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A SUMMARY OF ONE YEAR OF OBSERVATIONS OF 6300A AIRGLOW AT HALEAKALA

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F. E. ROACH, W. R. STEIGER, and W. E. BROWN

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TECHNICAL REPORT

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I. Introduction

The atomic oxygen transitions $^3P_{2,1} - {}^1D_2$ or $[OI]_{21}$ yield two prominent radiations in the night airglow at wave lengths of 6300.3A and 6363.8A. The excitation potential is 1.96 e.v. The "forbidden" nature of the transitions is apparent from the mean life of the $^1D_2$ state, 110 seconds.

The radiation 5577.3A is also due to a forbidden transition $^1D_2 - {}^1S_o$ or $[OI]_{32}$. The energy level diagram (figure 1) illustrates that the two radiations are related through their common energy level, $^1D_2$. After the emission of the green, 5577A, line there are two possibilities: the atom may (after ~ 110 seconds) emit the red (6300A, 6364A) lines or it may be deactivated by collision.

In most airglow (and auroral) manifestations the green and red emissions seem to have little in common. Their diurnal variations are in general so dissimilar (figures 2 and 3) as to imply entirely different excitation mechanisms. An oversimplified conclusion from this lack of co-variance of the two emissions is that the green line is produced at lower heights (~100 km) where the collisional deexcitation of the $^1D_2$ level discourages the emission of the 6300A* line; and that the red line occurs predominantly at greater heights (which we may designate generally as the F region) where collisions are infrequent. A corollary conclusion from the lack of co-variance is that excitation mechanisms occur in the F region that are more effective at 1.96 e.v. than at 4.17 e.v.

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*Henceforth we shall refer to 6300A emission with the understanding that we include also 6364A.

Direct measurements of the height of the emissions by rocket explorations are not inconsistent with the above interpretation. A number of measurements in mid-latitudes have placed the green line emission layer in the 100-kilometer region [Packer, 1961; Huruhata, 1962]. To date there has not been an isolation of the 6300A emitting layer but in one rocket ascent it was established that it was greater than 200 kilometers [Zipf and Heath, 1962].

Some general evidence favoring the F region for the emission of the red line may be mentioned. In the case of visual auroras of Type A the upper red border, due chiefly to 6300A, is higher than the lower green part of the aurora. Another 6300A phenomenon, the mid-latitude M-arc, has been found by triangulation to be at a height of about 400 kilometers [Roach and Roach, 1963]. Also it should be mentioned that tropical 6300A arcs have been shown by Barbier, et al [1961] to occur in the 275 kilometer region.

If one considers the world-wide aspects of the 6300A - 5577A problem, one of the impressive facts is the very wide spread of their relative and absolute intensities for the several different phenomena. In Table 1 we show that the intensity ratio, $\frac{Q(6300)}{Q(5577)}$, covers a range from the order of 80 or greater for M-arcs to $\frac{1}{5}$ for the quiescent airglow. The conclusion that is forced on us from this spread is that we must be dealing not only with a difference in the preferred emission heights but also with a variety of excitation conditions.

That we are concerned with many different kinds of excitation in the case of 6300A is indicated by the large number of different phenomena that have been isolated. Barbier [1958, 1961] has identified the following at Haute Provence (HP) and at Tamanrassett (T):

The polar aurora (HP)
The twilight phenomenon (HP, T)
The western sheet (HP)
The subpolar sheet (HP, T)
The tropical arc (T)
The mid-latitude arc (HP)
The "para" twilight phenomenon (T)

The purpose of this paper is to summarize more than a year of observational data on the 6300A emission made at the tropical station at Haleakala (geographic latitude N 20° 42' 43", geographic longitude W 156° 15' 47", magnetic latitude 20° 50' N, magnetic longitude 88° 27' W, altitude 10,012 feet or 3052 meters, A.S.L. on the island of Maui, Hawaii). We propose to give a general description of the observations with particular emphasis on the marked intensity enhancements which have frequently occurred.

II. The Observational Material

The airglow observing program at Haleakala involves two photometers: (1) a zenith photometer that records the night sky intensity successively in a 5-minute sequence through filters centered on wave lengths 5577, 6300, 5893, and 5300A [Purdy, Megill, and Roach, 1961] and (2) an alt-azimuth mounted photometer that scans the sky in a series of almucantars (zenith distances 80°, 75°, 70°, 60°, 40° and zenith) in a 15-minute sequence in wave lengths 5577, 6300, and 5893A [Roach, Megill, Rees, and Marovich, 1958]. The zenith photometer has a built-in standard light making absolute calibrations possible. The alt-azimuth photometer includes a modified Lyot birefringent quartz filter that isolates the monochromatic airglow emissions from the more or less continuous background of integrated starlight and zodiacal light.

During the 1961-62 observing period the recording for both photometers was on pen-and ink-strip charts. The large quantity of observational material covered by this report was made tractable by putting the measurements into digital form on punched cards which then could be processed by electronic computers available to us.

The method used in converting the readings into absolute units involves the calibration of the built-in standard light of the zenith photometer which has been a major preoccupation of the Fritz Peak Observatory. The reader is referred to a paper by Roach and Smith [1964] for a discussion of the problems involved in isolating the airglow from the background light.

The correction of the readings to what is called the local zenith intensity (LZI) outside the atmosphere has a long history starting with a paper by Roach and Pettit [1951]. In summary the procedure consists in: (1) subtracting out the scattered light from the lower atmosphere, (2) correcting for the extinction of the lower atmosphere, (3) correcting for the Van Rhijn increase of the line-of-sight brightness toward the horizon, and (4) multiplying by the absolute calibration coefficient to put the results in rayleighs. The processed data are printed out and in some cases put on a new deck of punched cards.

In Table 2 we show a log of the 149 nights included in the present report. In figures 3 and 4 we have plotted representative zenith intensities of 6300A versus time based on the zenith photometer observations. We note that there seem to be two classes of nocturnal variation: (1) what might be called the "classical" variation with the high post-twilight intensity decreasing rapidly (like a negative exponential curve) to a low value and (2) the classical curve interrupted by one or more dramatic increases in intensity extending over a period of about two hours. The classical variation is characteristic of the experience of observers in mid-latitudes (see figure 2). The abrupt increases illustrated in figure 4 are characteristic of the tropics and have been observed by Barbier [1964], A. and D. Delsemme [1960], Barbier, Roach and Steiger [1962], Carman and Gibson-Wilde [1964], Saito [1962], Davis and Smith [1964], Silverman and Casaverde [1961]. Observations over the sky indicate that the photometric increase covers a significant area with localized spotty regions sometimes arrayed in an arc-like orientation.

If we assume that the effective height of the 6300A emission is 250 kilometers, then our outer observational circle (80° zenith distance) has a radius of 1000 kilometers and includes a region of the eastern Pacific centered on the Hawaiian Islands, extending about half way to the equator on the south. The geographic and geomagnetic latitudes are practically identical, the geomagnetic equator crossing the geographic equator to the south of the Hawaiian Islands. The geomagnetic parallels are inclined about 11° E to the geographic parallels.

The all-sky observations from the birefringent photometer have been digitized on punched cards by a two man-year measurement program. Values of LZI are printed out in two ways: (1) a simple tabulation of the results as shown in Table 3 and (2) a print-out on a polar coordinate circle map with each value of LZI printed out in its position with respect to a geographical circle centered on the observer (see figure 5). An interpolation program is also included to indicate the positions on the circle plot of isophotes corresponding to sequentially selected values of the isophotes in rayleighs (see figure 6).

From this large mass of data we are reproducing in the present report in Table 4 the zenith values of the intensity of 6300A in rayleighs for 15-minute intervals.

III. The Correlation Between Q(6300) and the Ionospheric Parameters

Some time ago St. Amand [1955] reported a possible relationship between the 6300A mid-latitude airglow and the ionization in the F region. Barbier [1959] made a somewhat similar study of his observations at the Haute Provence Observatory. He assumed that the 6300A line is produced by a charge exchange followed by a dissociative recombination, as follows:

$$O_2 + O^+ \rightarrow O_2^+ + O^* \qquad (1)$$

$$O_2^+ + e \rightarrow O^* + O^{**} , \qquad (2)$$

in which rate of production of the excited oxygen atoms, O^*, which eventually emit 6300A, is proportional to the product of the O_2 number density, $[O_2]$, and electron number density, n_e. Hence the number of emissions per second in a vertical column 1 cm^2 in cross-section will be

$$Q = k\int_h^\infty [O_2]\, n_e dh. \qquad (3)$$

By assuming mean values of these quantities in the F region, Barbier infers a semi-empirical relationship between the airglow emission, Q, and the ionospheric parameters f_oF2 (critical frequency of the F2 region) and h'F (virtual height of the F2 region), as follows:

$$Q = k[O_2]_o(f_oF2)^2 e^{-\left(\frac{h'F-h_o}{H}\right)} \qquad (4)$$

where h_o is a reference height (~ 275 km) at which $[O_2]_o$ is taken, H is the O_2 scale height, and K is an empirical constant.

On the basis of a more detailed analysis of the reaction rates of (1) and (2), and considering also the reactions

$$N_2 + O^+ \rightarrow NO^+ + N^* \qquad (5)$$

$$NO^+ + e \rightarrow N^* + O^* , \qquad (6)$$

Peterson [1964] has computed the rate of emission of 6300A as a function of height. Assuming a Chapman-layer distribution for the electrons, he has carried out the integral over height and arrived at an expression for the emission rate, Q, essentially identical to equation 4, in which K involves the scale height, H, and also the effective rate coefficient of reaction (6).

Barbier [1959] found that the correlation between airglow observations in 6300A at Haute Provence and the computed values from his semi-empirical formula was only fair, and in some months very poor. Such was also the case at Maruyama as reported by Huruhata, et al [1959].

In the tropics, on the other hand, an equation of the form

$$Q(6300) = A + B\,(f_oF2)^2\, e^{-\left(\frac{h'F-h_o}{H}\right)} \qquad (7)$$

can be adjusted to fit the observations with a very high correlation on individual nights. Even on those nights when there are sporadic and large changes in intensity, the formula works very well. An example of such a night is shown in figure 7 where the observed and calculated intensities are shown. It has been found, however, that the constants A and B vary from one observing period to the next and probably also from night to night. Hence, the larger the block of data taken, the poorer the correlation will appear to be. In figure 8 we show the observed Q(6300) versus the calculated function $E = (f_oF2)^2\, e^{-\left(\frac{h'F-200}{40}\right)}$ for the 93 nights listed in table 5. The regression line gives A = 26.8 and B = 4.2 with a correlation coefficient of 0.74.*

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*The statistical method used here assumes that E and Q are equally uncertain, both being derived from experimental procedures of comparable accuracy. Thus, the regression line was found which minimized the square of the deviation of the experimental points from the regression line as measured perpendicular to the line. In general this line bisects the regression lines of Q on E and E on Q.

The correlation between the observed Q(6300) from Haleakala and the quantity A + B E has been calculated for various values of H. These results are shown in Table 6. It is evident that the correlations are in general quite high and that the best values result for a scale height in the range of 40 to 50 km.

On the night of Sept. 11/12, 1961, there were two very dramatic enhancements in 6300A. Although, under normal or quiescent conditions, the 5577A emission is quite unrelated to the 6300A emission, on this night enhancements in 5577A were observed in close coincidence with those in 6300A, as seen in figure 4. This suggests that a similar or related mechanism was responsible for the enhancements in both wave lengths.

As a working hypothesis, we suggest that the observed 5577A is due to emissions at two different heights, as illustrated in figure 9. The major component has its origin in the vicinity of 100 km and is quite unrelated to 6300A which has only a single component in the vicinity of 300 km. A second and usually minor component of 5577A appears in the vicinity of 300 km and is related to the 6300A emissions, perhaps through reactions (1) and (2) which are known to be capable of producing both 5577A and 6300A. Under conditions when the 5577A is rather strong (several hundred Rayleighs) in the major component and 6300A is relatively quiescent, then the minor component of 5577A which is correlated with 6300A will be rather insignificant and difficult to detect. However, when the "major" component of 5577A is unusually weak (100R or less) and 6300A is active with large enhancements of several hundred Rayleighs, then the "minor" component of 5577A correlated with the 6300A may become quite significant. This appears to be the case with the example illustrated, for the background or uncorrelated component of 5577A is unusually weak whereas 6300A shows unusually large enhancements. Similar examples can be found on other nights and a very good example is described by Saito [1962] at a latitude of 20° N on November 13, 1960. (see figure 10)

In view of the relationship between the ionospheric parameters and the observed airglow intensity, it appears that it may be feasible to extend our knowledge of the ionosphere by way of the all-sky airglow observations. Using the zenith observations of both airglow and ionosphere to determine the empirical constants A and B in the Barbier formula (7), one can then apply this formula to other parts of the sky. Unfortunately, there are two unknown ionospheric parameters and so the information is not sufficient. Because f_oF2 does not vary greatly over the visible sky at a given time, one could make an approximate solution for h'F by assuming a constant f_oF2 over the sky equal to the zenith value. The result of such a calculation is is shown in figure 11. In this way one could construct a "topographic" map of the ionosphere depicting h'F over the entire visible sky.

In the case of the September 11/12, 1961, data, the Barbier formula allows a rather good fit to the 6300A observations but not the 5577A. It was found that a relationship

$$Q(5577) = 70 + 200\, e^{-\left(\frac{h'F-200}{40}\right)} \tag{8}$$

worked rather well for the 5577A observations, as shown in figure 12. Just why this should be is not clear. The rate of production of O** in reactions (1) and (2) and hence the rate of emission of 5577A, is proportional to n_e at heights where n_e is large in comparison to $[O_2]$ and is proportional to n_e^2 at lower heights where n_e is small in comparison to $[O_2]$ [Ratcliffe, 1956]. At no time should it be independent of n_e, as seems to be the case in this example.

In cases where Q(5577) is also found to be related to the ionospheric parameters, such as the night of September 11/12, 1961, mentioned earlier, it is possible to solve for both h'F and f_oF2 from the airglow observations. One must assume, of course, that the two empirical formulas for 5577A and 6300A hold over the entire sky. This has been done for the night of September 11/12 and the results are shown in figure 13(a) and (b). In (a) are shown lines of equal height (h'F) and in (b) are shown lines of equal critical frequency (f_oF2). To the extent that such an analysis is valid, the results are quite dramatic and should be of considerable interest to the ionospheric physicist. One can make the observation that the variations in the height h'F over the field of view of radius approximately 1000 km are of the order of 5 to 10% of the horizontal dimensions, which is far greater than one finds on the surface of the earth where the variations are more like a fraction of 1%.

It is of interest to take note of the work of J. W. Wright [1959] who has produced vertical profiles of electron density along a section through the 75th meridian. These profiles show changes in height of the ionosphere along a North-South line. Our maps give somewhat similar information but in two dimensions. The decrease in height observed in the vicinity of 15° latitude is consistent with our observations. In figure 14 is a direct comparison of Wright's contours and ours.

IV. The Relationship Between Tropical Q(6300) and the Geomagnetic Field

Both the photometric (6300A) and the F-region ionospheric (f_OF2, $h'F_2$) phenomena show a synoptic dependence on the geomagnetic field. Each has a region of "singularity" about ± 15° from the magnetic (dip) equator. Direct evidence for the 15° preference in the case of 6300A has been obtained by Barbier, Weill, and Fafiotte [1961] and Barbier, Weill, Daguillon, and Marsan [1961] in two round-trip flights from France to South Africa. Two of Barbier's plots of Q(6300) versus dip latitude are shown in figures 15 and 16.

Similar observations on slow-moving ships are more difficult to interpret since seasonal and/or daily changes may mask the geographical term. The zenith observations from the research ship Eltanin as reported by Davis and Smith [1964] show a definite enhancement of 6300A at ± 15° magnetic latitude (figure 17).

The Japanese ship Soya has made several voyages between Japan and Antarctica with photometric equipment aboard. In figure 18 taken from Huruhata [1963] we show composite results illustrating the latitude changes of 6300A.

The literature on the F-region behavior in the tropics is extensive. In 1954, Appleton called attention to what he called a geographic anomaly in the distribution of f_OF2. In figure 19 we show his plots of f_OF2 versus magnetic latitude during the equinox for 0900, 1200, and 2100 local time. The "anomaly" shows up at the latter two times as a "bite out" or secondary minimum near the magnetic equator and maxima some 10° to 15° from the equator.

The effective height of the F layer and its change with latitude (magnetic) is shown in figure 14 taken from J. W. Wright [1959]. The iso-height lines clearly minimize about 15° from the magnetic equator.

We thus have a consistent picture of two phenomena, photometric and ionospheric, which correlate with each other via the Barbier formula and which both show a singular region approximately 15° from the magnetic equator. Later we shall review some of the attempts to rationalize the behavior of the F region in the tropics but here wish to return to the matter of its magnetic control.

A natural question arises as to whether there is any observable relationship between the tropical 6300A emission and planetary magnetic activity. In figure 20 we show a plot of nightly means of the zenith Q(6300) at Haleakala, including all of the data for a year, versus the planetary magnetic index Kp. There does not appear to be any evident relationship indicated by this scatter of points, but it is possible that the seasonal variation in Q(6300) (see Section VI) may be masking the effect. Thus, the seasonal variation was removed from the data and replotted in figure 21. There is no evident improvement as far as showing any relationship between the Q(6300) and Kp. It was then thought that since September, October, and November are the most active months in Q(6300), that these should be considered by themselves. Thus, in figure 22 we show only the Q(6300) data for those months versus Kp. There is perhaps a slight hint of some relationship evident, but we do not consider it significant. Removing the seasonal variation does not change the situation.

Various other things were tried such as using Q(6300) data from 80°S and 80°N along the meridian, but none of these showed any relationship to Kp.

We must conclude, then, that with this set of data and insofar as we have analyzed it, there does not appear to be any significant relationship between Q(6300) at Haleakala and the planetary magnetic index Kp. This result is perhaps somewhat surprising in view of the preceding statements about the magnetic control of the 6300A emissions.

V. The Alignment of Q(6300) Isophotes

The isophote maps can be roughly classified into two types: (1) those that show a "spotty" character with at least some of the isophotes making closed loops; and (2) those that show a somewhat "aligned" character with the isophotes roughly linear and parallel to each other.

The spotty character is often associated with the localized enhancements that have been discussed in some detail elsewhere in this report. The aligned character is almost always associated with morning and evening twilight effects, but also during the middle of the night there often appears to be a definite alignment.

It was felt that the directions of these alignments might not be purely random and that a determination of the preferred orientation, if any, would be of interest. For this study, the night was divided into three parts: (1) the "evening" period going from twilight to 1955; (2) the "midnight" period from 2155 to 0255; and (3) the "morning" period from 0410 into twilight. For each 15-minute interval during these periods for which an isophote map was available a determination was made as to whether the map was spotty or aligned. If aligned, the direction of alignment in the vicinity of the zenith was determined the direction being defined such that the brighter sky was to the left.

The analysis of 4,617 6300A isophote maps from July 1961 to July 1962 showed that 1,602 possessed an aligned character, and of these 188 were during the evening period, 728 were during the midnight period, and 180 were during the morning period. Figure 23 illustrates the frequency of occurrence of alignments during the year for the midnight period. Evidently they occur somewhat more frequently during the fall months than during the rest of the year, the period, also, when the average Q(6300) reaches a seasonal maximum. (see Section VI)

In figure 24 is plotted the azimuth of each evening alignment during the year. The solid curve on the graph represents the azimuth of the setting sun plus 90°. It is seen that the general trend of the alignments is to follow the solid curve, indicating that the increasing gradient of the evening airglow points in the general direction of the setting sun. This result is not at all surprising; rather, it is surprising that it does not point exactly in the direction of the setting sun, for it is seen that in the summer months the gradient points somewhat to the north of the setting sun, and somewhat to the south of the setting sun in the winter months.

The results for the morning period are plotted similarly in figure 25. Again, the same general conclusion follows: that the increasing gradient of the airglow points in the general direction of the rising sun, but in this case there is a rather consistent tendency for the direction to be somewhat north of the rising sun.

The midnight period maps showed alignments in all directions but a very high preponderance of alignments with an azimuth in the range of 281° to 290°. as illustrated in figure 26, which shows the number of alignments measured in each 10° interval of azimuth. The same data ~~is~~ are presented in figure 27 in the form of a polar plot. Shown also in figure 27 is the azimuth of the horizontal component of the geomagnetic field, 11° E of N.

One sees at once that the predominant direction of the isophotes is perpendicular to the direction of the geomagnetic field, with the gradient in the direction of the field, increasing from north to south. It seems highly unlikely that this is merely a coincidence and, in fact, is consistent with the concept of geomagnetic control of the 6300A emission as well as of the F region of the ionosphere as discussed in some detail in the previous section.

VI. The Seasonal Variation of Tropical Q(6300)

The airglow is a very complex phenomenon, as was pointed out in the introduction. It is almost certain that no single mechanism can account for all its aspects. Contributing to the total phenomenon there must be numerous factors such as the geomagnetic field, the equatorial electrojet, photochemical reactions, electric fields, collisions, solar radiation, etc. The search for seasonal variations in selected aspects of the airglow is an attempt to determine if there is any solar control and, if so, by what mechanism does it operate.

One of the aspects selected for study has been the position of the maximum intensity of Q(6300) along the meridian immediately after the end of twilight. If the latitude of the sun does have an influence on the distribution of the airglow, one would expect it to be most pronounced in the early evening. The observations do, in fact, show that there is a seasonal variation in the position of this maximum, moving southward in winter and northward in summer, in phase with the varying declination of the sun, as shown in figure 28.

These results were obtained from the analysis of data from 149 nights over a period of 13 months. The position of the evening maximum was measured on each night and these were averaged for each month. The results are shown in Table 7 in terms of the latitude of the maximum as well as the actual distance north (+) or south (-) of the observing site along the surface of the earth. The column headed "L" gives the value of McIlwain's [1961] "sheet parameter"* at a height of 300 km corresponding to the latitude of the maximum.

This seasonal variation is illustrated in another way in figure 29 where the relative intensity of Q(6300) just after twilight along the meridian has

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*In a perfect dipole field, L is the geocentric distance to the intersection of the pertinent line of force and the equatorial plane. In the actual field of the earth, L is approximately the same quantity as McIlwain uses. Points having a given value of L define a sheet on which a trapped particle is constrained to move.

been plotted for a number of nights during the year. The movement of the peak towards the south in the winter and towards the north in the summer is quite clear.

Another seasonal variation can be found by plotting the 3-month running means of the zenith intensity of 6300A during the hours 2200 to 0300 HST. The result is shown in figure 30, in which a pronounced maximum appears in September and a minimum in the months of January, February, and March. This is quite the reverse of the result obtained by A. and D. Delsemme [1960] who found a distinct maximum in March and a minimum in September at the southern hemisphere station (4° S Geomagnetic) at Lwiro. This suggests that the maxima and minima in both hemispheres occur at the equinoxes but out of phase with each other.

Still another device for illustrating a seasonal variation is shown in figures 31, 32, and 33. Here are arranged the mean hourly intensities for each hour of the night, for each month of the reporting period. The array becomes more intelligible by drawing in lines of equal intensity. The three charts represent different points along the meridian; 80° N, zenith, 80° S. In each case it can be seen that the morning hours are less bright than the evening hours. We also see that the south is always, on the average, brighter than the north, and in the south there is a clear indication that the months of September and October show the greatest degree of activity during the night.

A striking improvement in information value is obtained by taking the ratios of the intensities at 80° S with respect to 80° N. The result of this operation is shown in figure 34 where lines of equal ratio have been drawn in. The equinoctial months stand out as being those with the largest gradients along the meridian. During September at 0200 hrs., the south is brighter than the north by a factor of more than 6, on the average. In April the south reaches peaks relative to the north at 2300 hrs., as well as 0200 hrs. The only times when the north is brighter than the south are in the early evening hours from April to September and the late morning hours from February to July.

VII. The Interpretation of the 6300A Tropical Arcs

Any attempt to interpret the many diverse facts associated with the tropical 6300A arcs should grapple with the observations on two levels. We consider that there are two categories: (a) the prime facts, and (b) the secondary features. Ultimately a complete physical picture must be concerned with both, but it is well to search for a broad explanation with respect to the prime facts and subsequently modify it in detail as the secondary observational features are brought into the discussion.

In our opinion the prime facts are:

(a) There is a definitely established interrelationship between the 6300A tropical arcs and the F-region ionosphere,

(b) Both the 6300A arcs and the F-region ionosphere display a region of maximum intensity or activity some 15° (±) from the geomagnetic equator.

The ionospherists have for some time been concerned with the problem of the anomalous behavior of the tropical F-region. It appears that the ionospheric and optical phenomena have a common origin, and we propose to consider them together.

The prime facts indicate the general direction of the inquiry. We must be concerned with charged particles moving under the influence or constraint of the earth's magnetic field. Furthermore, the charged particles move into the F-region where they affect the balance of the ionization and enter into a photochemical reaction leading to the emission of 6300A and to a lesser extent 5577A. Now, if charged particles are moving along the geomagnetic lines in the vicinity of 15° of geomagnetic latitude there must necessarily be a vertical component of motion. This leads to two, and only two, possibilities. Either the vertical component of motion is upward or downward. A priori either direction might be considered as worthy of consideration. But two factors suggest that we should give greater weight to the downward hypothesis: (a) loss of ionization by collisions will be greater in the lower and denser parts of the atmosphere so that we may anticipate that the reservoir of ionization below the F-region would have difficulty in moving up the geomagnetic field lines; (b) gravity offers a force to propel the ionization downward.

The speculations have centered around the picture of ionization drifting sluggishly down from well above the equator to the F-region at 300 km at a latitude of about 15°. In figure 35 we show the general nature of the picture. For a terminal point at 15° latitude the equatorial origin is at 780 kilometers.

As early as 1946, Mitra offered the suggestion that the ionospheric tropical anomaly was caused by ionization in the 1000-kilometer region over the equator by the direct action of sunlight with subsequent drifting of the ionization down along the geomagnetic lines. In 1956, Martyn hypothesized that the origin of the ionization was in electrodynamic lift from the equatorial electrojet followed by a drift downward. Duncan [1960] calculated the ionization drift time to 20° magnetic latitude at various heights. In Table 8 we have assembled calculated drift times and supra-equatorial heights for pertinent latitudes based on Duncan's equations.

It is seen that a drift time of about 10 hours is required for particles originating at the equator at a height of about 780 km and arriving at the 300 km level at latitude 15°. Such a time is not inconsistent with a picture of the formation of particles at the equator, by either Mitra's or Martyn's mechanism, during the daytime and drifting to 15° latitude during the night resulting in the airglow emission.

It remains to demonstrate that such a mechanism could possibly account for the anomalous maximum in electron density located at about ± 15° geomagnetic latitude. Let us assume

1) an electron distribution over the geomagnetic equator similar to that found by Bowles [1962];
2) that electrons drift down along the magnetic field lines with drift times to the 300 km level as given in Table 8;
3) that the number of electrons per unit time reaching the 300 km level at a given latitude depends on the number density at the equator at a height corresponding to the field line passing through the 300 km level, and to the time of drift. It is assumed that electrons are lost during the drifting period by attachment at the rate of β per second. Hence, the rate at which electrons reach the 300 km level will be proportional to $n_e e^{-\beta t}$, where n_e is the appropriate supra-equatorial electron density and $\bar{t}$ is the drift times.

Shown is figure 36 curve (a) is a typical supra-equatorial electron density profile plotted versus the latitude corresponding to the intersection with the 300 km level of the magnetic field line passing through the appropriate supra-equatorial height. Curve (b) is the function $e^{-\beta t}$ where t is the drift time from Table 8 and β has been taken at 10^{-4}, as found from trial and error to give the best result. The curve representing the product of (a) and (b) shows a pronounced maximum around 15° latitude with this choice of β.

It is of interest to note that Ratcliffe, et al. [1956] found for the loss coefficient in the F-region a value of about 10^{-4} sec^{-1}.

It should be emphasized that these ideas are of a very tentative nature and are presented primarily to stimulate discussion on the problem.

ACKNOWLEDGMENTS

We wish to thank Miss Patricia Yap who, as a National Science Foundation Junior Science Apprentice, carried out the analysis of Section V. The helpful discussions with our colleagues, Drs. M. Huruhata, P. V. Kulkarni, and J. L. Weinberg are gratefully acknowledged.

