMT.

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[1] There is also an additional term, $a_{12} \cos 12t$, which is omitted here since it does not form a complete harmonic and since it is produced mainly by noise.

Formulas for computing the Fourier components are summarized by Jones and Gallet [1962a, Section 3.1]. Only the relations connecting them will be given here

$$a_j = c_j \cos \psi_j \qquad b_j = c_j \sin \psi_j$$
$$c_j = \sqrt{a_j^2 + b_j^2} \qquad \psi_j = \arctan \frac{b_j}{a_j} \; . \tag{3}$$

3.2 Analysis of Random Noise

For use in the following section, a brief discussion is given here of certain properties of ionospheric data and of the Fourier analysis of random noise. Ionospheric data may be considered as sampled values y_i from a function $f(x)$ which is the sum of two components: (1) the real physical characteristic $f_1(x)$ and (2) a random noise component $f_2(x)$. Thus each ionospheric datum is a sum

$$y_i = y_i^{(1)} + y_i^{(2)},$$

where (4)

$$y_i^{(1)} = f_1(x_i) \quad \text{and} \quad y_i^{(2)} = f_2(x_i).$$

The values of the noise $y_i^{(2)}$ are assumed to be independently, normally distributed, with mean zero and standard deviation σ, a quantity used as a measure of the noise. Table 2 contains estimated values of the average noise σ in foF2 medians for each month considered. These values are computed as described by Jones and Gallet [1962a, Section 4]. A value of σ is given for all stations taken together for a given month and for

TABLE 2

Average Noise σ (Mc/s) in foF2 Medians

	1954				1958			
	Mar.	Jun.	Sep.	Dec.	Mar.	Jun.	Sep.	Dec.
All Stations	0.17	0.15	0.19	0.19	0.25	0.24	0.29	0.27
Selected Latitude Bands:*								
$60^\circ < \lambda \leq 90^\circ$	0.10 (7)	0.057 (11)	0.076 (7)	0.10 (6)	0.32 (28)	0.15 (28)	0.26 (28)	0.30 (27)
$30^\circ < \lambda \leq 60^\circ$	0.11 (26)	0.10 (25)	0.14 (23)	0.15 (23)	0.19 (41)	0.12 (39)	0.20 (42)	0.22 (39)
$-30^\circ < \lambda \leq 30^\circ$	0.24 (23)	0.21 (22)	0.28 (23)	0.26 (24)	0.28 (28)	0.29 (32)	0.36 (24)	0.30 (34)
$-60^\circ < \lambda \leq -30^\circ$	0.15 (8)	0.14 (8)	0.12 (8)	0.14 (9)	0.23 (9)	0.35 (10)	0.31 (11)	0.25 (12)
$-90^\circ \leq \lambda \leq -60^\circ$	0.11 (2)	0.074 (2)	0.13 (2)	0.12 (2)	0.25 (12)	0.41 (9)	0.42 (8)	0.17 (6)

*(Numbers in parentheses indicate numbers of stations contained within the particular latitude bands.)

each of five selected latitudinal bands. For each fixed month, σ appears to have a significant latitudinal variation. To verify this observation, the likelihood ratio test [Hoel, pp. 189-166, 1954] has been used to test the equality of the variances σ^2 from the five separate latitude bands for each month. In each case the estimate of χ^2 (chi-square) obtained from this test was considerably beyond the 1% critical value. Hence it was concluded that the latitudinal variation of σ is significant. Variations in σ with seasons and solar activity also appear, but these do not play an important role in the present study.

Now suppose that a sample of values $y_1^{(2)}, y_2^{(2)}, \ldots, y_{24}^{(2)}$ of the random noise function $f_2(x)$ is Fourier analyzed. The statistical distribution of each Fourier component may be derived from the asymptotic solution for a random walk. Following Chapman and Bartels [1940, pp. 572-582] we set

$$g_i = \frac{1}{12} y_i^{(2)} \cos jx_i \quad \text{and} \quad h_i = \frac{1}{12} y_i^{(2)} \sin jx_i, \tag{5}$$

where the x_i are the 24 equidistant hour angles at which the $y_i^{(2)}$ are measured. Then the Fourier coefficients

$$a_j = \sum_1^{24} g_i \quad \text{and } b_j = \sum_1^{24} h_i, \qquad j = 1, 2, \ldots, 11 \tag{6}$$

become the coordinates of a random walk of 24 steps (g_i, h_i). It follows from a theorem of Markoff that a_j and b_j have independent, <u>normal</u>

distributions[2] with mean zero and variance $\sigma^2/12$. Thus it can be shown that the phase ψ_j is uniformly distributed and the amplitude c_j has a Rayleigh distribution with probability density function

$$p(r) = \frac{r}{\sigma^2/12} \exp\left[-\frac{r^2}{\sigma^2/6}\right], \quad 0 \le r < \infty \tag{7}$$

The expected values of c_j and c_j^2 are found to be

$$E(c_j) = \sqrt{\frac{\pi}{24}}\,\sigma, \quad \text{and} \quad E(c_j^2) = \frac{\sigma^2}{6} \tag{8}$$

respectively, independent of the frequency j.

It is clear that the phase ψ_j is the only one of the four Fourier components whose distribution will be independent of the noise σ. This is a useful result for testing harmonics, obtained from Fourier analysis of ionospheric data. For example, consider the distribution of phase angles ψ_j from all available stations for a given month, for a harmonic which is produced mainly by noise. From the preceding discussion, all of the phase angles would belong to a common uniformly distributed population, which can be tested by the standard chi-square test. On the other hand, with a different Fourier component, say amplitude, the c_j from different stations would not belong to a common Rayleigh-distributed population, since the distribution of the c_j depends on σ which, in turn, varies with geographic position (see Table 2). Thus the phase is the simplest Fourier component to use in such a test. Results of this nature are discussed in the following section.

[2] Note: These are the same for all frequencies.

4. Description of Graphs and Tables

4.1 General Description

The present atlas contains a series of illustrations, each consisting of two main parts: (1) a graph in polar coordinates of the distribution of amplitude c_j and phase ψ_j for all stations for a given month and harmonic and (2) corresponding tables of the distribution of phase for all stations combined (marked TOTAL) and for stations grouped in latitude bands of 30° width. In each case the distribution is described by giving the number of phase angles in each of four quadrants. For example, in the illustration of Harmonic 2 for September 1958, the table

TOTAL

80	12
14	6

implies: 12 phase angles between 0° and 90° (Quadrant I), 80 phase angles between -90° and 0° (Quadrant II), 14 phase angles between -180° and -90° (Quadrant III) and 6 phase angles between 90° and 180° (Quadrant IV). The number appearing in the corner of each box refers to the number of stations in the latitude band.

The basic graph shows the distribution of both amplitude and phase. Amplitude is measured radially by a scale given just above the graph. The amplitude scales, though fixed within a given harmonic, are expanded for certain harmonics (e.g., 2, 3, 4 and 7) to compensate for diminishing size in amplitude. Phase is measured from the upward vertical ray, positive in the counter-clockwise direction. Thus, for example, in Harmonic 1 the points of the graph act as hour hands of a clock giving the time displacement of maximum foF2 median from noon (LMT = 12). Phase angles of -15°, 0°, and 15° refer to displacements of one hour before noon, zero hours before noon, and one hour after noon, respectively. The coefficients a_j and b_j can also be seen indirectly since they are the projections on the vertical and horizontal axes[3].

In a sense, the graphs are three-dimensional since approximate station latitude is signified by use of special plotting symbols. The symbol for each latitude band is defined in the tables of phase distribution. Variations with season and solar activity are illustrated through the study of four seasonal months (March, June, September and December) for each of the years, 1954 and 1958, of low and high sunspot number (see Table 1). For each harmonic the material is so arranged that the equinox months (of the same year) appear on opposite pages, 1958 followed by 1954. In a similar order these are followed by the solstice months.

4.2 Amplitude Distribution

A number of variations of amplitude are apparent, perhaps the most prominent being that connected with solar activity. Amplitude increases with sunspot number in all harmonics; yet, the main trends in the amplitude distributions are preserved from year to year. For solstice

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[3] The graphs were produced by machine, plotting the a_j and b_j in rectangular coordinates.

months, amplitude is generally larger in winter than in summer. In equinox months, it reaches its maximum in the equatorial bands and decreases in the polar directions (particularly in Harmonics 1 - 8).

As an illustration of strong variation in amplitude and phase, we call attention to Harmonic 2 for December 1958. Amplitude increases from a low of 0.2 Mc/s to a high of about 2.5 Mc/s between 90°N and 60°N and then drops to a low of about 0.8 Mc/s between 60°N and 30°N. It climbs to a second maximum of 2.8 Mc/s between 0° and 30°N and then drops to relatively low values in the southern hemisphere. This dramatic latitudinal variation of amplitude is accompanied by a continuous shift in phase from $+60^{\circ}$ to -75° (through Quadrants I and II). Possibly a similar phenomenon occurred in the southern hemisphere in June 1958, but it is not clearly defined, perhaps due to the much fewer stations.

4.3 Phase Distribution

The distributions of phase are characterized by (1) systematic clustering of phase angles for low order harmonics and (2) comparatively uniform distribution for high order harmonics. These properties - to be expected from theory outlined in Section 3 - are useful for separating the harmonics produced mainly by noise from those representing mostly real physical variation.

For Harmonic 1 the main characteristic of phase distribution is the predominance of phase angles in Quadrant I, the distribution for all latitudes and all months combined being given by

27	677
11	12

Variations of a secondary nature also appear. For example, in Harmonic 1 for March 1958, the majority of phase angles are clustered between 0° and 60° (signifying shifts in maximum foF2 median of 0 to 4 hours after noon LMT). A small group of mostly equatorial stations, however, have their phase angles between 60° and 90° (shift of maximum foF2 median of 4 to 6 hours after noon LMT). This separate grouping of equatorial phase angles is repeated, with slight variations, in September 1958 and also in both equinox months of 1954.

By studying the graphs and tables given in the following series, many such apparent variations in the distributions of phase can be found. Our present interest, however, will be centered around the main trends in these distributions and the separation of uniform distributions from those exhibiting significant clustering features. For this purpose, we consider the distributions of phase for the equinox months of both years taken together in Table 3. As can be seen, Quadrant I is predominant for harmonics 1, 5 and 9; Quadrant II for harmonics 2, 6 and 10; Quadrant III for harmonics 3, 7 and 11; and Quadrant IV for harmonics 4 and 8. It is clear that the phase distributions tend to become more uniform with increasing harmonics.

TABLE 3

Distribution of Phase and Values of χ^2 (Chi-square)
from Diurnal Analysis of foF2 Median
for March and September of 1954 and 1958

	Quadrant				
Harmonic	I	II	III	IV	χ^2
1	352	3	3	2	1017
2	77	195	61	27	178
3	8	47	267	38	472
4	116	26	38	180	173
5	213	79	29	39	240
6	53	155	117	35	104
7	43	60	185	72	138
8	113	60	44	143	71
9	157	79	54	70	70
10	73	118	110	59	27
11	81	79	109	91	6

To compare these distributions with an exactly uniform distribution, Table 3 also gives values of the variable χ^2 (chi-square)

$$\chi^2 = \sum_{i=I}^{IV} \frac{(a_i - NP_i)^2}{NP_i} , \tag{9}$$

where a_i denotes the number of phase angles in the ith quadrant, N (=360) is the total number of phase angles (for the equinox months combined), and P_i (=1/4) is the probability of a phase angle from the uniformly distributed population being in the ith quadrant. A graph of the χ^2 values is shown in Figure 1.

With three degrees of freedom, the probability of $\chi^2 > 11.34$ is 0.01, if the distribution sampled is in fact uniform. Using this as a criterion, one could conclude that only Harmonic 11 is uniformly distributed. Yet, it is evident that the high order harmonics are definitely more uniform than the low order ones and that a natural cutoff could be made after Harmonics 5, 7, 9 and 10. There appears to be a twilight zone in which the optimum cutoff could be made. It should be pointed out that the low values of χ^2 for Harmonics 2 and 4 appear to be the result of systematic latitudinal variations of phase which make the combined distributions appear uniform.

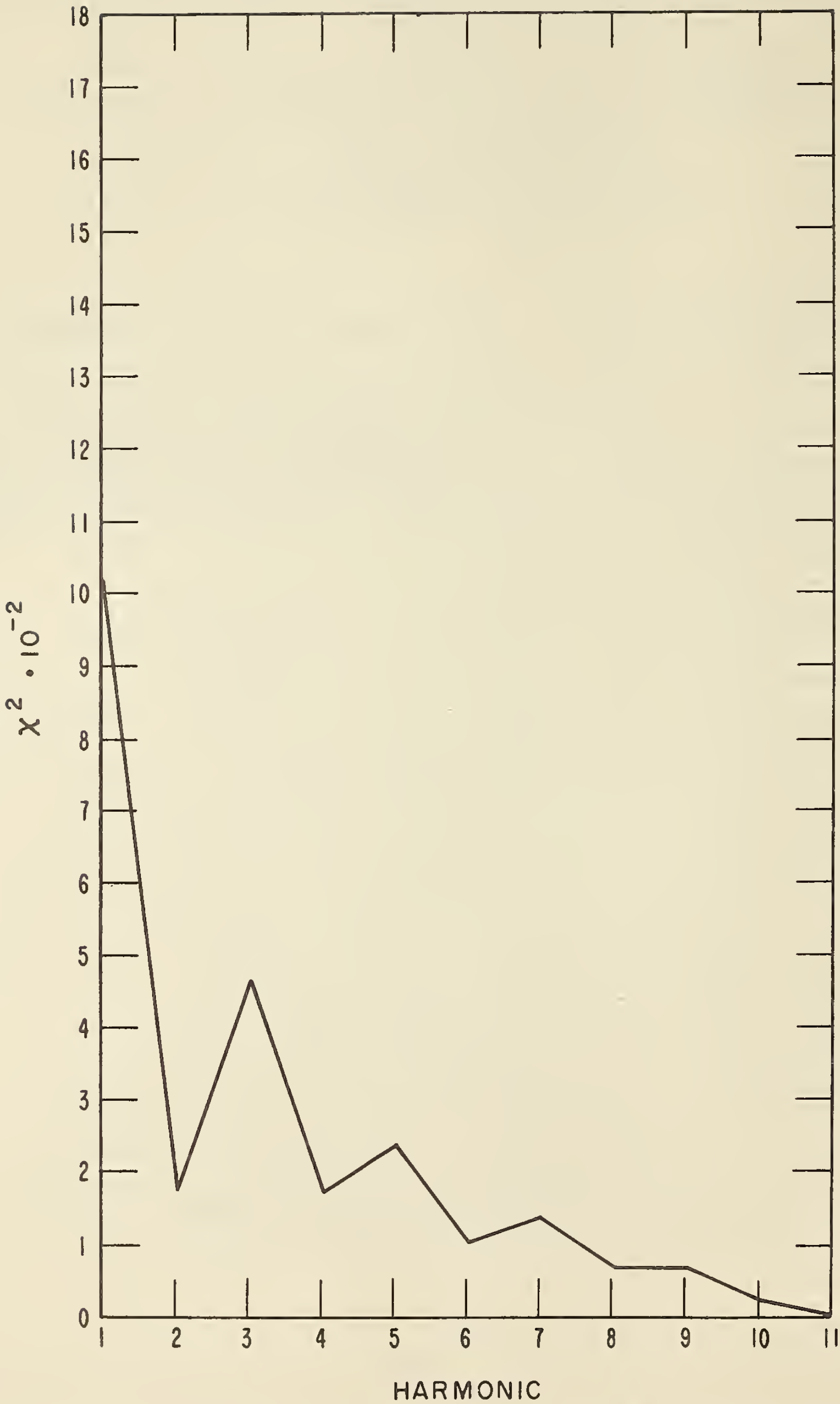

FIG. 1 VALUES OF CHI-SQUARE (χ^2) FOR TESTING UNIFORMITY OF PHASE DISTRIBUTIONS FROM DIURNAL ANALYSIS OF foF2 MEDIANS FOR MARCH AND SEPTEMBER OF 1954 AND 1958.

In a similar manner, Tables 4 and 5 contain the distributions of phase and corresponding values of χ^2 for June and December, respectively, with both years combined. Graphs of the χ^2 values are shown in Figures 2 and 3. Here the χ^2 test (using the one per cent criterion) leads us to conclude that for June Harmonics 5 through 11 are uniformly distributed in phase, whereas for December Harmonics 6 through 11 are uniform. These results appear to be in close agreement with those determined from studies of the Fourier spectra [Jones and Gallet, 1962a].

TABLE 4

Distribution of Phase and Values of χ^2 (Chi-square)
from Diurnal Analysis of foF2 Median
for June of 1954 and 1958

	Quadrant				
Harmonic	I	II	III	IV	χ^2
1	162	13	4	7	383
2	37	75	57	17	40
3	37	20	88	41	55
4	55	25	40	66	20
5	56	44	46	40	3
6	46	40	59	41	5
7	49	45	52	40	2
8	48	37	52	49	3
9	47	43	37	59	5
10	45	53	38	50	3
11	46	46	62	32	10

TABLE 5

Distribution of Phase and Values of χ^2 (Chi-square) from Diurnal Analysis of foF2 Median for December of 1954 and 1958

	Quadrant				
Harmonic	I	II	III	IV	χ^2
1	163	11	4	3	230
2	83	83	13	2	127
3	32	33	85	31	46
4	21	22	79	59	54
5	60	26	49	46	13
6	58	30	45	48	9
7	56	36	52	37	7
8	39	40	55	47	4
9	44	39	60	38	7
10	40	47	44	50	1
11	41	45	47	48	0.4

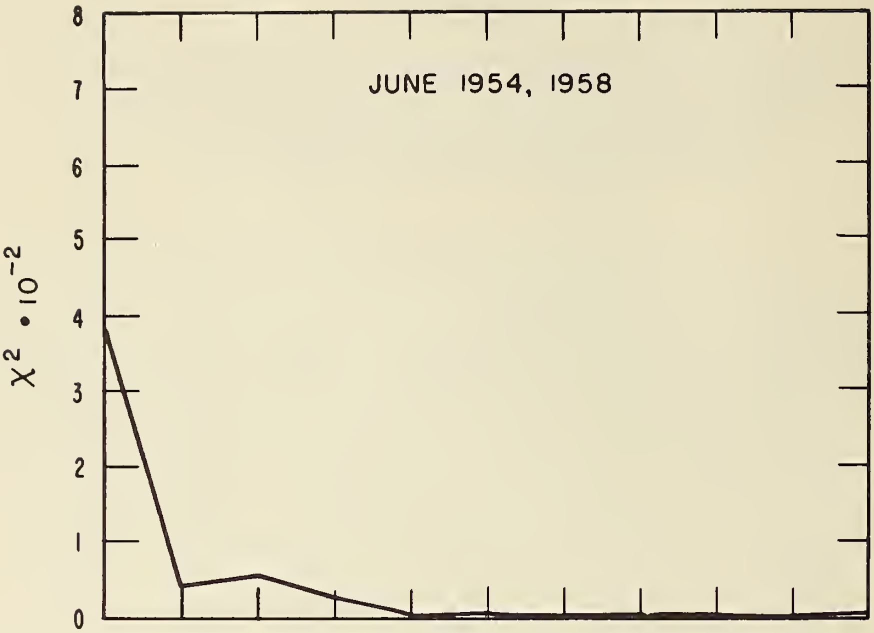

FIG. 2

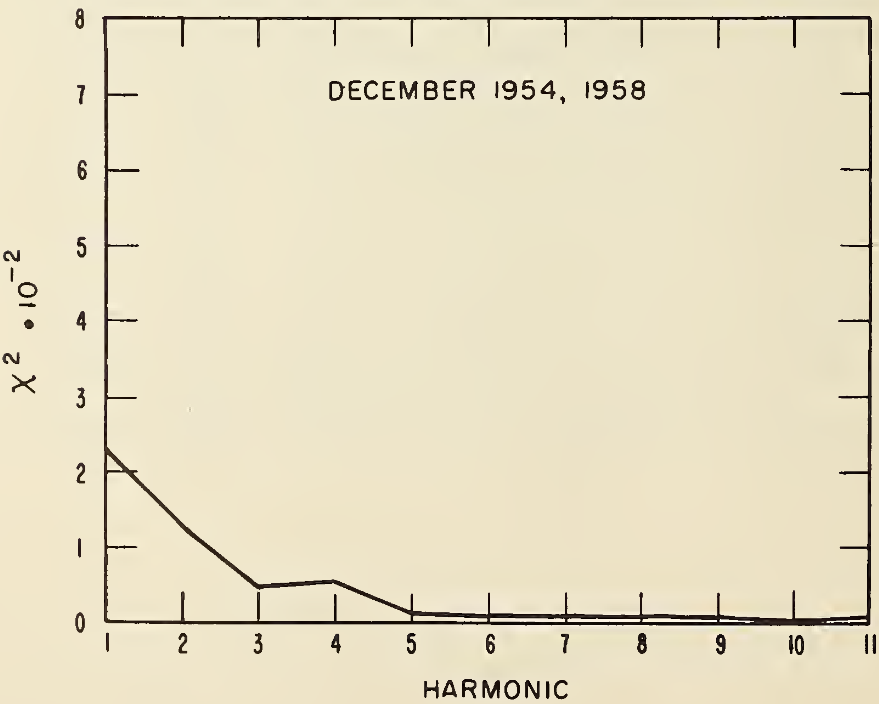

FIG. 3

VALUES OF CHI-SQUARE (χ^2) FOR TESTING UNIFORMITY OF PHASE DISTRIBUTIONS FROM DIURNAL ANALYSIS OF foF2 MEDIANS

ACKNOWLEDGMENTS

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SERIES OF GRAPHICAL REPRESENTATIONS OF

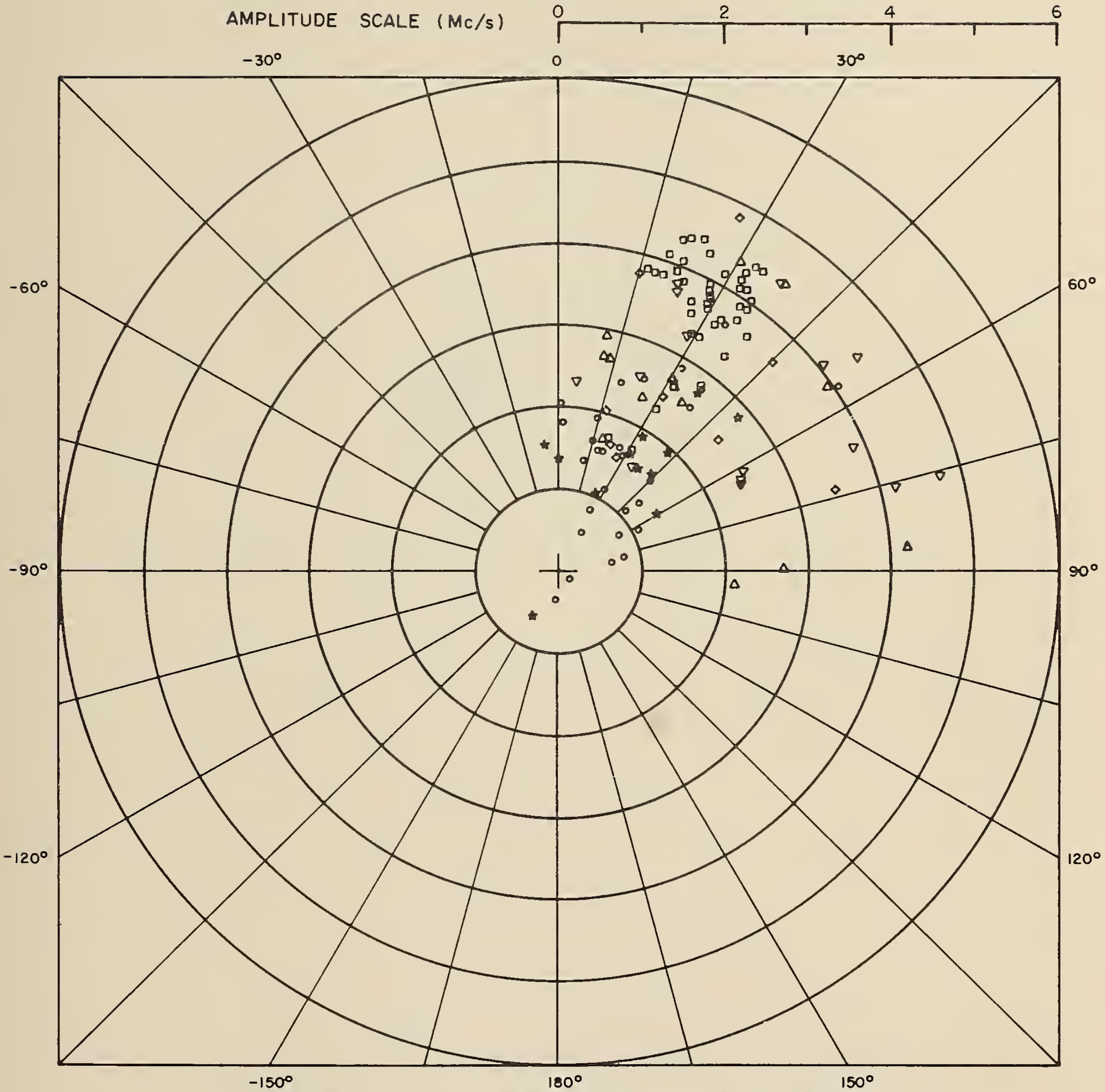
AMPLITUDE AND PHASE AND

TABLES OF PHASE DISTRIBUTION FROM

DIURNAL ANALYSIS OF foF2 MONTHLY MEDIAN

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC I 118 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 15 15	▫ 41 41	● 26 1 1 28
SOUTH	△ 12 1 13	◆ 9 9	★ 2 9 1 12

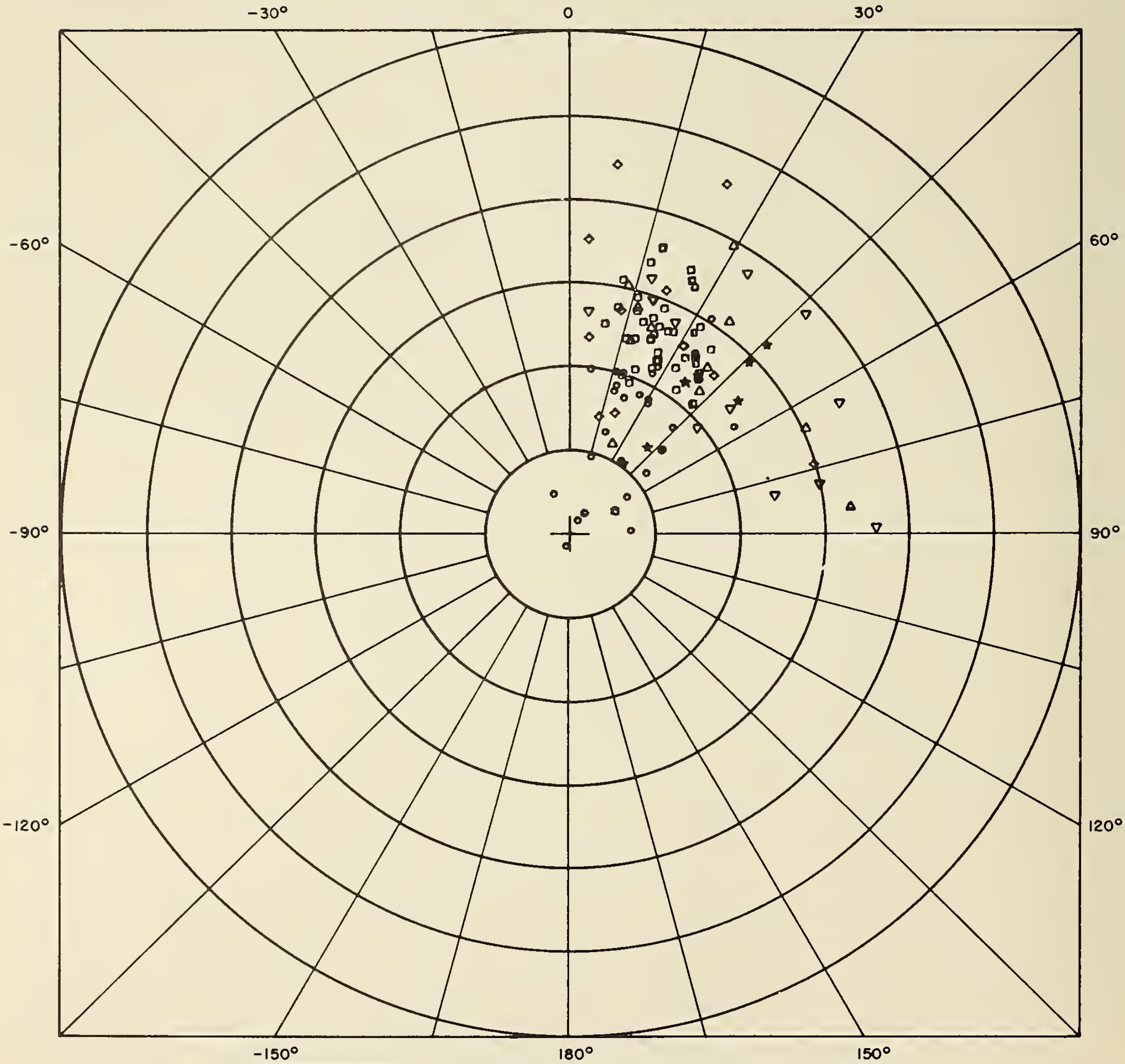
TOTAL

2	112
2	2

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 1 112 STATIONS

AMPLITUDE SCALE (Mc/s) 0 2 4 6



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 13 13	● 42 42	○ 1 26 1 28
SOUTH	△ 11 11	◆ 11 11	★ 7 7

TOTAL

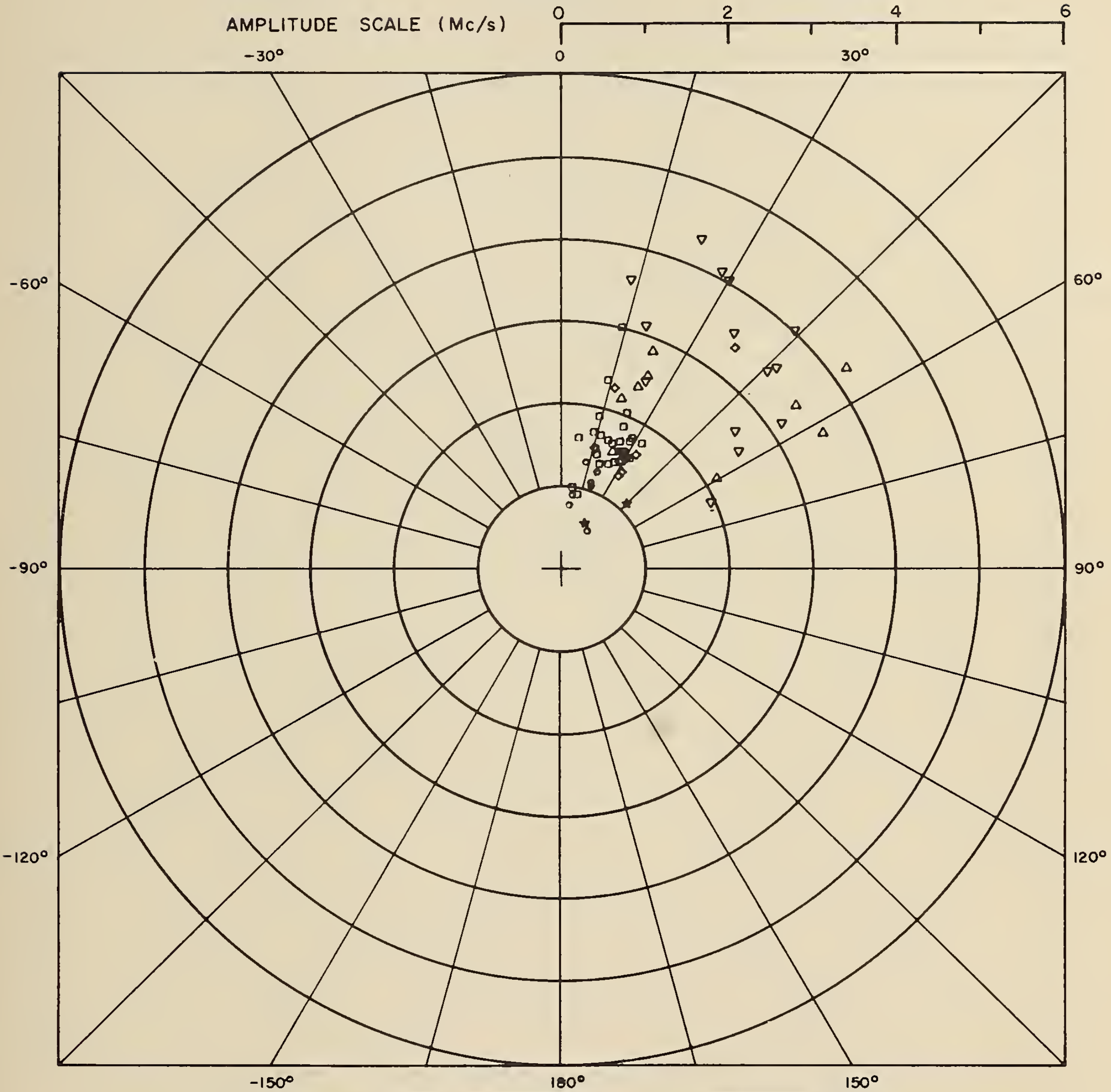
1 110

1

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC I 67 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

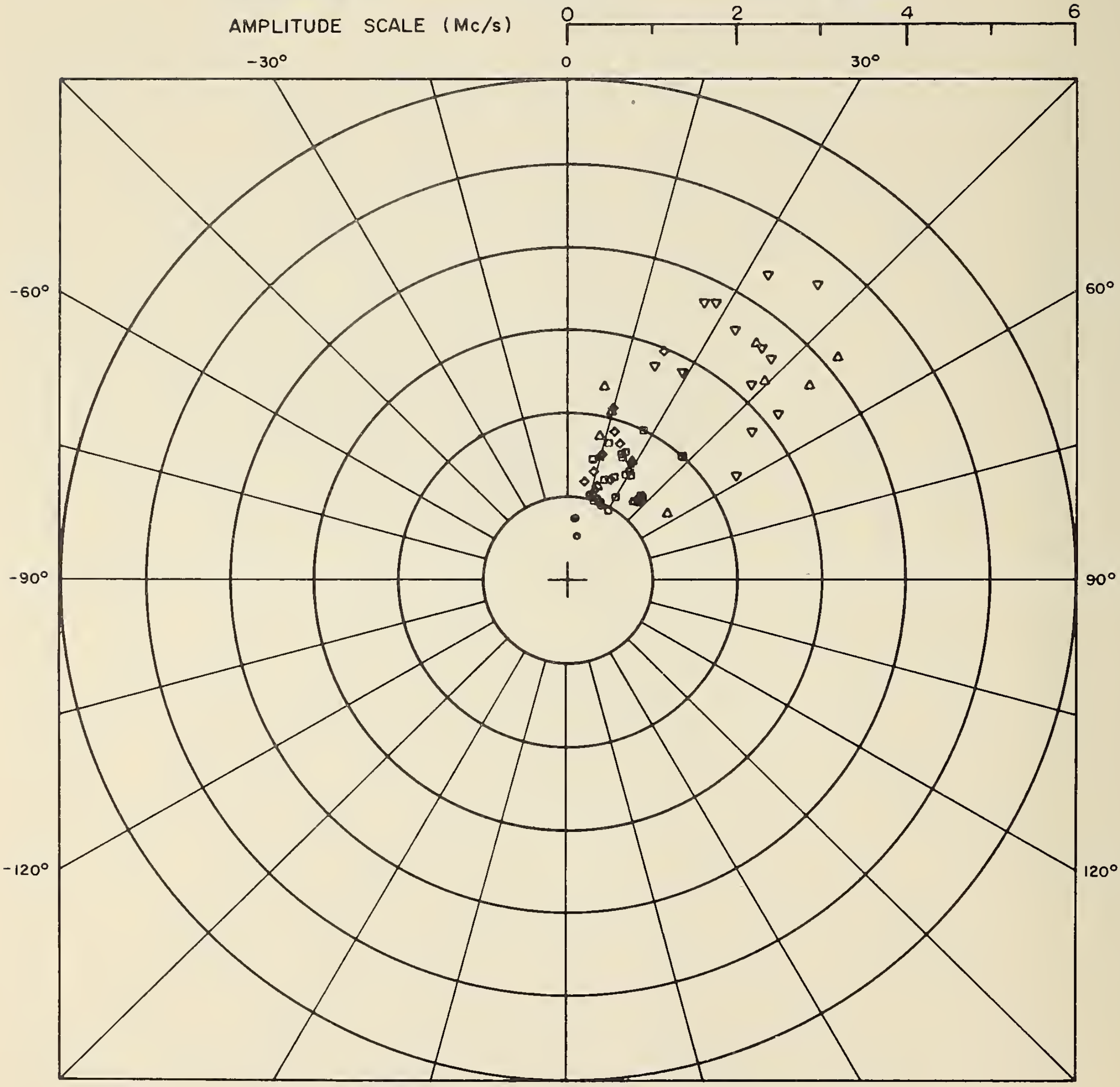
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 14 14	▫ 26 26	∘ 7 7
SOUTH	△ 9 9	◇ 9 9	★ 2 2

TOTAL

67

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC I 63 STATIONS



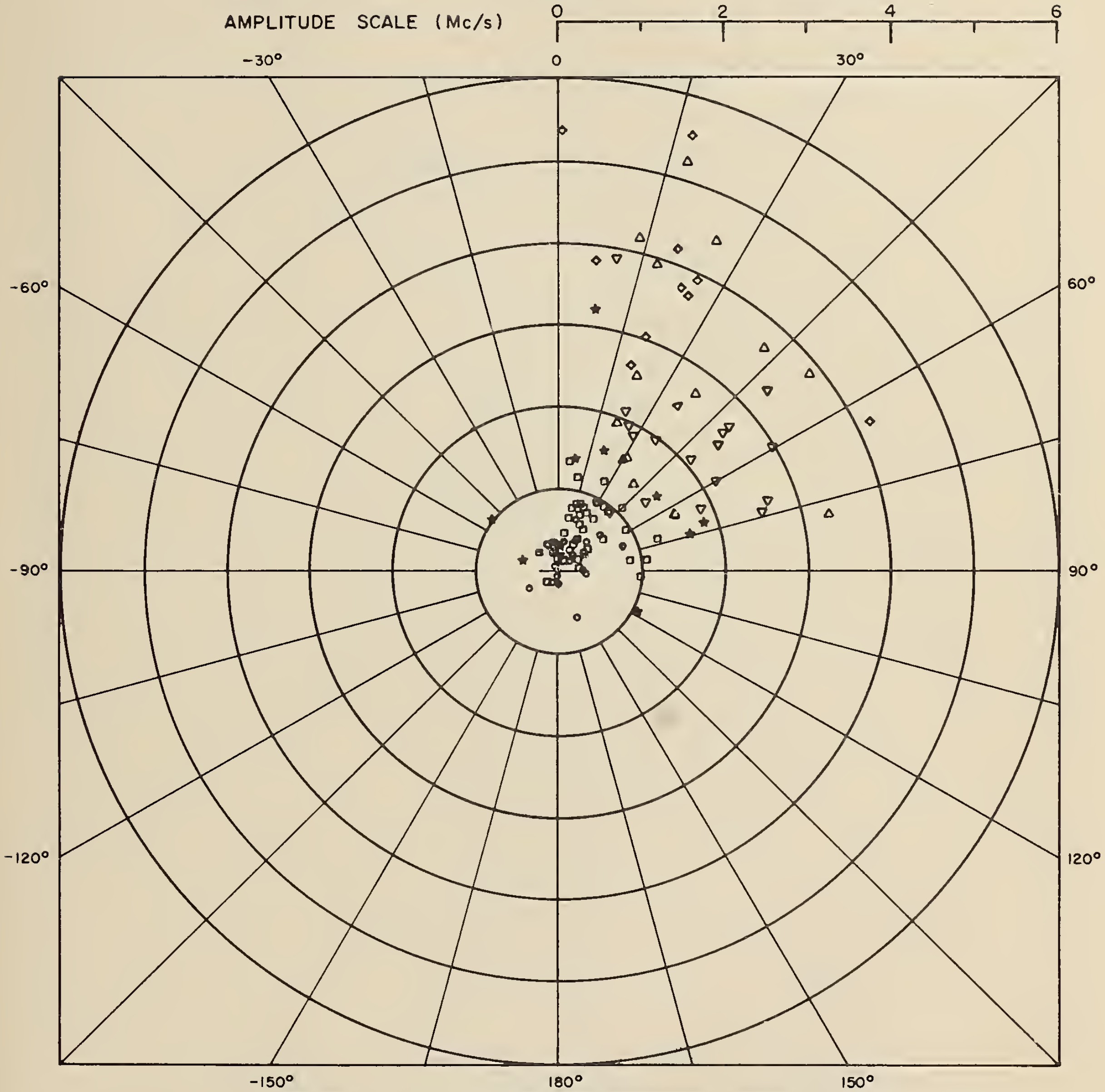
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 13 / 13	● 23 / 23	○ 7 / 7	63
SOUTH	△ 10 / 10	◆ 8 / 8	★ 2 / 2	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC I 118 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

<table>
<tr><td>LATITUDE</td><td>0° TO 30°</td><td>30° TO 60°</td><td>60° TO 90°</td><td>TOTAL</td></tr>
<tr><td>NORTH</td><td>▽ | 18
  |
18</td><td>● 3 | 33
2 | 1
39</td><td>∘ 4 | 17
2 | 5
28</td><td rowspan="2">9 | 98
4 | 7</td></tr>
<tr><td>SOUTH</td><td>△ | 14
  |
14</td><td>◆ | 10
  |
10</td><td>★ 2 | 6
  | 1
9</td></tr>
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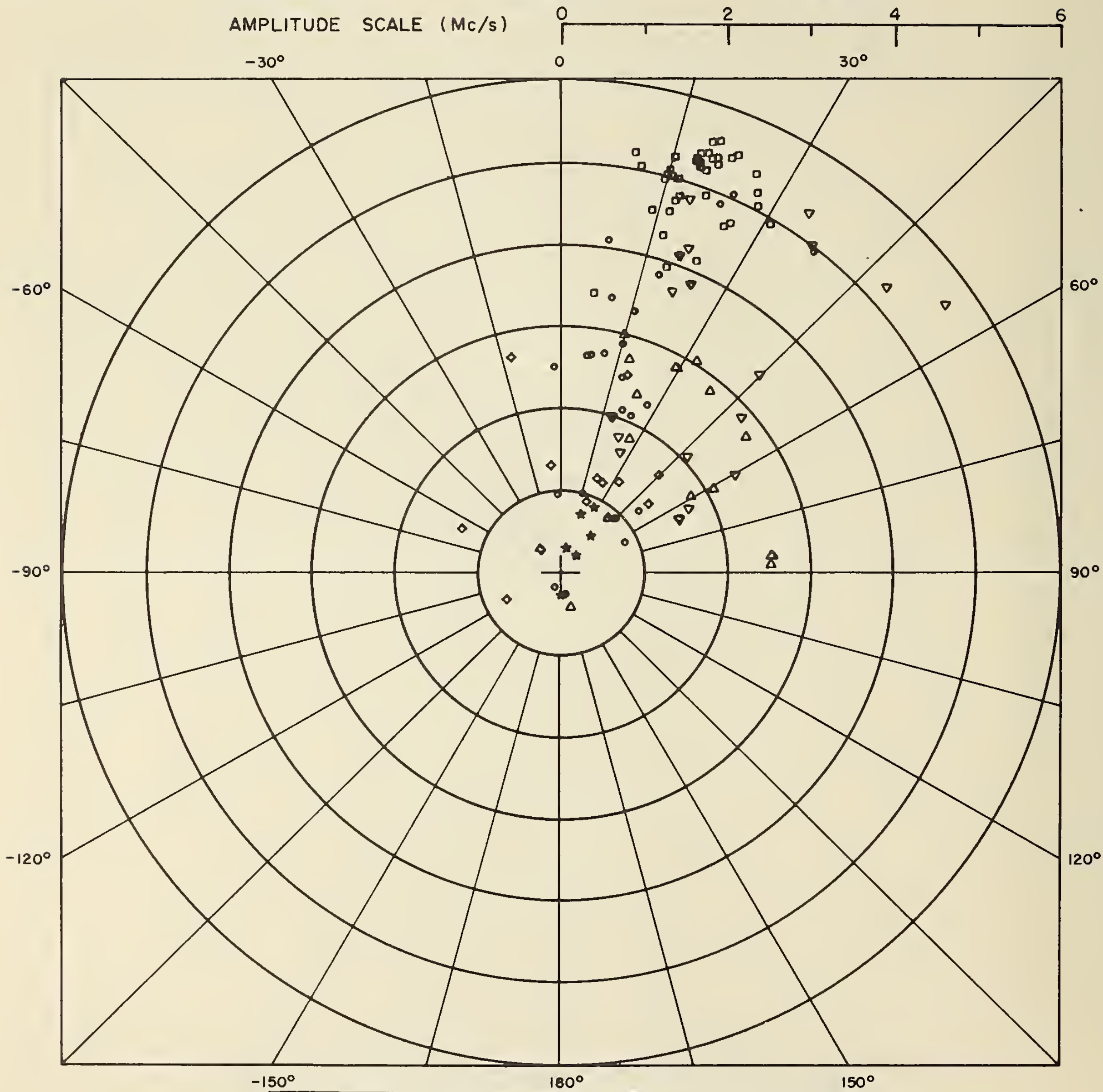
AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC I 116 STATIONS



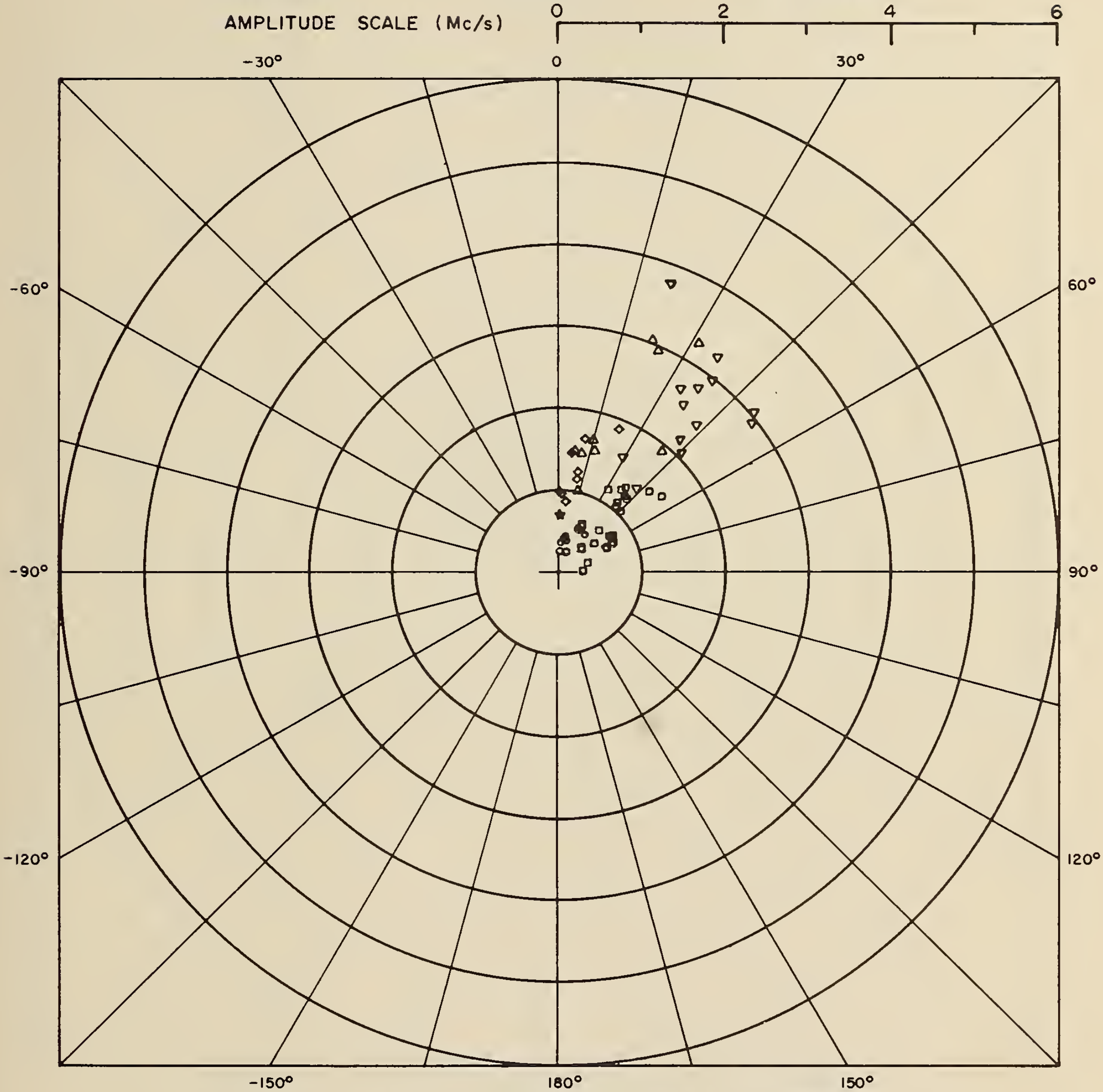
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 19 — 19	▫ 38 — 38	∘ 2, 23 / 1, 1 — 27
SOUTH	△ 13 / 1 — 14	◇ 4, 7 / 1 — 12	★ 5 / 1 — 6

TOTAL	
6	105
2	3

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC I 68 STATIONS



DISTRIBUTION OF THE PHASE

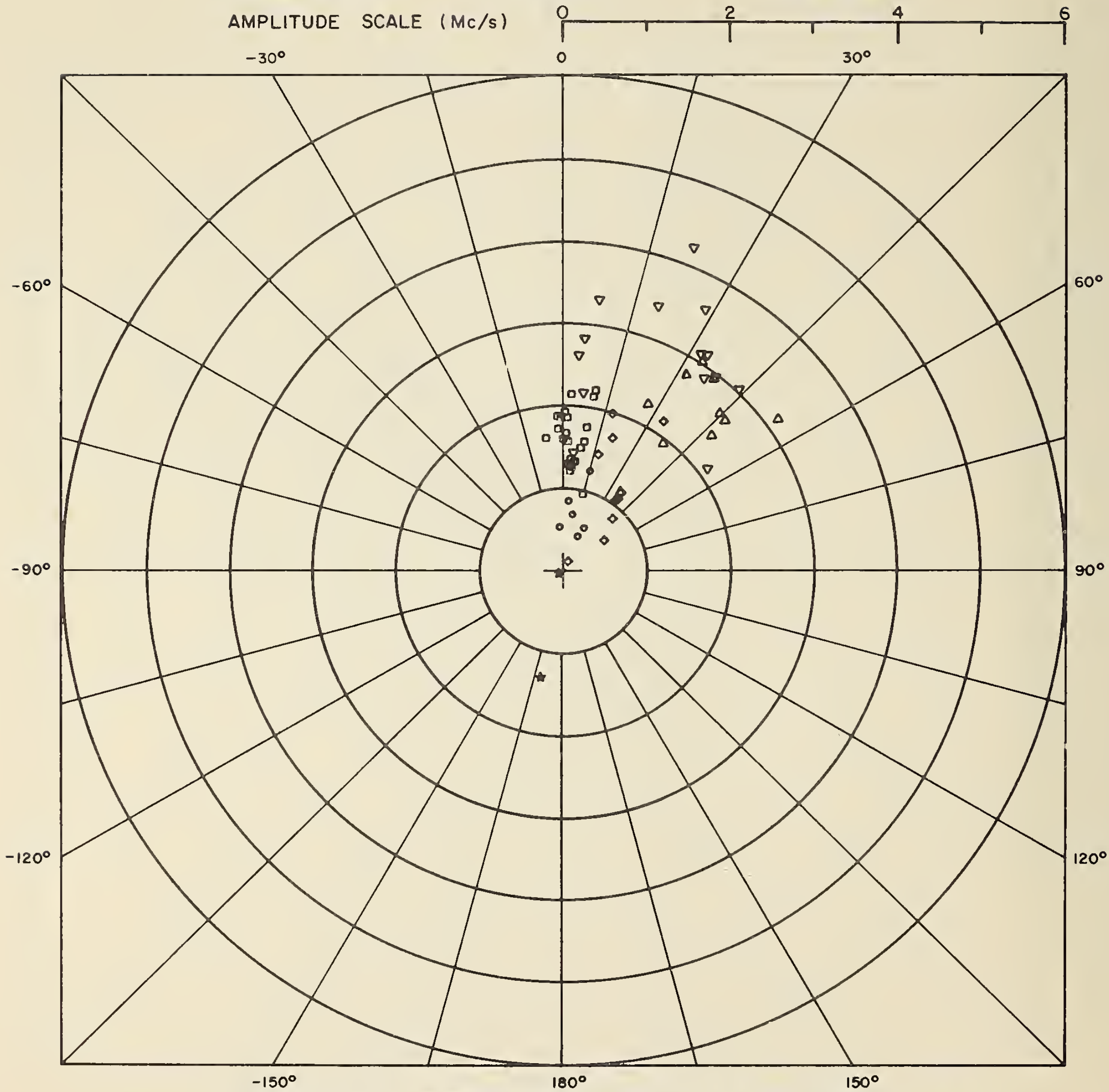
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 13 ; 13	◘ 25 ; 25	∘ 2 | 9 ; 11
SOUTH	△ 9 ; 9	◆ 1 | 7 ; 8	★ 1 | 1 ; 2

TOTAL

4 | 64

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC I 65 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ | 14 ; 14	● 4 | 19 ; 23	∘ 1 | 5 ; 6
SOUTH	△ | 10 ; 10	◆ | 10 ; 10	★ 2 | ; 2

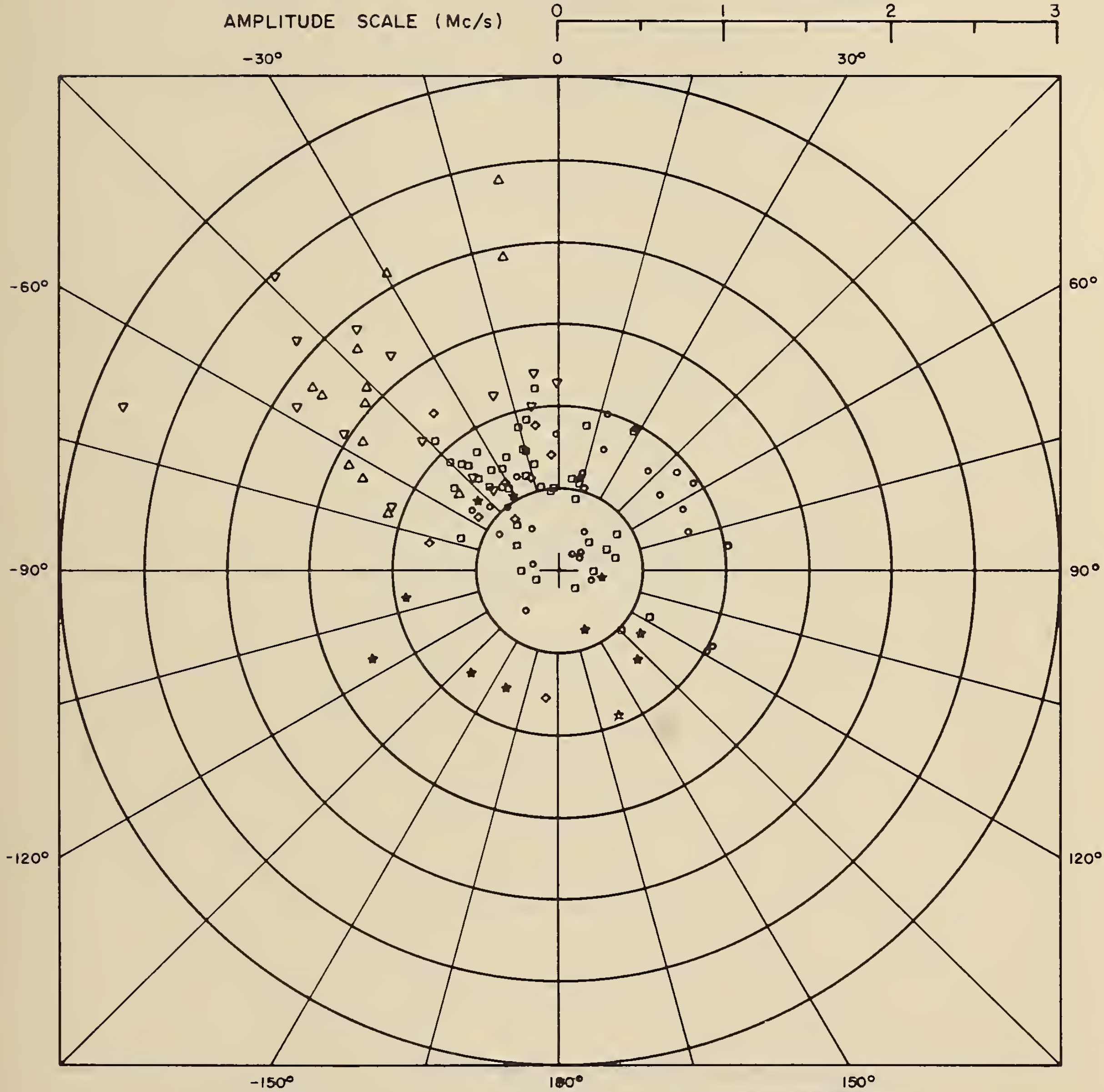
TOTAL

5	58
2	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 2 118 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

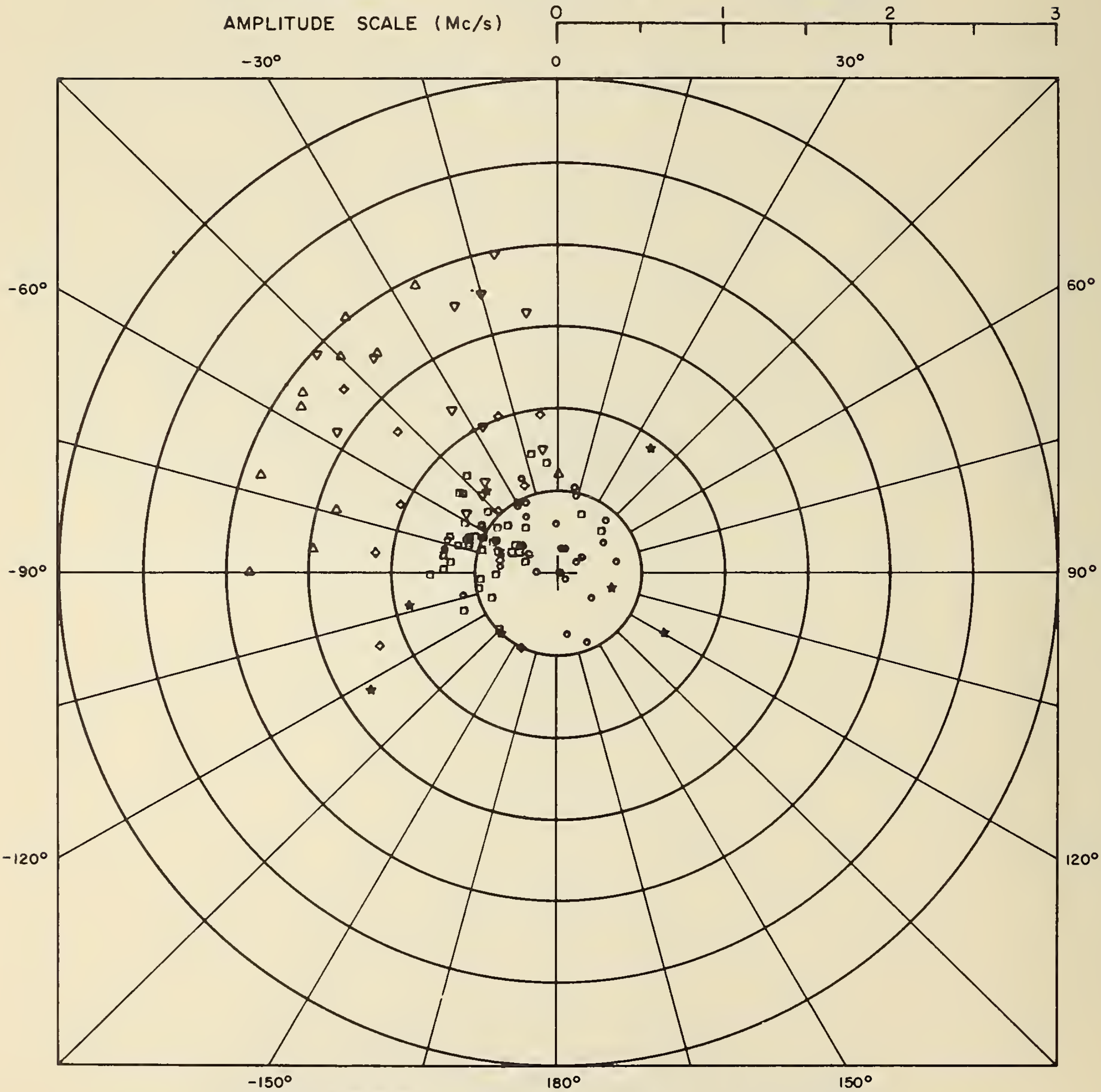
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 14 | 1 ; — | — ; 15	● 27 | 10 ; 1 | 3 ; 41	○ 7 | 17 ; 1 | 3 ; 28
SOUTH	△ 13 | — ; — | — ; 13	◆ 8 | — ; 1 | — ; 9	★ 2 | 1 ; 4 | 5 ; 12

TOTAL

71	29
7	11

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 2 112 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 13 │ │ 13	● 33 │ 2 7 │ 42	∘ 13 │ 9 2 │ 4 28
SOUTH	△ 11 │ │ 11	◆ 9 │ 2 │ 11	★ 1 │ 1 3 │ 2 7

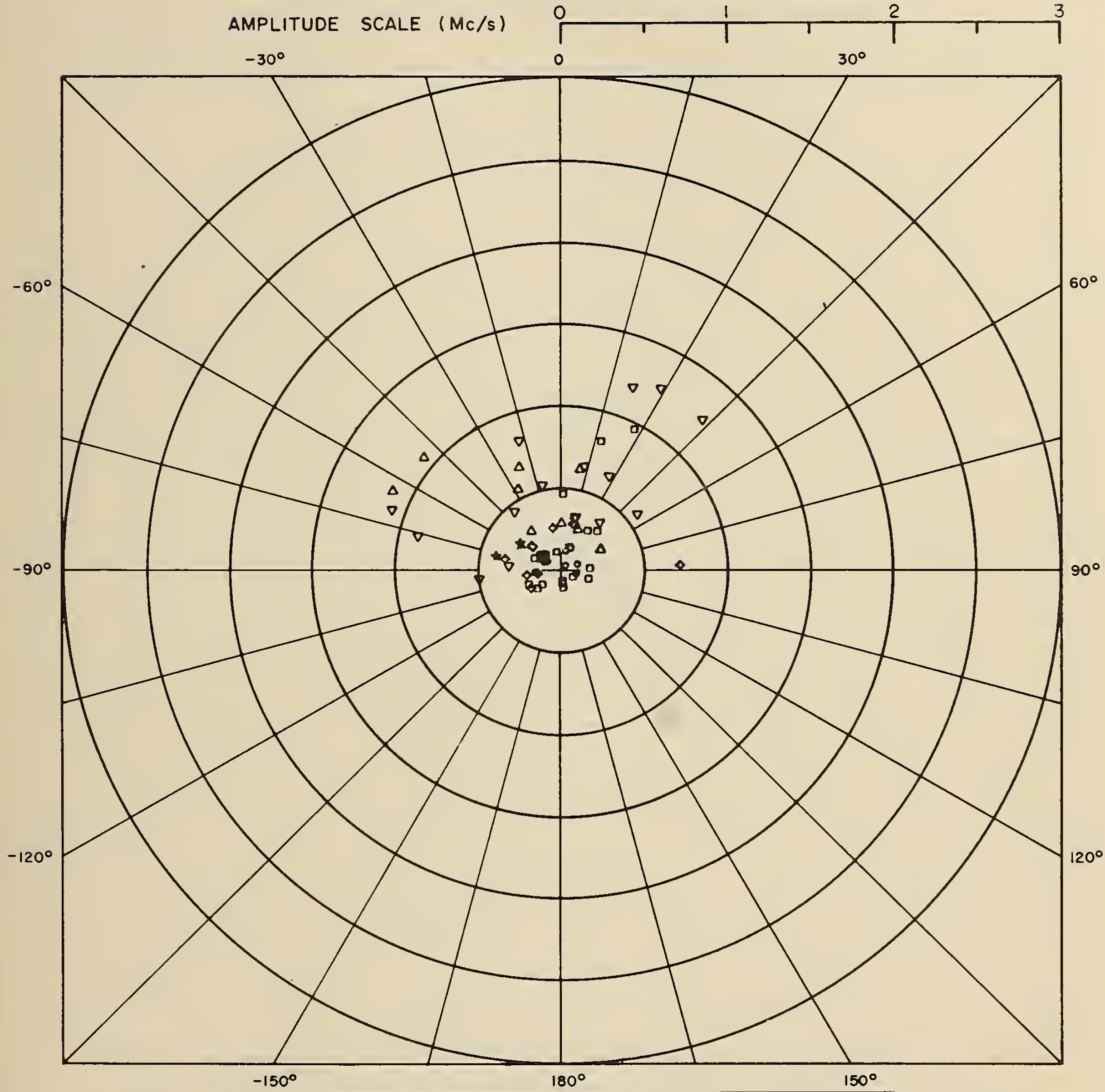
TOTAL

80	12
14	6

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 — HARMONIC 2 — 67 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

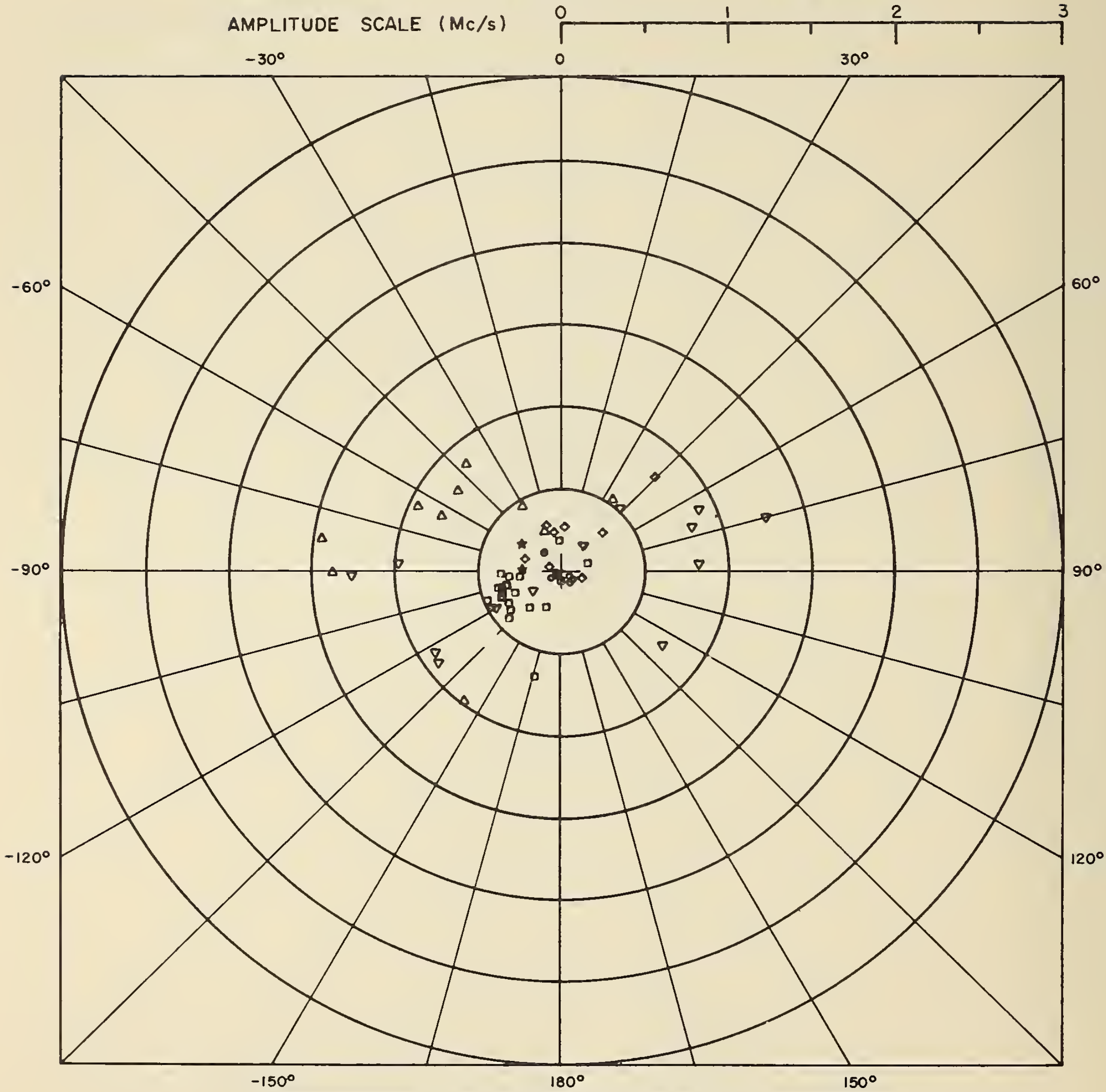
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 6 | 7 / 1 | — 14	◘ 9 | 9 / 6 | 2 — 26	∘ 2 | 3 / 1 | 1 — 7
SOUTH	△ 6 | 3 / | — 9	◆ 3 | 3 / 3 | — 9	★ 2 | / | — 2

TOTAL

28	25
11	3

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 2 63 STATIONS



DISTRIBUTION OF THE PHASE

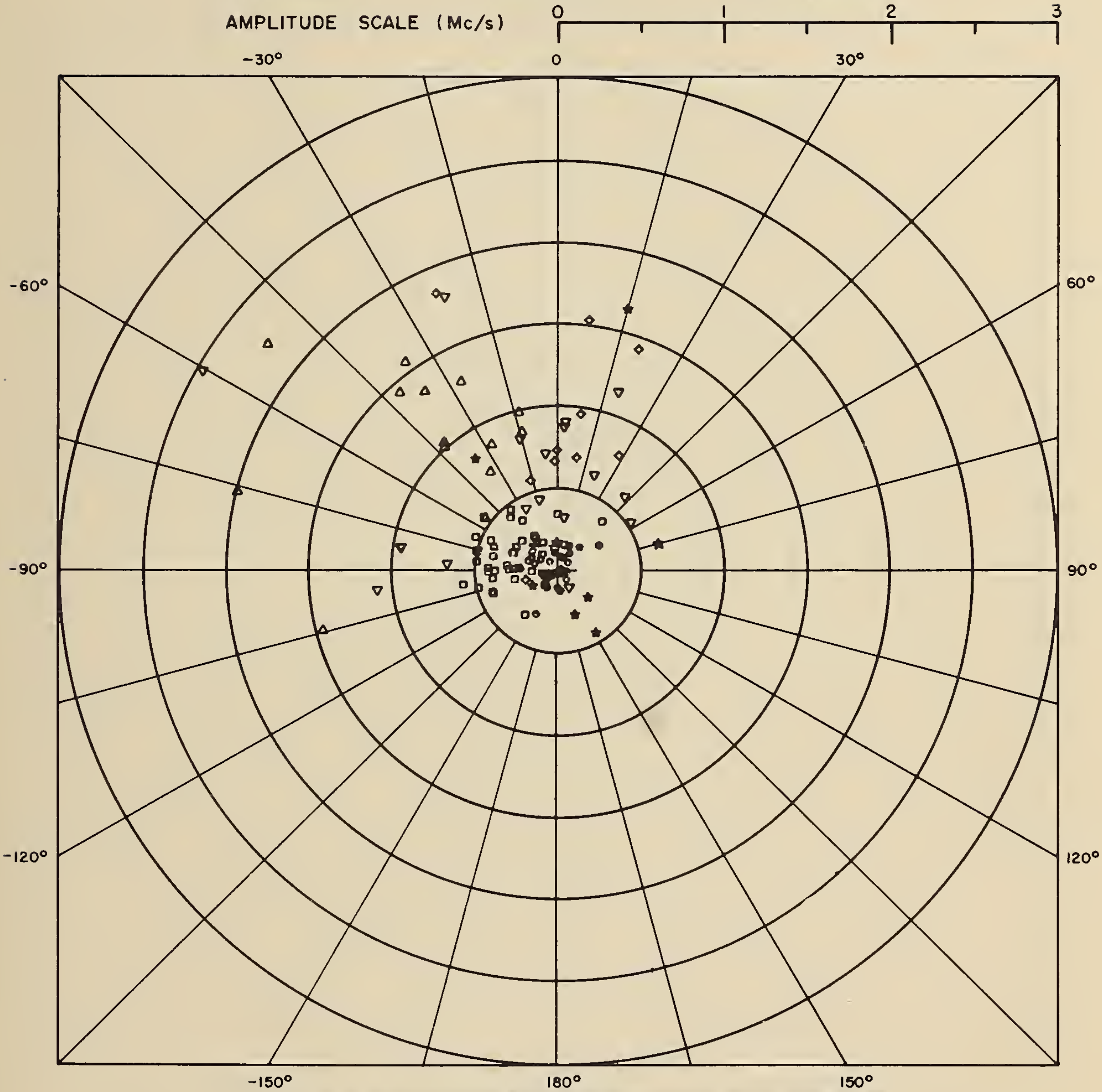
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 | 6 / 5 | 1 — 13	● 1 | 1 / 19 | 2 — 23	○ | 1 / 3 | 3 — 7
SOUTH	△ 7 | 1 / 2 | — 10	◇ 4 | 3 / | 1 — 8	★ 2 | / | — 2

TOTAL

16	11
29	7

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 2 118 STATIONS



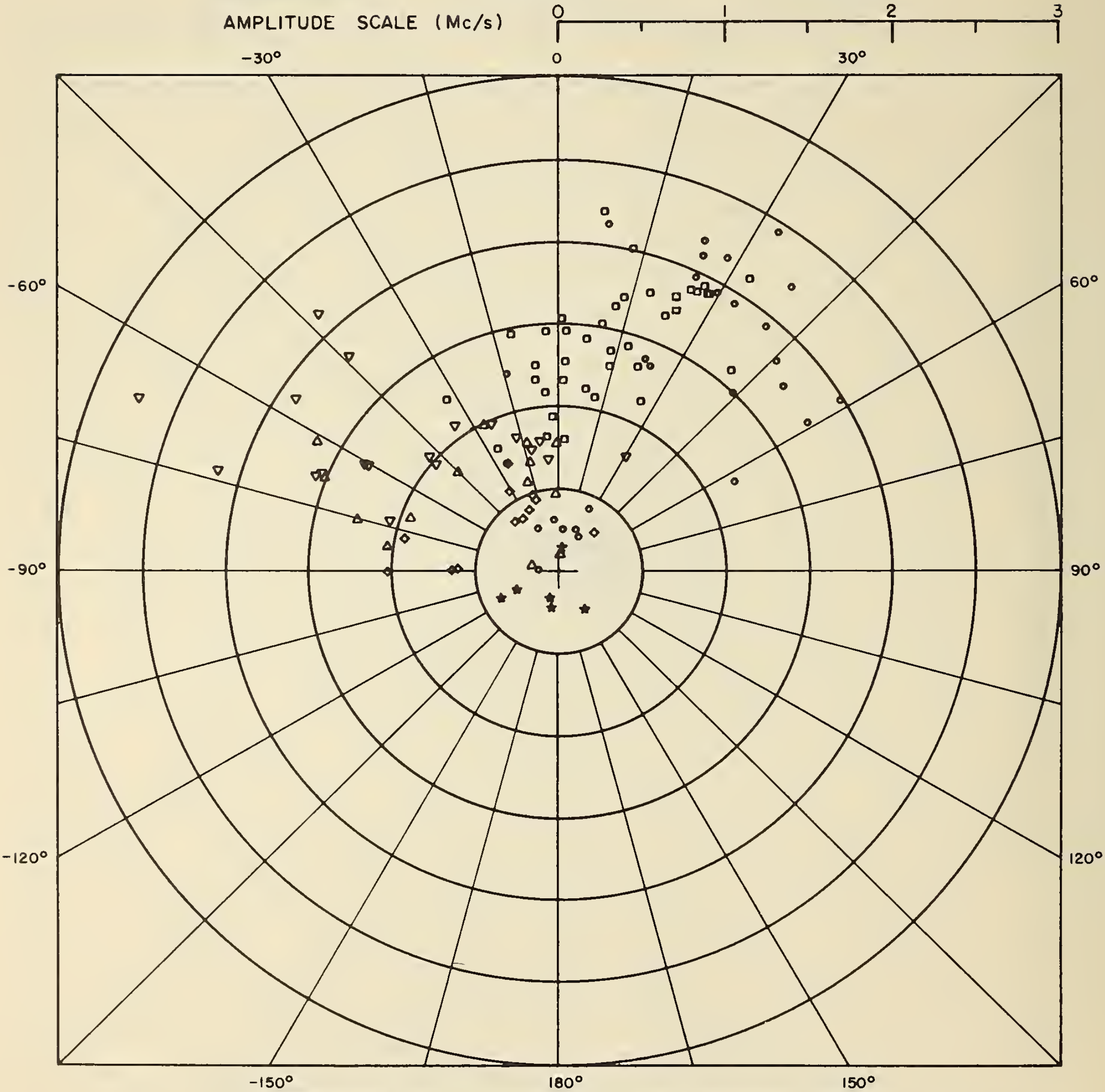
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 9 | 7 1 | 1 18	■ 26 | 2 10 | 1 39	∘ 9 | 6 10 | 3 28	64 | 22
SOUTH	△ 13 | 1 | 14	◆ 4 | 5 1 | 10	★ 3 | 2 1 | 3 9	24 | 8

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 2 116 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 18 / 1 — 19	● 9 / 29 — 38	∘ 5 / 22 — 27
SOUTH	△ 13 / 1 — 14	◆ 10 / 1; 1 / — 12	★ 1 / ; 4 / 1 — 6

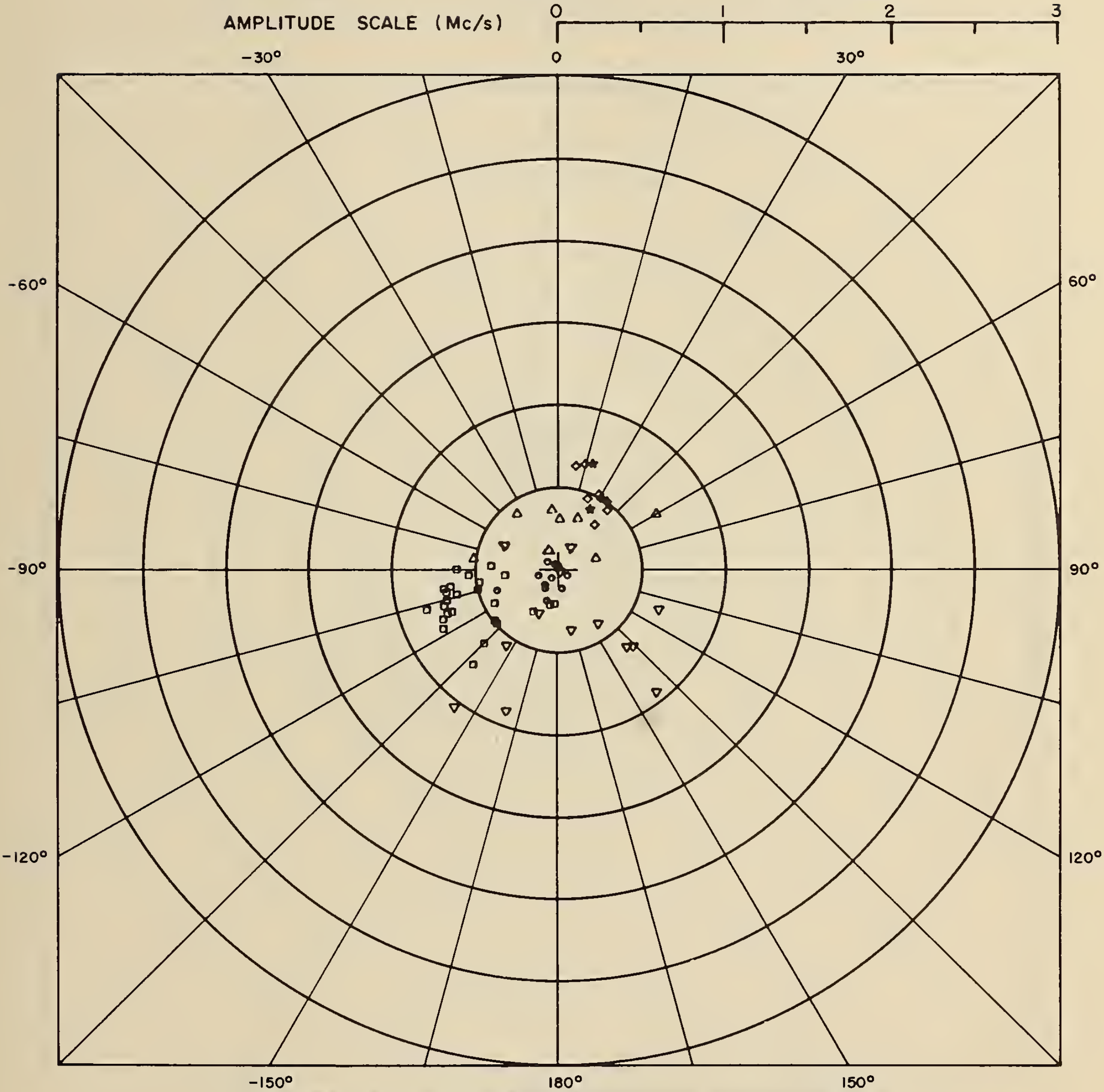
TOTAL

56	54
5	1

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 2 68 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 | 1 / 4 | 7 — 13	■ 2 | – / 23 | – — 25	∘ 3 | – / 6 | 2 — 11
SOUTH	△ 5 | 4 / – | – — 9	◆ – | 8 / – | – — 8	★ – | 2 / – | – — 2

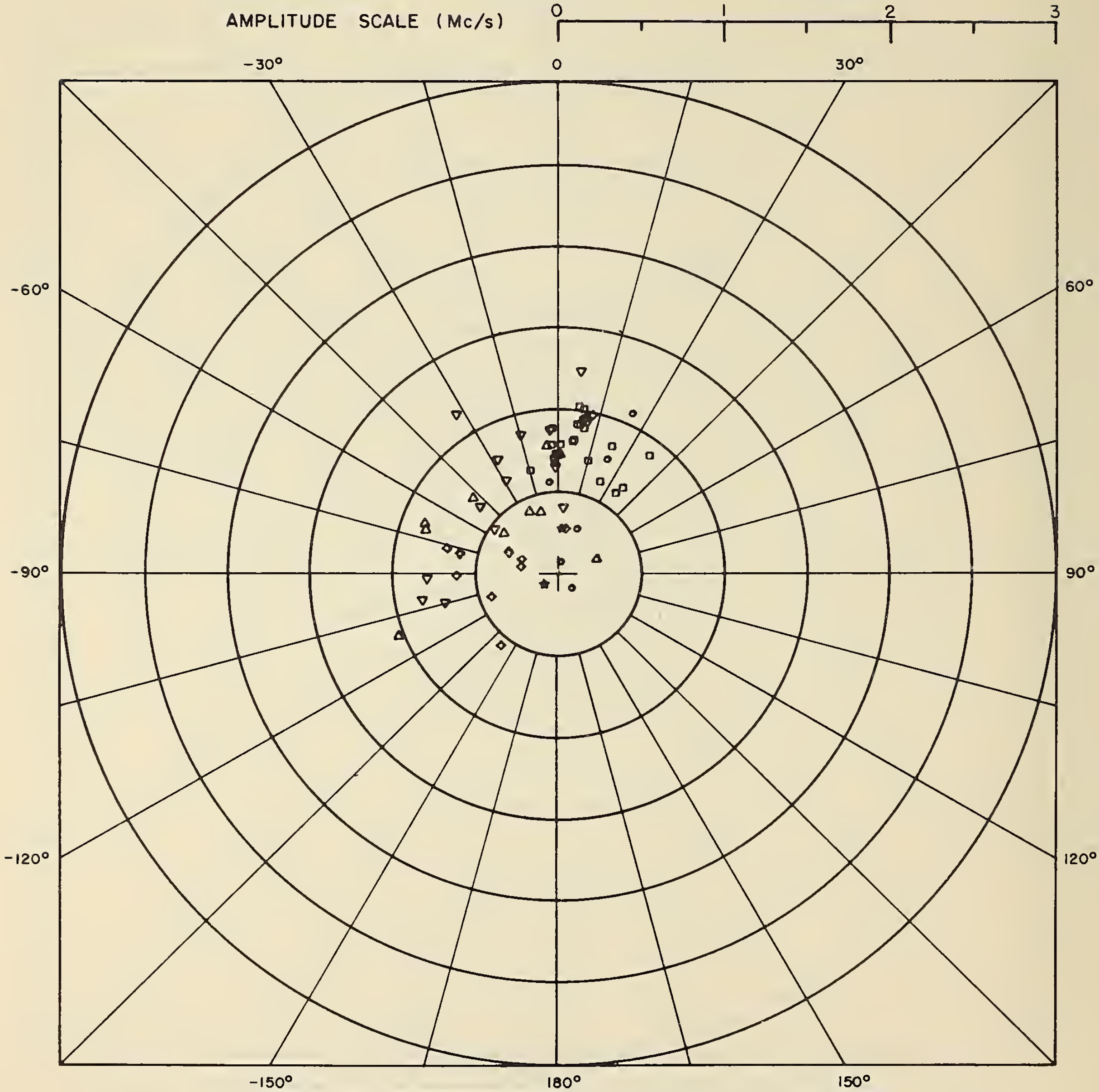
TOTAL

11	15
33	9

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 2 65 STATIONS

AMPLITUDE SCALE (Mc/s)



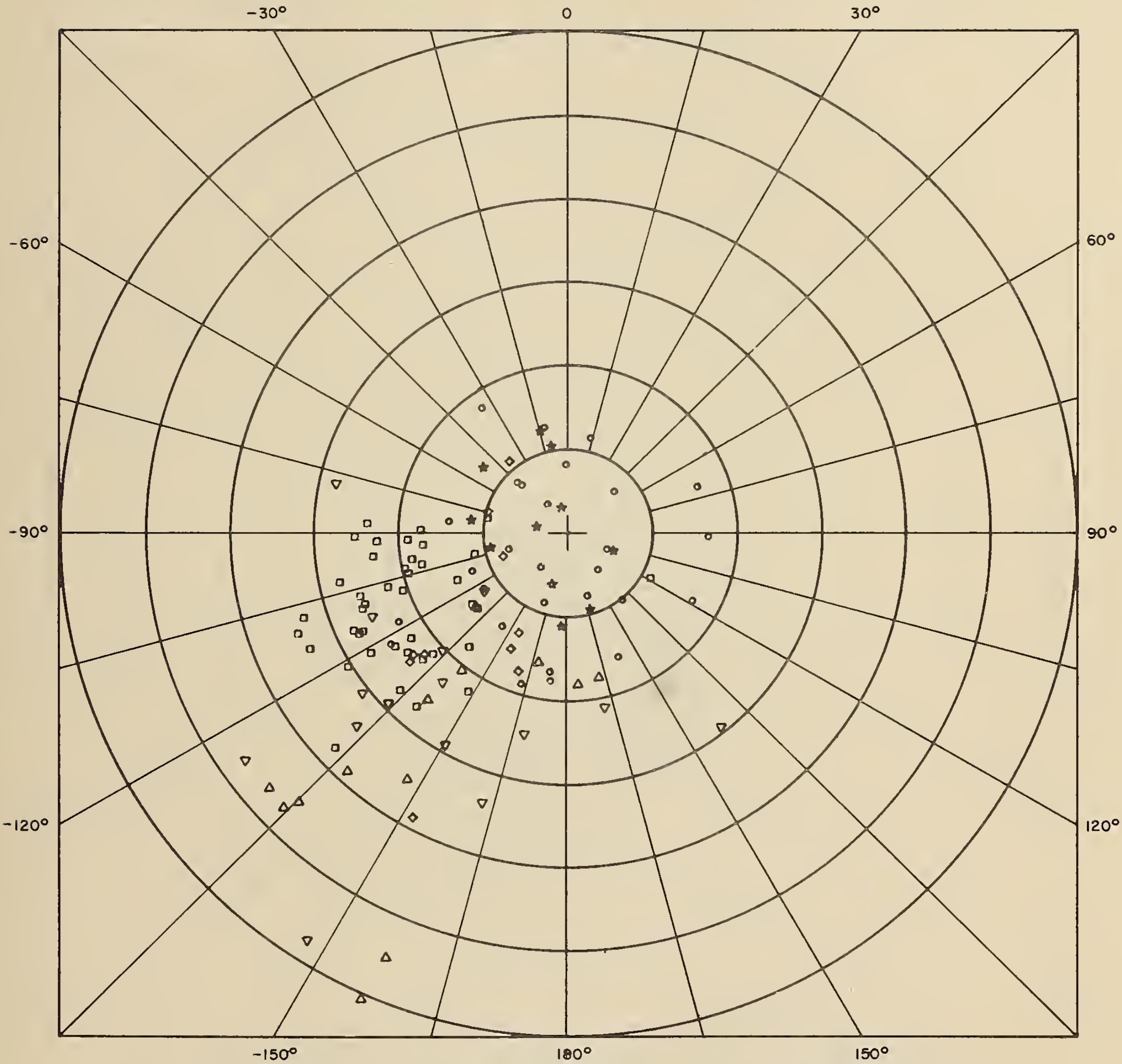
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 8 | 3 / 3 | ; 14	■ 6 | 17 ; 23	○ 1 | 4 / | 1 ; 6	27 | 29
SOUTH	△ 7 | 2 / 1 | ; 10	◆ 5 | 2 / 3 | ; 10	★ | 1 / 1 | ; 2	8 | 1

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 3 118 STATIONS

AMPLITUDE SCALE (Mc/s) 0 .5 1.0 1.5

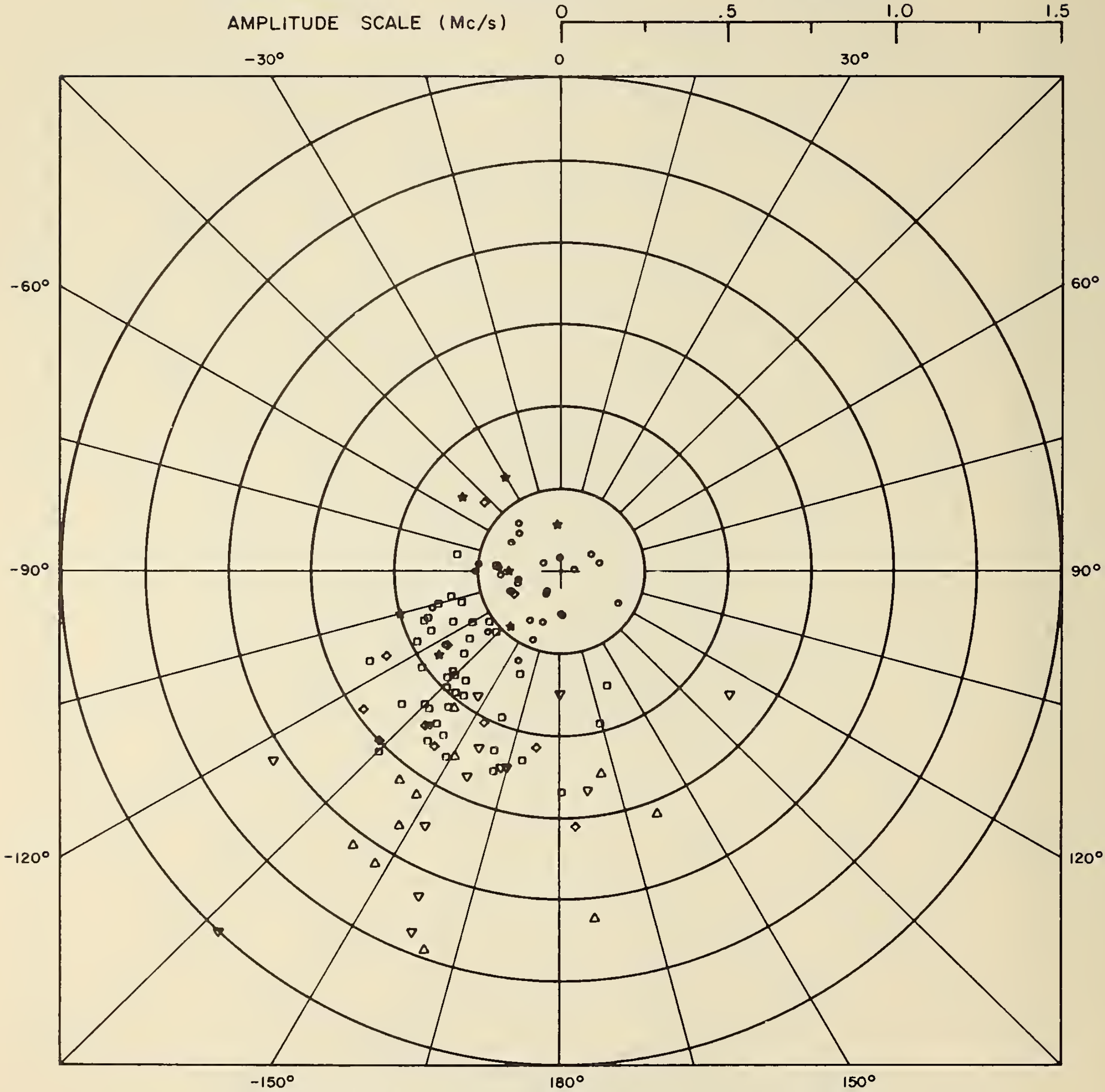


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°			30° TO 60°			60° TO 90°			TOTAL	
NORTH	1			3			6	4		18	4
	12	2	15	37	1	41	11	7	28		
SOUTH				1			7				
	11	2	13	8		9	3	2	12	82	14