REFERENCES

Appleton, E.V., J. Atmos. Terr. Phys. 5, 348 (1954)

Barbier, D., Ann. Geophys. 20, 22-33 (1964)

__________, Ann. Geophys. 17, 3 (1961)

__________, Ann. Geophys. 16, 544 (1960)

__________, Ann. Geophys. 15, 179-217 (1959)

__________, Ann. Geophys. 14, 334 (1958)

__________, C.R. Acad. Sci. 245, 1559-1561 (1957)

Barbier, D., F.E. Roach, and W.R. Steiger, J. Res. NBS 66D, 145-152 (1962)

Barbier, D., G. Weill, J. Daguillon, and J. Marsan, C.R. Acad. Sci. 252, 304 (1961)

Barbier, D., G. Weill, and M. Fafiotte, C.R. Acad. Sci. 252, 3102 (1961)

Barbier, D., G. Weill, and J. Glaume, Ann. Geophys. 17, 305-318 (1961)

Bowles, K.L., NBS Technical Note 169 (1962)

Carman, E.H. and B.C. Gibson-Wilde, J.G.R. 69, 487-491 (Feb. 1, 1964)

Chamberlain, J.W., Physics of the Aurora and Airglow, Academic Press (New York, 1961) p. 197

Davis, T.N. and L.L. Smith, in press (1964)

Delsemme, A. and D., Ann. Geophys. 16, 507-524 (1960)

Duncan, R.A., J. Atm. and Terr. Phys. 18, 89-100 (1960)

Huruhata, M., The Fourth International Symposium on Space Technology and Science, Proceedings, Tokyo, pp. 459-462 (1962)

__________, Japanese Antarctic Res. Expedition 1956-1962, Scientific Rept. Series A No. 2 (Oct. 1963)

Huruhata, M., T. Nakamura, H. Tanabe, and T. Tohmatsu, Rept. of Ion. & Space Res. Japan 13, 283-289 (1959)

McIlwain, C.E., J.G.R. 66, 3681 (1961)

Martyn, D.F., Austr. J. Phys. 9, 161 (1956)

Mitra, S.K., Nature 158, 668-669 (1946)

Packer, D.M., Ann. Geophys. 17, 67 (1961)

Peterson, V.L., in press (1964)

Purdy, C., L.R. Megill, and F.E. Roach, J. Res. NBS 65C, 213-216 (1961)

Ratcliffe, J.A., J. Atm. and Terr. Phys. 8, 260-269 (1956)

Ratcliffe, J.A., E.R. Schmerling, C.S.G.K. Setty, J.O. Thomas, Phil. Trans. Roy. Soc. A248, 621 (1956)

Roach, F.E., L.R. Megill, M.H. Rees, and E. Marovich, J. Atm. and Terr. Phys. 12, 171-186 (1958)

Roach, F.E. and H.B. Pettit, J. Geophys. Res. 56, 325 (1951)

Roach, F.E. and J.R. Roach, Planet. and Space Sci. 11, 523-545 (1963)

Roach, F.E. and L.L. Smith, in press (1964)

Saito, Bun-ichi, The Antarctic Record No. 14, pp. 1128-1130, Ministry of Education, Tokyo, Japan (Jan. 31, 1962)

Silverman, S.M. and M. Casaverde, J.G.R. 66, 323-326 (1961)

St. Amand, P., Ann. Geophys. 11, 450-460 (1955)

Wright, J.W., J.G.R. 65, 185-191 (Jan. 1960)

YAO, I.G., Annals of the IGY, Vol. XXIV (1962)

Zipf, E.C., Jr. and D.F. Heath, Trans. A.G.U. 43, 436 (Dec. 1962)

LIST OF FIGURES

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TABLE 1

Phenomenon	Q(6300) Rayleighs	Q(5577) Rayleighs	$\frac{Q(6300)}{Q(5577)}$	References
Aurora I.B.C. 111	50,000	100,000	1/2	Chamberlain (1961)
M-arc (typical)	6,000	?	(80)*	Roach and Roach (1963)
T-arc	500	100	5	Roach, Steiger, Brown (1964)
Mid-latitude Airglow	50	250	1/5	YAO (1962)

* On only one occasion (Barbier, 1960) has there been reported a concomitant enhancement of 6300 and 5577 in an M-arc with a ratio of 80.

Table 2. Log of 6300 A Zenith Observations

Night Observed	No. of Hours
1961	
July 18/19	8
19/20	8 1/2
20/21	7
Aug 2/3	4
3/4	5
5/6	6 1/2
6/7	6 1/2
7/8	8 1/2
9/10	6
10/11	8 1/2
11/12	8
12/13	9
13/14	9
14/15	8
15/16	7
16/17	5 1/2
8/31 - 9/1	4
Sept 1/2	9 1/2
2/3	5 1/2
3/4	4
4/5	6 1/2
5/6	8
6/7	6 1/2
7/8	8
10/11	4 1/2
11/12	8
12/13	9
13/14	8
14/15	9
15/16	7
16/17	6
17/18	5 1/2
Oct 1/2	5
4/5	8
5/6	4
6/7	7
7/8	5
8/9	5 1/2
10/11	7
11/12	8 1/2
Nov 3/4	9
4/5	9 1/2
5/6	5
6/7	9 1/2
7/8	10
8/9	10
9/10	10
10/11	10 1/2
11/12	9
12/13	7 1/2
16/17	2
28/29	8 1/2
29/30	6
11/30 - 12/1	2
Dec 9/10	11
10/11	9
14/15	2
15/16	3 1/2
30/31	5
12/31 - 1/1	6

Table 2, cont'd.

Night Observed	No. of Hours
1962	
Jan 1/2	8
2/3	9 1/2
3/4	5
4/5	10
5/6	1/2
10/11	7 1/2
11/12	6
13/14	4
26/27	2 1/2
29/30	7
30/31	4
Feb 2/3	8
3/4	10
4/5	10
5/6	10 1/2
6/7	9 1/2
7/8	3
8/9	7
9/10	6 1/2
10/11	6
11/12	5 1/2
12/13	3
Mar 1/2	8
2/3	9
3/4	1
5/6	4
6/7	8
7/8	6 1/2
10/11	4
25/26	3
26/27	1/2
30/31	7
3/31 - 4/1	8
Apr 1/2	9
2/3	9
3/4	9
4/5	9
5/6	8
6/7	5
7/8	8
8/9	5 1/2
9/10	5
10/11	2
26/27	1
28/29	2
29/30	7
4/30 - 5/1	3
May 1/2	1/2
4/5	2
5/6	8 1/2
6/7	1
10/11	3
11/12	3
23/24	2
24/25	4
25/26	5
26/27	5
28/29	7
29/30	8
5/31 - 6/1	2 1/2
June 1/2	8
2/3	8 1/2
3/4	3 1/2
4/5	7
5/6	6
6/7	6

Table 2, cont'd.

Night Observed	No. of Hours
7/8	5
8/9	4 1/2
10/11	3
11/12	2 1/2
12/13	2
13/14	1 1/2
14/15	1/2
23/24	4
24/25	4 1/2
25/26	5 1/2
26/27	6
27/28	7
28/29	7 1/2
29/30	8
6/30 - 7/1	8
July 5/6	6 1/2
7/8	5
9/10	1/2
10/11	3 1/2
12/13	2
13/14	1
14/15	1/2

TABLE 4

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

"0" entry indicates no data.

YEAR 1961 MONTH JUL

IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	162	117	83	94	101	81
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	307	175	186	168	116
8	0	0	0	0	0	0	0	0	0	0	155	129	143	147	143	170
9	0	0	0	0	0	0	0	0	0	0	122	79	94	62	73	66
10	0	0	0	0	0	0	0	0	0	0	76	99	82	69	89	81
11	0	0	0	0	0	0	0	0	0	0	145	105	79	77	66	66
12	0	0	0	0	0	0	0	0	0	0	411	364	204	208	265	130
13	0	0	0	0	0	0	0	0	0	0	0	72	67	60	47	39
14	0	0	0	0	0	0	0	0	0	0	0	0	86	84	78	77
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH JUL IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	60	61	73	99	88	66	53	54	64	73	68	92	75	0	0	0
5	0	0	94	1741	1779	2168	2254	2500	2552	3482	3370	2660	2656	3426	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	98	93	91	84	48	39	44	40	40	88	74	71	74	89	102	134
8	125	99	74	65	74	39	79	95	74	106	112	149	165	0	0	0
9	81	66	57	45	54	54	36	48	71	62	70	69	89	123	84	103
10	66	78	77	61	55	56	39	58	69	-0	58	75	73	130	94	113
11	72	46	38	61	61	31	44	57	57	85	77	99	94	101	114	126
12	113	156	136	118	114	115	64	48	67	59	95	96	102	91	116	63
13	49	44	46	45	69	77	48	64	60	65	71	87	48	59	45	76
14	98	73	54	28	41	53	86	92	76	66	82	176	78	124	76	69
15	77	61	62	59	59	60	65	58	50	0	0	0	0	0	0	0
16	0	0	0	0	0	41	40	51	70	46	93	43	72	43	52	53
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	15	46	52	45	35	62	62	46
19	0	0	0	0	0	0	0	68	133	111	147	253	331	247	322	441
20	0	0	0	0	0	0	0	0	0	0	23	39	24	23	21	30
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH JUL IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	86	74	83	85	154	0	0	0	0	0	0	0	0	0	0	0
8	272	152	134	95	50	74	71	0	0	0	0	0	0	0	0	0
9	137	109	117	98	53	83	36	37	52	38	69	0	0	0	0	0
10	121	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	161	143	117	124	111	122	74	100	160	117	84	0	0	0	0	0
12	73	67	-0	108	74	73	60	57	32	39	46	0	0	0	0	0
13	59	25	49	57	64	73	74	67	59	55	34	0	0	0	0	0
14	64	83	89	78	35	50	56	71	89	91	127	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	37	43	43	34	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	66	88	78	55	46	51	44	60	30	46	0	0	0	0	0	0
19	223	451	286	253	196	76	162	82	46	50	28	0	0	0	0	0
20	39	54	52	23	54	61	58	9	154	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH AUG IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	237	109	106	127	126	123
3	0	0	0	0	0	0	0	0	0	0	229	158	132	117	179	148
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	125	83	65	62	62	33	43
6	0	0	0	0	0	0	0	0	0	0	0	0	185	118	80	66
7	0	0	0	0	0	0	0	0	0	0	0	0	111	154	57	117
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	207	0	338	233	231
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	103
12	0	0	0	0	0	0	0	0	0	458	475	303	361	166	157	211
13	0	0	0	0	0	0	0	0	0	267	253	182	245	233	126	120
14	0	0	0	0	0	0	0	0	0	0	0	0	0	108	96	60
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH AUG IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	74	37	73	90	89	56	49	60	33	37	0	0	0	0	0	0
3	172	68	36	43	29	32	46	34	41	29	59	44	29	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	39	42	60	32	112	102	113	83	58	54	21	79	65	67	65	76
6	0	113	52	66	74	93	115	66	88	74	64	78	57	41	66	53
7	57	61	80	55	51	51	48	69	94	101	83	105	59	70	48	75
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	65	82	72	44	26	31	52	27	42	36	48	50	72	75	36
10	115	140	161	81	119	60	38	60	45	0	137	31	89	111	0	53
11	144	99	176	80	164	80	99	62	64	54	47	45	44	75	50	42
12	123	167	85	123	61	54	40	90	91	61	45	96	74	116	163	122
13	114	138	120	65	81	78	90	76	109	59	33	39	67	49	48	48
14	120	0	71	76	30	38	19	20	24	36	80	121	114	154	344	465
15	91	99	46	25	47	59	0	0	49	28	42	37	64	71	74	78
16	0	0	0	0	43	50	85	77	88	63	56	41	53	38	52	31
17	0	0	0	0	177	9280	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	57	55	34	50	41	41	36	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

IN UNITS OF RAYLEIGHS

YEAR 1961 MONTH AUG

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	77	83	68	0	0	0	0	0	0	0	0	0	0	0	0	0
6	65	59	50	35	59	54	0	0	0	0	0	0	0	0	0	0
7	92	67	100	79	107	87	101	71	40	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	77	70	65	53	63	91	102	82	86	0	0	0	0	0	0	0
10	41	34	89	165	94	67	64	65	35	28	49	46	0	0	0	0
11	52	28	50	85	71	71	94	92	74	80	89	66	0	0	0	0
12	117	163	173	128	151	104	133	132	131	89	95	68	0	0	0	0
13	80	87	123	118	124	89	56	45	19	17	18	32	12	0	0	0
14	295	256	190	225	482	0	43	71	63	72	0	31	31	0	0	0
15	101	72	88	87	70	60	75	51	60	69	95	69	0	0	0	0
16	51	38	43	30	37	68	64	94	97	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH SEP IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	176	167	192	126	0	178	0	-0
2	0	0	0	0	0	0	0	0	198	215	110	82	84	89	45	54
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	311	249	338	182	225	311	140	196	90
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	290	170	218
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	261	220	306	279	372	99	117	55
11	0	0	0	0	0	0	0	0	125	95	84	139	153	124	97	87
12	0	0	0	0	0	0	0	0	0	0	150	174	134	138	71	112
13	0	0	0	0	0	0	0	0	0	0	0	0	0	111	52	91
14	0	0	0	0	0	0	0	0	0	0	57	94	187	0	90	100
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	77	155	182
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH SEP IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	137	180	124	156	142	83	66	114	0	0	0	0	0	0	0	0
2	65	56	52	66	68	55	67	63	63	94	77	97	90	160	0	0
3	0	0	69	42	52	48	42	0	0	0	0	0	0	93	85	82
4	0	0	0	55	70	74	49	54	82	66	69	96	131	166	171	117
5	110	88	61	61	101	56	63	75	72	42	75	81	56	58	64	88
6	93	87	90	127	71	67	55	50	108	74	74	65	53	52	62	0
7	162	132	153	56	31	24	79	202	107	108	86	68	97	151	90	78
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	79	54	85	62	103	71	92	44	67	112	0	0	0	0	0	0
11	125	461	535	485	138	102	131	72	83	142	141	210	218	278	398	286
12	77	63	78	57	96	64	79	35	69	129	130	114	130	148	205	108
13	136	90	119	92	62	82	79	121	145	93	73	65	55	48	50	80
14	93	50	0	60	53	56	70	58	147	84	49	75	66	53	54	52
15	0	0	56	72	114	97	87	95	0	0	0	0	5	74	93	85
16	0	0	0	0	0	54	55	122	102	45	46	25	37	59	69	56
17	0	0	0	0	0	0	0	0	0	0	115	190	172	167	0	157
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH SEP IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	128	132	134	127	0	0	0	0	0	0	0	0	0	0	0	0
5	67	71	78	79	74	58	106	88	0	0	0	0	0	0	0	0
6	77	125	119	124	115	114	100	46	0	46	49	0	0	0	0	0
7	88	82	83	118	74	89	55	52	101	64	0	0	59	22	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	280	299	287	187	171	85	76	50	82	76	128	63	203	37	0	0
12	54	75	138	120	104	72	111	55	55	64	49	83	52	35	0	0
13	78	66	145	86	137	84	112	112	94	100	48	32	73	19	0	0
14	69	84	126	163	93	120	111	68	63	95	68	79	67	57	0	0
15	107	82	80	89	96	78	60	0	57	0	61	58	31	14	0	0
16	72	54	50	60	65	92	41	44	38	62	33	52	62	38	0	0
17	186	332	197	122	112	97	45	177	72	67	97	26	25	96	332	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH OCT IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	215	241	212	216	259	224	237	282	377	218
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	557	506	594	445	463	401	385	350	246
5	0	0	0	0	0	0	165	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	321	380	306	574	436	0	0	0	271	257
7	0	0	0	0	0	0	196	369	283	208	126	192	134	144	0	122
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	774	0	212	300	207	209	108	100	128
11	0	0	0	0	0	0	0	0	0	0	0	0	504	507	513	344
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH OCT IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	183	292	149	81	52	74	77	52	63	64	63	74	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	185	150	203	243	198	357	352	321	166	245	175	338	170	358	172	94
5	0	0	0	0	0	0	0	99	90	98	90	82	-0	63	57	120
6	110	160	145	196	152	157	164	136	87	88	76	58	66	54	104	68
7	98	111	95	96	120	100	81	88	101	99	120	94	0	127	162	130
8	0	91	64	79	68	84	90	85	80	81	86	109	74	59	56	66
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	99	43	114	102	71	58	83	82	65	104	67	104	62	42	72	26
11	385	430	276	338	284	165	157	118	116	113	90	98	66	72	100	57
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH OCT IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	82	182	133	221	209	214	0	0	0	0	0	0	0	0	0	0
5	79	130	73	87	63	68	90	96	64	84	0	0	0	0	0	0
6	70	74	66	85	112	99	122	80	111	99	115	86	84	63	0	0
7	99	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	53	54	72	113	79	79	83	72	70	98	59	63	133	40	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	42	24	25	0	0	0	0	0	0	0	0	0	0	0	0	0
11	120	75	160	115	109	94	83	75	84	75	56	40	44	32	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH NOV IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	172	279	166	199	103	157	130	115	128	132	135	185
4	0	0	0	0	0	0	0	0	182	180	171	137	120	62	64	72
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	134	156	138	106	114	84	123	110
7	0	0	0	0	0	276	182	117	150	101	122	190	150	180	100	177
8	0	0	0	0	194	359	160	190	207	240	128	135	111	50	144	109
9	0	0	0	0	374	245	169	16	139	85	101	136	112	106	115	122
10	0	0	0	0	0	0	0	0	174	37	107	113	103	94	5	120
11	0	0	0	0	0	0	0	0	0	0	0	0	0	199	103	150
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	207	201	151	133	89	54	73	71	44	64	63
29	0	0	0	0	191	190	174	123	86	70	85	105	72	61	79	86
30	0	0	0	0	0	0	147	218	133	109	82	87	113	104	50	97

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH NOV IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	83	0	79	0	126	118	148	137	109	88	85	84	57	81	74	81
4	51	90	59	51	61	122	18	25	18	163	113	122	111	63	133	82
5	0	120	182	187	114	117	46	103	120	63	89	136	77	45	0	87
6	111	206	163	149	179	113	130	118	134	151	181	177	172	128	108	127
7	117	115	100	82	57	141	74	55	66	90	100	123	107	73	35	71
8	125	122	81	96	123	114	101	114	117	127	110	130	95	83	67	78
9	137	101	107	82	106	120	75	61	79	45	31	86	80	64	31	80
10	71	95	87	85	69	87	60	71	59	82	78	61	54	59	65	46
11	96	74	64	86	61	45	90	95	72	106	160	220	109	134	132	80
12	53	74	78	154	56	98	62	70	51	46	29	39	54	59	42	40
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	64	85	65	69	134	86	50	45	0	0	0	0	0	0	0	0
29	70	60	37	35	32	58	22	51	57	56	38	0	0	0	0	0
30	100	107	159	95	139	112	110	152	172	145	135	115	106	113	115	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH NOV IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	58	72	47	89	52	66	51	0	0	0	0	0	0	0	0	0
4	72	131	0	117	114	130	88	213	125	95	0	0	0	0	0	0
5	72	67	234	122	166	114	108	86	84	151	114	193	72	140	83	0
6	104	136	0	56	97	93	147	47	89	80	89	83	110	64	86	0
7	126	92	156	89	55	52	67	57	107	71	210	38	55	0	57	0
8	52	82	92	88	92	86	82	80	65	88	69	68	56	26	18	0
9	29	22	57	20	28	35	51	42	35	94	51	53	48	0	0	0
10	52	69	69	76	52	77	52	53	34	95	51	60	75	64	51	0
11	110	104	107	117	130	74	99	56	85	63	98	34	68	42	59	0
12	41	43	48	38	54	57	34	38	43	40	66	62	95	73	29	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	103	60	58	45	54	76	53	56	84	60	22	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH DEC IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	79	92	59	50	46	43	41	54	45
10	0	0	0	0	0	0	0	0	0	0	0	82	66	95	95	128
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	286	228	214	154	139	128	120	107	107	124	120
31	0	0	0	0	0	0	215	139	113	131	94	99	0	91	61	78

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH DEC IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	55	64	54	48	48	54	46	31	26	39	26	15	40	17	28	39
10	108	110	87	67	94	59	107	74	51	51	52	90	39	44	63	42
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	61	78	76	76	80	54	38	80	45	59	55	41	38	26	20	31
31	70	76	97	62	55	73	45	46	57	43	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1961 MONTH DEC IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	22	46	34	36	35	30	31	27	23	36	32	46	45	36	69	80
10	32	36	25	0	35	62	74	73	154	106	103	91	83	119	74	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	108	109	82	63	75	54	32	0	39	33
15	0	31	42	42	30	38	25	25	28	26	31	22	0	43	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JAN IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	159	123	111	73	91	82	77	58	64	73	75
2	0	0	0	0	0	185	182	171	98	80	82	78	80	0	68	49
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	92	128	75	74	80	0	26	49	44	40	50
5	0	0	0	0	0	80	71	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	147	120	114	107	62	60	36	36	52	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	212	231	124	83	72	62	70	51	71	76
30	0	0	0	0	0	0	169	0	102	93	83	123	96	46	73	75
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JAN IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	68	60	58	47	26	29	29	14	10	40	15	29	9	27	10	33
2	0	50	60	72	25	44	34	41	6	25	29	30	30	25	22	21
3	0	0	0	0	0	0	0	0	0	0	0	27	21	6	15	10
4	49	74	66	42	37	44	31	42	35	26	27	41	25	25	16	26
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	11	24	17	29	25	22	41	22	24	28	33
11	0	0	0	0	0	0	0	12	0	4	13	11	15	13	11	32
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	70	75	53	48	45	42	23	34	53	36	24	36	24	32	35	37
30	51	74	64	44	49	50	34	47	22	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JAN IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	24	35	29	55	47	92	70	36	0	0	0	0	0	0	0	0
2	38	15	30	11	41	41	44	71	39	41	44	0	0	0	0	0
3	24	36	12	0	18	26	20	33	16	22	18	33	23	31	32	0
4	21	45	26	26	21	23	79	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	39	46	60	74	75	80	95	0	55	62	34	35	36	0	26	34
11	30	28	26	27	66	42	65	50	43	32	37	37	53	29	50	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	34	39	36	35	47	66	65	71	53	56	35	43	46	43	33	38
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962   MONTH FEB   IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	21	37	-0	0
3	0	0	0	0	0	0	231	192	136	161	42	32	48	31	30	53
4	0	0	0	0	0	0	0	129	109	92	57	101	0	122	107	79
5	0	0	0	0	0	0	59	123	93	98	75	36	11	50	43	36
6	0	0	0	0	0	0	0	0	0	0	74	42	27	51	31	41
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH FEB IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	60	67	69	47	27	26	32	41	41	48	59	49	31	42
3	63	79	100	62	74	40	43	51	49	39	46	38	33	57	65	73
4	45	41	47	50	35	53	17	40	35	51	28	56	37	53	47	52
5	62	81	175	85	97	37	99	45	49	45	19	61	26	40	46	36
6	34	50	55	51	71	65	57	30	32	42	27	54	34	31	24	47
7	0	37	37	56	48	46	29	31	44	24	17	16	46	0	0	0
8	0	0	0	29	25	20	20	5	17	16	18	28	44	34	36	23
9	0	0	0	0	0	0	45	34	34	34	37	41	43	22	35	34
10	0	0	0	0	0	0	0	0	0	0	42	43	17	16	38	31
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	27
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH FEB

IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	45	43	29	41	35	47	64	44	40	30	26	34	25	14	35	0
3	71	69	66	37	42	77	20	33	42	36	20	22	17	24	32	0
4	61	66	49	71	47	35	34	22	33	27	19	26	17	18	0	69
5	17	28	19	21	30	47	43	26	19	29	27	21	27	7	0	15
6	36	24	33	67	58	62	56	35	17	30	18	18	18	17	0	21
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	48	35	45	45	37	36	31	30	24	27	25	26	29	-0	78	64
9	20	42	35	28	23	31	34	48	35	47	30	31	23	0	19	17
10	44	39	39	24	21	56	18	17	21	33	42	24	22	0	40	50
11	18	34	49	31	49	65	40	35	54	44	53	52	42	41	38	46
12	0	0	40	63	62	42	81	26	32	57	79	70	102	121	62	57
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAR

IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	110	272	88	172	118	84	79	71	78
2	0	0	0	0	0	0	0	272	140	237	125	97	63	71	86	79
3	0	0	0	0	0	0	0	222	154	132	80	103	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	72	74	97	49	50	47	52
7	0	0	0	0	0	0	0	0	0	0	0	6456	6151	5405	6128	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	424	283	521	252	257	150	256
26	0	0	0	0	0	0	0	0	785	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	265	283	312	244	221	200	91	158
31	0	0	0	0	0	0	0	0	187	134	78	84	85	60	70	25

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAR IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	51	47	44	36	54	36	44	18	5	19	38	56	35	43	37	45
2	38	43	63	49	68	55	47	41	35	25	48	45	46	44	44	33
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	84	56	46	0	0	0	0	0	0	0	0	0
6	64	56	57	0	0	0	51	96	36	47	34	43	58	57	40	37
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	46	48	50	60	49	27	39
10	0	0	0	0	0	88	74	55	50	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	194	152	76	80	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	35	134	24	58	5	51	19	65	67	73	87	84	89	62	80	72
31	41	74	55	67	52	58	54	62	64	74	98	89	74	78	83	72

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAR IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	43	42	36	59	32	27	27	0	0	0	0	0	0	0	0	0
2	35	37	38	40	48	42	11	13	0	28	25	17	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	28	41	31	37	56	38	0	0	42	38	44	34	29	40	33	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	42	34	42	27	46	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	128	88	80	48	151	0	0	0	0	0	0	0	0	0	0
31	114	57	37	36	57	32	28	30	29	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH APR IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	188	158	187	109	89	68	77	44
2	0	0	0	0	0	0	0	0	133	143	95	94	63	56	59	68
3	0	0	0	0	0	0	0	406	232	151	156	82	118	71	56	28
4	0	0	0	0	0	0	0	0	0	111	105	120	79	61	47	36
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	43
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	16
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	68	86	68	76	81	55
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH APR IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	21	39	19	14	19	16	18	25	33	26	23	56	30	47	22	36
2	33	53	51	33	40	28	41	33	38	42	60	98	76	54	81	25
3	64	29	15	18	47	41	44	31	37	49	49	23	13	24	9	14
4	42	36	16	25	16	29	23	36	31	25	33	42	40	33	38	0
5	47	43	20	27	13	39	42	47	47	56	63	43	25	32	29	86
6	0	0	0	0	0	0	0	0	0	38	44	60	34	26	28	29
7	0	0	39	37	26	16	32	14	22	32	30	32	26	39	0	34
8	0	0	0	0	0	0	0	19	13	15	26	26	22	62	0	52
9	0	0	0	0	0	0	0	0	0	43	41	51	26	0	44	17
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	35	96	57	29	114	76	113	151	141	0	235	270	317	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	50	67	80	56	30
29	48	38	40	37	0	34	28	23	61	83	36	24	21	56	46	49
30	0	0	0	0	0	0	0	0	0	0	0	0	0	92	64	61

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH APR IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	45	39	38	44	56	54	39	25	54	43	40	32	0	0	0
2	142	56	57	73	48	31	41	33	28	23	20	26	22	0	0	0
3	7	20	13	26	50	57	52	39	28	47	54	29	21	0	0	0
4	31	47	44	33	45	46	34	36	20	16	17	23	47	0	0	0
5	39	37	32	41	21	24	47	47	71	112	84	79	72	0	0	0
6	33	47	35	55	68	54	33	42	46	36	41	40	47	0	0	0
7	22	47	56	62	62	57	35	44	50	35	34	35	40	0	0	0
8	48	40	75	51	63	39	36	31	29	29	26	33	54	0	0	0
9	20	24	21	29	31	22	16	37	39	48	52	46	64	0	0	0
10	0	0	0	34	29	30	36	52	27	36	55	40	55	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	90	59	70	74	106	0	0	0	0	0	0	0	0	0	0	0
29	43	40	47	55	32	36	20	0	0	0	0	0	0	0	0	0
30	74	117	72	35	46	73	80	51	79	97	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAY IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	200	259	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	315	273	0	0	0	248	81	63
5	0	0	0	0	0	0	0	0	0	0	0	97	67	72	53	48
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	29	35	47
24	0	0	0	0	0	0	0	0	0	325	264	181	207	113	106	37
25	0	0	0	0	0	0	0	0	0	141	351	149	140	80	97	107
26	0	0	0	0	0	0	0	0	0	0	200	137	167	228	72	80
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	339	29	40	850	0
29	0	0	0	0	0	0	0	0	0	191	335	98	66	99	93	85
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	36	37	97