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 3 112 STATIONS



DISTRIBUTION OF THE PHASE

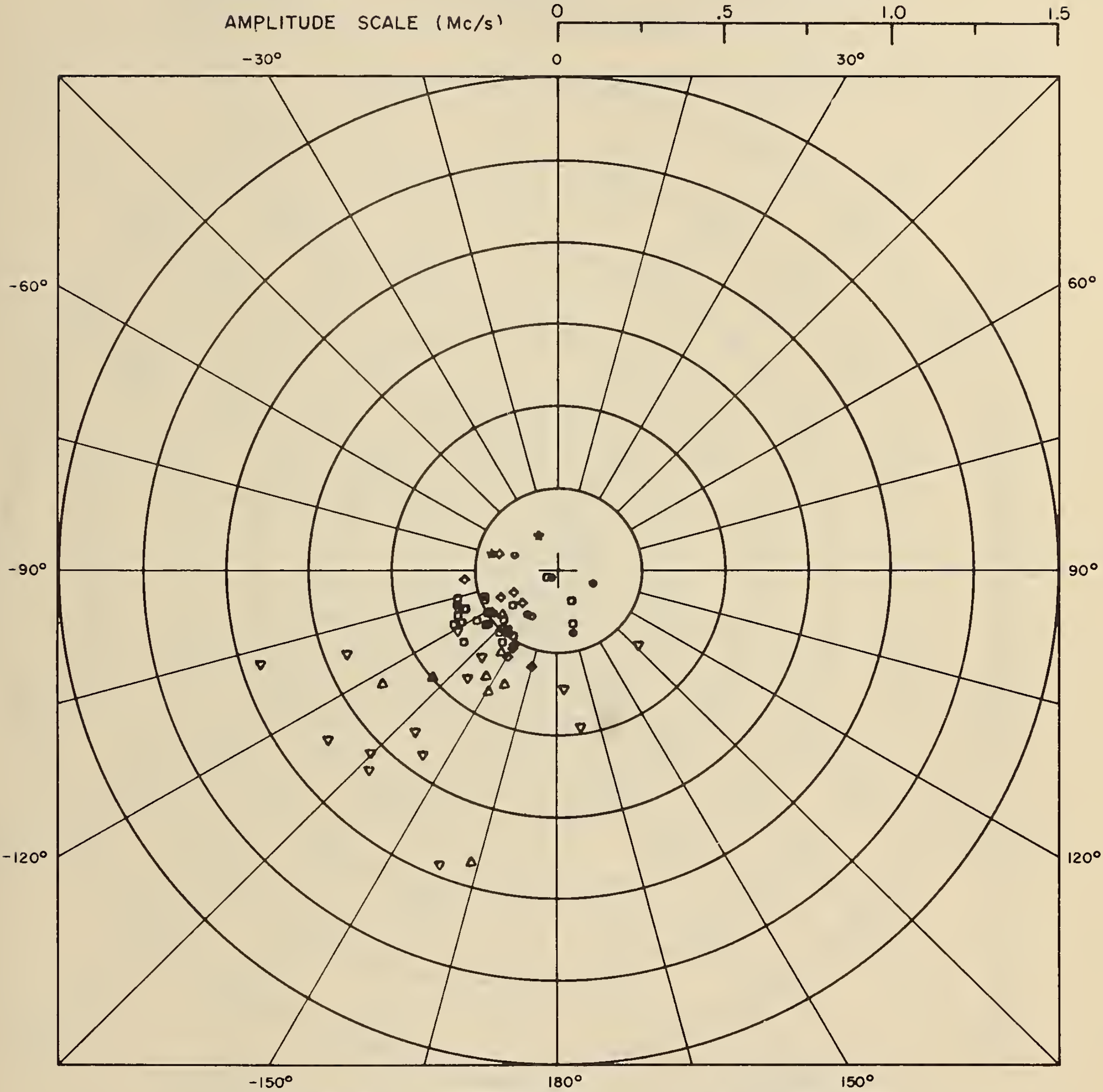
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 11 | 2 13	◘ 2 | 37 | 3 42	○ 7 | 3 16 | 2 28
SOUTH	△ 8 | 3 11	◆ 1 | 9 | 1 11	★ 4 | 3 | 7

TOTAL

14	3
84	11

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 3 67 STATIONS



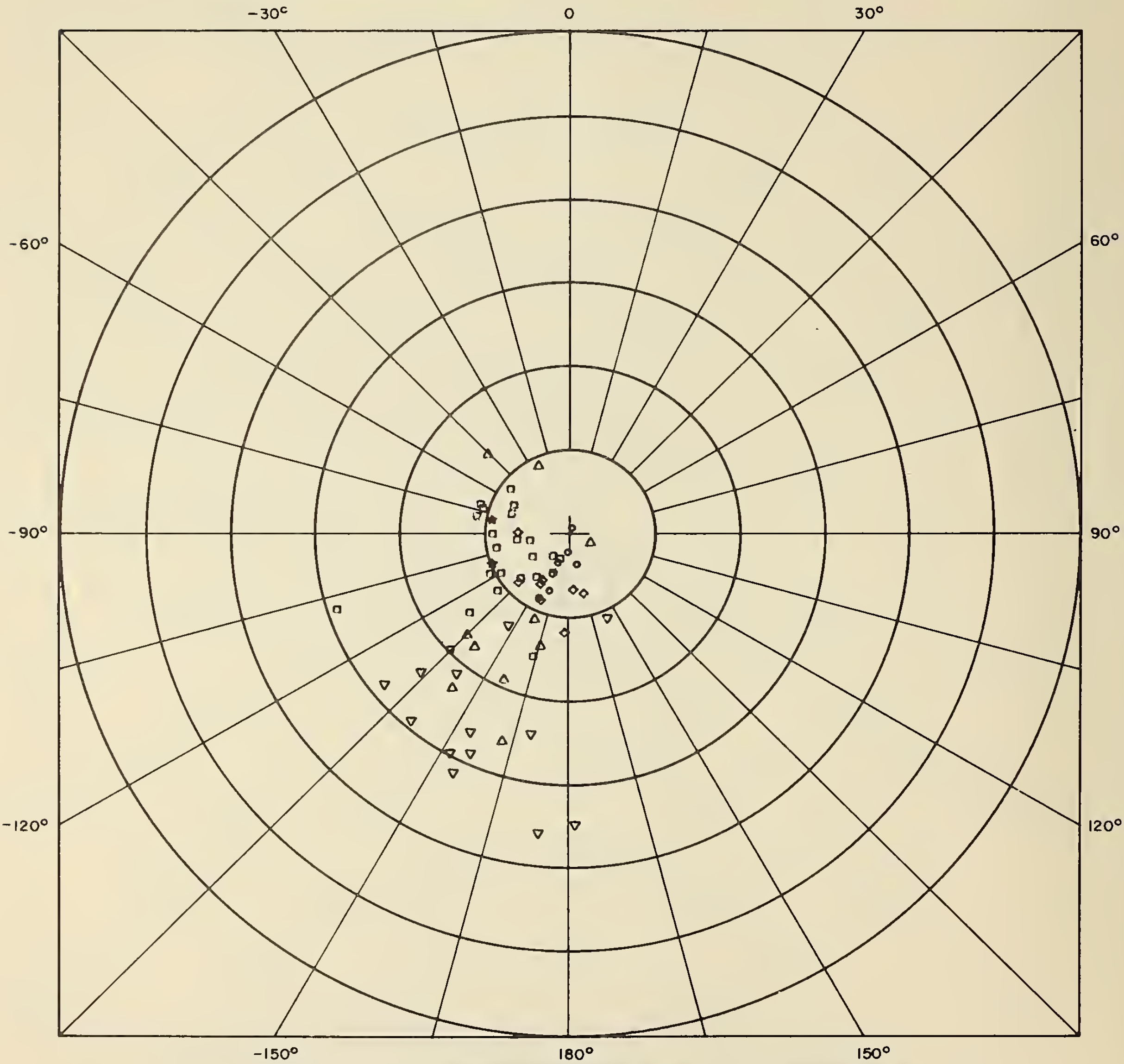
DISTRIBUTION OF THE PHASE

<table>
<tr><th>LATITUDE</th><th>0° TO 30°</th><th>30° TO 60°</th><th>60° TO 90°</th><th>TOTAL</th></tr>
<tr><td>NORTH</td><td>▽
 |
11 | 3   14</td><td>□
 |
24 | 2   26</td><td>○
1 |
4 | 2   7</td><td rowspan="2">4 |
56 | 7</td></tr>
<tr><td>SOUTH</td><td>△
 |
9 | 9</td><td>◆
1 |
8 | 9</td><td>★
2 |
 | 2</td></tr>
</table>

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 3 63 STATIONS

AMPLITUDE SCALE (Mc/s) 0 .5 1.0 1.5



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ $\begin{array}{c\|c} & \\ \hline 11 & 2 \end{array}$ 13	▫ $\begin{array}{c\|c} 7 & \\ \hline 16 & \end{array}$ 23	∘ $\begin{array}{c\|c} & 1 \\ \hline 5 & 1 \end{array}$ 7
SOUTH	△ $\begin{array}{c\|c} 2 & \\ \hline 7 & 1 \end{array}$ 10	◇ $\begin{array}{c\|c} 1 & \\ \hline 5 & 2 \end{array}$ 8	★ $\begin{array}{c\|c} 1 & \\ \hline 1 & \end{array}$ 2

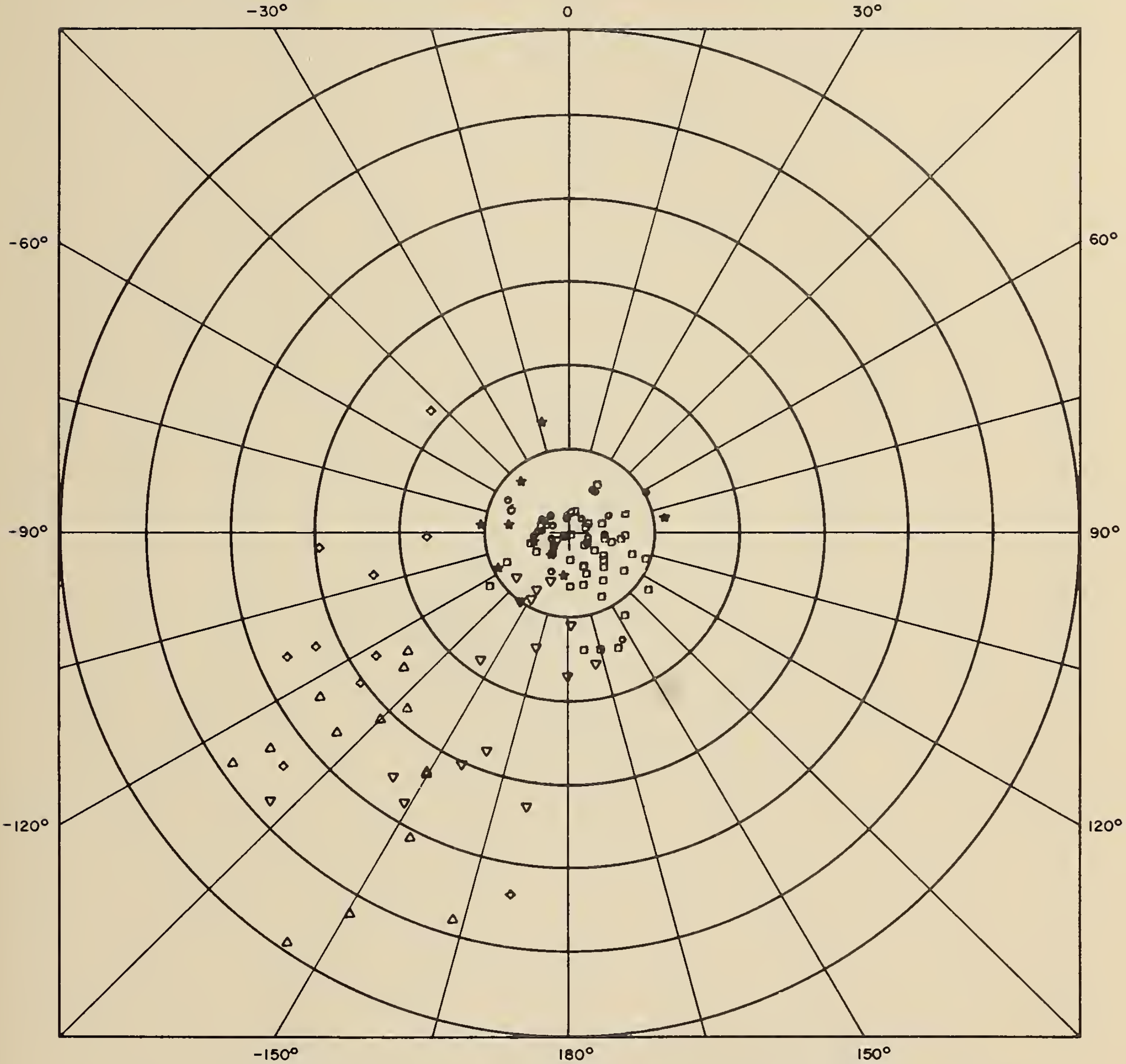
TOTAL

$\begin{array}{c|c} 11 & 1 \\ \hline 45 & 6 \end{array}$

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 3 118 STATIONS

AMPLITUDE SCALE (Mc/s) 0 .5 1.0 1.5



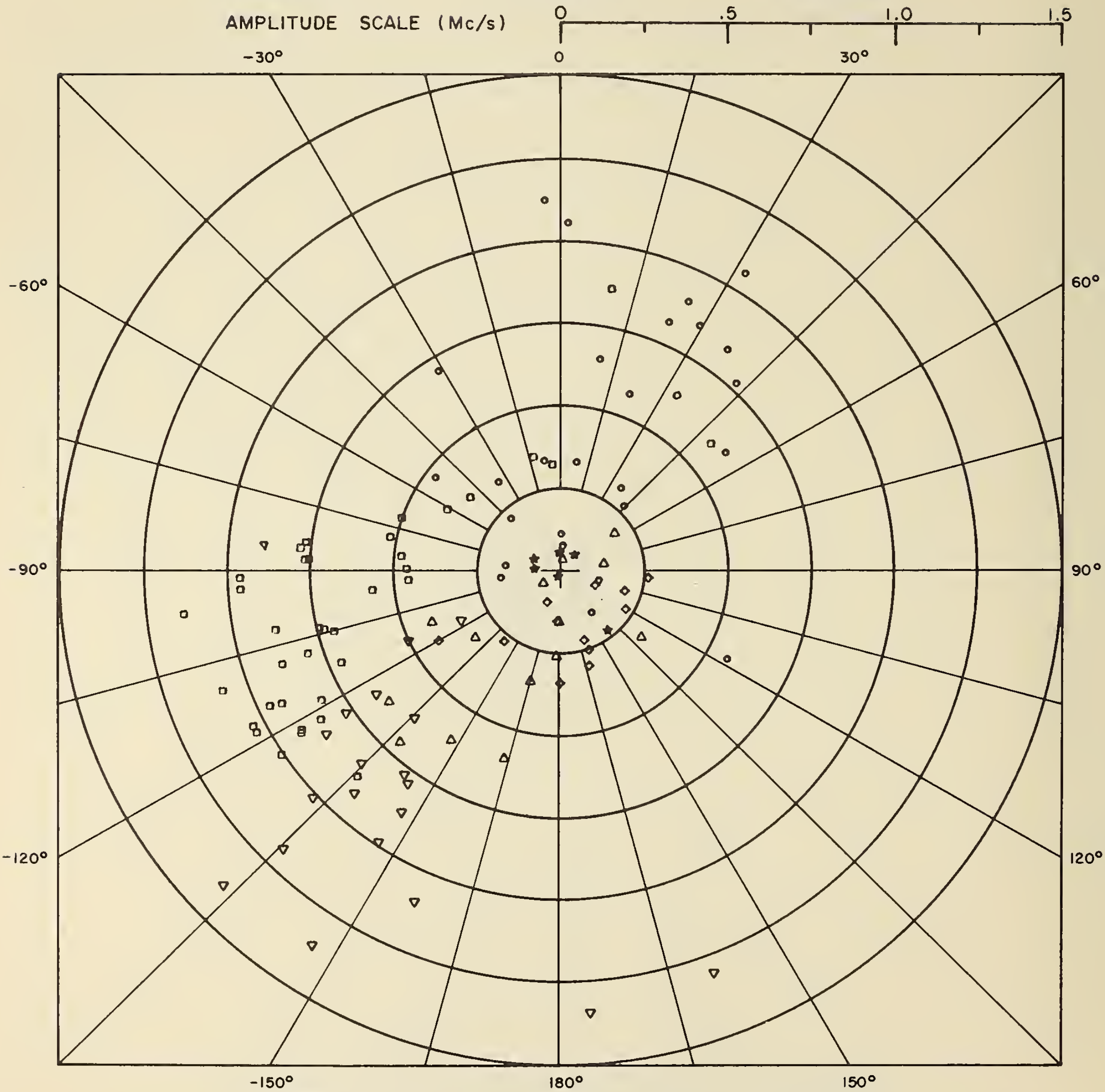
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 15 | 3 — 18	■ 1 | 6 / 5 | 27 — 39	○ 11 | 6 / 8 | 3 — 28	17 | 13
SOUTH	△ 14 — 14	◇ 1 / 9 — 10	★ 4 | 1 / 4 — 9	55 | 33

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 3 116 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ $\begin{array}{c\|c} & \\ \hline 17 & 2 \end{array}$ 19	◉ $\begin{array}{c\|c} 13 & 2 \\ \hline 23 & \end{array}$ 38	○ $\begin{array}{c\|c} 7 & 16 \\ \hline 1 & 3 \end{array}$ 27
SOUTH	△ $\begin{array}{c\|c} & 3 \\ \hline 8 & 3 \end{array}$ 14	◆ $\begin{array}{c\|c} & \\ \hline 3 & 9 \end{array}$ 12	★ $\begin{array}{c\|c} 2 & 2 \\ \hline & 2 \end{array}$ 6

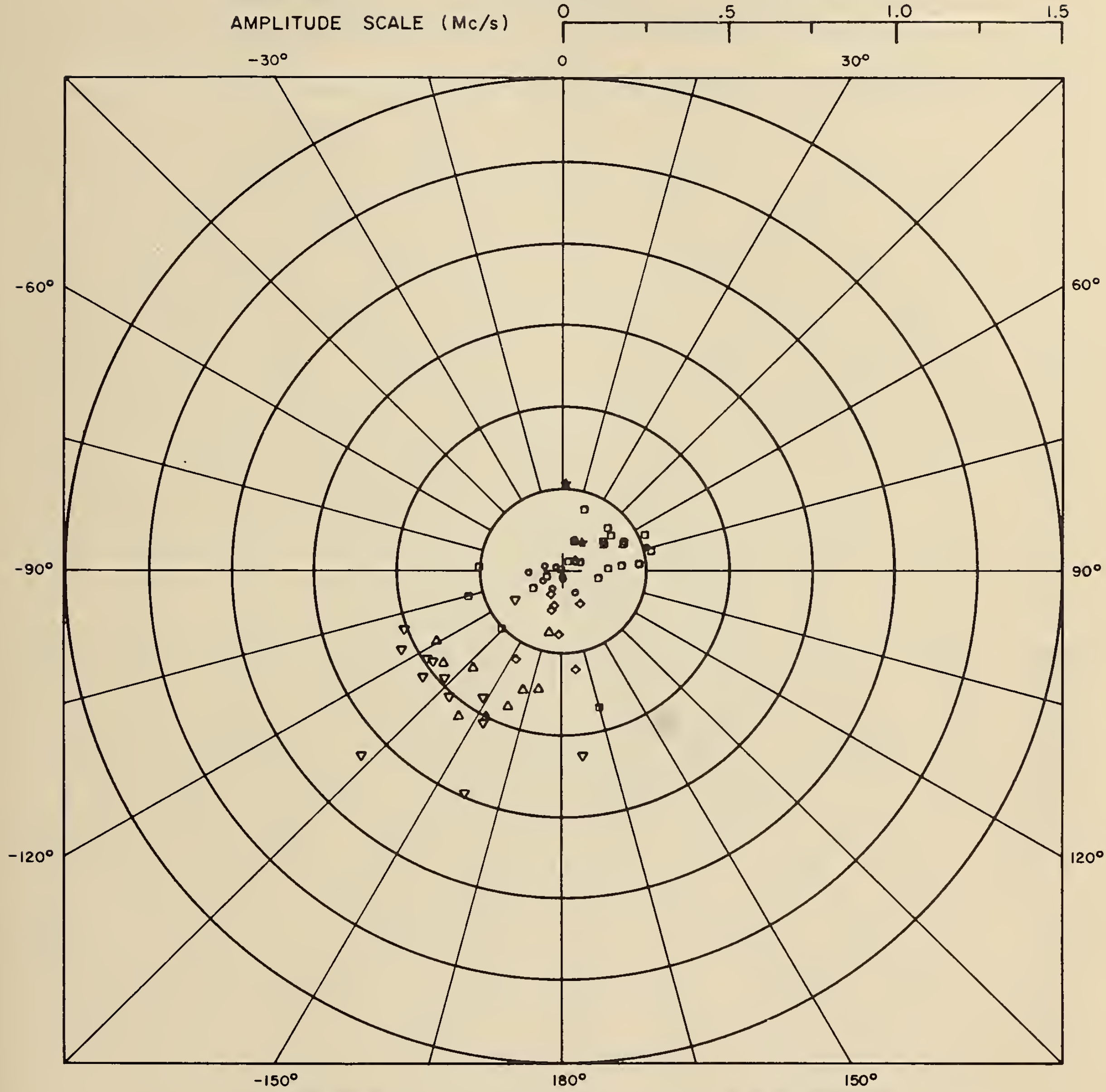
TOTAL

$$\begin{array}{c|c} 22 & 23 \\ \hline 52 & 19 \end{array}$$

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 3 68 STATIONS

AMPLITUDE SCALE (Mc/s)



LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 12 | 1 — 13	● 1 | 18, 4 | 2 — 25	∘ 2 | 3, 3 | 3 — 11
SOUTH	△ 9 — 9	◆ 1, 5 | 2 — 8	★ 2 — 2

DISTRIBUTION OF THE PHASE

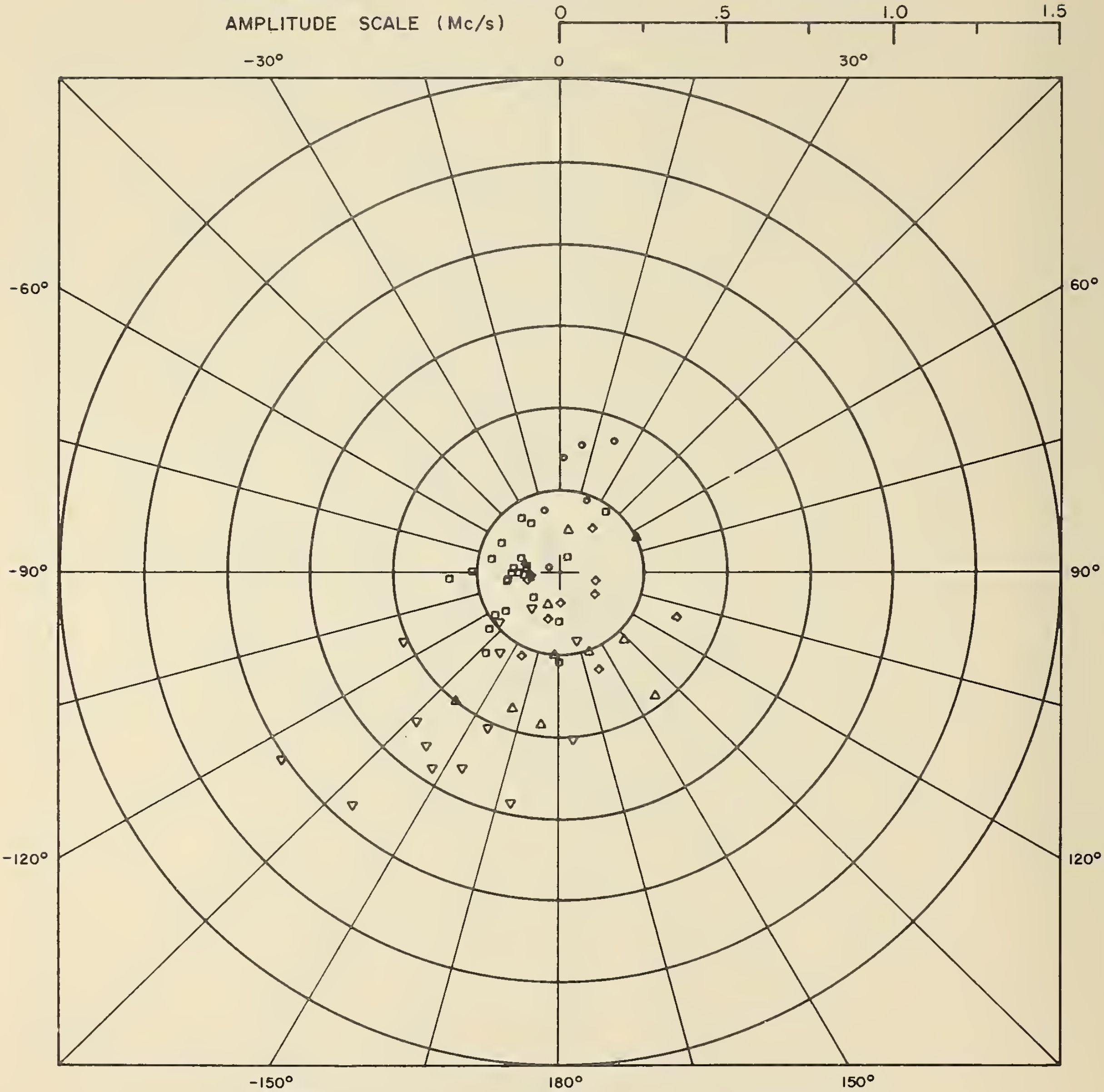
TOTAL

3	24
33	8

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 3 65 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

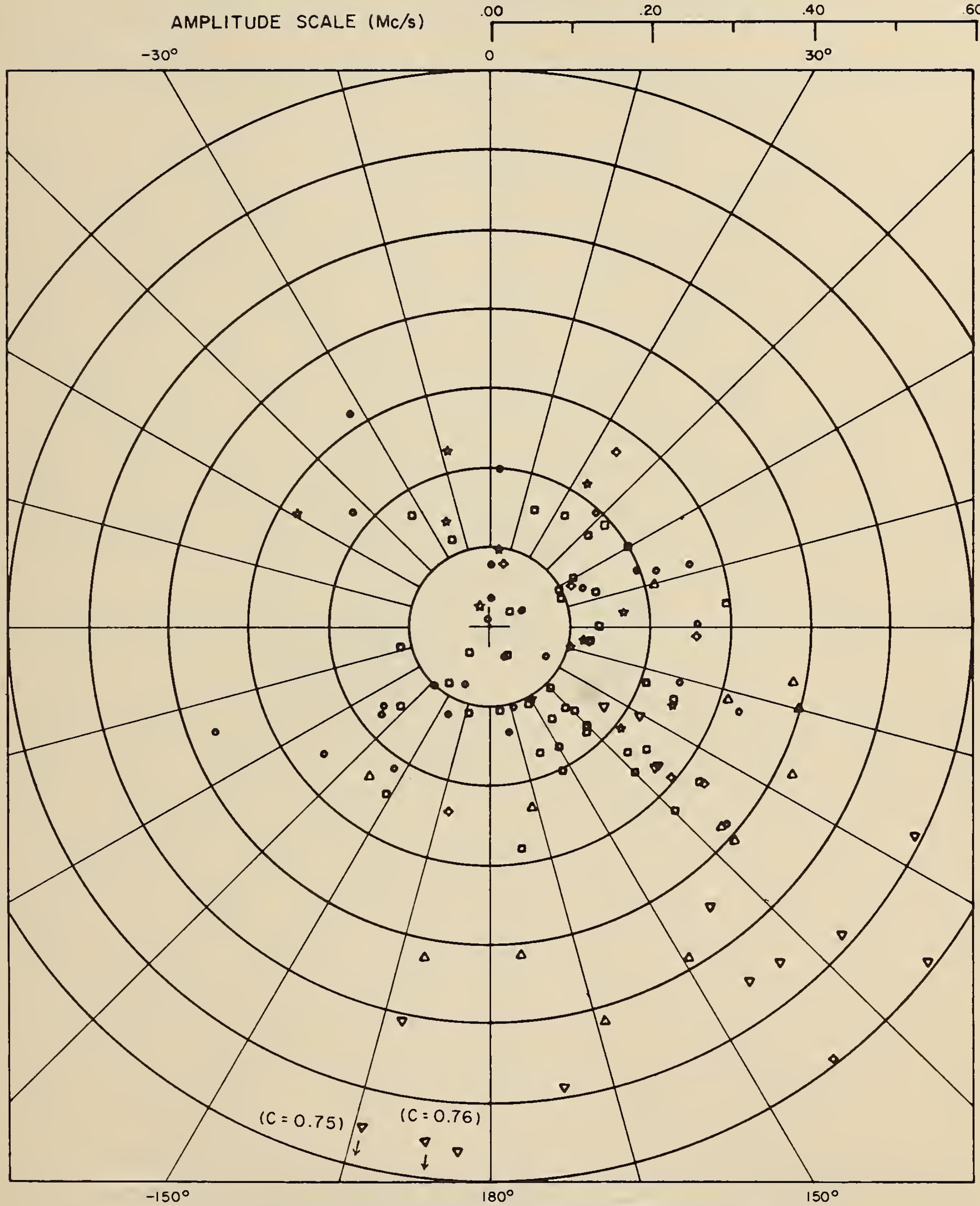
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ | 12 | 2 14	■ 8 | 2 11 | 2 23	○ 2 | 4 | 6
SOUTH	△ | 2 5 | 3 10	◆ | 1 4 | 5 10	★ | 1 1 | 2

TOTAL

11	9
33	12

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 4 118 STATIONS

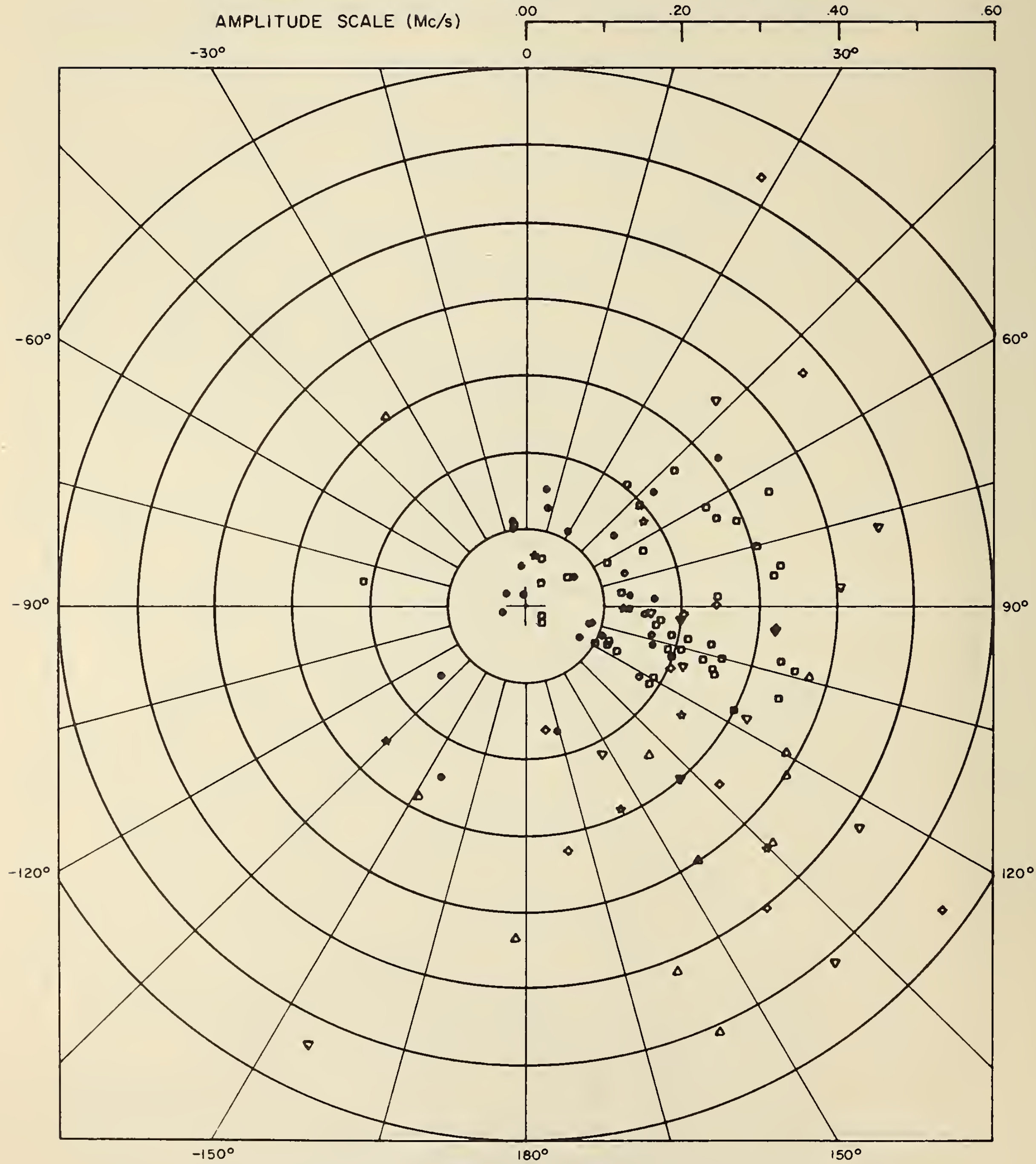


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ — | — ; 4 | 11 — 15	▫ 2 | 12 ; 6 | 21 — 41	• 3 | 10 ; 8 | 7 — 28	9 | 29
SOUTH	△ — | 1 ; 2 | 10 — 13	◆ — | 3 ; 1 | 5 — 9	★ 4 | 3 ; — | 5 — 12	21 | 59

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 4 112 STATIONS

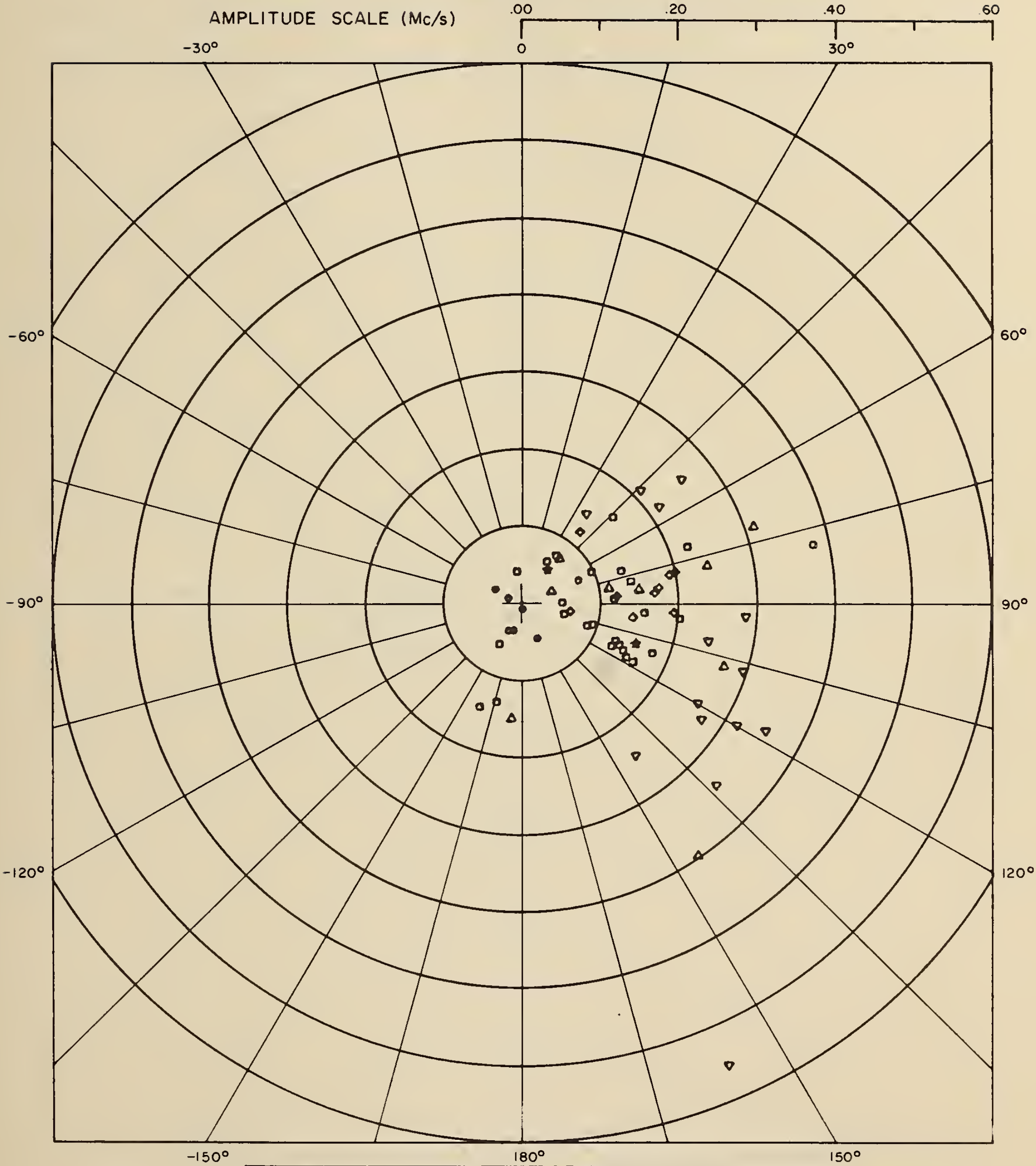


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ |3 / 1|9 — 13	▫ 2|17 / |23 — 42	• 5|10 / 3|10 — 28	8|35
SOUTH	△ |1 / 2|8 — 11	◆ |3 / |8 — 11	★ |2 / 1|4 — 7	7|62

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 4 67 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ | 4 / | 10 14	● 1 | 10 / 3 | 12 26	• 2 | 1 / 2 | 2 7
SOUTH	△ | 6 / 1 | 2 9	◆ | 6 / | 3 9	★ | 1 / | 1 2

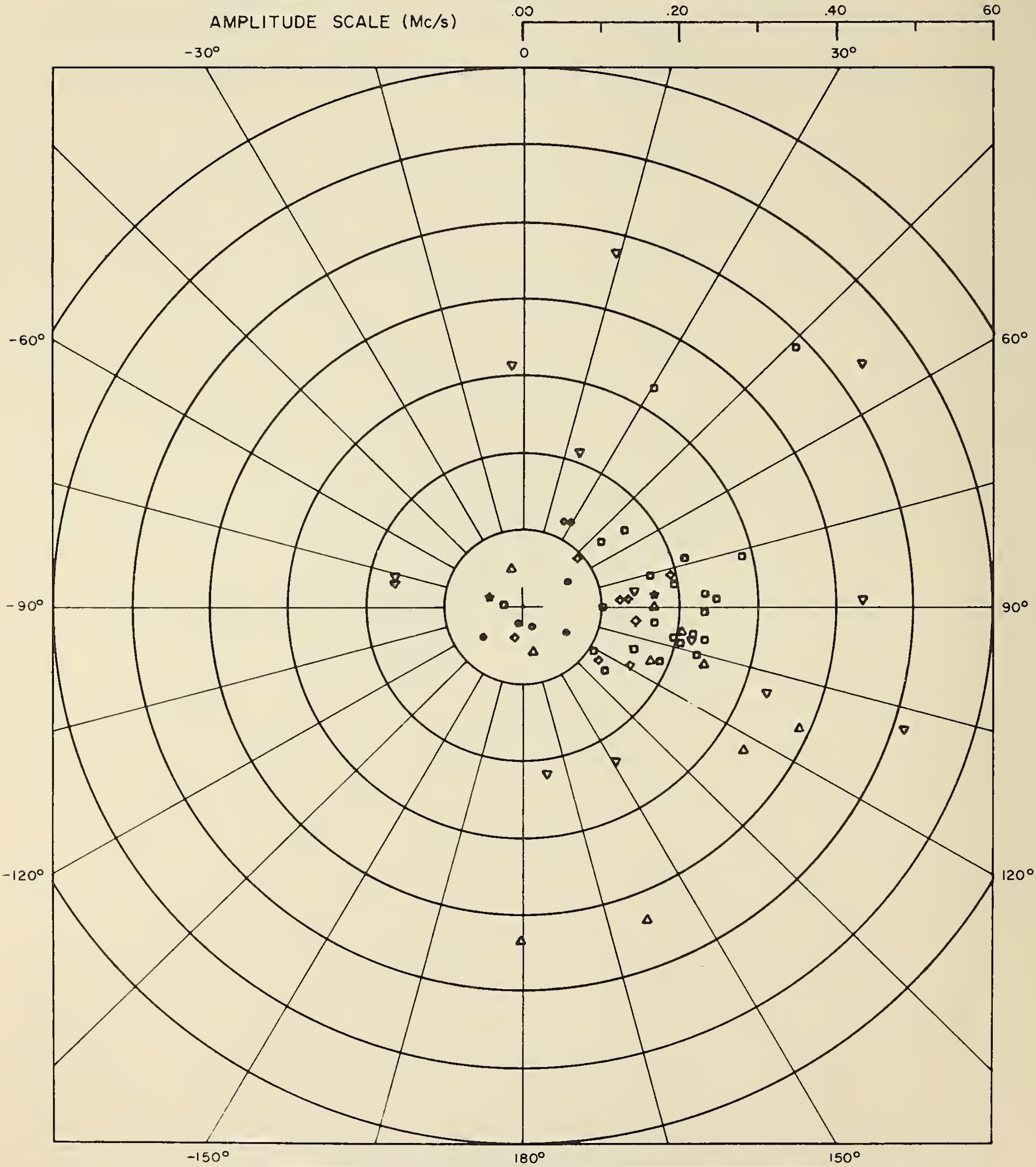
TOTAL

3	28
6	30

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 4 63 STATIONS

AMPLITUDE SCALE (Mc/s)



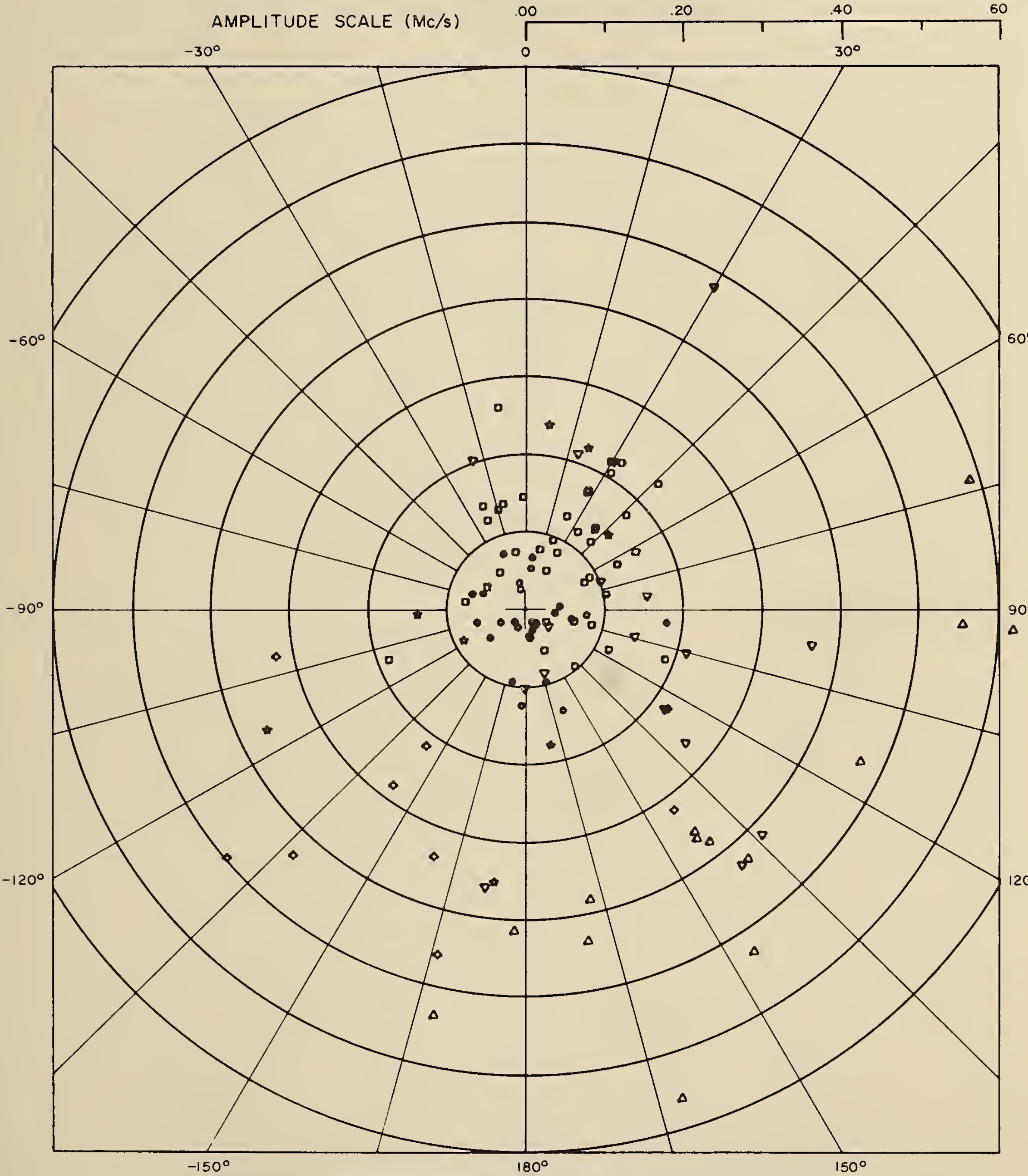
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 3 5 / – 5 ; 13	▫ 1 10 / – 12 ; 23	• – 3 / 2 2 ; 7	6 24
SOUTH	△ 1 1 / 1 7 ; 10	◆ – 4 / 1 3 ; 8	★ 1 1 / – – ; 2	4 29

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 4 118 STATIONS

AMPLITUDE SCALE (Mc/s)

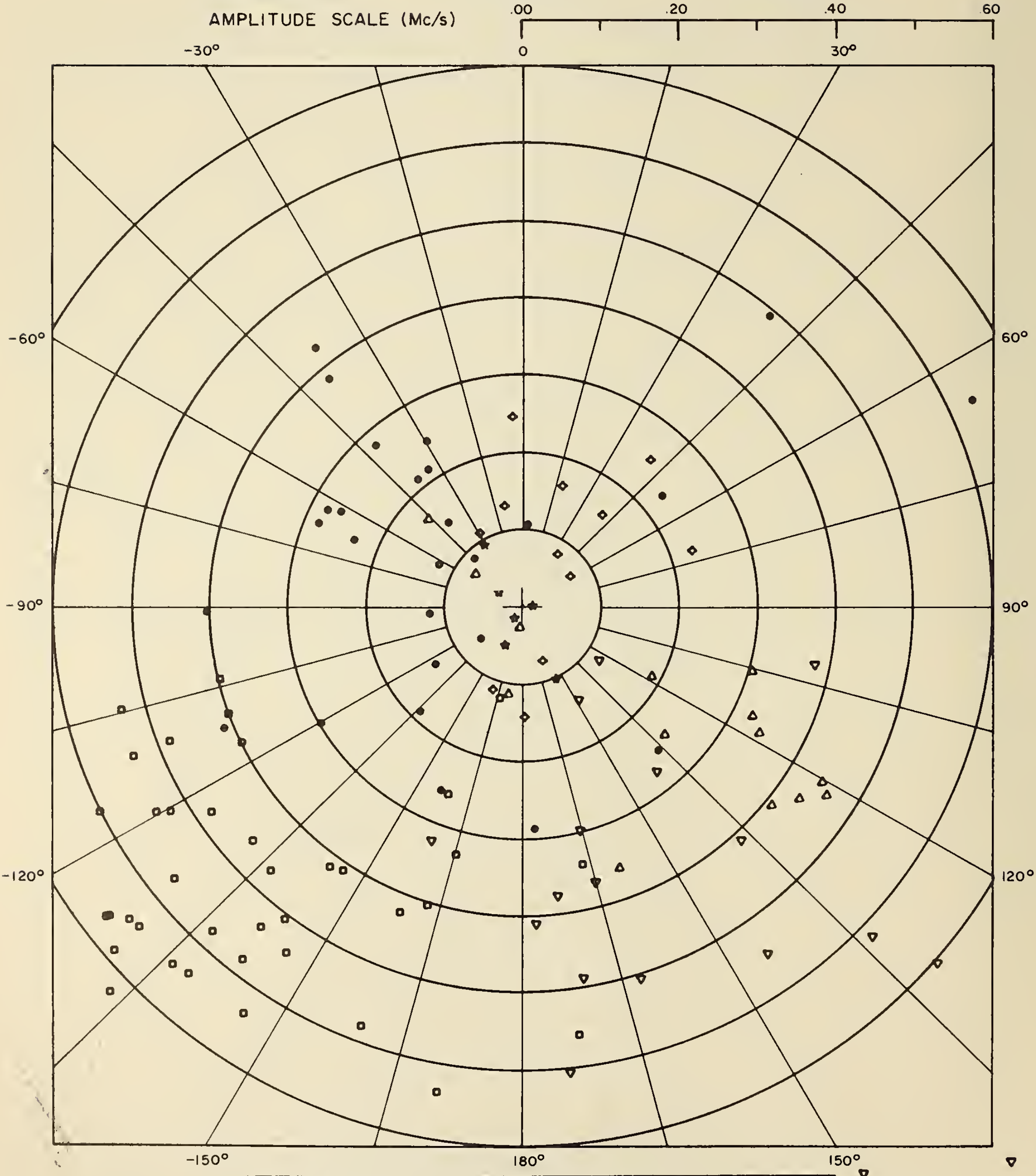


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 1 6 / 2 9 — 18	□ 10 21 / 1 7 — 39	○ 6 3 / 7 12 — 28	17 35
SOUTH	△ 1 / 2 11 — 14	◇ 8 2 — 10	☆ 4 / 4 1 — 9	24 42