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAY IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	66	0	0	0	0	0	0	0	34	32	35	50	37	47	56	39
5	21	38	96	57	33	72	109	0	83	36	0	50	0	40	66	77
6	0	0	0	0	0	0	0	0	0	0	29	42	37	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	67
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	78	46	0	47	27	0	0	0	0	0	0	0	0	0	0	0
24	66	43	67	67	32	61	24	23	19	0	0	0	0	0	0	0
25	54	0	41	17	22	27	38	73	63	82	79	58	98	0	0	0
26	59	0	29	36	38	27	53	79	47	47	37	73	68	80	66	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	142	212	149	0	144	0	37	0	17	13	151	0	0	31	0	5
29	10	64	66	62	117	80	108	97	88	65	75	161	60	78	92	67
30	0	0	0	0	30	255	17	0	26	0	0	8	165	39	60	1
31	0	54	53	83	11	48	50	75	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH MAY

IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	66	147	70	58	134	62	41	57	54	0	0	0	0	0	0	0
5	120	75	60	102	87	104	70	43	37	26	66	48	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	83	78	92	52	63	41	54	36	18	61	34	8	0	0	0	0
11	80	88	85	60	73	87	85	72	70	82	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	17	15	0	32	0	0	0	0	0	0	0	0	0	0	0	0
29	93	115	53	47	55	37	27	50	35	33	0	0	0	0	0	0
30	53	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUN IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	239	0	210	41	32	16
2	0	0	0	0	0	0	0	0	0	0	0	197	533	345	194	32
3	0	0	0	0	0	0	0	0	0	0	0	331	199	66	52	112
4	0	0	0	0	0	0	0	0	0	0	0	0	0	188	6	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	51	25	8	0	9
24	0	0	0	0	0	0	0	0	0	0	0	172	144	117	115	91
25	0	0	0	0	0	0	0	0	0	0	447	437	211	337	323	207
26	0	0	0	0	0	0	0	0	0	0	128	101	167	61	93	58
27	0	0	0	0	0	0	0	0	0	0	0	45	316	164	0	229
28	0	0	0	0	0	0	0	0	0	0	71	80	76	-0	57	106
29	0	0	0	0	0	0	0	0	0	0	0	65	56	41	19	34
30	0	0	0	0	0	0	0	0	0	0	0	5	52	0	7	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUN IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	5393	19	13	44	16	58	0	110	162	0	41	0	8	87	0	46
2	218	81	19	53	23	20	21	86	4	8	37	30	87	26	0	19
3	23	37	23	20	12	16	18	0	0	0	0	0	0	0	0	0
4	46	73	7	218	72	8	55	71	33	46	0	8	11	29	16	17
5	0	43	24	37	0	0	53	0	-0	0	24	0	28	9	16	43
6	0	0	0	0	5	95	20	25	2	330	0	0	0	19	11	26
7	0	0	0	0	0	0	0	63	85	61	74	0	9	59	75	71
8	0	0	0	0	0	0	0	0	0	0	37	0	65	46	10	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	98
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	7	10	0	67	0	0	0	0	0	0	0	0	0	0	0	0
24	49	124	86	58	95	22	64	93	0	50	95	119	65	0	0	0
25	167	205	275	146	107	149	69	37	104	62	56	139	132	68	101	84
26	39	59	43	68	75	29	21	53	243	37	30	59	39	74	77	69
27	84	21	30	21	34	11	75	35	14	66	24	118	130	72	103	100
28	82	72	27	0	39	30	33	174	189	122	38	41	64	83	70	84
29	0	26	50	37	31	50	43	37	58	10	51	29	19	21	34	0
30	62	0	0	0	0	0	3	0	0	0	0	0	40	0	0	7

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUN IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	125	18	0	129	0	21	29	102	0	27	0	0	0	0	0
2	7	0	106	4	99	53	19	7	13	100	-0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	69	0	95	40	15	199	90	73	68	31	65	0	0	0	0	0
5	22	0	0	40	8	56	119	10	14	58	0	0	0	0	0	0
6	4	22	26	0	0	0	0	0	13	5	0	0	0	0	0	0
7	14	16	58	49	25	81	39	52	145	166	162	0	0	0	0	0
8	14	89	40	3	56	0	90	75	118	76	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	68	92	123	23	170	205	66	115	61	77	46	0	0	0	0	0
11	0	41	121	19	69	3	13	52	14	29	45	0	0	0	0	0
12	0	0	0	0	129	10	5	44	0	17	16	0	0	0	0	0
13	0	0	0	0	0	13	48	40	41	57	54	0	0	0	0	0
14	0	0	0	0	0	0	0	0	228	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	56	71	44	0	0	0	0	0	0	0	0	0	0	0	0	0
27	49	108	75	191	0	-0	0	0	0	0	0	0	0	0	0	0
28	79	119	170	184	121	84	50	98	19	0	0	0	0	0	0	0
29	3	14	76	47	86	37	48	56	76	58	102	0	0	0	0	0
30	60	143	46	22	69	179	32	36	0	29	27	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUL IN UNITS OF RAYLEIGHS

DAY	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	147	104	75	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	231	236	443	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	229	312	111
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	94	79	48	177	315
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
26	0	0	0	0	0	0	0	0	0	0	0	116	78	42	355	44
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	175	92	52	76	112	43
29	0	0	0	0	0	0	0	0	0	0	140	59	38	33	58	43
30	0	0	0	0	0	0	0	0	0	0	0	0	41	47	33	67
31	0	0	0	0	0	0	0	0	0	0	163	218	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUL IN UNITS OF RAYLEIGHS

DAY	2200	2215	2230	2245	2300	2315	2330	2345	0000	0015	0030	0045	0100	0115	0130	0145
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	-0	0	0	0	0	0	0	0
5	0	0	-0	30	62	67	42	41	50	29	89	46	68	58	78	32
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	50	33	51	42	44	47	68	73	114	139
8	0	0	0	42	0	0	1121	182	148	97	84	75	150	93	41	54
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	41	10	40
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	91	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	0
23	54	380	49	47	67	93	62	73	34	74	106	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	76	43	0	0	482	64	29	0	8	5	165	174	1107	74	0	0
26	0	0	114	5	42	8	38	0	0	20	0	21	89	36	72	58
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	42	8	28	26	61	67	21	118	16	80	28	88	127	134	102
29	134	14	34	20	72	40	53	131	0	44	14	32	62	60	102	101
30	21	4	39	34	39	34	9	0	0	0	0	0	0	0	0	0
31	0	0	75	48	71	18	0	0	0	0	0	0	0	0	0	0

6300A AIRGLOW ZENITH INTENSITIES
HALEAKALA, HAWAII

YEAR 1962 MONTH JUL IN UNITS OF RAYLEIGHS

DAY	0200	0215	0230	0245	0300	0315	0330	0345	0400	0415	0430	0445	0500	0515	0530	0545
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	51	60	55	67	51	35	122	83	126	98	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	30	84	52	48	76	47	43	28	55	36	93	0	0	0	0	0
8	26	33	33	32	9	54	76	6	36	10	10	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0
10	66	214	97	59	101	25	9	0	0	11	72	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	47	10	21	17	29	18	31	38	0	0	0	0	0
13	0	0	0	0	0	0	0	37	49	49	56	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	22	25	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	112	36	49	17	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	-0	0	0	0	0	0	0	0	0	0	0	0	0
28	93	124	78	116	79	77	36	0	0	0	0	0	0	0	0	0
29	93	85	77	115	0	0	0	57	50	27	20	44	0	0	0	0
30	0	117	27	61	81	29	13	22	14	23	16	84	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: Observations Observed and Calculated Q(6300) Together With

Selected Ionospheric and Geomagnetic Data for 93 Nights

DATE		MEAN* IONOSPHERIC PARAMETERS			MEAN* Q(6300) (rayleighs)		Kp
Month	Day	f_oF_2 (Mc/s)	$h'F_2$ (km)	E	Obs.	Calc.	
1961							
9	5/6	5.1	260	5.88	65	77	1-, 1+, 1+
9	11/12	9.3	228	50.26	259	248	5_o, 3_o, 2+
10	5/6	4.5	240	11.8	73	157	1+, 2-, 1+
10	8/9	3.2	244	3.97	89	85	1_o, 1-, 0+
10	11/12	5.9	236	19.62	94	154	4_o, 3-, 3-
10	19/20	3.5	241	5.63	85	80	1+, 2-, 0+
10	24/25	3.5	233	5.52	100	101	1_o, 1_o, 2+
11	4/5	3.8	245	6.46	94	110	3_o, 3_o, 5-
11	5/6	3.9	238	9.08	105	108	5-, 4_o, 2+
11	6/7	5.0	225	13.48	150	155	4+, 5_o, 4+
11	7/8	3.7	237	6.99	72	87	4_o, 2_o, 3+
11	8/9	4.2	226	9.40	89	96	4-, 2+, 2+
11	9/10	2.8	236	5.13	59	70	1_o, 1_o, 1_o
11	10/11	2.7	234	3.58	63	67	1-, 0+, 0+
11	11/12	4.8	232	10.52	103	113	3+, 2+, 3_o
11	12/13	3.0	237	4.20	54	58	1-, 1-, 0_o
11	16/17	2.6	209	5.60	79	84	1_o, 1-, 4_o
11	19/20	2.8	232	4.28	100	112	4-, 3-, 4-
11	27/28	3.2	250	3.36	63	76	0_o, 0+, 0+
11	28/29	3.1	254	2.85	38	41	1_o, 0+, 0+
11	29/30	3.3	239	4.36	44	45	1_o, 0_o, 0+
12	9/10	2.5	248	2.84	39	47	0+, 2_o, 2-
12	10/11	3.3	257	5.00	60	93	4-, 3_o, 1+
12	15/16	2.8	230	3.88	34	48	1+, 1_o, 1-
12	30/31	2.6	285	1.37	41	41	1+, 1+, 1+
12	31/1	2.2	304	1.25	36	30	1_o, 1-, 1-

* MEANS are for 5 hrs., 2200-0300

Table 5, cont'd.

DATE		MEAN IONOSPHERIC PARAMETERS			MEAN Q(6300) (rayleighs)		Kp
Month	Day	f_oF_2 (Mc/s)	$h'F_2$ (km)	E	Obs.	Calc.	
1962							
1	1/2	2.5	287	1.65	29	32	3_o, 3+, 2-
1	2/3	2.3	270	1.62	32	30	0_o, 1-, 1-
1	3/4	2.0	250	0.88	15	15	0+, 1-, 0_o
1	29/30	2.9	248	2.33	35	30	2+, 2-, 2_o
1	30/31	2.9	236	3.71	50	52	0+, 0_o, 0_o
2	2/3	3.2	234	4.87	49	50	1+, 0+, 1-
2	3/4	3.7	223	7.95	63	69	2-, 3+, 5_o
2	4/5	3.4	250	4.59	45	56	0+, 1-, 2-
2	5/6	2.9	228	5.48	48	59	1-, 1_o, 1-
2	6/7	3.1	242	3.88	42	50	4-, 4_o, 3+
2	7/8	2.8	236	3.43	34	47	1-, 2-, 2-
2	8/9	2.6	257	3.26	31	51	1_o, 1_o, 2_o
2	9/10	2.9	243	3.05	33	38	0+, 0+, 1_o
2	10/11	2.5	262	1.66	28	33	0+, 3-, 3-
2	11/12	3.2	257	2.79	28	61	3_o, 3-, 2_o
2	12/13	2.3	258	1.56	36	40	2-, 3+, 3-
3	1/2	3.6	234	6.12	31	37	2_o, 1-, 3-
3	2/3	3.6	222	7.44	52	55	1-, 1_o, 3+
3	5/6	3.4	246	4.79	67	35	4+, 4+, 6-
3	6/7	3.4	229	5.31	45	50	3_o, 2-, 2+
3	7/8	3.8	237	6.02	58	58	1_o, 0_o, 0+
3	10/11	3.2	244	4.18	61	62	2+, 3_o, 2-
3	31/1	4.9	233	11.24	64	66	4-, 4-, 2+
4	1/2	3.5	251	4.04	35	47	0+, 1_o, 1_o
4	2/3	4.3	247	8.18	51	67	4-, 2_o, 2-
4	3/4	4.9	252	7.12	35	42	4-, 4_o, 2-
4	4/5	3.5	252	3.93	33	33	1-, 2-, 1_o
4	7/8	3.9	276	3.97	36	40	3_o, 3-, 4-
4	8/9	4.6	264	5.82	31	40	3_o, 2-, 3_o
4	9/10	4.4	290	2.43	20	25	2_o, 4+, 5_o
4	26/27	6.5	241	24.65	98	153	2-, 2-, 1+

Table 5, cont'd.

DATE		MEAN IONOSPHERIC PARAMETERS			MEAN Q(6300) (rayleighs)		Kp
Month	Day	f_oF_2 (Mc/s)	$h'F_2$ (km)	E	Obs.	Calc.	
1962							
4	28/29	5.3	261	6.21	73	78	1_o, 1+, 2+
4	29/30	5.6	282	4.75	35	100	1−, 1−, 0+
4	30/1	5.3	260	8.27	73	76	1_o, 1_o, 1−
5	5/6	6.9	267	9.43	69	69	1+, 3+, 4+
5	10/11	6.9	267	9.30	76	68	1+, 0+, 3_o
5	11/12	7.2	269	9.34	84	85	1+, 1_o, 0+
5	23/24	6.8	261	10.90	93	101	0+, 0+, 0_o
5	24/25	6.1	260	8.32	48	51	0_o, 0+, 0+
5	25/26	7.7	257	15.85	73	84	1−, 1−, 1_o
5	26/27	7.8	288	6.87	62	58	3−, 2+, 3_o
5	28/29	6.3	265	12.84	22	27	2+, 2−, 1+
5	29/30	6.9	245	17.80	86	94	1_o, 0+, 1_o
5	31/1	7.1	271	8.29	54	54	3_o, 3−, 2_o
6	1/2	7.1	250	15.10	33	34	1−, 2−, 1−
6	4/5	7.2	265	12.22	25	30	2+, 2_o, 1_o
6	6/7	5.8	288	4.24	11	11	4−, 3−, 2_o
6	7/8	5.7	262	8.12	88	72	1+, 1−, 1−
6	8/9	7.7	274	11.12	77	107	3+, 4−, 4−
6	10/11	6.7	268	9.44	68	82	2_o, 1+, 2−
6	11/12	7.7	250	19.61	91	136	2+, 2+, 3−
6	12/13	6.2	261	9.27	60	67	2+, 2−, 1−
6	13/14	8.2	235	31.18	148	152	2−, 2−, 2−
6	14/15	5.8	271	6.27	8	9	2_o, 2_o, 3_o
6	15/16	5.5	264	6.66	8	8	1_o, 1_o, 1+
6	23/24	7.3	259	13.2	84	97	2_o, 2−, 1+
6	24/25	7.3	253	15.20	110	99	3−, 1+, 1+
6	25/26	6.3	243	17.50	103	125	2_o, 1+, 1+
6	26/27	7.0	——	——	40		4−, 3_o, 4_o
6	27/28	6.2	259	10.32	62	74	3+, 4−, 4−

Table 5, cont'd.

DATE		MEAN IONOSPHERIC PARAMETERS			MEAN Q(6300) (rayleighs)		Kp
Month	Day	f_oF_2 (Mc/s)	$h'F_2$ (km)	E	Obs.	Calc.	
1962							
6	28/29	5.2	259	6.60	89	83	3_o, 3-, 3+
6	29/30	5.3	285	4.18	41	61	3+, 3_o, 2_o
6	30/1	6.1	250	11.44	84	100	3-, 3_o, 2+
7	5/6	6.4	274	6.81	61	72	3-, 4-, 2_o
7	10/11	5.4	247	11.51	87	91	3-, 2_o, 3-
7	12/13	5.2	258	6.81	39	38	2-, 1+, 3-
7	13/14	6.4	258	12.10	84	104	3-, 2-, 2-

Table 6: Correlation Between Observed and Calculated Q(6300) for Various Values of Scale Height

Date			Correlation Coefficient			No. of Observations Used
Yr.	Mo.	Night	H = 30 km	40 km	50 km	
61	9	5/6	0.979	0.980	0.978	39
		11/12	761	707	660	39
	10	5/6	943	946	948	24
		8/9	810	869	904	27
		11/12	934	969	984	32
		19/20	920	932	925	11
		24/25	911	904	899	15
	11	4/5	939	944	945	42
		5/6	954	954	950	25
		6/7	934	927	913	35
		7/8	908	941	955	36
		8/9	944	942	938	44
		9/10	888	887	879	39
		10/11	872	894	899	45
		11/12	973	970	958	44
		12/13	572	648	696	35
		16/17	578	689	743	24
		19/20	756	770	776	28
		27/28	350	340	316	38
		28/29	938	937	931	40
		29/30	972	973	972	32
	12	9/10	879	888	887	27
		10/11	587	608	621	19
		15/16	010	120	231	8
		30/31	773	832	861	36
		31/1	882	915	930	19
62	1	1/2	724	772	794	42
		2/3	941	950	953	41
		3/4	905	891	877	7
		29/30	962	965	968	11
		30/31	943	951	956	8
	2	2/3	436	521	575	30
		3/4	819	802	782	44
		4/5	814	778	744	41
		5/6	562	597	600	41
		6/7	487	545	567	41
		7/8	937	957	966	23
		8/9	515	501	492	25

Table 6, cont'd.

Date Yr.	Mo.	Night	Correlation Coefficient H = 30 km	40 km	50 km	No. of Observations Used
		9/10	0.620	0.590	0.564	34
		10/11	667	694	705	34
		11/12	835	859	875	16
		12/13	939	950	951	24
	3	1/2	722	847	899	37
		2/3	816	884	910	39
		5/6	919	944	959	4
		6/7	074	187	271	33
		7/8	277	243	221	7
		10/11	797	832	853	26
		31/1	255	236	221	23
	4	1/2	772	778	781	39
		2/3	417	416	413	33
		3/4	829	831	831	40
		4/5	953	958	961	31
		7/8	713	740	755	34
		8/9	904	907	902	40
		9/10	725	677	608	31
		26/27	037	056	075	13
		28/29	727	622	499	3
		29/30	223	172	125	14
		30/1	-0.055	-0.098	-0.127	14
	5	5/6	0.660	0.645	0.627	28
		10/11	954	940	930	9
		11/12	840	853	863	3
		23/24	683	594	474	33
		24/25	929	943	948	32
		25/26	830	849	850	31
		26/27	810	844	860	21
		28/29	920	937	941	26
		29/30	383	437	477	25
		31/1	420	419	419	7
	6	1/2	1.000	1.000	1.000	2
		4/5	0.667	0.634	0.590	27
		6/7	863	865	860	33
		7/8	911	928	936	34
		8/9	710	703	688	34
		10/11	368	343	310	36
		11/12	867	849	834	5
		12/13	513	583	624	26
		13/14	943	963	971	33
		14/15	682	709	718	32
		15/16	906	932	937	34
		23/24	824	853	856	6
		24/25	923	858	789	7
		25/26	989	995	997	7
		26/27	995	997	998	3
		27/28	705	725	732	10
		28/29	837	763	669	8
		29/30	431	444	444	9
		30/1	953	943	932	10
	7	5/6	095	037	-0.016	8
		10/11	938	958	0.964	36
		12/13	962	966	967	11
		13/14	715	726	728	31
Ave			0.735	0.745	0.743	

Table 7

SEASONAL VARIATION IN POSITION

OF 6300 EVENING MAXIMUM ALONG MERIDIAN

GROUP	No. of Nights	Mean Date	Dec. of Sun	6300 Evening Maximum Position km	Lat.	L
1	16	1961 June 9	22.90	+ 645	26.6	1.28
2	15	July 13	21.90	+ 670	26.8	1.28
3	14	Aug. 12	15.12	+ 100	21.6	1.19
4	16	Sept. 9	5.33	- 225	18.7	1.14
5	13	Oct. 13	- 7.60	- 530	15.9	1.11
6	12	Nov. 10	-17.02	- 960	12.0	1.07
7	10	1961 Dec. 7	-22.51	- 950	12.1	1.07
8	6	1962 Jan. 2	-22.98	- 1090	10.8	1.07
9	11	Feb. 6	-15.83	- 850	13.0	1.08
10	4	Mar. 6	- 5.93	- 650	14.8	1.10
11	10	Apr. 2	+ 4.65	- 220	18.7	1.14
12	4	May 4	+15.77	- 100	19.8	1.16
13	18	June 6	+22.58	+ 325	23.7	1.22

Table 8. Electron Drift Times to 300 kilometers

Latitudes (Geomagnetic)	Equatorial Height (kilometers)	Drift Time (hours)	
		500 to 300 km	Equator to 300 km
25°	1750	4.48	5.5
24	1622	4.72	5.7
23	1502	5.00	6.0
22	1389	5.32	6.3
21	1283	5.68	6.7
20	1184	6.10	7.1
19	1091	6.53	7.5
18	1004	7.09	8.1
17	924	7.75	8.7
16	848	8.47	9.5
15	779	9.43	10.4
14	715	10.6	11.6
13	656	12.2	13.2
12	601	14.1	15.1
11	553	16.9	17.9
10	507	21.5	22.5
9	467	28.6	29.6
8	432	42.5	43.5
7	400	83.3	84.3
6	374		
5	351		