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 4 116 STATIONS

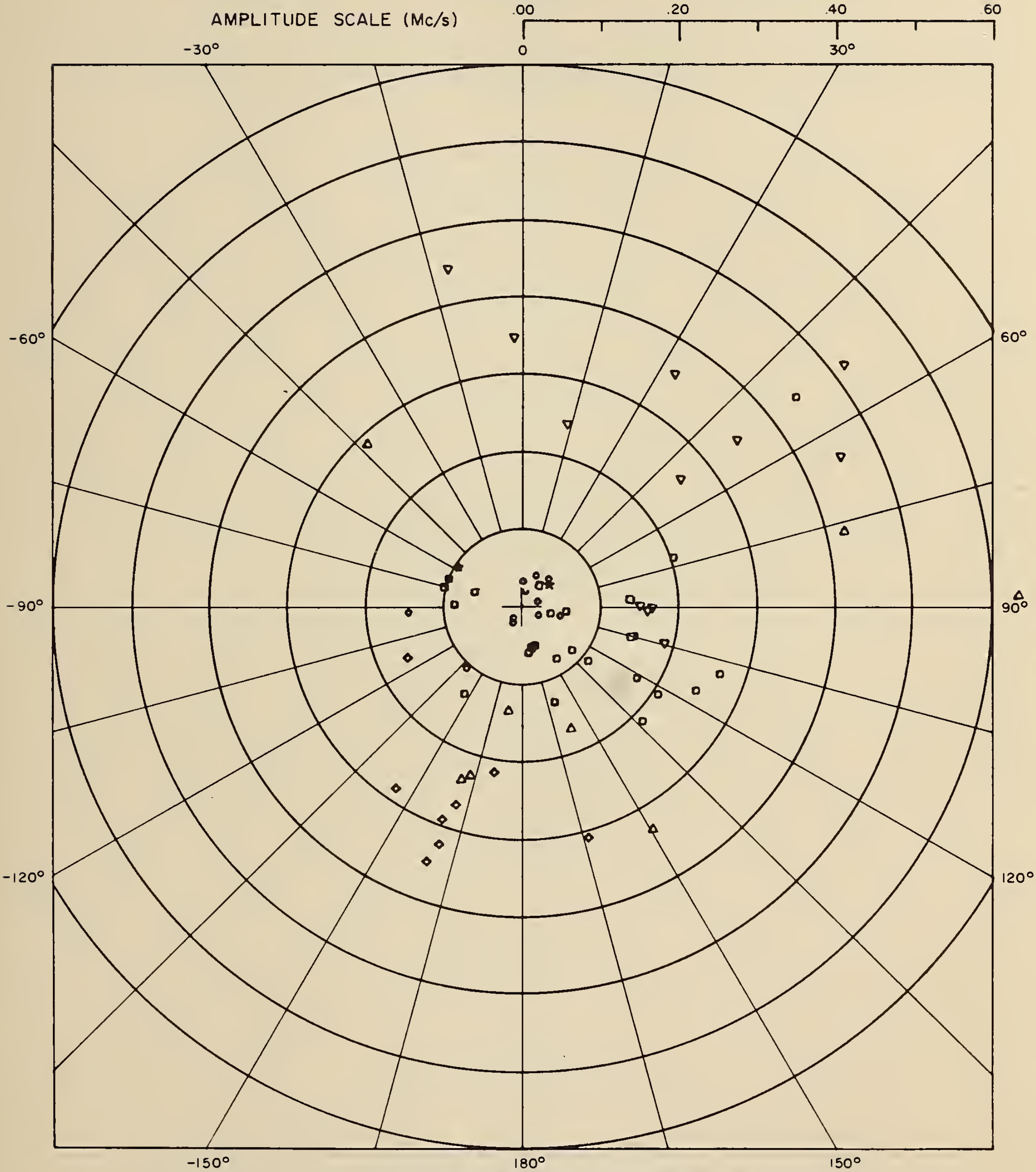


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ — / 1, 18 — 19	□ — / 36, 2 — 38	● 13, 4 / 8, 2 — 27	20, 11 / 50, 35
SOUTH	△ 2 / 2, 10 — 14	◇ 3, 6 / 1, 2 — 12	★ 2, 1 / 2, 1 — 6	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 4 68 STATIONS

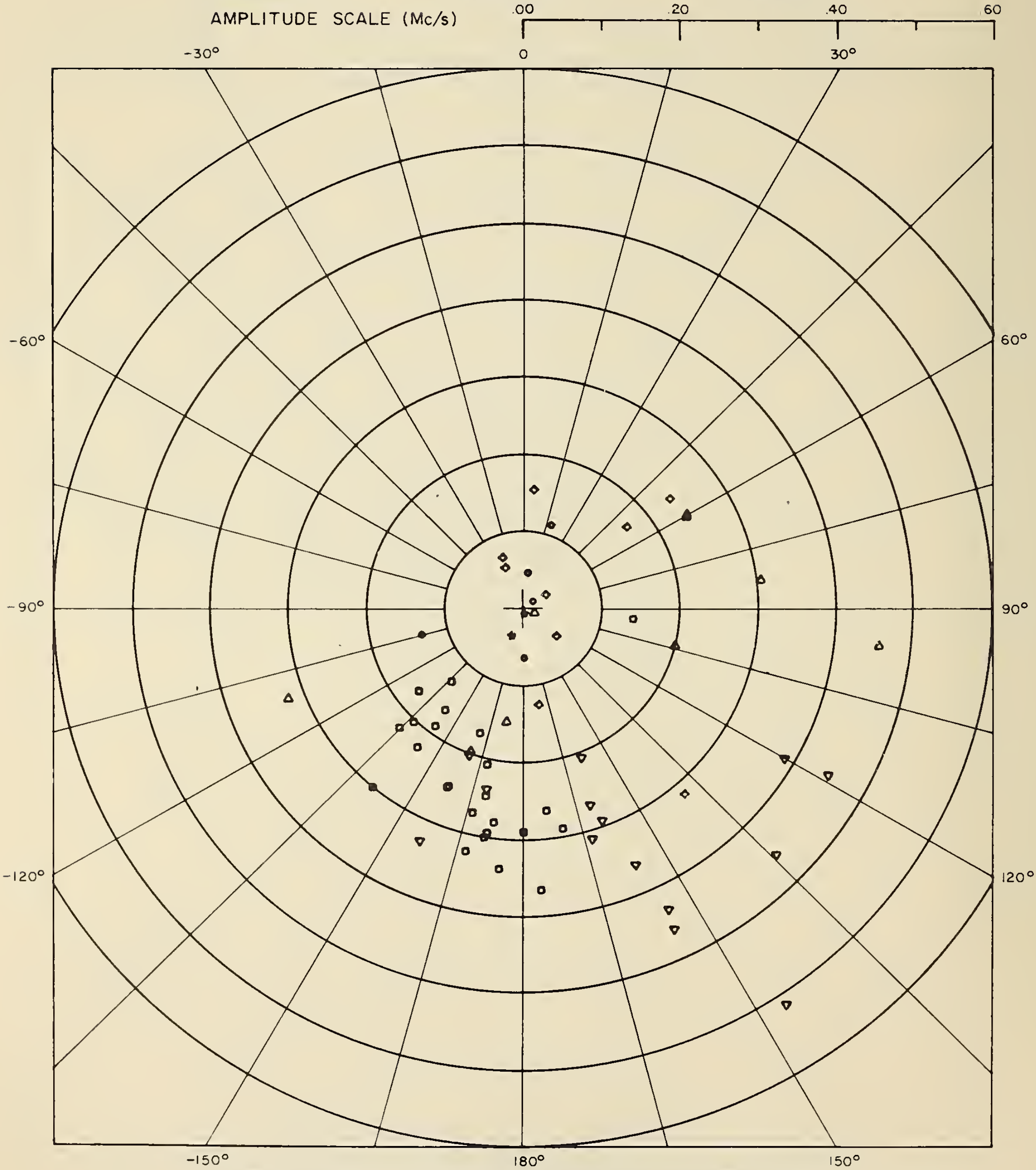


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 2, 8 / –, 3 — 13	◘ 4, 4 / 1, 16 — 25	• –, 5 / 4, 2 — 11	8, 20
SOUTH	△ 1, 2 / 4, 2 — 9	◆ –, – / 7, 1 — 8	★ 1, 1 / –, – — 2	16, 24

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 4 65 STATIONS



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<tr><td>NORTH</td><td>▽
 │
3 │ 11
14</td><td>■
 │
19 │ 4
23</td><td>●
 │ 3
1 │ 2
6</td><td rowspan="2">2 │ 10
29 │ 24</td></tr>
<tr><td>SOUTH</td><td>△
 │ 3
4 │ 3
10</td><td>◆
2 │ 4
1 │ 3
10</td><td>★
 │
1 │ 1
2</td></tr>
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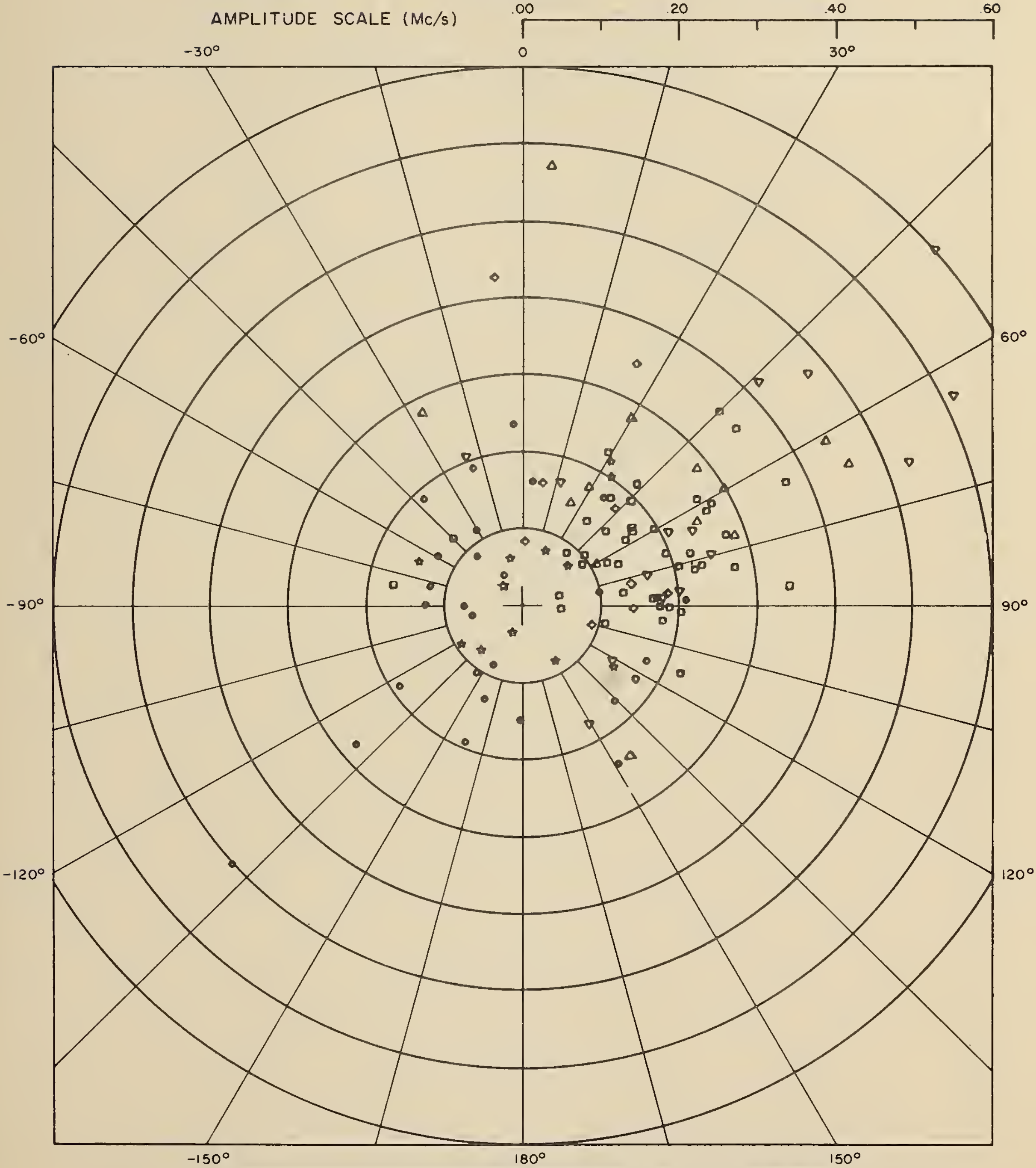
AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 5 118 STATIONS

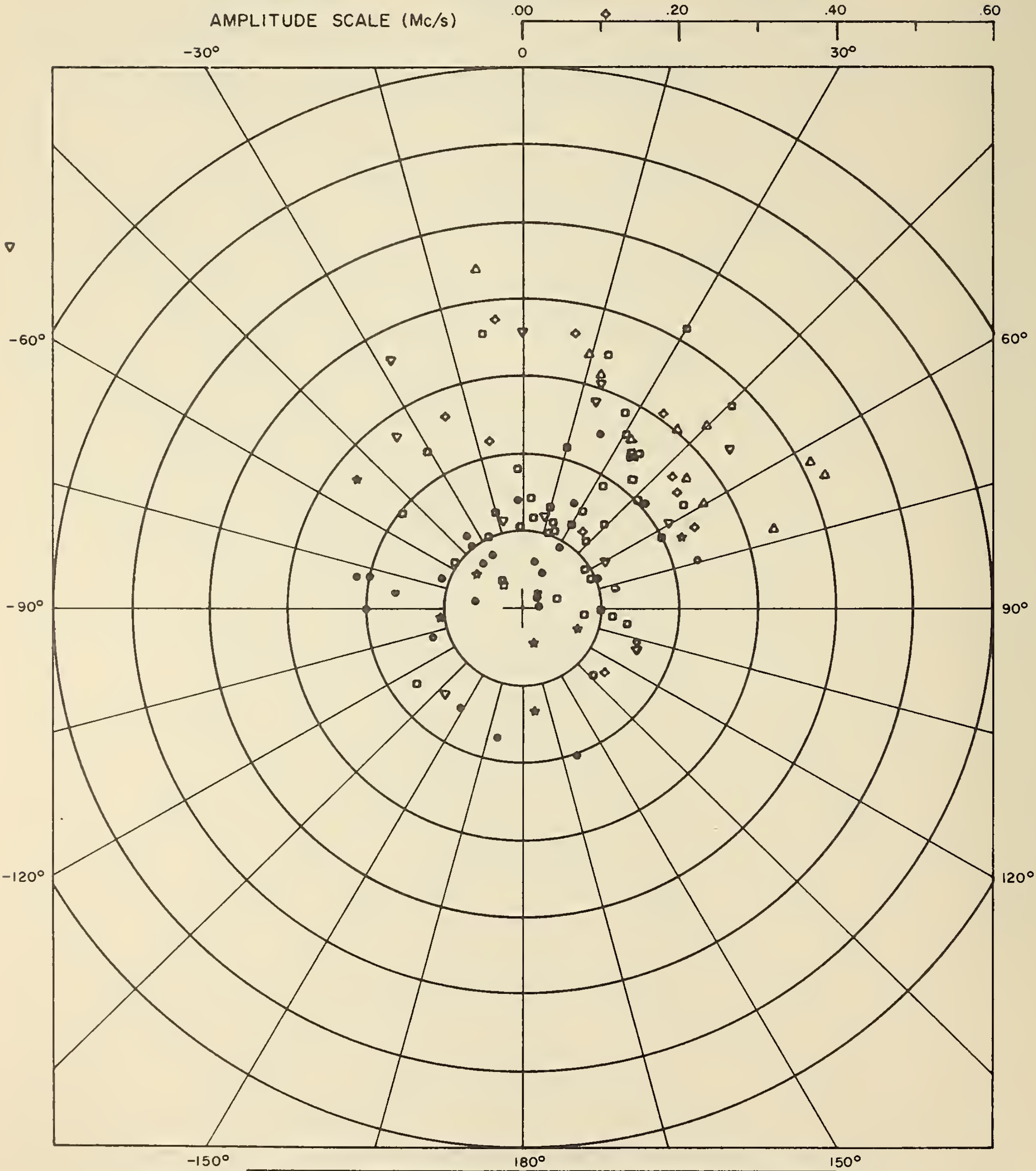


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 1 | 12 ; — | 2 ; 15	■ 2 | 32 ; — | 7 ; 41	○ 8 | 5 ; 11 | 4 ; 28	16 | 70
SOUTH	△ 1 | 11 ; — | 1 ; 13	◆ 1 | 6 ; — | 2 ; 9	★ 3 | 4 ; 3 | 2 ; 12	14 | 18

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 5 112 STATIONS



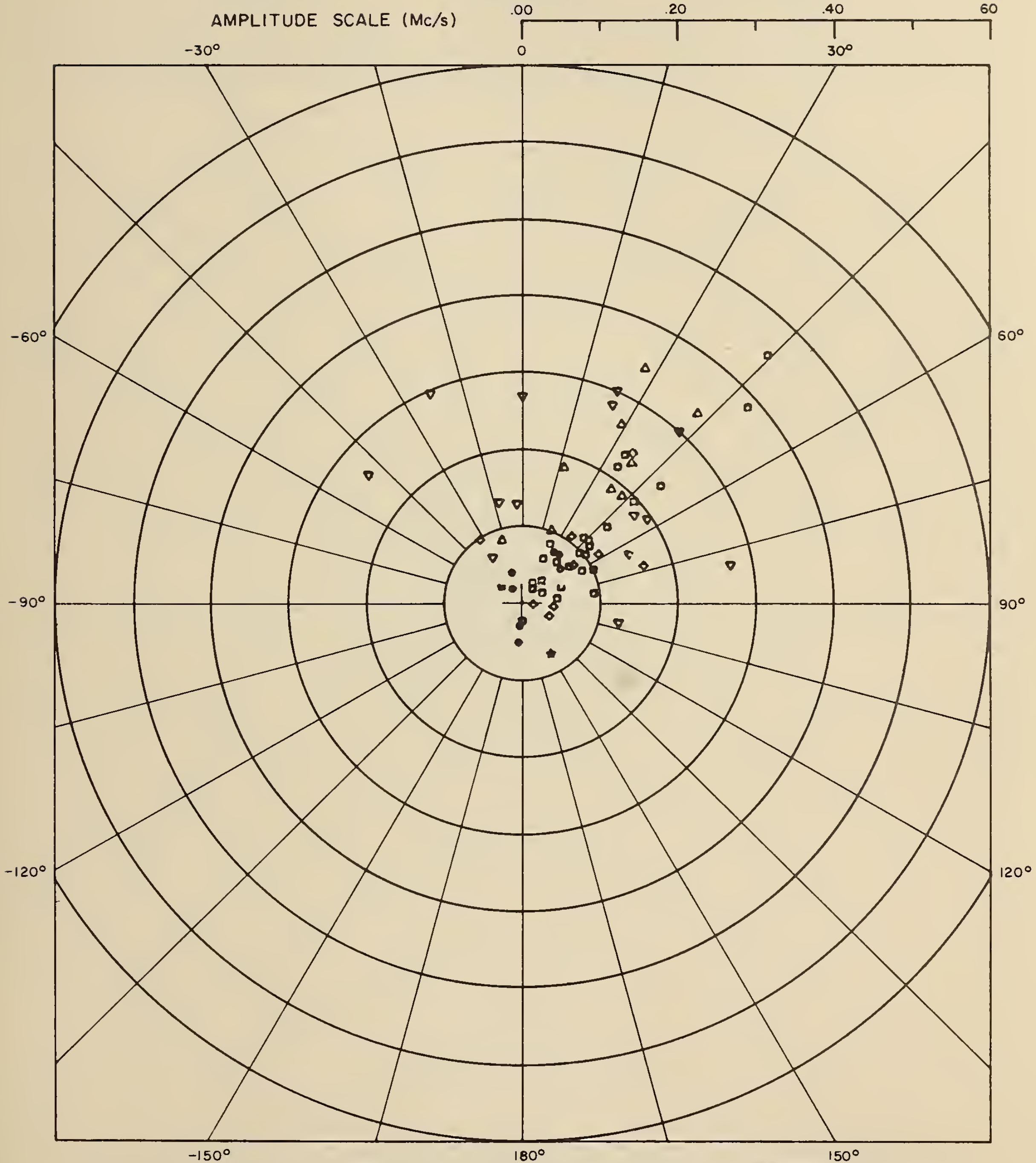
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 5 | 6 / 1 | 1 — 13	◘ 10 | 27 / 1 | 4 — 42	• 10 | 11 / 4 | 3 — 28	31 | 62 / 7 | 12
SOUTH	△ 1 | 10 — 11	◇ 3 | 7 / | 1 — 11	★ 2 | 1 / 1 | 3 — 7	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 5 67 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

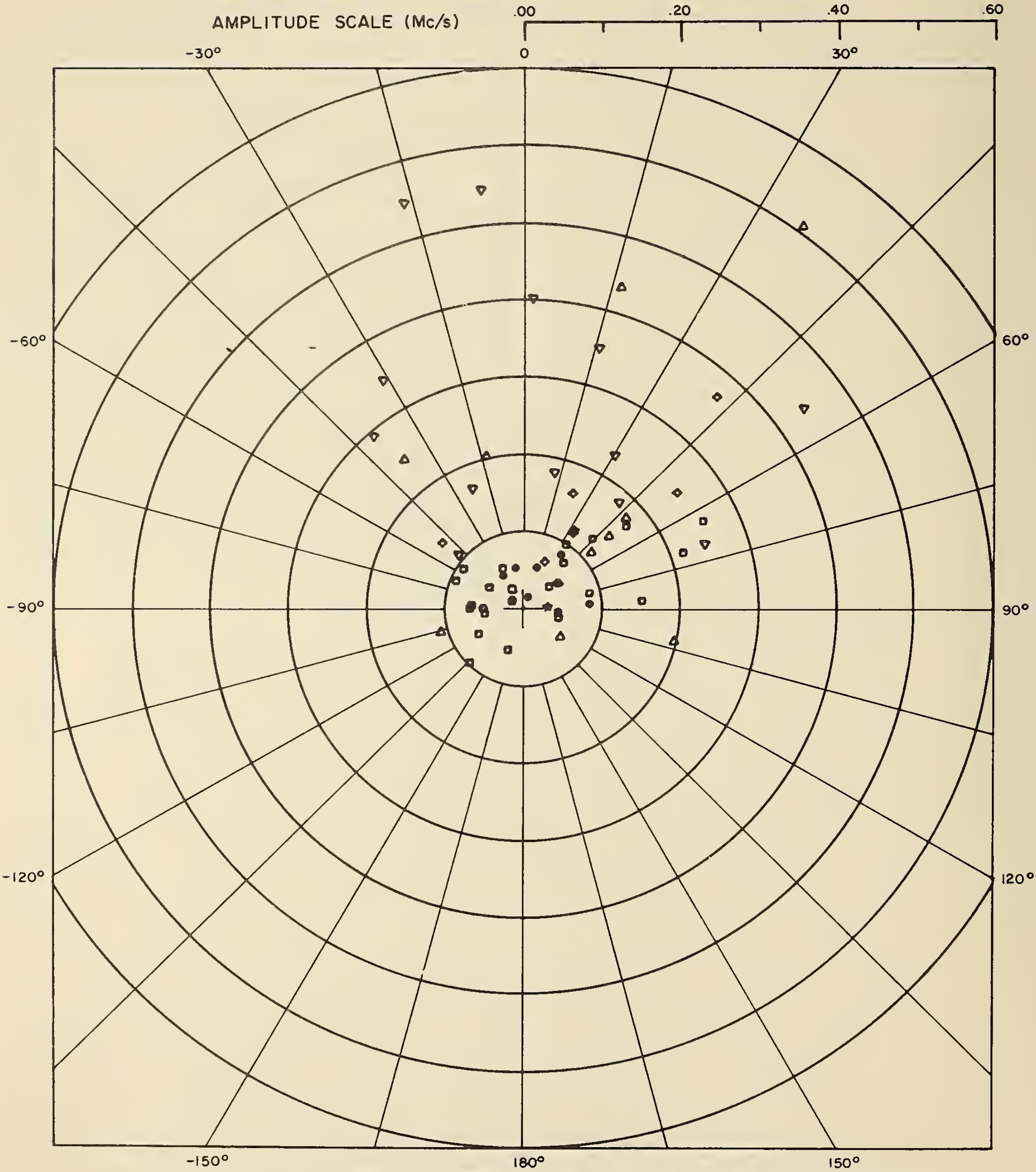
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 6 / 7 ; — / 1 ; 14	▫ — / 25 ; 1 / — ; 26	∘ 2 / 3 ; 2 / — ; 7
SOUTH	△ 1 / 8 ; — / — ; 9	◇ 1 / 5 ; — / 3 ; 9	★ 1 / — ; — / 1 ; 2

TOTAL

11	48
3	5

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 5 63 STATIONS



DISTRIBUTION OF THE PHASE

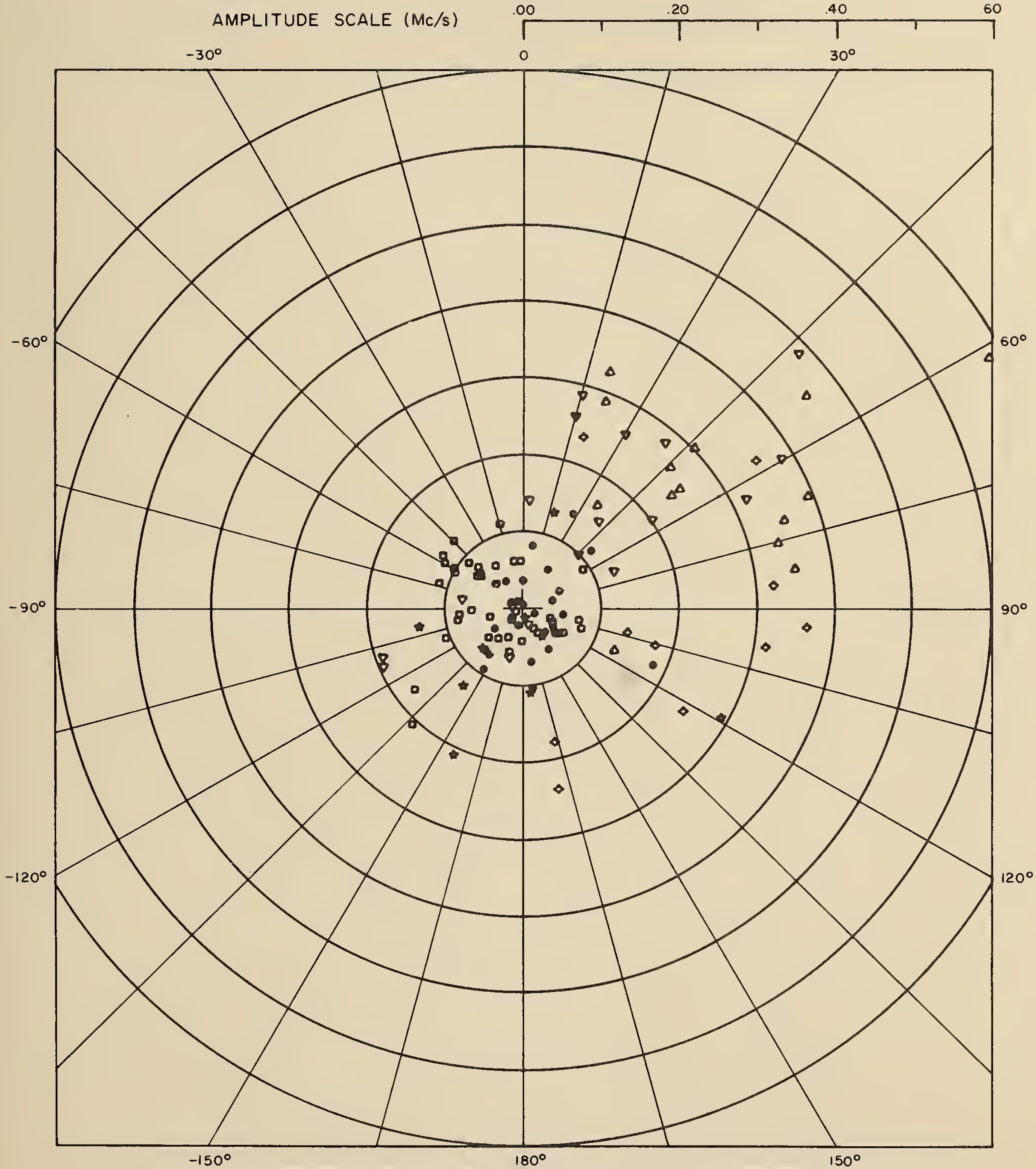
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 6 | 7 13	■ 9 | 9 4 | 1 23	• 3 | 3 | 1 7
SOUTH	△ 2 | 5 1 | 2 10	◆ 1 | 7 8	★ | 2 2

TOTAL

21	33
5	4

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 5 118 STATIONS



DISTRIBUTION OF THE PHASE

<table>
<tr><td>LATITUDE</td><td>0° TO 30°</td><td>30° TO 60°</td><td>60° TO 90°</td></tr>
<tr><td>NORTH</td><td>▽ 2 12
3 1
18</td><td>◘ 17 1
14 7
39</td><td>∘ 4 8
6 10
28</td></tr>
<tr><td>SOUTH</td><td>△ 13
1
14</td><td>◆ 3
7
10</td><td>★ 1
4 4
9</td></tr>
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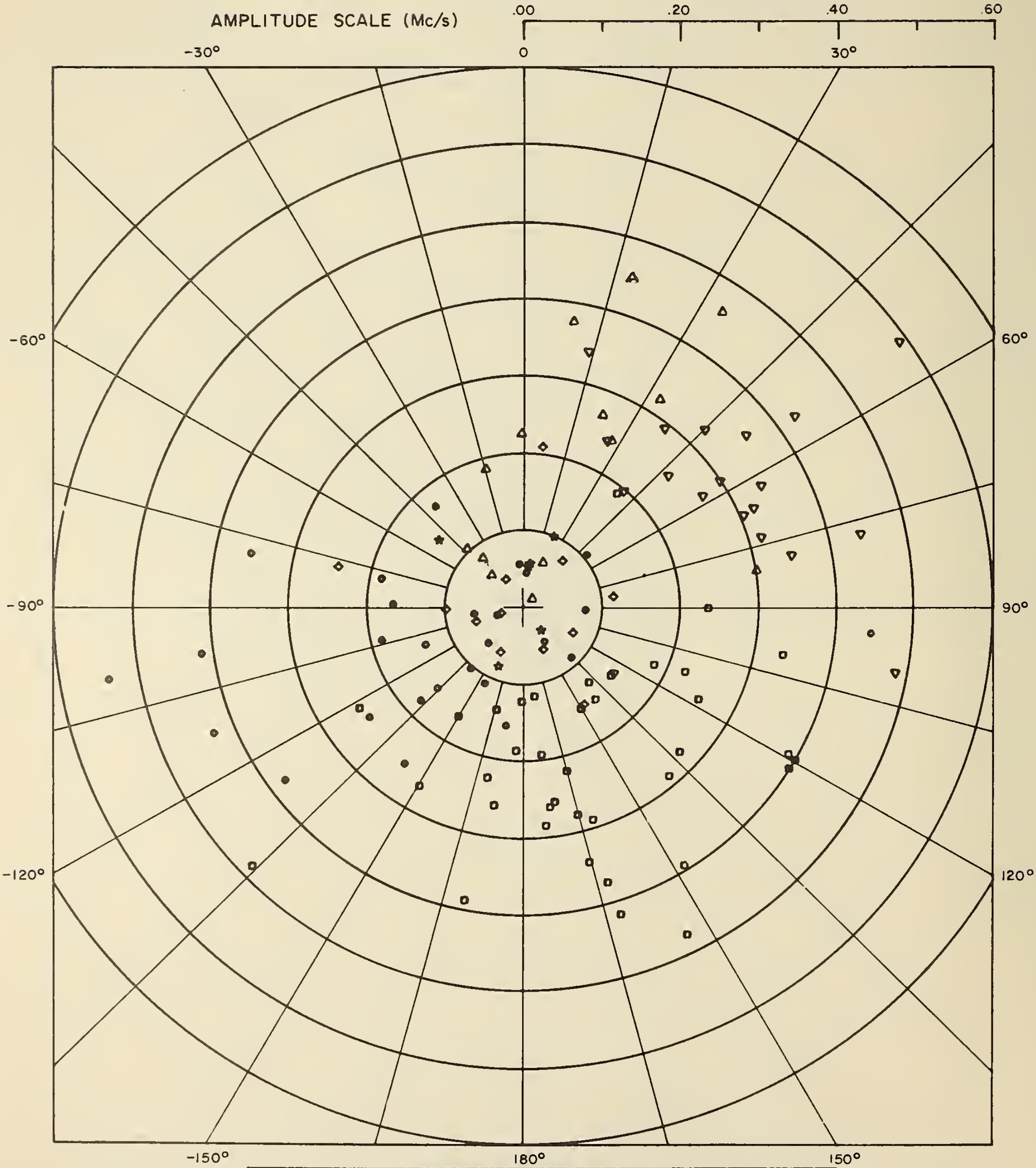
TOTAL

23	38
27	30

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 5 116 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ –│17 –│2 19	■ –│2 10│26 38	○ 5│2 16│4 27
SOUTH	△ 5│9 –│– 14	◆ 3│3 3│3 12	★ 1│3 1│1 6

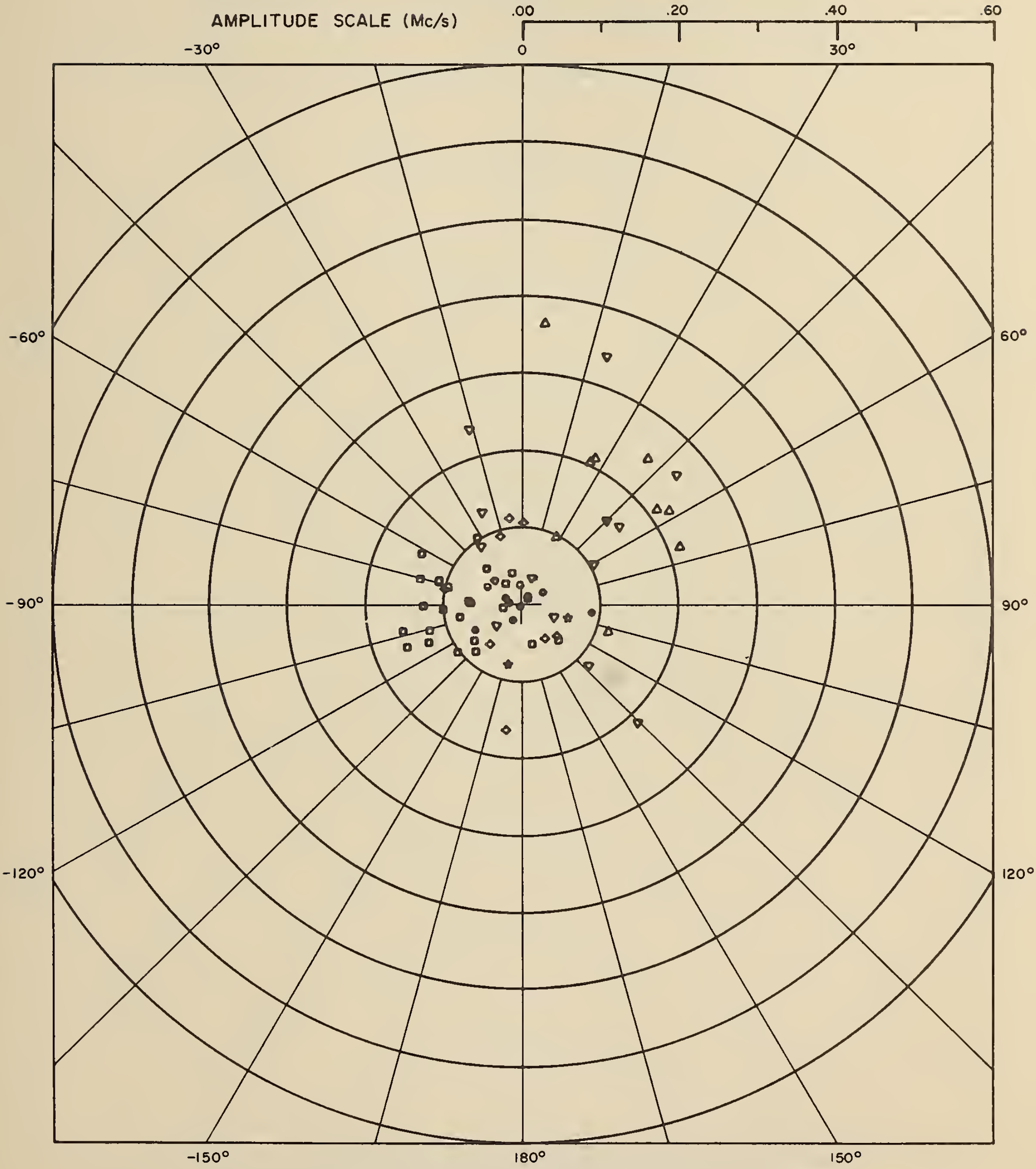
TOTAL

14	36
30	36

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 5 68 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

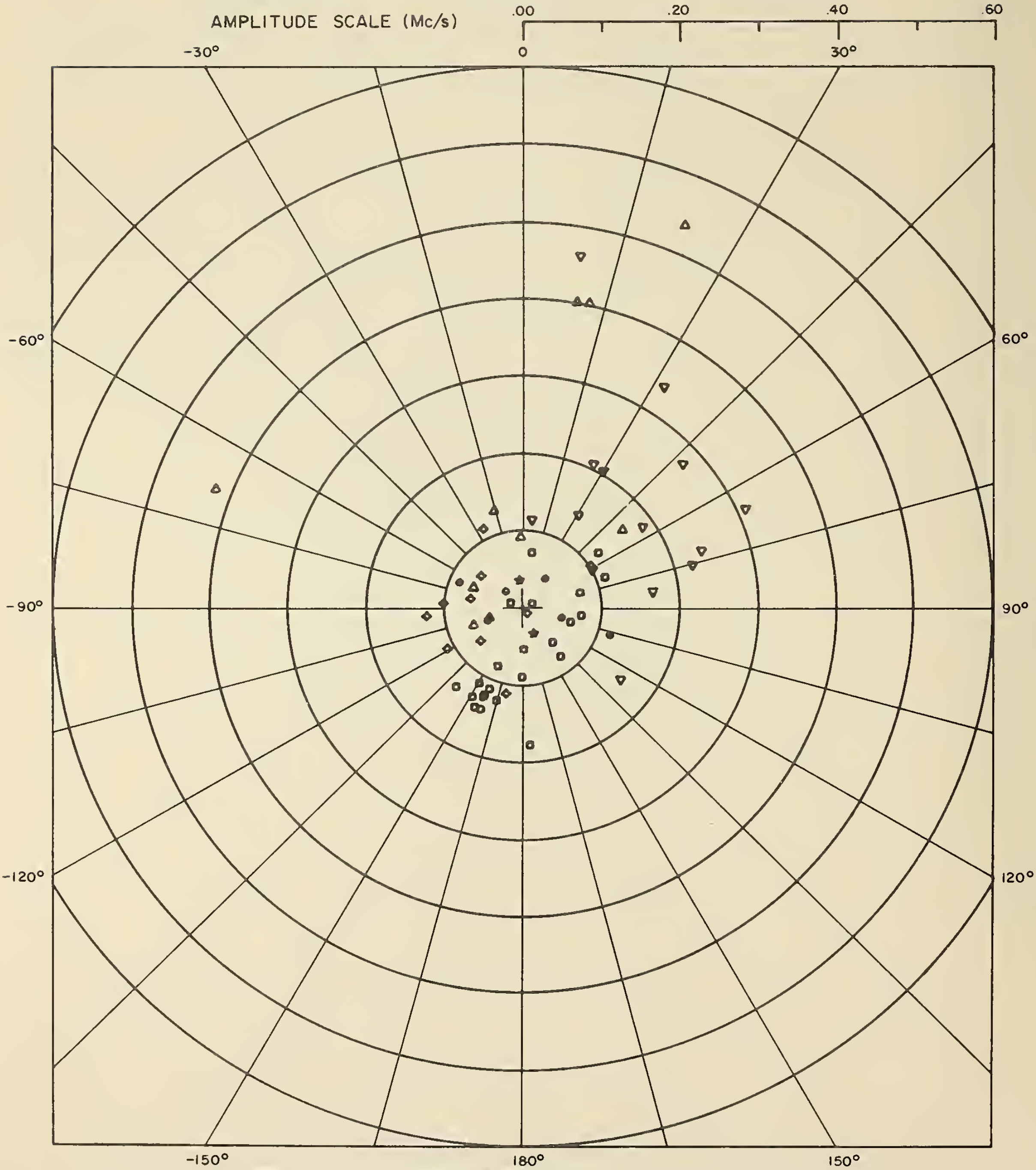
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 3 | 6 / 1 | 3 — 13	□ 10 | 1 / 12 | 2 — 25	○ 5 | 2 / 3 | 1 — 11
SOUTH	△ | 8 / | 1 — 9	◇ 3 | 1 / 2 | 2 — 8	★ | / 1 | 1 — 2

TOTAL

21	18
19	10

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 5 65 STATIONS



DISTRIBUTION OF THE PHASE

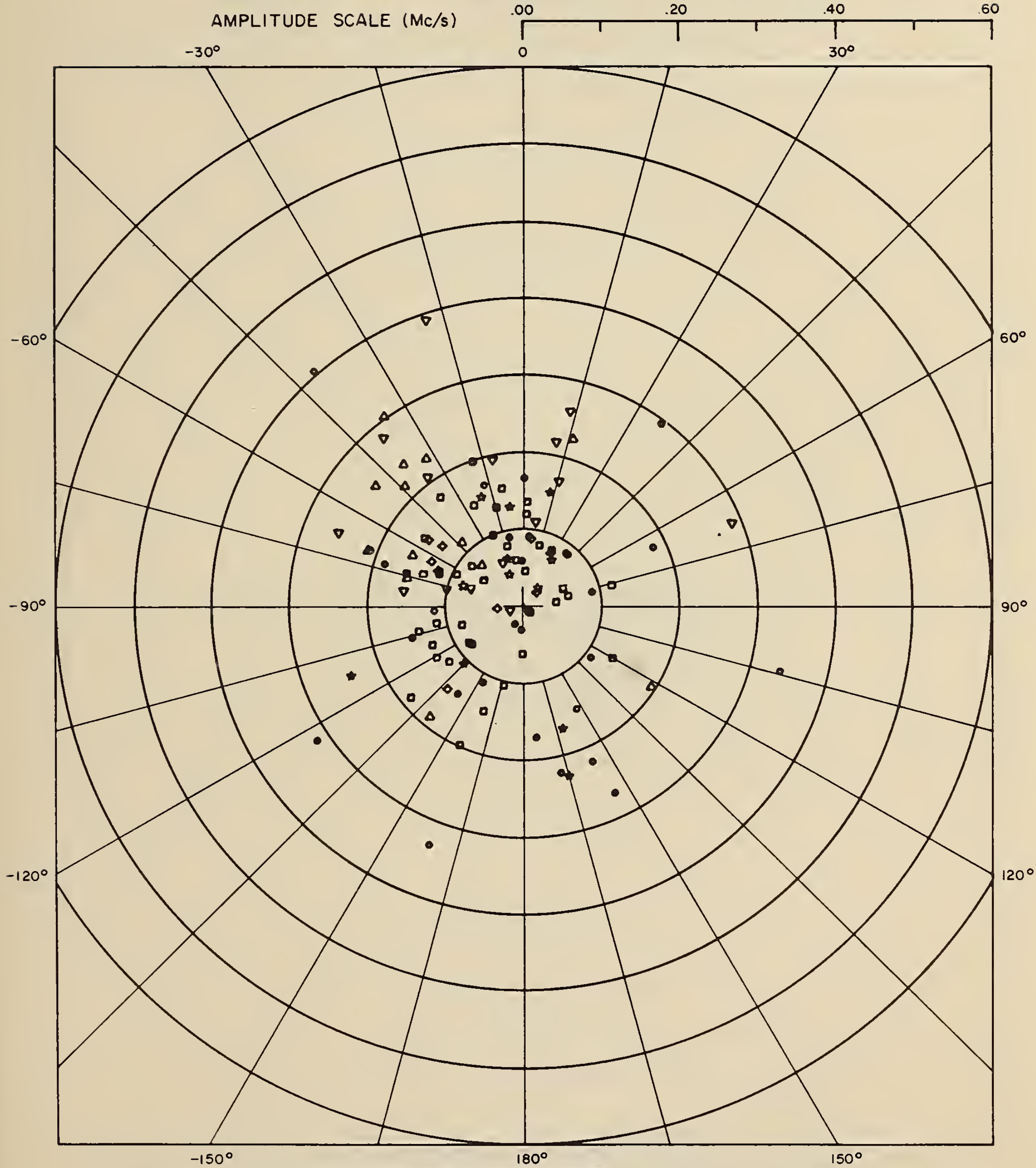
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ [— 13 / — 1] 14	◘ [1 5 / 12 5] 23	∘ [2 1 / 1 2] 6
SOUTH	△ [4 4 / 2 —] 10	◇ [4 1 / 4 1] 10	★ [1 — / — 1] 2

TOTAL

12	24
19	10

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 6 118 STATIONS



DISTRIBUTION OF THE PHASE

<table>
<tr><th>LATITUDE</th><th>0° TO 30°</th><th>30° TO 60°</th><th>60° TO 90°</th></tr>
<tr><td>NORTH</td><td>▽ 9 5
1
15</td><td>□ 16 9
13 3
41</td><td>○ 6 7
8 7
28</td></tr>
<tr><td>SOUTH</td><td>△ 10 1
1 1
13</td><td>◇ 4 3
2
9</td><td>★ 5 3
2 2
12</td></tr>
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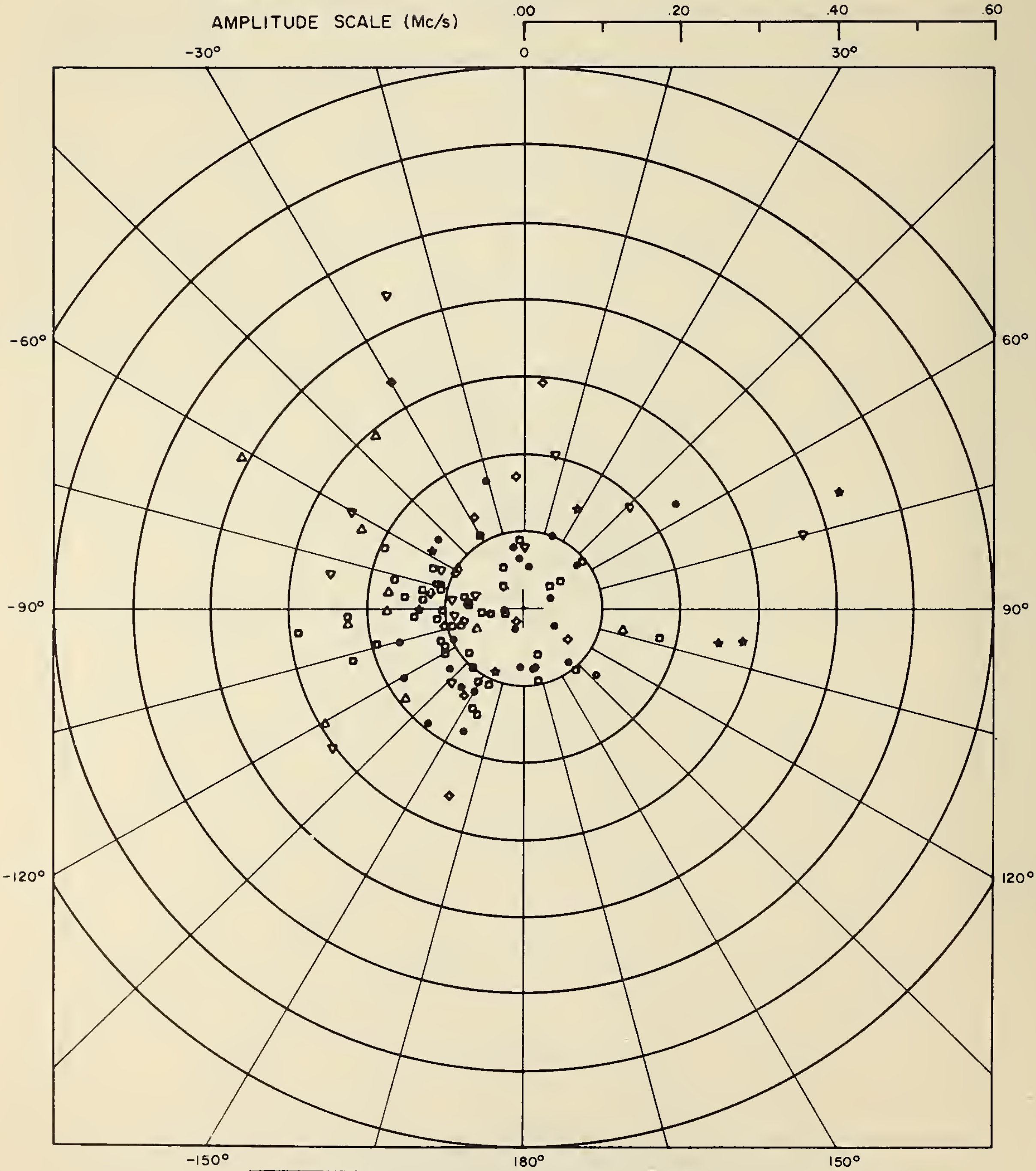
TOTAL