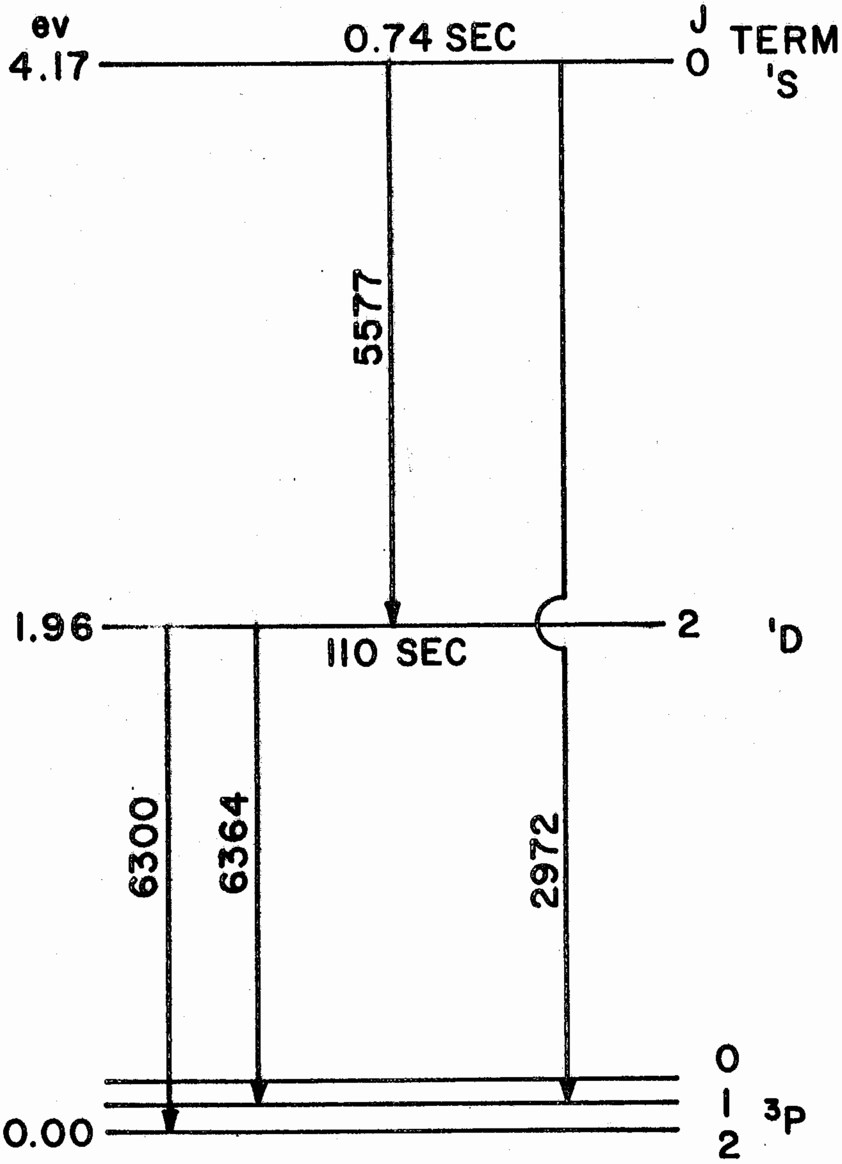

ev
4.17
0.74 SEC
J
0
TERM
'S
5577
1.96
110 SEC
2
'D
6300
6364
2972
0.00
0
1
2
3P

Figure 1

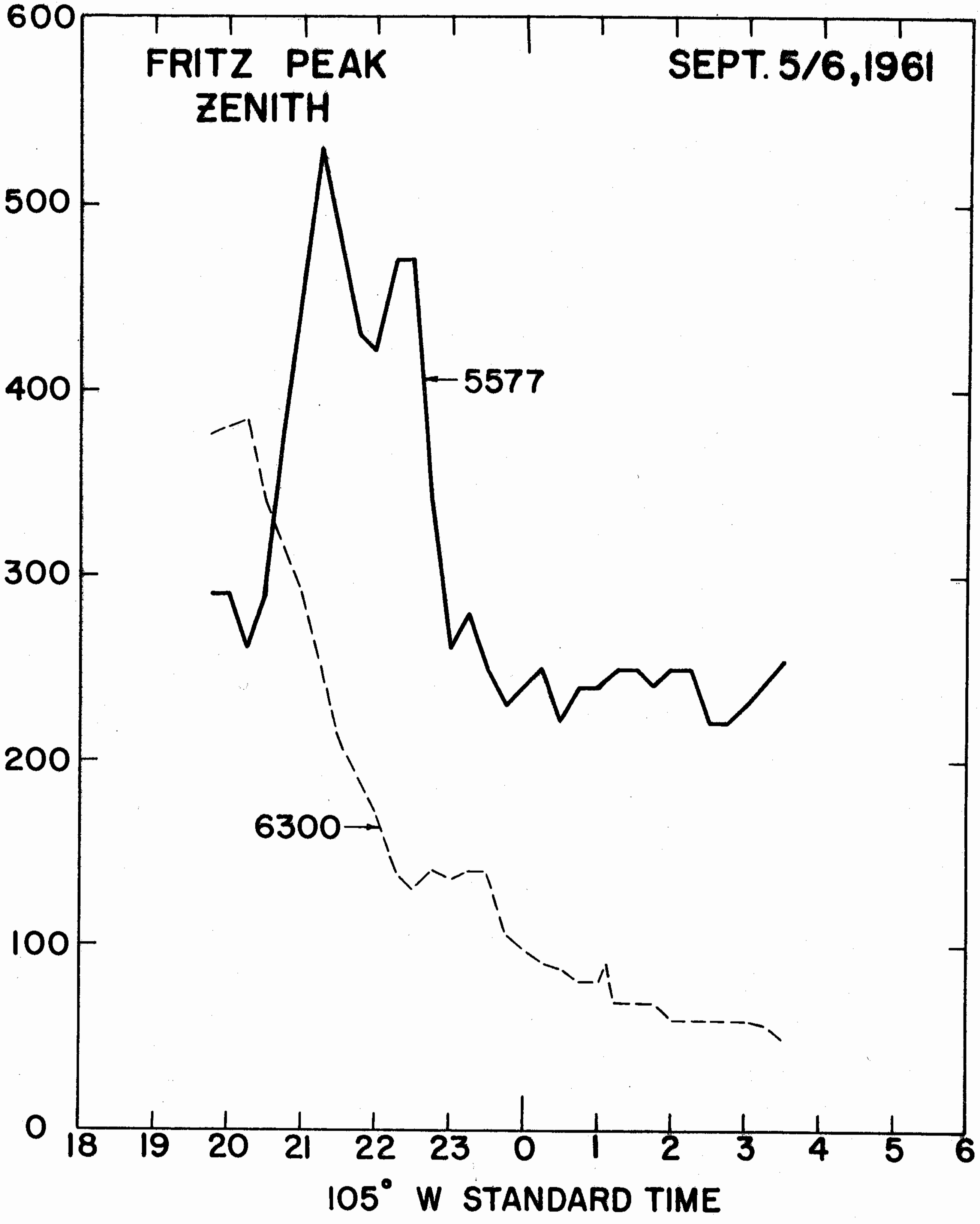
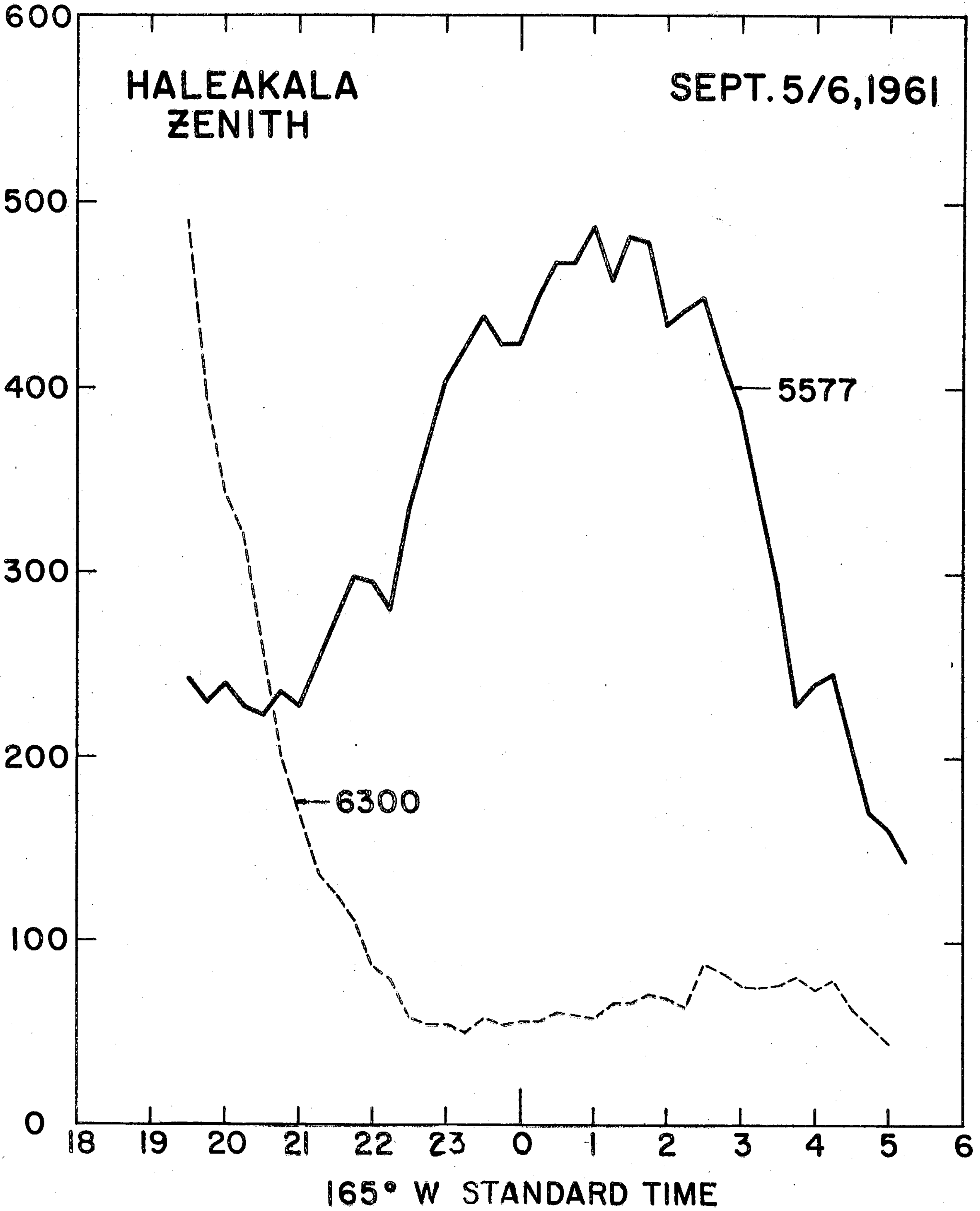

FRITZ PEAK
ZENITH
SEPT. 5/6, 1961
5577
6300
Q IN RAYLEIGHS
600
500
400
300
200
100
0
18
19
20
21
22
23
0
1
2
3
4
5
6
105° W STANDARD TIME

Figure 2



HALEAKALA
ZENITH
SEPT. 5/6, 1961
Q IN RAYLEIGHS
600
500
400
300
200
100
0
18
19
20
21
22
23
0
1
2
3
4
5
6
165° W STANDARD TIME
5577
6300

Figure 3

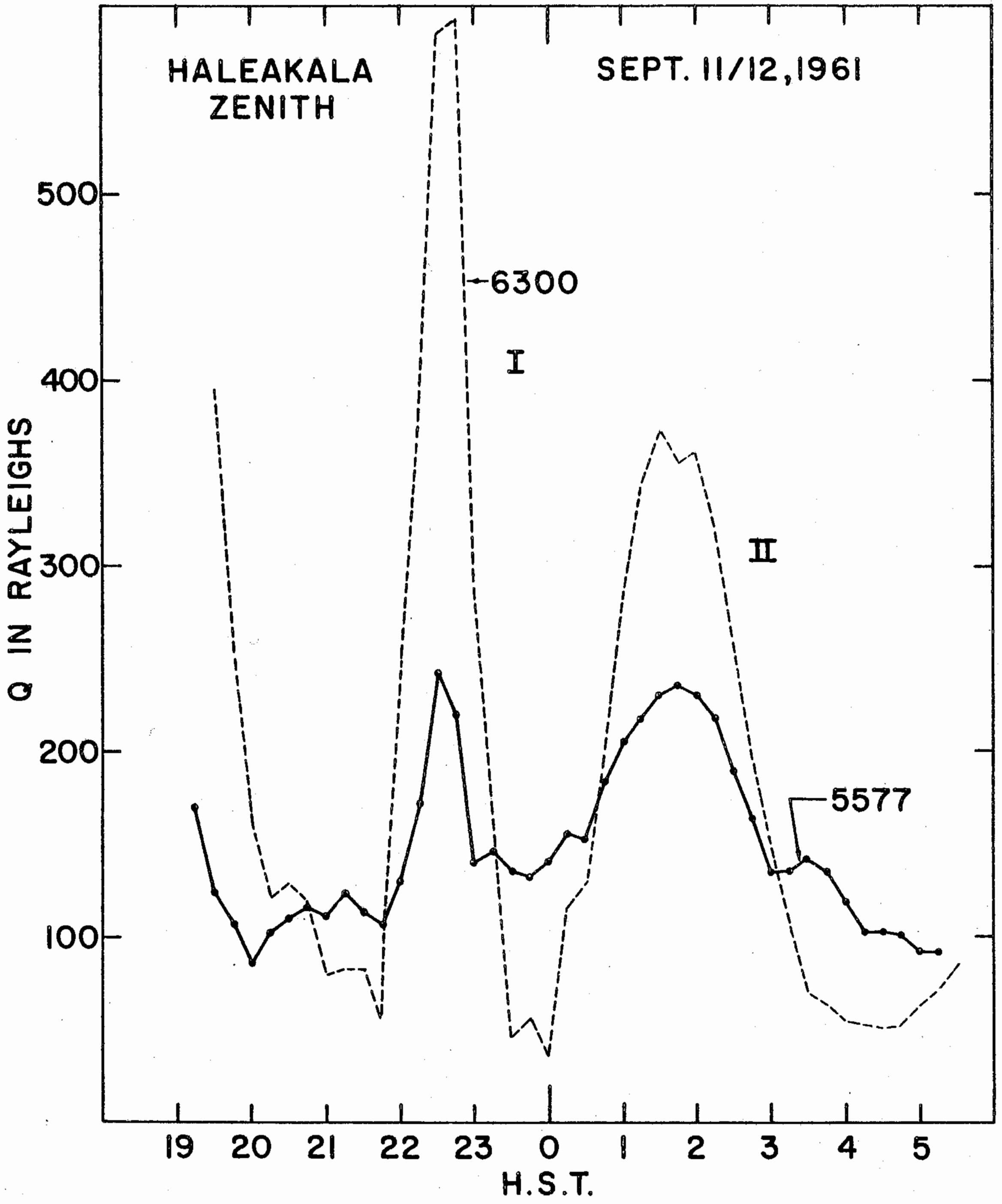

HALEAKALA
ZENITH
SEPT. 11/12, 1961
500
400
300
200
100
Q IN RAYLEIGHS
6300
I
II
5577
19
20
21
22
23
0
1
2
3
4
5
H.S.T.

Figure 4

Table 3

```
                                                                     PROGRAM LZIB63
                                                                         STA 2C
                                                                Q= C.46      REL SENS=200000.
SEN   J  TYPE ALT C YR MO DA  MST       N                       E                       S                       W                       Z
254 333   330  80 3 61  9 11 2225      79    60   137   165   139   289   290   224   157   140   140   394   542   286   214   175   585
               75                     108    67   228   260   356   512   386   275   226   121   397   525   467   330   295   111
               70                     138   111   144   295   371   518   529   440   571   184   318   543   600   407   353   110
               60                     225   165   213   279   407   437   249   567   619    73   131   181   217   371   187   139
               40                     378   183   159   142   130   103   156   614   682   144    68    68    65   100   121   434
```

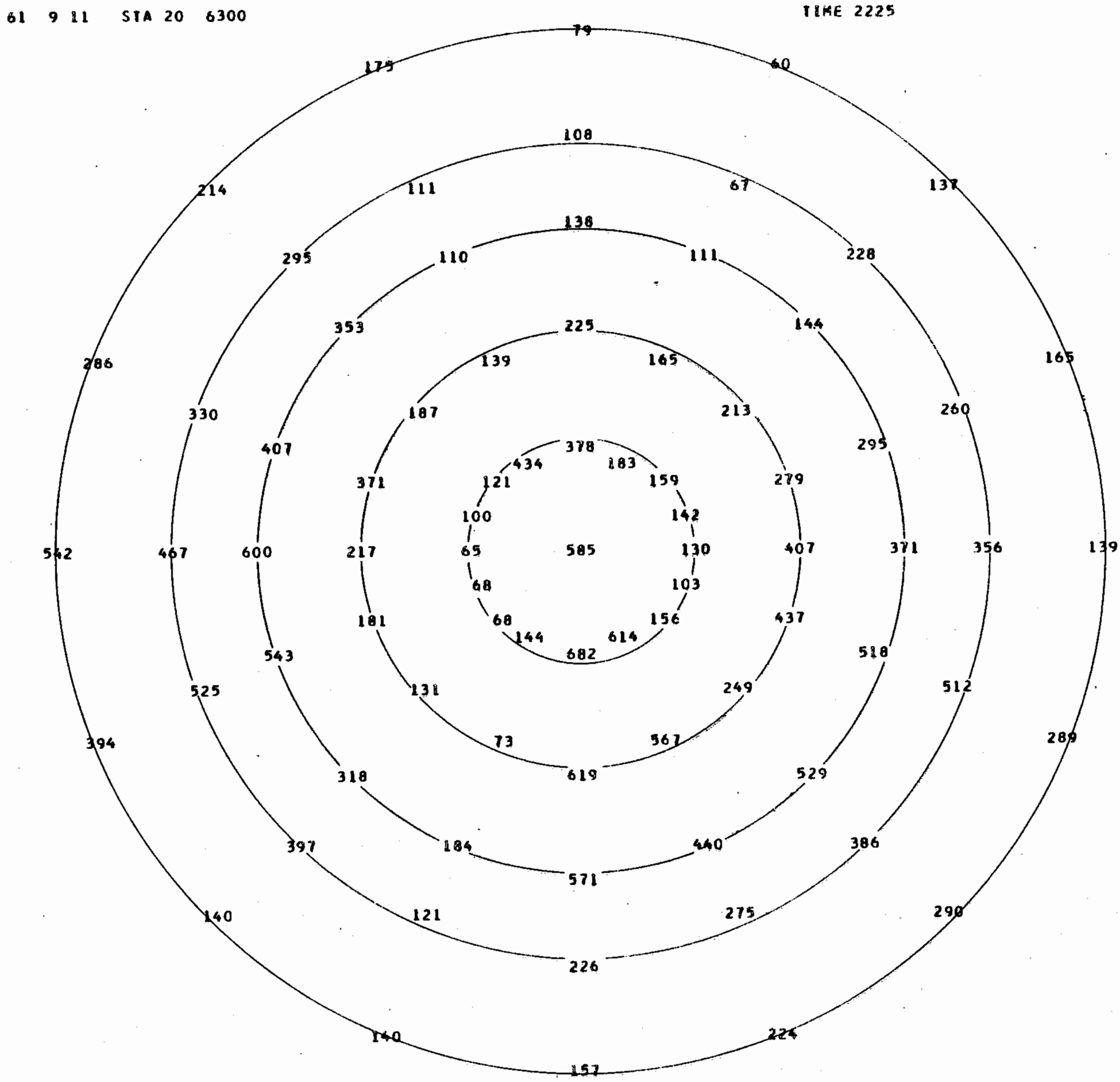


Figure 5

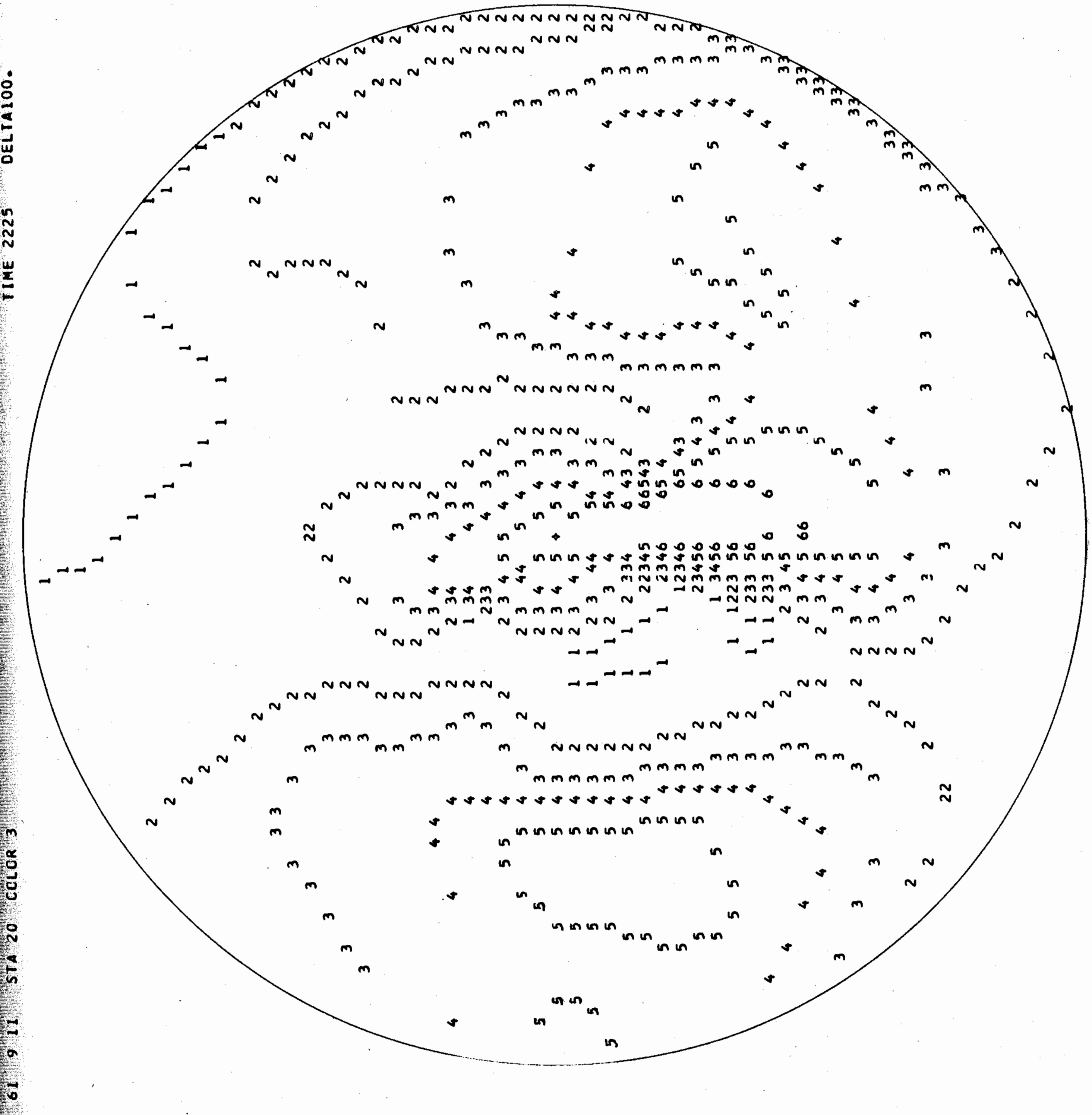


Figure 6

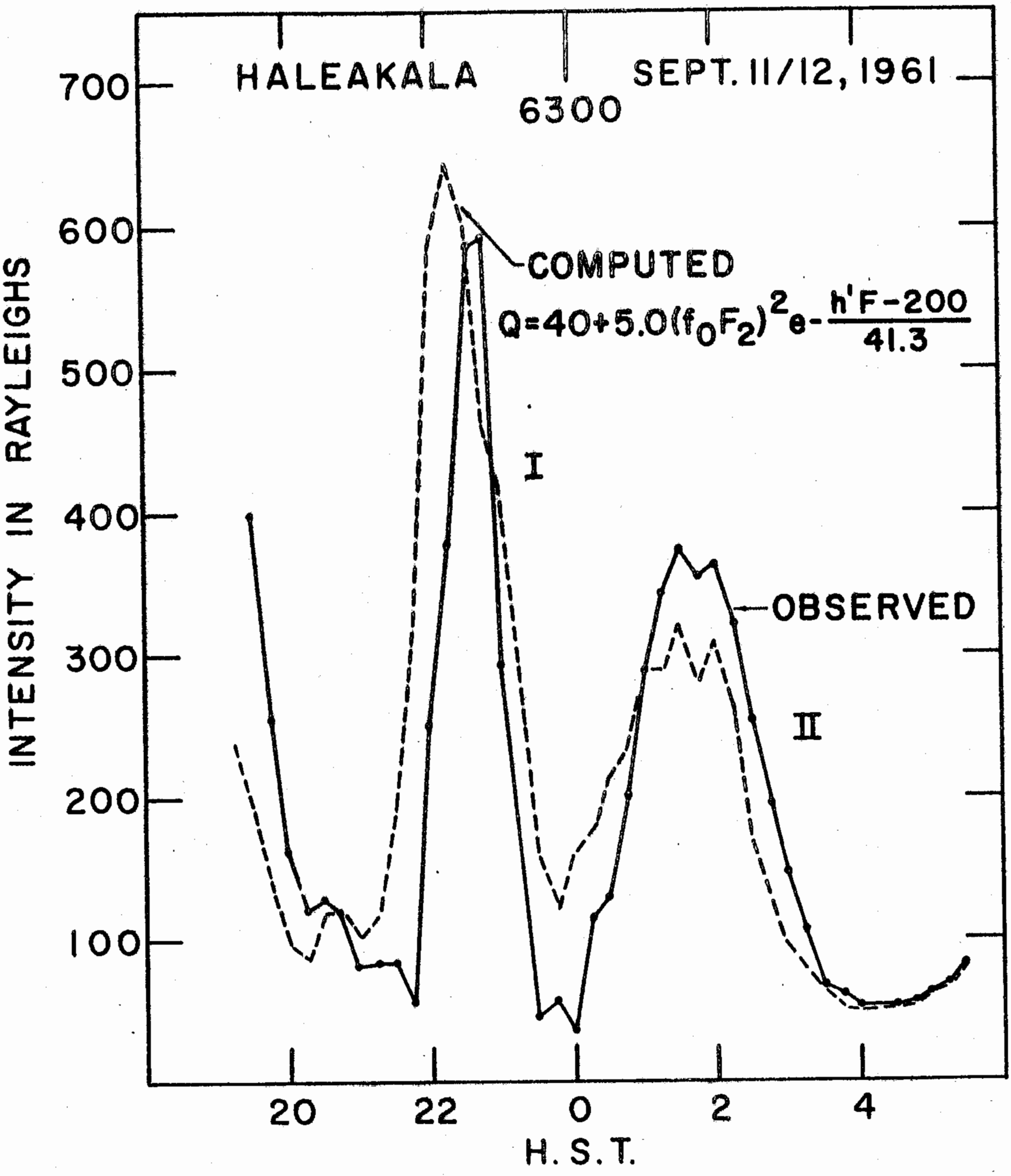

HALEAKALA
6300
SEPT. 11/12, 1961
COMPUTED
$Q=40+5.0(f_0F_2)^2 e^{-\frac{h'F-200}{41.3}}$
I
OBSERVED
II
INTENSITY IN RAYLEIGHS
700
600
500
400
300
200
100
20
22
0
2
4
H. S. T.

Figure 7

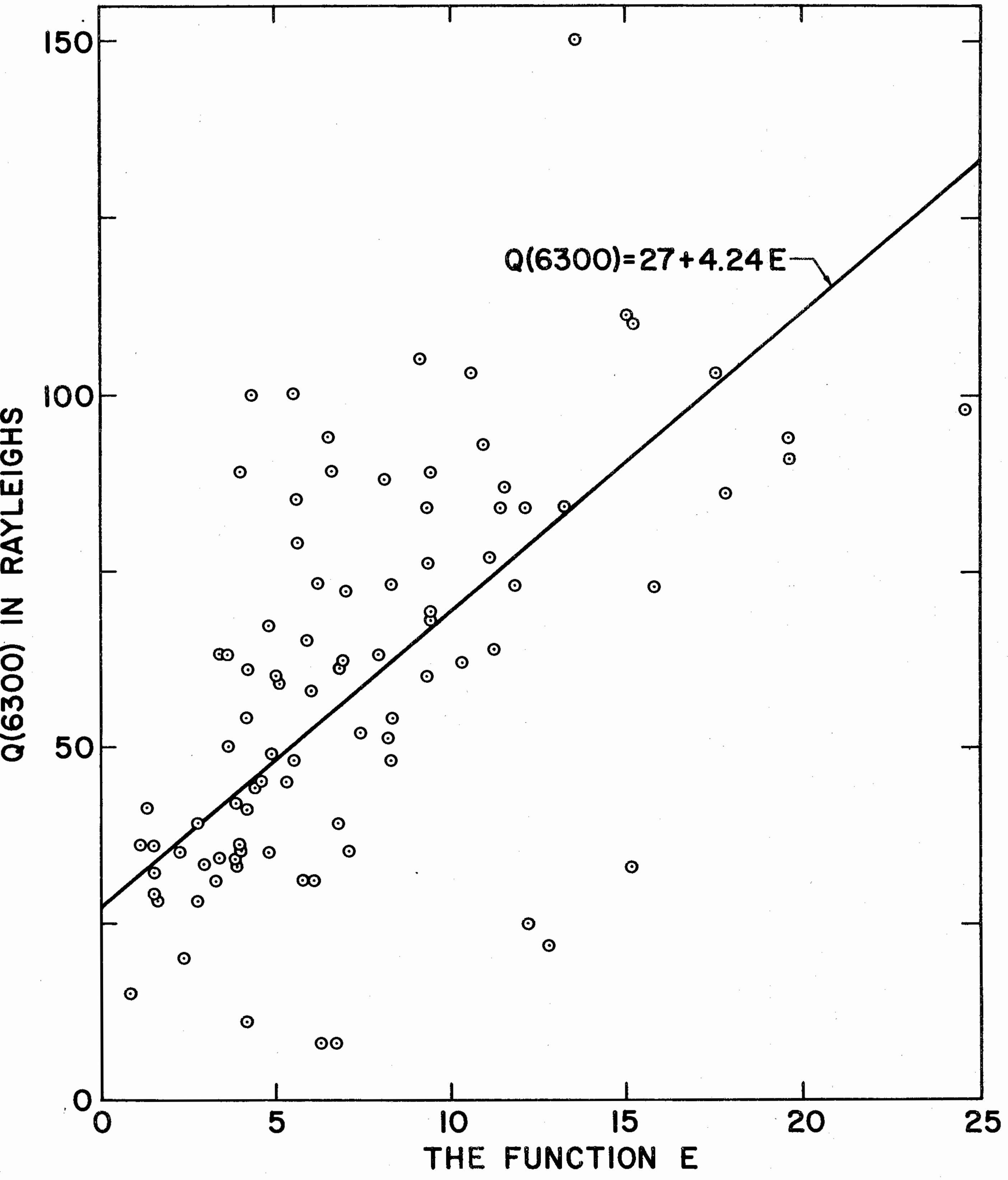

Q(6300)=27+4.24E
150
100
50
0
Q(6300) IN RAYLEIGHS
0
5
10
15
20
25
THE FUNCTION E

Figure 8

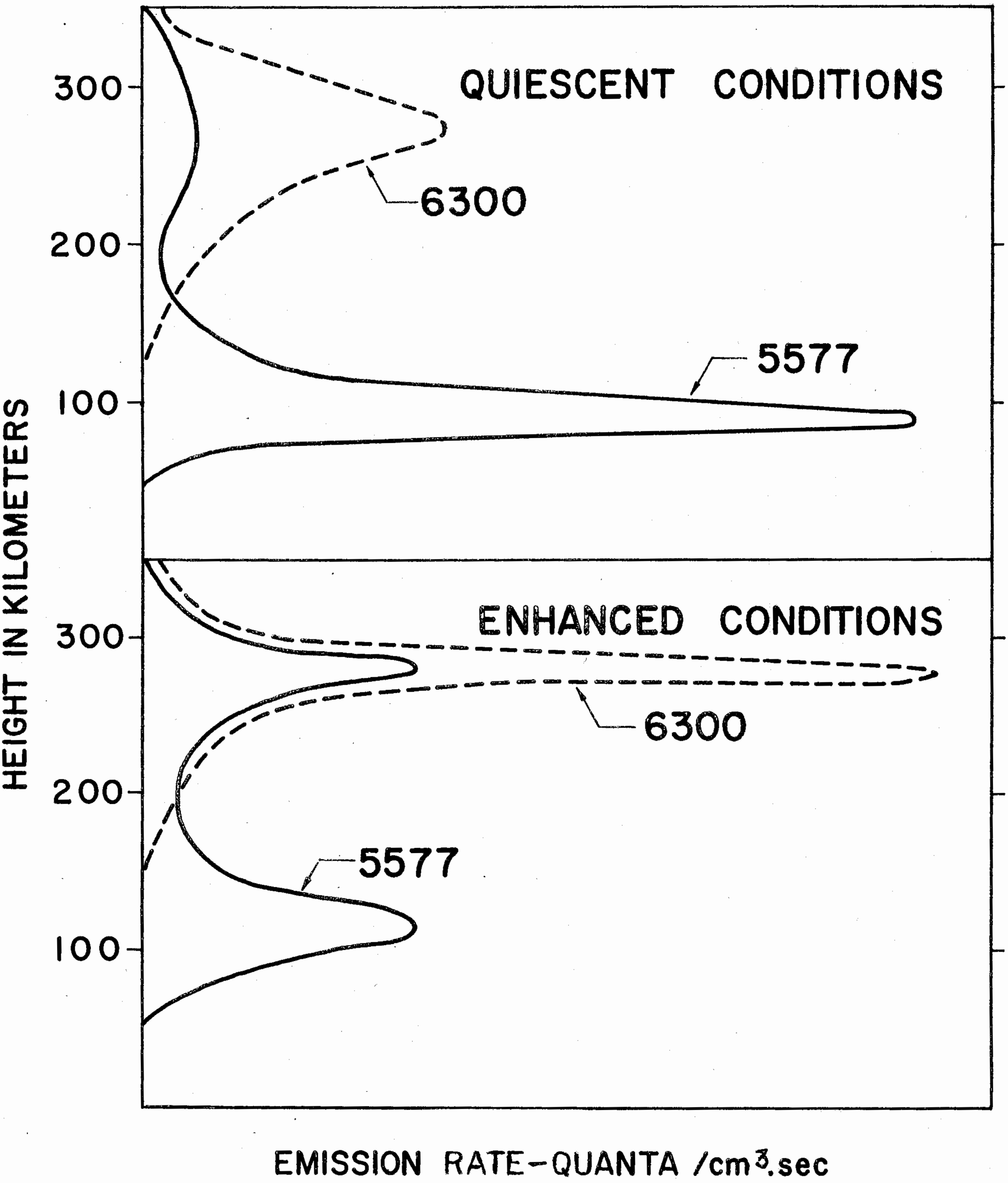

QUIESCENT CONDITIONS
300
200
100
6300
5577
ENHANCED CONDITIONS
300
200
100
6300
5577
HEIGHT IN KILOMETERS
EMISSION RATE-QUANTA /cm³.sec