50	28
27	13

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 6 112 STATIONS



DISTRIBUTION OF THE PHASE

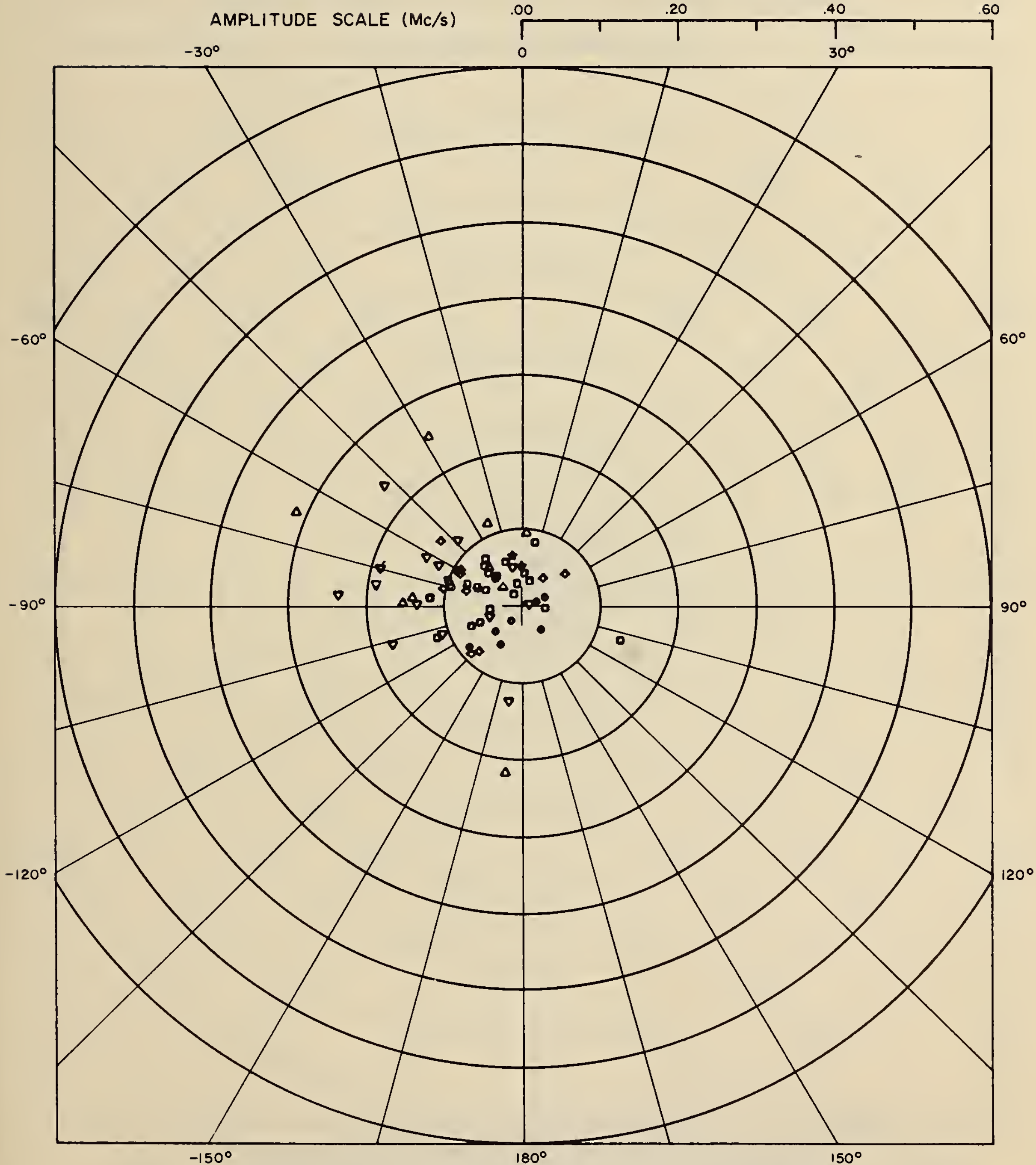
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 7 | 3 / 3 | — 13	◘ 14 | 3 / 21 | 4 — 42	○ 7 | 5 / 11 | 5 — 28
SOUTH	△ 5 | / 5 | 1 — 11	◇ 5 | 1 / 4 | 1 — 11	★ 2 | 2 / 1 | 2 — 7

TOTAL

40	14
45	13

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 6 67 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 9 | 4 | 1 14	▣ 17 | 3 4 | 2 26	○ | 2 4 | 1 7
SOUTH	△ 7 | 1 1 | 9	◆ 5 | 2 2 | 9	★ 2 | | 2

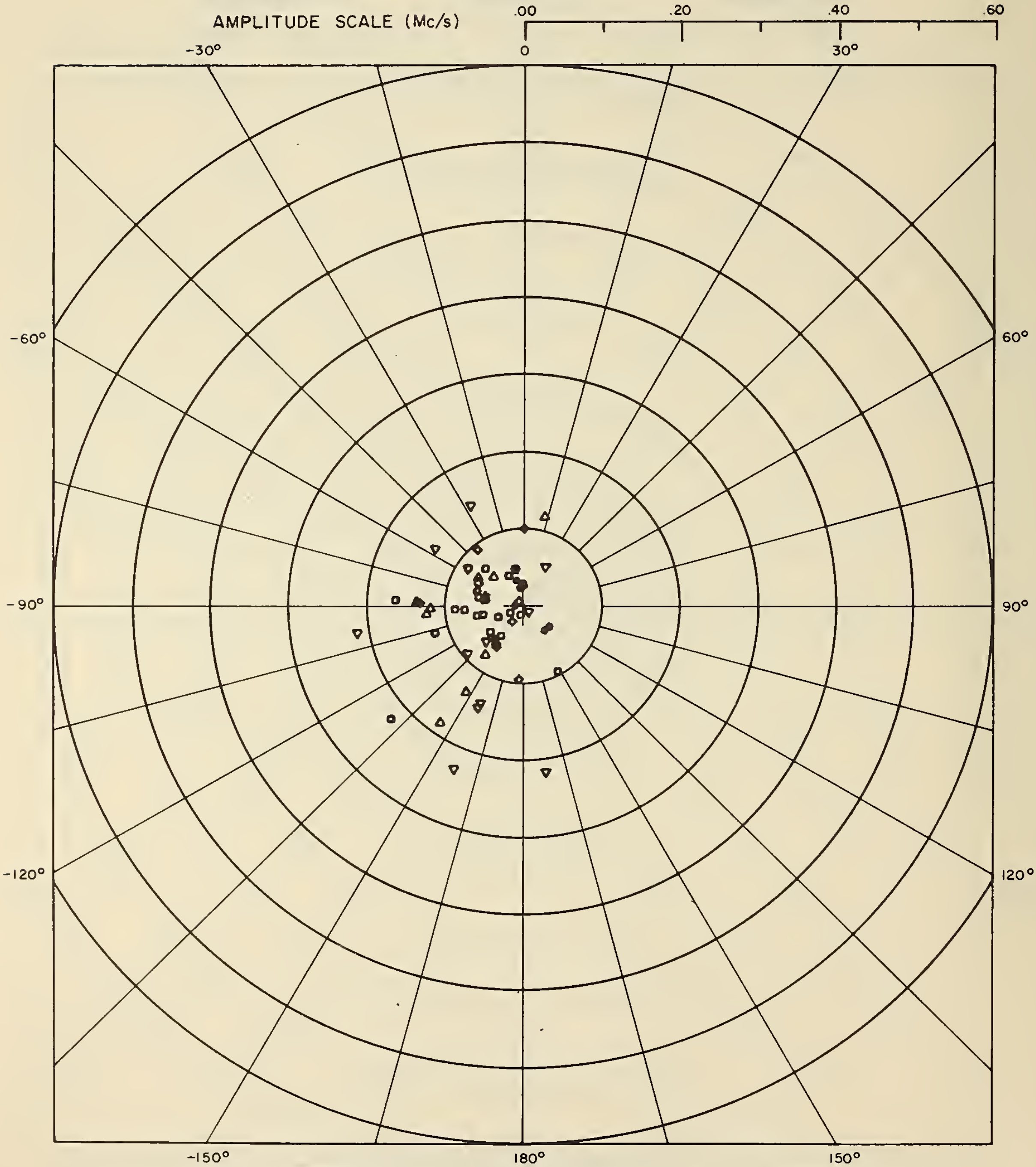
TOTAL

40	8
15	4

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 6 63 STATIONS

AMPLITUDE SCALE (Mc/s)



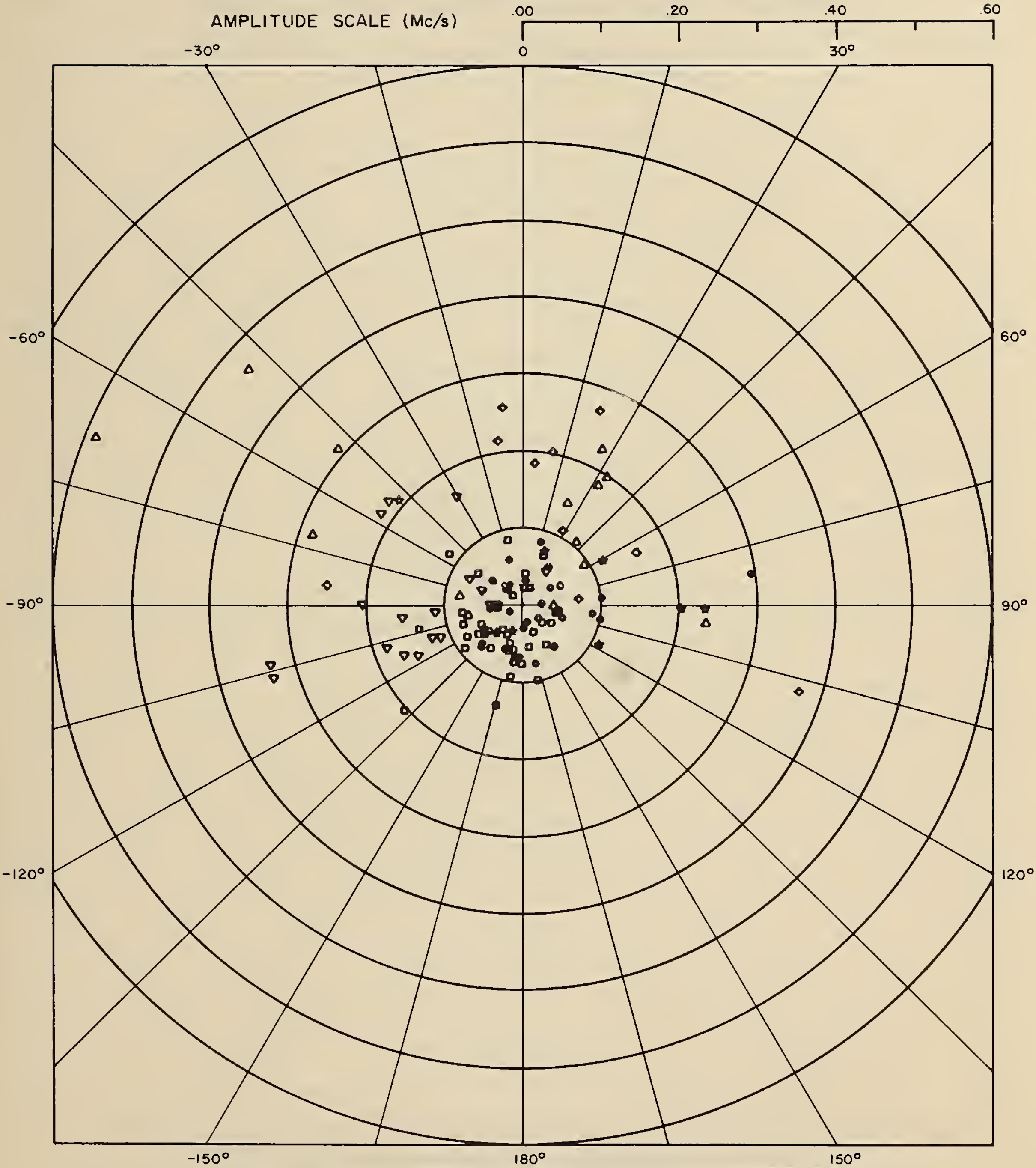
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 3 | 1 / 7 | 2 — 13	● 11 | / 11 | 1 — 23	○ 3 | / 2 | 2 — 7	25 | 3
SOUTH	△ 3 | 1 / 6 | — 10	◆ 3 | 1 / 4 | — 8	★ 2 | / | — 2	30 | 5

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 6 118 STATIONS

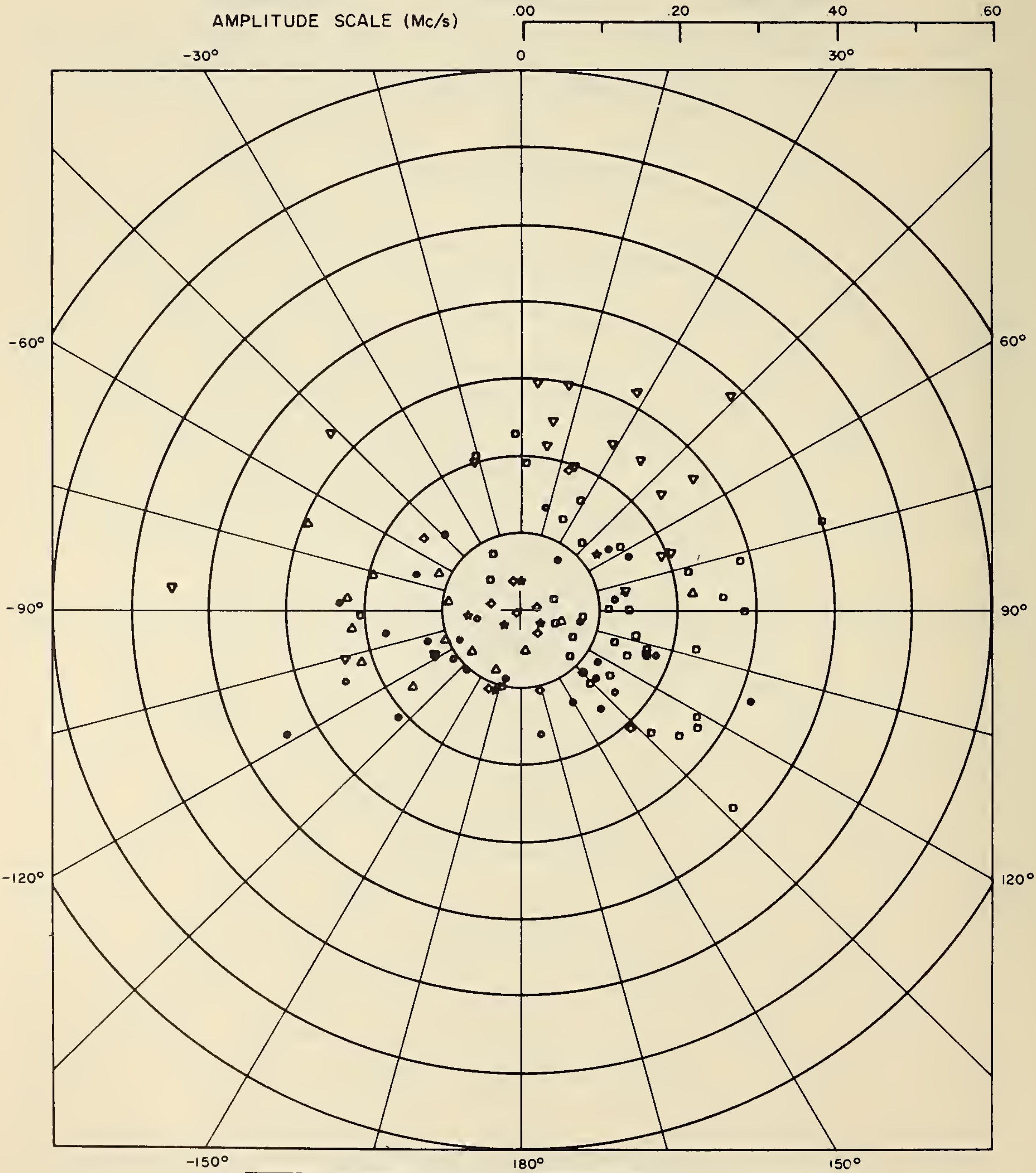
AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE	LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
	NORTH	▽ 6 | 2 ; 10 | — 18	■ 3 | 5 ; 23 | 8 — 39	○ 4 | 9 ; 6 | 9 — 28	22 | 31 ; 43 | 22
	SOUTH	△ 5 | 7 ; 1 | 1 — 14	◇ 3 | 6 ; | 1 — 10	★ 1 | 2 ; 3 | 3 — 9	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 6 116 STATIONS



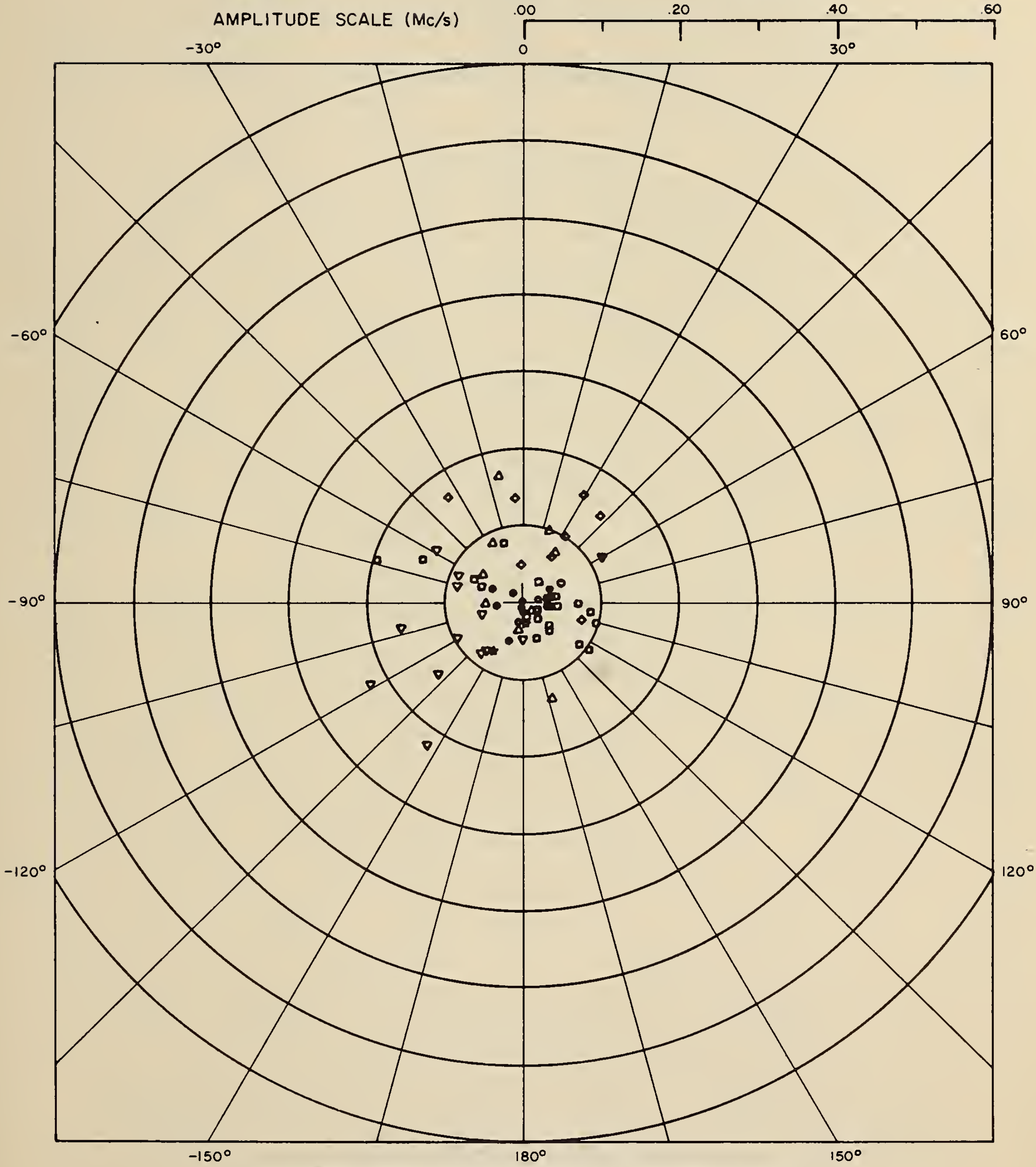
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°		30° TO 60°		60° TO 90°		TOTAL
NORTH	▽ 3 | 14 / 2 |	19	■ 4 | 12 / 2 | 20	38	○ 3 | 5 / 10 | 9	27	19 | 35
SOUTH	△ 5 | 1 / 6 | 2	14	◆ 3 | 2 / 3 | 4	12	★ 1 | 1 / 3 | 1	6	26 | 36

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 6 68 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 3 | 1 / 9 | — 13	◘ 5 | 5 / | 15 — 25	∘ 3 | 3 / 5 | — 11
SOUTH	△ 4 | 2 / 1 | 2 — 9	◆ 3 | 4 / | 1 — 8	★ / 1 | 1 — 2

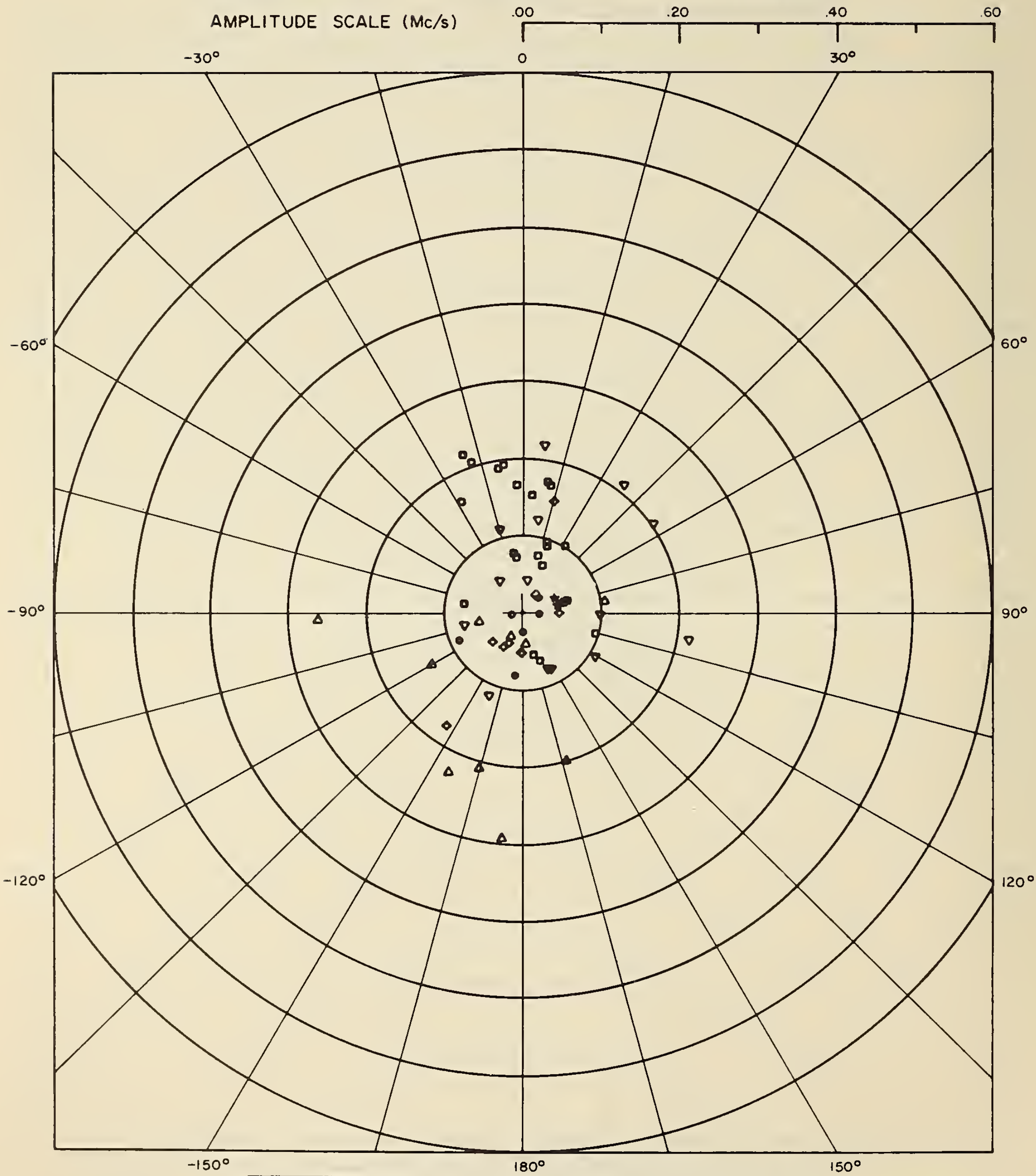
TOTAL

18	15
16	19

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 6 65 STATIONS

AMPLITUDE SCALE (Mc/s)

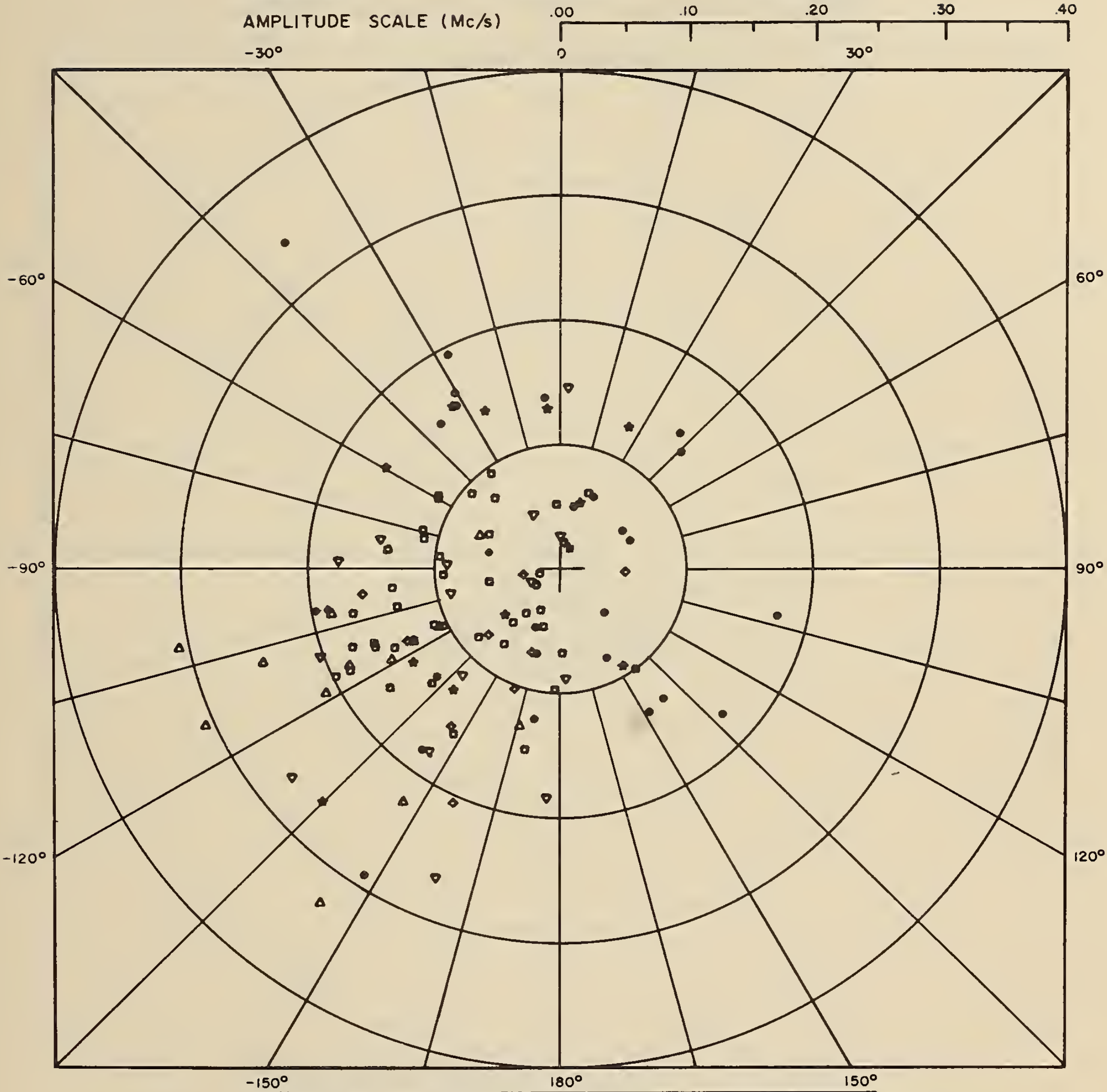


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 2 | 5 2 | 5 14	▫ 9 | 11 | 3 23	∘ | 1 4 | 1 6	11 | 23
SOUTH	△ | 1 7 | 2 10	◆ | 3 6 | 1 10	★ | 2 | 2	19 | 12

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 7 118 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 4 | 2 8 | 1 15	■ 11 | 2 26 | 2 41	● 7 | 6 9 | 6 28
SOUTH	△ 1 | 12 | 13	◆ | 8 | 1 9	★ 4 | 3 4 | 1 12

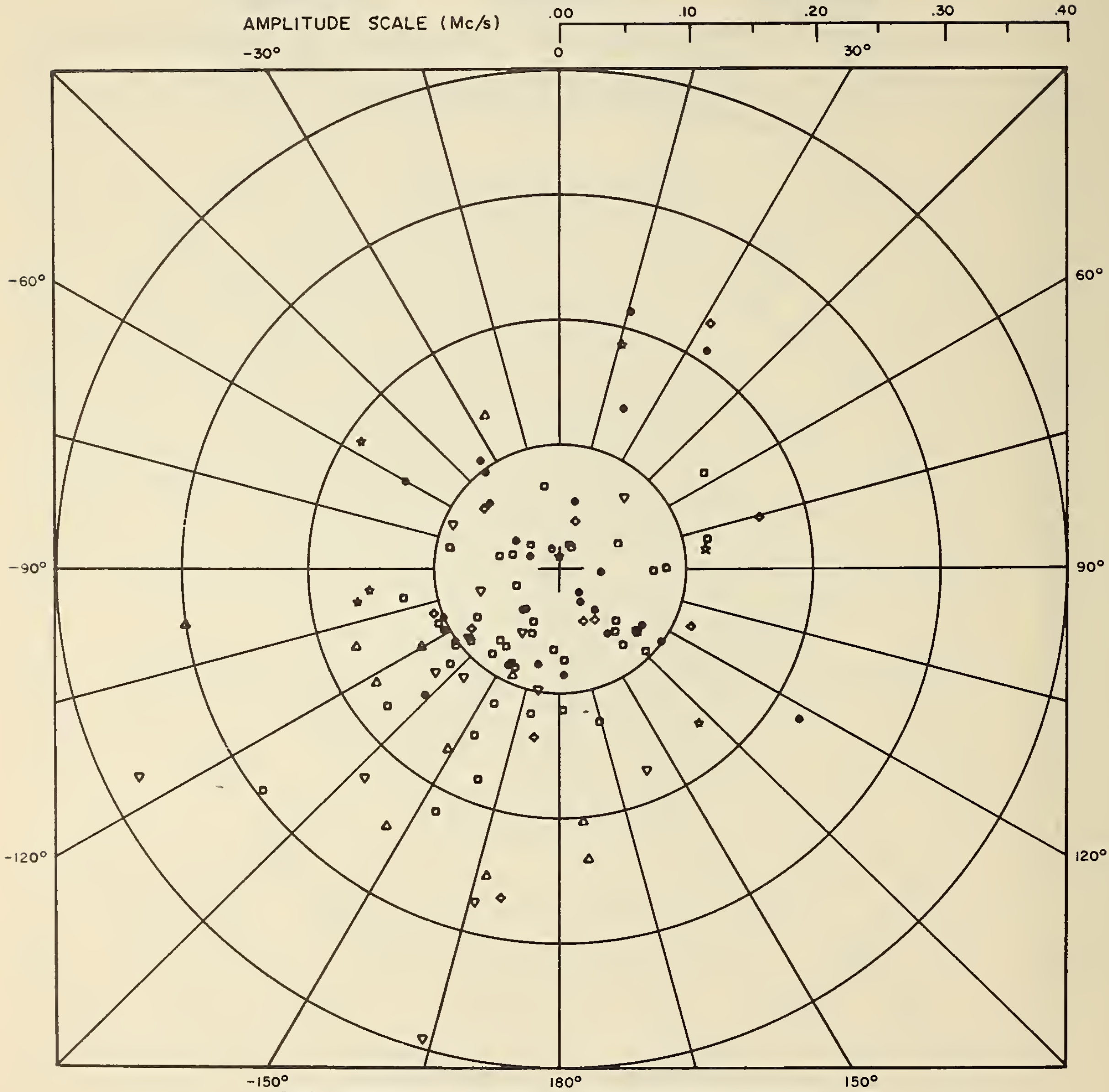
TOTAL

27	13
67	11

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 7 112 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

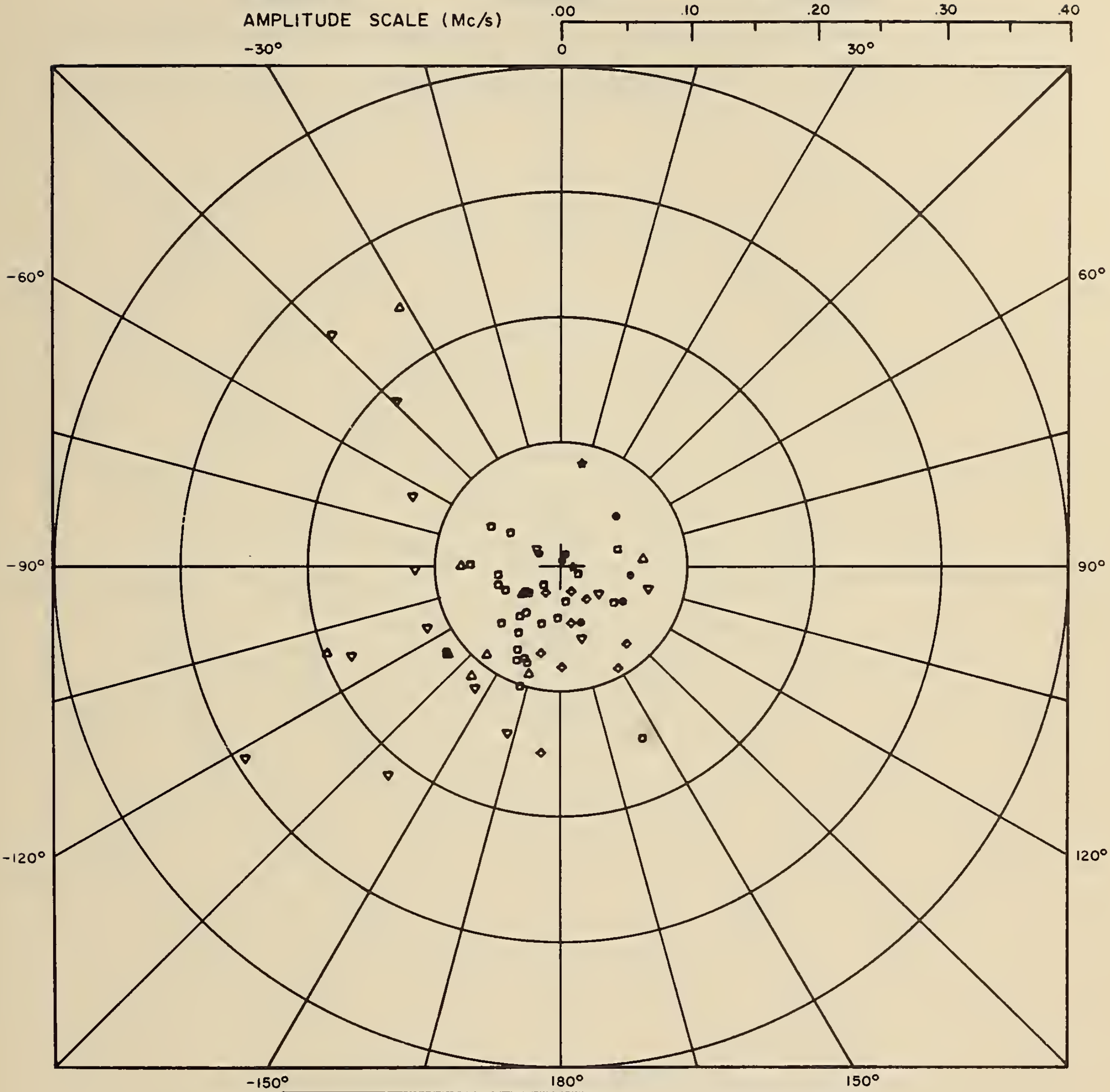
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 1 10 1 13	◘ 5 7 22 8 42	∘ 7 4 8 9 28
SOUTH	△ 1 8 2 11	◆ 1 3 4 3 11	★ 2 2 2 1 7

TOTAL

17	17
54	24

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

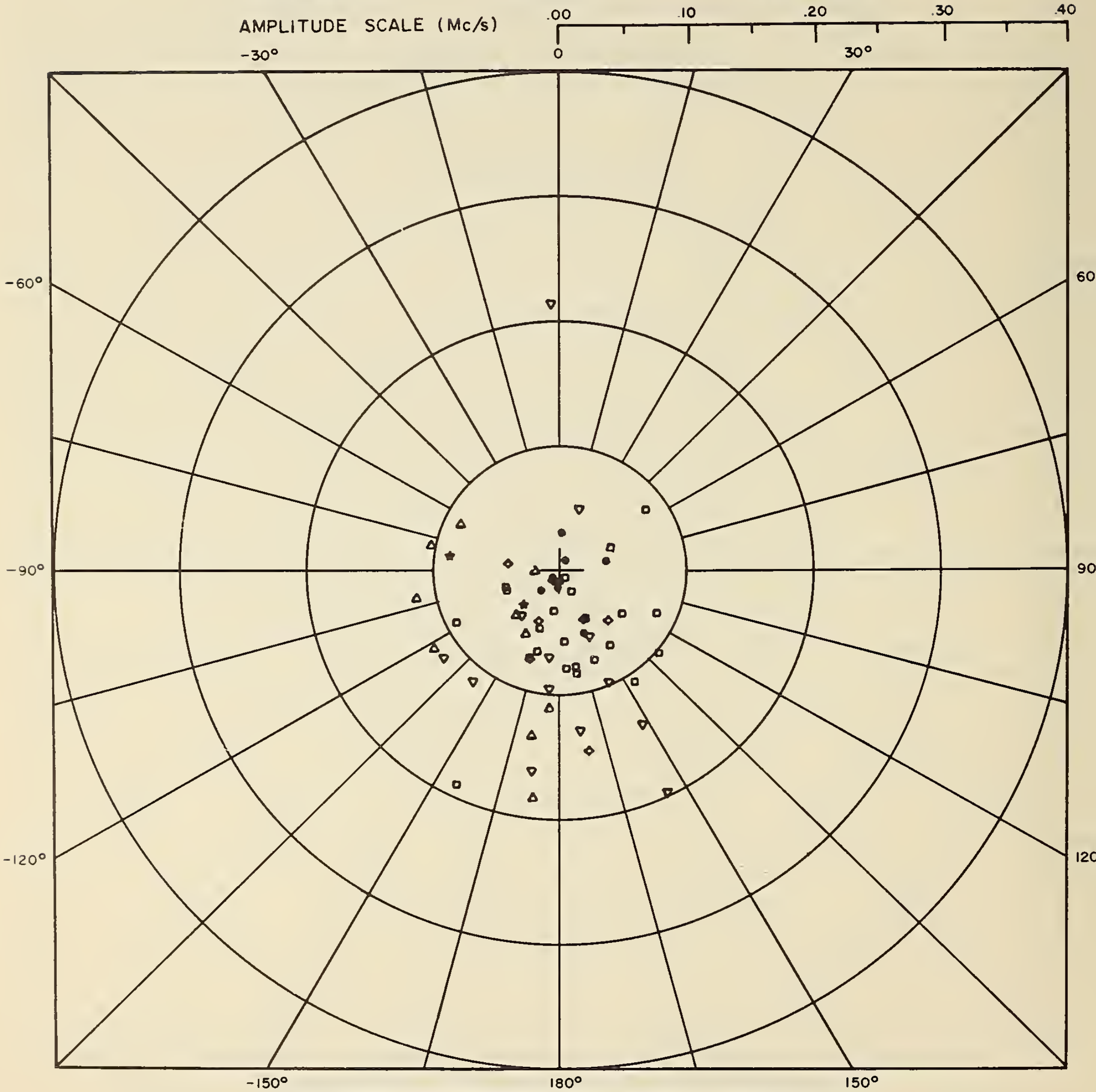
MARCH 1954 HARMONIC 7 67 STATIONS



DISTRIBUTION OF THE PHASE	LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
	NORTH	▽ 4 7 3 14	□ 3 1 18 4 26	• 1 3 3 7	10 7
	SOUTH	△ 2 1 6 9	◆ 4 5 9	★ 2 2	35 15

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 7 63 STATIONS



DISTRIBUTION OF THE PHASE

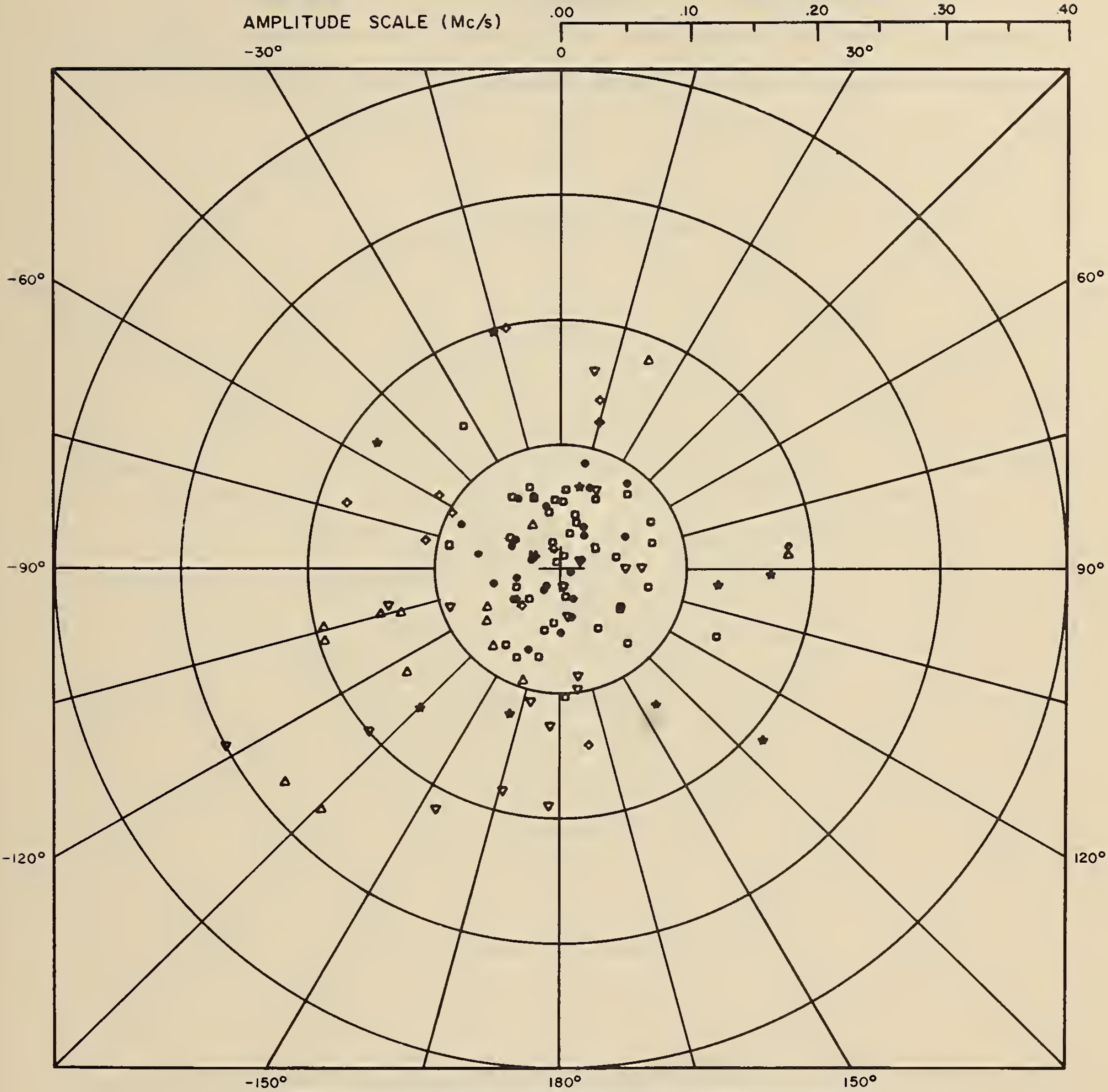
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 | 1 / 6 | 5 — 13	▫ | 2 / 8 | 13 — 23	∘ | 3 / 3 | 1 — 7
SOUTH	△ 3 | / 7 | — 10	◇ 1 | / 4 | 3 — 8	★ 1 | / 1 | — 2