Figure 9

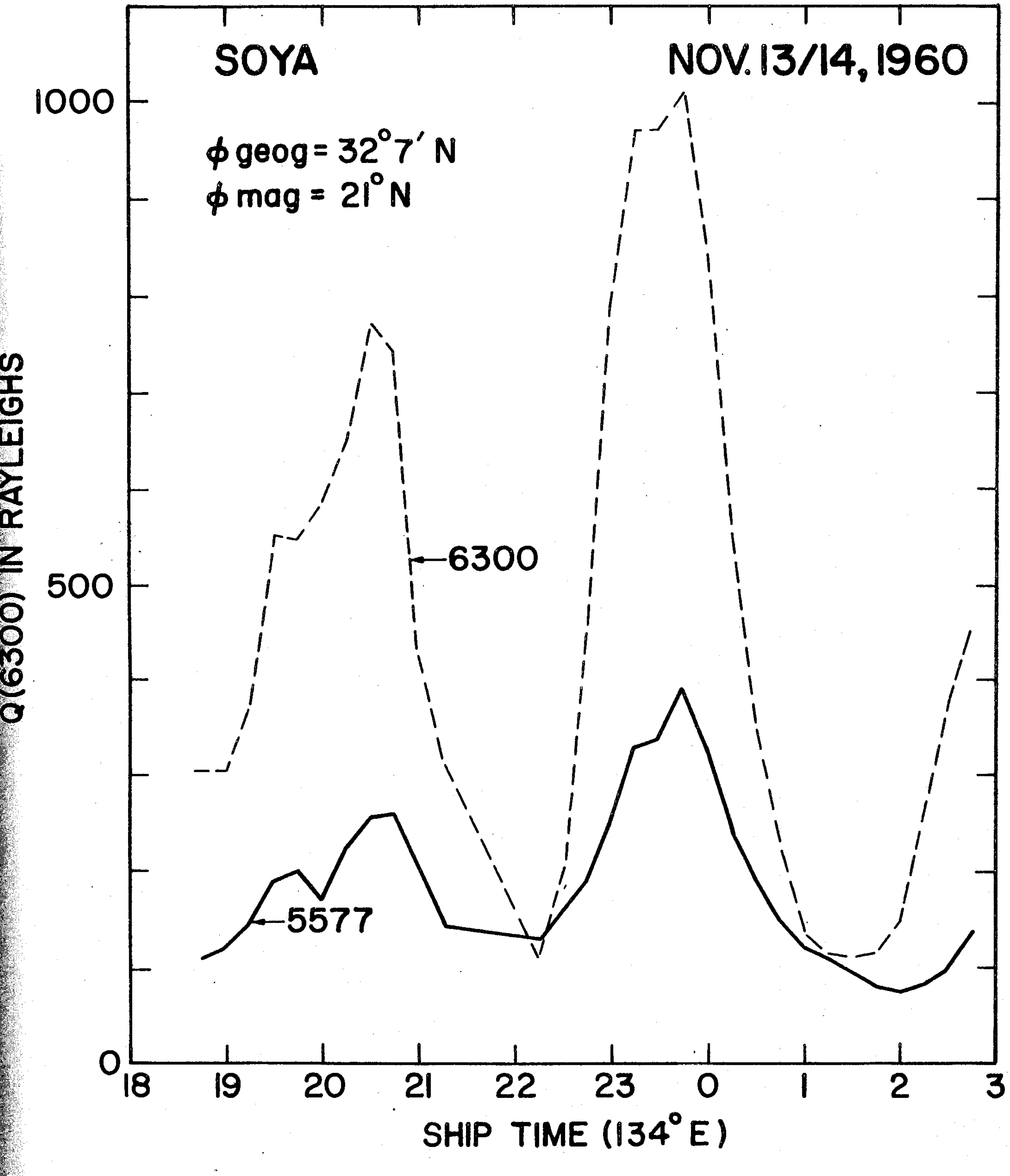

SOYA
NOV. 13/14, 1960
ϕ geog = 32° 7′ N
ϕ mag = 21° N
1000
500
0
Q(6300) IN RAYLEIGHS
6300
5577
18
19
20
21
22
23
0
1
2
3
SHIP TIME (134° E)

Figure 10

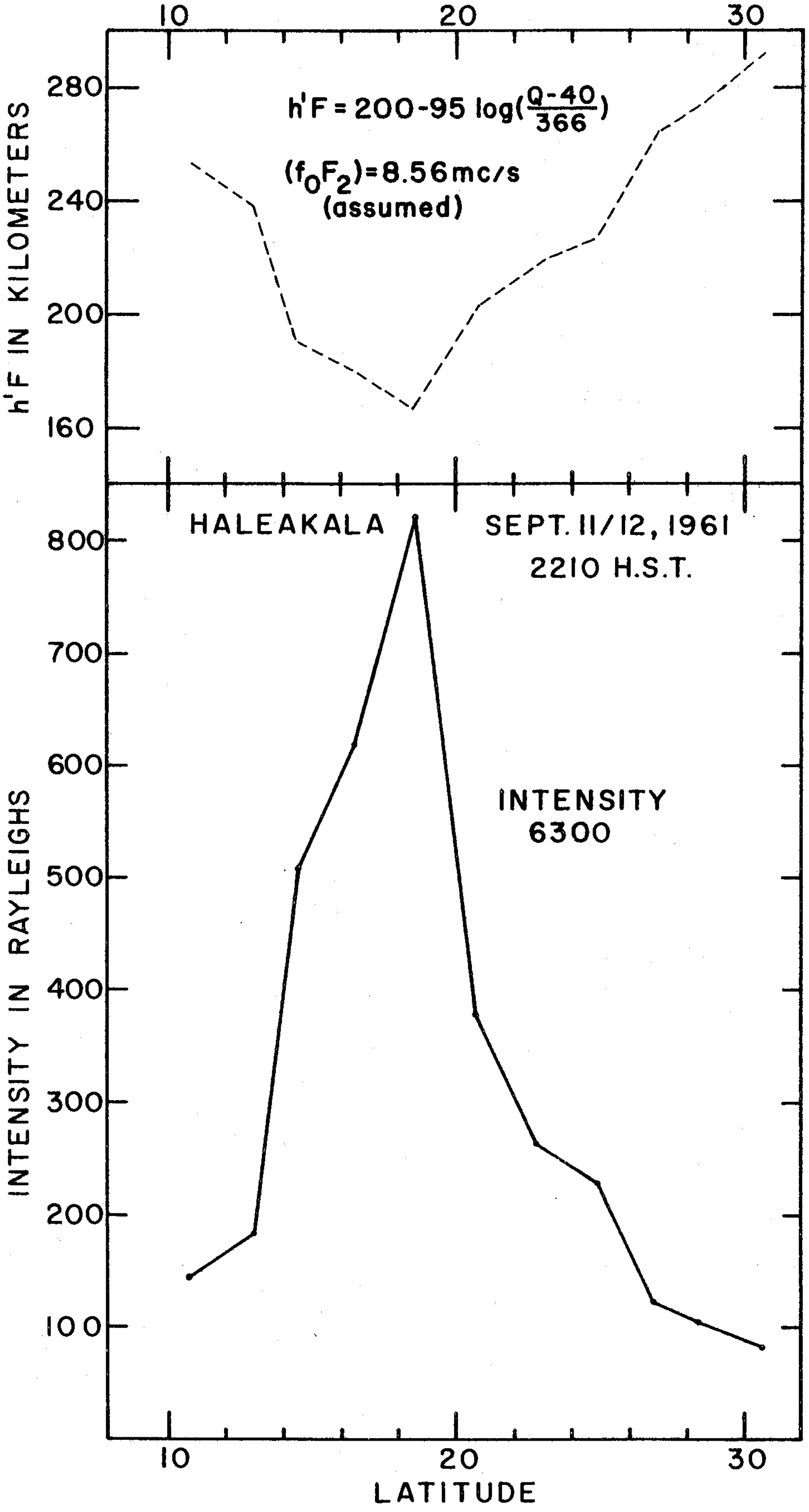

10
20
30
h'F IN KILOMETERS
280
240
200
160
h'F = 200-95 log($\frac{Q-40}{366}$)
(f_0F_2)=8.56mc/s
(assumed)
HALEAKALA
SEPT. 11/12, 1961
2210 H.S.T.
INTENSITY IN RAYLEIGHS
800
700
600
500
400
300
200
100
INTENSITY
6300
10
20
30
LATITUDE

Figure 11

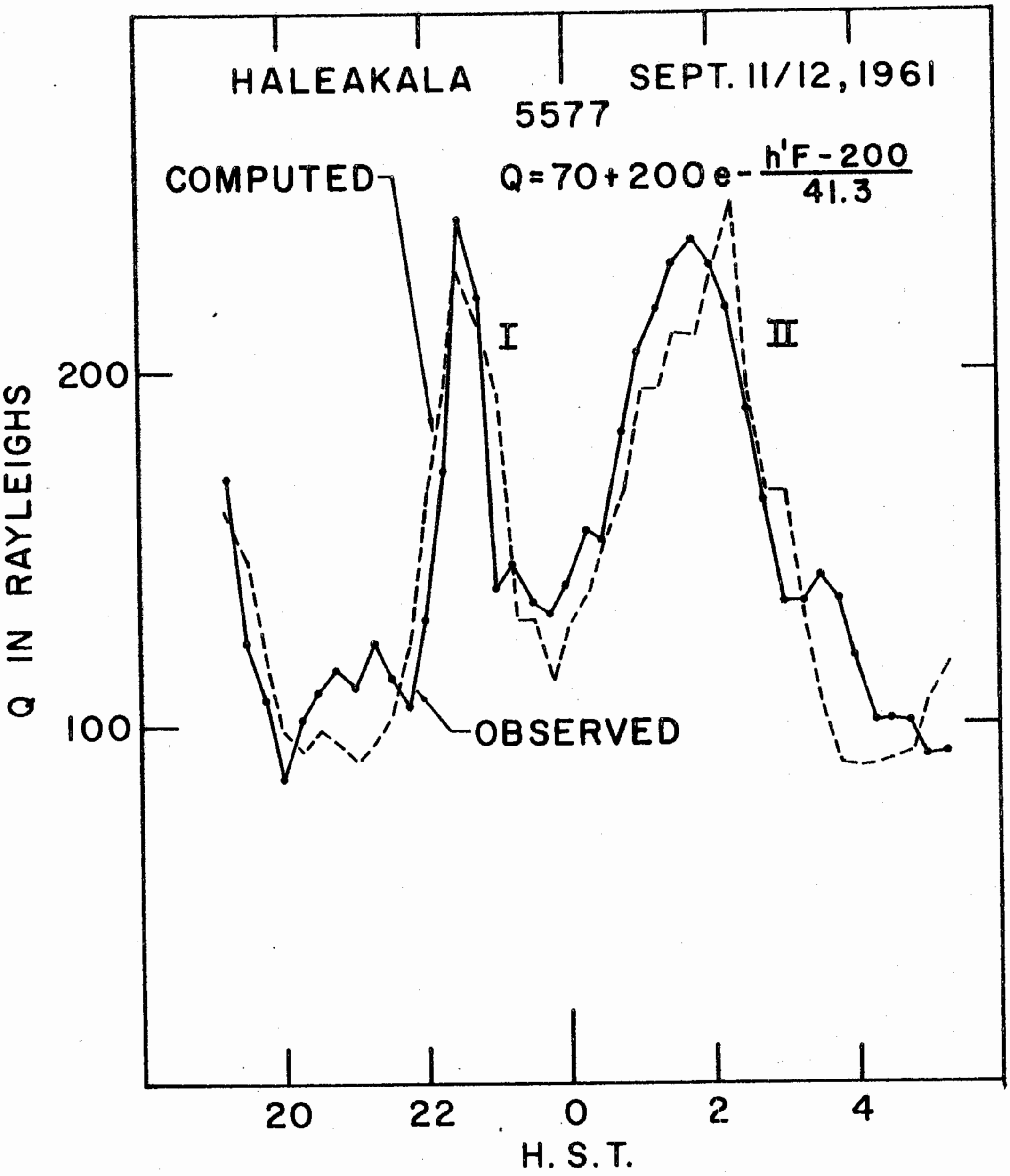

HALEAKALA
SEPT. 11/12, 1961
5577
COMPUTED
$Q = 70 + 200\,e^{-\frac{h'F-200}{41.3}}$
I
II
OBSERVED
200
100
Q IN RAYLEIGHS
20
22
0
2
4
H. S. T.

Figure 12

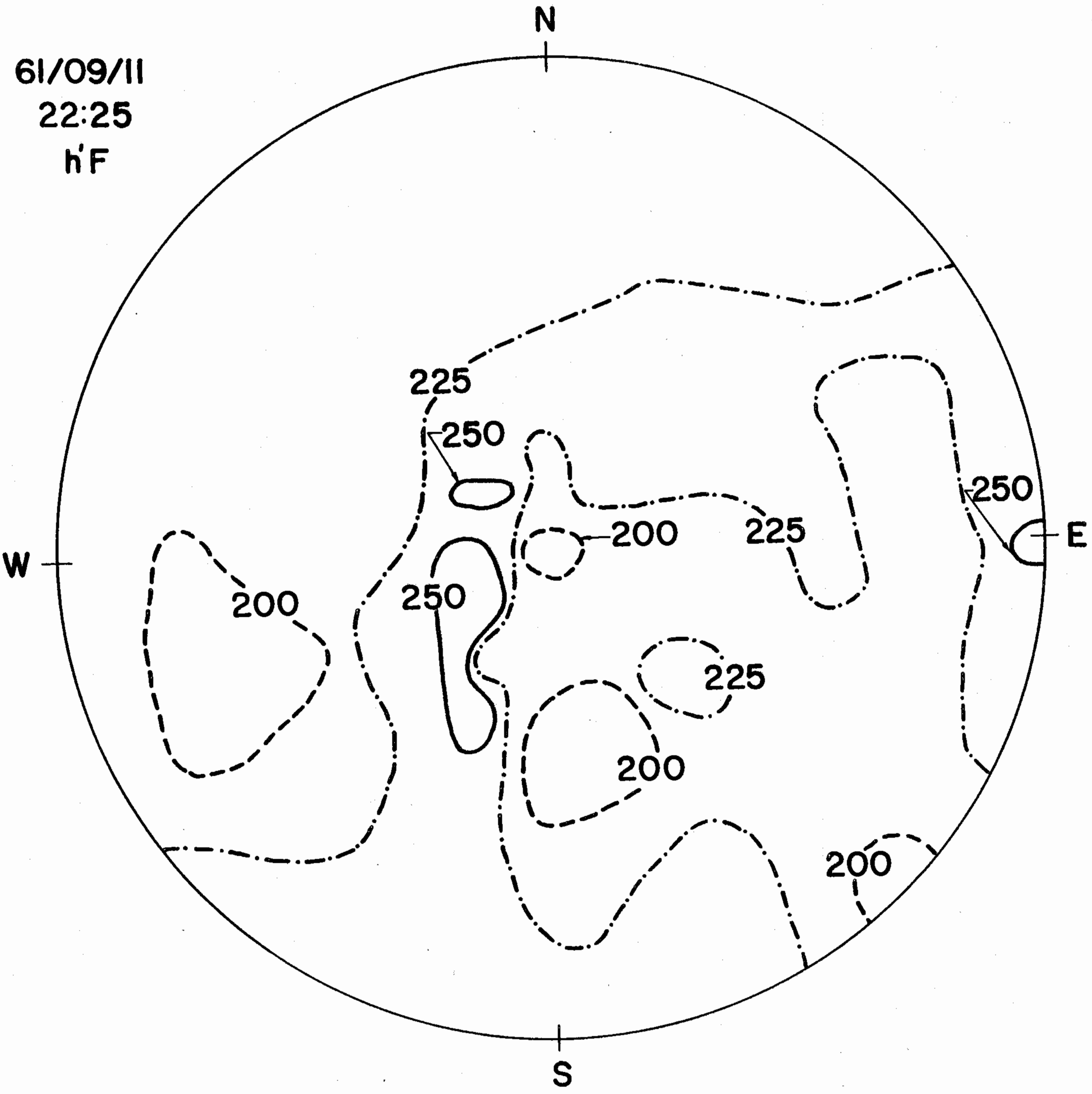


Figure 13A

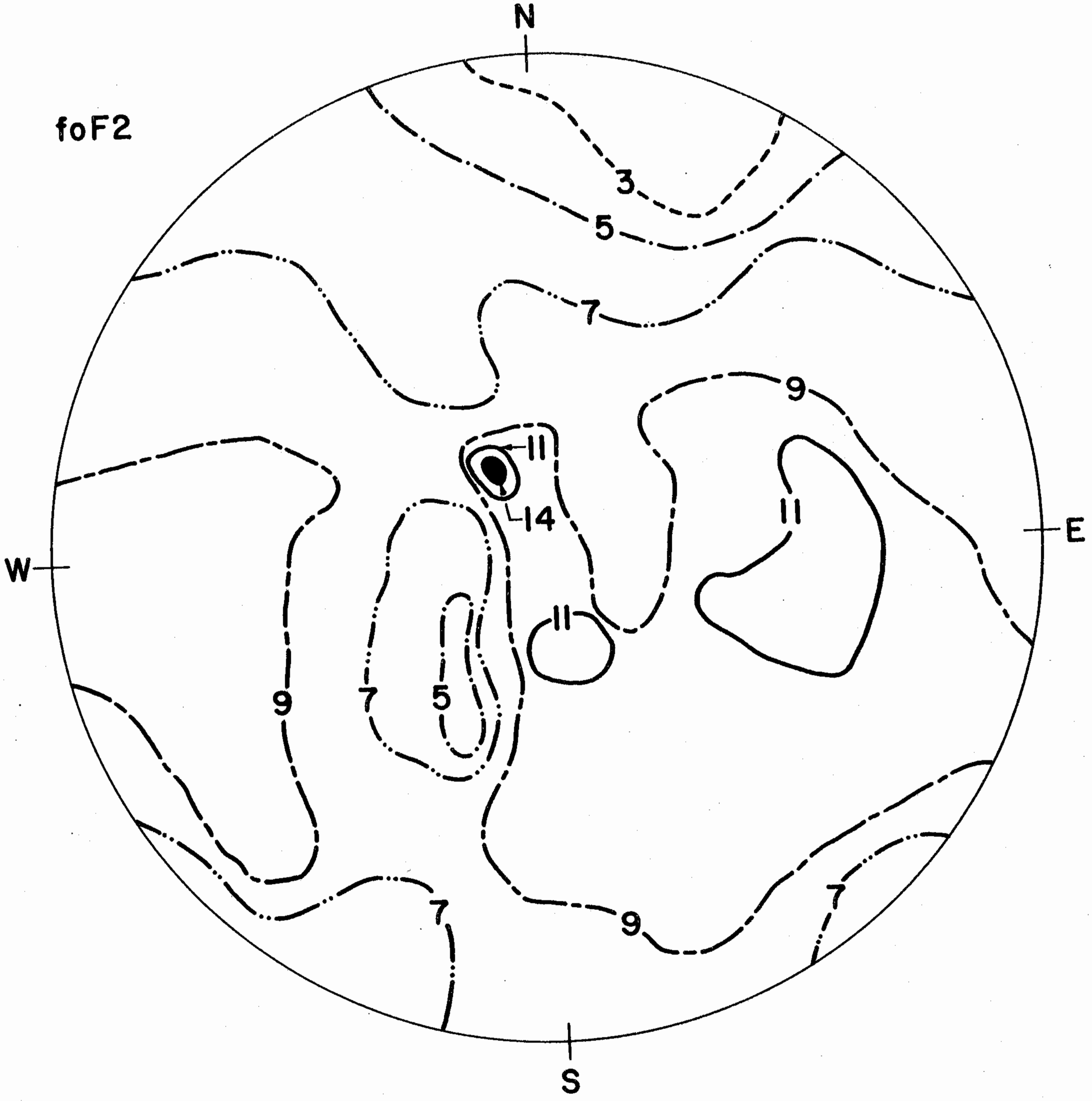


Figure 13B

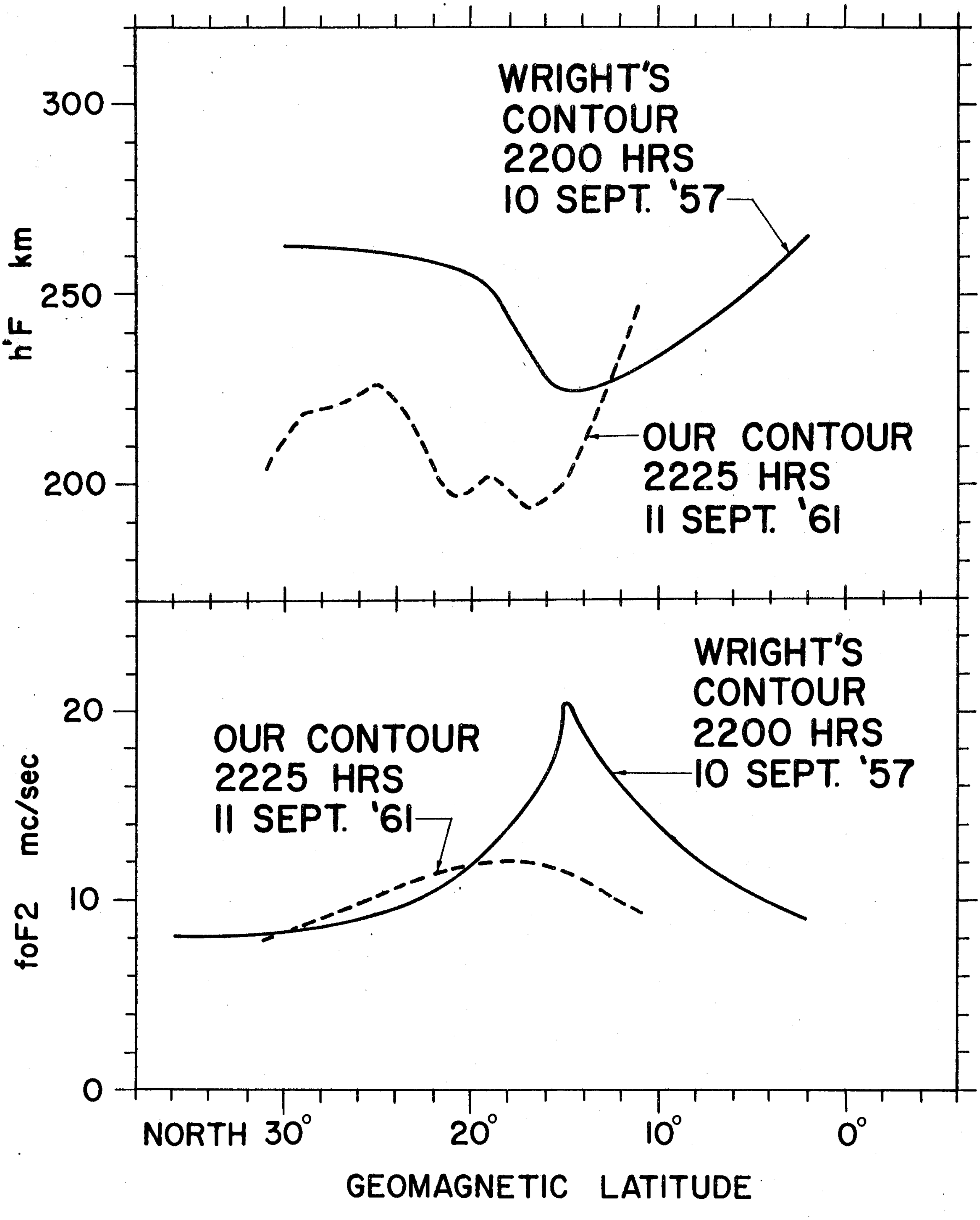
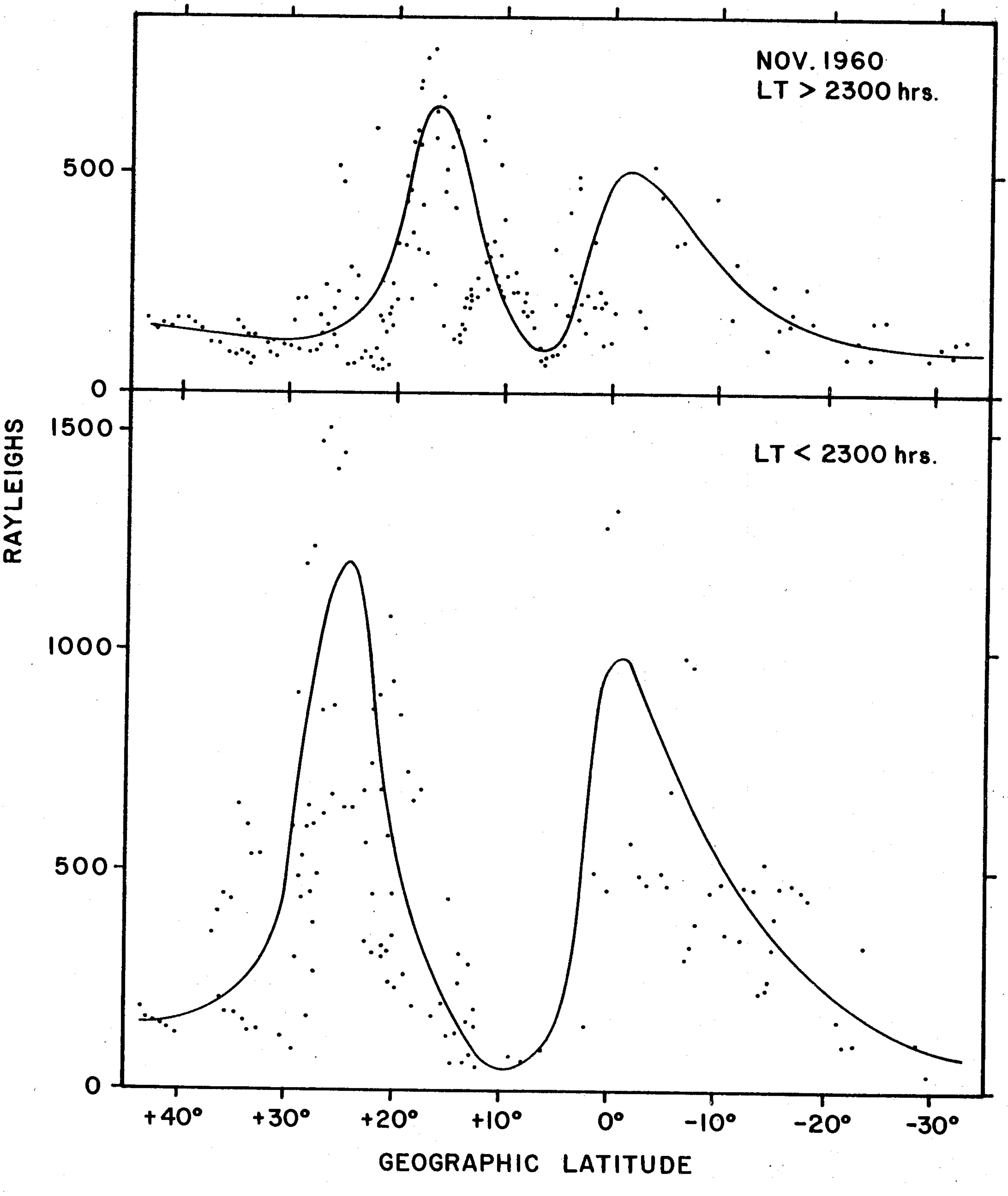

300
250
200
h'F km
20
10
0
foF2 mc/sec
WRIGHT'S CONTOUR 2200 HRS 10 SEPT. '57
OUR CONTOUR 2225 HRS 11 SEPT. '61
WRIGHT'S CONTOUR 2200 HRS 10 SEPT. '57
OUR CONTOUR 2225 HRS 11 SEPT. '61
NORTH 30°
20°
10°
0°
GEOMAGNETIC LATITUDE

Figure 14



NOV. 1960
LT > 2300 hrs.
LT < 2300 hrs.
RAYLEIGHS
0
500
1500
1000
500
0
+40°
+30°
+20°
+10°
0°
-10°
-20°
-30°
GEOGRAPHIC LATITUDE

Figure 15

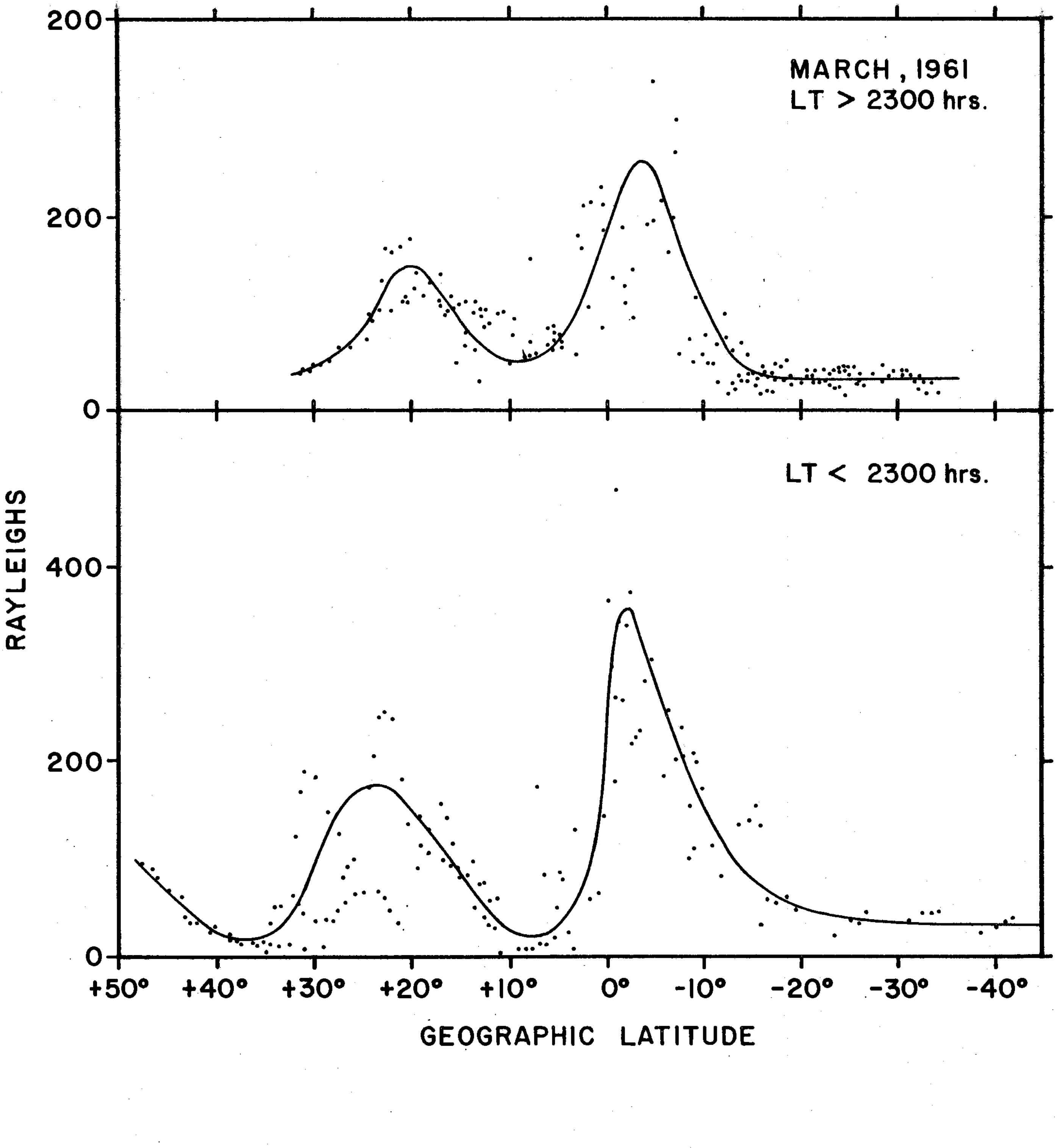

200
200
0
400
200
0
RAYLEIGHS
MARCH, 1961
LT > 2300 hrs.
LT < 2300 hrs.
+50°
+40°
+30°
+20°
+10°
0°
-10°
-20°
-30°
-40°
GEOGRAPHIC LATITUDE

Figure 16

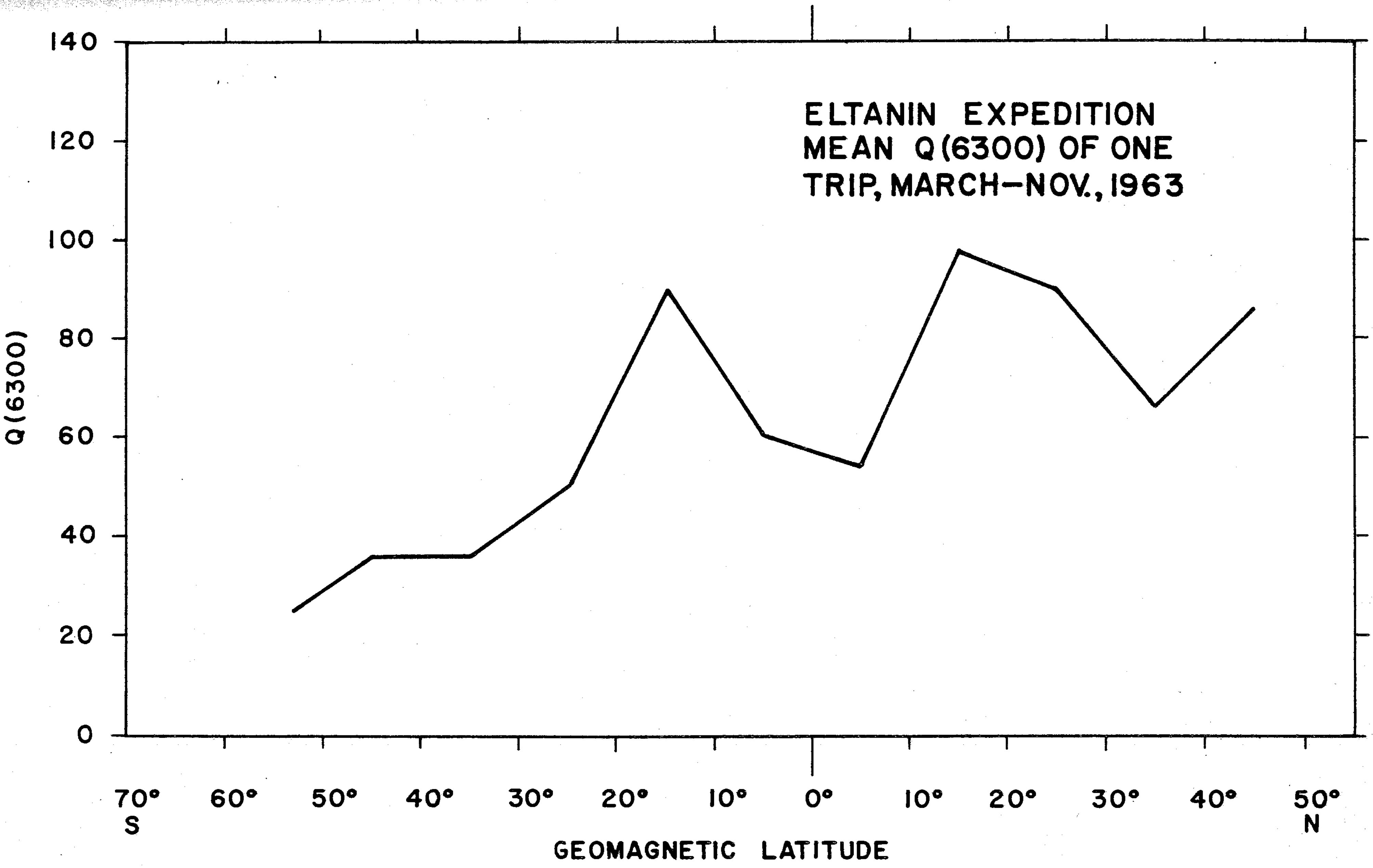

ELTANIN EXPEDITION
MEAN Q(6300) OF ONE
TRIP, MARCH—NOV., 1963
Q(6300)
140
120
100
80
60
40
20
0
70° S
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50° N
GEOMAGNETIC LATITUDE

Figure 17

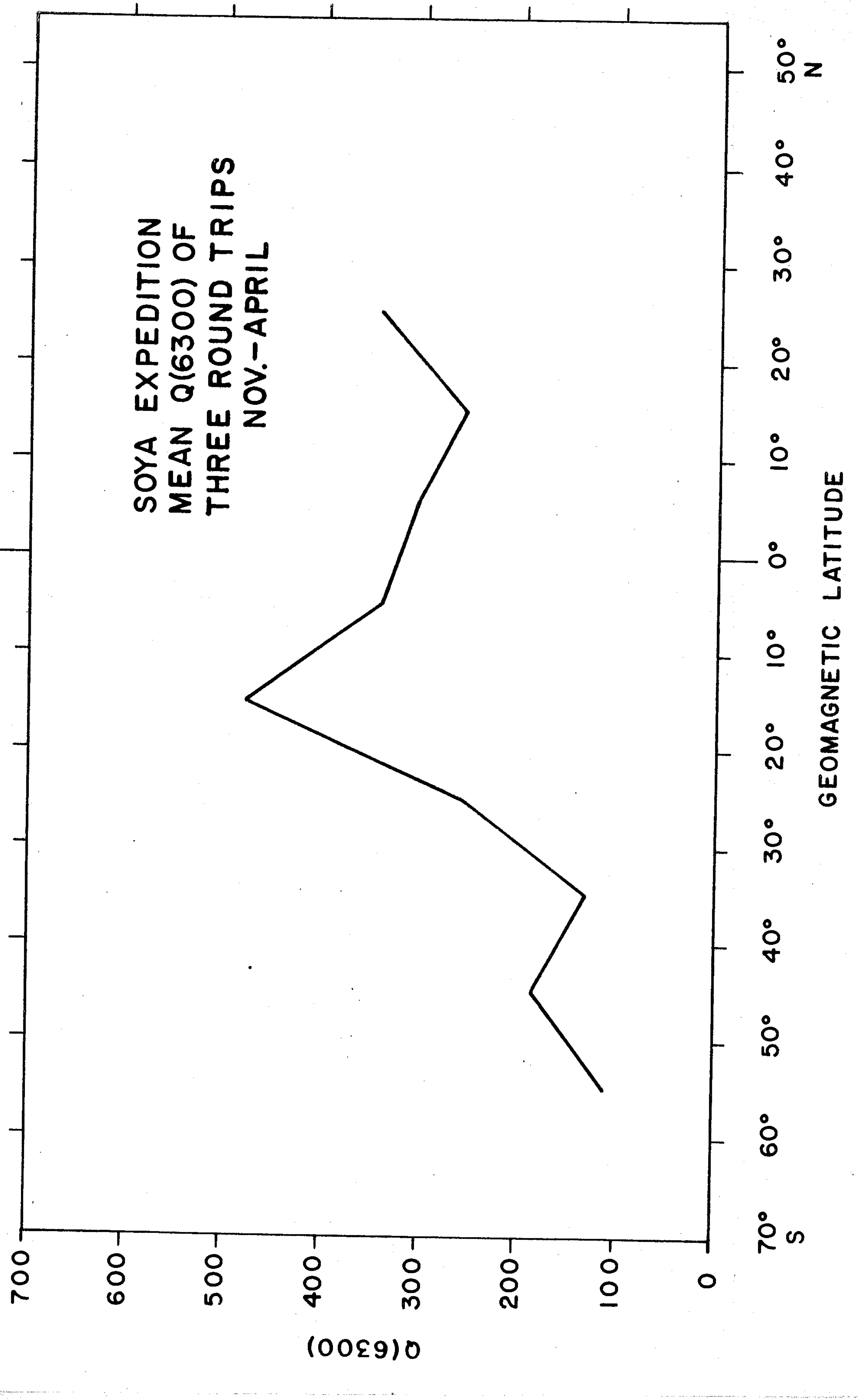

SOYA EXPEDITION
MEAN Q(6300) OF
THREE ROUND TRIPS
NOV.-APRIL
Q(6300)
700
600
500
400
300
200
100
0
GEOMAGNETIC LATITUDE
70° S
60°
50°
40°
30°
20°
10°
0°
10°
20°
30°
40°
50° N

Figure 18

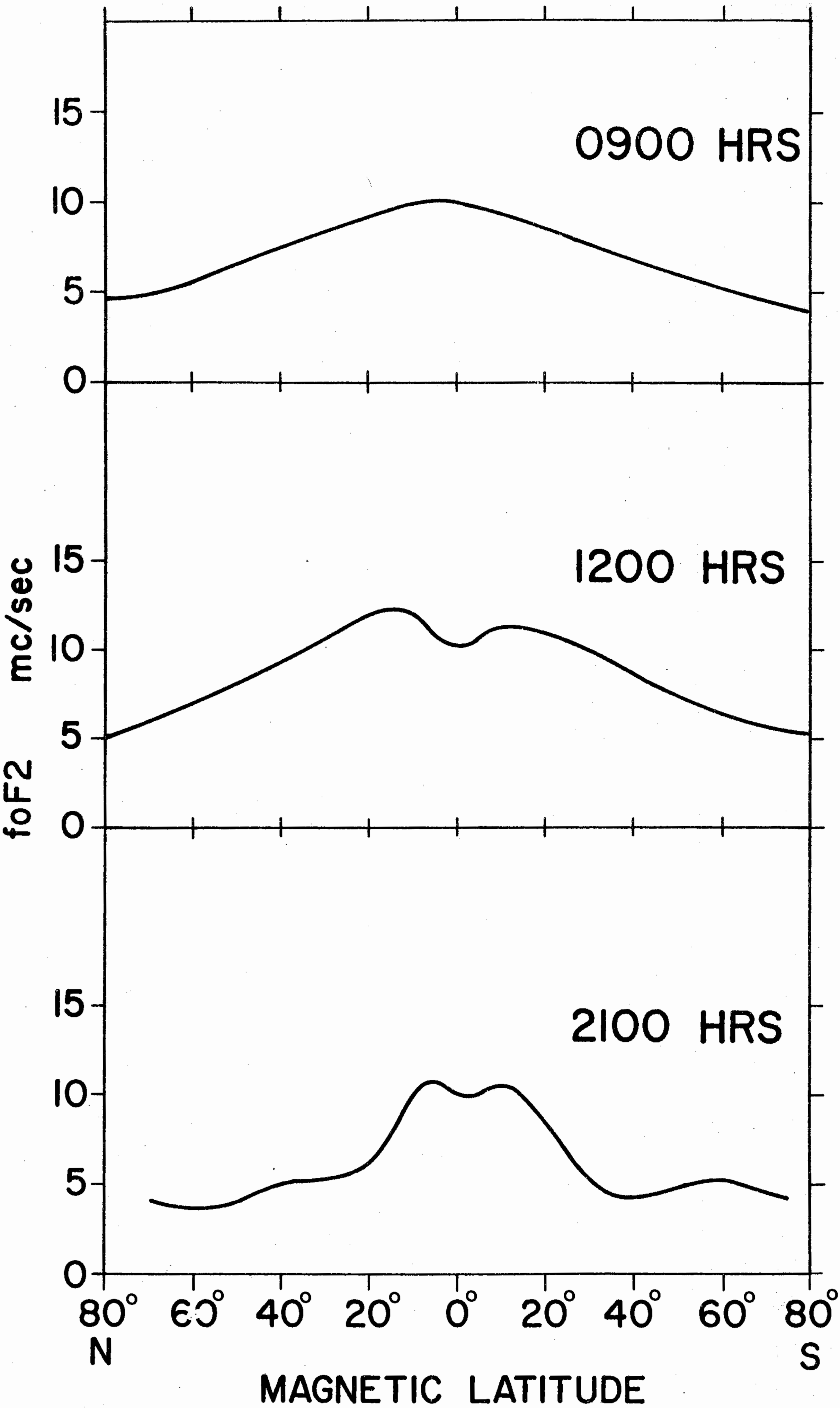

0900 HRS
1200 HRS
2100 HRS
foF2 mc/sec
15
10
5
0
80°
60°
40°
20°
0°
20°
40°
60°
80°
N
S
MAGNETIC LATITUDE

Figure 19

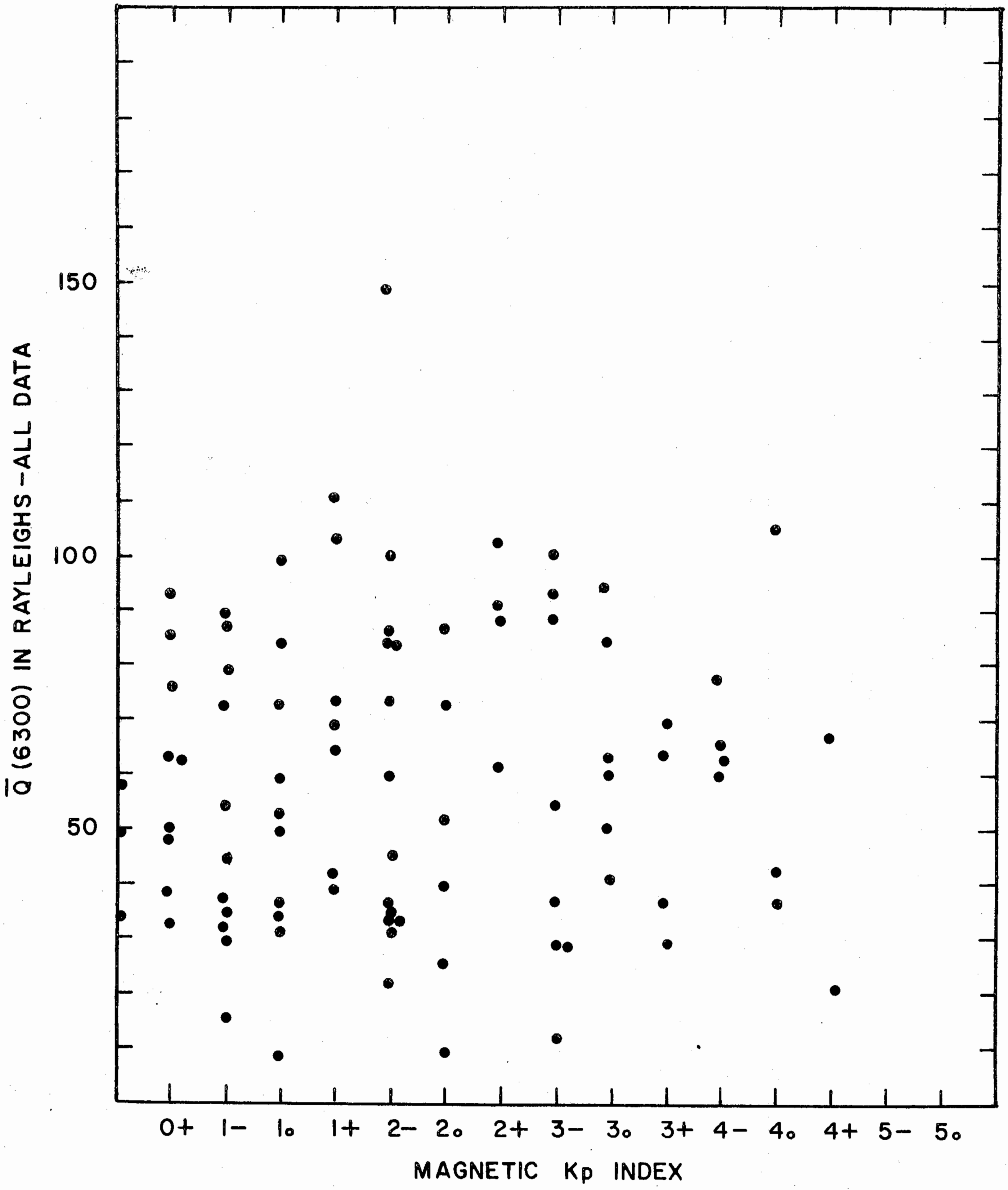
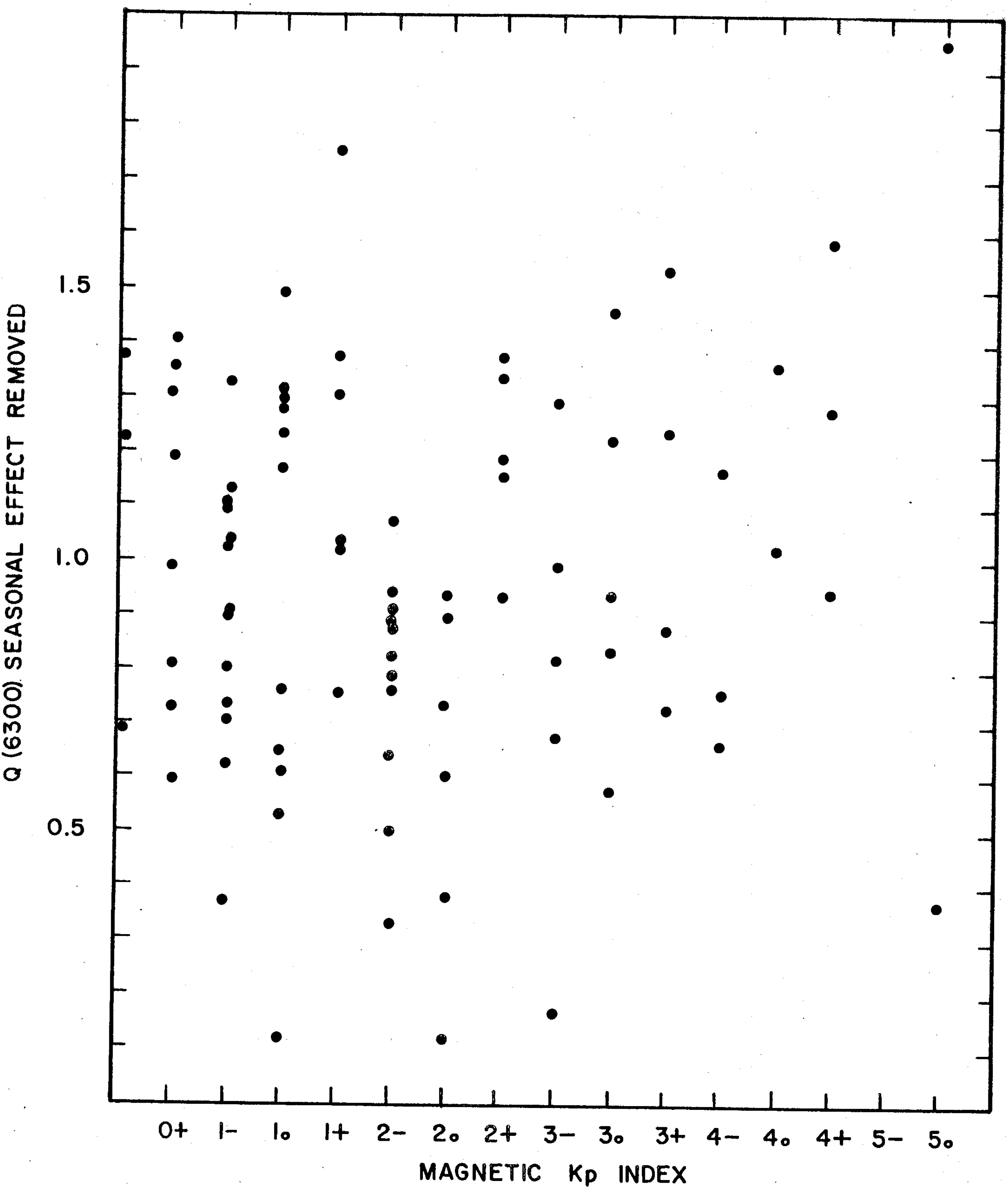

150
100
50
$\overline{Q}$ (6300) IN RAYLEIGHS - ALL DATA
0+
1-
1o
1+
2-
2o
2+
3-
3o
3+
4-
4o
4+
5-
5o
MAGNETIC Kp INDEX