TOTAL

6	6
29	22

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 7 118 STATIONS



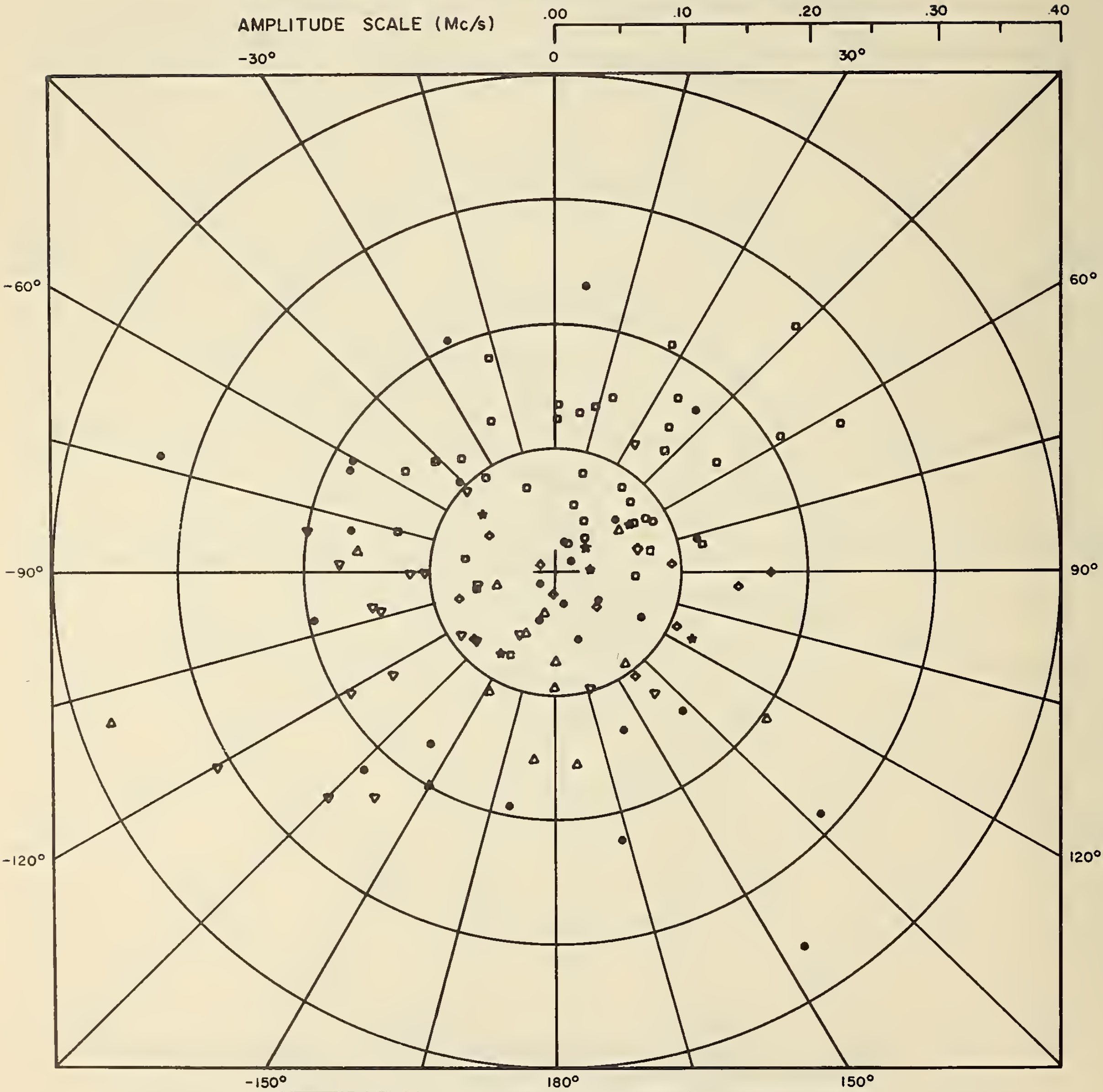
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ [, 5 / 9, 4] 18	■ [11, 12 / 7, 9] 39	● [9, 8 / 8, 3] 28
SOUTH	△ [1, 2 / 11,] 14	◆ [6, 2 / 1, 1] 10	★ [2, 1 / 2, 4] 9

TOTAL	
29	30
38	21

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 7 116 STATIONS



DISTRIBUTION OF THE PHASE

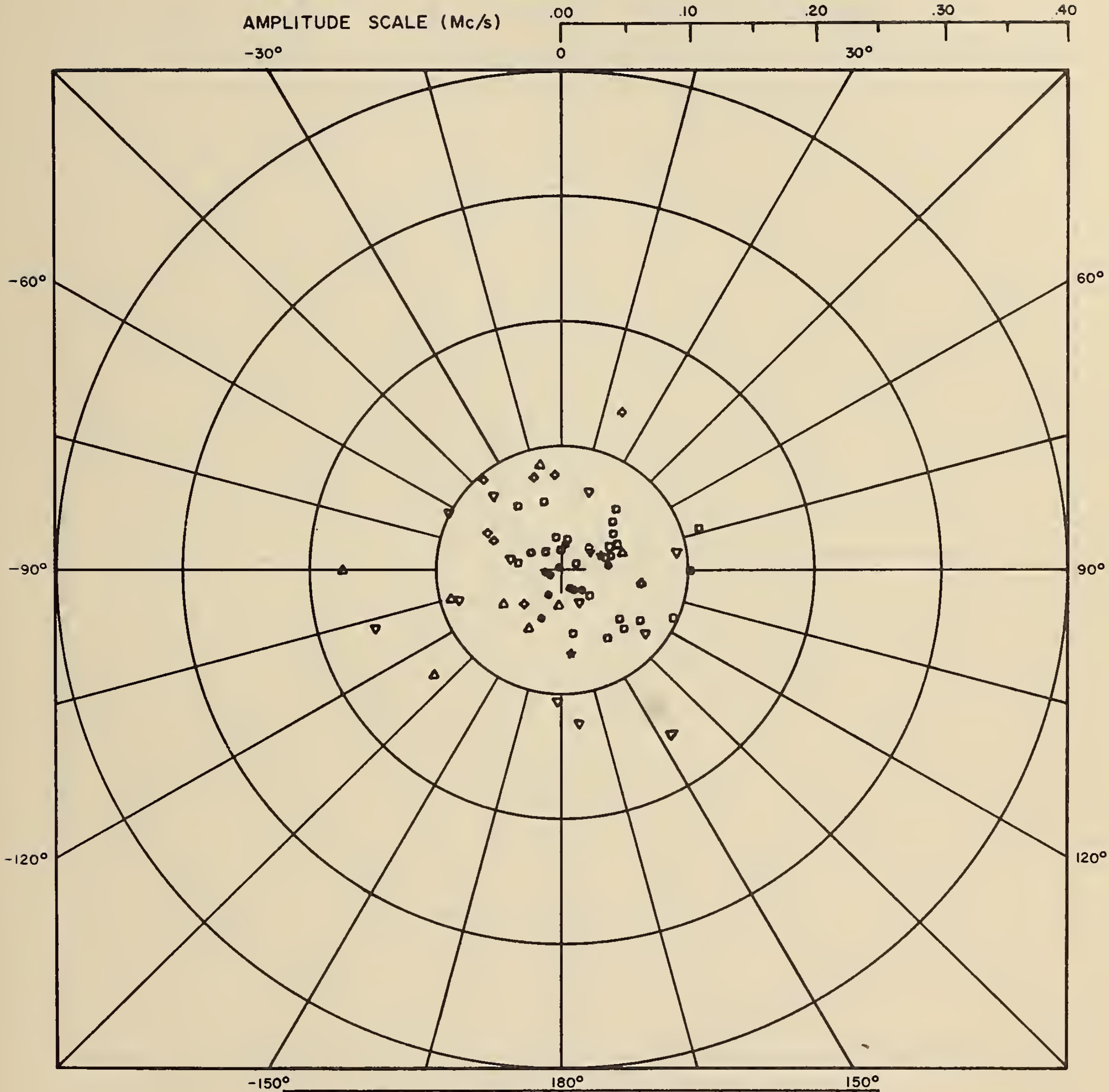
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 4 | 1 / 12 | 2 — 19	▫ 10 | 25 / 2 | 1 — 38	• 6 | 6 / 6 | 9 — 27
SOUTH	△ 1 | 1 / 9 | 3 — 14	◇ 2 | 3 / 3 | 4 — 12	★ 1 | 3 / 1 | 1 — 6

TOTAL	
24	39
33	20

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 7 68 STATIONS

AMPLITUDE SCALE (Mc/s)



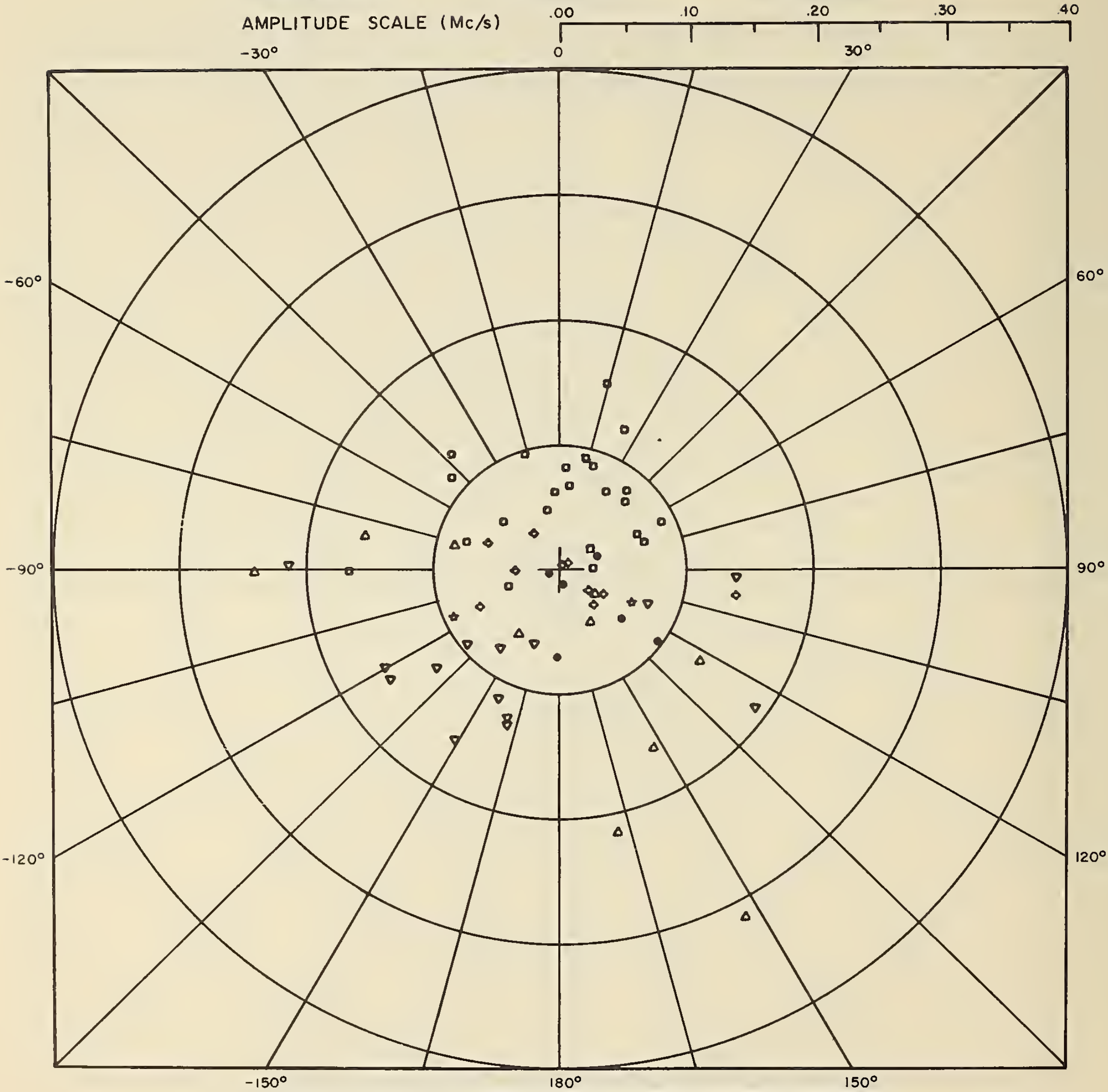
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 3 | 3 3 | 4 13	■ 7 | 10 | 8 25	○ | 3 4 | 4 11	16 | 19
SOUTH	△ 1 | 1 6 | 1 9	◆ 5 | 1 1 | 1 8	★ | 1 | 1 2	14 | 19

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 7 65 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°

NORTH	▽
	   | 1
	 10 | 3
	 14
		▫
		 7 | 14
		 2 |
		 23
			∘
			   | 1
			 2 | 3
			 6

SOUTH	△ 2 | 2 | 6 10	◇ 2 | 2 2 | 4 10	★ | 1 | 1 2

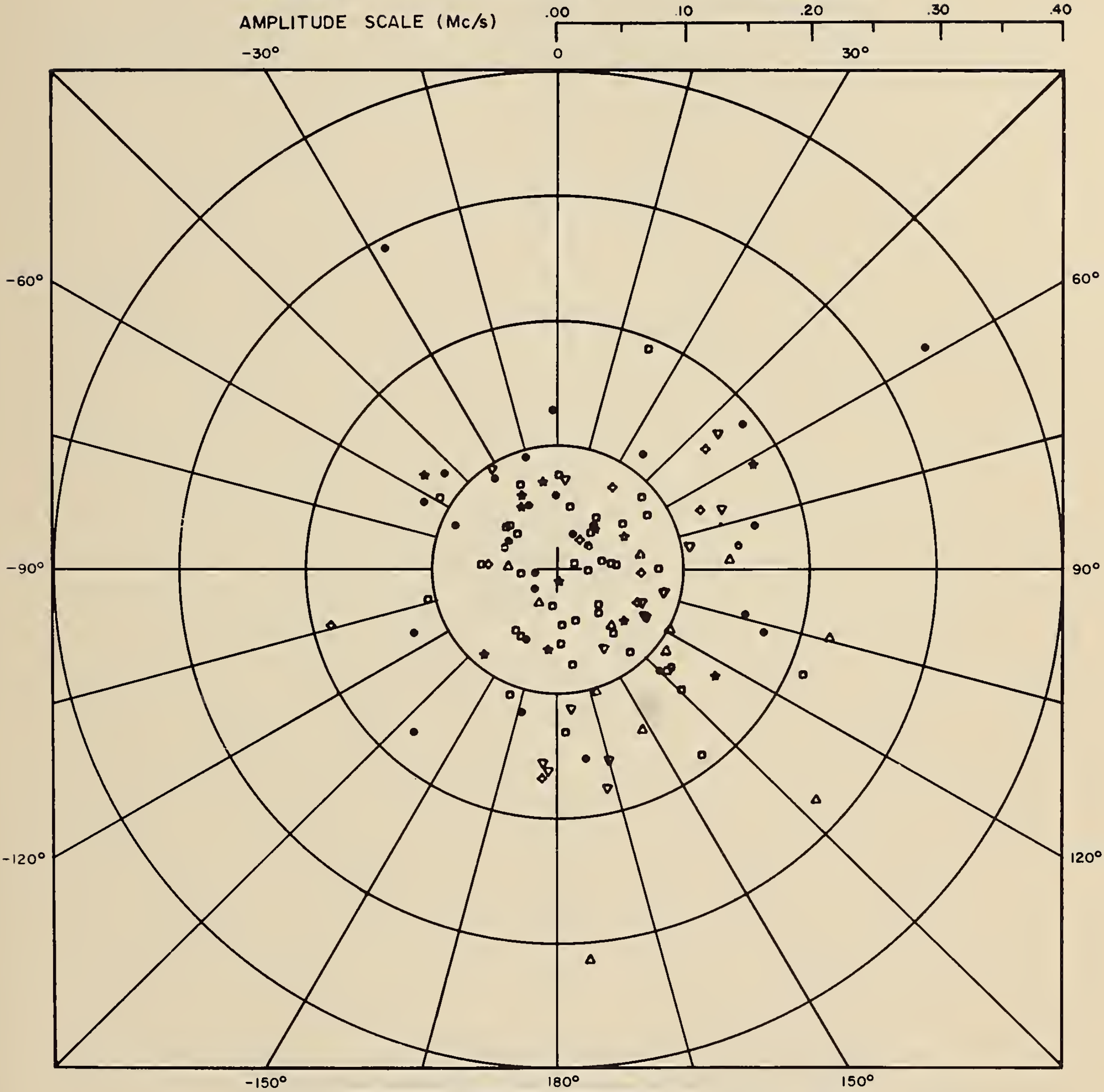
TOTAL

12	17
19	17

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 8 118 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

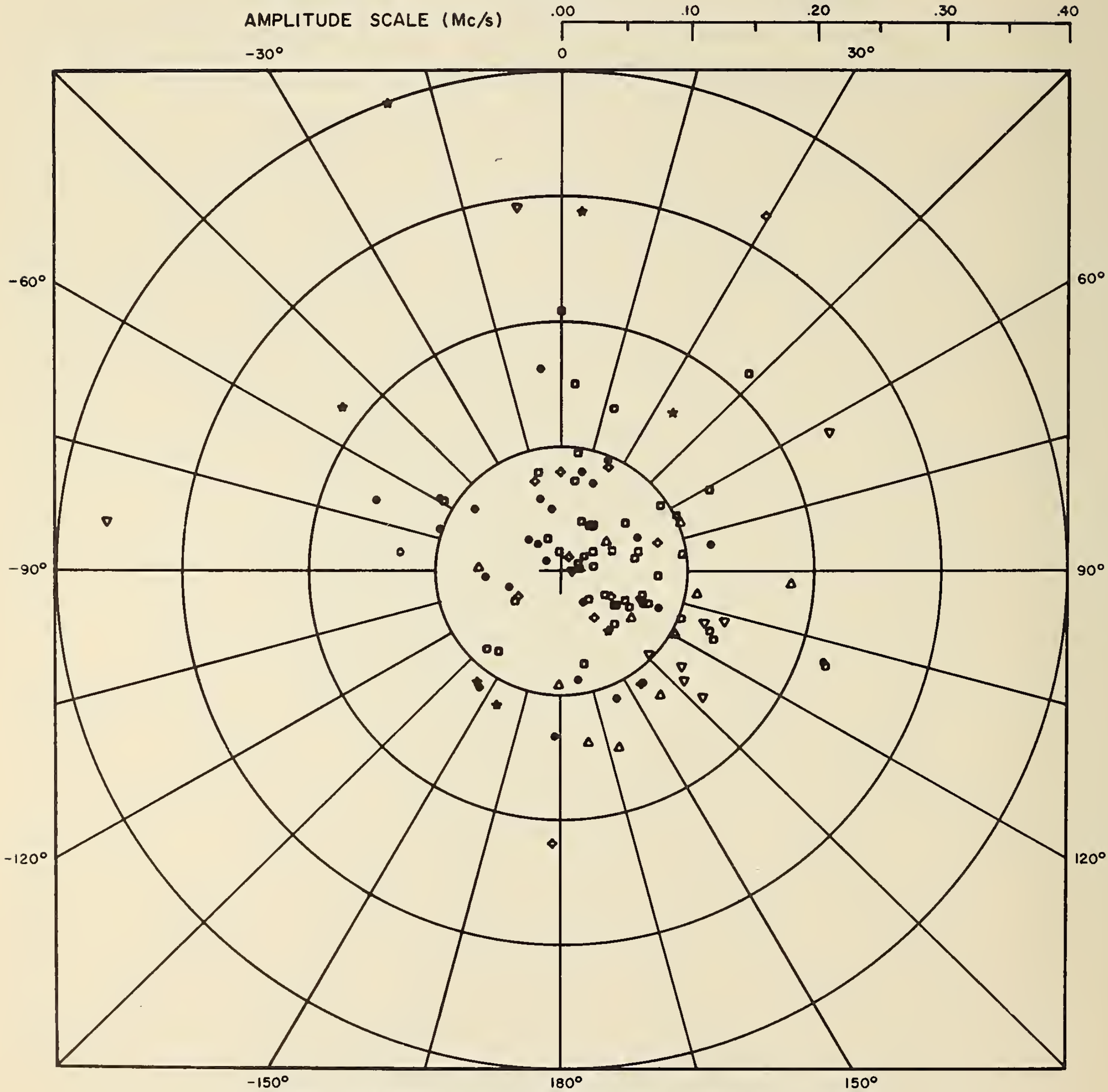
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 4 / 2 8 — 15	○ 6 15 / 6 14 — 41	• 11 7 / 6 4 — 28
SOUTH	△ 1 2 / 1 9 — 13	◇ 1 4 / 2 2 — 9	★ 4 3 / 2 3 — 12

TOTAL

24	35
19	40

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 8 112 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 4 / 7 — 13	▫ 4 20 / 3 15 — 42	∘ 11 6 / 4 7 — 28
SOUTH	△ 1 2 / 1 7 — 11	◇ 2 4 / 2 3 — 11	★ 2 2 / 2 1 — 7

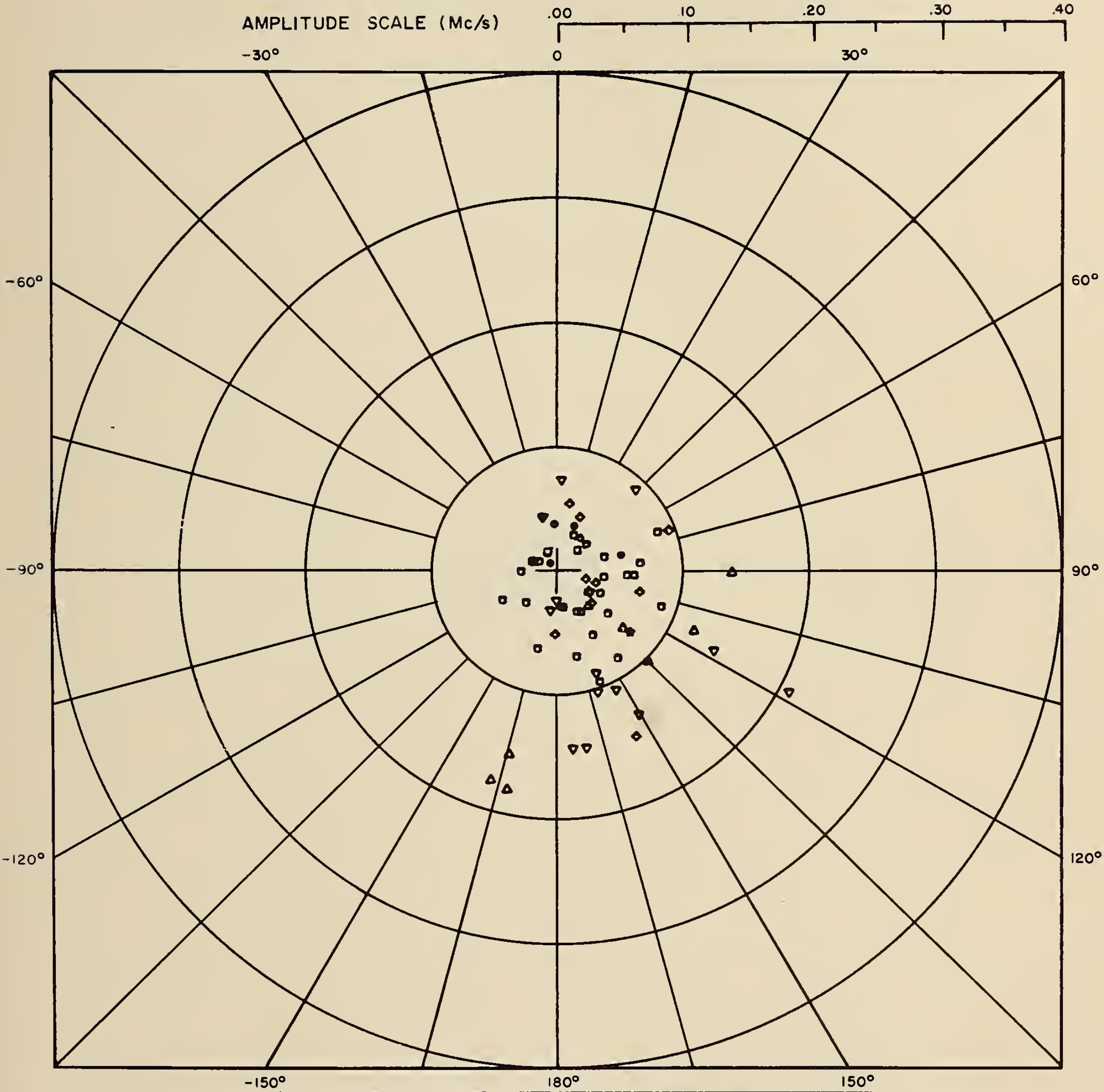
TOTAL

22	38
12	40

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 8 67 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

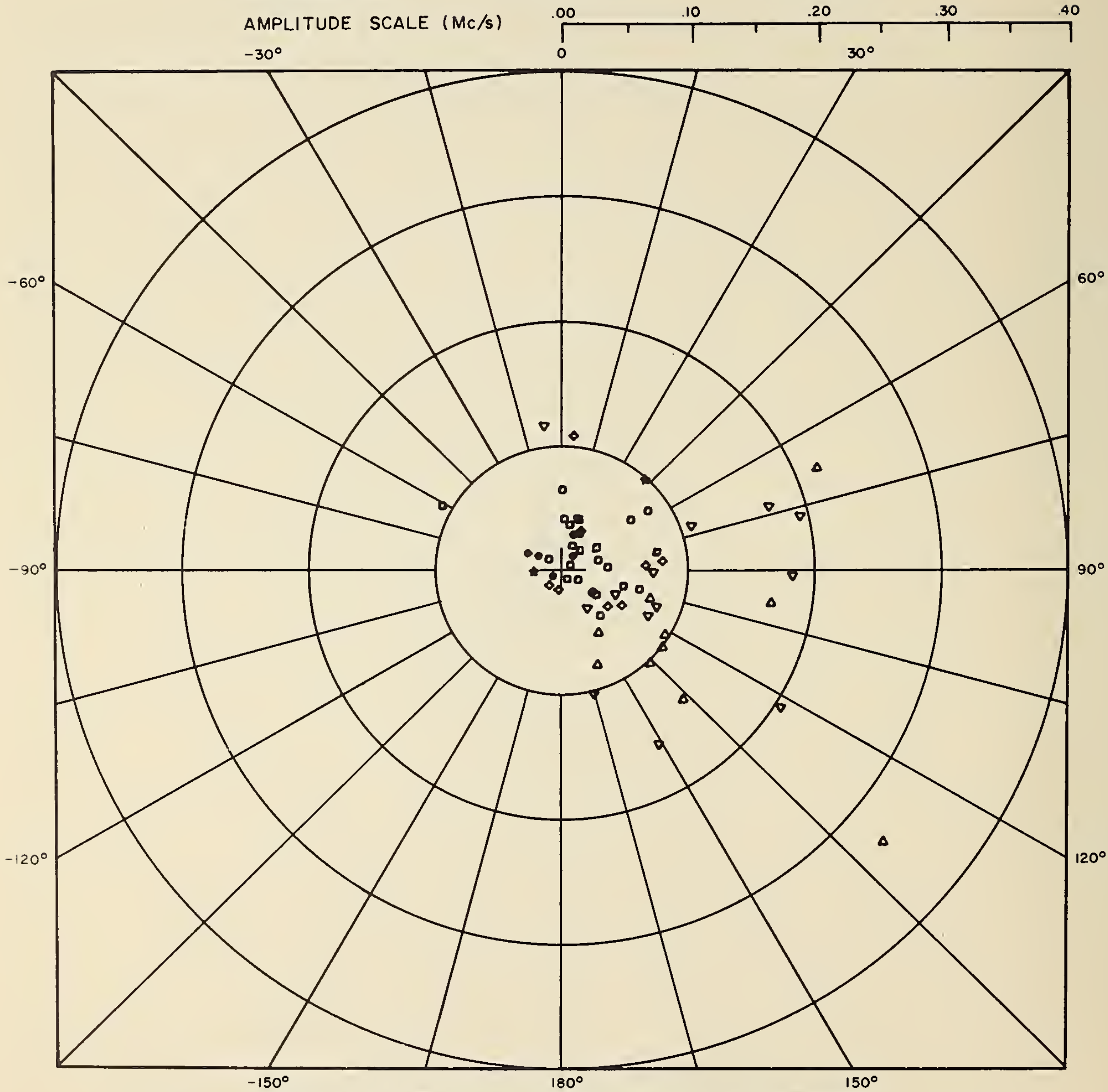
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1 | 2 2 | 9 14	■ 3 | 6 4 | 13 26	● 3 | 3 | 1 7
SOUTH	△ | 3 | 6 9	◆ | 3 1 | 5 9	★ 1 | | 1 2

TOTAL

8	14
10	35

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 8 63 STATIONS



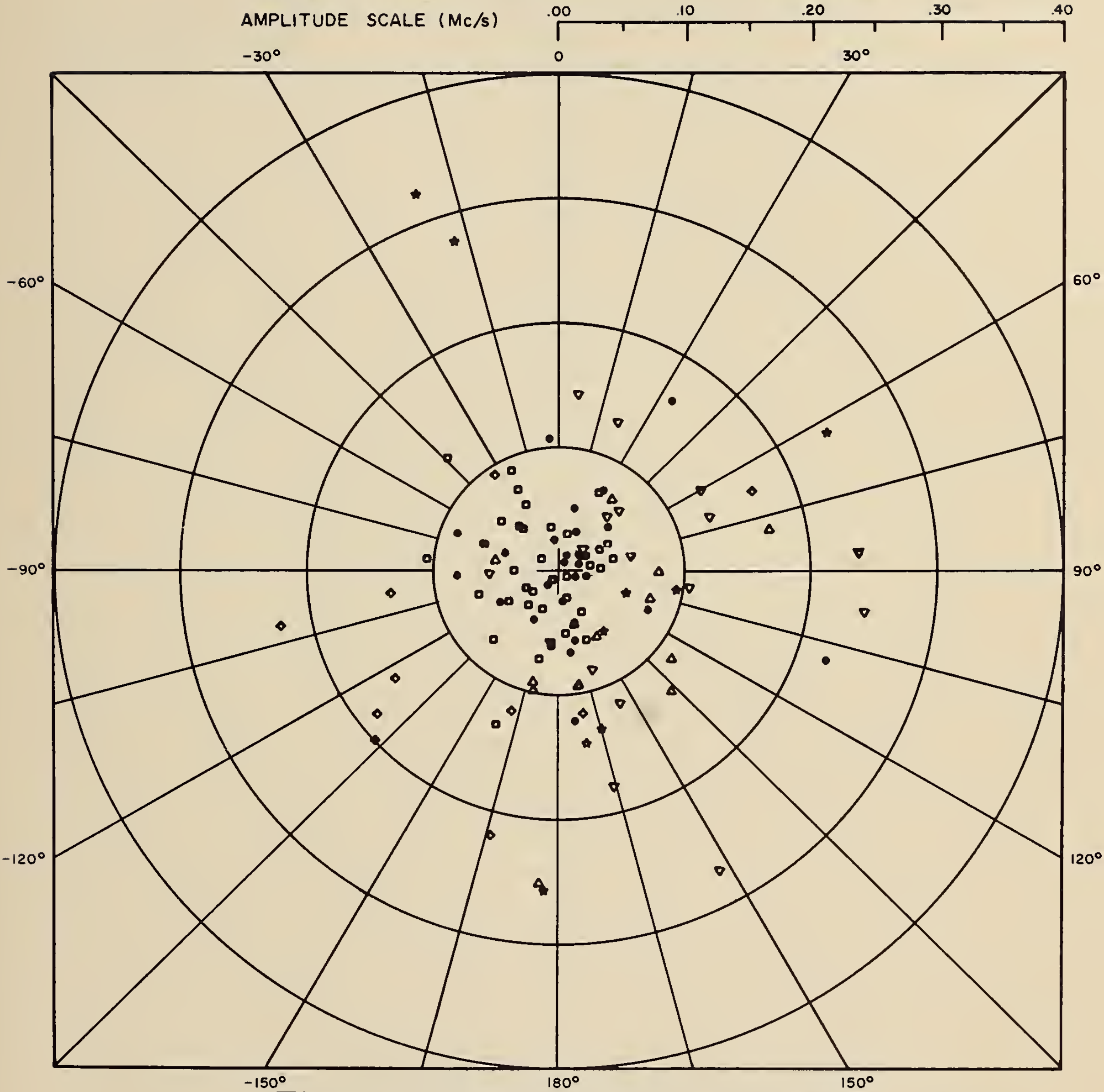
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 1 3 9 13	■ 2 15 6 23	● 2 2 1 2 7	6 26
SOUTH	△ 1 9 10	◆ 4 2 2 8	★ 1 1 2	3 28

AMPLITUDE. AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 8 118 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

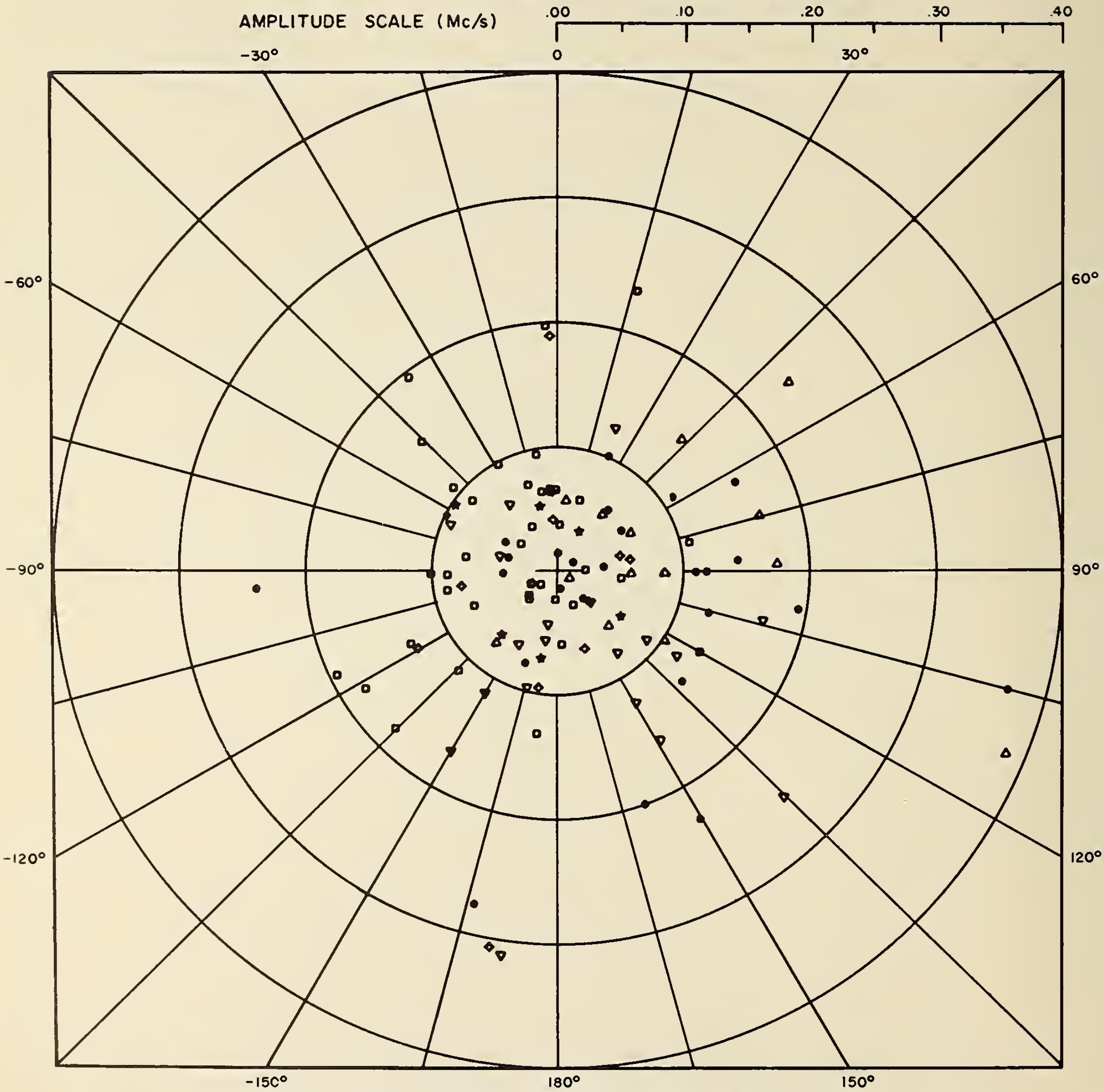
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 10 2 6 18	□ 12 9 12 6 39	∘ 5 10 4 9 28
SOUTH	△ 1 3 3 7 14	◆ 1 1 7 1 10	★ 2 1 1 5 9

TOTAL

21	34
29	34

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 8 116 STATIONS

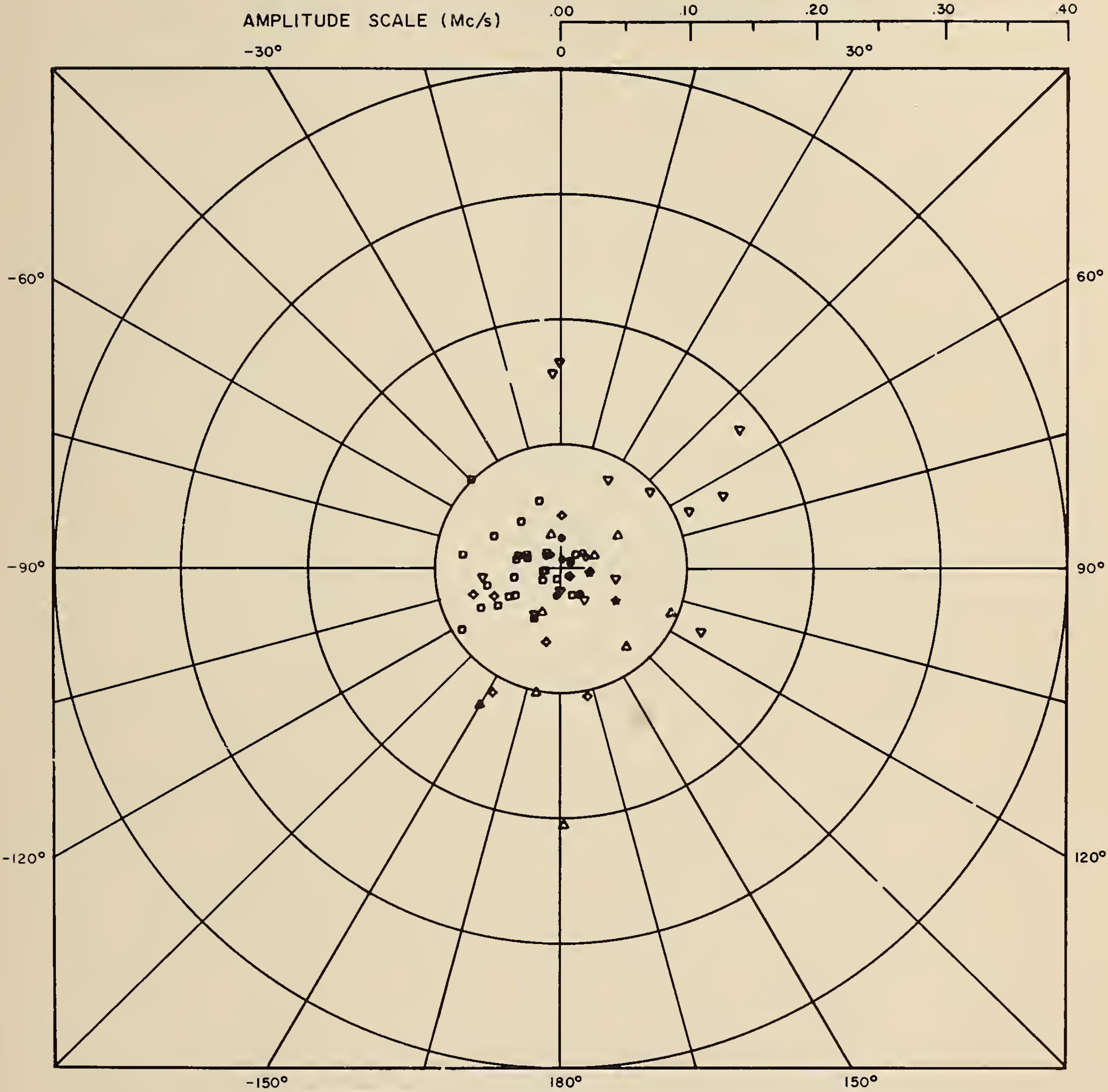


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 3 | 1 / 7 | 8 — 19	▪ 14 | 5 / 15 | 4 — 38	∘ 3 | 10 / 4 | 10 — 27	26 | 27
SOUTH	△ | 8 / 1 | 5 — 14	◆ 4 | 2 / 5 | 1 — 12	★ 2 | 1 / 2 | 1 — 6	34 | 29

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 8 68 STATIONS



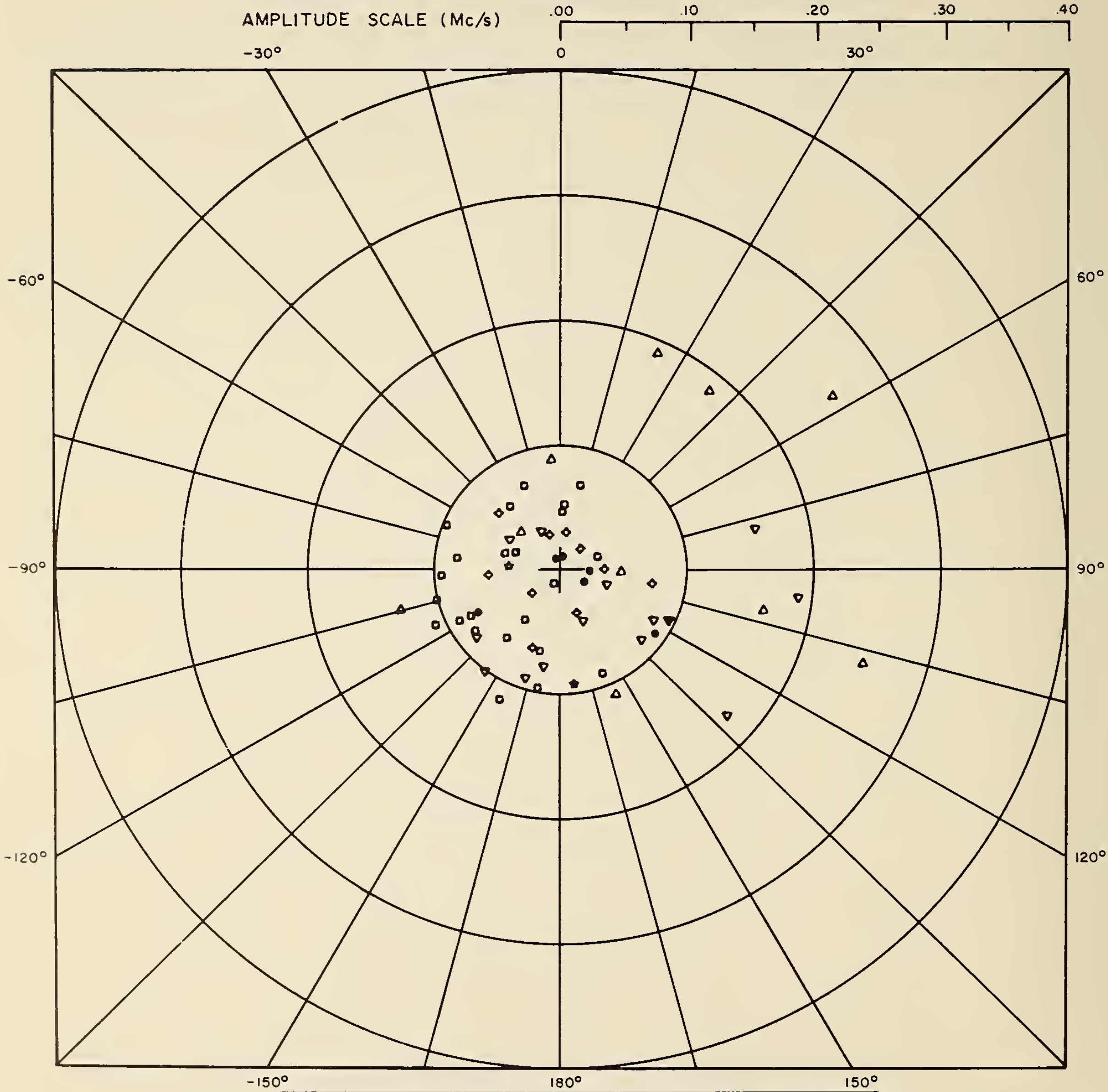
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 | 5 / 3 | 3 — 13	▪ 10 | 2 / 12 | 1 — 25	∘ 2 | 5 / 1 | 3 — 11
SOUTH	△ 1 | 2 / 3 | 3 — 9	◆ 1 | / 4 | 3 — 8	★ | / | 2 — 2

TOTAL	
16	14
23	15

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 8 65 STATIONS



DISTRIBUTION OF THE PHASE

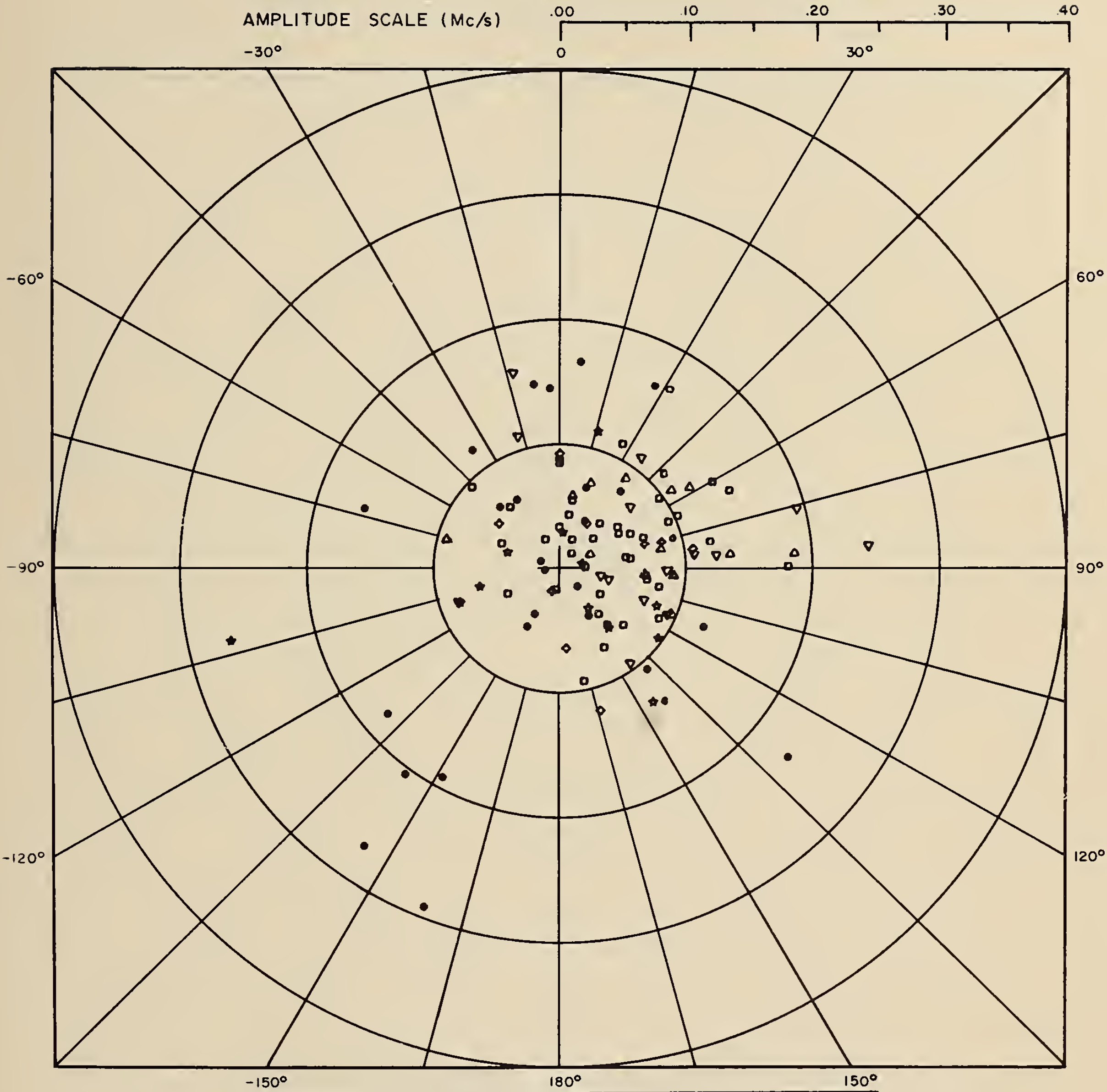
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 1 / 4 7 — 14	▢ 6 4 / 12 1 — 23	∘ 1 1 / 1 3 — 6
SOUTH	△ 2 3 / 1 4 — 10	◇ 2 3 / 3 2 — 10	★ 1 / 1 — 2