Figure 20



Q̄ (6300) SEASONAL EFFECT REMOVED
1.5
1.0
0.5
0+
1-
1o
1+
2-
2o
2+
3-
3o
3+
4-
4o
4+
5-
5o
MAGNETIC Kp INDEX

Figure 21

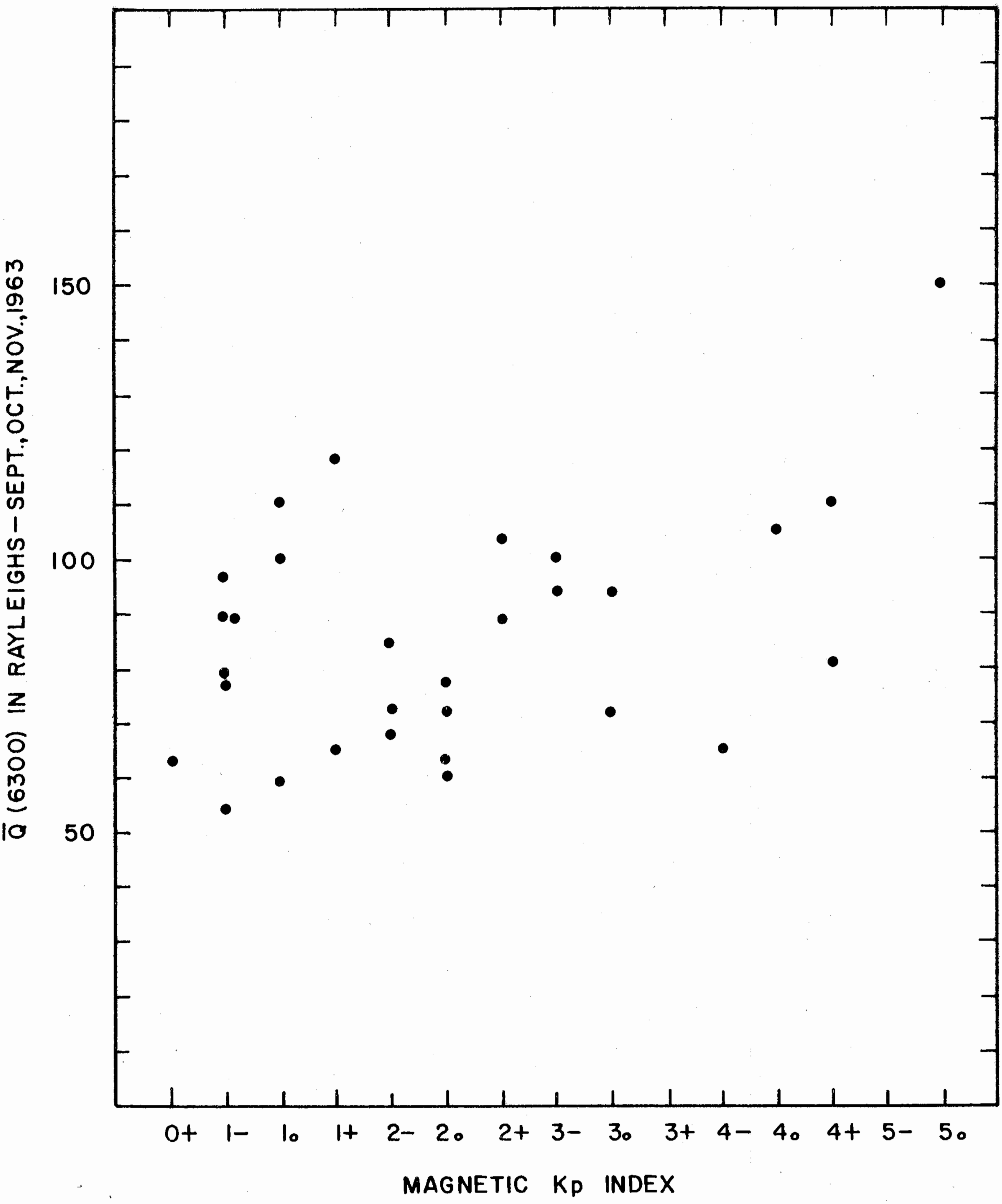
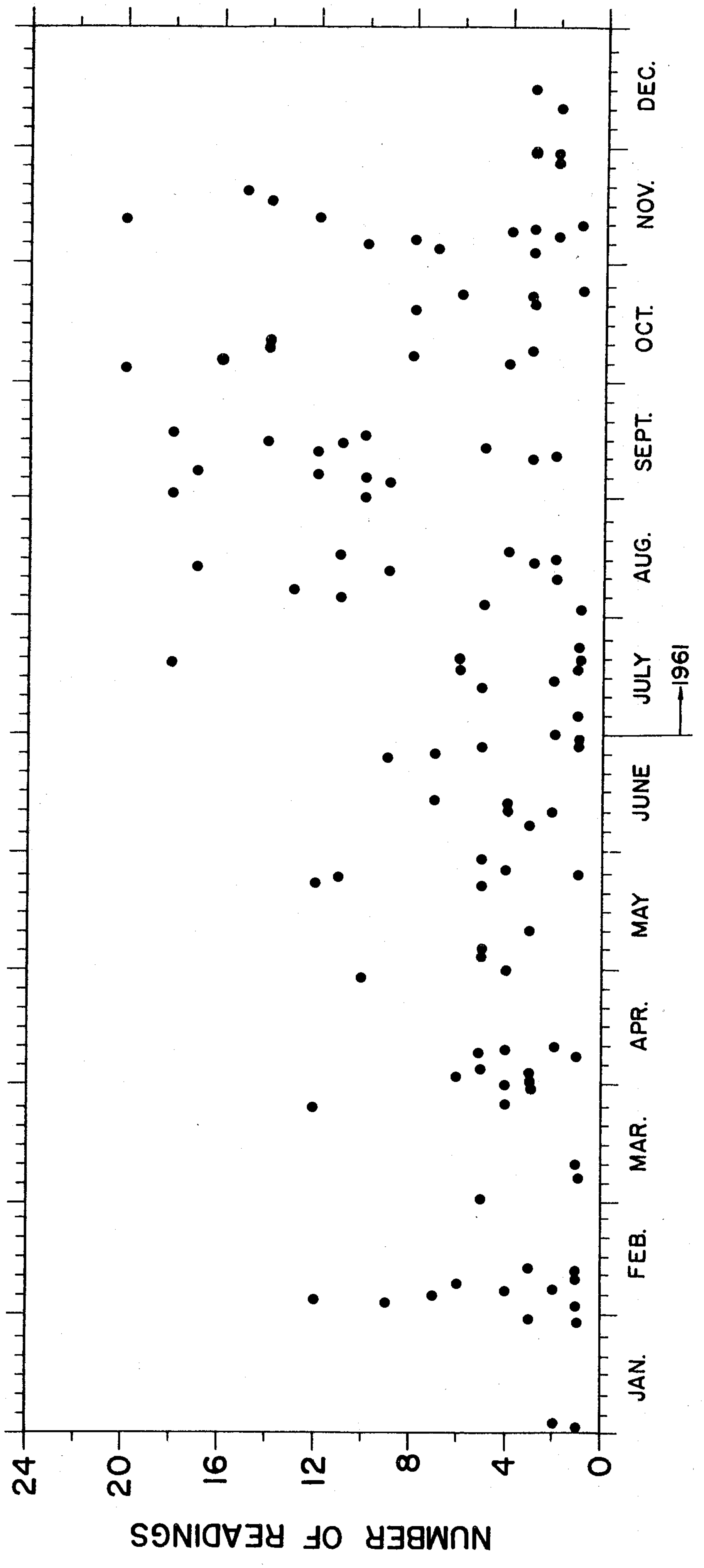

Q̄ (6300) IN RAYLEIGHS—SEPT., OCT., NOV., 1963
150
100
50
0+
1-
1o
1+
2-
2o
2+
3-
3o
3+
4-
4o
4+
5-
5o
MAGNETIC Kp INDEX

Figure 22



JULY 1961 TO JULY 1962

Figure 23

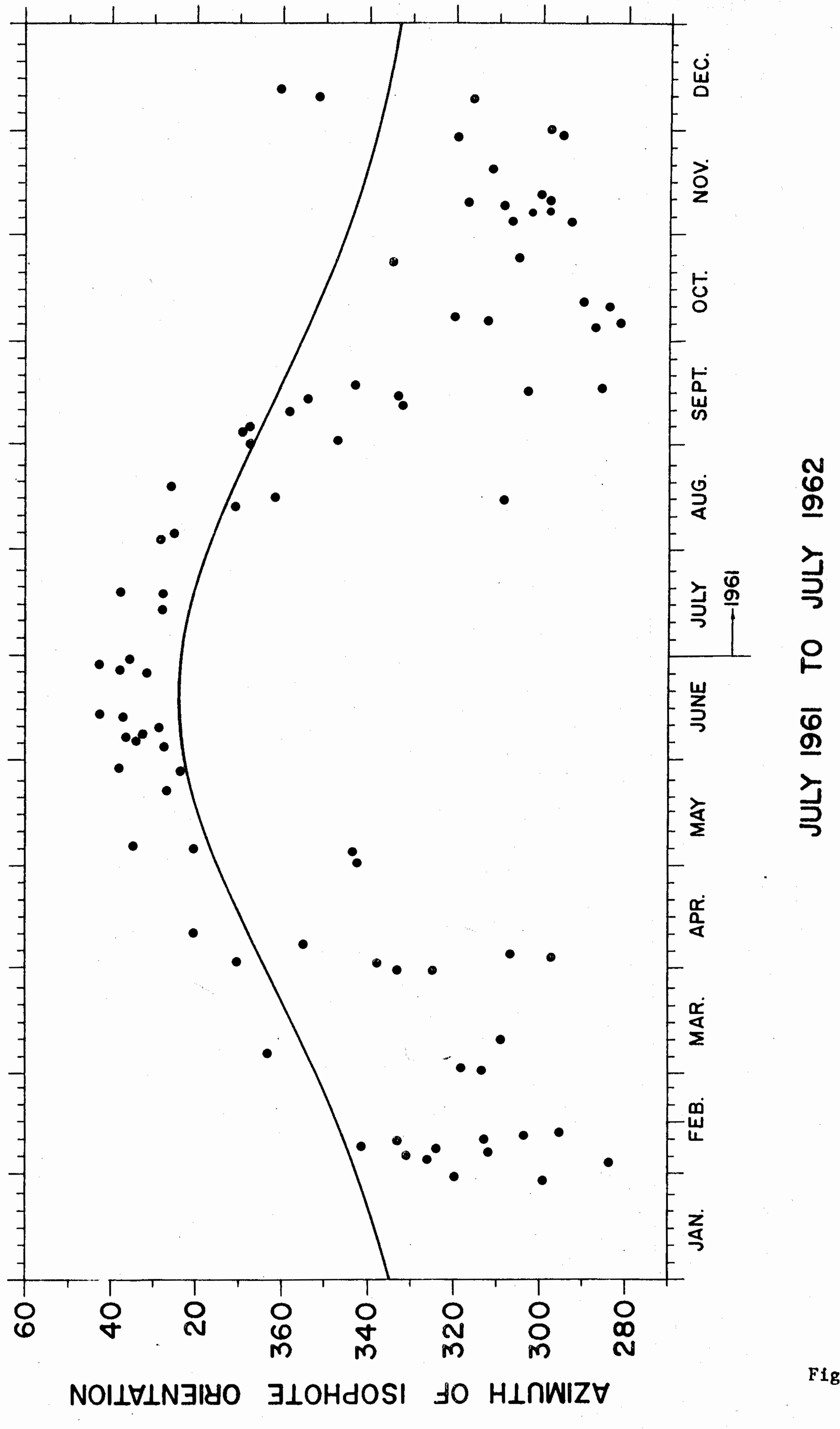
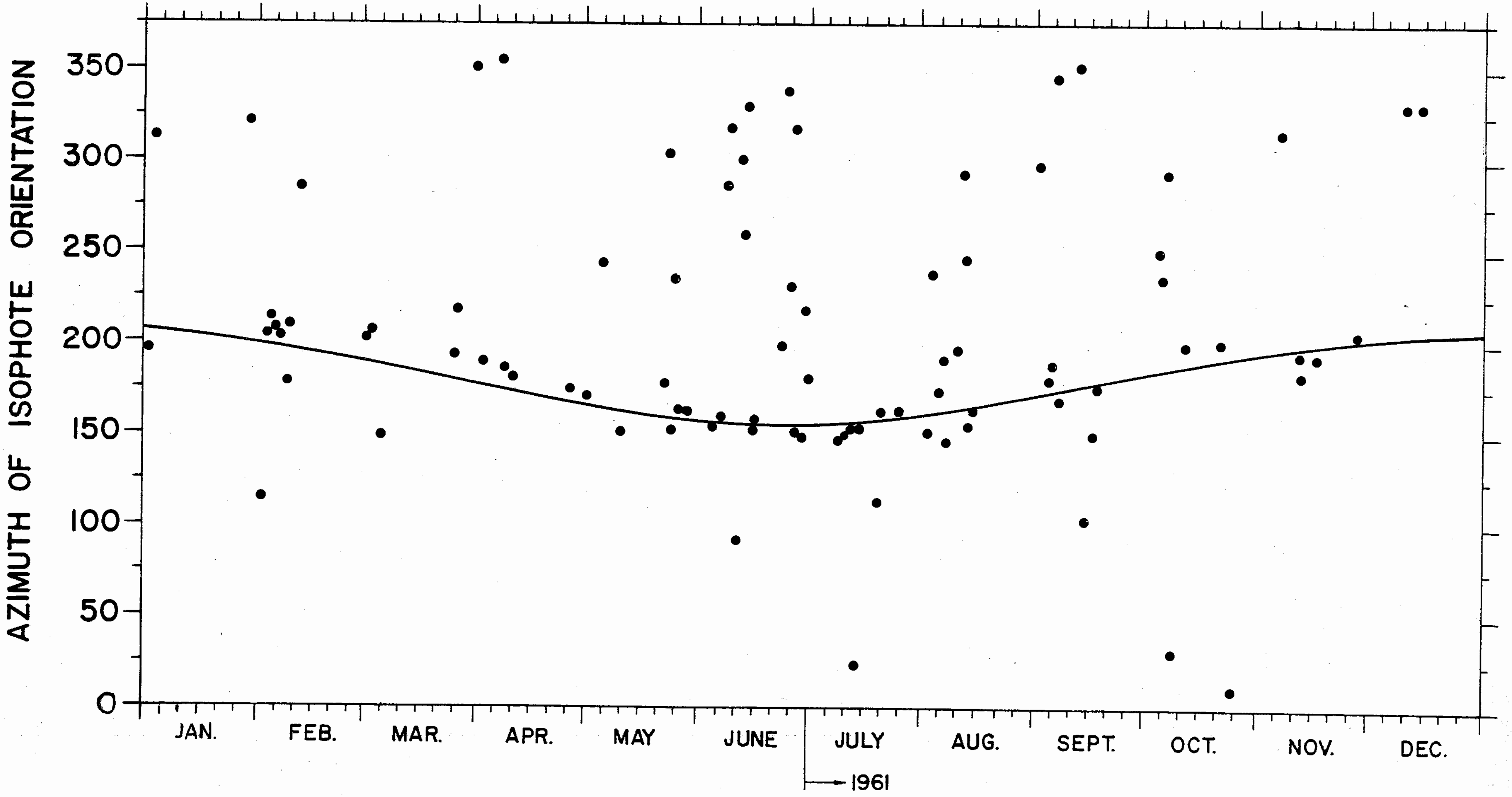

AZIMUTH OF ISOPHOTE ORIENTATION
60
40
20
360
340
320
300
280
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
1961
JULY 1961 TO JULY 1962

Figure 24



JULY 1961 TO JULY 1962

Figure 25

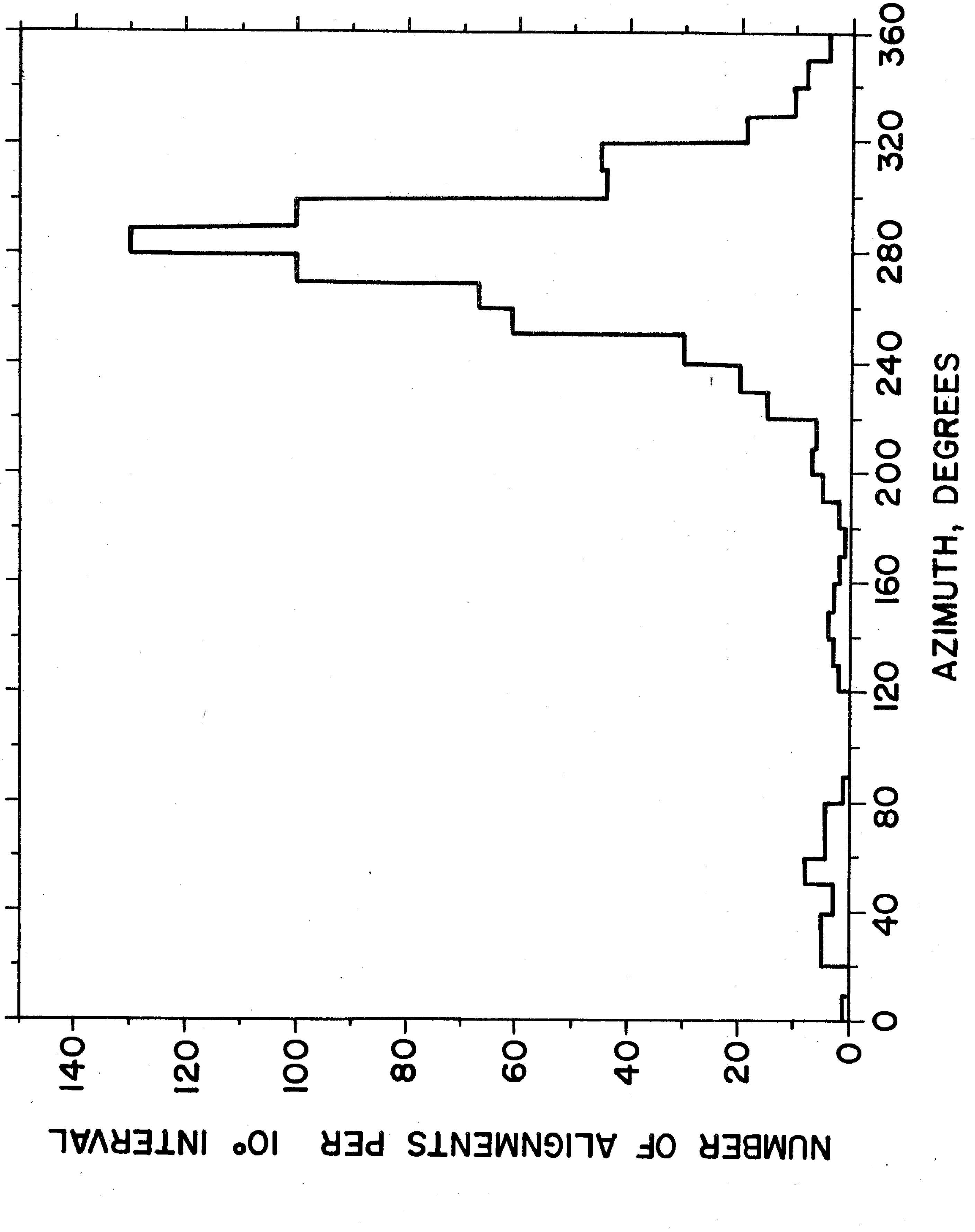

NUMBER OF ALIGNMENTS PER 10° INTERVAL
0
20
40
60
80
100
120
140
AZIMUTH, DEGREES
0
40
80
120
160
200
240
280
320
360

Figure 26

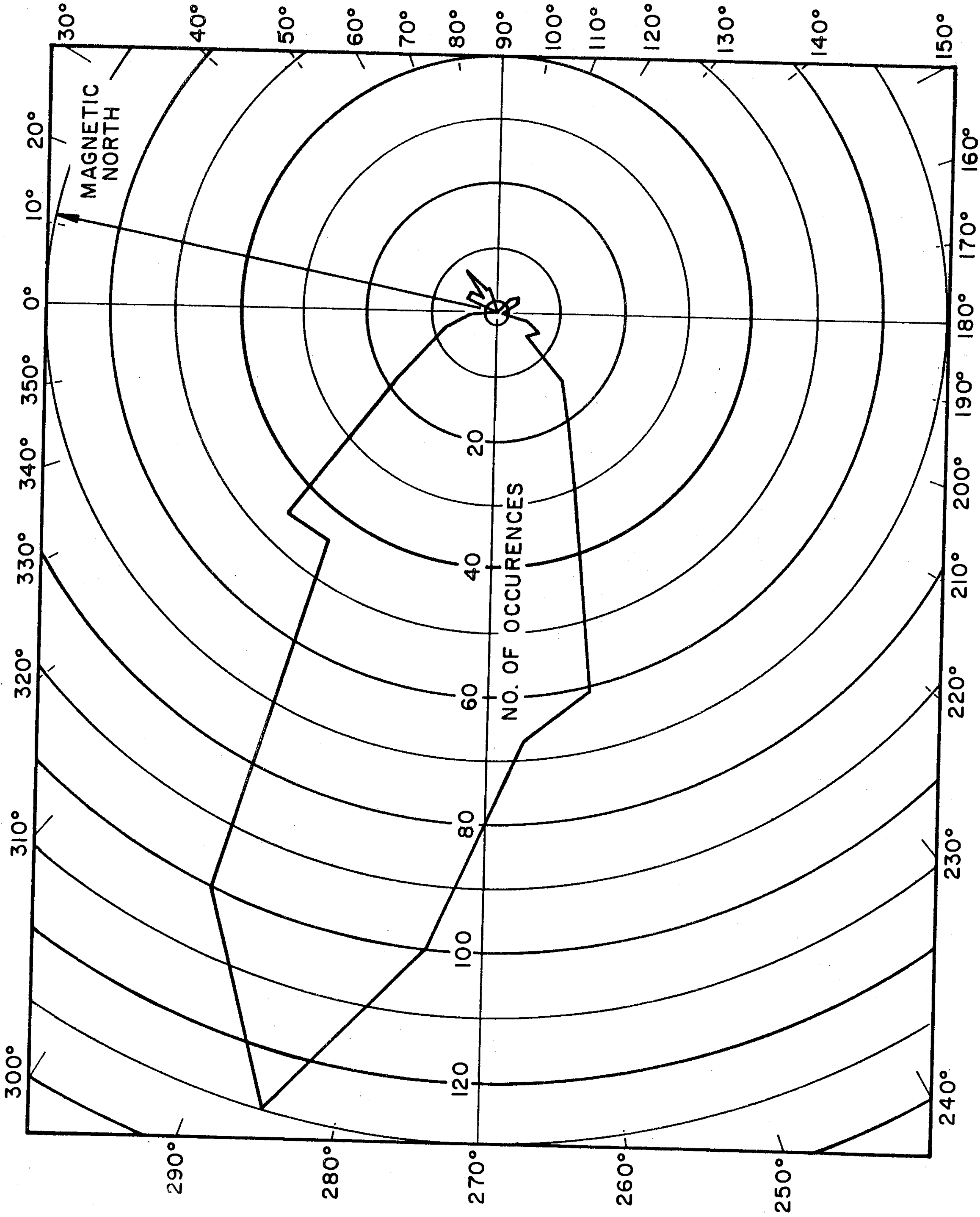

MAGNETIC NORTH
NO. OF OCCURENCES
20
40
60
80
100
120
0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°
160°
170°
180°
190°
200°
210°
220°
230°
240°
250°
260°
270°
280°
290°
300°
310°
320°
330°
340°
350°

Figure 27

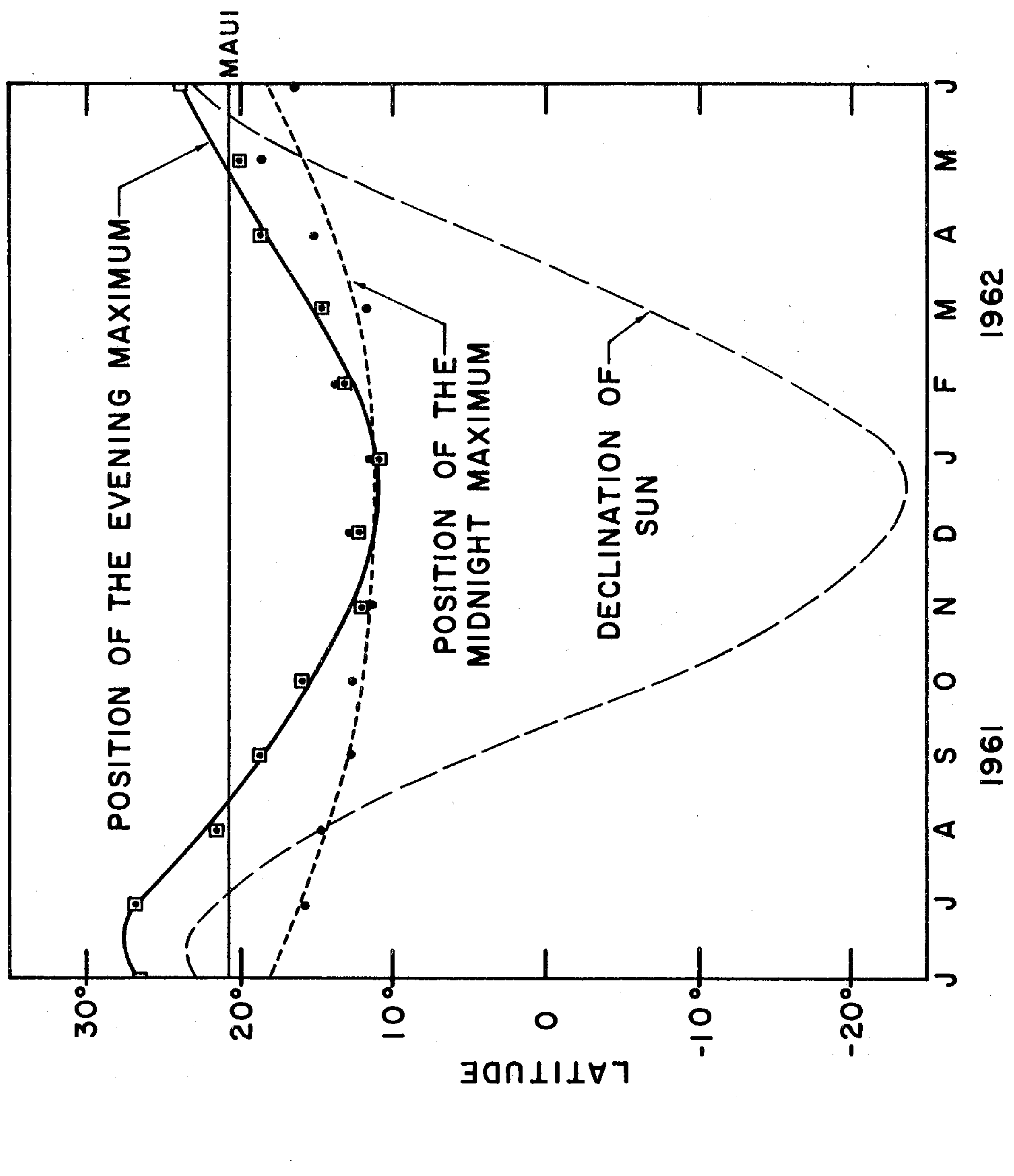

LATITUDE
30°
20°
10°
0
-10°
-20°
J
J
A
S
O
N
D
J
F
M
A
M
J
1961
1962
MAUI
POSITION OF THE EVENING MAXIMUM
POSITION OF THE MIDNIGHT MAXIMUM
DECLINATION OF SUN

Figure 28

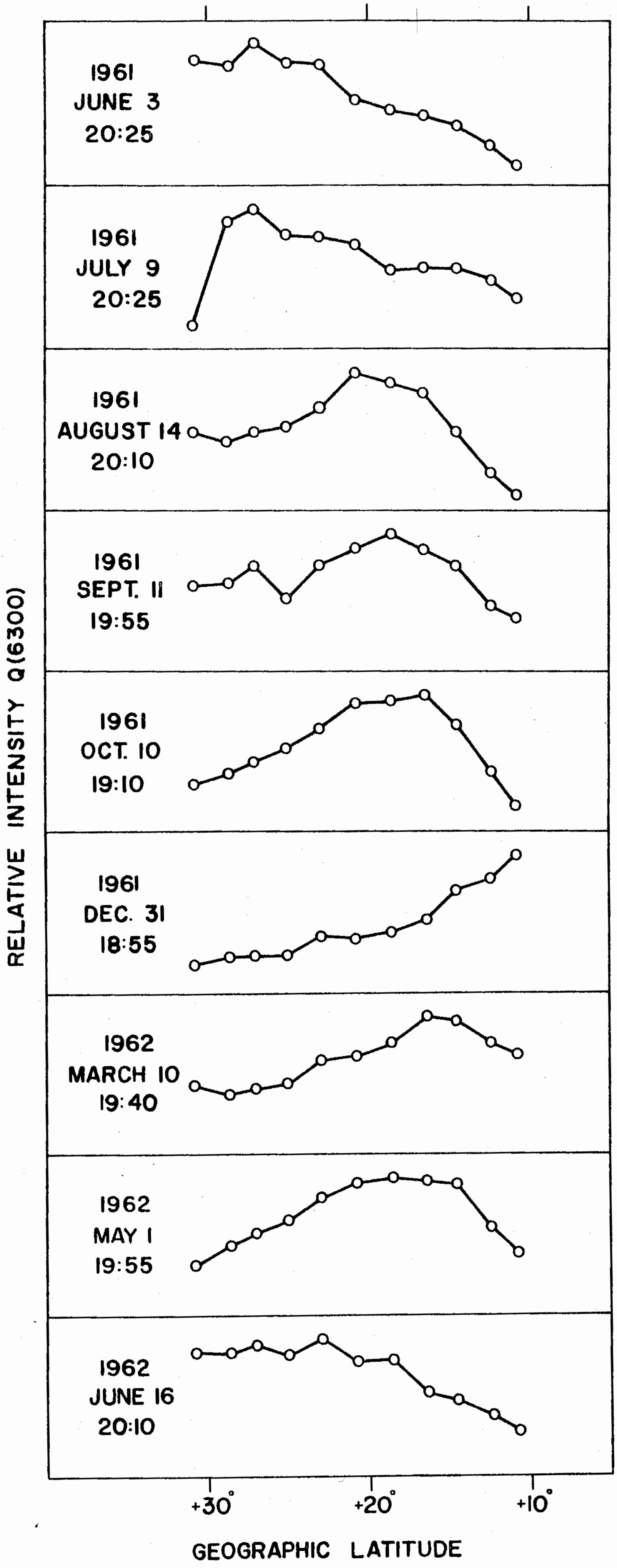

1961
JUNE 3
20:25
1961
JULY 9
20:25
1961
AUGUST 14
20:10
1961
SEPT. 11
19:55
1961
OCT. 10
19:10
1961
DEC. 31
18:55
1962
MARCH 10
19:40
1962
MAY 1
19:55
1962
JUNE 16
20:10
RELATIVE INTENSITY Q(6300)
+30°
+20°
+10°
GEOGRAPHIC LATITUDE

Figure 29

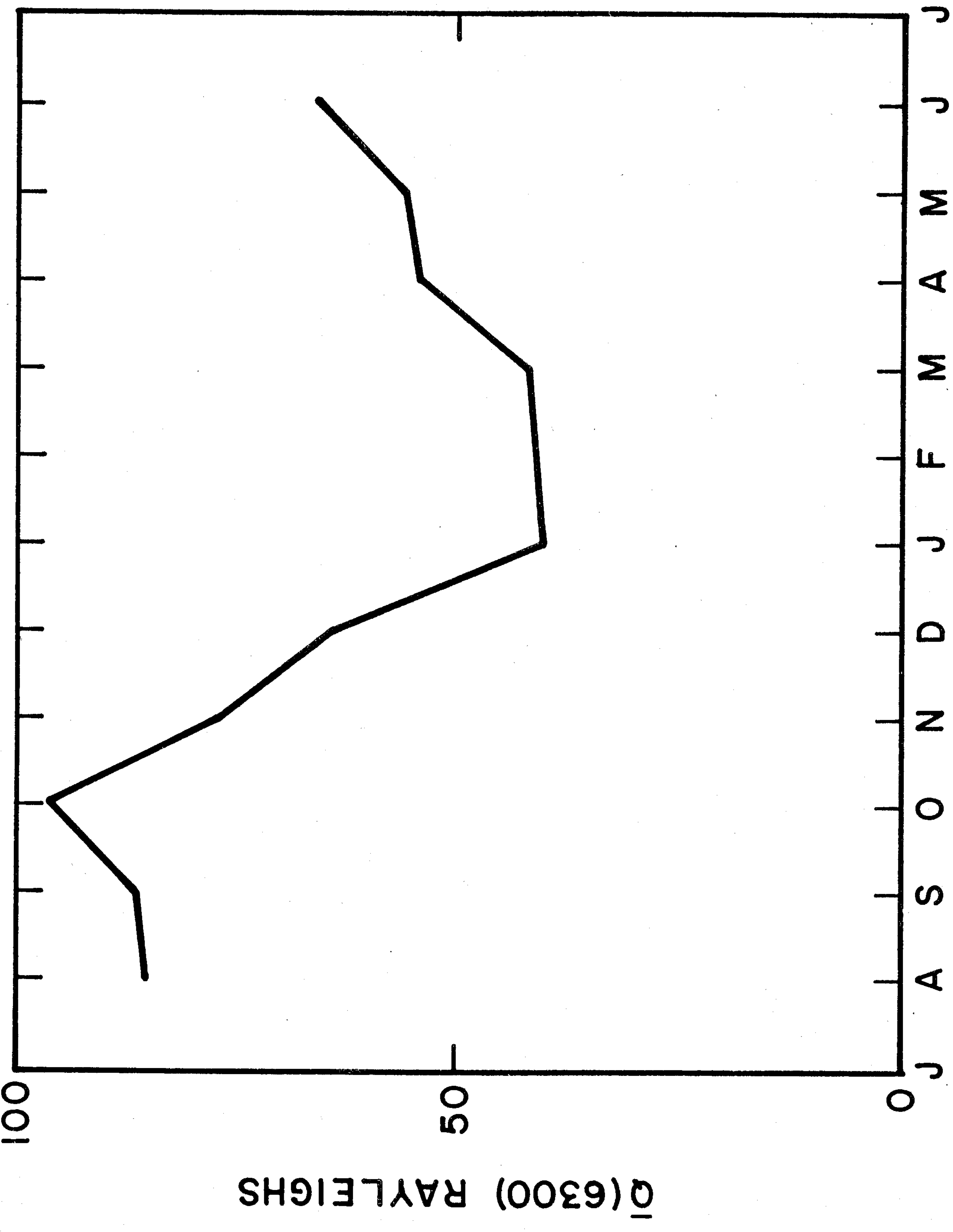


Figure 30

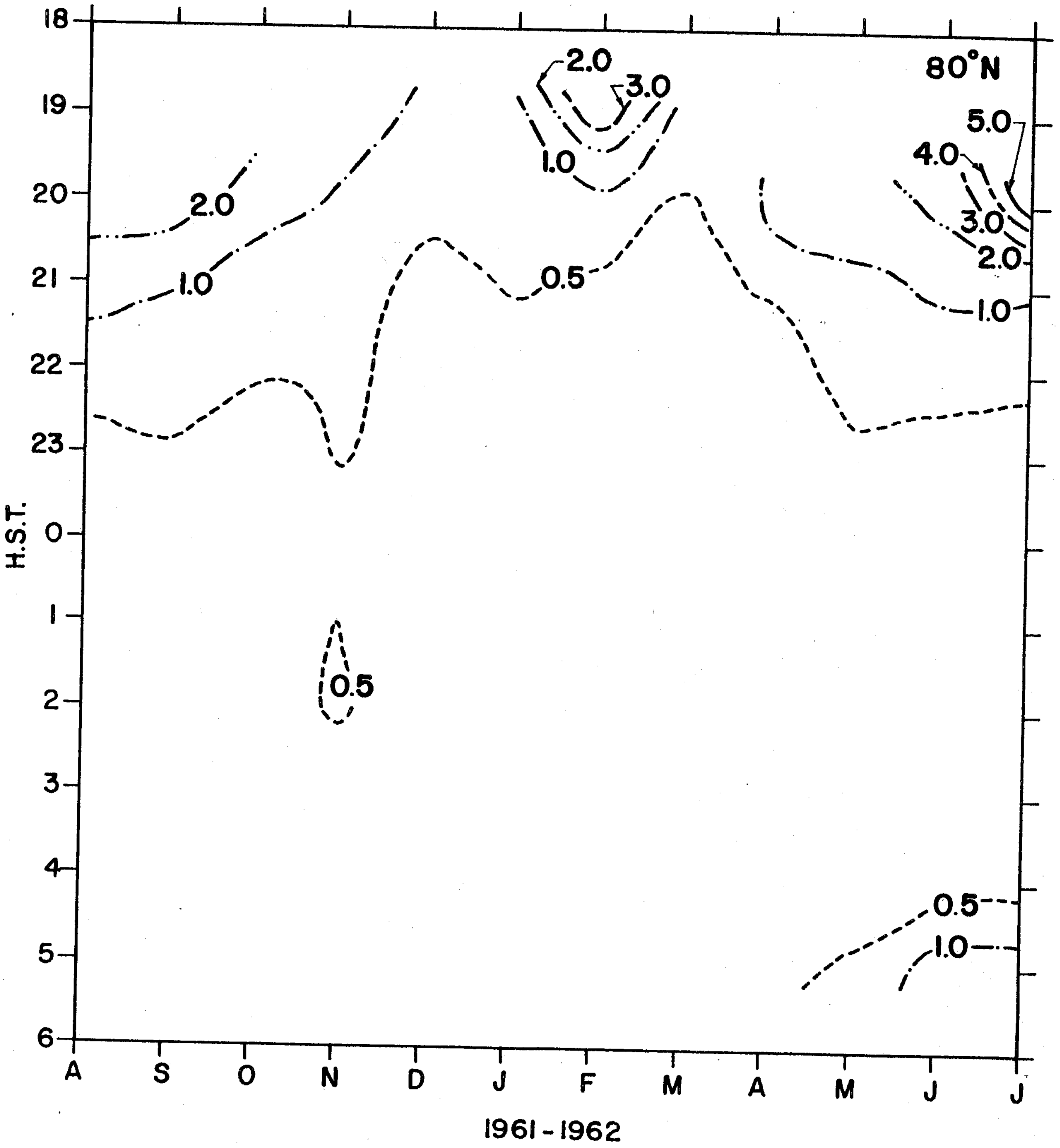

80°N
H.S.T.
18
19
20
21
22
23
0
1
2
3
4
5
6
A
S
O
N
D
J
F
M
A
M
J
J
1961 - 1962
2.0
1.0
0.5
3.0
4.0
5.0

Figure 31

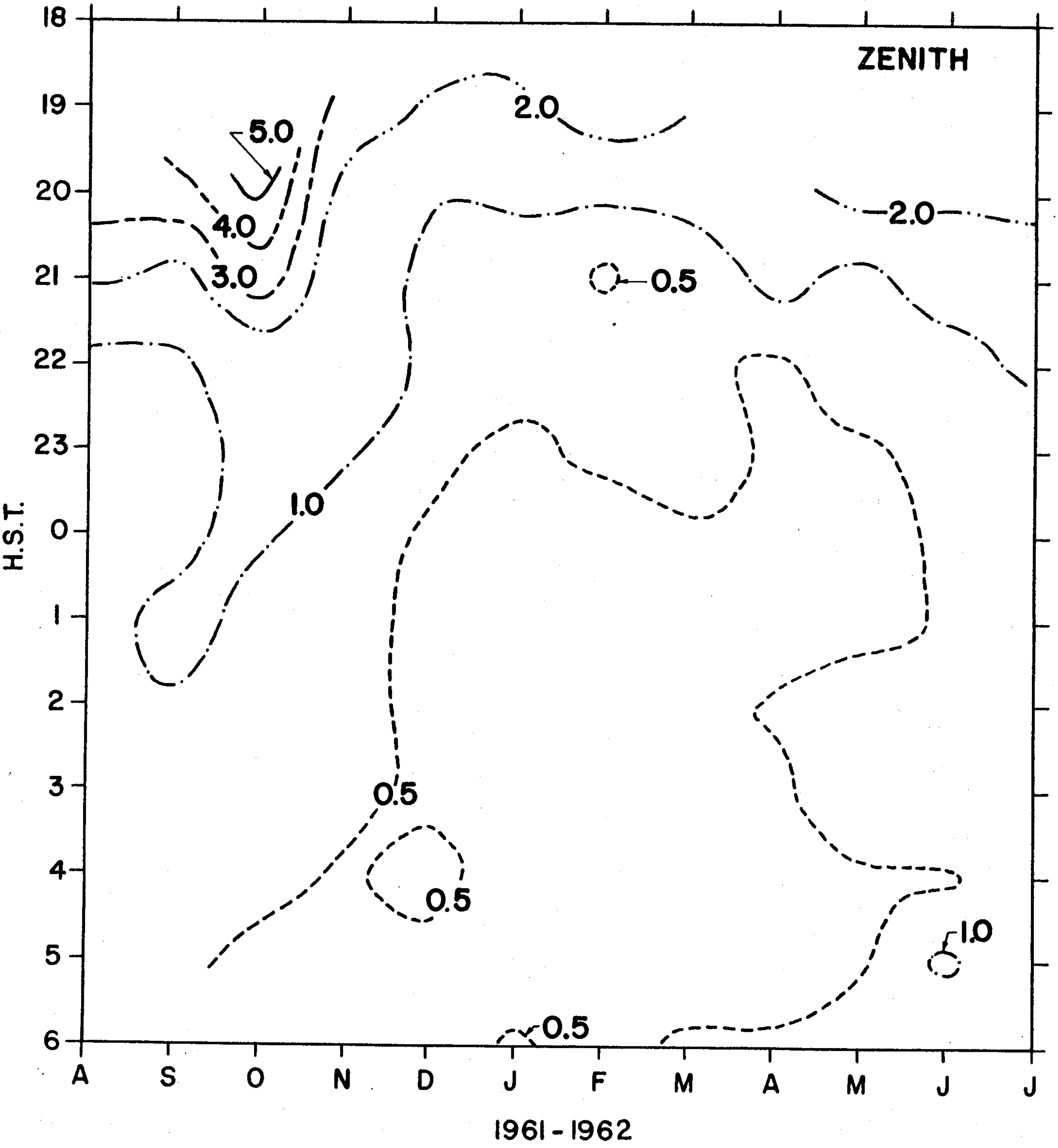

ZENITH
18
19
20
21
22
23
0
1
2
3
4
5
6
H.S.T.
5.0
4.0
3.0
2.0
2.0
2.0
1.0
0.5
0.5
0.5
0.5
1.0
A
S
O
N
D
J
F
M
A
M
J
J
1961 - 1962

Figure 32

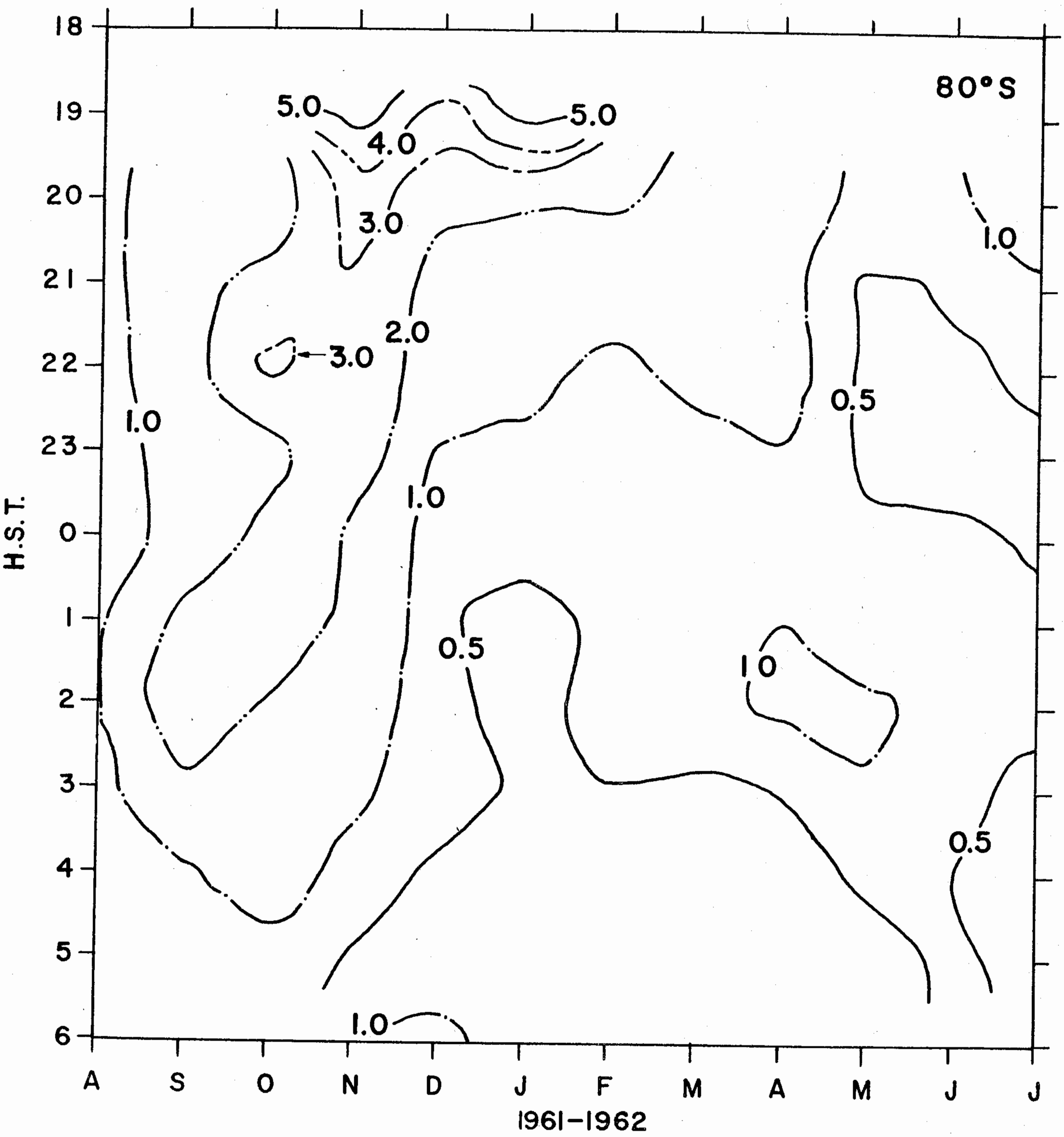

80°S
H.S.T.
18
19
20
21
22
23
0
1
2
3
4
5
6
A
S
O
N
D
J
F
M
A
M
J
J
1961-1962
5.0
4.0
3.0
2.0
1.0
0.5

Figure 33

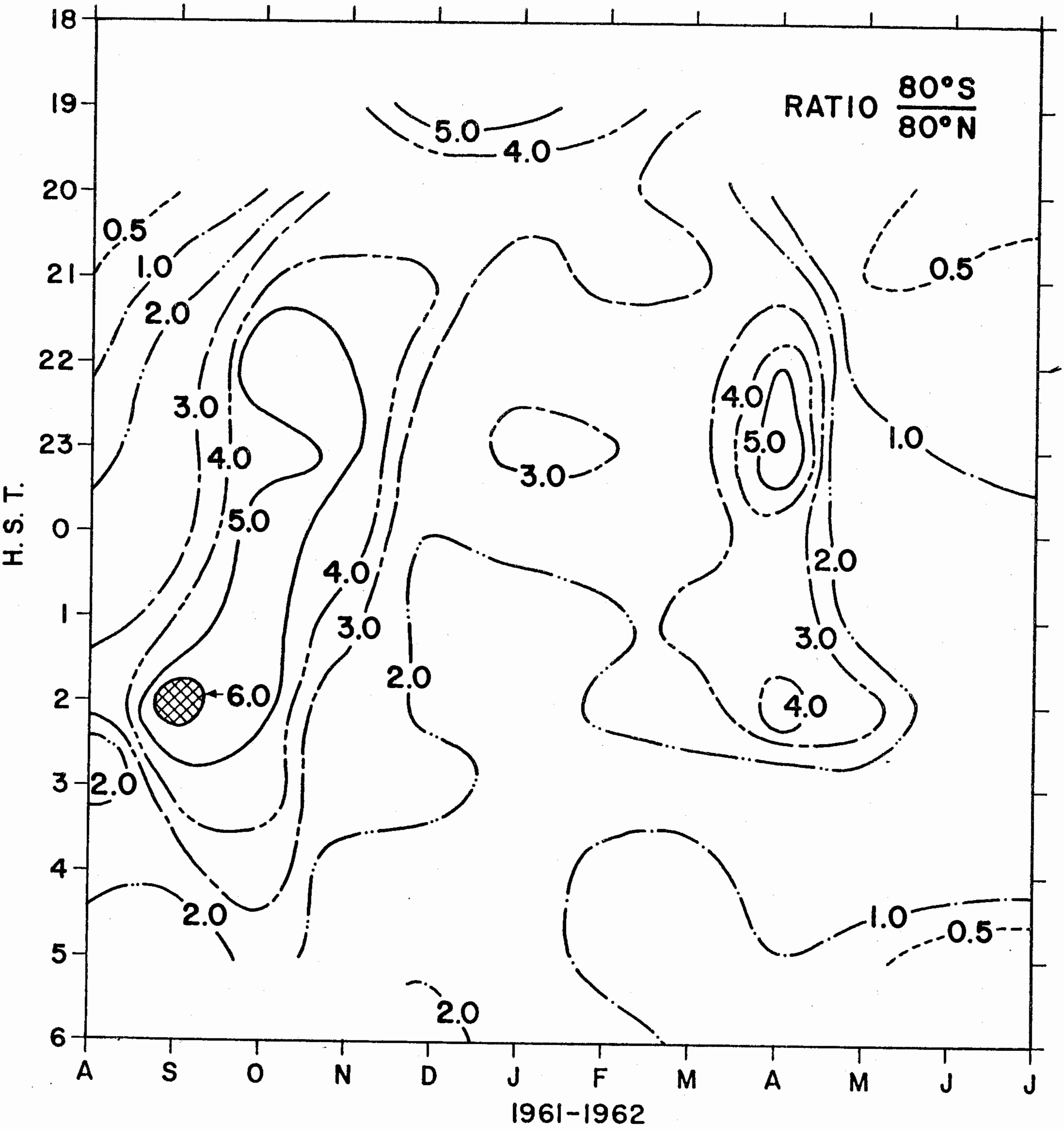

RATIO $\frac{80°S}{80°N}$
H. S. T.
18
19
20
21
22
23
0
1
2
3
4
5
6
A
S
O
N
D
J
F
M
A
M
J
J
1961-1962
0.5
1.0
2.0
3.0
4.0
5.0
6.0
5.0
4.0
3.0
4.0
5.0
2.0
3.0
4.0
1.0
0.5
2.0
2.0
2.0
1.0
0.5
4.0
3.0
2.0

Figure 34

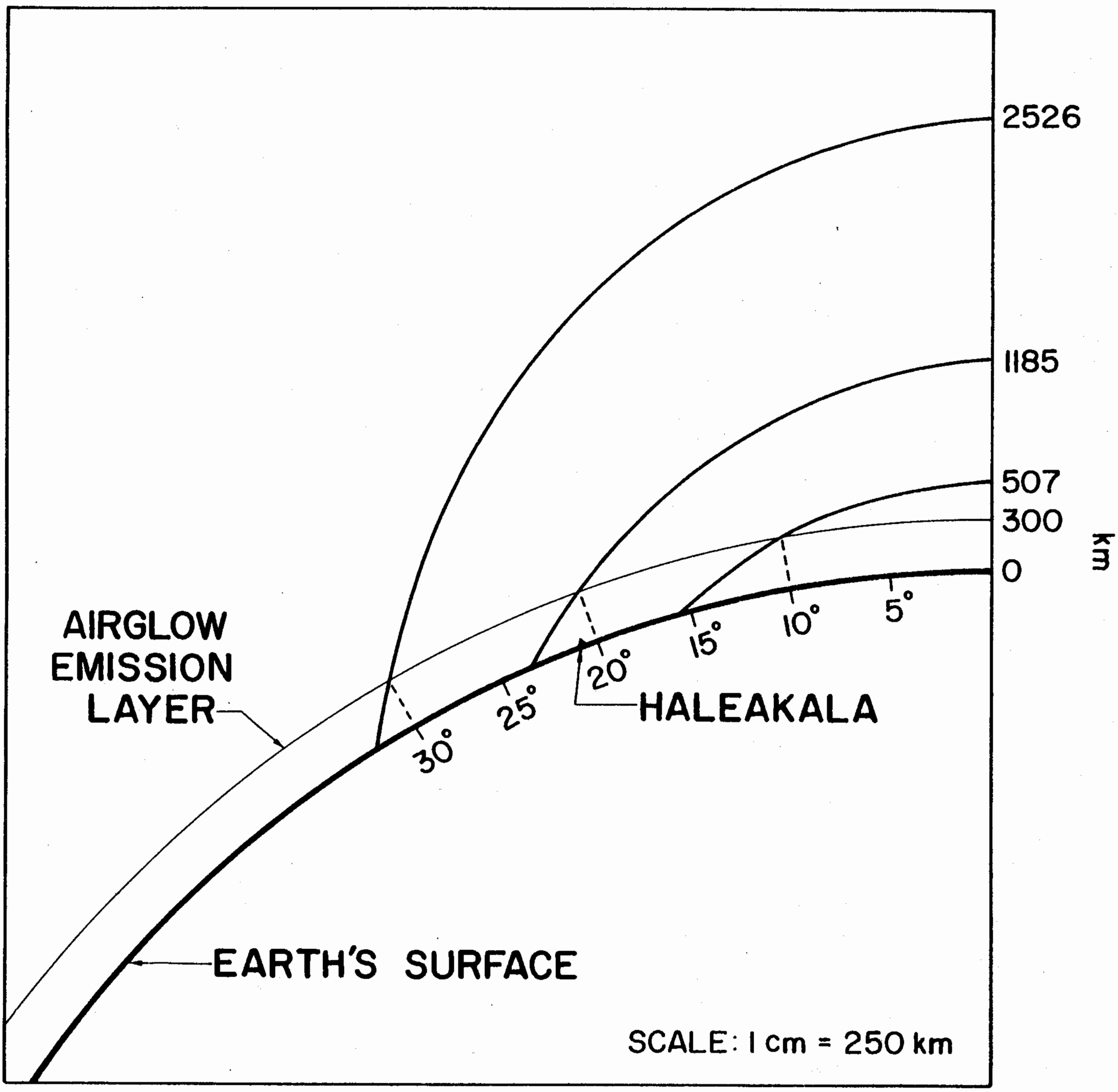

2526
1185
507
300
0
km
AIRGLOW EMISSION LAYER
HALEAKALA
5°
10°
15°
20°
25°
30°
EARTH'S SURFACE
SCALE: 1 cm = 250 km

Figure 35

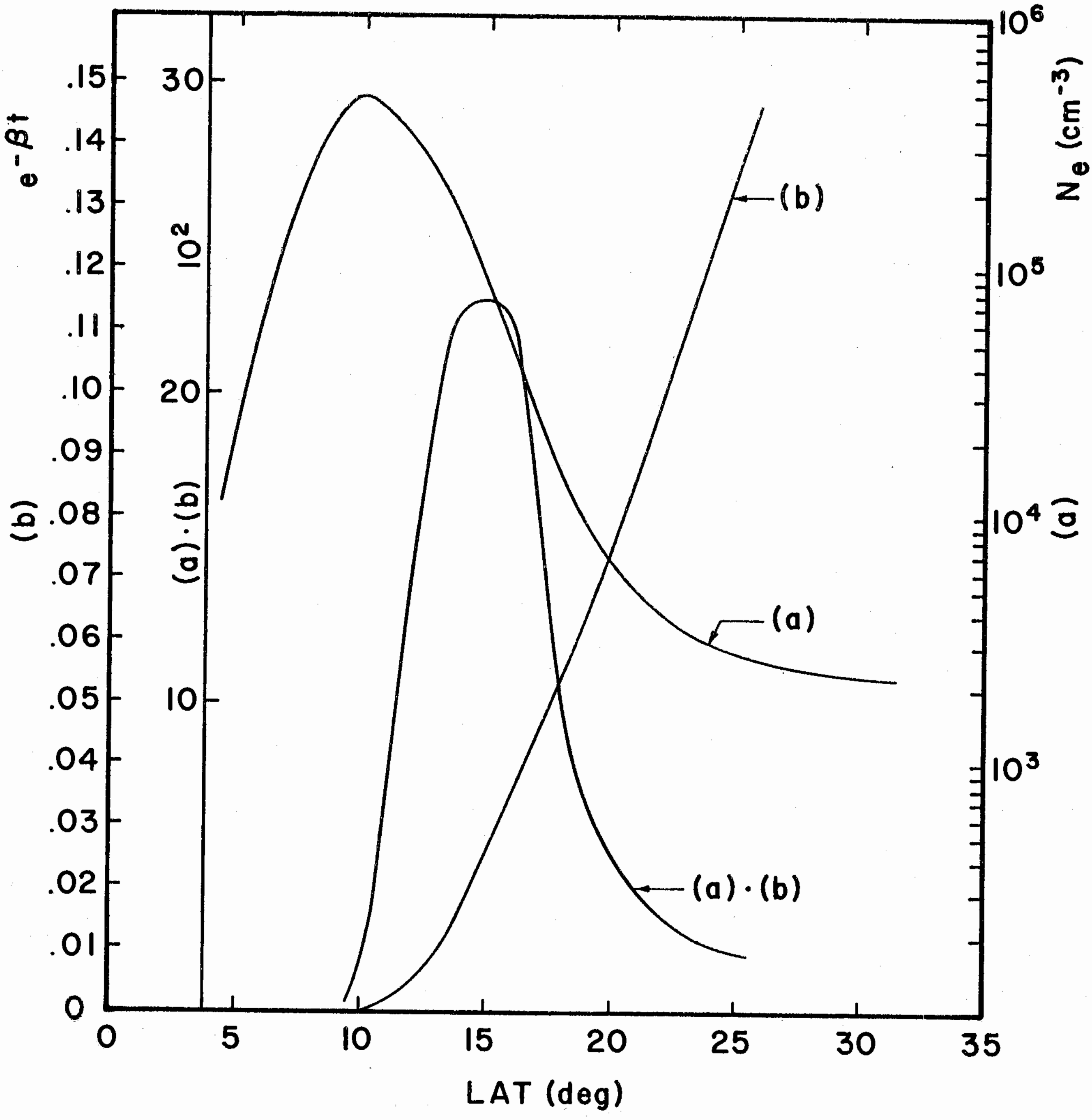

e^-βt
(b)
.15
.14
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
10²
(a)·(b)
30
20
10
10⁶
10⁵
10⁴
10³
N_e (cm⁻³)
(a)
(b)
(a)
(a)·(b)
0
5
10
15
20
25
30
35
LAT (deg)

Figure 36