TOTAL

14	12
21	18

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 9 118 STATIONS

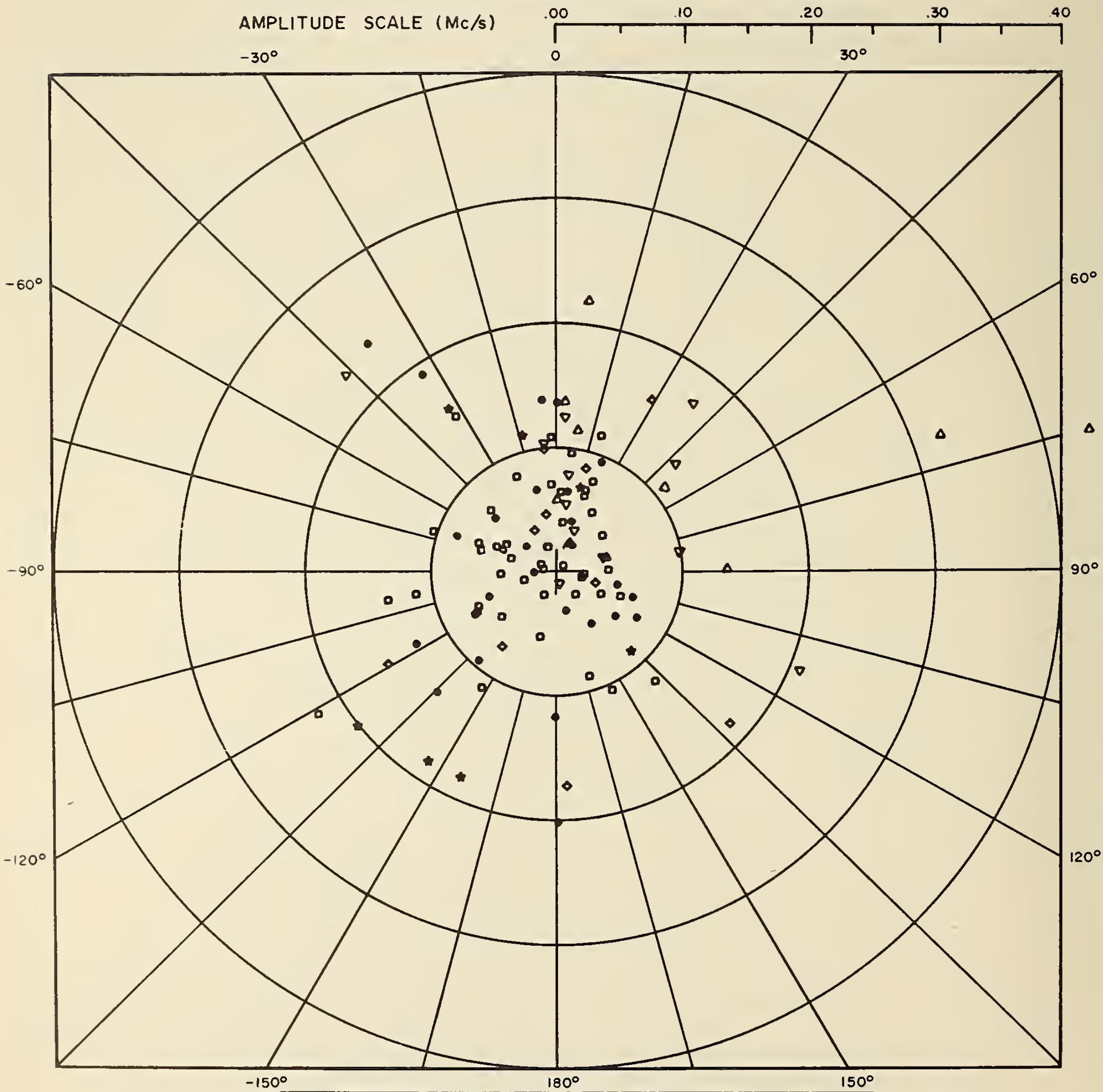


DISTRIBUTION OF THE PHASE	LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
	NORTH	▽ 2 | 6 / 1 | 6 — 15	□ 4 | 25 / 2 | 10 — 41	• 7 | 7 / 8 | 6 — 28	16 | 55
	SOUTH	△ 1 | 9 / | 3 — 13	◇ 1 | 5 / 1 | 2 — 9	★ 1 | 3 / 3 | 5 — 12	15 | 32

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 9 112 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

<table>
<tr><th>LATITUDE</th><th>0° TO 30°</th><th>30° TO 60°</th><th>60° TO 90°</th><th>TOTAL</th></tr>
<tr><td>NORTH</td><td>▽<table><tr><td>2</td><td>9</td></tr><tr><td></td><td>2</td></tr></table>13</td><td>□<table><tr><td>14</td><td>10</td></tr><tr><td>10</td><td>8</td></tr></table>42</td><td>○<table><tr><td>9</td><td>5</td></tr><tr><td>7</td><td>7</td></tr></table>28</td><td rowspan="2"><table><tr><td>30</td><td>38</td></tr><tr><td>23</td><td>21</td></tr></table></td></tr>
<tr><td>SOUTH</td><td>△<table><tr><td></td><td>11</td></tr><tr><td></td><td></td></tr></table>11</td><td>◇<table><tr><td>3</td><td>2</td></tr><tr><td>3</td><td>3</td></tr></table>11</td><td>★<table><tr><td>2</td><td>1</td></tr><tr><td>3</td><td>1</td></tr></table>7</td></tr>
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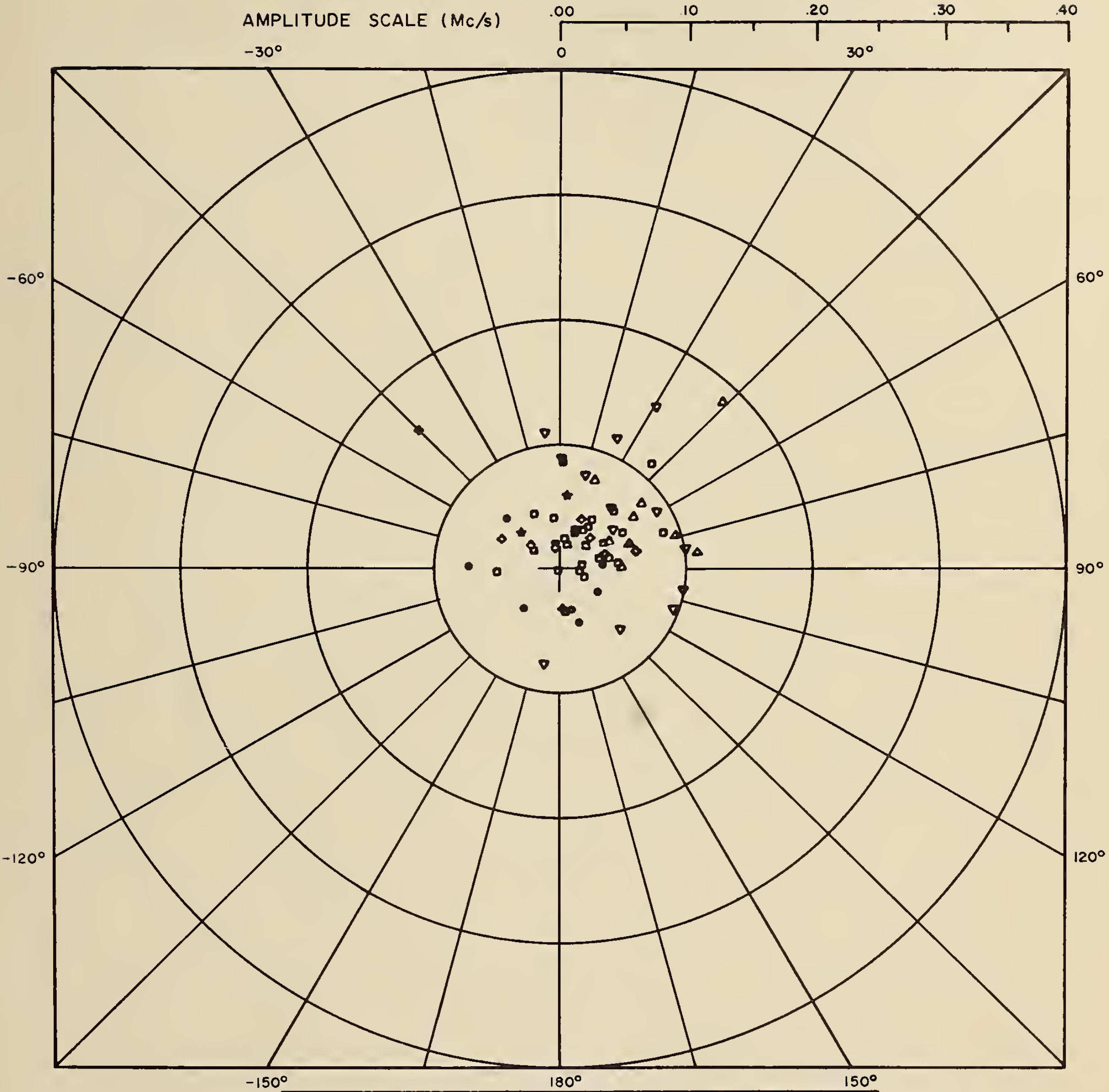
AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 9 67 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 8 / 1 3 — 14	▢ 4 17 / 2 3 — 26	∘ 2 1 / 1 3 — 7
SOUTH	△ 9 — 9	◆ 4 4 / 1 — 9	★ 1 1 — 2

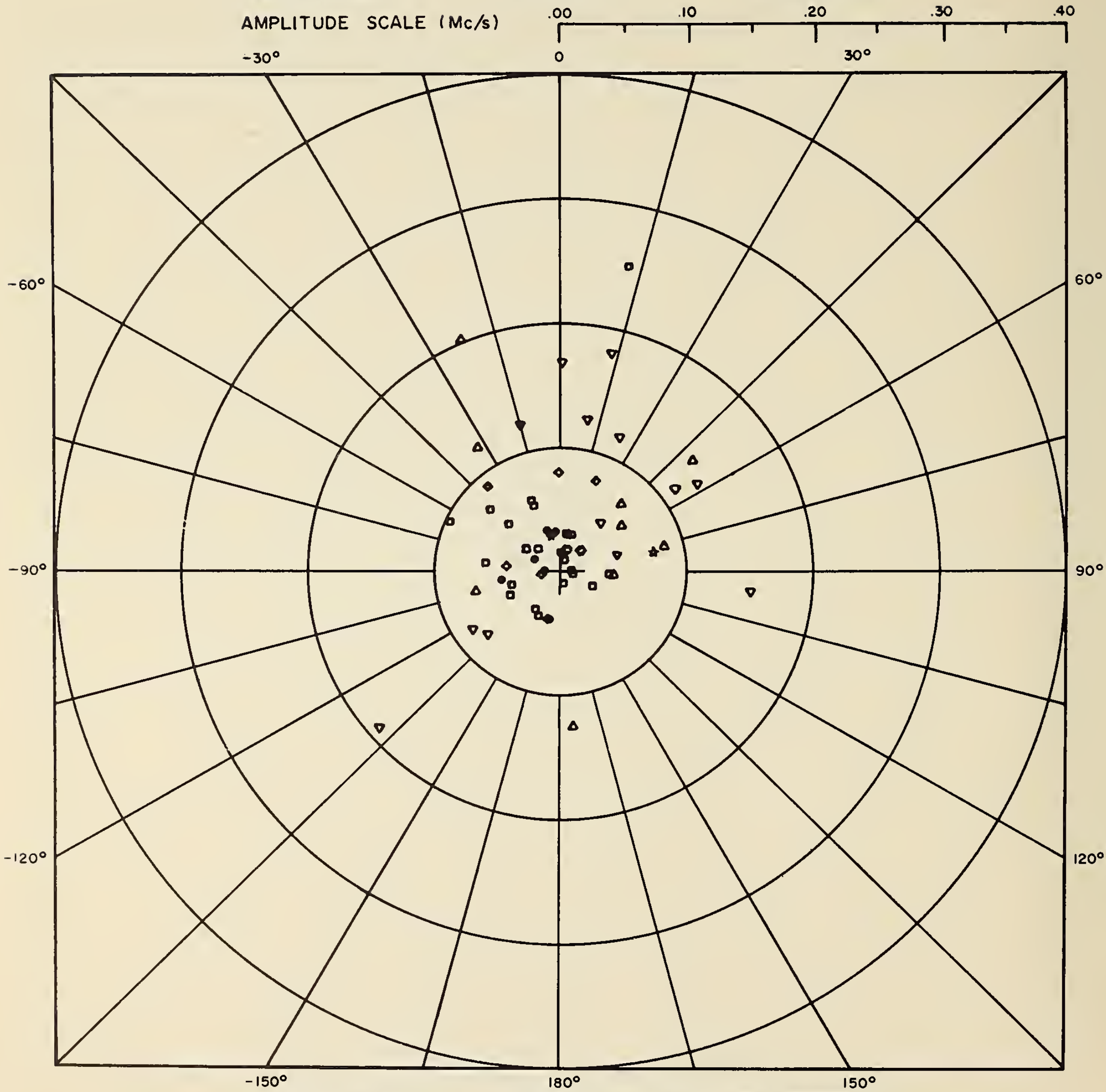
TOTAL

13	40
4	10

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 9 63 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 | 7 / 3 | 1 — 13	▫ 8 | 7 / 4 | 4 — 23	∘ 4 | 1 / 2 | — 7
SOUTH	△ 2 | 5 / 1 | 2 — 10	◇ 3 | 3 / 2 | — 8	★ 1 | 1 / | — 2

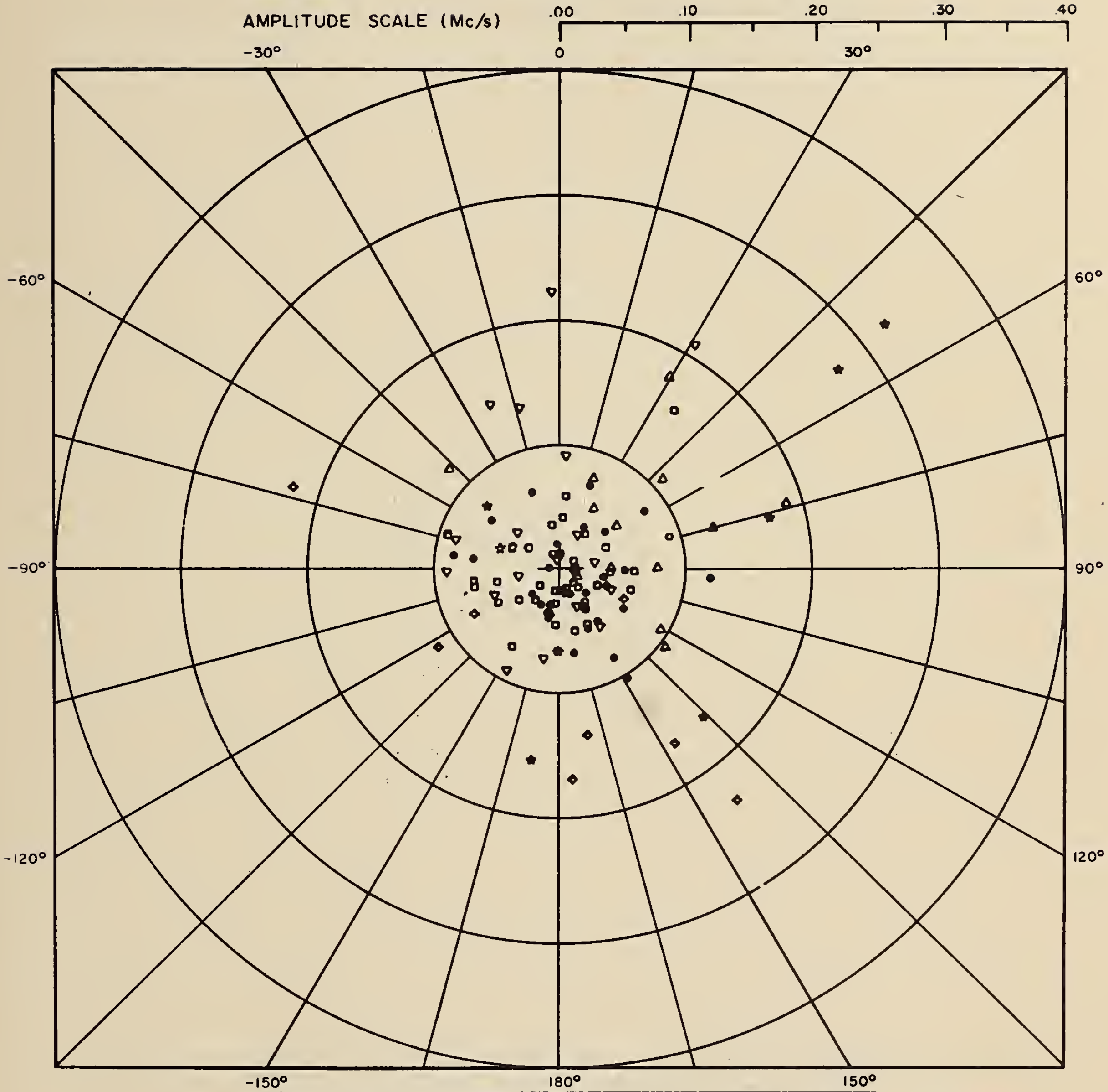
TOTAL

20	24
12	7

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 9 118 STATIONS

AMPLITUDE SCALE (Mc/s)

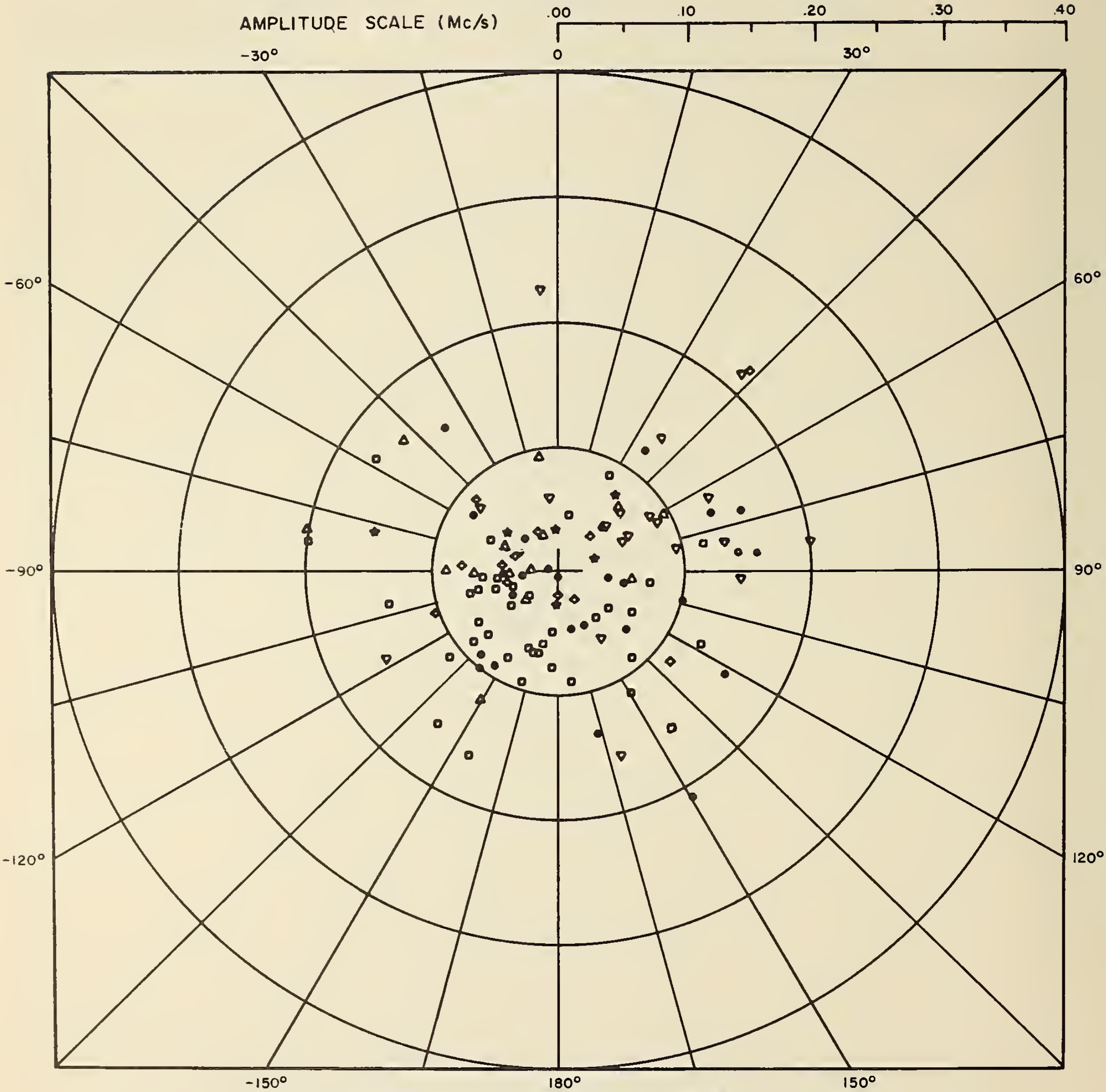


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 6 4 / 5 3 — 18	● 6 7 / 12 14 — 39	○ 7 5 / 5 11 — 28	23 29 / 27 39
SOUTH	△ 1 9 / 1 3 — 14	◆ 1 1 / 2 6 — 10	★ 2 3 / 2 2 — 9	

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 9 116 STATIONS



DISTRIBUTION OF THE PHASE

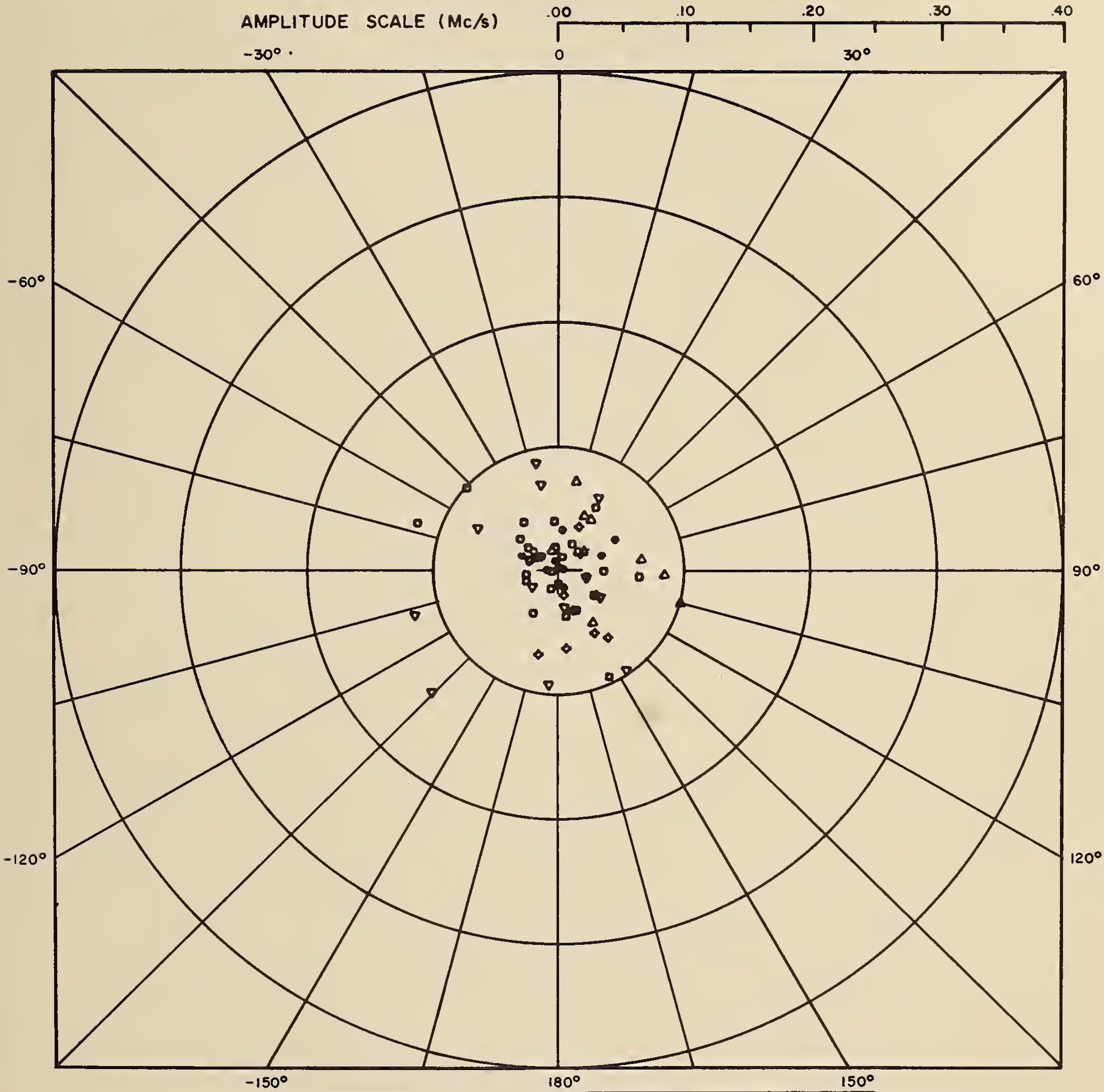
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 3 │ 12 1 │ 3 19	▫ 3 │ 3 23 │ 9 38	∘ 5 │ 6 7 │ 9 27
SOUTH	△ 7 │ 2 4 │ 1 14	◇ 5 │ 2 3 │ 2 12	★ 3 │ 2 1 │ 6

TOTAL

26	27
39	24

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 9 68 STATIONS



DISTRIBUTION OF THE PHASE

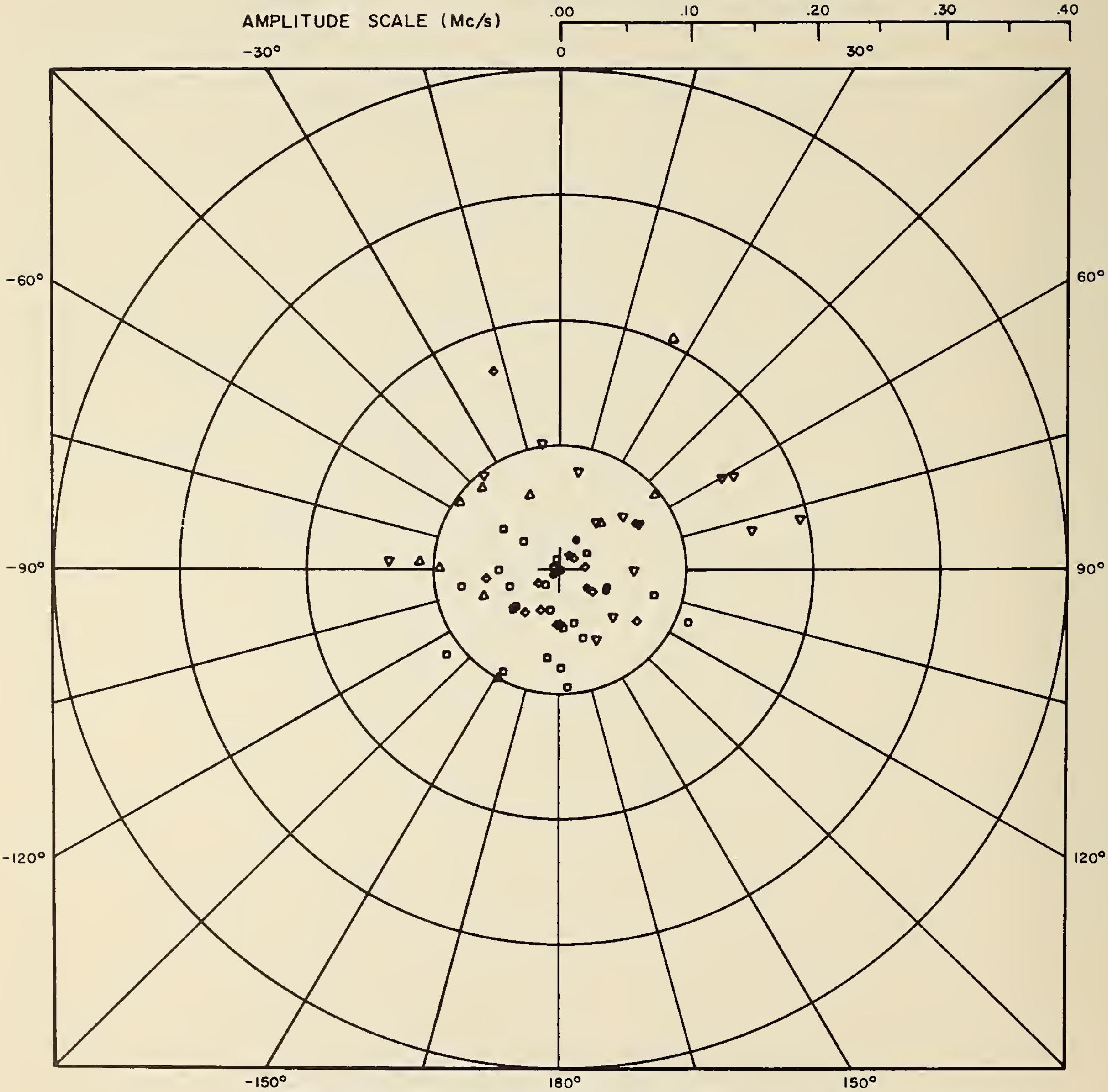
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 4 | 1 / 4 | 4 — 13	○ 10 | 5 / 5 | 5 — 25	∘ 4 | 5 / | 2 — 11
SOUTH	△ 2 | 4 / | 3 — 9	◆ | 2 / 1 | 5 — 8	★ | 1 / | 1 — 2

TOTAL

20	18
10	20

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 9 65 STATIONS

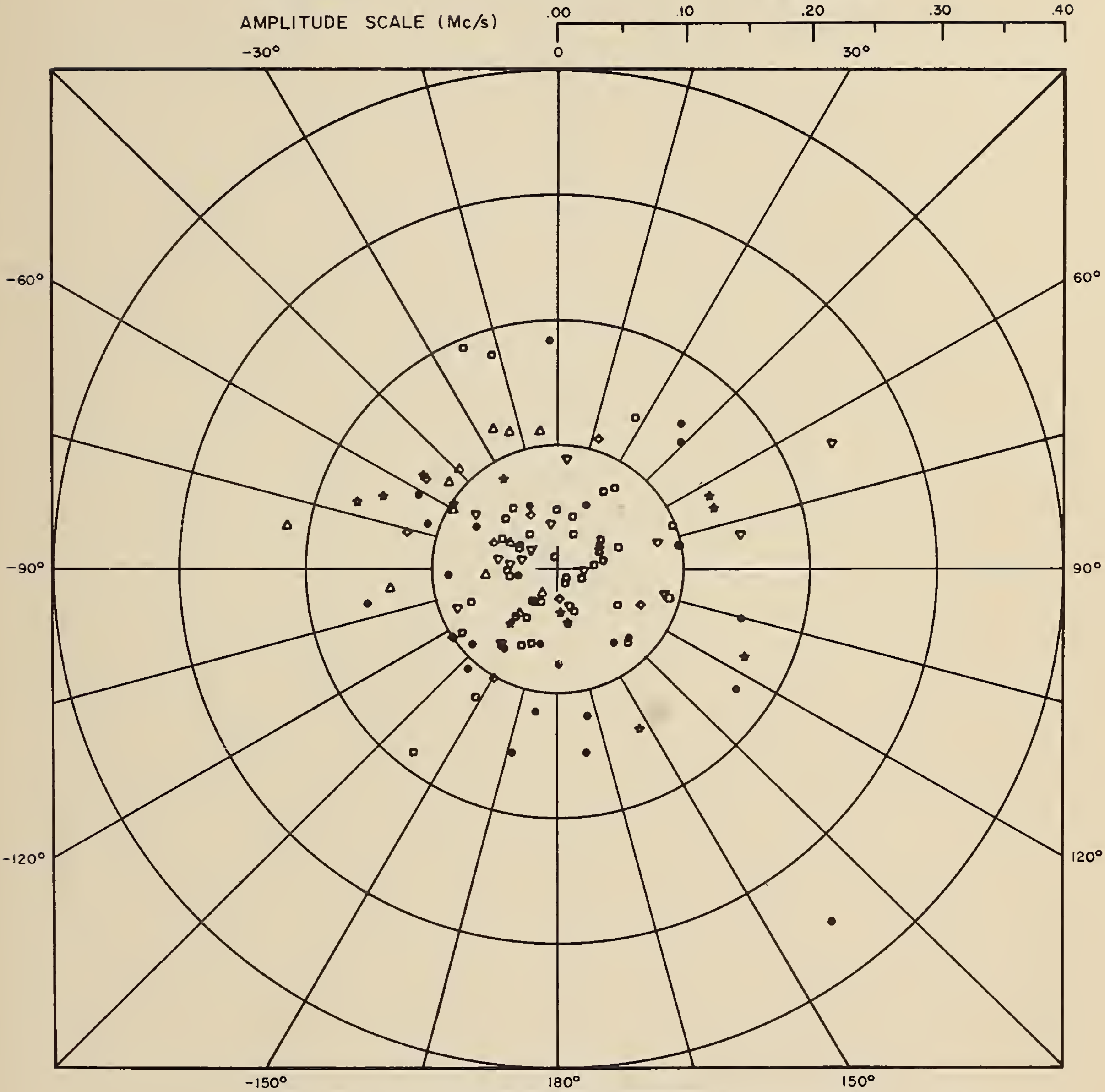


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 3 | 8 / — | 3 ; 14	● 4 | 1 / 12 | 6 ; 23	∘ — | 2 / 1 | 3 ; 6	13 | 17
SOUTH	△ 5 | 3 / 2 | — ; 10	◆ 1 | 2 / 5 | 2 ; 10	★ — | 1 / 1 | — ; 2	21 | 14

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC 10 118 STATIONS



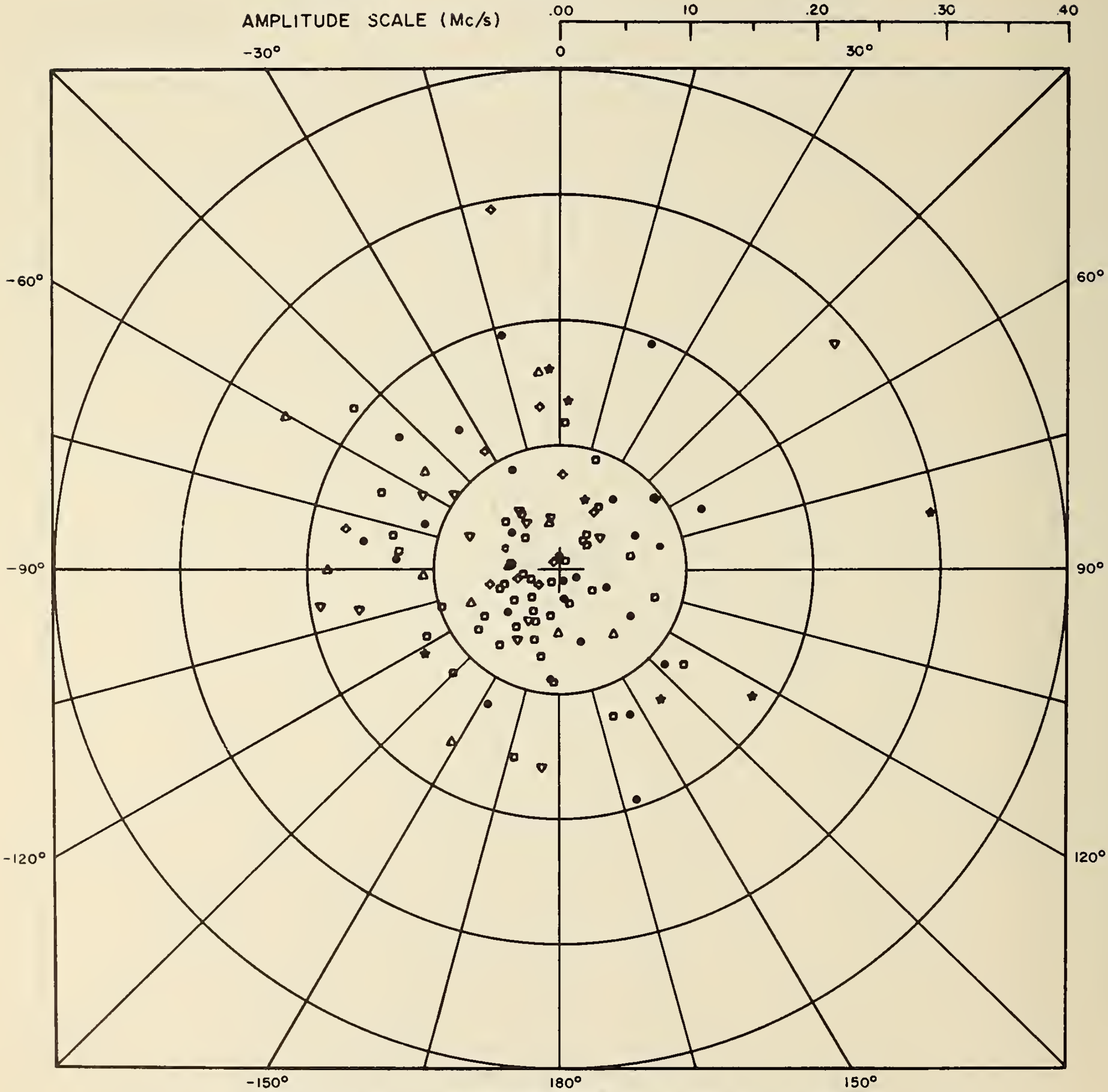
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 6 | 5 / 2 | 2 — 15	● 10 | 11 / 13 | 7 — 41	∘ 5 | 4 / 11 | 8 — 28
SOUTH	△ 8 | 1 / 4 | — 13	◆ 4 | 1 / 3 | 1 — 9	★ 5 | 2 / 2 | 3 — 12

TOTAL	
38	24
35	21

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 10 112 STATIONS

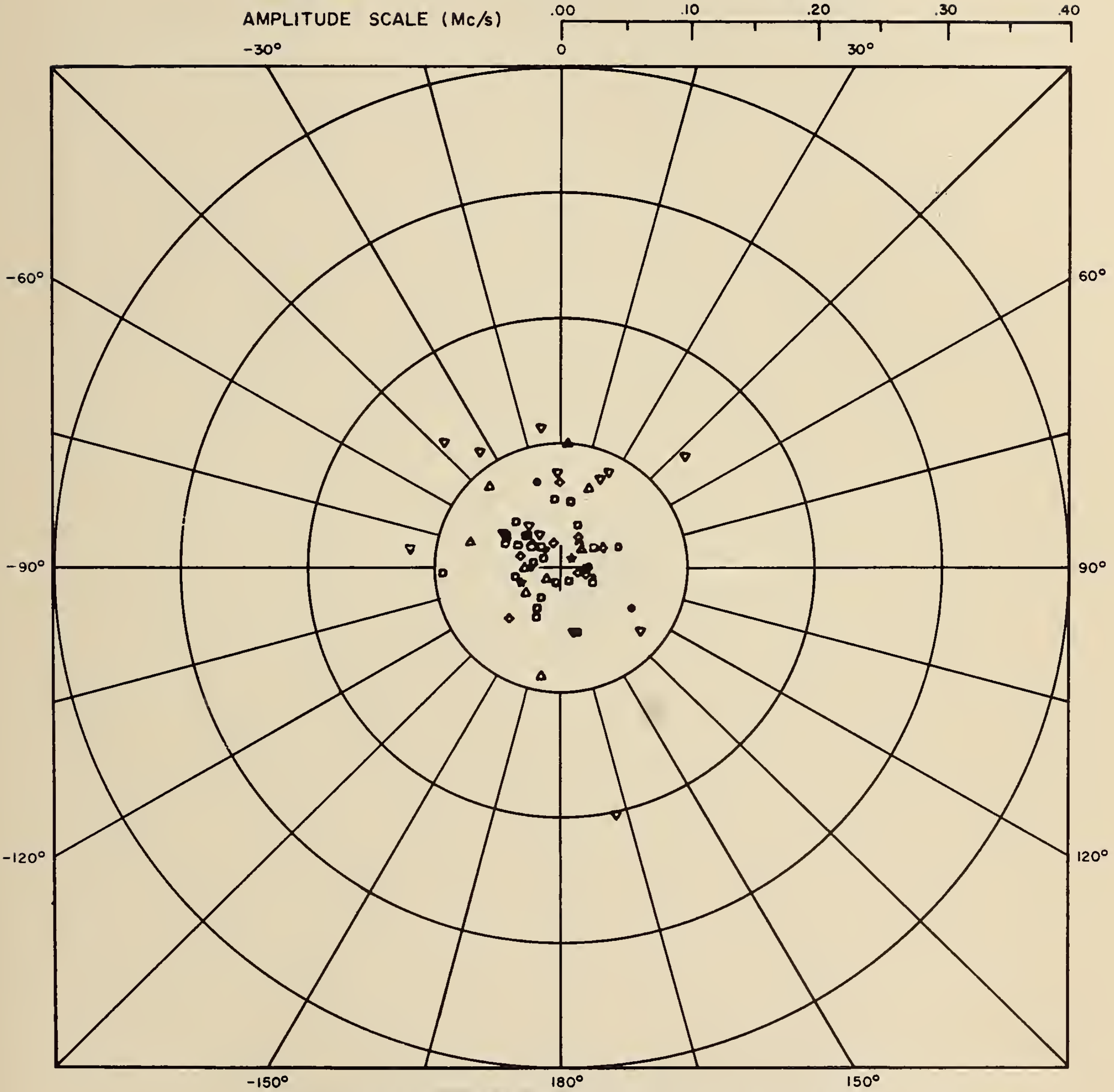


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 6 2 / 5 — 13	▫ 9 7 / 21 5 — 42	∘ 10 6 / 3 9 — 28	37 21
SOUTH	△ 6 / 4 1 — 11	◆ 5 3 / 3 — 11	★ 1 3 / 1 2 — 7	37 17

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC 10 67 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 8 , 3 / — , 3 — 14	□ 12 , 4 / 6 , 4 — 26	○ 3 , 2 / — , 2 — 7
SOUTH	△ 2 , 3 / 4 , — — 9	◆ 4 , 2 / 1 , 2 — 9	★ — , 1 / 1 , — — 2

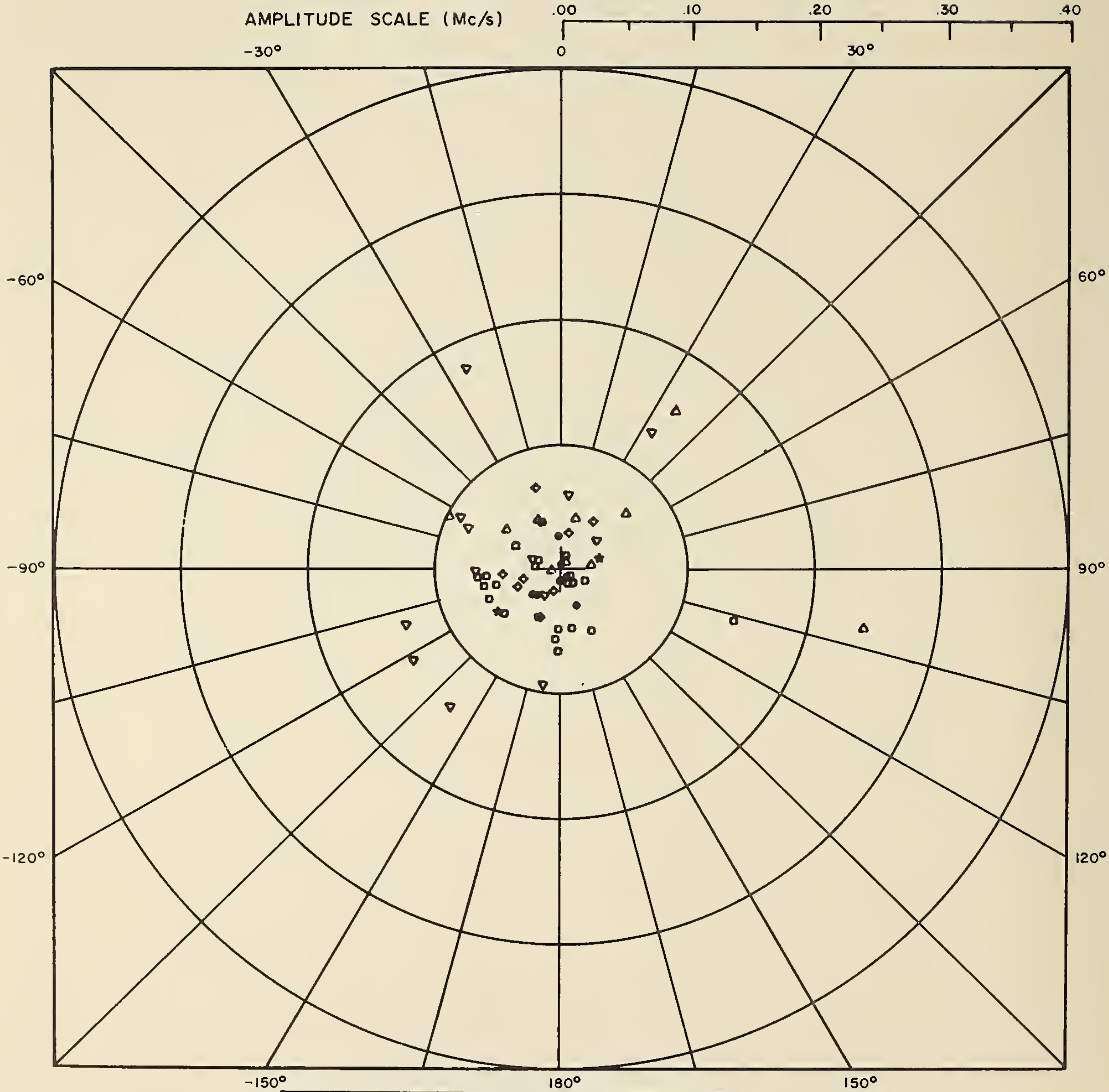
TOTAL

29 , 15 / 12 , 11

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 10 63 STATIONS

AMPLITUDE SCALE (Mc/s)

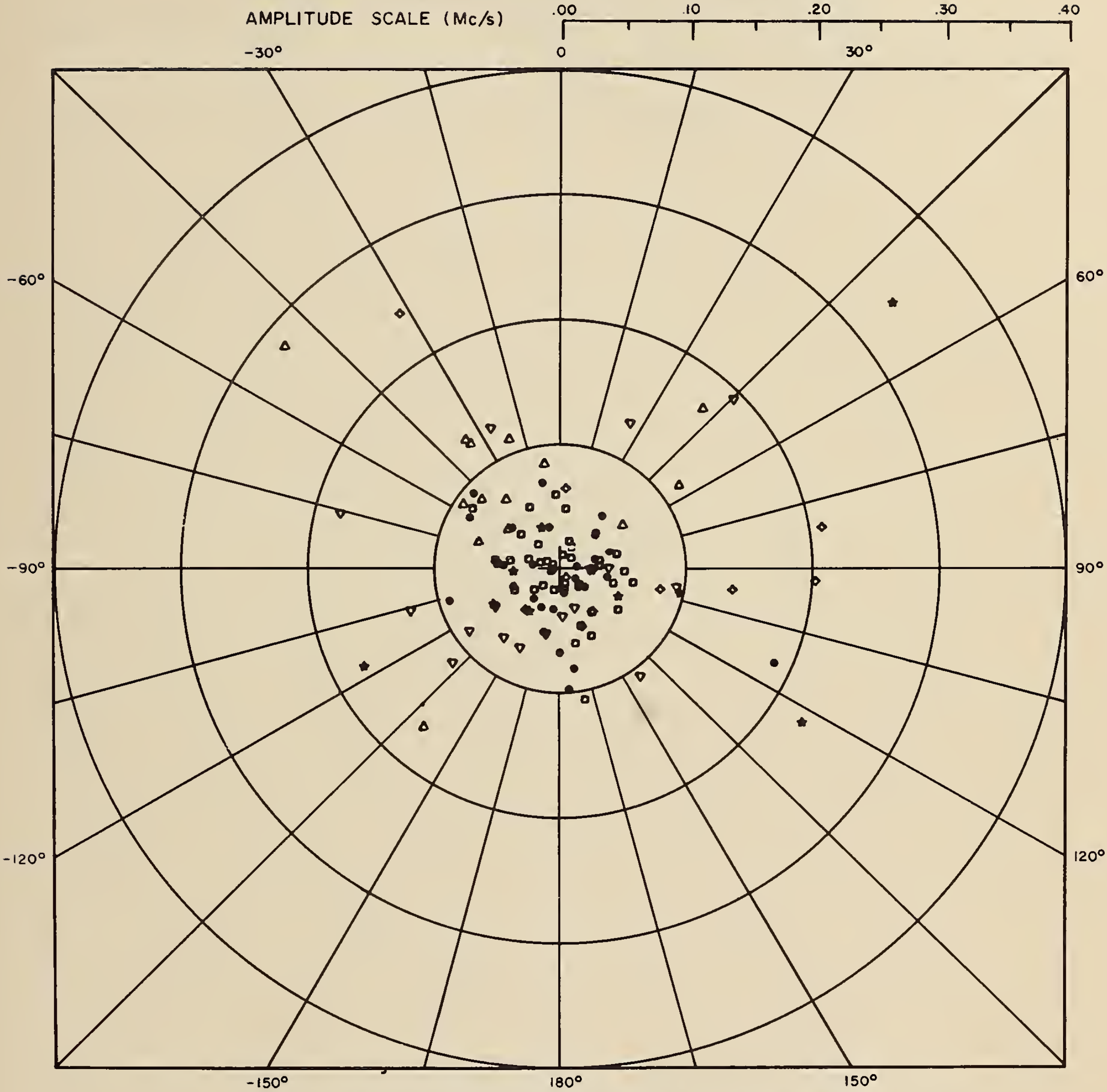


DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	▽ 4 3 6 — 13	● 4 2 10 7 — 23	∘ 2 3 2 — 7	14 13
SOUTH	△ 3 5 1 1 — 10	◆ 1 2 5 — 8	★ 1 1 — 2	26 10

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 10 118 STATIONS



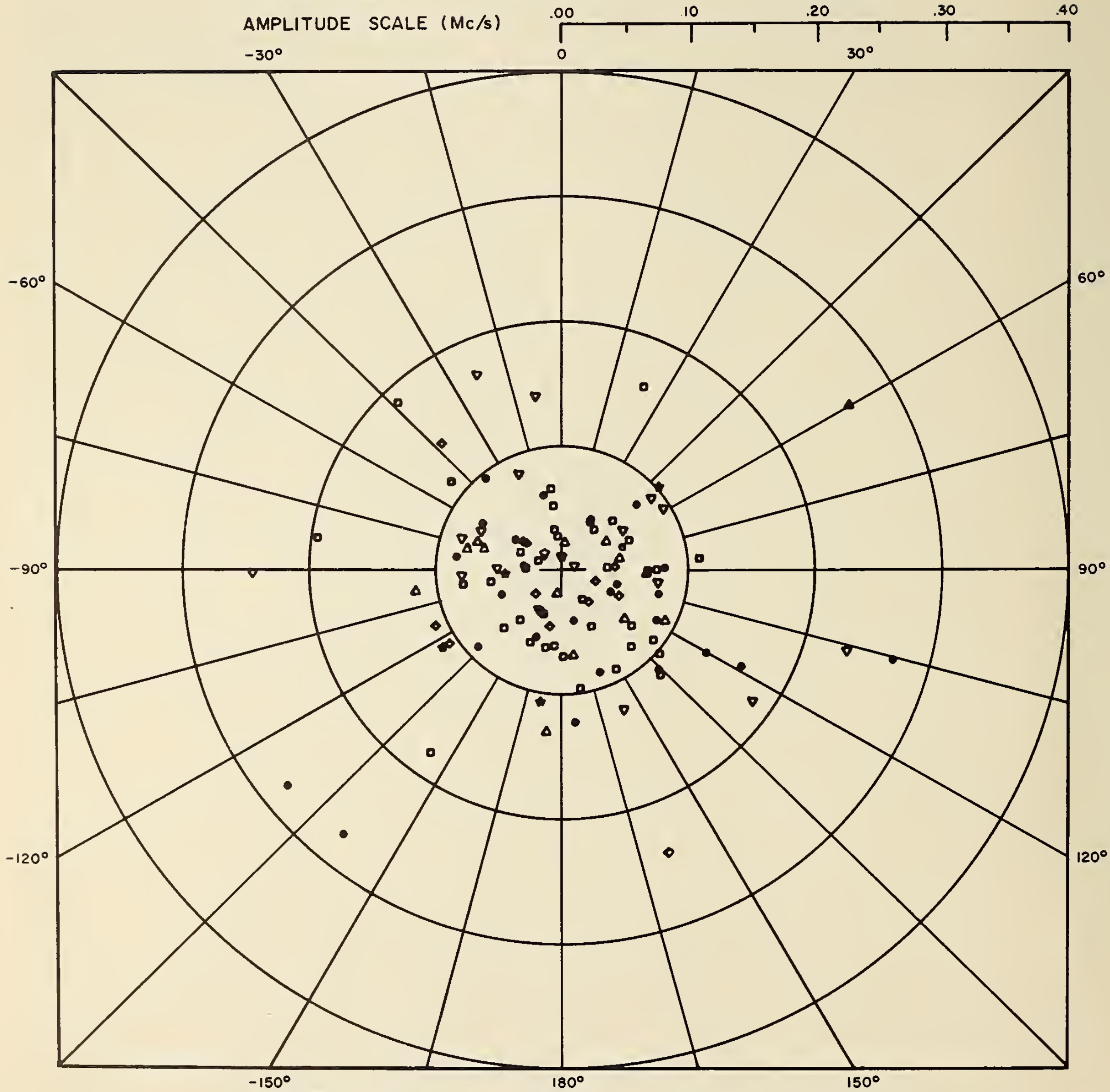
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2, 4 / 7, 5 — 18	● 14, 7 / 5, 13 — 39	∘ 7, 6 / 7, 8 — 28
SOUTH	△ 10, 3 / 1 — 14	◆ 1, 2 / 1, 6 — 10	★ 1, 1 / 4, 3 — 9

TOTAL	
35	23
25	35

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC 10 116 STATIONS



DISTRIBUTION OF THE PHASE

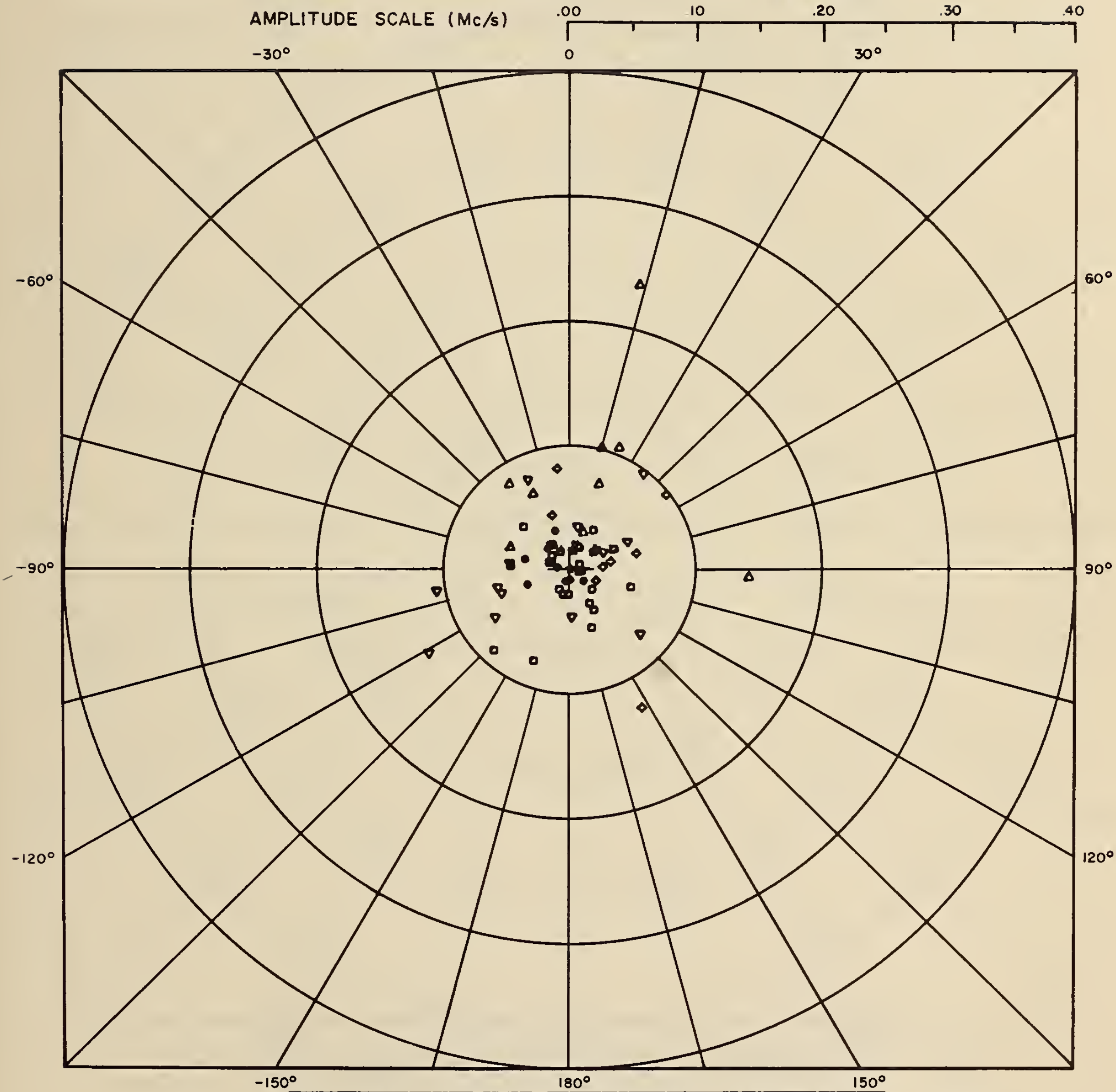
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 8 4 3 4 19	▫ 10 9 9 10 38	• 6 4 6 11 27
SOUTH	△ 3 4 3 4 14	◆ 3 1 4 4 12	★ 3 1 2 6

TOTAL

33	23
27	33

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 10 68 STATIONS



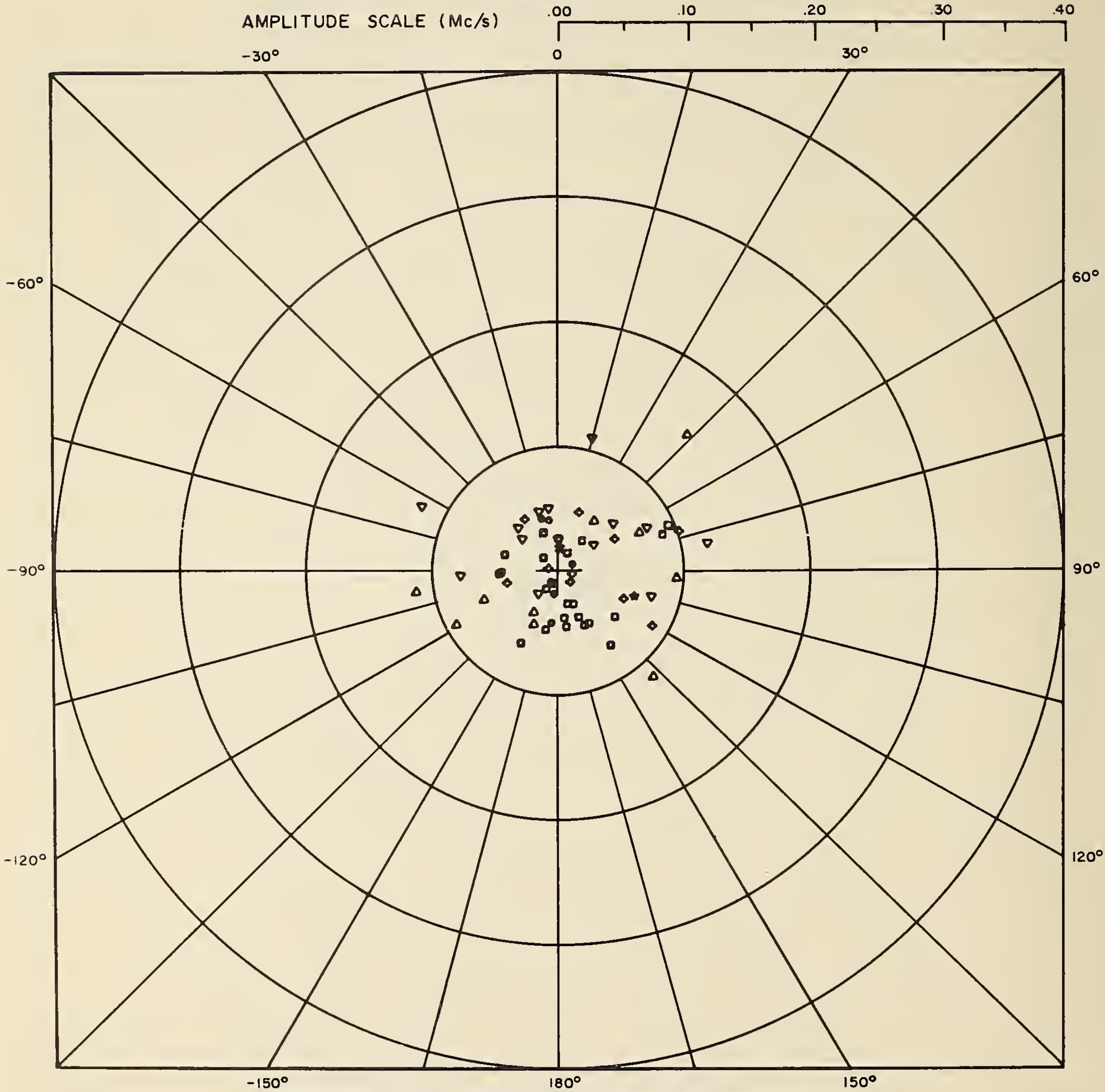
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°	TOTAL
NORTH	2 | 4 / 5 | 2 — 13	7 | 6 / 5 | 7 — 25	4 | 2 / 3 | 2 — 11	18 | 22
SOUTH	3 | 5 / | 1 — 9	2 | 4 / | 2 — 8	| 1 / | 1 — 2	13 | 15

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 10 65 STATIONS

AMPLITUDE SCALE (Mc/s)



DISTRIBUTION OF THE PHASE

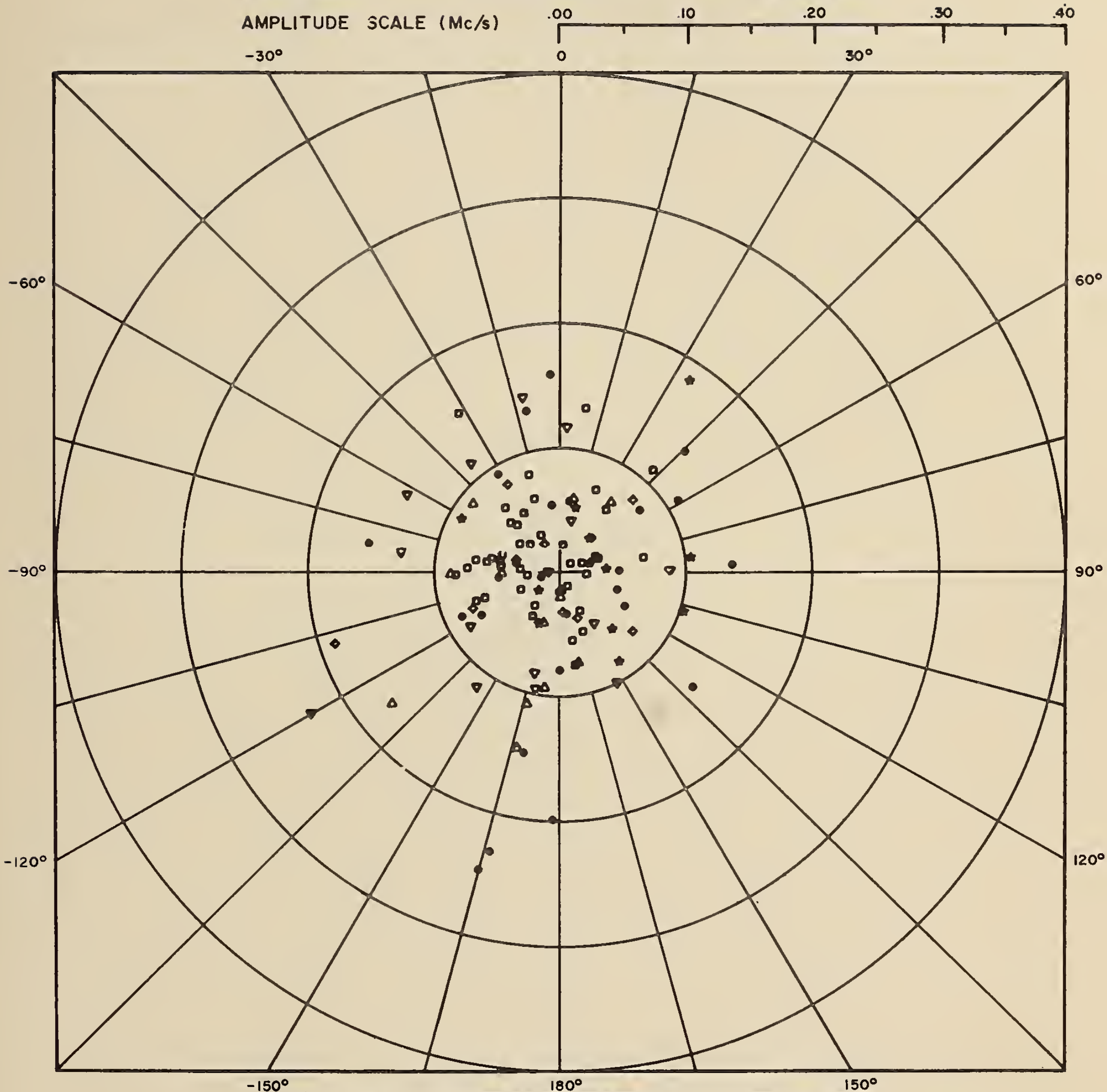
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 6 | 5 2 | 1 14	□ 4 | 4 6 | 9 23	○ 2 | 1 3 | 6
SOUTH	△ | 3 5 | 2 10	◇ 2 | 3 1 | 4 10	★ | 1 | 1 2

TOTAL

14	17
17	17

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1958 HARMONIC II 118 STATIONS



DISTRIBUTION OF THE PHASE

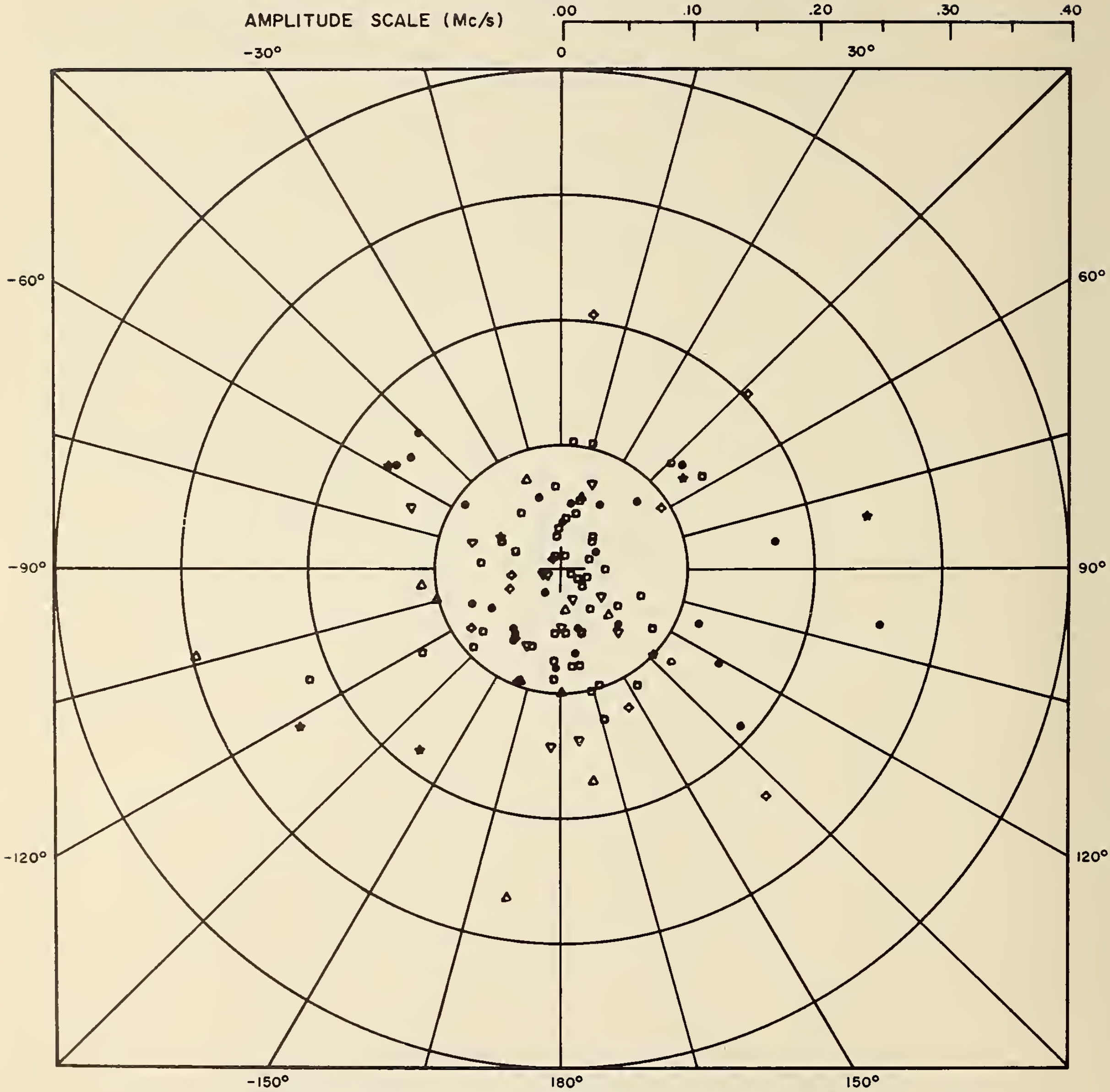
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 5 | 3 / 5 | 2 — 15	● 18 | 10 / 7 | 6 — 41	• 6 | 6 / 9 | 7 — 28
SOUTH	△ 1 | 2 / 7 | 3 — 13	◆ 3 | 1 / 2 | 3 — 9	★ 1 | 6 / 2 | 3 — 12

TOTAL

34	28
32	24

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1958 HARMONIC 11 112 STATIONS



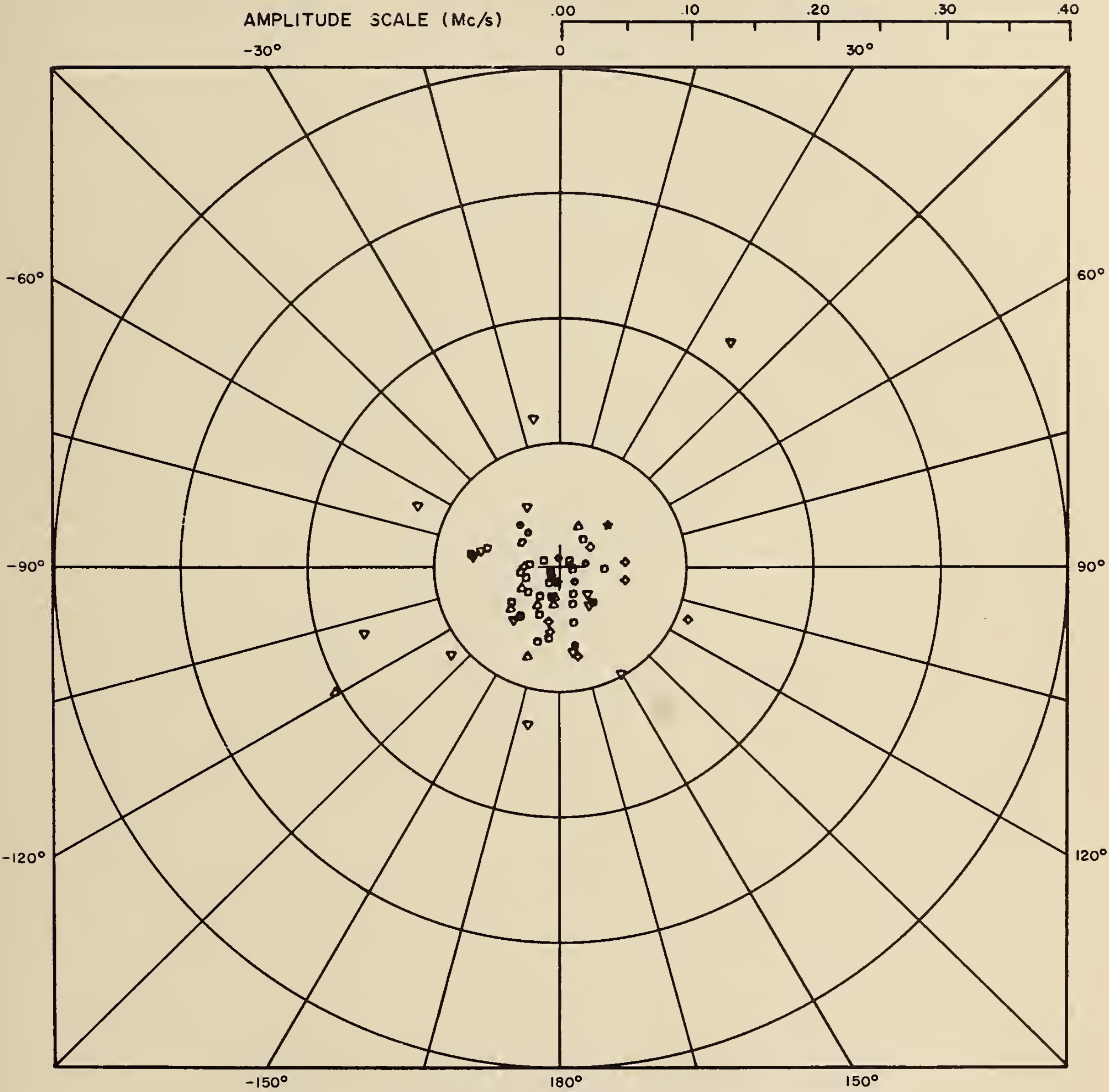
DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 1 4 6 13	□ 8 11 8 15 42	● 6 7 7 8 28
SOUTH	△ 1 1 5 4 11	◆ 1 3 5 2 11	★ 2 2 2 1 7

TOTAL	
20	25
31	36

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

MARCH 1954 HARMONIC II 67 STATIONS



DISTRIBUTION OF THE PHASE

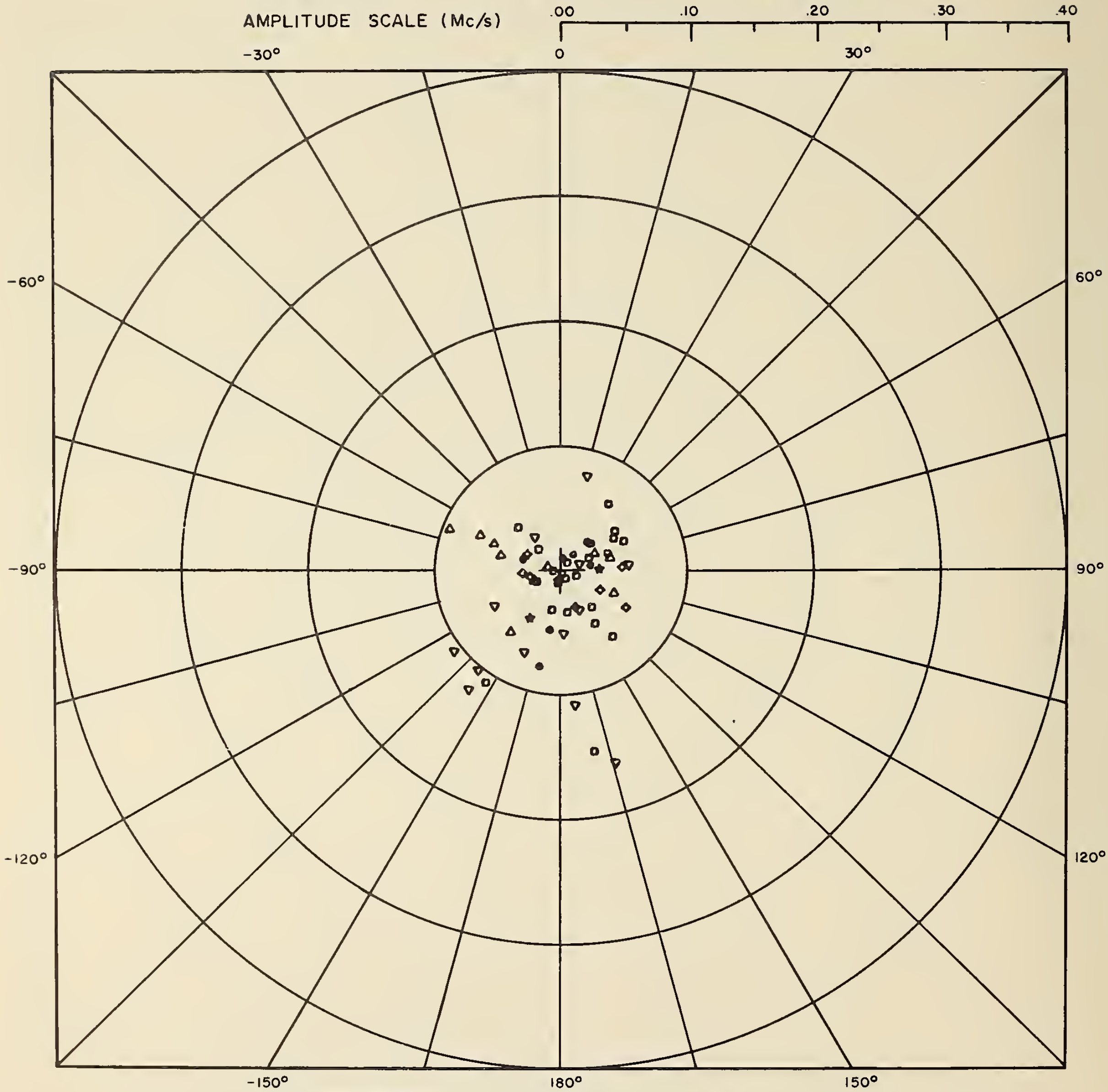
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 5 | 1 4 | 4 14	● 5 | 2 13 | 6 26	∘ 3 | 1 1 | 2 7
SOUTH	△ | 1 8 | 9	◆ 1 | 3 2 | 3 9	★ | 1 1 | 2

TOTAL

14	9
29	15

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

SEPTEMBER 1954 HARMONIC 11 63 STATIONS



DISTRIBUTION OF THE PHASE

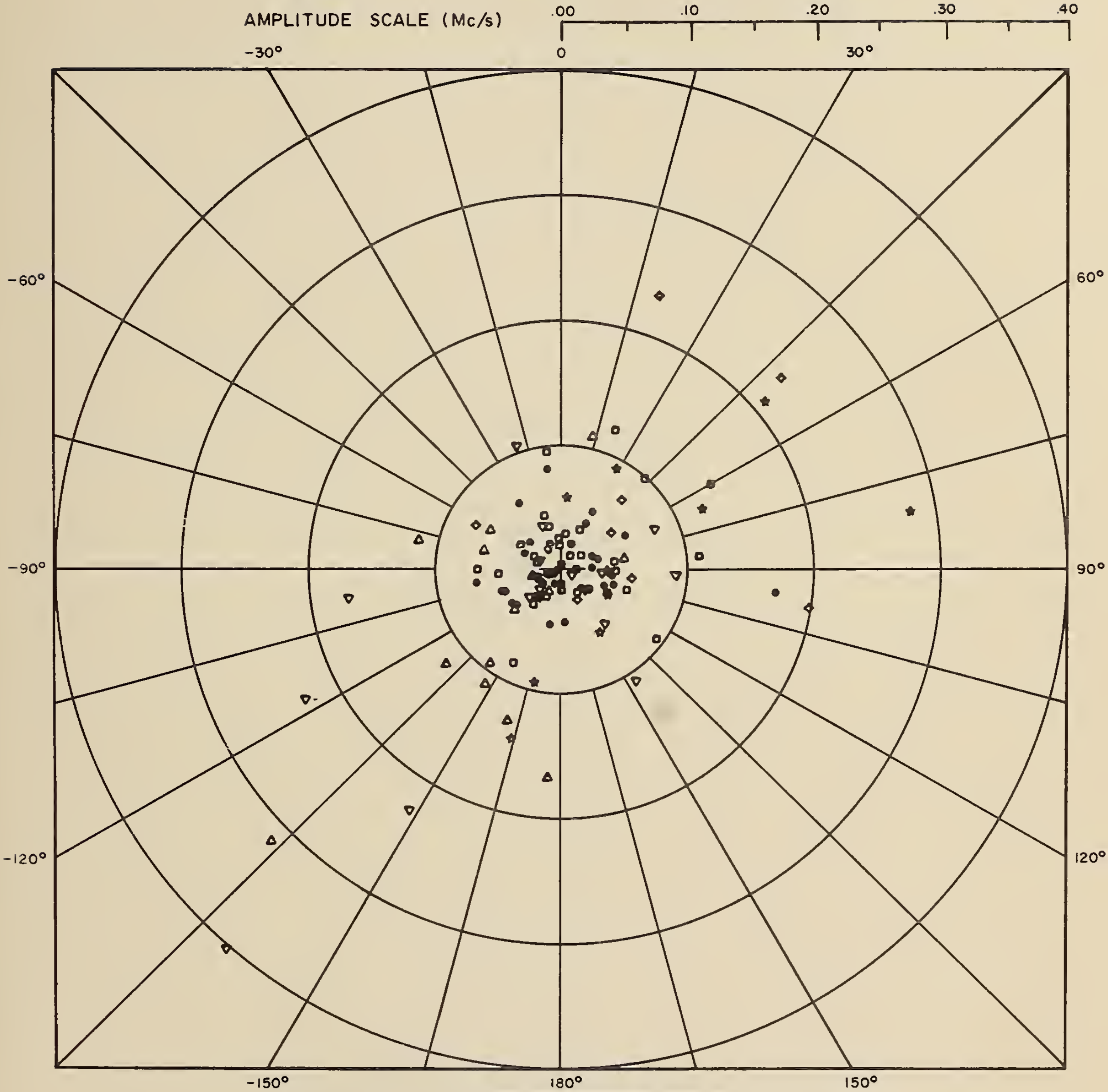
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 1, 3 / 5, 4 — 13	■ 3, 8 / 4, 8 — 23	• 1, 4 / 2, — 7
SOUTH	△ 5, 2 / 2, 1 — 10	◆ 1, 1 / 3, 3 — 8	★ , 1 / 1, — 2

TOTAL

11	19
17	16

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1958 HARMONIC 11 118 STATIONS



DISTRIBUTION OF THE PHASE

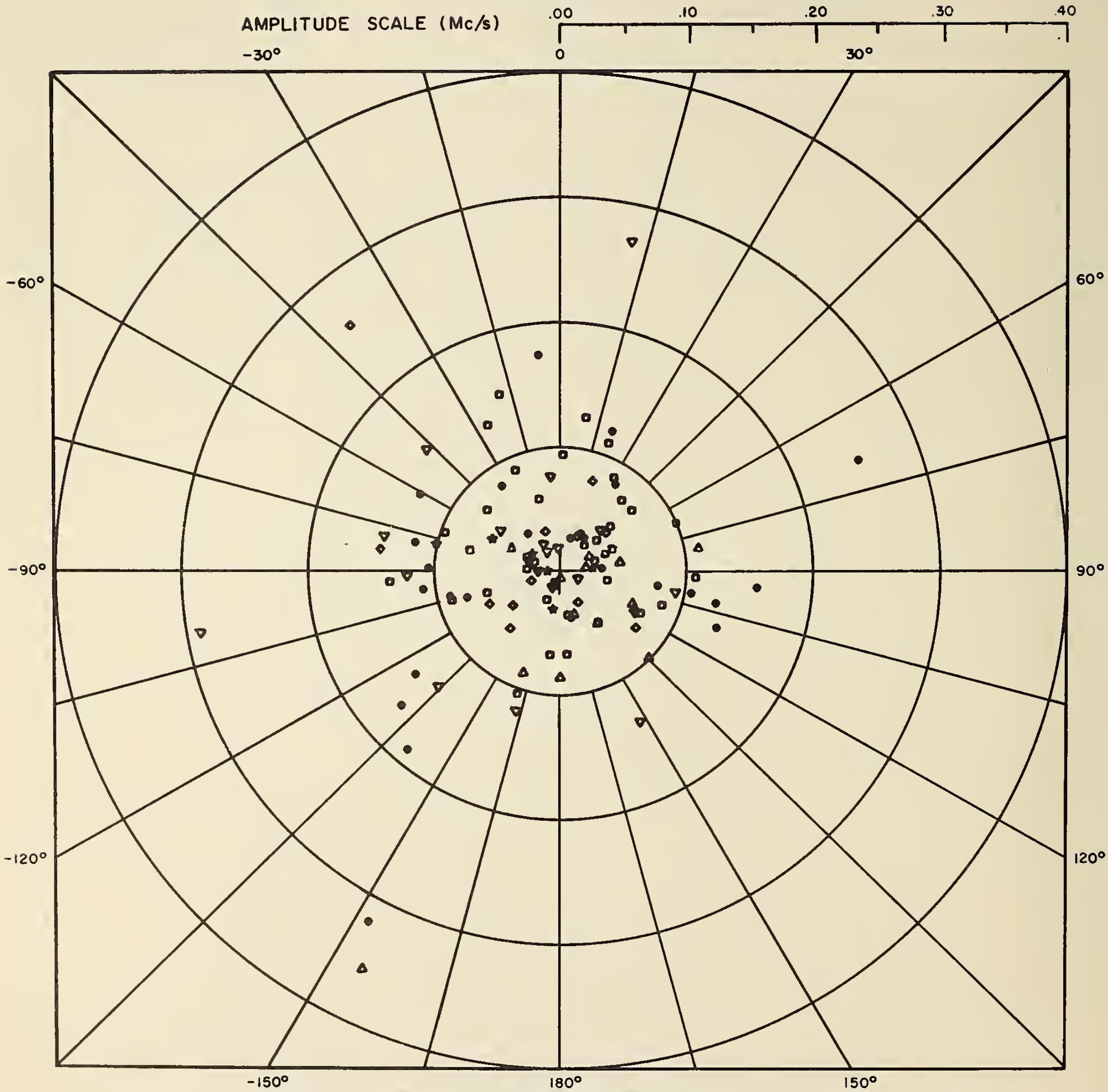
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 3 | 1 ; 8 | 6 ; 18	● 11 | 12 ; 9 | 7 ; 39	○ 5 | 7 ; 10 | 6 ; 28
SOUTH	△ 3 | 2 ; 9 | ; 14	◆ 1 | 5 ; 1 | 3 ; 10	★ | 5 ; 2 | 2 ; 9

TOTAL

23	32
39	24

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1958 HARMONIC II 116 STATIONS



DISTRIBUTION OF THE PHASE

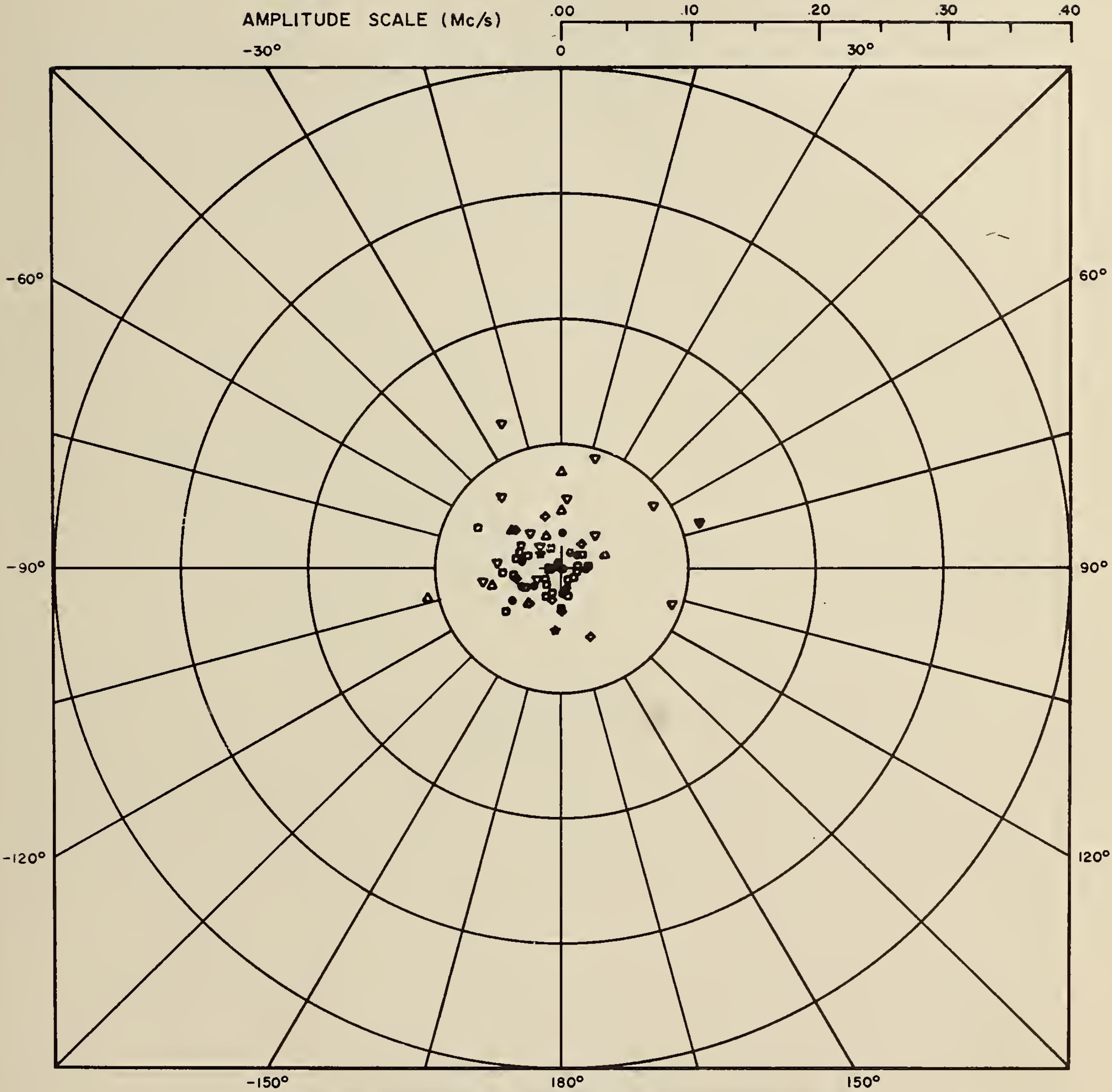
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 8 | 2 / 5 | 4 — 19	● 10 | 13 / 8 | 7 — 38	∘ 7 | 7 / 7 | 6 — 27
SOUTH	△ 1 | 4 / 2 | 7 — 14	◇ 3 | 3 / 4 | 2 — 12	★ 4 | 1 / 1 — 6

TOTAL

33	30
27	26

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

JUNE 1954 HARMONIC 11 68 STATIONS



DISTRIBUTION OF THE PHASE

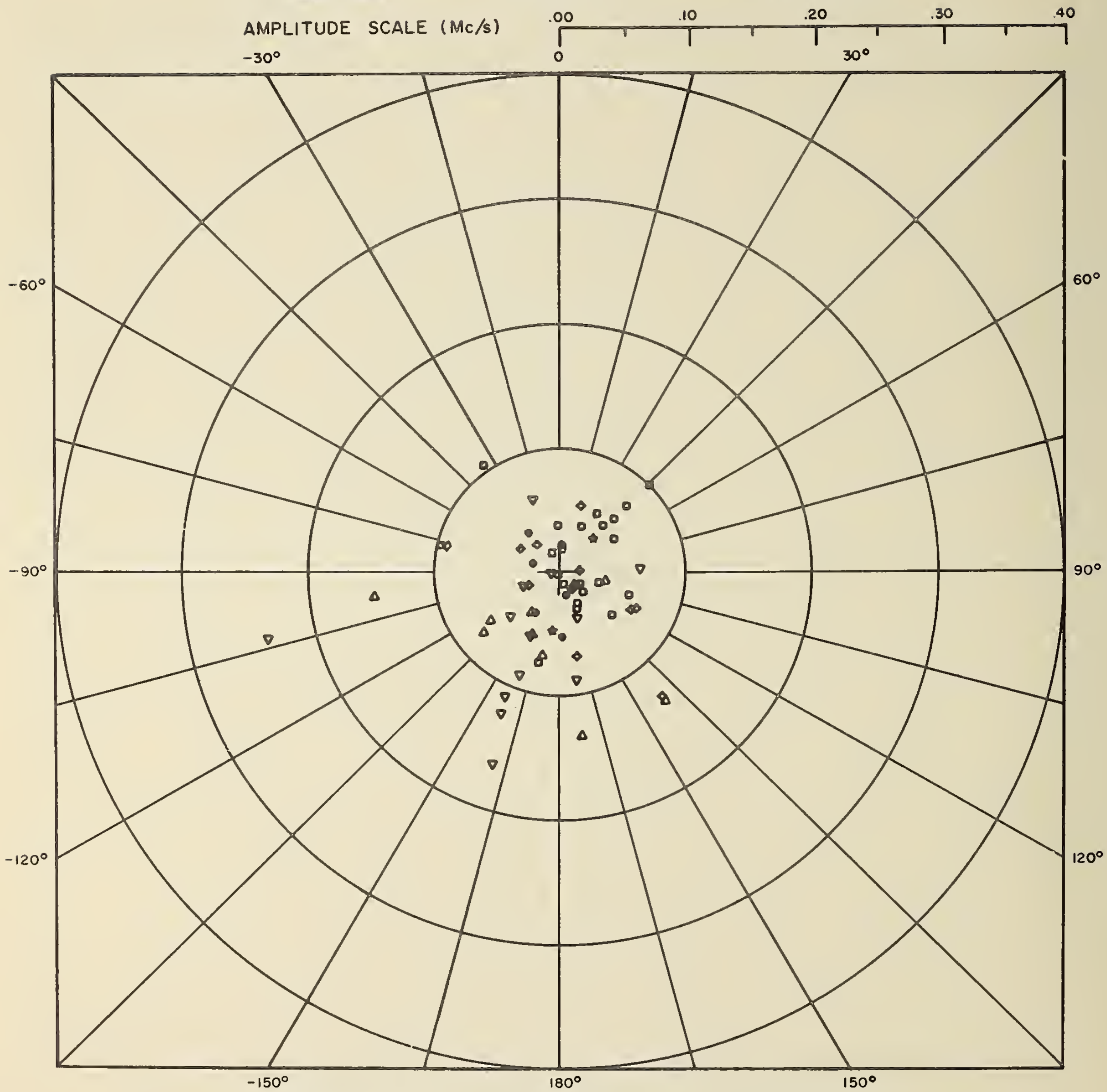
LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 5 | 5 2 | 1 13	● 8 | 4 9 | 4 25	○ 2 | 3 4 | 2 11
SOUTH	△ 5 | 1 3 | 9	◆ 2 | 1 4 | 1 8	★ | 1 | 1 2

TOTAL

23	14
23	8

AMPLITUDE AND PHASE FOR foF2 MONTHLY MEDIAN

DECEMBER 1954 HARMONIC 11 65 STATIONS



DISTRIBUTION OF THE PHASE

LATITUDE	0° TO 30°	30° TO 60°	60° TO 90°
NORTH	▽ 2 | 1 / 9 | 2 — 14	■ 5 | 7 / 2 | 9 — 23	○ 3 | / 1 | 2 — 6
SOUTH	△ | / 6 | 4 — 10	◆ 2 | 2 / 1 | 5 — 10	★ | 1 / 1 | — 2

TOTAL

12	11
20	22

DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS