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PERIODIC VARIATIONS IN STRATOSPHERIC MERIDIONAL WIND FROM 20-65 KM, AT 80°N TO 8°S

By

G. D. Nastrom, A. D. Belmont, and D. G. Dartt

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ABSTRACT

The variability of stratospheric meridional winds is examined in both space and time. Height-latitude sections for January along 70^{o}E and 90^{o}W show a divergence zone above 50 km near 60^{o}N over the former and an intense convergence zone above 40 km near 50^{o}N over North America. This latter structure, with southward winds in the Arctic and northward winds at mid-latitudes over North America, persists from October through April. Tidal winds seem to dominate all other circulation features in summer at all latitudes, and throughout the year at low latitudes. To help understand the observed patterns of variability, long-term periodic features are analyzed. The quasi-biennial oscillation, annual wave, and four-month wave have amplitudes of about 10, 20, and 10 m/sec respectively in the arctic near 45 km. The phase of the annual wave changes by nearly 180^{o} in a narrow zone near 45^{o}N. The semiannual wave has an amplitude of 10 m/sec near 50^{o}N above 50 km with equinoctial phase dates in the region of maximum amplitude. This polar semiannual wave corresponds closely to that previously found in the zonal wind.

I. INTRODUCTION

The status of our understanding of the zonal component of the wind in the stratosphere and lower mesosphere is well illustrated by the recent exchange in the literature concerning the exact latitude of the tropical center of the semiannual oscillation (van Loon, et al, 1973; Reed, 1973; Belmont and Dartt, 1973). By contrast, it seems that the only attempt so far to decompose harmonically the meridional wind in this region of the atmosphere has been by Justus and Woodrum (1973), using only three rocket stations. Although several observational models of the zonal wind have been presented in recent works (Groves, 1971; Belmont, et al, 1974), Groves (1969 and 1970) appears to have been the last to model the meridional wind from observations. The object of this report paper is to prepare an up-to-date observational model of the meridional wind, 20-90 km, and to analyze the long-term (greater than one month) periodic features of the meridional wind.* Shorter period features, such as tides, will be referred to often, but an analysis of their characteristics is beyond the scope of this study.

II. DATA, 20-70 KM

Rawinsonde observations provide a dense and continuous data base up to about 20 or 25 km. At 30 km some rawinsonde observations are still available but their reliability and number deteriorate such that they are little better than rocket observations, on a station-by-station basis. Rawinsonde observations for 1200 GMT for the stations listed in Table 1 were extracted from serial climatological publications of the U. S. and Canadian Meteorological Services in the form of monthly means; an indicator of the

* Unless specifically stated otherwise, the word "wind" will be used to identify the meridional component throughout this report.

number of observations used to compute each mean was also available. In the region 30-70 km the results of the Meteorological Rocket Network (MRN) were used. Multiple rocket ascents in a single day were averaged and weighted as one day. The data had previously been consolidated into semi-monthly periods (for other purposes), thus individual observations were not used in this study, except as noted. The source of all rocket data was the National Climatic Center, Asheville. The MRN stations used for periodic analysis and the period of record of each are included in Table 8, and the monthly mean profiles at 2 km intervals, 20-70 km, are in Appendix A. Those additional stations which were used for other analyses but which had insufficient data for periodic analysis are listed in Table 2.

Above about 60 km the number of MRN soundings falls off very rapidly, and special techniques must be used to probe the region above 70 km. Thus, due to the large differences in data availability and measurement techniques, the analysis has been divided into two regions: 20-70 km and 70-90 km. Results for 20-70 km will be discussed first.

III. INFLUENCE OF SMALL-SCALE VARIABILITY

A. TIME (TIDES)

Both the zonal and meridional components of the wind are affected by small-scale variability in time and space. Since the amplitude of large-scale features in the zonal wind is large compared to that of small-scale ones, the influence of small-scale features is generally disregarded in studies of the zonal wind. The influence of small-scale features cannot be overlooked when examining the meridional wind, however, since they are often of the same order of magnitude as the large-scale features; sometimes the small-scale features are dominant.

As noted, the diurnal tide is one small-scale feature that must be taken into account. Details of present tidal theory (Chapman and Lindzen, 1970) are too uncertain to use for correcting basic data for the effect of tides. However, observational evidence of the character of the tide at MRN heights is available for the summertime (Reed, et al, 1969), and for all seasons at balloon heights (Wallace and Hartranft, 1969; Belmont and Dartt, 1970).

Most observations at MRN stations are taken at a fixed local time each day. Thus, one must anticipate that the monthly or seasonal means are aliased by the diurnal tide. Listed below are seven MRN stations, the local time when most observations are taken, and the percentage of observations taken in the three hour period centered at that time; 1964-71.

	Local Time	Percent
Cape Kennedy	10	76
Fort Greely	11	72
Antigua	11	74
Ascension	15	88
Point Mugu	10	52
Barking Sands	11	91
Thule	11	73

Figures 1 and 2 are mean summer (June, July, August) vertical profiles at Cape Kennedy and Fort Greely. For comparison, the estimated tidal winds at various hours throughout the day, computed using the amplitudes and phases given by Reed, et al, (1969) are also plotted. The similarity of the observed mean profile to the tidal wind profile at the most frequent observation hour is significant when one considers that the observed means also contain some data from other hours of the day. This strongly suggests that the computed summertime means are merely a reflection of the magnitude of the tidal wind at the time of day that the observations are taken and that if the data were evenly distributed through all hours of the day the computed mean would be zero. Comparison of profiles at tropical stations shows this similarity for all seasons.

Aliasing of the monthly means by the diurnal tide is probably present in all of the MRN and rawinsonde data due to the fixed hour of observation. At extra-tropical latitudes during seasons other than summer, however, the contribution to the mean from features other than the tide is so large that tidal effects cannot be discerned. The significance of the influence of the diurnal tide on transport computations, and the effect obtained by neglecting this factor, has been studied at balloon heights (Belmont and Dartt, 1970).

B. SPACE (LONGITUDE VARIATIONS)

Longitudinal variations in the mean meridional wind are present at tropospheric heights as the well-known wave number three structure, especially evident in winter (Oort and Rasmusson, 1970). As altitude is increased the pattern transforms into the wave number two structure observed in the mid-stratosphere (van Loon, et al, 1972). Some of the longitudinal variations in wind in the upper stratosphere and mesosphere can be seen in Figures 3 and 4. Figure 3 presents the observed mean January meridional wind at 50 km in vector form on a polar projection. The vectors are centered at the individual station locations. Flow across the pole and a well-defined convergence zone at mid-latitudes over North America are the most prominent features. The irregular geographic distribution of stations does not permit one to determine how many standing waves are present, although it does appear that there may be a mid-latitude divergence zone near 5°E. These longitudinal variations imply that standing eddies are present in the upper stratosphere. The observing network is not yet dense enough at these levels to resolve wave structure on most scales, but the likely existence of waves must not be ignored when examining stratospheric data.

The presence of a mid-latitude convergence zone over North America is interesting and is consistent with estimates of divergence in the zonal wind. Differencing the mean January meridional winds at Thule and Wallops Island, and at Primrose Lake and White Sands, yields an estimate of convergence of about 1 m/s/degree of latitude in both cases. From continuity, this could be balanced by a vertical velocity gradient of 0.9 cm/s/km or by zonal wind divergence of 9 m/s/1000 km. The magnitude of both of these options is reasonable; in fact, differencing the mean January zonal winds at Wallops Island and Point Mugu at 50 km yields divergence of about 11 m/s/1000 km. The internal consistency of these values indicates that quasi-permanent circulation patterns are probably present in the upper stratosphere just as they are in the troposphere (the Aleutian low, for example). During January, the north-south gradient of meridional wind (9 m/s/1000 km) appears larger than the east-west gradient of the meridional wind (2 m/s/1000 km) between Wallops and Mugu. This suggests that the irrotational component of the meridional flow may be longer than the rotational component at these heights. Thus, meridional winds derived from the pressure or thermal fields using the geostrophic approximation may not be representative of the actual meridional winds present.

Figure 4 presents the mean January meridional wind at 90 km in vector form on a polar projection. Stations used are listed in Table 5. At this height it appears there may be convergence at the pole; however, the scanty number of observations at Barrow gives little weight to the mean there. A mid-latitude convergence zone can be seen near 90^{o}W and near 70^{o}E. The means at 90 km are much smaller than those at 50 km, otherwise little change in general pattern can be detected between these figures. At this altitude the largest longitudinal variations occur in January (Sprenger, et al, 1971). As pointed out by Kochanski (1963), features of the circulation in this region are very complex and a variety of models could be fitted equally well to the same data.

Height-latitude sections of the mean January winds are presented in Figures 5 and 6 for stations near 70^{o}E and 90^{o}W respectively. Note the mid-latitude convergence zone in Figure 6 as opposed to the mid-latitude divergence zone in Figure 5. The mid-latitude zero wind line is nearly vertical in both figures and both have maxima near 50 km in the Arctic and above 60 km near 40^{o}N.

As MRN data along all meridians are collected at very nearly the same local time, the observed longitudinal variations are most certainly real, large-scale phenomena and not caused by sampling the progressing diurnal tide at different locations along its waveform. The persistence of these so-called standing eddies can be described by the standard deviations of the monthly means. The standard deviations at 30, 40, and 50 km for January and July at Fort Greely, Churchill, Wallops, and Cape Kennedy are listed in Table 3 along with the number of monthly means used to compute each. Note that the standard deviations at Churchill and Fort Grrely have inverse trends with altitude during January. The Fort Greely values increase with increased altitude while the Churchill values decline above 40 km. Interpretation of this behavior in terms of the circulation of the stratosphere must await better data coverage than we have now.

IV. MONTHLY MEANS AND STATISTICS, 20-70 KM

A. PREPARATION OF 90°W VALUES

In order to reduce longitudinal variations only stations within 30° of 90°W were used when preparing the height-latitude and time-latitude sections discussed below. A height-latitude section for each month was prepared using the MRN monthly means, 12 GMT rawinsonde data, and grenade data (see Table 5). Each monthly mean value was weighted during analysis by the number of observations used to compute the mean. The same data were used to prepare time-latitude sections at 20, 30, . ., 60 km. Figures 6-9 present the height-latitude sections for January, April July, and October respectively and Figure 10 shows the time-latitude section for 40 km.

Values of the monthly mean meridional winds were read off the analyzed height-latitude sections at 5° latitude intervals for 20, 30, . ., 60 km. In order to gain the benefit of interpolation in both time and space, these 5° latitude values were compared with the analyzed time-latitude sections and any significant differences were resolved. The resulting values, representative of the middle of the month, are tabulated in Appendix B.

B. YEARLY MARCH OF THE MERIDIONAL WIND

Examination of the height-latitude sections (Figure 6-9) discloses a number of features during autumn through spring. In October (Figure 9) a region of southward winds extends from the arctic to 55°N, while northward winds are organized as a broad belt from 0° - 55°N, above 40 km. The region of southward winds expands southward and intensifies until January (Figure 6), when these winds have their largest magnitude (over 30 m/s) of the year, between 40 and 50 km in arctic regions, with a secondary maximum near 60 km at 40°N. The January maxima are directed southward and northward respectively, while the zero wind line is near where the mean westerly jet occurs (Belmont, et al, 1974a). After January the winds begin to decrease, and by April (Figure 7) there is only a small core of southward winds near 30 km in the arctic and a diffuse band of northward winds above 50 km.

As pointed out in connection with Figures 1 and 2, the summertime profiles exhibit characteristics which are very similar to those of the tidal wind. Since most observations are taken in late morning, one may think of Figure 8 as a crude approximation of a cross-section of the magnitude of the tidal winds in July just prior to local noon.

The progression of the northward-southward structure and the apparent impressions of the tides are also present in Figure 10, a time-latitude section of the wind at 40 km. The appearance of the zero wind line north of 40^{o}N has a similar appearance to the spring and fall reversal lines seen on time-latitude sections of the zonal wind at this height (Belmont, et al, 1974a).

C. STANDARD DEVIATIONS

Standard deviations of the daily winds are tabulated by station and month in Appendix C at 2 km intervals, 20-70 km, along with the monthly mean wind and number of observations used. These values were computed using individual observations for the period 1969-1971 (except as noted). The standard deviations are descriptive of transient eddies and can be attributed, in part, to gravity waves, diurnal tide, synoptic events, sudden warmings, and errors of observation. When daily values become available for the eleven years of record used in Appendix A, standard deviations will be included there and Appendix C can be eliminated.

Figures 11 and 12 present the spatial patterns of the standard deviations of individual observations in January and July, respectively. In both January and July the maximum standard deviations parallel the locations of maximum wind. However, note that in July at 50 km the mean wind (Figure 8) changes little with latitude but that the standard deviation (Figure 12) steadily decreases as latitude is increased. Little longitudinal variability of the standard deviations could be found with the stations available.

V. PERIODIC ANALYSIS, 20-70KM

The eleven-year time series of semi-monthly means for each station listed in Table 2 was analyzed for periodic variations using a periodic regression technique (see Belmont and Dartt, 1973). Frequencies analyzed were the long-term mean, quasi-biennial oscillation (QBO), and the first six harmonics of the annual wave. Tests with QBO periods ranging from 23 to 32 months showed little difference, so a QBO of 29 months was used in order to be consistant with previous analysis of the zonal wind (Belmont, et al, 1974). Only the results for the mean, QBO, and first three harmonics of the annual wave are included here. The second three harmonics of the annual wave had small amplitudes, relatively large error estimates, and rapid or irregular phase variations; making their interpretation tenuous if not meaningless. Periodic results are given in Table 8.

The periodic regression technique can be used to analyze a time-series of irregularily spaced data points and can include frequencies that are not integral divisions of the period of record. Also, this technique simultaneously determines a statistical estimate of the errors in amplitude and phase for each frequency included. These error estimates were essential when evaluating the spatial patterns of the amplitude and phase of the component waves.

A. LONGITUDINAL VARIATIONS

Due to unidentified, but possible, presence of standing eddies, longitudinal variations should be expected in the periodic features of the wind also. Figure 13 shows the height profiles of amplitude and phase of the annual wave at Heiss Island and Thule, and Figure 14 compares the annual waves' parameters at Volgograd and Primrose Lake. Note that the phase dates are nearly reversed between each of these pairs of stations. Thus, the results presented in Figures 15-23 are limited to stations within 30^{o} of 90^{o}W. The dashed-dotted line in Figure 14 denotes uncertainty in the phase profile between 40 and 50 km. This uncertainty is due to the large error estimate associated with a value that does not fit the pattern above or below it. A dashed-dotted line will be used in all following figures to imply uncertainty resulting from large error estimates, conflicting values, or simply a lack of stations.

B. LONG-TERM MEAN (FIGURE 15)

This pattern is basically a reflection of the northward-southward winter pattern at mid and high latitudes (since summer values are nearly zero). A southward core located near 40 km in the arctic and a northward band above 45 km near 45^{o}N are the most prominent features. That the low latitude means are due to aliasing by the tidal wind is suggested by the antisymmetry of the Ascension (8^{o}S) and Sherman (9^{o}N) profiles above 40 km.

C. QUASI-BIENNIAL OSCILLATION (FIGURES 16-17)

This component of the variance has a significant maximum in the arctic near 40 km. However, no appreciable counterpart to the well-known tropical QBO in the zonal wind was found; in fact, the amplitudes below 50 km south of $40^{\circ}N$ are so small that a 1 m/s isoline is included to emphasize the pattern. Despite this, in Figure 16, the maximum amplitude of the QBO near 40 km in the arctic is nearly 10 m/s.

Since the QBO is not tied to a fixed calandar, its time of maximum northward wind is relative. The zero line in Figure 17 is a relative starting time, with the wave moving northward and downward, reaching $60^{\circ}N$ at 25 km 24 months after its first appearance at low latitudes. The uncertainty indicated by the dashed-dotted lines in Figure 17 is due to large errors and conflicting values, since when the amplitude is near zero, phase can take on any value.

D. ANNUAL WAVE (FIGURES 18-19)

1. Description

The annual wave is found to be the most significant periodic feature of the meridional wind. It has its maximum amplitude in the arctic near 50 km (Figure 18) with a secondary maximum near $40^{\circ}N$ at 50 km. The phase dates (time of maximum northward wind) of the two maxima are antisymmetri about a zone of minimum amplitude near $45^{\circ}N$. The northern wave appears nearly simultaneously over the entire arctic upper stratosphere and propagates rapidly downward. The mid-latitude wave appears simultaneously over nearly the entire mid-latitude upper stratosphere.

2. Aliasing by the Diurnal Tide

A large annual wave would be expected from inspection of the height-latitude diagrams, and is consistant with previous work (Justus and Woodrum, 1973). However, present tidal theory (Chapman and Lindzen, 1970; McKenzie, 1968) and observational studies indicate that the phase of the diurnal tide is constant throughout the year at high latitudes, but that the amplitude undergoes a seasonal variation. Thus, the diurnal variation can alias the data so as to distort the amplitude of the annual wave.

In a preliminary effort to determine the effect of aliasing by the diurnal tide upon the amplitude of the annual wave, several experiments were performed in curve-fitting a three year time series (1965-1967) of individual Fort Greely observations. These three years of observations were all that were immediately available in a non-consolidated form. The distribution of observations throughout the 24 hour period is so biased toward one time that little quantitative significance can be given to the results of these tests. However, the values for the diurnal tide are so similar to those obtained by Reed, et al (1969), (who used summer values, 1959-1966) that these tests probably describe the general effect of the diurnal tide.

Examples of the results of six tests and the frequencies included for each are given in Table 4. M is the long-term mean; A is the annual wave; D is the diurnal wave; and ALL refers to the mean, QBO, and first six harmonics of the annual wave, thus, not including the diurnal wave. A times D is an amplitude modulated diurnal wave with the period of modulation equal to one year.

In Table 4, note that the amplitude of the annual wave at all levels is nearly insensitive to the presence of other frequencies. The phase also showed little change. The mean, however, especially at 30 and 40 km, changes significantly between examples when the diurnal wave is included and when it is not. The algebraic change of the mean (i.e., more negative when the diurnal wave is included) is consistent with the discussion of Figure 2, since at the primary observation time the diurnal wind component is positive. Thus, the diurnal tide aliases the mean but not the annual wave, so that in the context of this study with respect to the annual wave, the seasonal variation of the amplitude of the diurnal tide is insignificant.

E. SEMIANNUAL WAVE (FIGURES 20-21)

The half-yearly component of the variance has its maximum amplitude above 55 km in the arctic regions. A broad ridge of relatively large values near 55°N extends downward with values in excess of 2.5 m/s everywhere above 25 km. This area of maximum amplitude is analogous to that found in the zonal wind (Belmont and Dartt, 1973); however, no counterpart to the tropical semiannual wave in the zonal wind was found.

The phase of the polar maximum of the semiannual wave is equinoctial, appearing over nearly the entire region of large amplitudes at the same time. It propagates downward and northward reaching highest latitudes two months later. It also propagates southward, reaching the mid and low latitude upper stratosphere about three months later.

F. TERANNUAL WAVE (FIGURES 22-23)

The amplitude of the four month wave has maxima near 45 km at highest latitudes, and above 60 km near 40°N, and has nearly zero amplitude below 50 km south of 40°N. The wave first appears in the region of the polar maximum amplitude and propagates southward reaching a region of minimum amplitudes near 45°N about six weeks later. The phase progression in other regions is often vague due to large error estimates.

This wave apparently arises from the square-wave nature of the yearly cycle of the wind in high latitudes. As seen in Figure 10, the values at a given station latitude are relatively constant in summer and winter, with rapid changes during spring and autumn. Harmonic decomposition of a pure square wave will yield a pronounced third harmonic whose phase follows the phase of the first harmonic by one-sixth the period of the first harmonic. At high latitudes this feature is borne out by the phase dates of the annual and four month waves: 6/2 and 8/2. This reasoning also helps justify the strong rate of change of phase shown in the four-month wave near 45°N, since that is where the annual wave does the same.

G. SUMMARY

The usefulness of periodic analysis as a means of describing the observed wind field is described by the amount of variability removed from the semi-mon thly data. Figure 24 presents the percentage of variability explained by the mean, QBO, and the first six harmonics of the annual wave. Over 50% is explained in the arctic below 40 km and above 50 km, and south of 40^{o}N between 40 and 60 km. Percent explained variability is the same as percent explained variance except that the long-term mean is included in the regression matrix so that the mean also accounts for part of the variability.

VI. MERIDIONAL WINDS ANALYZED, 70-90 KM

A. DATA AND LIMITATIONS

The bulk of wind data available in the 70-90 km region were obtained by the acoustic-grenade technique or by ground-based radio reflection or meteor trail drift measurements. Grenade data have the advantage of being derived by a consistent measurement technique at all stations and for the entire period of record (Theon, et al, 1972). On the other hand, grenade data are few in number and when comparing monthly means, one must bear in mind that all or most of the observations for a given month may be from the same year, and that the "observation year" may change from one month to the next.

Data from ground based measurements (meteor trails, partial radio reflections) are relatively plentiful compared with grenade observations. Altitude resolution, however, is a major problem when making these observations (Teptin, 1972; Barnes, 1973). Teptin (1972) has stated that failure to take account of instrumental parameters may lead to misinterpretation of results. These limitations on the available data must be kept in mind when interpreting the summaries presented below.

B. MEANS

Table 5 lists the grenade and ground-based stations for which data in the 70-90 km regions were available. Grenade measurements are reported in the form of vertical profiles for each ascent. These profiles have been linearly interpolated at 5 km intervals and consolidated by month. The data for Kourou (5°N), Natal (6°S), and Ascension (8°S) have been combined to form an estimate of meridional wind behavior in tropical regions at high altitudes. The resulting mean profiles are presented in Table 6.

Measurements obtained with ground based techniques may be ascribed to a particular level when reported, or they may be merely described as "in the meteor zone." In the latter case the values have been arbitrarily assigned to the 90 km level, since this is near the center of the meteor zone (Teptin, 1972), although in some cases they may be representative of a higher level (Barnes, 1973): Table 7 is a summary of the mean monthly winds obtained by ground based techniques. Ground based measurements are frequent enough to resolve the tidal winds and the prevailing wind, and the grenade experiments were fairly evenly distributed throughout the day (Theon, 1972) so that cancellation of tidal effects should occur. Thus, these means should be relatively free of bias due to tides. Longitudinal variations were discussed in connection with Figure 4. There were too few observations, however, to obtain standard deviations.

Periodic features in the winds measured by ground based techniques have been studied by several groups (Lysenko, et al, 1969; Teptin, 1972; Greenhow and Neufeld, 1961). However, Teptin suggests that results at different stations can be compared only after taking account of the instrumental parameters (Teptin, 1972). The relatively small number of observations by grenade experiments did not permit meaningful periodic analysis of that data.

These summaries have been included in the interest of completeness. As noted above, the uncertainties of the measurements or their scarcity could very well render them meaningless. Until the issues discussed in the literature are resolved and a "normalized" data base is available, use of high altitude wind measurements must be on a provisional basis.

VII. CONCLUSION

Meridional winds in the height region 20-90 km exhibit a large degree of organization. Along 90°W a two-cell structure is present from October through April, with northward winds over 20 m/s in mid-latitudes above 60 km and southward winds over 30 m/s in the Arctic near 45 km. An inverse pattern is found along 70°E during the winter. Summertime profiles are probably different from zero because of aliasing by the diurnal tide. Thorough study of the diurnal tide at all latitudes and in all seasons has not yet been made; however, such a study would be helpful in interpreting the dynamics of the stratosphere and mesosphere.

Periodic components succeed in explaining nearly as much of the observed variability of the semi-monthly meridional wind at high altitudes and high latitudes as they do for the zonal wind. The annual wave is the most prominent feature, with maximum amplitude of 20 m/s in the Arctic near 45 km. It undergoes a 180° phase shift near 45°N. The QBO and ter-annual wave both have maxima of nearly 10 m/s at the same place as the annual wave.

The semiannual wave has maximum amplitude of nearly 10 m/s above 60 km near 60°N, with equinoctial phase. The semiannual wave in the zonal wind has maximum amplitude in the same place and also has equinoctial phase (Belmont and Dartt, 1973). This implies there is a semiannual northward transport of zonal momentum away from the region where maximum amplitudes of the waves are found. That this must affect the dynamics of the strat-osphere and mesosphere is clear; however, this phenomenon and its import-ance remain to be examined.

VIII. REFERENCES

Barnes, A. A.; Radar meteor trail task final report; Air Force Cambridge Research Laboratories, ERP#397, Bedford, 41 pp., 1972.

Barnes, A. A.; Status report on radar meteor wind and density measurements; Bull. Am. Met. Soc., 54, 9, 900-909, 1973.

Belmont, A. D., and D. G. Dartt; The variability of tropical stratospheric winds; J. Geophys. Res., 75, 15, 3133-3145, 1970.

Belmont, A. D. and D. G. Dartt; Semiannual variation in zonal wind from 20 to 65km at 80°N-10°S, J. Geophys. Res., 78, 27, 6373-6376, 1973.

Belmont, A. D., D. G. Dartt, and G. D. Nastrom; Periodic variations in stratospheric zonal wind from 20-65 km, at 80°N to 70°S; Quart. J. Roy. Met. Soc., 100, 91-99, 1974.

Belmont, A. D., D. G. Dartt, and G. D. Nastrom; The seasonal reversal of stratospheric circulation, to be submitted for publication; 1974a.

Chapman, S. and R. S. Lindzen; Atmospheric Tides, Gordon and Breach, New York, 200 pp., 1970.

Greenhow, J. S. and E. L. Neufeld; Winds in the upper atmosphere, Quart. J. Roy. Meteorol. Soc. 87, 472-489, 1961.

Gregory, J. B., and D. T. Rees; High altitude winds at Saskatoon, Canada, Report No. 1; Atmospheric Dynamics Group, University of Saskatchewan, 1970.

Gregory, J. B. and D. E. Rossiter; High altitude winds and tides at Saskatoon, Canada, Report No. 2; Atmospheric Dynamics Group, University of Saskatchewan, 1972.

Groves, G. V.; Wind models from 60 to 130 km altitude for different months and latitudes; J. Brit. Interplan. Soc., 22, 285-307, 1969.

Groves, G. V.; Seasonal and latitudinal models of atmospheric structure between 30 and 120 km altitude; in Space Research X, North-Holland Publishing Company, Amsterdam, 137-150, 1970.

Groves, G. V.; Atmospheric structure and its variations in the region from 25 to 120 km; Air Force Cambridge Research Laboratories, ERP#368, Bedford, 200 pp., 1971.

Justus, C. G. and A. Woodrum; Short and long period atmospheric variations between 25 and 200 km; NASA CR-2203, Washington, D.C., 86 pp., 1973.

Kashcheyev, B. L. and I. A. Lysenko; Atmospheric circulation in the meteor zone; J. Atmos. Terr. Phys., 30, 903-906, 1967.

Kochanski, A.; Circulation and temperatures at 70- to 100- kilometer height; J. Geophys. Res., 68, 1, 213-226, 1963.

Lysenko, I. A., B. L. Kashcheyev, K. A. Karimov, M. K. Nazarenko, A. D. Orlyansky, Y. T. Fialko and R. P. Chebotarev; Results of radar-meteor tracking studies on atmospheric circulation over Eurasia and the arctic; Izv., Atmospheric and Oceanic Physics, 5, 9, 893-902, 1969.

Lysenko, I. A., A. D. Orlyansky, and Y. I. Portnyagin; A study of the wind regime at an altitude of about 100 km by the meteor-radar method; Phil. Trans. R. Soc. Lond. A., 271, 601-610, 1972.

McKenzie, D. J.; The diurnal atmospheric tide with Newtonian cooling and longitudinally dependent drives; Ph.D. Thesis, University of Washington, 139 pp., 1968.

Müller, H. G.; Atmospheric tides in the meteor zone; Planet. Space Sci, 14, 1253-1272, 1966.

Oort, A. H. and E. M. Rasmusson; On the annual variation of the monthly mean meridional circulation; Mon. Wea. Rev., 98, 6, 423-442, 1970.

Reed, R. J.; Comments on paper by Harry van Loon, Karin Labitzke, and Roy L. Jenne, "Half-yearly wave in the stratosphere"; J. Geophys. Res., 78, 9, 1484-1485, 1973.

Reed, R. J., M. J. Oard and M. Siemenski; A comparison of observed and theoretical diurnal tidal motions between 30 and 60 kilometers; Mon. Wea. Rev., 97, 6, 456-459, 1969.

Roper, R., 1974 Personal communication.

Sprenger, K., I. A. Lysenko, K. M. Grayziger, and A. D. Oplyanskiy; Winds at heights of 90-100 km from data on meteor trail drift and ionospheric inhomogeneities; Izv., Atmospheric and Oceanic Physics, 7,4, 455-458, 1971.

Teptin, G. M.; Upper-atmosphere motion, as determined by observations of radio echoes from meteor trails; Izv., Atmospheric and Oceanic Physics, 8, 3, 243-263, 1972.

Theon, J., 1974 Personal communication.

Theon, J. S., W. S. Smith, J. F. Casey, and B. R. Kirkwood; The mean observed meteorological structure and circulation of the stratosphere and mesophere; NASA TR R-375, Washington D. C., 77 pp., 1972.

van Loon, H., R. L. Jenne, and K. Labitzke; Climatology of the stratosphere in the northern hemisphere, Part 2; in Meteorologische Abhandlungen, 100, 5, 1972.

van Loon, H., K. Labitzke and R. L. Jenne; Reply to "Comments on paper" by Harry van Loon, Karin Labitzke, and Roy L. Jenne, "Half-yearly wave in the stratosphere"; J. Geophys. Res. 78, 9, 1486, 1973.

Wallace, J. M. and F. R. Hartranft; Diurnal wind variations, surface to 30 kilometers; Mon. Wea. Rev., 97, 6, 443-455, 1969.

Zadorina, F. K., G. B. Pokrovskii, V. V. Sidorov, G. M. Teptin, and A. M. Fakhrutdinova; Atmospheric motions in the height range from 80 to 100 km according to radar observations of meteors at Kazan; Izv., Atmospheric and Oceanic Physics, 3, 1, 3-15, 1967.

Table 1. RAWINSONDE STATIONS

STATION	LATITUDE	LONGITUDE	PERIOD OF RECORD
EUREKA	80	86	1964-1971
RESOLUTE	75	95	1961-1971
HALL BEACH	69	81	1964-1971
CORAL HARBOR	64	83	1964-1971
CHURCHILL	59	94	1961-1971
TROUT LAKE	54	90	1964-1971
MOOSONEE	51	81	1961-1971
SAULT ST. MARIE	46	85	1961-1971
BUFFALO*	43	79	1964-1971
WASHINGTON	39	78	1961-1971
CHARLESTON	33	80	1961-1971
MIAMI	26	80	1964-1971
SWAN ISLAND	18	84	1961-1971
SAN ANDREAS*	13	81	1964-1971
BOGOTA*	5	74	1964-1971

* 10 mb data not available or insufficient for these stations.
All data are for 12 GMT.

Table 2. METEOROLOGICAL ROCKET STATIONS

Rocket stations subjected to periodic analysis are listed in Table 8.

STATIONS	LATITUDE	LONGITUDE	YEARS	N(50 km, JAN)
ARENOSILLO	37 N	7 W	1968-1970	12
GREEN RIVER	39 N	110 W	1968-1969	5
SONMIANI	25 N	67 E	1965-1970	5
THUMBA	8 N	77 E	1965-1972	12
UCHINOURA	31 N	131 E	1967	3
WEST GEIRINISH	57 N	7 W	1965-1971	42

Table 3. STANDARD DEVIATIONS OF JANUARY AND JULY MONTHLY MEAN MERIDIONAL WINDS

		30 KM		40 KM		50 KM		60 KM	
	STATION	σ	N	σ	N	σ	N	σ	N
January	KENNEDY	2.5	11	2.8	10	6.2	10	10.4	5
	WALLOPS	2.8	6	4.7	6	5.4	6	9.5	2
	CHURCHILL	20.2	7	21.3	7	15.7	7	- - -	
	GREELY	9.8	7	19.0	7	25.4	7	- - -	
July	KENNEDY	.7	11	1.6	11	2.6	11	3.6	6
	WALLOPS	.9	10	1.6	10	3.6	10	1.6	3
	CHURCHILL	1.0	5	2.7	5	2.2	5	- - -	
	GREELY	0.0	7	.7	7	3.5	7	3.5	5

N given in years; a year was included only if the number of observations was over five.

Table 4. TESTS OF ALIASING OF THE ANNUAL WAVE BY THE DIURNAL WAVE

Frequencies	Mean (M/S)			Annual Amplitude (M/S)			Diurnal Amplitude (M/S)		
	30km	40km	50km	30km	40km	50km	30km	40km	50km
1. A + D				8.3	12.6	14.0	8.7	13.6	7.4
2. M + A + D	-8.7	-13.0	-7.5	8.7	13.3	14.6	4.3	6.4	8.8
3. M + (A x D)	-4.3	-6.9	-3.6						
4. M + A + (A x D)	-4.4	-7.1	-4.1	8.2	13.8	14.1			
5. ALL + D	-7.4	-10.5	-4.5	9.0	13.8	15.4	2.8	3.6	6.5
6. ALL	-4.7	-7.4	-4.5	8.9	13.6	15.1			

(See text for explanation of frequencies used)

Table 5. GRENADE, RADIO AND METEOR WIND STATIONS, 40-90 KM

	STATION	LAT.	LONG.	PERIOD OF RECORD	MEASUREMENT TECHNIQUE	REFERENCE
1.	BARROW	71 N	157 W	1965-1972	Grenade	Theon, 1974
2.	CHURCHILL	59 N	94 W	1962-1971	Grenade	Theon, 1974
3.	WALLOPS	38 N	75 W	1962-1971	Grenade	Theon, 1974
	KOUROU	5 N	53 W	1971	Grenade	Theon, 1974
4.	NATAL	6 S	35 W	1966-1968	Grenade	Theon, 1974
	ASCENSION	8 S	14 W	1964	Grenade	Theon, 1974
5.	HEISS IS.	80 N	38 E	1965-1967	Radio/Meteor	Lysenko, et al, 1969
						Lysenko, 1972
6.	COLLEGE	65 N	148 W	1970-1971	Radio/Meteor	Roper, 1974
7.	TOMSK	57 N	85 E	1965-1966	Radio/Meteor	Lysenko, et al, 1969
8.	KAZAN	56 N	49 E	1964-1965	Radio/Meteor	Zadorina, et al
9.	OBNINSK	55 N	37 E	1964-1966	Radio/Meteor	Kashcheyev and Lysenko, 1967
						Lysenko, et al, 1969
10.	KUHLUNGSBORN	54 N	12 E	1964-1966	Radio/Meteor	Sprenger, et al, 1971
	COLLM	51 N	13 E		Radio/Meteor	Sprenger, et al, 1971
11.	SHEFFIELD	54 N	1 W	1964-1965	Radio/Meteor	Muller, 1966
12.	JODRELL BANK	53 N	2 W	1953-1958	Radio/Meteor	Kochanski, 1963
13.	SASKATOON	52 N	106 W	1969-1971	Radio/Meteor	Gregory and Rees, 1970
						Gregory and Rossiter, 1972
14.	KIEV	50 N	31 E	1965-1966	Radio/Meteor	Lysenko, et al, 1969
15.	KHARKOV	50 N	36 E	1964-1966	Radio/Meteor	Kashcheyev and Lysenko, 1967
16.	GARCHY	47 N	3 E	(No data)	Radio/Meteor	Roper, 1974
17.	DURHAM	43 N	71 W	1970	Radio/Meteor	Roper, 1974
18.	FRUNZE	43 N	73 E	1966	Radio/Meteor	Lysenko, et al, 1969
19.	DUSHANBE	39 N	69 E	1965-1966	Radio/Meteor	Lysenko, et al, 1969
20.	PALO ALTO	37 N	122 W	1967	Radio/Meteor	Barnes, 1972

Table 6. GRENADE DATA, 40-90 KM

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS (M/SEC TIMES TEN)

STATION NATAL LAT -6 LONG 35

MONTH/LEVEL			50		60		70		80		90
1	393	-20									
N=	1	1									
S=											
2	-53	82	249	234	-661	94					
N=	1	1	1	1	1	1					
S=											
3	6	38	6	-71	-67	-8	100	56			
N=	3	3	3	3	3	3	3	3	3	3	3
S=	20	23	14	38	55	89	129	76	182	262	712
4											
N=											
S=											
5	4	-3	50	29	-74	-49	23	-88			
N=	2	2	2	2	2	2	2	2	2	2	1
S=	48	30	44	68	73	17	34	183	166	66	461
6	39	63	10	-44	23	-71	-31	-71			
N=	3	3	3	3	3	3	3	3	3	3	3
S=	17	62	50	60	62	77	115	117	316	213	313
7											
N=											
S=											
8	-4	-8	-29	-121	-41	-0	-12	44			
N=	8	7	7	7	7	7	7	8	5	5	5
S=	34	47	75	150	167	205	156	180	211	424	216
9	-58	-35	-29	6	-59	-35	-105	-144			
N=	11	13	13	13	13	11	11	11	13	12	11
S=	32	44	48	54	45	94	113	106	217	510	493
10	-18	10	66	60	78	-111	-109	-71			
N=	8	8	8	8	8	8	8	8	8	8	8
S=	16	32	60	125	84	143	151	90	321	525	777
11											
N=											
S=											
12	14	1	84	-27	16	-4	48	80			
N=	4	4	4	4	4	4	4	4	4	4	3
S=	3	15	60	57	108	37	63	82	309	108	571

STATION WALLOPS LAT 38 LONG 75

MONTH/LEVEL			50		60		70		80		90
1	92	113	183	222	67	41	-44	143	-58	237	29
N=	11	12	12	12	12	12	12	12	10	8	7
S=	77	170	196	171	331	206	208	308	321	384	1125
2	47	83	49	110	76	-19	14	-8	190	-221	274
N=	10	13	13	13	13	13	13	11	9	4	1
S=	89	158	214	173	226	186	181	269	107	279	
3	-32	-1	21	114	118	13	13	114	222	-36	392
N=	6	7	7	7	7	7	7	7	7	5	2
S=	75	145	136	262	230	71	130	198	327	614	428
4	-66	-79	23	13	-9	21	23	223	-240	-20	-430
N=	3	4	4	4	4	4	1	3	3	3	2
S=	41	26	75	65	114	71	68	219	256	194	522
5	-95	-69	-39	5	-15	47	176	49	-97	45	72
N=	6	6	6	6	6	6	6	6	6	6	4
S=	56	56	77	58	45	98	11	90	143	545	379
6	-18	34	105	110	-109	294	112	150	102	-1002	-88
N=	3	3	3	3	3	1	3	3	1	1	1
S=	26	23	17	47	344	275	44	133	170		
7	-51	-56	-6	1	94	112	-57	-94	32	-327	1
N=	3	4	4	4	4	4	4	4	3	3	3
S=	46	81	81	62	48	35	268	174	368	326	463
8	-65	-38	-87	-47	-10	-66	25	-58	-125	-200	-358
N=	4	8	9	9	9	9	9	9	8	7	4
S=	69	71	76	133	178	187	157	144	303	510	448
9	23	11	37	31	-32	-64	-121	106	213	77	107
N=	3	3	3	3	3	4	4	3	3	3	3
S=	11	28	28	79	78	49	162	52	183	157	78
10	-11	-20	-29	-45	-0	140	-61	-26	62	231	27
N=	2	6	6	6	6	6	6	6	6	6	1
S=	12	65	80	58	77	187	191	147	218	231	
11	-36	52	106	49	146	56	52	122	-125	-216	58
N=	1	4	6	6	6	6	6	5	5	5	4
S=		22	129	143	196	192	110	190	351	399	855
12	162	173	174	119	168	135	138	46	-100	-262	-1569
N=	3	5	5	5	5	5	5	5	3	3	2
S=	180	151	99	190	171	231	139	560	244	498	1479

STATION CHURCHILL LAT 59 LONG 94

MONTH/LEVEL			50		60		70		80		90
1	-178	-79	4	109	110	-39	15	123	107	208	-68
N=	10	11	11	11	11	11	11	11	11	11	10
S=	285	315	333	245	242	360	398	236	472	513	633
2	-108	-84	-104	31	132	150	86	46	-85	183	-15
N=	9	14	14	15	15	15	15	15	14	12	8
S=	359	312	299	387	324	323	355	348	499	350	1140
3		64	11	55	86	-1	-313	-299	-343	-545	-1394
N=		1	1	1	1	1	1	1	1	1	1
S=											
4		-32	54	-5	103	-181	-268	214	257	-22	
N=		1	1	1	1	1	1	1	1	1	
S=											
5	-26	23	26	-155	-130	-17	64	75	5	-250	51
N=	2	2	2	2	2	2	2	2	2	2	2
S=	58	29	100	43	51	14	47	105	35	89	178
6	-58	-9	26	-132	-57	-1	4	-91	-253	283	-534
N=	2	3	3	3	3	3	3	3	3	2	2
S=	41	77	136	280	71	164	168	74	192	166	1345
7	78	202	179	-272	-16	4	531	219	146	124	156
N=	1	1	1	1	1	1	1	1	1	1	1
S=											
8	15	-31	-61	-80	26	26	20	-49	-201	27	-159
N=	6	8	9	9	9	9	9	9	9	9	4
S=	42	49	97	74	192	184	127	231	502	397	508
9	30	13	47	78	-252	-103	-70	247	120	757	124
N=	1	1	1	1	1	1	1	1	1	1	1
S=											
10	30	-8	-61	-177	-59	64	92	209	235	-130	662
N=	6	6	6	6	6	6	6	6	6	5	3
S=	124	155	81	180	194	159	210	247	269	188	91
11	-279	-324	-284	-231	-117	-91	135	-574	74	581	1250
N=	2	2	2	2	2	2	2	2	2	2	2
S=	33	66	98	13	20	165	74	236	3	350	493
12	-121	-87	-229	-181	-52	-216	-2	-15	21	-311	-594
N=	2	4	4	4	4	4	4	4	4	4	2
S=	54	28	54	198	203	199	180	314	129	265	345

STATION BARROW LAT 71 LONG 157

MONTH/LEVEL			50		60		70		80		90
1	-309	-426	-369	-362	-310	-203	-170	-58	27	-55	227
N=	10	11	11	11	11	11	11	10	9	9	9
S=	209	265	322	283	329	432	263	405	313	394	801
2	-392	-390	-258	-263	-176	-141	-58	-59	193	153	-128
N=	11	13	13	13	12	12	12	12	12	12	9
S=	224	303	200	368	202	169	211	308	444	341	507
3											
N=											
S=											
4	56	7	9	56	44	-14	-92	135	47	-247	225
N=	4	4	4	4	4	4	4	4	4	4	4
S=	98	145	105	147	191	138	22	253	125	428	426
5	-21	-23	20	9	-24	27	56	-39	41	138	-205
N=	6	6	6	6	6	6	6	6	6	5	4
S=	33	63	94	81	127	111	160	120	207	755	488
6	17	3	13	-84	22	-213	-61	-342	-133	32	-9
N=	3	3	3	3	3	3	3	3	2	2	2
S=	19	17	83	30	95	119	27	231	26	320	185
7											
N=											
S=											
8	5	-10	-18	-69	-27	-30	-23	-83	-77	-152	-13
N=	2	3	6	6	6	6	6	6	6	6	5
S=	26	57	47	53	84	122	122	108	373	160	512
9	168	192	4	152	196	125	336	113	-172	-112	458
N=	1	1	1	1	1	1	1	1	1	1	1
S=											
10	-72	-32	-62	-74	8	-79	-194	-21	-90	-15	-287
N=	6	6	6	6	6	5	5	5	5	4	2
S=	117	182	127	164	168	173	76	81	686	161	771
11	11	-122	-58	74	-157	-162	-98	-79	-39	-863	1913
N=	2	2	2	2	2	2	2	2	2	2	2
S=	32	73	67	107	208	357	52	234	84	690	2233
12	-454	-604	-623	-639	-586	-638	-594	-778	-91	-141	-39
N=	4	4	4	4	4	4	4	4	4	4	4
S=	237	431	505	379	430	284	453	130	269	316	688

Table 7. RADIO/METEOR MONTHLY MEAN MERIDIONAL WINDS (M/S), 75 - 90 KM

A. 90 KM OR UNSPECIFIED HEIGHT

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	4^{2}	-24^{2}	-9^{2}	2^{2}	-10	-12	-11	-12	7^{2}	-8^{2}	-5^{2}	14^{2}
6	-3											-6
7	-4	4								-8	-13	5
8	-6	5	4	-6	-1		-7	-5	-6	-6	2	2
9	-8^{3}	-7^{3}	8^{2}	-4^{2}	-13^{2}	-9^{2}	-8^{2}	-7^{2}	-5^{2}	-4^{2}	0^{2}	-5^{2}
10	-10^{3}	-16^{3}	-15^{3}	-14^{3}	-11^{3}	-8^{3}	-9^{3}	-6^{3}	-6^{3}	-9^{3}	-6^{3}	-8^{3}
11	-9	-4	-2	-14	-22	-14	-16	-9	-2	1	5	-5
12 (92km)	-5	3	1	-2	-11	-13	-12	-10	-3	2	3	2
13	-1	6	3^{2}	25^{2}	-6^{2}	0^{2}						
14	-5								-3	3	2	-7
15	-1^{3}	3^{3}	2^{2}	-6^{2}	-8^{2}	-9^{2}	-7^{2}	2^{2}	3^{2}	2^{2}	5^{2}	-9^{2}
16			(No data)									
17			4									
18									-4	-7	-2	6
19	4	8							3	-5	-2	14
20 (95km)					-4	-6	-5	0	-2			

NOTE: Exponents refer to number of monthly means available. No exponent indicates one available.

Table 7. (CONT'D)

B. 85 KM

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6	-3											-6
12 (82km)	-8	-1	-2	-5	-14	-17	-15	-13	-6	0	1	-1
13	-1	19	8[2]	-5[2]	-2	-6						
17			-2									

C. 80 KM

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6	-9											-17
13	25	2	11[2]	8[2]	-11	-12						
17			-2									

D. 75 KM

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
13		3	20[2]	20	2	1						

Table 8. PERIODIC ANALYSIS RESULTS

A. STATION LIST, NUMBER OF OBSERVATIONS, MEAN, AND ERROR OF THE MEAN

LEVEL (KM) / STATION	NAME	LAT	LON	YEARS	NUMBER OF OBSERVATIONS 20	30	40	50	60	64	MEAN (M/S) 20	30	40	50	60	64	ERROR OF THE MEAN (M/S) 20	30	40	50	60	64
1	HEISS	80	-58	11/62- 1/70	156	162	154	56	0	0	-1.8	3.0	11.3	24.3	0.0	0.0	.9	1.6	2.3	5.2	0.0	0.0
2	THULE	77	69	6/65-12/71	314	334	319	263	79	25	-1.6	-9.0	-11.0	-7.7	-1.5	11.8	.7	1.1	1.7	1.7	3.4	19.2
3	GREELY	64	146	4/61- 8/71	1045	1042	1021	910	300	40	-.0	-3.5	-6.5	-4.2	-.6	13.1	.2	.3	.5	.6	1.1	92.9
4	CHURCHILL	59	94	1/61-12/71	603	750	742	691	244	56	-3.4	-4.7	-4.1	-.1	-4.9	-42.6	.3	.5	.6	.5	1.2	38.8
5	PRIMROSE	55	110	7/64-12/71	287	283	279	242	143	73	-1.7	-3.2	-2.8	2.4	12.1	24.9	.3	.5	.7	.9	1.8	4.4
6	VOLGOGRAD	49	-45	9/65- 1/70	141	142	136	111	0	0	.2	2.9	4.1	1.4	0.0	0.0	.5	.8	1.5	1.7	0.0	0.0
7	WALLOPS	38	87	1/61-12/71	852	892	907	825	281	86	.2	2.2	3.7	9.4	7.0	2.8	.1	.2	.2	.4	.8	2.0
8	PT.MUGU	34	119	1/61-12/71	1654	1707	1724	1641	438	116	.0	-.1	.3	7.3	4.1	7.4	.1	.1	.1	.2	.5	1.9
9	WSMR	32	107	1/61-12/71	1790	1795	1753	1642	1188	673	1.0	1.4	1.2	8.3	7.7	6.1	.1	.1	.1	.3	.3	.6
10	KENNEDY	28	76	1/61-12/71	1401	1557	1602	1479	499	114	.0	2.0	1.2	7.2	6.8	4.0	.1	.1	.1	.2	.6	1.3
11	HAWAII	22	160	4/62-12/71	1113	1169	1215	1162	313	90	-.1	.6	.7	5.6	8.1	2.6	.1	.1	.1	.2	.8	1.6
12	GR.TURK	21	71	9/63-12/66	180	209	206	167	0	0	-.9	.1	1.1	5.4	0.0	0.0	.2	.2	.3	.8	0.0	0.0
13	ANTIGUA	17	62	6/63-12/71	478	504	506	417	51	0	-1.7	.4	.0	6.0	7.9	0.0	.6	.1	.7	.4	2.0	0.0
14	SHERMAN	9	80	3/66-12/71	555	592	596	556	278	73	-.1	-1.3	1.2	5.0	3.6	10.9	.1	.2	.2	.3	.6	3.4
15	KWAJALEIN	8	167	3/63-10/71	291	295	298	285	133	23	1.2	.3	.7	4.7	-4.9	0.0	.3	.1	.2	.4	.9	0.0
16	ASCENSION	-8	15	10/62-12/71	927	981	1009	975	386	68	.1	-.3	1.4	-4.0	-3.8	-5.3	.1	.1	.1	.2	.9	2.1

B. AMPLITUDE (M/S) AND PHASE (DEGREES), WITH ERRORS, OF THE QBO (28 MONTH)

LEVEL (KM) / STATION	AMPLITUDE 20	30	40	50	60	64	AMPLITUDE ERROR 20	30	40	50	60	64	PHASE 20	30	40	50	60	64	PHASE ERROR 20	30	40	50	60	64
1	3.1	1.3	3.6	2.4	0.0	0.0	1.2	1.6	2.6	5.9	0.0	0.0	36	126	155	-136	0	0	21	80	62	93	0	0
2	2.0	4.9	9.5	6.6	4.8	20.3	.9	1.4	2.2	2.1	3.0	22.0	-21	-71	-74	-73	-136	-18	31	17	13	20	51	80
3	.5	.3	1.7	2.1	4.0	19.2	.2	.1	.7	.8	1.3	5.5	44	-164	-95	-68	1	31	30	76	17	23	20	15
4	2.0	3.0	4.0	1.5	1.7	18.9	.4	.7	.8	.6	1.3	17.0	76	28	9	1	-138	91	12	14	12	27	64	76
5	.4	1.8	.8	5.0	4.8	10.1	.3	.6	.7	1.3	2.3	4.9	27	58	-28	-90	-104	-128	58	21	72	14	31	35
6	1.8	1.6	5.3	2.4	0.0	0.0	.6	1.0	1.9	1.8	0.0	0.0	-46	-11	28	122	0	0	22	51	23	64	0	0
7	.0	.5	.7	.5	2.6	.3	.1	.2	.3	.5	1.1	1.6	-138	-22	-77	-141	-129	-135	99	31	29	70	28	101
8	.1	.4	.7	.7	.8	4.0	.1	.1	.2	.3	.6	1.9	-107	-19	27	-153	-50	-117	62	12	13	31	62	32
9	.4	.6	.8	.2	.7	1.1	.1	.1	.2	.3	.4	.7	64	4	-9	170	-83	-20	24	10	16	88	49	54
10	.4	.1	1.1	1.0	.7	7.9	.1	.1	.2	.3	.6	1.8	-26	143	-133	-159	68	-137	11	69	8	21	68	13
11	.1	.2	.3	.6	1.5	5.5	.1	.1	.1	.3	.9	2.1	78	-168	-23	138	31	-95	37	32	28	29	46	21
12	.6	1.2	2.4	.5	0.0	0.0	.2	.3	.5	.7	0.0	0.0	89	74	164	-165	0	0	23	15	10	86	0	0
13	.8	.6	.4	.9	.4	0.0	.6	.1	.2	.5	1.7	0.0	-51	162	-129	-87	98	0	62	12	52	40	100	0
14	.6	2.2	.8	.4	3.3	1.9	.2	.3	.2	.3	.9	3.5	166	128	109	61	85	110	16	7	17	68	14	71
15	.7	.8	1.2	.6	2.3	4.3	.4	.1	.3	.5	1.1	5.9	135	113	45	-133	37	70	46	11	14	66	36	52
16	.4	.4	.8	1.3	2.0	2.3	.1	.1	.1	.3	1.1	2.3	-113	69	92	28	158	152	11	18	11	13	41	77

C. AMPLITUDE (M/S) AND PHASE (DEGREES), WITH ERRORS, OF THE ANNUAL WAVE

LEVEL (KM) / STATION	AMPLITUDE 20	30	40	50	60	64	AMPLITUDE ERROR 20	30	40	50	60	64	PHASE 20	30	40	50	60	64	PHASE ERROR 20	30	40	50	60	64
1	3.2	8.7	12.8	27.5	0.0	0.0	1.1	2.2	3.1	6.8	0.0	0.0	159	46	20	-10	0	0	23	15	15	17	0	0
2	4.1	12.3	18.3	18.1	12.6	10.0	1.0	1.4	2.2	2.2	3.1	11.4	-119	-161	-175	-171	-175	174	14	7	7	7	17	61
3	2.8	6.6	11.7	12.8	14.0	5.4	.3	.5	.8	.8	1.5	82.9	-142	-160	-167	-167	-175	3	5	3	3	3	6	100
4	2.8	9.2	9.9	6.1	10.8	12.2	.4	.7	.9	.7	1.6	33.6	-159	-168	-170	-176	-177	-92	8	4	5	6	8	82
5	2.2	5.9	7.9	7.5	5.7	5.7	.4	.7	1.1	1.4	2.2	4.3	-143	-177	-179	-176	138	29	10	5	6	9	26	64
6	.5	3.4	.9	4.0	0.0	0.0	.5	1.1	1.4	2.1	0.0	0.0	162	-13	3	-32	0	0	71	20	87	39	0	0
7	.6	2.0	4.4	7.7	6.3	1.5	.1	.2	.3	.6	1.1	2.0	-25	-0	-1	0	10	162	16	6	4	4	11	84
8	1.8	.9	.6	2.6	4.7	3.6	.1	.1	.2	.3	.7	2.2	-171	171	-31	13	13	45	3	6	16	7	9	49
9	.7	.3	1.9	5.0	5.1	2.0	.1	.1	.2	.4	.5	.8	153	-7	-9	1	7	-27	12	19	6	4	5	26
10	.4	2.1	2.1	2.7	4.8	2.0	.1	.1	.2	.3	.8	1.4	-68	24	-17	-15	27	59	10	1	4	7	9	61
11	1.0	.5	1.0	1.4	2.7	3.5	.1	.1	.1	.3	1.0	1.7	-168	100	57	9	2	-65	4	9	7	12	23	36
12	.6	.4	2.4	1.9	0.0	0.0	.2	.2	.4	.9	0.0	0.0	-105	-139	29	-23	0	0	21	43	10	33	0	0
13	1.8	.2	1.0	1.8	4.1	0.0	.8	.1	.3	.5	2.2	0.0	165	-116	-33	-121	126	0	26	53	16	20	42	0
14	.5	1.4	.5	.8	2.4	9.0	.1	.3	.2	.4	.8	4.0	155	-122	-122	145	-109	162	19	11	34	38	20	33
15	1.7	.3	1.2	1.8	1.1	0.0	.5	.1	.3	.6	.9	0.0	112	63	133	132	24	0	16	26	13	19	69	0
16	.5	.7	1.2	2.7	1.6	5.1	.1	.1	.2	.3	1.0	2.6	148	-161	176	-168	-139	-48	9	9	7	6	53	38

D. AMPLITUDE (M/S) AND PHASE (DEGREES), WITH ERRORS, OF THE SEMIANNUAL WAVE

LEVEL (KM) / STATION	AMPLITUDE 20	30	40	50	60	64	AMPLITUDE ERROR 20	30	40	50	60	64	PHASE 20	30	40	50	60	64	PHASE ERROR 20	30	40	50	60	64
1	5.4	7.4	6.9	2.1	0.0	0.0	1.2	2.2	2.9	4.9	0.0	0.0	131	122	138	14	0	0	12	18	29	95	0	0
2	3.1	.4	1.6	1.7	10.7	14.3	.9	1.0	1.6	1.6	2.9	8.2	-62	24	4	-150	-153	-151	18	93	75	73	18	47
3	1.3	2.0	2.9	2.1	3.3	9.6	.3	.4	.7	.8	1.4	56.1	-132	-115	-139	-129	-147	164	11	13	15	24	29	97
4	2.0	4.7	5.2	2.8	5.6	27.7	.4	.7	.9	.7	1.5	28.6	-112	-155	-163	176	-178	-162	12	9	9	14	17	83
5	1.8	2.6	5.2	7.4	6.5	3.6	.4	.7	1.0	1.3	2.3	3.9	-145	178	157	179	173	18	12	14	11	9	22	79
6	1.9	1.5	2.0	3.2	0.0	0.0	.6	.9	1.5	2.0	0.0	0.0	2	14	-71	-109	0	0	20	52	64	53	0	0
7	.5	1.1	2.9	4.3	2.2	2.9	.1	.2	.3	.6	1.1	2.3	112	-12	-2	-3	28	-35	20	11	6	8	34	65
8	.2	.7	1.0	1.9	1.1	5.8	.1	.1	.2	.3	.6	2.3	-96	-165	12	16	62	76	31	7	9	10	42	28
9	.1	.3	1.6	2.4	1.1	3.1	.1	.1	.2	.4	.5	.8	-95	-61	14	6	-38	-62	81	27	7	8	27	17
10	.5	1.0	1.8	2.2	2.5	4.9	.1	.1	.2	.4	.8	1.7	87	-18	-23	-18	125	110	8	7	4	9	19	21
11	.1	.3	.8	1.6	1.4	3.4	.1	.1	.1	.3	.9	1.7	0	-177	101	-6	16	-12	53	13	9	11	50	37
12	.4	1.4	1.7	4.8	0.0	0.0	.2	.3	.4	1.0	0.0	0.0	-17	-94	13	-67	0	0	31	11	15	12	0	0
13	2.0	.2	1.0	2.1	3.7	0.0	.7	.1	.3	.6	2.1	0.0	90	-99	-13	25	-6	0	23	48	15	16	46	0
14	.2	1.3	1.8	1.2	.8	13.1	.1	.3	.2	.4	.6	4.4	-133	-23	-44	57	-120	-77	63	13	7	22	66	20
15	2.0	.4	.9	1.0	1.7	0.0	.5	.1	.1	.5	1.0	0.0	-88	2	-176	-154	-78	0	13	21	17	37	63	0
16	.5	.6	.8	1.8	2.5	6.4	.1	.1	.1	.3	1.1	2.6	157	36	-86	-89	-170	92	9	11	10	10	31	29

Table 8. PERIODIC ANALYSIS RESULTS (CONT'D)

F. AMPLITUDE(M/S) AND PHASE (DEGREES), WITH ERRORS, OF THE FOUR MONTH WAVE

	AMPLITUDE						AMPLITUDE ERROR						PHASE						PHASE ERROR					
LEVEL(KM) STATION	20	30	40	50	60	64	20	30	40	50	60	64	20	30	40	50	60	64	20	30	40	50	60	64
1	3.7	7.6	12.7	6.9	0.0	0.0	1.1	2.1	3.0	5.4	0.0	0.0	-163	164	-165	-72	0	0	19	17	14	64	0	0
2	2.3	3.6	7.4	5.3	7.1	4.2	.9	1.4	2.2	2.1	3.0	7.5	-24	-13	17	22	130	-88	25	24	17	25	29	83
3	.3	.1	.9	3.3	2.9	14.3	.2	.3	.6	.8	1.4	66.0	85	-70	-3	7	-22	120	58	95	59	14	34	97
4	.9	.8	1.7	2.3	2.4	15.2	.4	.6	.8	.7	1.4	24.6	-61	142	119	99	120	14	30	61	33	17	45	79
5	1.1	1.2	3.8	4.4	4.7	4.7	.4	.6	1.0	1.2	2.1	4.0	-56	133	134	-170	-128	-32	21	35	15	17	32	68
6	1.6	2.8	2.9	1.9	0.0	0.0	.6	1.1	1.7	1.8	0.0	0.0	20	31	-8	142	0	0	26	26	49	73	0	0
7	.6	.2	.9	.4	2.3	6.3	.2	.2	.3	.4	1.0	2.6	-175	-76	13	75	52	-28	14	74	21	78	31	26
8	.1	.2	.2	.6	1.8	1.6	.1	.1	.1	.3	.7	1.8	-69	177	18	14	85	-167	62	23	47	37	24	80
9	.8	.6	.9	.9	.7	.3	.1	.1	.2	.3	.4	.6	42	-124	41	32	-9	98	9	10	12	25	47	92
10	.7	.4	.9	1.9	3.1	3.9	.1	.1	.2	.3	.8	1.7	178	-112	-25	-118	-111	-166	5	22	9	10	15	29
11	.3	.4	.2	1.5	.9	1.4	.1	.1	.1	.3	.7	1.4	-72	-77	8	-3	-133	-166	15	11	58	11	74	75
12	.5	.7	.3	1.7	0.0	0.0	.2	.3	.3	.9	0.0	0.0	-100	106	93	-36	0	0	23	26	74	39	0	0
13	2.1	.2	.4	.9	2.4	0.0	.8	.1	.2	.5	2.0	0.0	83	-47	-139	-46	46	0	22	53	44	41	67	0
14	.9	.5	1.5	1.0	1.6	7.8	.2	.3	.2	.4	.9	4.2	155	-43	34	126	-108	-34	9	36	9	29	34	39
15	2.3	.2	.1	.4	4.3	0.0	.5	.1	.2	.4	1.2	0.0	1	-145	-10	-42	-108	0	12	47	83	77	17	0
16	.2	.3	.3	.3	1.2	4.1	.1	.1	.1	.2	.9	2.5	-17	17	-96	-121	90	-61	26	27	28	61	64	50

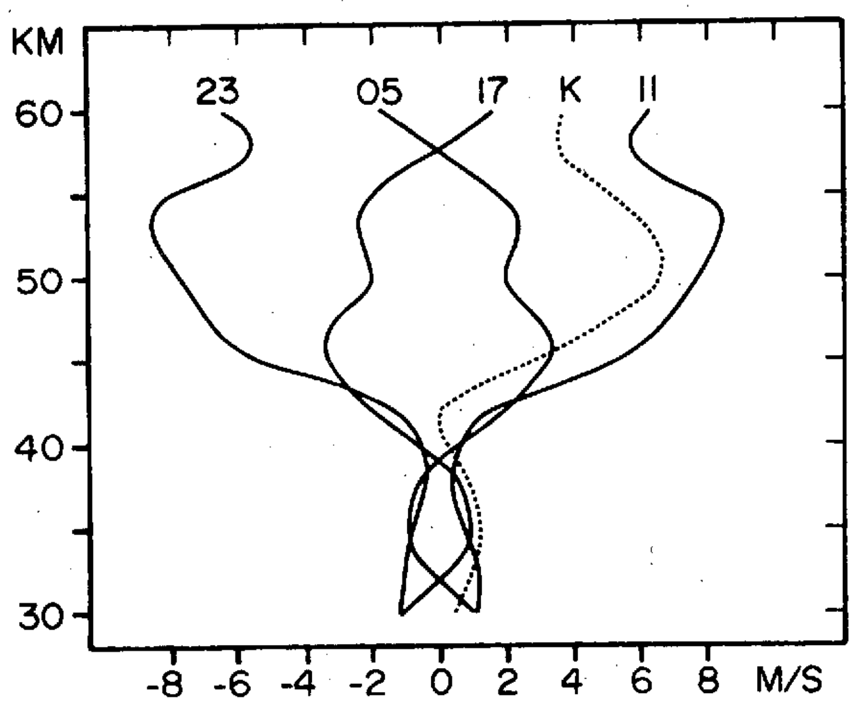

Figure 1. Mean summer (June, July, August) meridional wind observed at Cape Kennedy (dotted) compared to estimated tidal winds computed from amplitudes and phases given by Reed, et al, (1969).

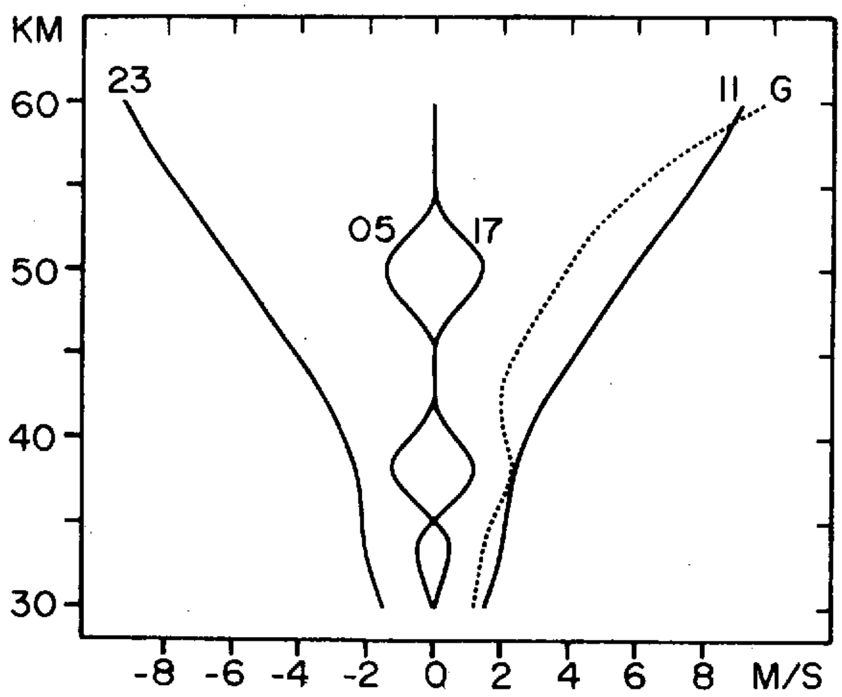

Figure 2. Same as Figure 1 for Fort Greeley.

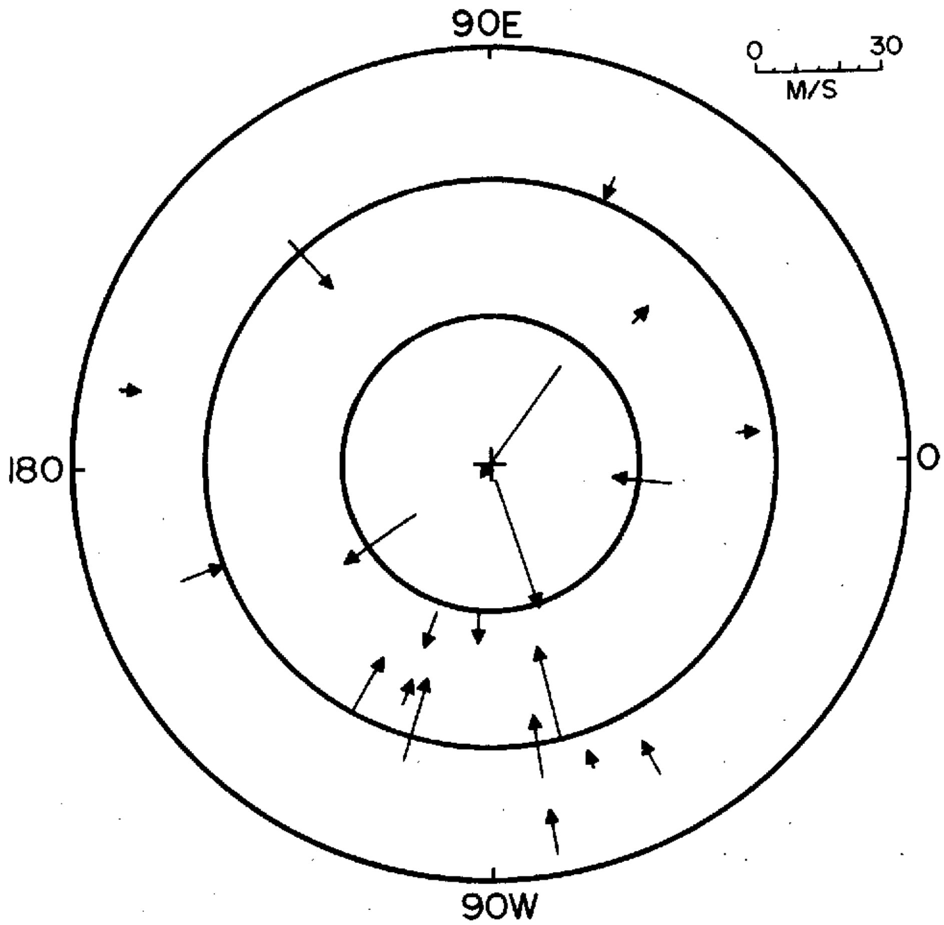

Figure 3. Observed mean January meridional winds at 50 km. Vectors are centered on stations.

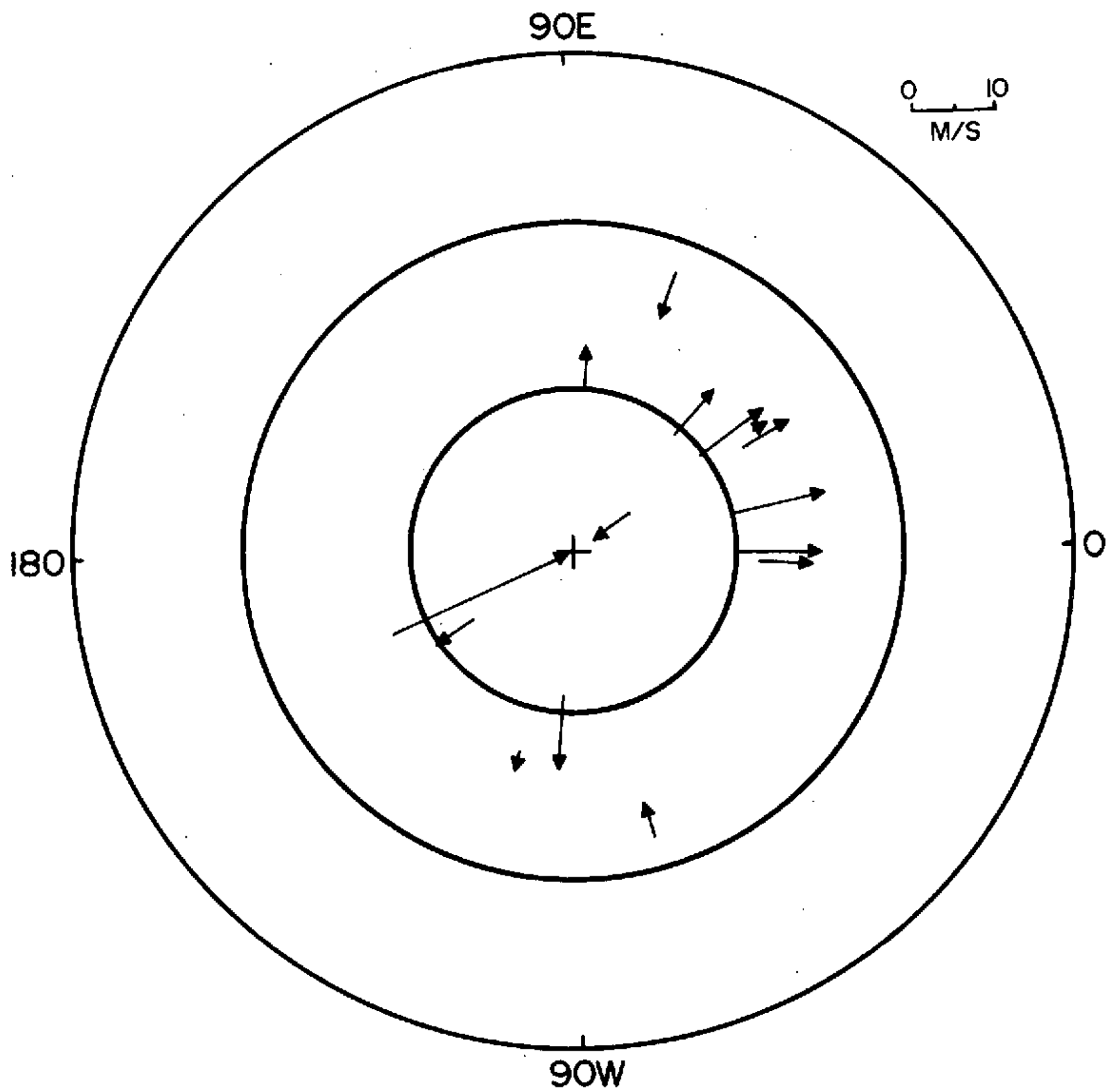

Figure 4. Same as Figure 3 for 90 km.

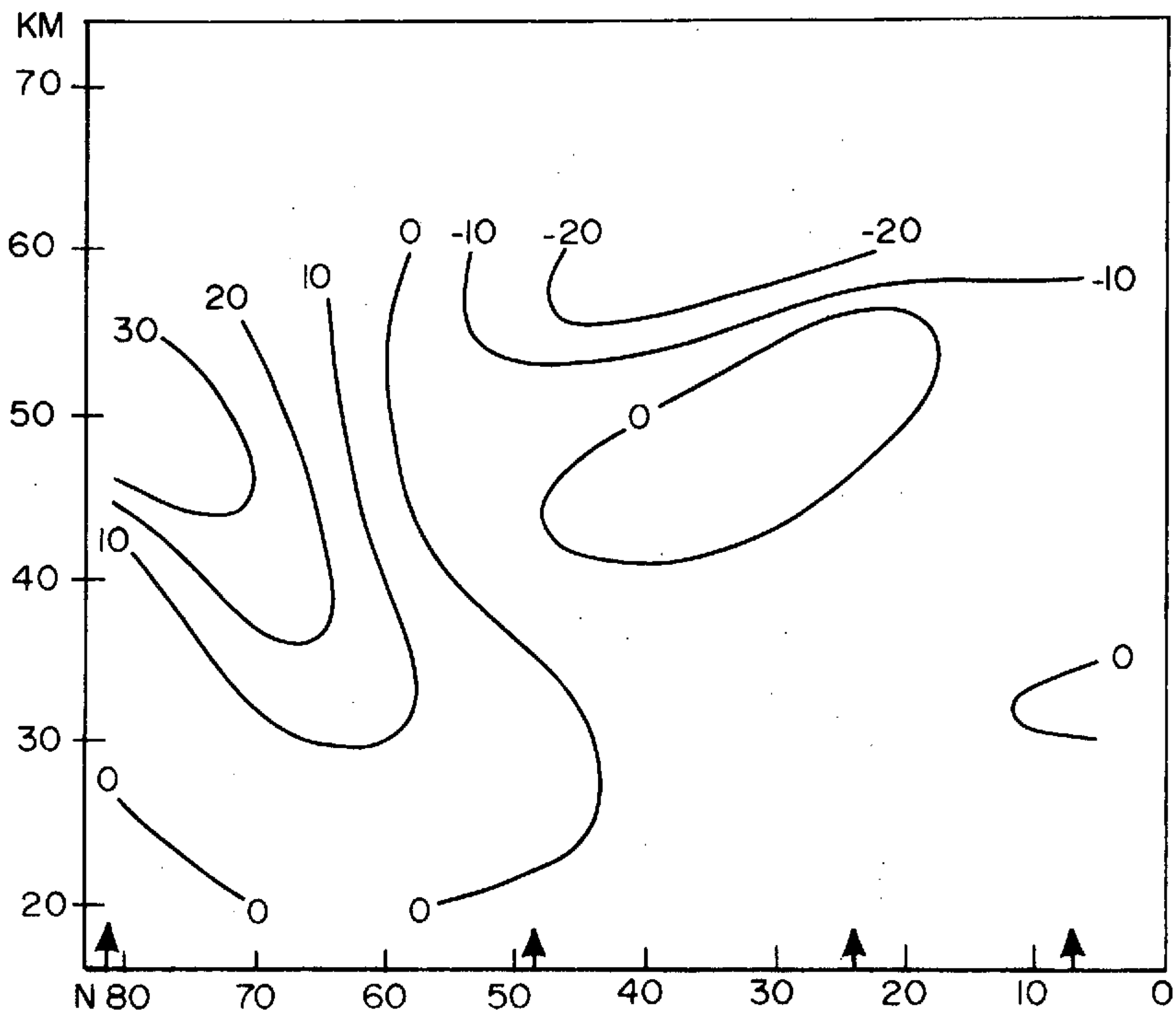

Figure 5. Mean height-latitude section of meridional wind near 70°E in January.

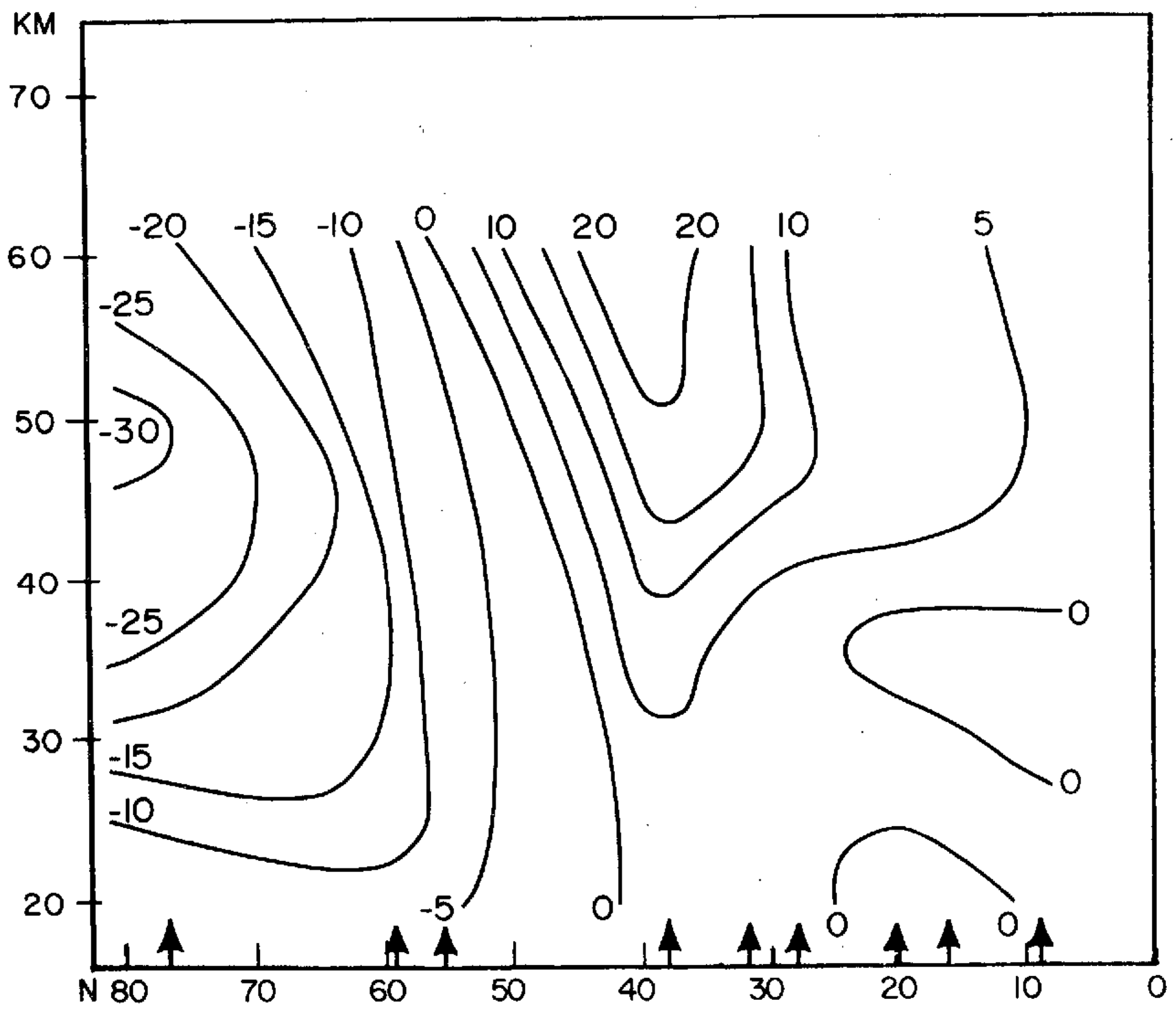

Figure 6. Same as Figure 5, near 90°W, January.

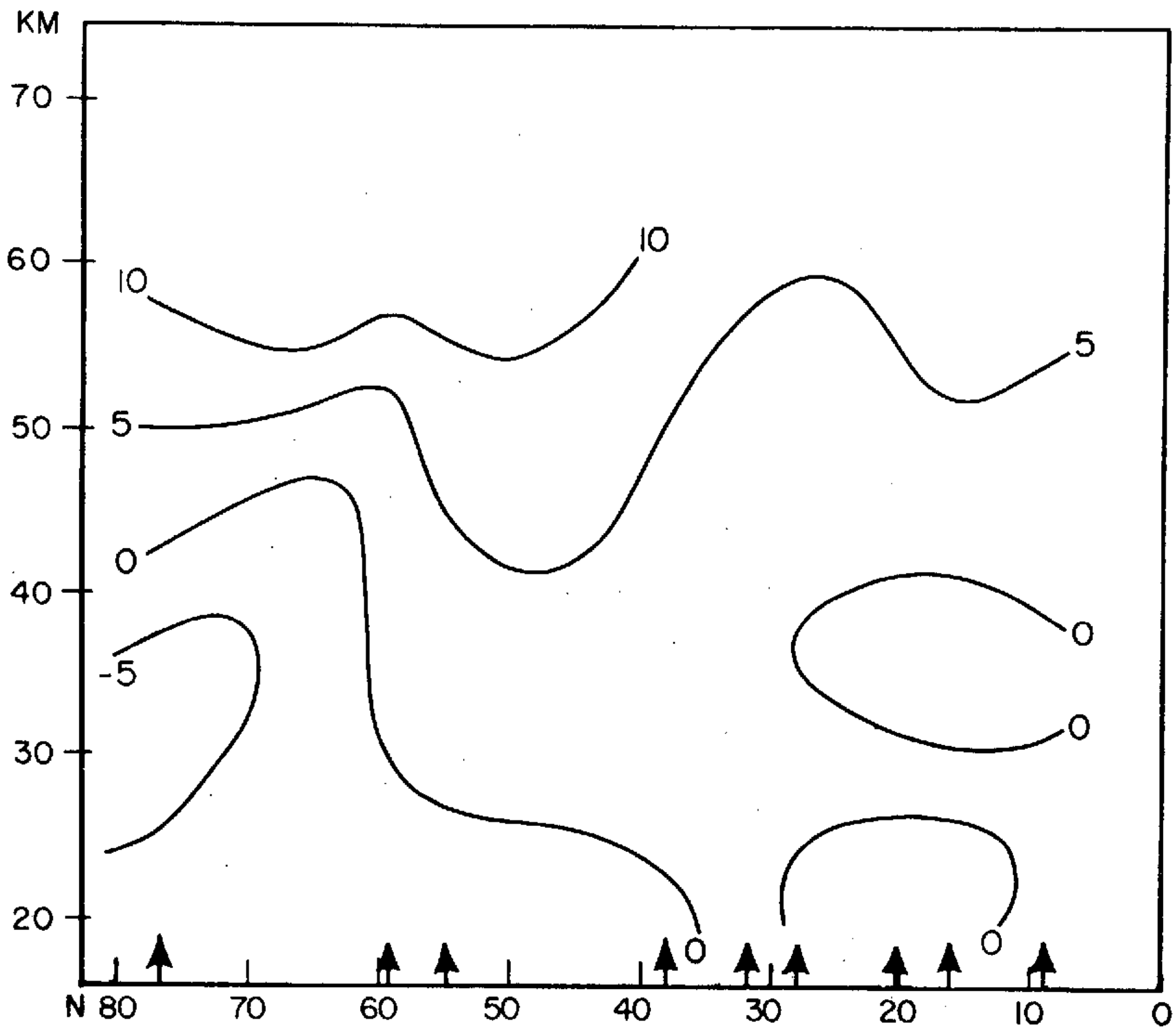

Figure 7. Same as Figure 5, near 90°W, April.

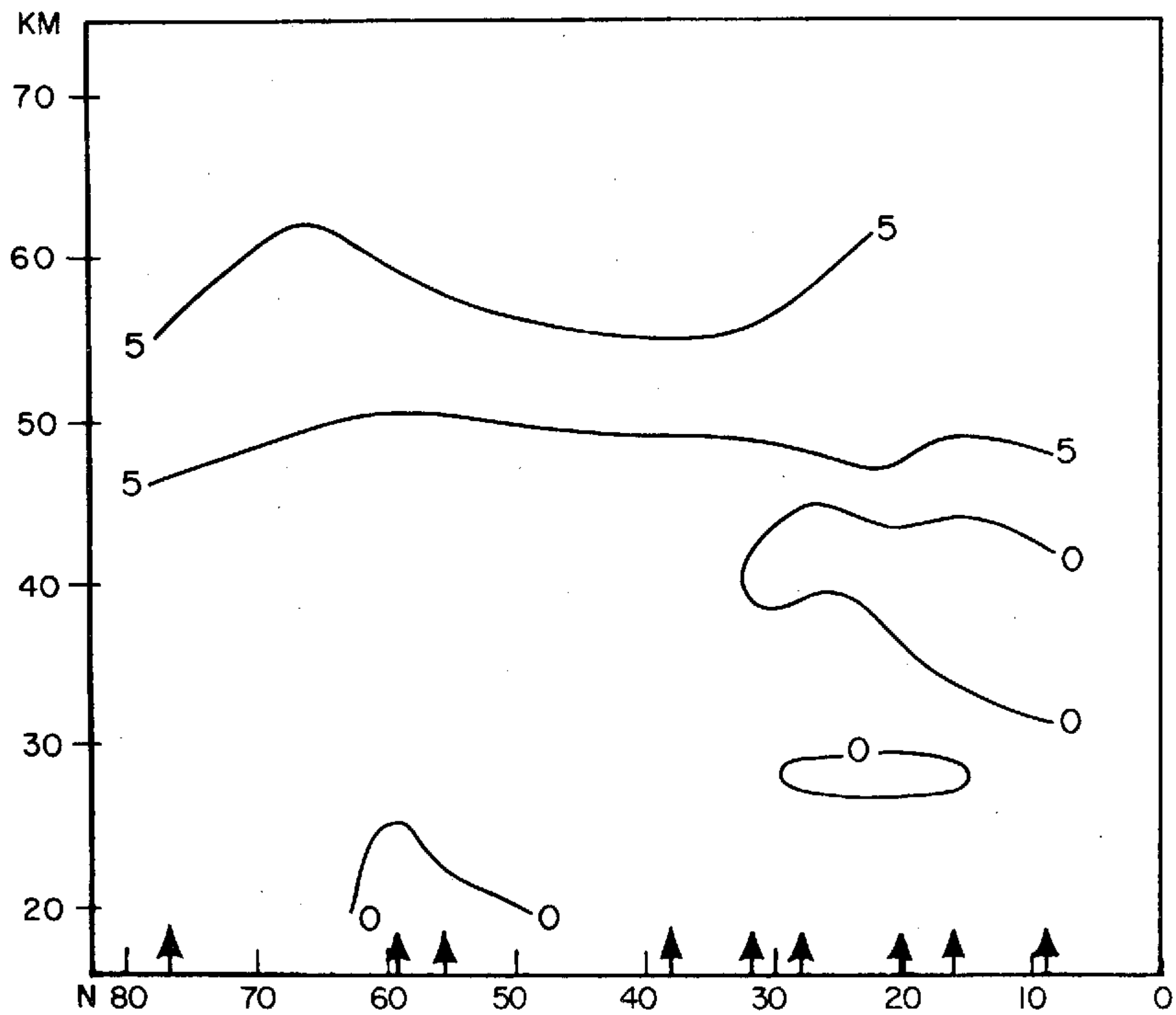

Figure 8. Same as Figure 5, near 90°W, July.

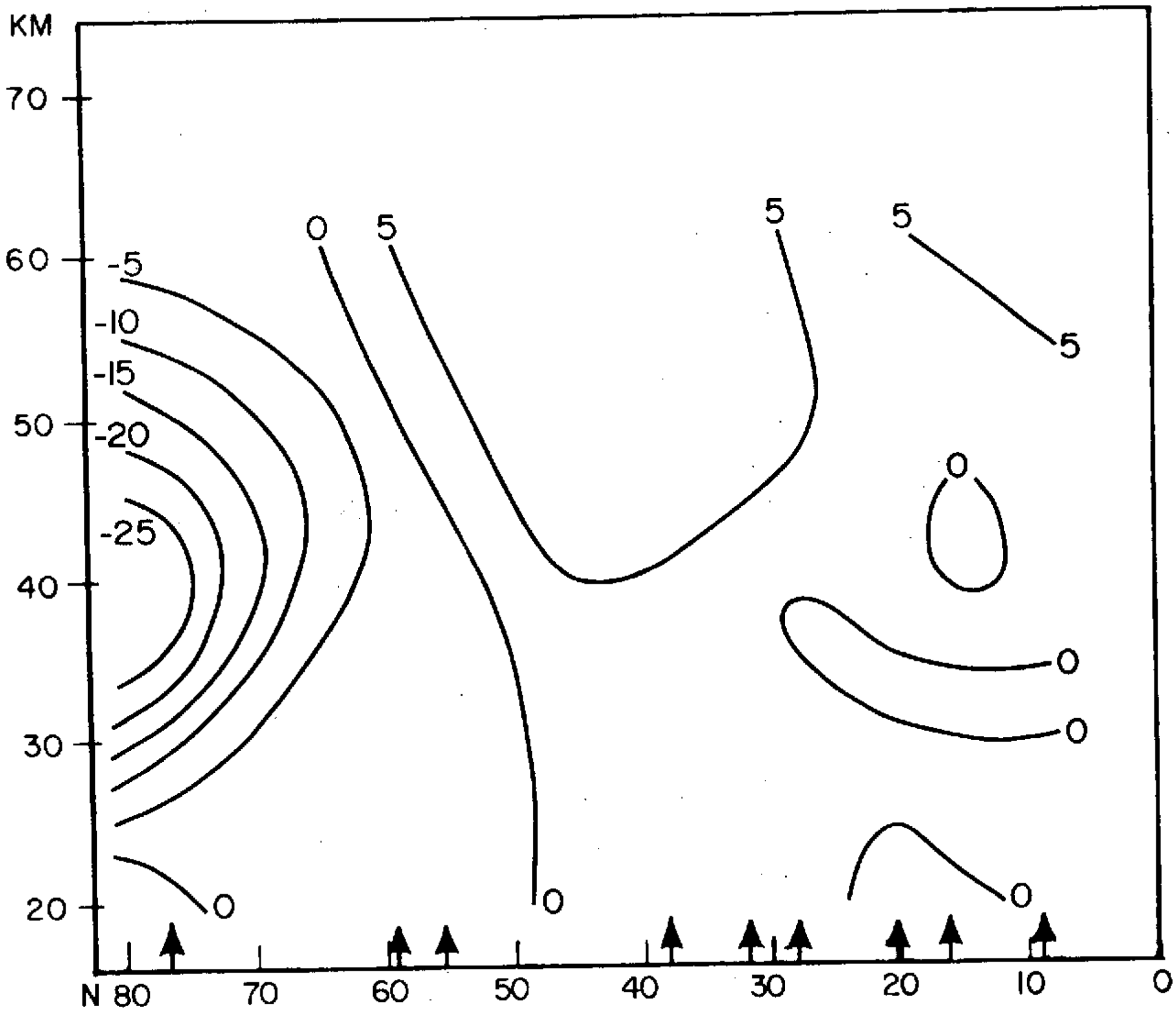

Figure 9. Same as Figure 5, near 90^{o}W, October.

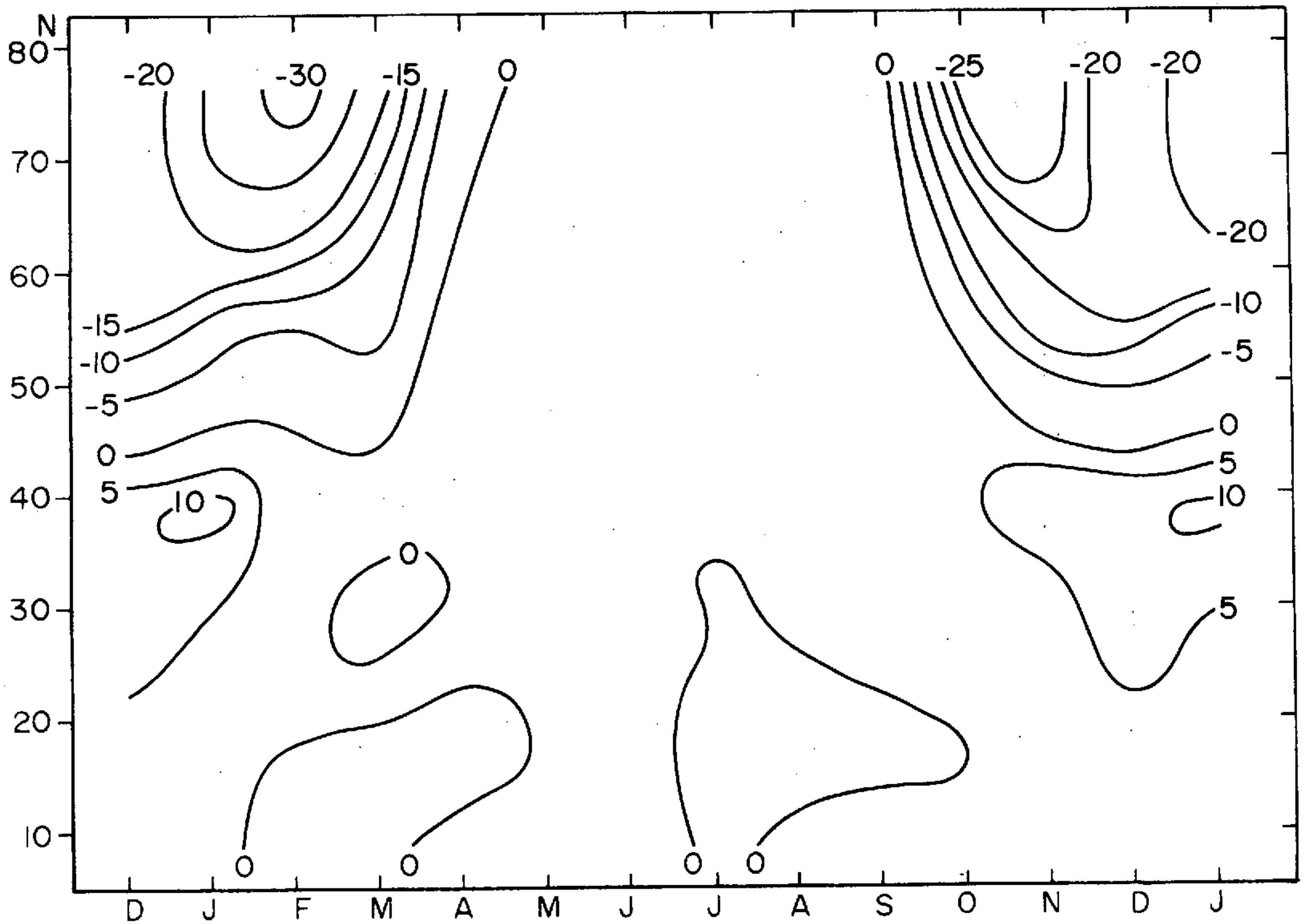

Figure 10. Mean latitude-time section of meridional wind at 40 km.

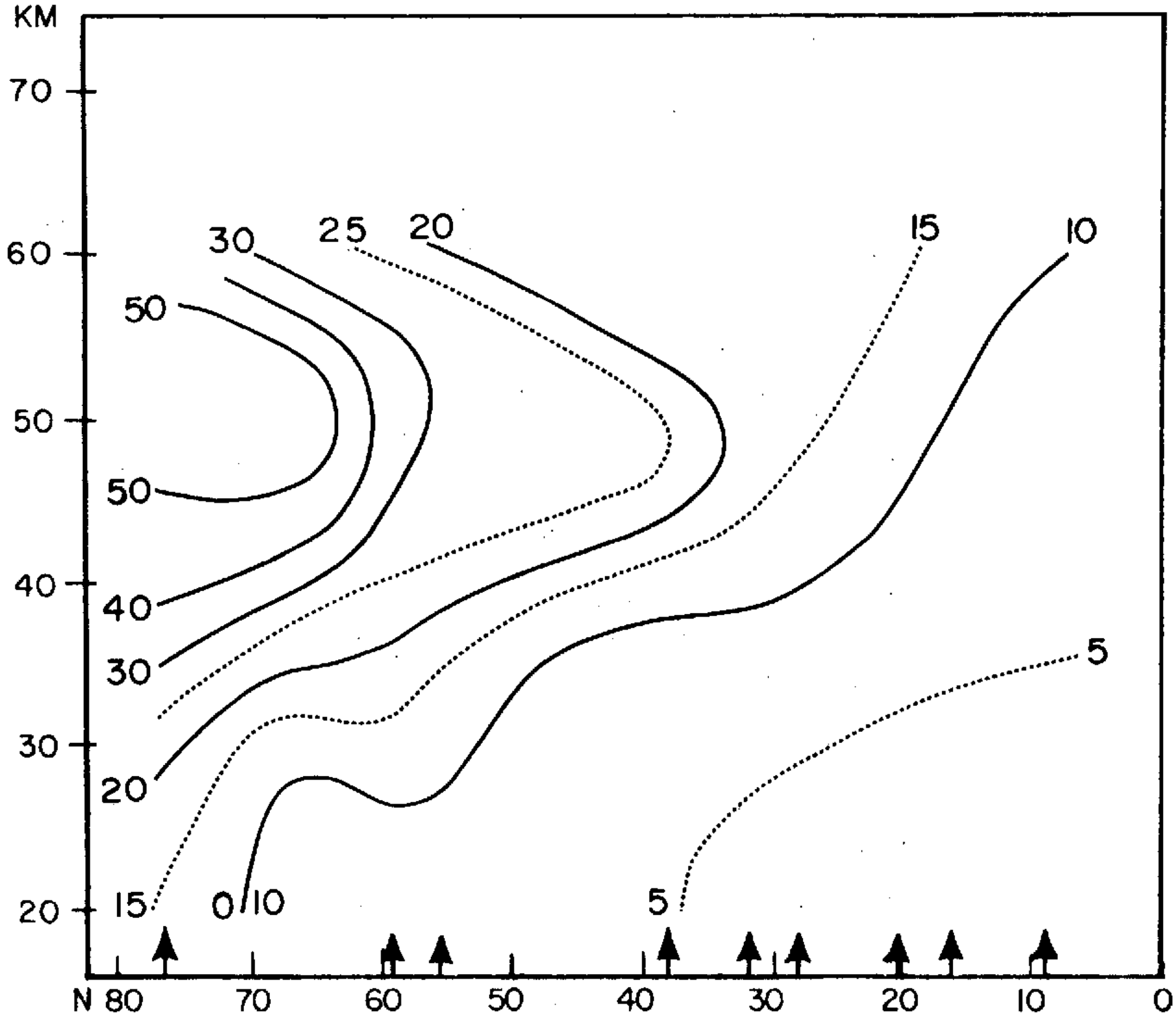

Figure 11. Standard deviation of daily observations in January, 1969-71.

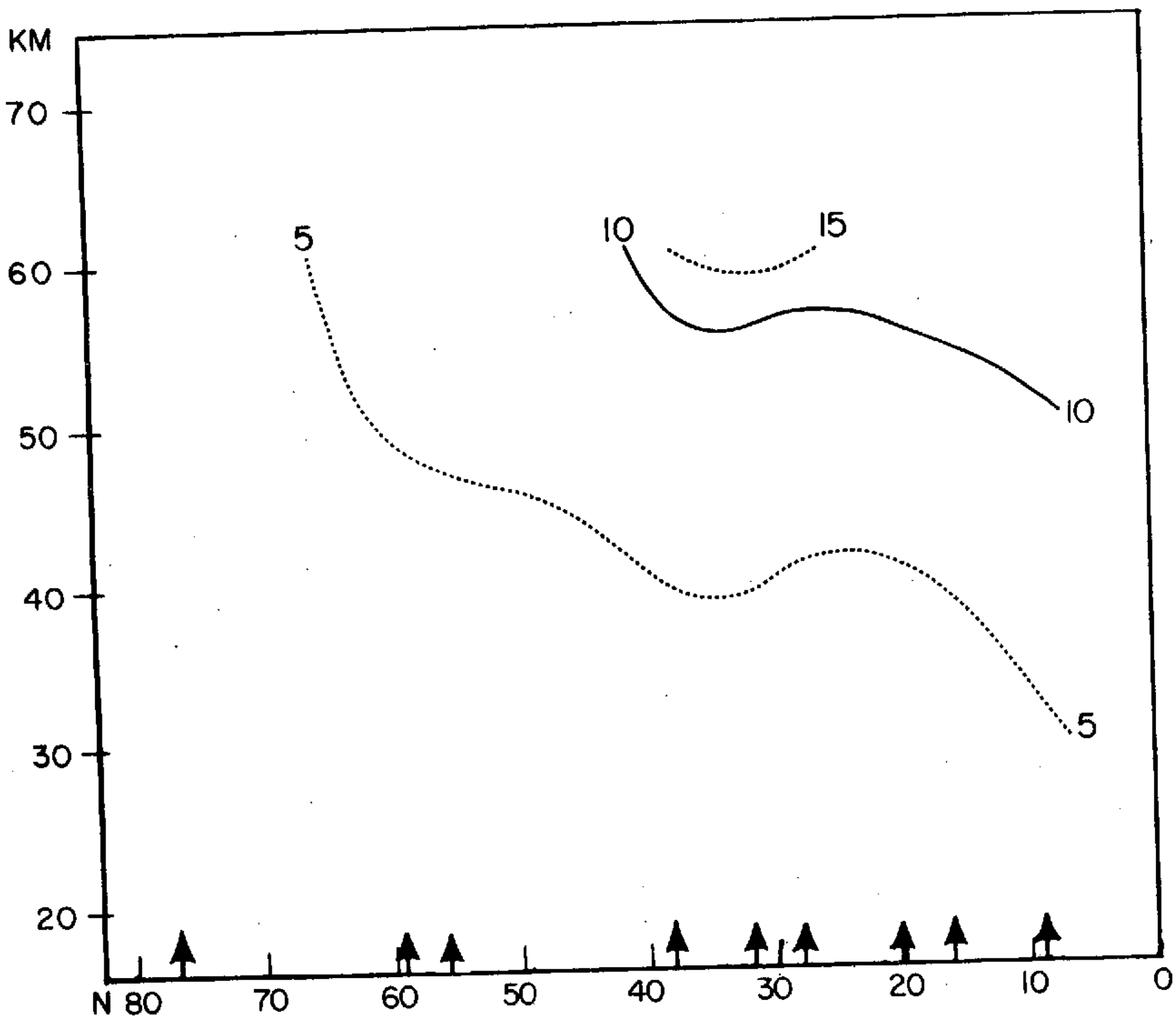

Figure 12. Same as Figure 11 for July.

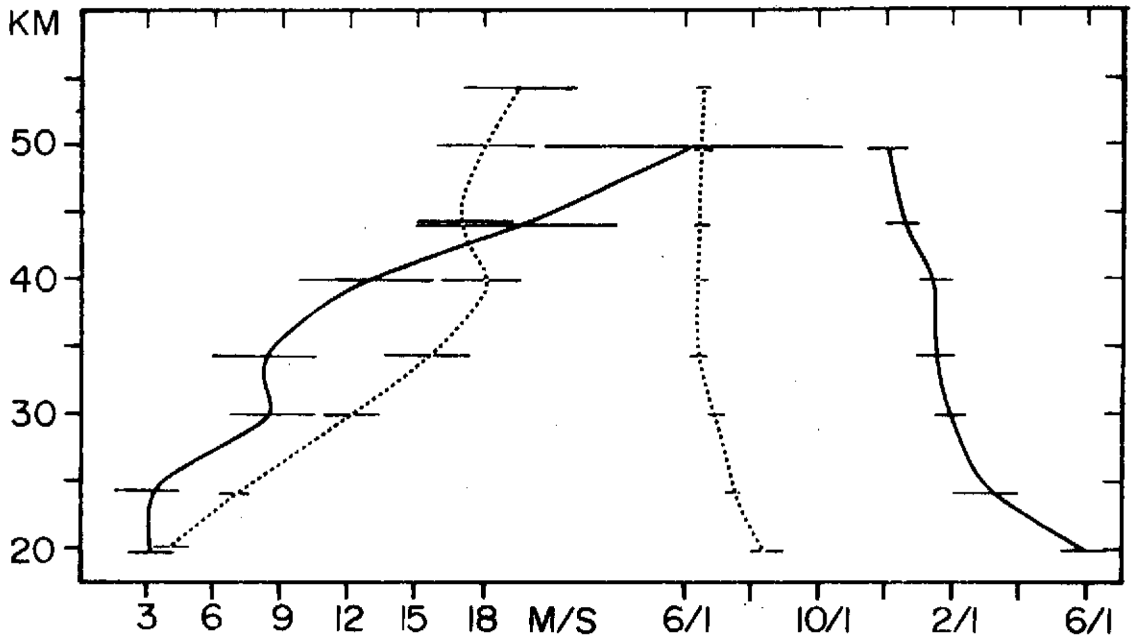

Figure 13. Amplitude and phase of annual wave at Heiss Island and Thule

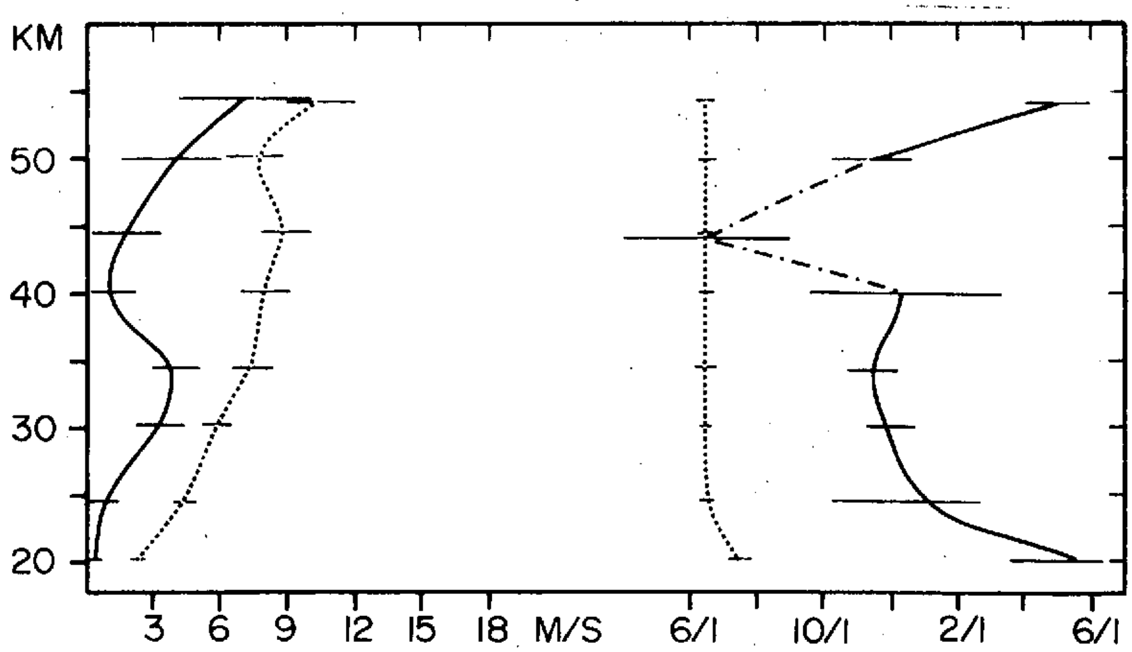

Figure 14. Same as Figure 13 for Volgagrad and Primrose Lake.

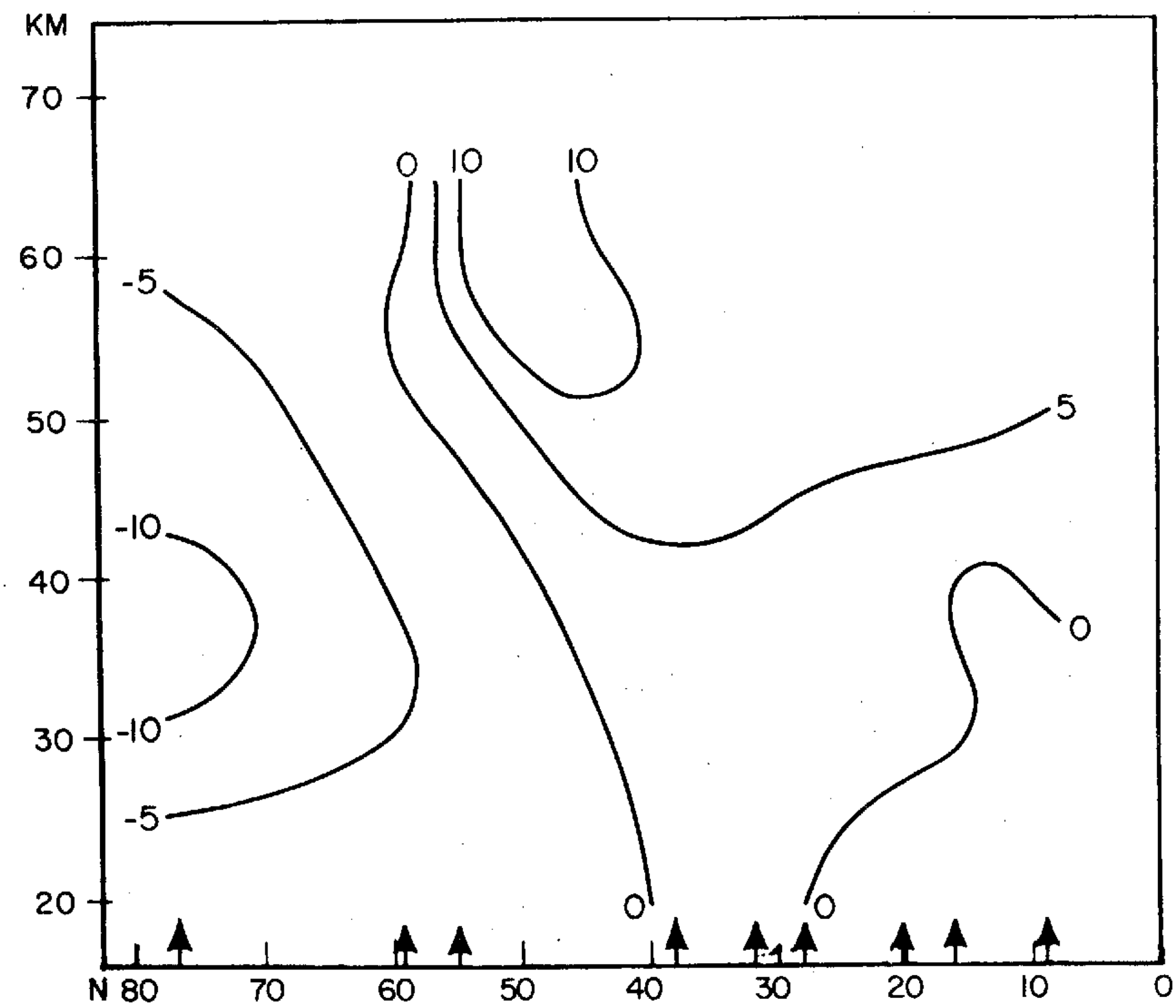

Figure 15. Amplitude of eleven-year mean meridional wind.

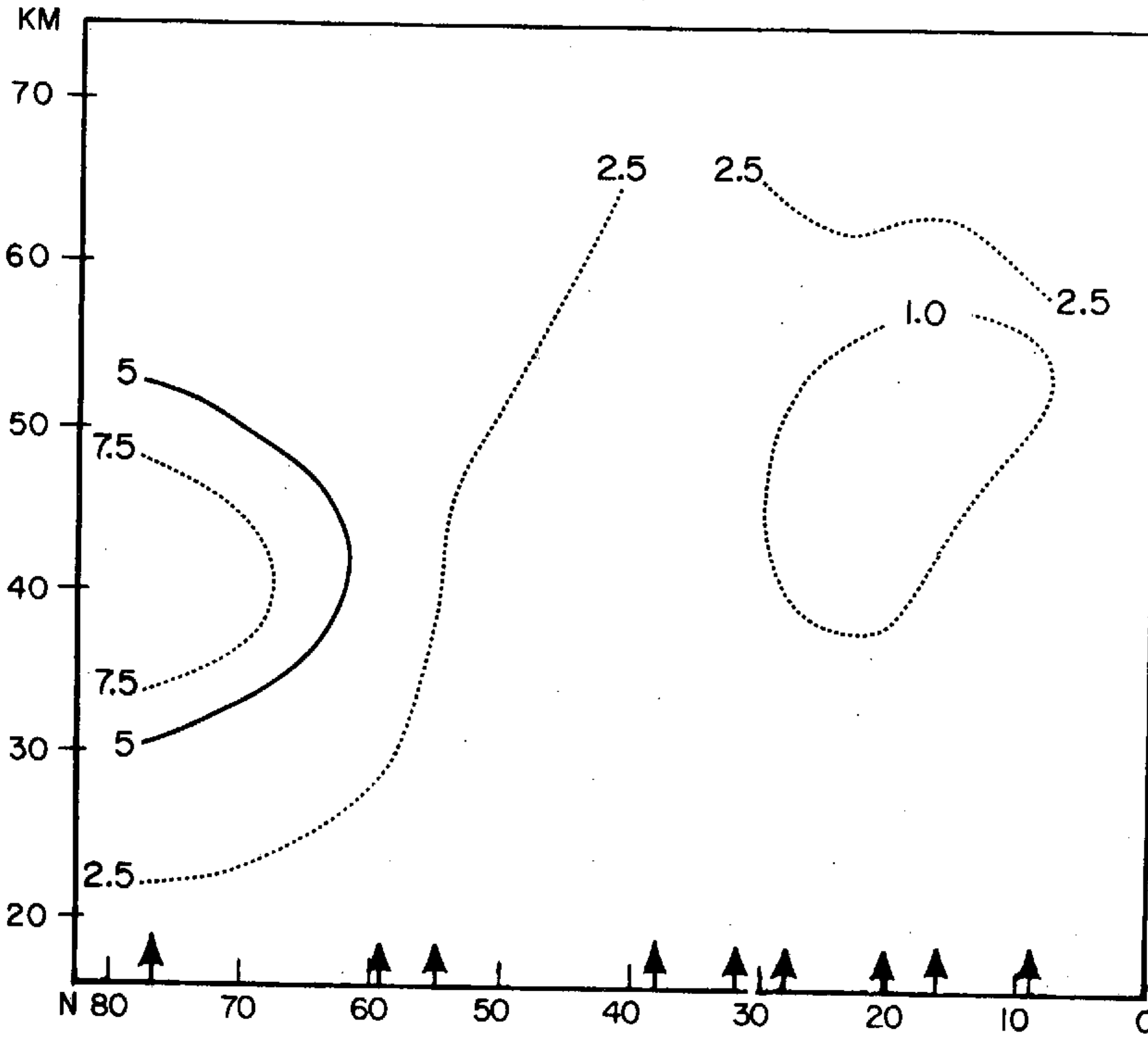

Figure 16. Amplitude of quasi-biennial period in meridional wind.

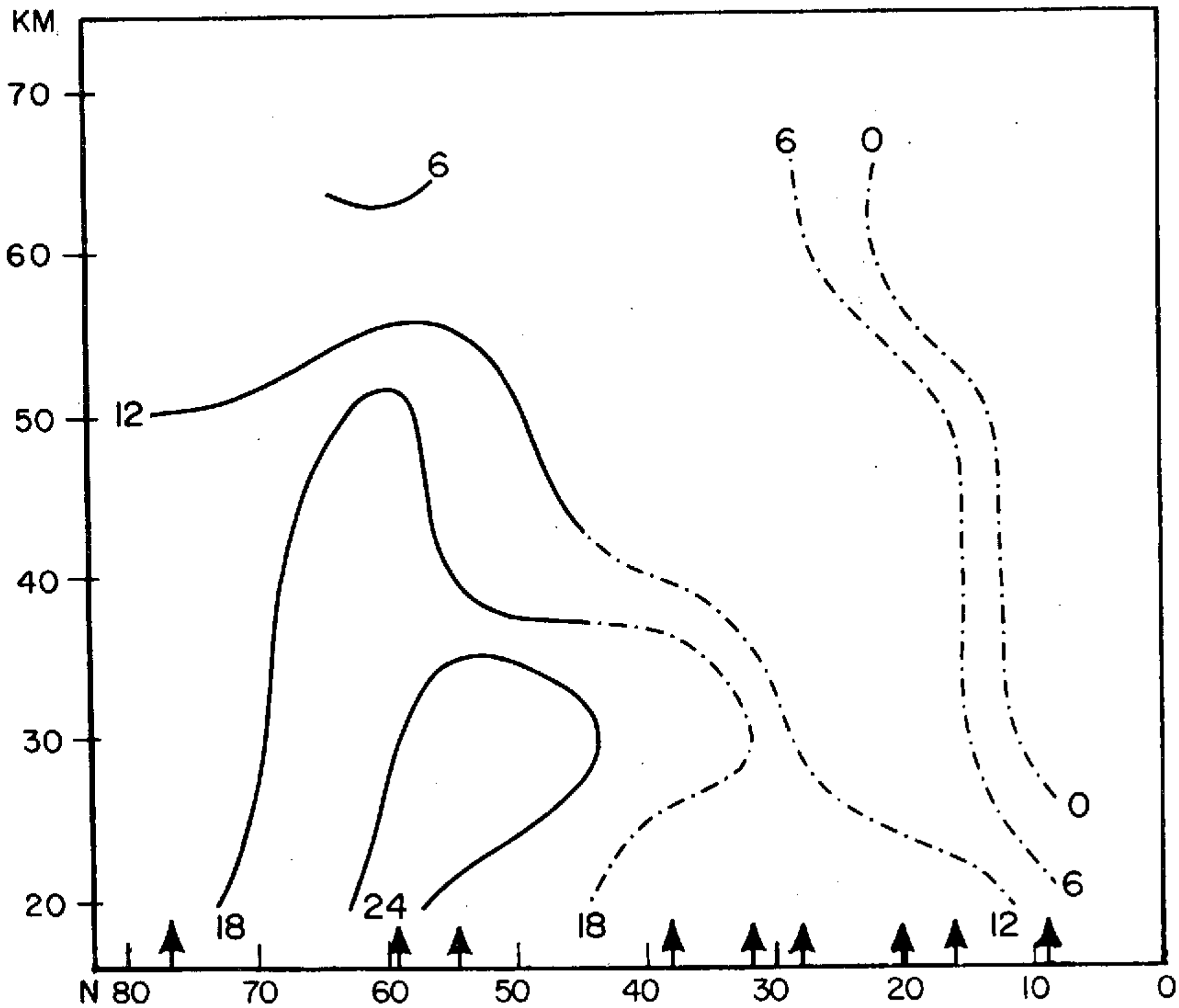

Figure 17. Phase of quasi-biennial period in meridional wind.

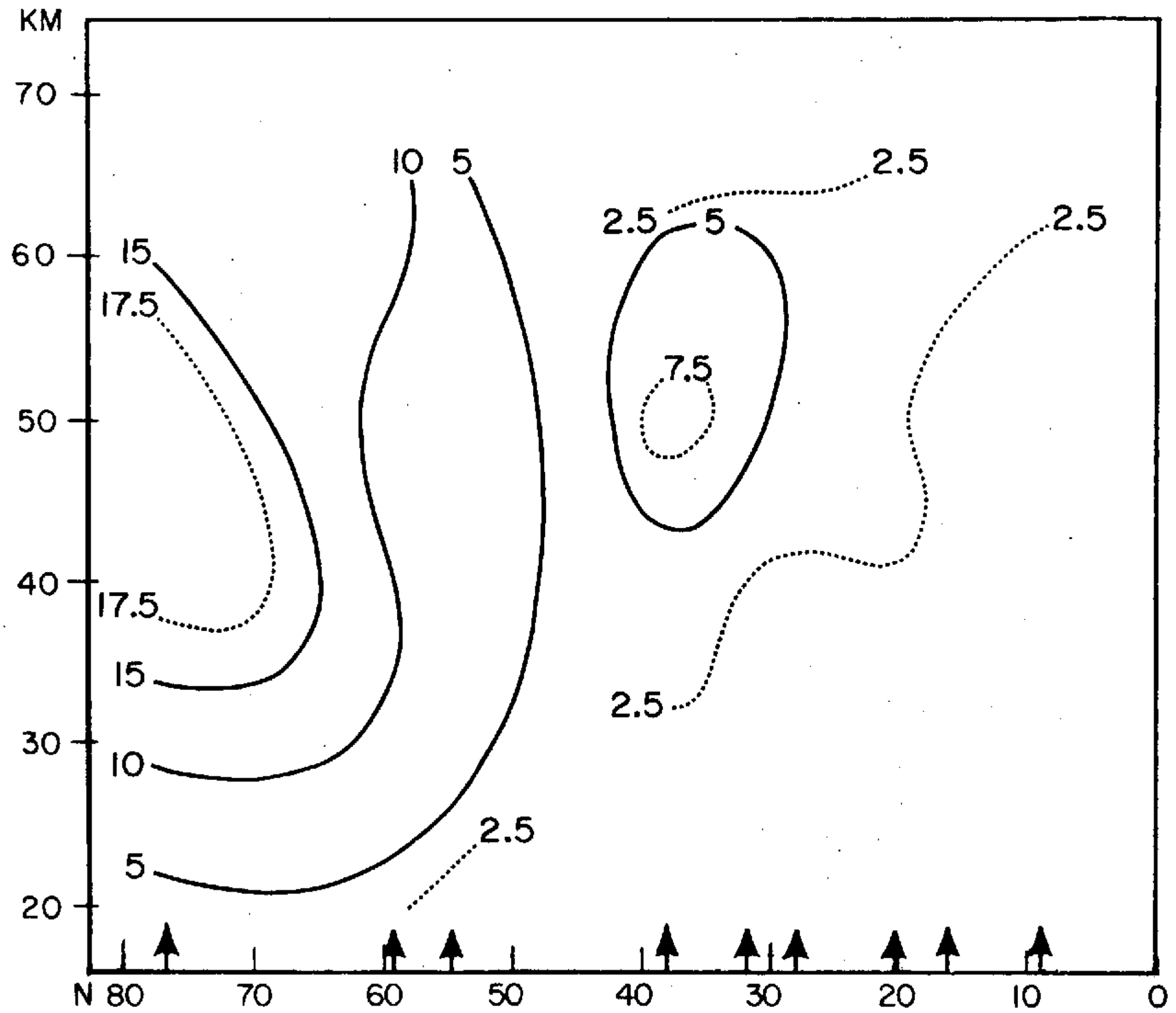

Figure 18. Amplitude of annual period in meridional wind.

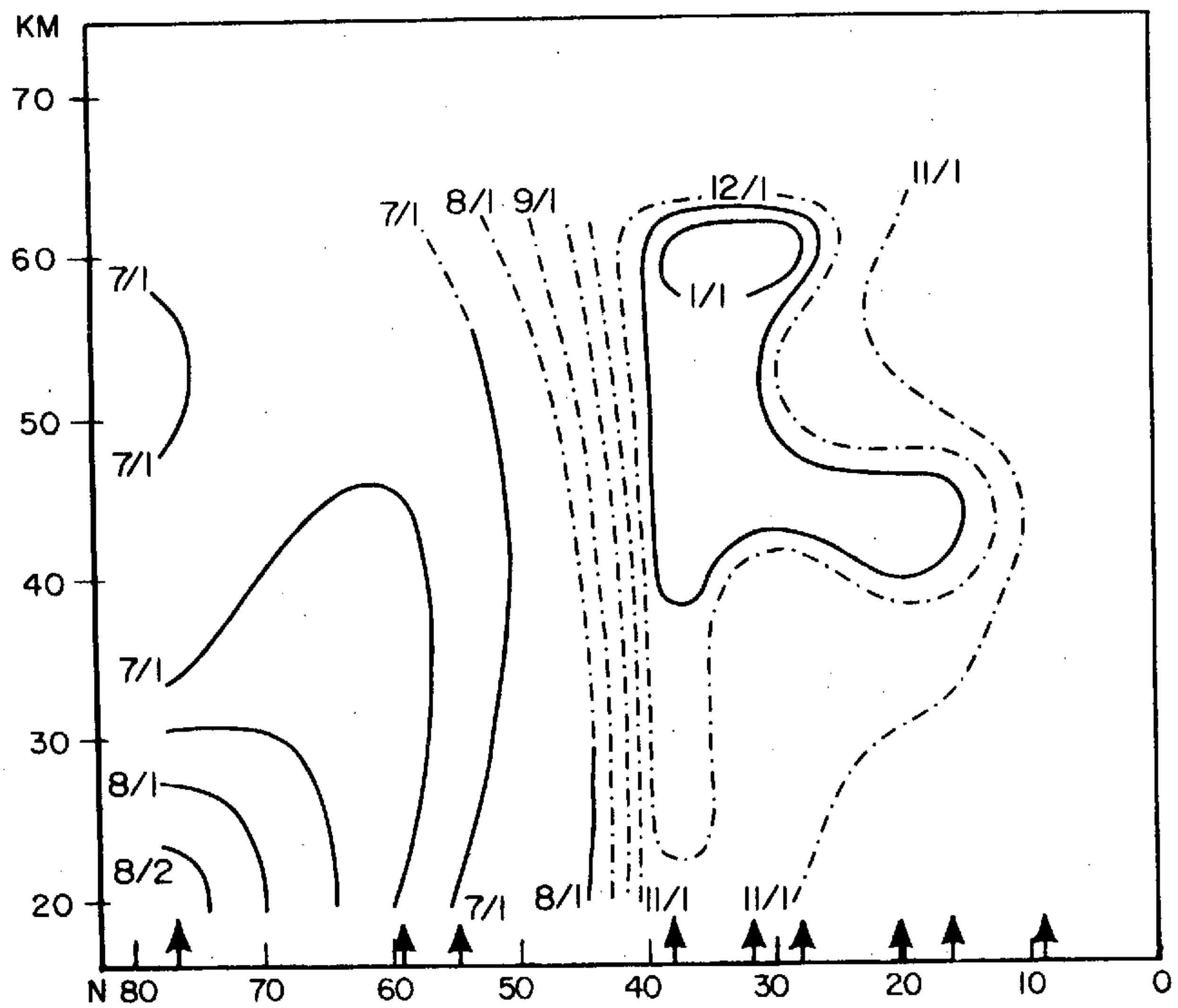

Figure 19. Phase of annual period in meridional wind. Only monthly intervals from 8/1 to 12/1.

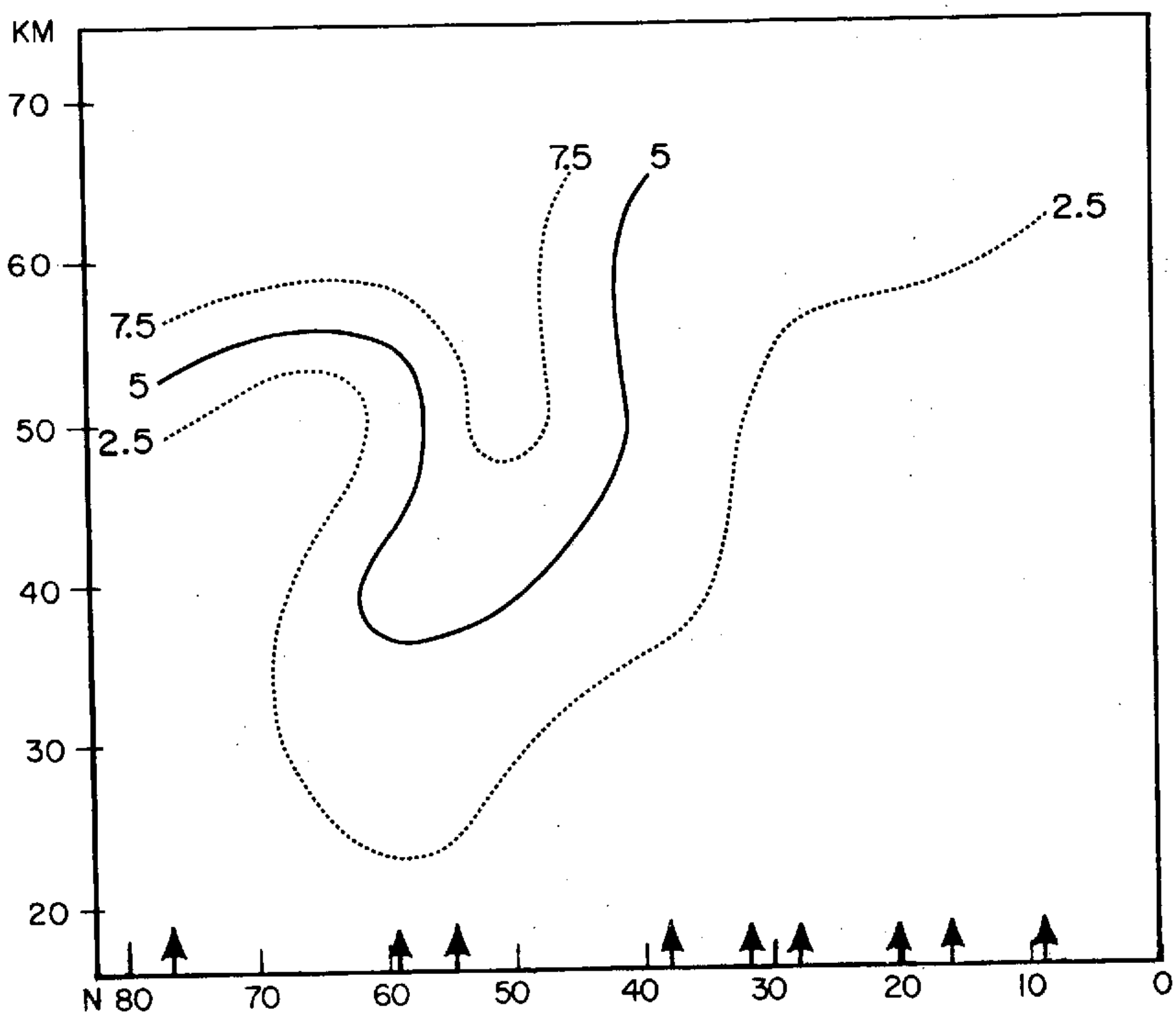

Figure 20. Amplitude of semiannual period in meridional wind.

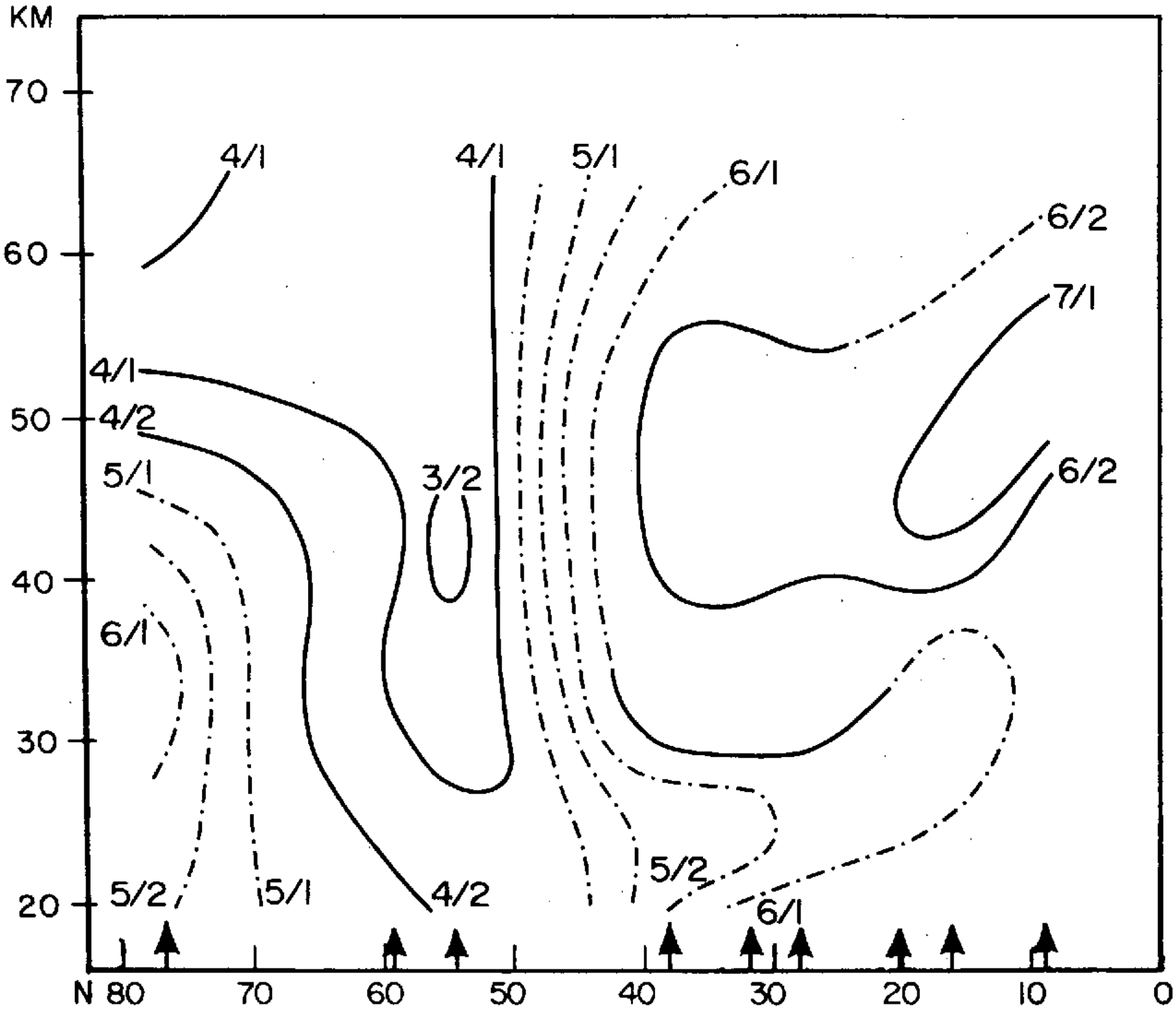

Figure 21. Phase of semiannual period in meridional wind.

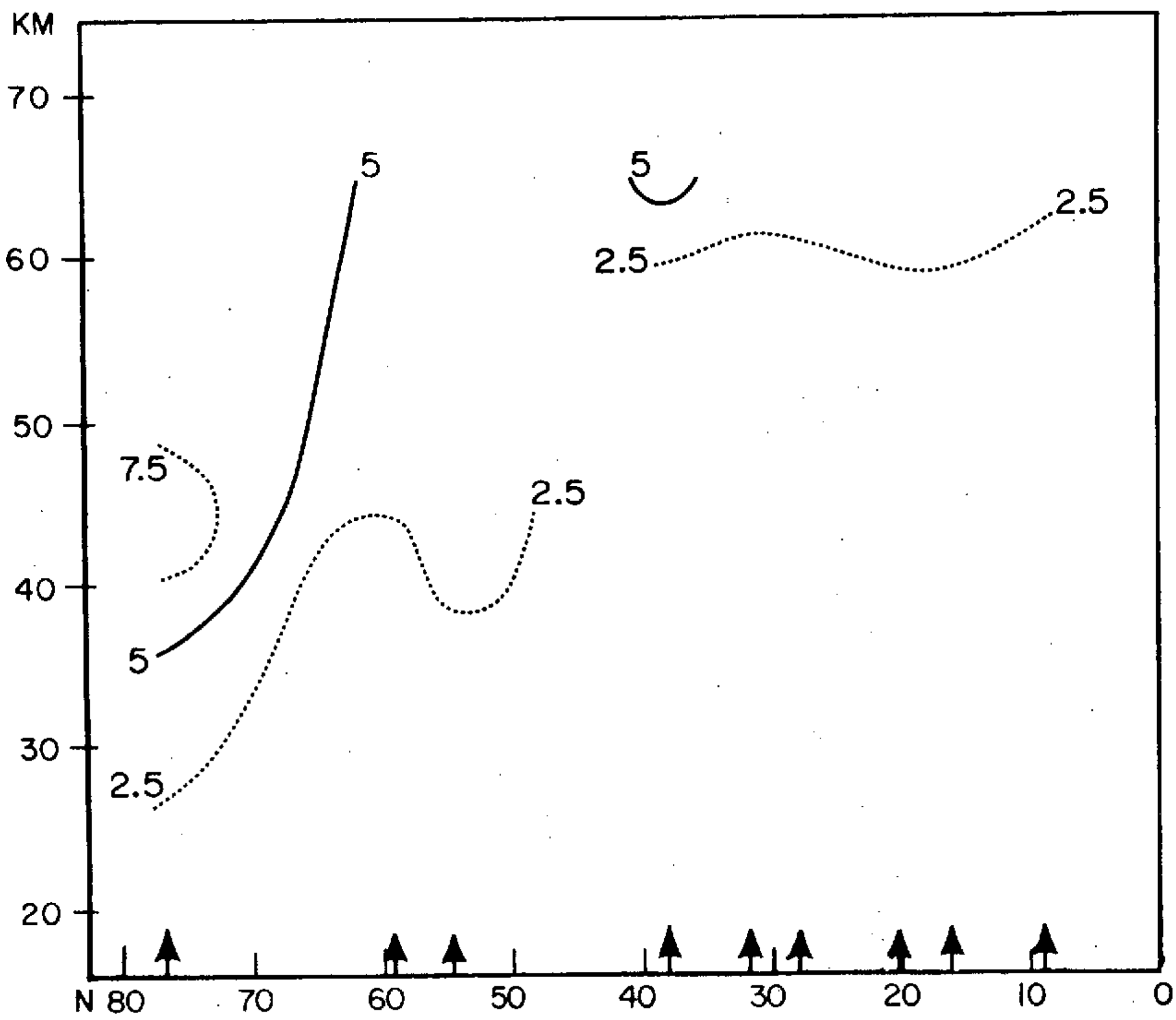

Figure 22. Amplitude of terannual period in meridional wind.

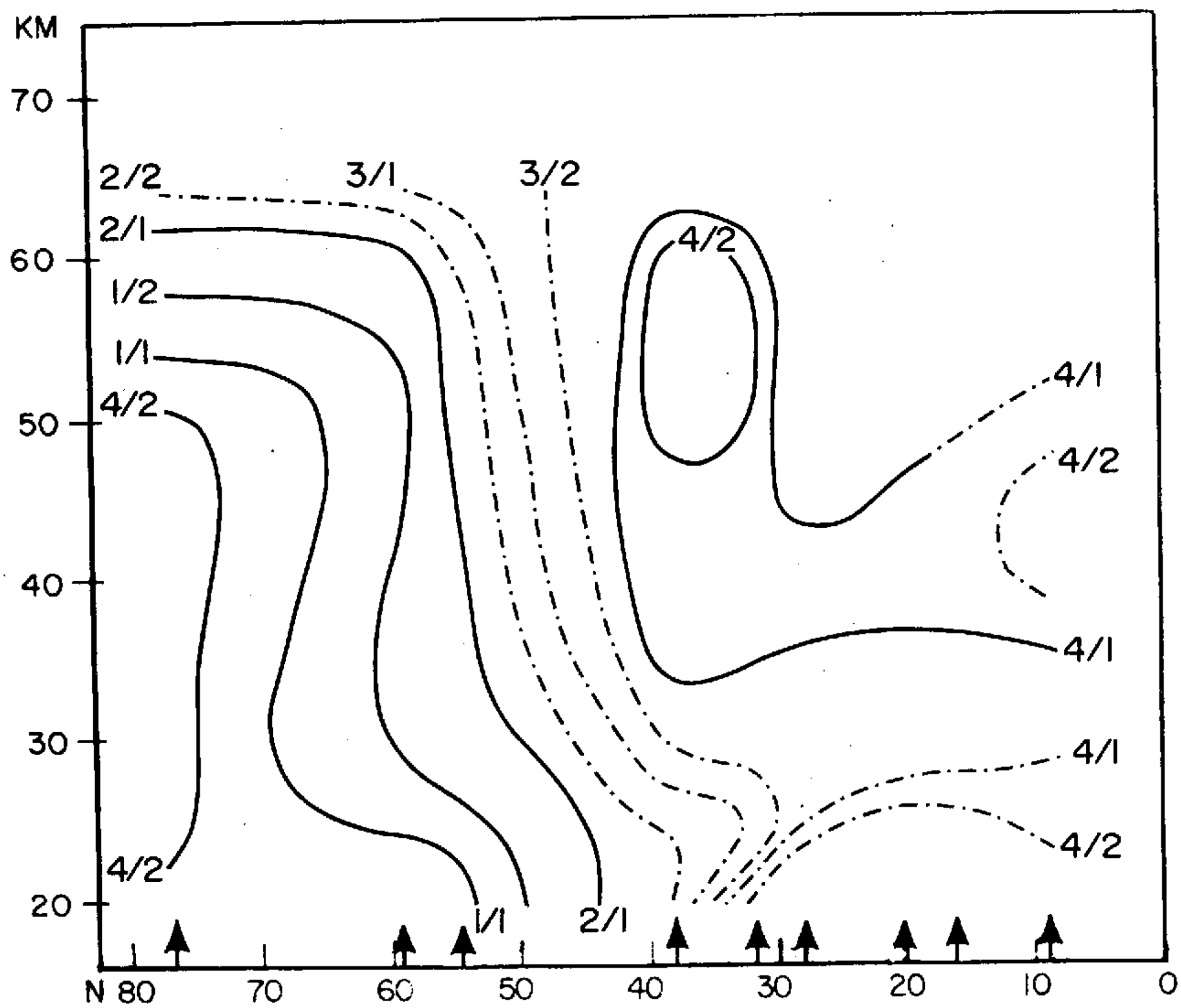

Figure 23. Phase of terannual period in meridional wind.

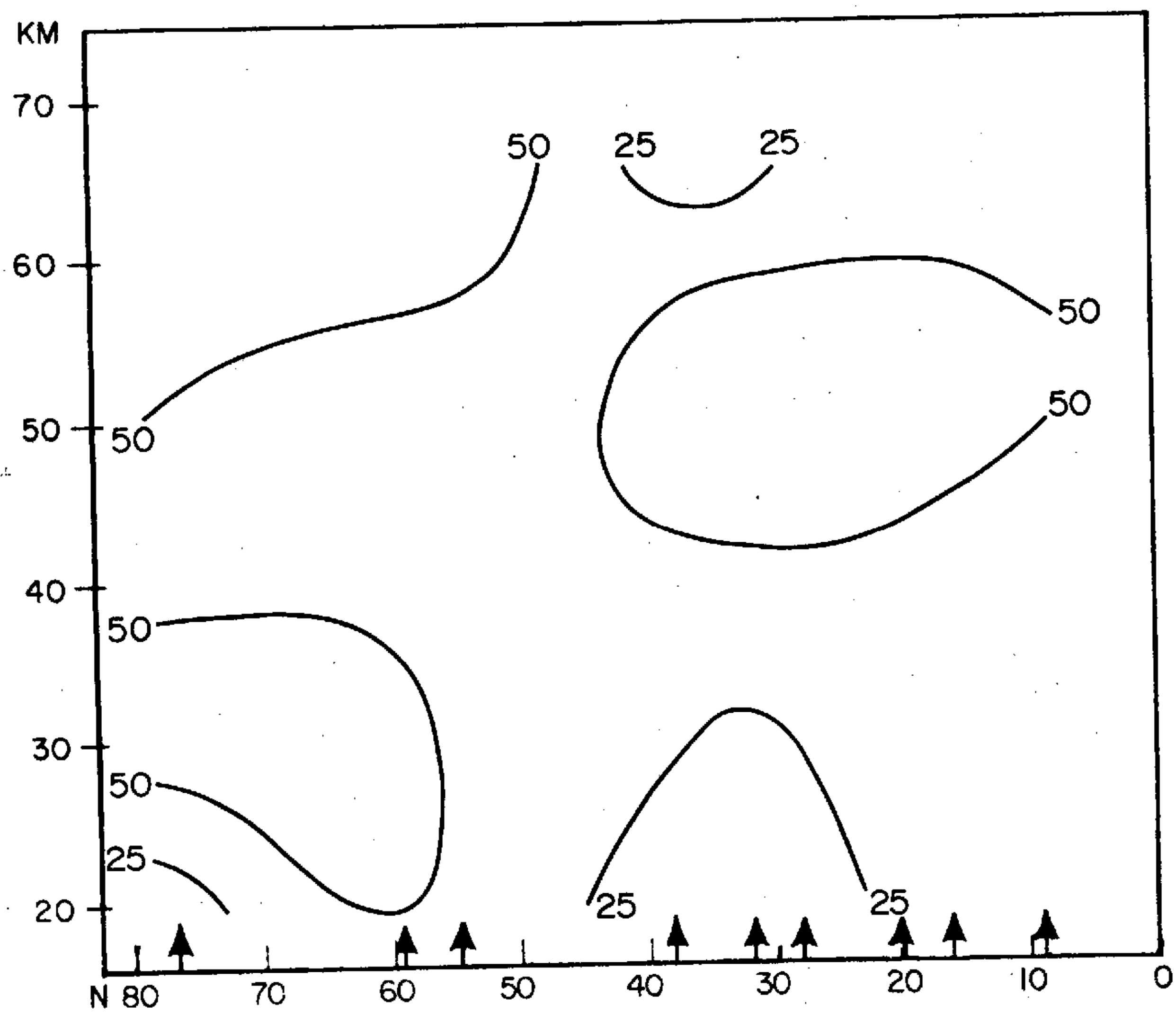

Figure 24. Percent of variability of semi-monthly data explained by eight periodic components.

APPENDIX A: LONG-PERIOD MONTHLY MEAN MERIDIONAL WINDS, 20-70 KM, BY STATION, AT 2 KM INTERVALS.

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR HEISS

PERIOD OF RECORD 11/62 TO 1/70 LATITUDE 80 LONGITUDE -58 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-46	-54	-30	10	26	49	62	69	66	70	39	-10	61	323	316	309	305	47	-65	-202	-337					
N=	21	21	22	22	22	22	22	22	22	22	22	17	12	7	4	4	3	2	2	2	2					
2	120	180	255	265	322	428	423	512	507	545	582	531	534	537	380	283										
N=	13	13	13	13	13	13	13	13	13	13	12	11	11	8	8	3										
3	57	39	72	104	41	116	96	131	137	170	157	245	225	252	47	60										
N=	6	6	6	7	7	7	7	7	7	6	6	6	6	4	3	2										
4	-26	-9	-30	-30	-46	-22	-7	-5	-47	6	10	-46	-159	-99	107	66	150	45	-25	180	190					
N=	17	17	19	18	18	17	17	17	17	17	15	11	9	8	6	5	2	2	2	1	1					
5	-69	-64	-45	-85	-44	-18	-16	-8	-31	19	22	109	25	-49	-112	12	50	15	15	10	15					
N=	18	18	18	19	19	19	19	19	19	18	18	9	8	7	6	4	2	2	2	2	2					
6	7	-6	4	29	14	-5	18	5	12	12	4	97	116	24	-6	-0	45	17	10	-0	10					
N=	17	17	17	17	17	17	17	17	17	17	17	9	9	7	7	6	6	3	3	3	3					
7	20	18	-2	42	21	-57	-21	38	4	4	27	64	28	36	-2	-32	-50	-0	113	153	183					
N=	18	18	18	18	19	19	19	19	19	19	19	19	18	14	13	11	6	4	3	3	3					
8	-5	4	1	-24	5	-60	5	12	24	25	4	-42	-3	393	503	320										
N=	10	10	10	11	11	11	11	11	11	11	11	8	7	3	3	3										
9	25	42	20	35	-0	25	33	56	14	9	92	73	47	89	120	120	67	23	-20	-90	130					
N=	12	12	12	12	12	12	12	12	12	11	11	9	7	7	5	4	4	3	3	3	2					
10	-64	-56	-49	-40	-26	8	-1	24	87	140	92	70	192	274	354	404	580	630	640	630	570					
N=	8	8	9	9	9	9	9	9	9	9	9	8	6	5	5	5	1	1	1	1	1					
11	-14	-30	39	31	88	46	88	160	136	118	321	350	361	370	392	406	430	585	610	520	350					
N=	8	8	9	9	9	9	9	9	8	8	7	7	7	6	6	5	3	2	1	1	1					
12	-108	-100	-64	-14	-17	-1	1	7	160	141	134	788	506	620	682	748	633	553	470	500	-440					
N=	8	8	8	8	7	7	7	7	7	7	7	6	5	5	5	4	3	3	3	2	1					

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR THULE

PERIOD OF RECORD 6/65 TO 12/71 LATITUDE 77 LONGITUDE 69 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-65	-97	-100	-138	-175	-200	-212	-261	-250	-265	-255	-249	-253	-231	-302	-301	-283	-351	-244	-236	-325	-330	-300	-260		
N=	21	21	21	21	21	21	21	20	20	19	19	19	19	17	13	12	12	9	8	7	4	1	1	1		
2	-113	-121	-164	-213	-249	-260	-258	-255	-278	-213	-305	-235	-234	-234	-287	-270	-322	-228	-145	50	25	40	10			
N=	14	14	14	14	14	14	14	14	14	14	14	14	14	14	11	11	5	5	4	3	2	2	1			
3	-36	-55	-59	-93	-120	-131	-172	-172	-192	-200	-227	-197	-244	-225	-216	-198	-188	-240	-184	-107	-155	-120	-40			
N=	19	19	19	19	19	20	20	20	20	20	20	20	18	18	17	17	17	13	13	7	4	3	1			
4	-29	-42	-41	-51	-62	-71	-59	-61	-51	-34	-35	-22	24	26	37	43	67	63	77	104	110	135	240			
N=	24	25	24	25	25	24	24	24	23	22	22	22	22	21	21	20	18	14	8	5	5	2	1			
5	10	7	12	20	20	-3	-6	-7	16	21	39	17	9	2	14	10	24	10	-27	66	28	-47	-40	90		
N=	19	17	17	17	17	17	17	17	17	16	16	15	14	14	14	13	12	10	6	4	3	3	2	1		
6	5	5	6	6	9	9	10	17	7		14	27	18	24	29	27	28	29	30	29	25	60	-47			
N=	49	49	51	51	51	51	51	51	50	50	49	49	49	48	45	41	39	35	29	24	14	9	3			
7	6	15	8	6	10	13	1	22	17	19	17	26	21	42	51	64	52	46	40	45	17	17	-109	86	75	-91
N=	35	35	37	37	36	36	35	35	35	34	33	31	31	31	31	29	27	26	25	19	13	4	2	1	2	2
8	-7	3	10	14	14	13	20	27	25	20	31	25	38	51	48	41	60	65	75	73	36	9	43	55	100	
N=	28	29	36	38	39	42	42	42	42	42	40	40	38	36	35	32	26	22	21	15	8	4	3	2	1	
9	7	-31	1	13	4	18	3	18	14	28	20	30	25	50	41	37	59	49	49	23	-4	-25	-68	-255	-395	
N=	28	31	31	31	31	31	31	31	30	30	30	30	30	29	26	25	19	14	14	12	9	4	4	2	2	
10	2	31	-22	-47	-83	-122	-236	-251	-260	-265	-278	-260	-250	-210	-177	-169	-135	-56	166	266	256	214	135			
N=	28	28	30	31	30	27	26	26	26	26	25	25	22	21	21	19	18	14	9	6	5	5	2			
11	-35	-70	-125	-173	-220	-245	-255	-273	-291	-296	-295	-287	-295	-296	-290	-273	-272	-229	-163	-167	-151	-93	-63	-85		
N=	36	36	36	36	36	36	36	36	36	36	36	36	36	35	33	31	24	19	14	13	10	7	3	2		
12	112	-6	-24	-9	-48	-60	-85	-107	-117	-143	-146	-122	-112	-94	-109	-113	-214	-231	-105	-96	-231	-187	-218	-283		
N=	15	15	15	15	15	15	15	15	15	15	15	16	15	14	13	13	8	6	4	3	2	2	2	2		

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR GREELY

PERIOD OF RECORD 4/61 TO 8/71 LATITUDE 64 LONGITUDE 146 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-49	-57	-76	-95	-111	-131	-149	-159	-177	-191	-189	-199	-215	-202	-206	-176	-138	-133	-114	-125	-255	-78				
N=	82	82	82	82	81	81	80	80	80	79	80	78	76	73	72	69	64	53	37	18	10	3				
2	-22	-37	-48	-68	-100	-89	-114	-134	-149	-170	-175	-193	-202	-205	-189	-184	-187	-167	-172	-158	-165	-70	173	232	164	365
N=	96	96	97	98	98	98	98	98	98	96	96	94	91	91	88	85	82	72	48	31	19	14	5	2	2	2
3	-34	-50	-61	-66	-75	-82	-87	-77	-80	-74	-78	-86	-72	-66	-63	-61	-49	-55	-31	-14	-20	88	134			
N=	99	99	99	98	98	98	99	98	98	98	97	97	97	93	90	86	80	65	46	27	13	2	1			
4	18	10	6	6	3	-1	-9	-9	-11	-16	-17	-8	-17	-7	1	17	55	52	106	77	121	129	94	110	146	150
N=	110	108	107	107	105	104	103	103	100	99	100	98	96	93	91	89	85	79	62	39	20	10	5	2	1	1
5	22	14	16	15	14	15	17	13	20	19	22	20	24	24	32	42	59	62	82	89	72	178	82			
N=	97	98	98	98	98	97	96	96	97	97	97	97	95	93	91	91	90	84	75	63	37	19	5			
6	7	14	13	12	17	15	18	14	22	25	22	19	16	28	38	57	58	58	78	85	111	104	69	102		
N=	82	82	82	82	82	82	82	82	82	84	83	83	83	83	83	82	81	81	77	64	50	24	6	2		
7	10	8	10	10	11	14	12	13	20	28	17	24	20	17	38	56	63	55	63	83	100	78	114	260	-80	39
N=	92	92	92	92	92	92	92	92	92	93	93	93	91	90	89	88	87	82	76	69	50	24	7	1	2	3
8	29	9	9	8	6	3	12	18	15	16	12	14	19	30	31	33	37	45	65	70	76	64	103	55	54	-22
N=	74	74	74	74	74	74	74	74	74	75	75	74	72	72	70	69	68	66	63	57	41	19	7	4	3	3
9	21	19	14	9	6	4	2	6	6	13	3	11	21	25	55	58	70	75	77	71	65	167	330	320		
N=	78	78	78	78	78	78	78	78	77	75	75	72	72	66	66	66	65	58	49	45	29	10	1	1		
10	36	38	23	19	7	-15	-25	-32	-43	-48	-74	-76	-85	-80	-74	-77	-69	-55	-14	-38	-1	-2				
N=	93	93	92	93	92	91	91	91	90	87	86	84	79	77	74	70	65	59	48	30	11	4				
11	-16	-10	-28	-42	-54	-65	-81	-98	-100	-118	-123	-145	-166	-166	-205	-162	-161	-154	-137	-119	-199	-380	-112	-120		
N=	82	82	82	82	82	82	81	79	78	77	74	72	71	69	67	62	58	49	41	27	8	4	1	1		
12	-14	-3	-18	-44	-70	-103	-134	-157	-180	-203	-232	-249	-241	-187	-156	-150	-171	-177	-183	-94	-43	-20	70			
N=	62	62	61	63	63	65	66	65	66	66	65	65	63	58	55	53	51	45	30	19	12	4	2			

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR CHURCHILL

PERIOD OF RECORD 1/61 TO 12/71 LATITUDE 59 LONGITUDE 94 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-70	-105	-116	-134	-152	-167	-177	-180	-179	-176	-169	-149	-128	-90	-93	-65	-66	-32	-41	-69	-164	-239	-438	-400		
N=	64	64	81	81	82	82	82	81	81	81	81	80	80	78	77	75	68	57	35	22	19	14	5	1		
2	-96	-89	-93	-108	-110	-126	-123	-122	-129	-115	-114	-95	-85	-62	-37	-23	2	-30	-73	-124	-157	-354	-549	-560	-857	
N=	60	60	69	70	70	68	67	67	65	65	66	65	65	63	64	62	58	47	36	26	17	13	8	2	1	
3	-23	-32	-34	-30	-36	-43	-35	-60	-57	-63	-55	-46	-53	-45	-36	-22	-6	-17	-9	26	-2	-94	-147			
N=	64	64	71	70	72	72	71	71	71	70	70	70	69	67	67	65	56	43	30	22	16	8	3			
4	-24	-57	-11	-2	-12	1	7	7	15	24	32	32	40	49	41	47	42	39	33	7	-27	8	-190			
N=	40	40	47	47	46	46	46	45	45	45	45	45	45	45	45	45	43	35	32	21	14	6	3			
5	-12	-11	-4	4	2	12	7	5	11	8	7	27	19	15	29	34	34	47	47	41	47	26	-155			
N=	28	28	41	42	42	42	42	42	42	42	42	42	42	42	41	41	40	40	36	26	18	5	2			
6	-18	-44	-27	-3	6	8	8	13	21	19	20	22	12	14	28	32	64	77	66	48	15	-46	-400			
N=	42	42	47	48	48	48	48	48	48	48	48	47	47	45	44	44	42	38	34	24	15	5	1			
7	-20	-13	-4	-3	6	3	6	11	18	21	12	13	14	9	30	41	67	59	71	48	44	-4				
N=	38	37	43	44	44	44	44	44	43	43	43	43	42	41	41	39	37	36	30	20	13	5				
8	-27	3		-3		-1	7	3	9	14	3	9	16	12	14	26	39	33	30	33	-13	-2	-77	-140		
N=	52	52	66	68	70	70	70	70	70	70	70	70	70	70	68	66	60	55	46	31	21	8	3	1		
9	-22	-61	-10	2	9	13	20	26	26	26	30	23	31	31	29	42	44	40	28	18	36	43	30	-390		
N=	36	36	54	55	55	55	54	54	54	54	54	54	52	52	52	51	48	47	40	31	22	12	7	1		
10	-28	-16	-18	-33	-31	-20	-25	-20	-18	-17	-4	8	14	5	-1	20	29	17	24	66	29	-41	-115	-255		
N=	53	59	61	62	62	62	62	63	63	63	62	62	60	57	55	54	53	50	40	29	22	12	8	2		
11	-23	-54	-57	-67	-83	-95	-116	-130	-140	-131	-126	-123	-119	-118	-107	-88	-64	-94	-98	-106	-250	-348	-533	-470		
N=	53	53	71	72	71	70	69	69	69	69	69	69	68	68	68	65	62	55	50	39	33	16	8	2		
12	-76	-39	-104	-145	-174	-182	-141	-200	-198	-179	-181	-143	-121	-109	-96	-82	-61	-43	-59	-99	-164	-259	-379	-330		
N=	73	74	89	91	91	91	91	92	92	92	92	92	92	90	88	84	82	71	57	45	34	22	8	2		

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR PRIMROSE

PERIOD OF RECORD 7/64 TO 12/71 LATITUDE 55 LONGITUDE 110 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-65	-74	-84	-81	-88	-77	-77	-88	-75	-80	-82	-66	-83	-81	-60	-56	-53	-54	-76	32	5	37	245			
N=	28	28	28	28	28	28	28	28	29	28	28	27	25	22	21	21	21	19	18	16	11	4	4			
2	-43	-50	-53	-60	-46	-57	-78	-54	-50	-40	-16	-22	-43	-48	-39	-31	-20	-25	32	73	135	139	226	207	403	443
N=	26	26	26	26	27	27	27	27	27	27	27	26	25	25	25	25	25	24	24	19	13	7	7	4	3	3
3	-18	-13	-15	-27	-27	-35	-45	-47	-47	-58	-58	-51	-61	-29	10	34	58	67	108	155	278	310	293	380	710	
N=	20	20	20	20	20	20	20	20	20	21	21	21	20	20	20	19	19	18	17	11	8	6	3	2	1	
4	10	20	21	10	6	16	32	24	30	38	38	30	46	71	76	76	85	90	104	109	154	166	174	246	314	462
N=	27	24	26	26	26	26	25	24	24	24	24	24	23	23	23	23	22	22	22	20	17	11	9	7	7	4
5	-7	-8	6	12		1	2	3	-1	12	-8	9	12	4	20	23	37	64	92	85	117	130	212	222	385	340
N=	36	34	34	34	34	34	34	34	34	34	34	33	31	30	30	29	27	27	24	24	16	12	8	4	2	1
6	-30	-9	-8	2	4	7	14	12	21	25	34	30	17	26	55	56	65	85	109	99	124	109	175	230	360	
N=	16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	12	11	11	10	4	2	1	
7	-4	-3	10	2	14	8	4	26	29	21	7	32	27	14	7	40	98	83	85	101	66	221	196	326	422	
N=	20	20	20	20	20	20	19	19	19	18	18	18	16	13	13	11	10	9	8	8	8	8	5	5	4	
8	8	9	2	11	15	8	17	9	16	20	23	52	52	29	25	62	91	107	109	127	147	199	215	257	275	620
N=	35	36	36	36	36	35	35	35	35	35	35	35	35	34	34	34	32	31	30	26	23	21	15	12	4	2
9	-0	13	10	3	12	6	13	14	26	31	40	46	63	48	53	57	63	110	112	87	116	91	213	222	400	530
N=	31	31	31	31	31	31	31	30	30	29	28	27	26	26	24	22	20	18	18	17	14	10	7	5	3	2
10	-6	-20	-18	-12	-31	-30	-18	-46	-36	-6	-2	4	-1	17	26	65	46	70	82	96	99	148	164	205	316	
N=	20	20	20	21	21	20	20	20	20	20	20	20	21	21	21	20	19	19	16	15	13	11	7	2	2	
11	-6	-17	-43	-46	-68	-70	-86	-75	-101	-99	-121	-107	-96	-91	-61	29	-8	7	87	41	54	48	120	-30	30	230
N=	18	18	17	17	17	17	17	17	17	18	18	18	17	17	15	13	13	13	11	8	5	4	2	1	1	1
12	-44	-86	-89	-56	-130	-141	-166	-170	-198	-137	-185	-220	-174	-153	-187	-159	-163	-173	-165	-92	-22	167	315	160		
N=	10	10	10	10	10	10	10	10	10	10	11	10	10	10	10	10	9	8	7	6	4	3	2	2		

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR VOLGOGRAD

PERIOD OF RECORD 9/65 TO 1/70 LATITUDE 49 LONGITUDE -45 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	25	44	41	86	50	65	44	66	-17	-16	11	104	190	88	-45	-14	16	20	-390	-870						
N=	13	13	13	13	13	13	13	13	13	13	13	12	12	12	10	10	5	3	1	1						
2	-32	-19	-22	-10	17	54	41	41	11	28	47	61	88	21	34	86	-25	-11								
N=	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	3								
3	8	-22	21	-43	-19	-11	3	-12	-34	-21	-31	-36	-177	-204	-100	-28	70	191								
N=	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	3								
4	-13	-20	-28	-27	-37	2	-25	-4	-21	12	22	64	75	18	17	43	78	72	130							
N=	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	12	9	6	2							
5	15	-1	-11	-15	20	3	57	5	-11	-25	32	49	41	2	-8	18	83	147								
N=	11	11	11	11	11	11	11	10	10	10	9	9	9	9	9	8	6	3								
6	19	28	2	-1	35	16	-18	-21	26	-21	61	194	165	-65	-158	-53	-88	-36	-13	200						
N=	10	10	10	10	10	10	10	10	10	10	9	9	8	8	6	6	5	5	3	1						
7	1	8	5	-14	23	-22	-27	-22	14	-29	-44	-72	-34	-86	-68	-6	99	105	214	170						
N=	14	14	14	14	14	14	14	14	14	14	14	14	14	13	11	11	10	9	5	1						
8	30	18	35	28	42	40	43	40	52	85	67	57	52	-100	-110	-110										
N=	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1										
9	-5	-10	2	3	8	12	23	44	50	40	33	42	16	2	36	23	-40	-56	10							
N=	11	11	11	11	11	11	11	11	11	11	11	11	11	9	9	9	5	5	2							
10	-24	-1	-17	10	19	56	32	29	38	13	9	11	55	99	109	111	52	15	160	40						
N=	15	15	15	16	16	16	16	16	16	16	15	15	14	14	11	11	9	8	2	1						
11	-13	-12	-29	-4	4	1	-17	-11	49	97	68	-8	37	59	-6	74	-70	-164	-125	-25	145					
N=	17	17	17	17	17	17	17	17	17	17	16	16	16	16	15	14	9	7	2	2	2					
12	35	53	58	56	90	128	94	104	120	128	103	21	-108	-118	-47	-14	-2	-2	43	10	140	290	420			
N=	16	16	16	16	16	16	16	16	16	16	16	15	15	15	14	11	10	8	3	1	1	1	1			

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR WALLOPS

PERIOD OF RECORD 1/61 TO 12/71 LATITUDE 38 LONGITUDE 76 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	12	11	8	15	45	53	56	48	40	69	109	124	159	192	186	201	223	226	216	197	228	220		-243	-278	-353
N=	52	52	54	55	58	59	52	63	65	64	65	64	43	63	61	58	50	46	39	34	25	18	8	1	1	1
2	13	12	16	19	27	27	17	2	-6	5	33	57	88	117	138	141	146	146	139	101	67	25	-92	-132	-78	-56
N=	54	55	57	58	58	59	60	61	61	63	63	66	63	61	59	54	52	41	38	30	25	20	13	6	2	1
3	3	8	11	10	18	10	5	3	-10	6	11	32	53	53	62	47	45	72	78	73	80	136	71			
N=	66	66	67	67	68	68	69	69	70	71	71	70	70	70	69	64	56	47	36	24	18	8	4			
4	-17		7	11	13	16	15	4	2	7	17	26	33	39	44	45	55	74	72	76	49	89	79	65	57	130
N=	76	76	77	78	78	79	79	79	79	78	78	78	78	78	77	75	71	64	52	43	30	14	10	4	2	2
5	1	6	4	7	1	10	10	11	6		11	20	24	35	44	54	59	62	48	14	11	20	13	-18	-99	
N=	81	82	83	83	83	83	83	83	82	82	81	81	80	80	80	78	74	70	54	43	29	15	10	6	2	
6	-7	4	6	7	2	10	10	9	11	4	9	17	34	52	55	49	38	28	23	39	42	28	38	74	121	35
N=	80	80	80	81	82	82	82	83	83	83	82	81	78	77	77	73	66	60	52	38	27	16	11	6	3	1
7	3	7	5	2	6	16	10	7	2	2	22	16	19	41	47	48	57	47	33	33	15	9	64			
N=	83	84	84	84	84	85	85	85	85	86	86	85	85	84	84	82	76	62	51	39	32	13	4			
8	5	2	4		2	4	8	14	10	3	2	12	23	37	48	35	9	22	43	20	11	59	73	3	117	80
N=	98	99	100	100	102	102	102	101	101	102	102	100	100	97	93	90	80	71	54	38	21	12	6	3	3	3
9		1	4	4	-0	4	6	6	7	5	9	17	30	38	54	47	73	83	61	53	50	-8	-46	10		
N=	76	74	76	78	78	78	79	79	80	79	79	78	77	77	75	72	61	55	39	26	15	6	3	1		
10	6	16	13	23	29	31	35	39	35	30	40	60	60	68	85	90	75	81	80	58	69		-27	-24	-80	60
N=	74	74	74	75	77	80	80	81	81	82	82	81	76	78	78	76	69	57	45	33	21	13	8	3	1	1
11	11	18	30	38	43	42	51	44	39	47	69	97	181	166	181	179	180	184	122	124	81	11	14	-43	-28	187
N=	57	57	58	58	57	59	59	60	60	60	60	59	59	58	56	51	47	40	33	23	21	13	6	4	2	2
12	-4	-9	1	5	21	43	64	76	75	49	98	107	138	181	181	189	150	120	126	98	88	44	105	-85	40	80
N=	55	55	56	58	58	58	59	59	59	59	58	57	56	55	53	52	46	40	32	22	17	10	1	2	1	1

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR PT.MUGU

PERIOD OF RECORD 1/61 TO 12/71 LATITUDE 34 LONGITUDE 119 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-17	-17	-13	-4	-9	-7	5	18	20	18	27	42	54	75	97	118	117	114	123	116	135	109	149	228	113	
N=	117	118	119	119	122	122	122	121	122	123	123	123	123	120	119	114	109	95	81	60	37	20	12	3	2	
2	-9	-23	-25	-15	-11	-8	-6	6	1	-9	-17	3	29	53	74	78	79	87	94	79	65	92	87	120		
N=	108	108	110	110	110	110	110	110	110	110	110	110	110	108	106	105	97	90	73	46	33	18	4	1		
3	-14	4	8	6	13	7	24	39	29	12	3	11	33	54	70	69	63	75	70	61	40	-19	230	40	-150	-240
N=	119	119	119	119	119	114	119	119	119	119	118	118	117	116	116	112	108	91	69	45	29	11	1	1	1	1
4	14	8	9	11	11	10	15	22	21	3	-16	2	32	44	56	52	41	26	38	42	31	-4	8	-30	-89	-101
N=	148	149	149	150	151	152	151	151	151	151	151	150	149	149	148	144	135	111	89	68	37	12	9	6	6	6
5	12	-1	4	4	7	4	11	15	9	6		-1	18	42	54	60	48	35	40	35	4	22	-4	11	17	80
N=	161	161	162	166	169	170	172	172	172	172	172	172	171	170	167	162	156	136	102	70	29	12	8	5	4	2
6	12	3	5	5	4	3	8	14	5	5	4	6	12	38	49	57	71	64	40	19	10	54	61	173	350	330
N=	165	166	166	166	166	166	165	167	168	169	170	170	169	168	167	165	149	136	117	75	46	27	20	4	1	1
7	20	10	9	5	-1	1	16	13	6	10	7	-2	17	40	58	63	63	63	43	-4	2	32	108	159	210	227
N=	168	169	169	169	170	171	171	172	172	172	172	172	172	170	169	166	159	145	121	85	44	28	13	8	4	4
8	11	-1	-0	1	-1	3	13	17	10	4	2	-5	7	25	44	61	70	60	52	31	-10	-18	60	73	72	76
N=	157	158	160	162	163	164	164	164	164	164	164	163	161	160	159	155	149	135	102	69	43	24	12	8	5	5
9	1	-1	4	2	-0	-1	14	24	8	-0	-2	-0	5	21	35	36	51	55	49	24	31	38	31	11	-20	-18
N=	144	145	146	148	149	149	150	149	149	149	149	148	147	143	142	137	130	110	94	57	30	15	12	8	5	3
10	-1	-6	-6	-1	3	2	20	35	33	16		2	12	34	58	79	79	81	82	67	87	90	106	49	70	-67
N=	158	160	160	164	164	168	170	170	173	173	173	173	172	172	170	167	154	141	121	95	50	27	16	9	3	3
11	-8	-6	-14	-4	-6		8	16	27	24	11	5	11	21	44	66	70	86	77	56		-16	-64	-113	-7	30
N=	100	101	101	102	101	104	106	106	107	107	108	109	109	108	107	104	97	91	73	50	34	16	5	3	3	3
12	-17	-12	-20	-26	-23	-26	-21	-8	9	8	13	17	40	87	118	129	139	126	129	141	88	59	192	147	-17	-163
N=	109	110	110	112	112	112	112	114	114	114	114	113	113	113	113	110	103	95	76	57	30	10	4	3	3	3

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR WSMR

PERIOD OF RECORD 1/61 TO 12/71   LATITUDE 32   LONGITUDE 107   (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	14	1	-8	-1	11	20	32	33	32	30	60	96	118	134	162	173	168	176	176	146	152	87	64	65	-97	-83
N=	118	118	119	119	119	120	120	120	120	118	118	117	114	112	111	106	103	100	95	89	88	71	45	34	26	20
2	-7	-8	-6	4	1	5	9	13	-13	-19	1	21	35	61	76	88	89	81	94	102	82	72	45	-11	-6	-87
N=	124	124	124	124	124	122	122	122	122	120	118	114	113	110	110	110	110	106	102	95	84	69	53	30	15	11
3	14	15	6	10	17	18	29	19	7	-11	-1	22	44	63	66	66	59	64	51	53	62	56	25	-24	-107	-28
N=	129	130	130	130	129	129	129	130	129	128	126	124	122	122	120	116	111	108	100	91	75	56	40	26	16	11
4	17	10	7	9	14	14	13	12	11	-11	-12	27	53	49	60	54	42	33	41	74	89	70	63	34	-6	-37
N=	164	164	164	164	164	164	164	164	164	164	161	161	161	160	154	151	147	145	136	125	110	100	73	36	22	12
5	21	2	6	9	8	6	19	13	7	4	1	11	30	38	46	48	55	50	27	30	39	58	72	36	-4	-40
N=	162	163	163	164	164	163	163	163	161	159	160	159	158	158	157	154	150	149	141	135	125	102	75	43	32	17
6	16	3	6	8	8	13	13	9	12	9	10	5	24	38	51	57	56	52	33	36	32	56	46	66	37	80
N=	158	158	158	158	158	158	158	159	159	158	157	155	155	153	153	152	150	145	142	137	124	97	72	52	32	18
7	-3	11	3	5	5	18	15	11	9	10	-4	13	48	50	48	37	39	55	47	44	40	64	58	40	-11	25
N=	157	158	158	158	157	157	154	154	153	153	152	149	149	145	144	140	136	132	122	112	94	78	59	40	25	17
8	21	4	3	6	6	7	12	16	12	9	5	8	28	47	55	65	62	53	37	30	25	18	19	31	-38	147
N=	174	174	174	174	175	175	174	172	172	171	168	166	163	162	159	155	150	146	138	125	107	78	57	39	16	7
9	12	-1	7	6	-2	5	22	19	-5	-1	8	19	18	24	56	47	56	46	70	61	66	77	70	23	-3	-162
N=	171	171	171	172	172	172	172	172	172	169	167	166	165	164	161	161	154	145	136	129	105	82	59	41	19	7
10	2	3	1	4	8	21	30	26	16	4	3	17	45	66	86	87	83	84	79	66	81	67	71	29	78	-12
N=	158	158	159	159	159	159	159	159	158	156	156	152	149	147	143	140	132	130	122	115	104	84	61	43	21	11
11	-3	3	2	10	14	23	37	41	38	27	19	41	66	91	109	122	135	127	111	119	126	118	110	69	43	104
N=	148	148	148	148	148	148	148	148	148	147	145	145	145	142	139	139	136	132	124	119	95	68	46	30	16	9
12	11	-7	-14	67	-6	11	32	43	51	50	65	73	101	128	132	137	134	141	136	133	125	107	110	147	133	37
N=	127	128	128	129	129	128	128	128	126	126	125	122	122	120	119	118	114	113	105	93	77	59	33	20	13	10

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR KENNEDY

PERIOD OF RECORD 1/61 TO 12/71   LATITUDE 28   LONGITUDE 81   (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	3	-1	9	16	29	39	46	21	18	25	29	40	46	87	106	98	85	88	94	127	127	91	96	54	37	49
N=	146	146	149	154	166	157	160	162	161	161	160	158	156	155	151	145	137	123	103	72	41	19	12	8	8	8
2	16	3	3	24	26	34	41	10	-2	-4	1	30	44	71	78	68	69	70	86	89	125	102	116	-93	36	67
N=	126	128	130	137	139	138	148	143	146	147	147	150	148	145	142	136	129	116	97	71	46	16	6	3	5	5
3		-6	-1	11	99	24	17	10	1	-8	-7	6	11	48	63	70	61	68	59	61	163	151	80	-84	-64	-44
N=	108	108	109	110	120	122	123	124	123	126	126	120	124	122	122	120	113	99	76	56	31	15	9	6	4	4
4	-17	-9		14	16	17	9	-1	-8	-9	2	8	24	48	33	31	34	38	46	38	69	114	49	26	5	-103
N=	110	110	111	119	122	125	127	127	128	131	135	135	134	133	130	127	124	110	93	71	43	14	8	5	4	4
5	-8	3	4	3	6	10	11	5	-3	1	-0	9	18	30	29	45	47	51	45	31	5	-26	-20	33	42	-145
N=	99	98	99	109	115	115	118	118	118	117	119	119	115	110	108	104	98	90	76	57	30	14	6	5	6	6
6	4	10	-4	1	9	15	20	14	10	13	2		25	46	65	77	71	50	31	19	5	-5	-37	-77	79	192
N=	96	98	97	110	114	115	115	116	116	116	116	115	115	113	111	108	98	95	88	75	48	20	8	6	6	5
7	1	10	2	-12	-12	1	9	8	6	3	3	-10	-2	33	50	67	68	63	71	43	37	-27	42	149	70	-10
N=	131	131	132	138	143	146	146	150	149	150	150	149	148	147	145	141	137	127	117	94	57	25	10	8	9	9
8	2	14	1	-10	-9	-1	16	10	4	13		-13	3	28	52	55	67	61	38	47	76	59	41	-16	-14	49
N=	123	124	124	131	133	133	134	134	135	135	134	133	132	131	128	124	120	114	99	73	39	27	14	12	8	6
9	2	4	2	-2	-3	-0	14	17	10	3	4	-2	10	30	35	46	55	72	64	60	36	-3	37	-28	-98	-83
N=	107	108	108	120	124	125	125	125	125	123	123	121	120	117	110	107	99	91	78	63	39	18	9	7	7	6
10	3	5	4	10	13	11	17	10	-10	-3	7	20	35	47	60	60	65	57	40	22	24	28	5	102	-57	-418
N=	117	117	118	123	126	129	134	136	136	136	139	140	139	137	131	127	120	108	90	69	46	21	11	3	3	3
11	5	6	2	22	35	42	47	51	37	19	45	65	116	143	164	157	146	149	129	134	135	104	17	200	97	63
N=	114	115	116	118	118	119	120	120	117	120	119	120	119	116	115	115	109	98	79	68	43	30	14	10	11	9
12	-7	-7	2	14	31	49	67	79	57	51	57	59	70	76	94	93	98	77	80	69	43	60	19	85	40	-19
N=	124	125	126	129	132	133	133	134	134	134	134	134	136	135	130	125	114	110	92	68	37	14	7	7	8	8

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR HAWAII

PERIOD OF RECORD 4/62 TO 12/71 LATITUDE 22. LONGITUDE 160 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-10		7	16	21	-2	1	-1	-7	-5	5	35	32	39	69	53	23	27	70	147	58	16	-123	-108	-154	
N=	71	72	73	74	74	74	74	74	74	74	74	74	74	73	72	71	69	62	54	36	15	10	4	3	1	
2	-10	-4	5	13	17	10	2	3	7	18	16	33	41	54	58	54	46	35	67	102	86	33	120			
N=	65	65	65	65	65	65	65	65	65	65	65	65	64	63	63	62	59	55	48	35	16	8	4			
3	-5	-2	6	19	23	15	7	29	38	34	30	49	64	66	61	48	29	49	82	119	93	-42	-133			
N=	68	68	69	69	69	69	69	69	69	69	69	68	68	68	67	65	63	59	54	36	12	6	3			
4	3	-2	6	13	12	12	6	-5	5	9	3	14	31	48	53	48	42	47	77	81	33	5	-29	-111	-276	-291
N=	111	111	111	111	111	112	112	112	112	112	113	113	113	112	109	107	104	99	86	65	27	14	7	4	3	3
5	3	3	9	7	5	9	7	1	4	4	-4		38	60	62	62	58	48	62	64	94	75	5	50	-93	-380
N=	108	114	117	119	120	120	120	121	121	121	121	120	118	117	116	111	103	96	76	47	23	15	6	4	3	3
6	6	8	7	9	9	5	6	12	9	7	4	9	26	45	45	47	56	70	76	68	31	39	20	-5	6	-77
N=	92	96	98	102	102	102	104	109	114	116	118	116	117	114	111	109	103	93	75	54	23	12	7	6	5	4
7	10	5	6	6	5	1	23	17	1	4	4	9	27	44	44	45	67	71	70	94	113	74	-15	-86	-70	-87
N=	89	90	91	93	94	96	101	103	105	106	110	111	110	110	108	103	87	76	66	44	24	12	11	5	3	3
8	12	2	4	6	4	8	13	18	10	-0		3	30	48	49	53	78	90	87	77	53	39	42	10	-43	-225
N=	102	104	106	109	110	110	113	114	116	118	118	119	119	119	119	117	107	101	80	61	39	22	17	9	5	4
9	-4	4	10	6	9	5	16	15	5	2	6	6	19	39	43	44	49	54	63	55	57	8	-24	110	184	222
N=	117	119	121	121	121	121	121	121	121	121	120	120	120	120	119	116	111	102	89	72	50	25	12	1	1	1
10	-5	1	3	9	8	-6	1	15	7	8	5	14	33	45	42	42	49	52	56	79	74	25	51	69	55	81
N=	129	130	130	131	132	132	132	132	132	132	131	132	132	132	132	131	121	109	97	65	34	16	10	6	4	4
11	-2	-8		12	16	12	5	1	-2	-9	-25	-2	29	35	46	51	45	40	38	51	104	76	-17	65	2	-115
N=	78	80	81	84	84	84	86	87	87	89	89	91	91	88	87	85	83	76	71	50	29	11	5	3	3	3
12	-16	-7	-0	12	22	6	-2	4	18	13	32	52	77	96	115	132	127	120	134	126	162	291	165	32	-35	-20
N=	83	83	83	84	84	84	84	84	84	85	87	87	87	87	86	85	83	79	63	46	21	7	4	3	2	2

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR GR.TURK

PERIOD OF RECORD 9/63 TO 12/66 LATITUDE 21 LONGITUDE 71 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-20	-43	-36	25	10	-17	1	7	-17	9	13	59	90	97	62	4	28	69	32	89						
N=	11	11	11	20	21	21	21	21	21	21	20	20	20	19	19	17	13	6	3	1						
2	-7	-31	-29	23	-1	-20	11	2	-16	2	80	69	68	44	35	30	44	120	161	40						
N=	8	8	8	13	13	13	13	13	13	13	13	13	11	10	9	6	7	6	4	2						
3	-27	-41	-16	19	12	-6	-4	9	16	31	5	19	43	54	64	46	70	56	29	112	402					
N=	18	18	18	20	20	20	20	20	20	20	20	19	19	19	19	17	15	11	8	5	2					
4	-8	-50	-37	11	12	-7	-24	-20	-13	-22	-23	28	36	56	54	40	52	110	103	95						
N=	16	16	16	18	18	18	18	18	17	17	17	15	15	15	15	14	11	6	4	2						
5	-13	33	38		18	31	8	23	2	-4	3	33	43	24	62	92	76	69	81	140						
N=	8	8	8	8	8	6	8	8	8	8	8	8	8	8	8	6	5	4	3	1						
6	-5	9	7	-3	-9	4	23	8	-4	5		-13	42	54	55	62	54	69	87	90	-80					
N=	15	15	15	15	15	15	15	15	15	15	15	14	14	12	10	9	8	7	5	4	1					
7	2	35	28	-9	-11	-11	19	10	-3	2	-5	-10	17	56	69	7	7	82	93	81						
N=	18	18	18	18	19	19	19	19	19	19	19	19	19	18	17	15	13	10	7	4						
8	-4	-22	-15	-16	-10	-1	16	-1	-9	3	-35	-21	18	35	-3	6	22	30	184	290						
N=	14	14	14	14	14	14	14	14	14	14	14	14	13	13	11	10	9	5	2	1						
9	-15	7	23	-2	-0	3	-1	13	9	4	-1	-6	8	28	39	68	83	46	64	173	258					
N=	22	22	22	26	26	26	26	26	25	25	25	25	24	24	24	22	19	13	10	5	2					
10	-5	-33	-24	22	3	19	-2	1	2	7	6	27	18	28	46	38	16	10	10	48	141	173	419			
N=	27	27	27	31	32	32	32	32	32	32	32	32	31	30	29	28	25	24	19	10	3	1	1			
11	6	-35	-37	36	8	4	-11	15	22	17	-20	-17	-3	26	88	126	142	65	32	79	230	428				
N=	13	13	13	13	13	13	13	13	13	13	13	13	13	13	12	13	11	10	10	8	4	2				
12	1	-13	-20	16	16	23	57	75	46	55	56	59	141	112	84	137	49	-13	-36	51	218					
N=	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	7	7	4	1					

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR ANTIGUA

PERIOD OF RECORD 5/61 TO 12/71 LATITUDE 17 LONGITUDE 62 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-3	-12	1	8	6	-7	-12	-21	-36	-19	4	42	63	36	67	63	76	61	85	186	120					
N=	39	39	39	46	46	46	46	46	47	47	47	46	46	45	41	40	33	27	18	7	2					
2	-12	-27	-16	9	13	6	12	-12	-15	-2	-5	17	29	41	48	40	68	79	109	102	53	140				
N=	46	46	47	48	48	48	48	47	47	47	50	50	50	51	47	46	40	28	21	13	7	3				
3	-19	-32	-1	17	19	5	3	4	-18	-17	-10	8	16	26	24	36	62	58	65	32	48	41	-170	-186		
N=	44	44	44	46	46	46	46	46	45	46	46	46	46	43	40	38	34	28	21	13	8	2	1	1		
4	-20	-39	-20	9	1	-3	-1	-5	-6	-6	-10	14	29	33	37	38	45	70	104	118	120	95	24	-23	-96	-132
N=	46	46	46	47	47	47	47	47	47	47	47	47	47	49	46	42	37	25	14	9	6	4	3	2	1	1
5	-2	4	7	1		13	17	8	6	1	-6	-11	9	27	34	58	66	59	49	73	133		-10			
N=	31	31	31	31	31	31	31	31	31	31	31	37	32	30	30	29	26	24	20	15	5	2	1			
6	4	14	12	1	1	-3	-4	-6	3	-1	-8	-7	2	27	54	87	98	47	-1	34	127	-28				
N=	29	30	30	30	30	30	30	29	29	29	29	28	27	26	26	24	18	12	7	4	3	1				
7	3	-2	1	-0	-1	2	11		-11	9	7	-5	-6	-8	38	89	78	66	88	94	114	110				
N=	34	34	34	34	34	34	34	34	34	34	34	33	33	29	27	22	19	15	8	6	2	2				
8	3	9	12	6	1	7	8	-7	5	3	-18	15	20	22	40	85	84	49	34	72	45	190				
N=	36	36	36	36	36	36	36	36	36	36	36	35	33	31	29	23	20	17	14	5	2	1				
9	-7	-1	6	7	-2	6	7	-7	1	-13	-1	9	15	44	54	68	76	57	30	60	43	66				
N=	38	38	39	42	42	42	42	42	42	43	43	41	40	39	37	36	34	30	19	13	3	1				
10	-9	-4	10	9	5	1	-7	-8	7	15	-3	-11	-1	12	-1	29	12	21	21	46	-9	10				
N=	61	61	62	65	65	65	66	67	67	68	69	69	68	66	62	58	53	46	33	21	9	1				
11	-127	-205	-215	-137	-33	9	-2	12	10	29	29	25	53	70	73	89	86	70	66	111	13					
N=	30	30	30	31	33	33	33	33	33	33	32	32	32	31	30	28	27	21	17	7	2					
12	-7	-11	-12	18	13	9	-2	12	4	12	17	26	36	43	33	50	73	105	90	149	75	100				
N=	44	45	45	45	45	46	45	43	43	42	42	41	39	38	35	31	27	20	15	8	2	1				

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR SHERMAN

PERIOD OF RECORD 3/66 TO 12/71 LATITUDE 9 LONGITUDE 80 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	2	11	21	12	-5	-16	-12	-16	-5	17	14	16	21	23	41	69	26	-13	7	-51	-20	-19	21	390		
N=	52	52	51	51	51	51	51	51	41	51	51	51	50	49	48	43	39	17	29	21	18	12	7	1		
2	15	10	-7	-8	-37	-41	-47	-42	-9	-15	-13	12	-3	10	47	48	95	80	48	44	-8	-28	-87			
N=	23	24	24	24	24	24	24	24	24	24	24	24	24	23	22	19	19	19	17	13	10	5	3			
3	-8	-5	-16	-3	-39	-41	-53	-21	-14	-11	-32	-3	-16	8	35	58	71	69	80	93	43	-7	-2	70		
N=	33	33	33	34	34	34	34	34	34	34	34	34	35	35	34	32	30	27	25	22	17	11	4	2		
4	5	8	6	9	13	-3	-9	-20	-4	12	30	12	33	25	20	35	38	78	82	57	38	72	203			
N=	51	51	51	51	51	51	51	51	51	54	56	56	57	57	56	55	52	47	43	33	25	13	3			
5	4	-33	11	-3	-1	-6	-14	-14	2	9	35	24	35	27	27	44	41	45	53	37	-3	72	109	149		
N=	59	60	60	60	60	60	60	60	60	62	61	60	60	59	58	55	52	51	45	31	22	12	5	1		
6	8	21	14	-1	-0	-6	-15	-13	-52	4	23	39	44	18	48	75	54	112	108	46	35	108	33	83	-110	
N=	61	61	61	61	61	61	61	61	61	60	60	60	60	60	60	58	57	55	48	40	30	17	8	4	1	
7	3	-5	6	4	7	14	-20	-7	-10	-4	-2	3	13	28	50	58	46	102	109	77	54	10	215	190		
N=	55	55	56	59	59	59	59	59	59	59	59	59	59	59	59	59	58	53	49	38	33	24	12	2		
8	-6	22	24	8	-0	-6	-18	-17	-13	9	12	6	24	36	58	51	73	58	60	68	48	21	43	-120		
N=	45	47	54	60	60	60	60	60	60	60	60	60	60	59	59	59	59	58	49	39	30	17	9	1		
9	-5	-15	1	-4	-10	-33	-26	-17	-8	-26	8	-12	4	21	19	40	35	-0	19	28	80	8	-27			
N=	34	35	35	35	35	35	35	35	35	35	34	34	33	32	31	29	27	24	19	18	14	7	3			
10	1	5	10	10	5	-6	-22	-23	1	-4	2	13	7	16	12	45	60	52	81	117	57	162	113	105	280	
N=	46	46	46	46	49	51	53	53	53	53	51	53	53	53	52	52	47	45	36	30	25	13	9	2	1	
11	4	8	18	17	8	-1	-4	10	12	25	18	28	37	41	21	27	16	18	48	80	27	22	116	10	200	
N=	49	48	46	50	54	51	51	51	51	51	51	51	53	51	50	49	47	45	41	34	29	19	10	1	1	
12	-28	-5	1	16	13	-12	-20		25	10	17	11	22	11	51	40	26	26	29	47	59	26	120			
N=	51	51	51	57	53	51	53	53	51	51	51	50	49	48	47	46	45	41	41	32	25	17	4			

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR KWAJALEIN

PERIOD OF RECORD 3/61 TO 10/71 LATITUDE 9 LONGITUDE 167 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	3	-6	16	2	4	5	18	-5	-1	-3	-5		12	72	62	14	35	39	-9	-80	-85	-98	-102			
N=	27	27	27	28	28	29	29	29	29	28	28	28	27	27	26	26	25	24	24	20	15	9	5			
2	-9	-10	-5	1	17	11	1	-16	-14	2	9	-1	19	58	27	62	73	13	-29	-47	-101	-174	-215			
N=	21	21	21	22	22	22	22	22	24	24	24	24	24	23	21	21	21	21	19	15	10	7	2			
3	-4	18	-3	6	26	-3	-3	-2	-6	30	35	25		3	24	57	73	33	37	21	22	-8	-150			
N=	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	27	28	28	25	19	14	8	3			
4	101	147	39	5	8	8	3	-8	6	21	24	41	46	54	50	89	51	-6	-33	-57	-56	-80				
N=	20	21	21	21	21	21	22	22	22	20	20	20	20	20	20	19	17	14	12	8	5	3				
5	5	-10	2		1	5	2	-7	4	12	19	20	26	39	56	43	42	29	14	-32	-42	-50	100			
N=	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	18	17	12	6	3	1			
6	3	4	-1	9	-3	4	18	-11	3	21	15	16	22	31	42	49	49	12	-20	-40	-54	-14	8			
N=	24	24	24	24	24	24	25	25	25	25	25	25	25	24	24	24	23	23	22	19	11	4	3			
7	-3	16	6	2	14	4	8	7	7	11	-2	9	22	28	32	49	40	64	35	-28	-27	-190				
N=	21	21	21	21	21	21	22	23	23	23	21	23	23	23	23	22	22	20	18	11	7	1				
8	-1	6	2	18	-5	-4	-7	-13	-17	3	12	28	22	46	43	51	66	39	17	-37	-78					
N=	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	31	31	28	25	21	13					
9	-0	-12	8	8	9	-2	-13	-6	6	12	5	17	33	14	16	22	56	61	23	-32	-105	-30				
N=	33	33	33	33	33	31	33	33	33	33	33	33	33	32	32	32	32	31	30	22	12	1				
10	2	13	-0	-1	2	-1	-2	-5	4	11	-6	-15	19	38	62	64	40	9	-6	12	-53	-52	-30	-70		
N=	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	22	17	9	3	1		
11	6	-8	-4	-15	-2	3	-10	-17	-1	-18	1	22	52	21	33	18	32	40	42	25	8	1	-160			
N=	13	13	13	13	13	13	13	13	13	14	14	14	14	14	14	14	14	13	13	11	11	6	3			
12	18	4	-7	8	13	5	11	7	6	5	-12	27	35	27	27	42	9	32	69	50	-22	-127	20			
N=	23	23	23	23	23	23	23	23	23	23	22	22	22	22	21	20	20	18	18	18	12	4	3			

VERTICAL PROFILES OF MONTHLY MEAN MERIDIONAL WIND AND NUMBER OF OBSERVATIONS, 20 TO 70 KM, FOR ASCENSION

PERIOD OF RECORD 10/62 TO 12/71 LATITUDE -8 LONGITUDE 15 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-0	26	5	-30	-9	-2	3	12	10	9	-5	-18	-33	-60	-78	-93	-72	-51	-11	-13	-30	-11	18	83	235	195
N=	61	61	61	66	66	66	66	66	66	66	66	65	65	65	64	62	62	58	56	47	23	11	4	3	2	2
2	2	28	10	-20	-14	-8	-3	6	4	9	8	3	-11	-31	-48	-66	-64	-41	-28	-33	-61	-97	-71	26	58	140
N=	83	83	85	85	85	85	85	85	85	85	85	87	88	88	87	89	89	84	82	62	34	14	8	5	4	4
3	9	49	32	-30	-23	-10	10	15	8	-4	6	11	17	-6	-41	-54	-51	-42	-23	-37	-51	-70	-24	-249	39	105
N=	62	62	62	65	67	67	67	67	67	69	75	80	79	75	74	73	72	68	61	50	25	14	8	5	4	2
4	5	13	13	-6	-4	-9	-1	22	8	14	26	28	20	5	-16	-24	-22	1	20	15	-38	-104	-86	15	-111	-237
N=	63	63	63	69	70	70	70	70	77	81	85	84	83	82	81	80	78	75	63	50	28	17	12	5	4	4
5	10	13	5	7	-8	1	15	13	17	27	34	38	36	30	19	-1	-12	14	29	7	-16	-89	-179	-78	29	9
N=	61	61	61	65	65	65	65	70	72	73	73	73	73	73	73	73	72	69	66	57	35	17	9	6	6	5
6	-5	-42	-47	-32	-12	8	-2	-5	14	8	17	19	20	22	3	-19	-11	-13	-15	-30	-92	-129	-177	-90	-170	-100
N=	68	68	68	70	71	71	71	73	73	73	73	72	71	69	68	66	65	62	59	51	29	10	3	1	1	1
7	4	-9	6	2		4	11	4	9	15	23	28	26	26	7	-24	-36	-20	-1	-9	-28	36	92	167	188	70
N=	94	94	94	95	96	98	100	100	100	99	99	99	98	95	94	91	90	84	77	67	35	15	6	4	4	4
8	9	12	7	-9	-6	4	-0	4	1	13	21	25	34	18	-4	-29	-46	-31	-3	-4	-26	7	29	244	95	-220
N=	93	93	93	93	95	97	100	98	95	95	94	94	93	92	92	90	88	87	84	68	41	22	13	5	2	2
9	-0	7	-4	-10	-9	-4	-3	9	1	3	4	9	15	8	-17	-45	-45	-34	-17	-1	8	5	-16	3	-27	57
N=	83	83	83	86	87	87	87	87	87	87	87	87	87	86	85	85	83	80	74	57	35	13	7	4	3	3
10	3	1	6	-8	-16	-15	-2	-1	8	14	9	11	-12	-30	-40	-39	-35	-37	-32	-42	-47	-31	-36	28	55	60
N=	106	106	106	110	110	111	112	111	111	113	113	113	112	112	110	110	107	102	89	68	34	15	5	4	4	4
11	-9	-6	-9	-1	-14	-6	10	14	18	15	27	27	25	2	-26	-32	-33	-37	-39	-59	-20	-47	-34	29	-16	67
N=	90	90	90	93	94	95	95	96	97	96	94	92	92	92	92	92	91	87	80	64	32	15	7	7	5	4
12	-10	-8	-8	-20	-4	-4	-3	5	8	-1	-2	7	2	-24	-38	-50	-65	-66	-69	-83	-113	-135	-78	-5	97	107
N=	63	63	63	66	67	69	66	66	65	65	65	65	64	64	64	64	62	61	55	51	35	16	6	4	3	3

APPENDIX B: MONTHLY MEAN MERIDIONAL WINDS NEAREST 90°W AT 5° LATITUDE AND 10 KM INTERVALS

20 KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-7	-12	-4	-3	0	0	0	-1	1	0	-7	-7
75	-8	-10	-4	-3	1	1	1	-1	1	0	-5	-5
70	-8	-9	-5	-3	1	1	1	-1	1	-1	-4	-5
65	-8	-8	-4	-2	1	0	0	-1	1	-1	-3	-5
60	-8	-6	-4	-2	-1	-2	-1	-2	-1	-2	-2	-5
55	-6	-4	-2	-2	-1	-3	-1	-1	0	-1	-1	-4
50	-4	-3	-1	-1	-1	-1	0	-1	0	0	-1	-3
45	-2	-1	0	-1	0	-1	0	0	0	0	-1	-3
40	1	1	1	-1	0	-1	0	0	0	1	1	-1
35	2	0	1	0	1	1	1	1	1	1	1	-1
30	2	1	1	1	0	1	1	1	1	0	1	0
25	0	0	-1	-1	-1	0	0	0	0	0	1	-1
20	-1	-1	-2	-1	-1	0	1	0	-1	0	0	-1
15	-1	-1	-2	-1	0	0	0	0	-1	-1	-2	-1
10	0	-1	-1	0	0	1	0	-1	-1	0	0	-2

30 KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-18	-25	-14	-6	0	0	0	1	1	-16	-24	-8
75	-18	-23	-15	-6	0	1	0	1	1	-10	-21	-8
70	-18	-19	-12	-4	1	1	1	1	1	-5	-15	-9
65	-17	-14	-8	-2	1	2	1	1	1	-3	-12	-12
60	-16	-12	-5	0	1	1	1	1	1	-3	-9	-16
55	-8	-7	-4	1	0	1	1	2	1	-3	-8	-14
50	-4	-4	-3	1	-1	0	1	1	1	-1	-6	-7
45	-2	-2	-1	1	0	0	1	1	1	1	-3	-2
40	3	1	-1	1	1	1	1	1	0	3	1	3
35	4	1	1	1	1	1	1	1	0	2	1	4
30	3	2	2	1	1	1	1	1	1	2	2	4
25	2	2	2	1	1	1	0	1	1	1	3	3
20	1	2	1	0	1	0	0	1	1	0	1	2
15	0	1	1	0	0	-1	1	1	0	0	-1	1
10	-1	-1	0	0	-1	-1	0	0	-2	-1	0	0

APPENDIX B: (CONT'D)

40 KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-27	-35	-	-	-	-	-	2	-	-28	-	-15
75	-26	-30	-21	-3	4	1	2	3	2	-25	-28	-14
70	-24	-25	-13	-3	3	1	2	2	2	-17	-24	-16
65	-20	-19	-8	-2	2	2	2	1	2	-8	-17	-22
60	-16	-12	-7	1	1	2	1	1	3	-3	-13	-19
55	-8	-4	-6	3	1	3	1	2	4	-1	-11	-18
50	-4	-2	-4	4	1	3	1	2	4	2	-5	-8
45	0	-1	-2	4	1	2	2	1	3	5	1	2
40	10	1	1	3	1	1	2	1	1	5	5	8
35	9	2	1	1	0	1	1	1	1	3	5	9
30	5	2	0	1	0	1	-1	1	1	2	3	8
25	4	2	0	0	0	0	0	0	1	1	2	6
20	3	1	1	-1	0	0	-1	-2	0	1	-1	4
15	3	-1	-1	-1	1	1	-1	-2	0	-1	3	2
10	2	-1	-2	2	2	1	0	0	1	0	2	3

50 KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-34	-28	-	-	-	-	-	5	-	-18	-	-12
75	-28	-26	-17	5	2	3	5	5	5	-14	-27	-13
70	-23	-22	-10	5	2	3	5	5	5	-10	-23	-16
65	-18	-17	-7	3	3	4	5	4	6	-7	-18	-18
60	-10	-8	-3	3	3	5	4	3	6	-2	-11	-18
55	-6	-2	3	7	3	6	5	3	6	3	-3	-16
50	0	2	5	8	3	7	5	2	6	6	5	-6
45	9	10	7	7	4	6	5	2	6	6	10	7
40	18	13	7	6	4	5	5	4	6	7	16	15
35	18	10	7	4	5	6	6	6	5	8	15	15
30	15	8	6	4	5	6	6	6	5	8	13	11
25	9	7	6	4	5	7	6	6	5	5	11	8
20	8	6	6	5	6	6	6	5	5	4	5	7
15	7	6	6	5	5	6	5	5	6	2	7	5
10	5	5	5	3	4	5	5	6	4	2	2	3

APPENDIX B: (CONT'D)

60 KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-22	-19	-	-	-	-	-	8	-	-4	-	-
75	-20	-18	-15	11	2	5	2	8	3	-4	-15	-
70	-14	-18	-8	11	6	7	5	8	5	-2	-14	-
65	-12	-16	-3	12	7	9	8	7	6	0	-12	-14
60	-7	-5	-1	11	7	6	5	4	6	3	-10	-16
55	2	7	6	12	7	10	4	5	8	8	5	-13
50	11	14	6	12	5	5	4	3	7	8	6	-4
45	19	15	7	10	3	4	3	3	6	7	6	7
40	23	9	8	8	1	4	2	1	5	7	8	11
35	20	7	8	7	1	3	1	1	5	8	10	12
30	13	7	6	7	2	3	3	4	4	8	12	10
25	8	8	7	5	5	3	5	6	5	3	12	8
20	8	8	6	6	8	2	6	5	6	4	10	9
15	6	5	5	6	9	2	7	5	6	5	8	8
10	3	3	4	5	5	4	5	5	7	6	5	6

APPENDIX C: THREE YEAR (1969-1971) MONTHLY MEANS AND STANDARD DEVIATIONS, MERIDIONAL WINDS, 20-80 KM, AT 2 KM INTERVALS.

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR HEISS

PERIOD OF RECORD 1/62 TO 12/70 LATITUDE 80 LONGITUDE -58 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-45	-53	-29	10	26	49	62	69	86	70	39	-9	61	323	316	309	305	47	-64	-201	-336					
N=	21	21	22	22	22	22	22	22	22	22	22	17	12	7	4	4	3	2	2	2	2					
	86	148	129	150	189	186	250	214	277	273	323	409	446	314	327	328	372	222	125	22	42					
2	120	180	255	265	322	428	423	512	507	545	582	531	534	537	380	283										
N=	13	13	13	13	13	13	13	13	13	13	12	11	11	8	8	3										
	125	146	188	234	392	327	415	407	435	545	560	556	507	380	318	441										
3	97	39	72	104	41	116	96	131	137	170	157	245	225	252	47	60										
N=	6	6	6	7	7	7	7	7	7	6	6	6	6	4	3	2										
	118	125	121	159	148	170	153	165	194	193	244	177	227	213	250	330										
4	-25	-8	-29	-29	-45	-21	-6	-4	-46	6	10	-45	-158	-98	107	66	150	45	-24	180	190					
N=	17	17	19	18	18	17	17	17	17	17	15	11	9	8	6	5	2	2	2	1	1					
	123	111	116	166	120	135	193	198	173	183	199	153	193	286	225	225	120	165	205							
5	-68	-63	-44	-84	-43	-17	-15	-7	-30	19	22	109	25	-48	-111	12	50	15	15	10	15					
N=	18	18	18	19	19	19	19	19	19	18	18	9	8	7	6	4	2	2	2	2	2					
	122	108	96	100	95	68	55	48	100	80	138	207	222	247	278	105	60	95	65		85					
6	7	-5	4	29	14	-4	18	5	12	12	4	97	116	24	-5		45	17	10		10					
N=	17	17	17	17	17	17	17	17	17	17	17	9	9	7	7	6	6	3	3	3	3					
	33	41	49	54	51	76	69	60	78	53	56	66	112	136	134	115	171	105	71	57	83					
7	20	18	-1	42	21	-56	-20	38	4	4	27	64	28	36	-1	-31	-49		113	153	183					
N=	18	18	18	18	19	19	19	19	19	19	19	19	18	14	13	11	6	4	3	3	3					
	50	41	101	45	49	336	256	126	95	91	78	85	118	174	165	170	127	109	62	122	198					
8	-4	4	1	-23	5	-59	5	12	24	25	4	-41	-2	393	503	320										
N=	10	10	10	11	11	11	11	11	11	11	11	8	7	3	3	3										
	42	38	46	68	67	42	52	51	87	45	87	100	153	190	114	92										
9	25	42	20	35		25	33	56	14	9	92	73	47	89	120	120	67	23	-19	-89	130					
N=	12	12	12	12	12	12	12	12	12	11	11	9	7	7	5	4	4	3	3	3	2					
	35	54	66	32	89	105	92	83	120	124	124	102	127	95	86	125	102	85	136	262	30					
10	-63	-55	-48	-39	-25	8	-2	24	87	140	92	70	192	274	354	404	580	630	640	630	570					
N=	8	8	9	9	9	9	9	9	9	9	9	8	6	5	5	5	1	1	1	1	1					
	34	34	38	77	74	92	75	68	139	192	88	97	266	314	305	267										
11	-13	-29	39	31	88	46	88	160	136	118	321	350	361	370	392	406	430	505	610	520	350					
N=	8	8	9	9	9	9	9	9	8	8	7	7	7	6	6	5	3	2	1	1	1					
	67	95	130	112	126	100	131	148	256	331	163	180	284	332	317	315	248	35								
12	-107	-99	-63	-13	-36	-0	3	7	160	141	134	288	506	620	682	748	633	553	470	500	-439					
N=	8	8	8	8	7	7	7	7	7	7	7	6	5	5	5	4	3	3	3	2	1					
	128	114	169	194	166	194	188	239	278	223	326	342	332	312	330	387	466	514	579	730						

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR THULE

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 77 LONGITUDE 69 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-69	-105	-106	-144	-186	-214	-227	-281	-270	-289	-279	-274	-279	-260	-301	-300	-282	-350	-243	-235	-324	-329	-299	-259		
N=	20	20	20	20	20	20	20	19	19	18	18	18	18	16	13	12	12	9	8	7	4	1	1	1		
	159	182	179	181	204	225	267	312	323	362	410	455	463	508	579	580	560	585	561	421	293					
2	-126	-141	-207	-261	-309	-327	-345	-368	-390	-377	-460	-375	-378	-378	-418	-369	-321	-227	-144	50	25	40	10			
N=	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7	5	5	4	3	2	2	1			
	142	100	111	110	101	109	115	186	234	300	329	352	405	407	361	357	338	298	263	57	5	20				
3	-19	-53	-64	-109	-144	-157	-212	-214	-232	-250	-278	-275	-272	-247	-242	-217	-204	-239	-183	-106	-154	-119	-39			
N=	16	16	16	16	16	16	16	16	16	16	16	16	16	16	15	15	15	13	13	7	4	3	1			
	198	216	255	248	251	241	233	241	254	257	265	279	270	268	248	234	236	185	157	157	67	65				
4	-48	-61	-40	-19	-21	-7	-6	-17	-6	20	28	21	74	66	61	55	88	68	92	104	110	135	240			
N=	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	9	6	5	5	5	2	1			
	57	56	55	34	47	46	67	40	53	53	82	59	52	62	68	56	57	43	34	33	40	45				
5	3	-12	-5	19	7	-15	-28	-10	7	18	22	12	10	-12	-16	-35	-3	-17	-42	67	30	-14	-39	90		
N=	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	5	5	5	4	3	2	2	2	1		
	10	14	10	49	27	26	39	34	66	85	62	66	66	99	205	151	131	132	111	91	100	85	100			
6	-0	5	11	4	7	8	6	8	14	-0	10	20	11	15	15	16	18	17	11	16	20	39	-46			
N=	25	25	25	25	25	25	25	25	25	25	24	24	24	24	22	19	19	19	15	14	11	7	3			
	18	52	42	20	23	22	36	27	26	32	41	34	36	57	68	58	49	69	79	100	89	135	127			
7	-6	2	-1	3	-1	10	5	4	4	12	7	30	3	35	60	62	43	32	27	70	64	150				
N=	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	10	10	9	7	5	2				
	13	47	39	20	21	28	26	24	36	38	31	74	22	31	32	33	32	45	42	48	46	60				
8	-10	8	-1		8	9	16	14	15	15	21	15	35	45	34	30	36	59	61	74	65	33	43	55	100	
N=	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	3	3	2	1	
	24	44	24	28	15	27	20	36	24	17	23	27	43	45	41	48	55	64	75	72	46	26	34	45		
9	2	-102	-1	12	5	24	18	20	26	12	24	57	20	36	30	15	2	12	18	-0	-19	-24	-67	-254	-394	
N=	12	12	12	12	12	12	12	12	11	11	11	11	11	10	10	10	10	10	10	9	7	4	4	2	2	
	18	333	57	47	49	60	57	77	57	73	95	68	73	71	86	94	97	78	48	51	61	105	175	215	225	
10	23	29	50	35	28	35	13	27	27	34	33	38	85	131	136	167	192	174	267	306	302	250	135			
N=	11	11	12	12	12	12	12	12	12	12	12	12	11	10	10	9	9	7	6	5	4	4	2			
	69	87	90	111	134	122	116	154	151	140	140	183	125	121	136	158	157	160	172	184	217	216	245			
11	-88	-71	-95	-123	-148	-148	-148	-156	-198	-149	-149	-135	-170	-164	-162	-158	-170	-176	-136	-149	-157	-92	-62	-84		
N=	17	17	17	17	17	17	17	17	17	17	17	17	17	17	16	16	14	11	11	10	9	7	3	2		
	128	249	139	139	156	140	122	123	145	117	118	96	142	137	150	160	218	209	156	135	149	132	69	85		
12	-10	-19	-55	-55	-71	-86	-122	-133	-142	-190	-195	-158	-109	-79	-48	-55	-66		93	100	-109	-139	-209	-269		
N=	10	10	10	10	10	10	10	10	10	10	10	10	9	8	8	8	4	4	3	2	1	1	1	1		
	127	135	146	167	136	174	163	165	180	176	185	193	105	99	95	79	28	57	102	180						

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR GREELY

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 64 LONGITUDE 146 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1		11	7	-9	-11	-19	-20	-25	-47	-64	-67	-104	-134	-154	-162	-118	-74	-101	-234	-167	-284	-249				
N=	30	30	30	30	29	29	29	29	29	29	29	28	26	24	23	23	21	18	15	10	6	1				
	43	50	56	69	93	115	146	182	231	274	343	396	464	536	574	572	580	609	396	529	553					
2	-12	-16	-24	-32	-35	-52	-79	-90	-99	-141	-167	-187	-206	-206	-209	-217	-252	-211	-260	-276	-413	-382				
N=	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	22	20	15	10	5	3				
	75	76	75	79	79	80	87	109	116	120	128	150	162	188	209	251	277	300	322	298	201	162				
3	-1	-14	-33	-52	-71	-104	-128	-136	-149	-164	-161	-188	-164	-150	-152	-140	-138	-147	-103	-64	13					
N=	22	22	22	22	22	22	22	22	22	22	22	22	22	19	18	18	17	16	14	8	3					
	39	46	56	66	73	88	107	105	117	126	164	182	193	159	152	182	157	148	108	80	53					
4	32	21	15	13	7	-2	-4	-11	-16	-27	-35	-23	-32	-8	5	10	53	43	156	39	128	210	160			
N=	35	35	35	35	35	35	35	35	35	35	36	36	35	34	33	31	29	27	21	14	6	1	1			
	44	36	36	36	43	51	58	68	86	104	119	146	125	136	150	167	134	167	208	84	30					
5	27	21	20	17	15	13	21	13	22	13	28	39	14	19	18	31	67	53	81	105	70	408	-9			
N=	28	28	28	28	28	28	28	28	28	28	28	28	28	26	26	26	26	23	21	16	6	5	1			
	42	16	19	18	27	27	31	29	34	39	42	41	50	50	77	73	86	87	113	131	155	309				
6	14	20	17	17	21	11	25	22	27	19	29	31	24	11	27	56	49	48	80	67	143	147	60			
N=	21	21	21	21	21	21	21	21	21	22	22	22	22	22	22	22	21	21	20	16	15	7	1			
	42	10	9	16	13	22	12	15	26	30	30	30	42	56	77	77	65	82	115	185	126	102				
7	10	15	8	14	7	12	10	12	25	26	9	14	31	30	29	39	64	79	69	127	114	43	240	260		
N=	20	20	20	20	20	20	20	20	20	20	20	20	19	18	18	17	17	14	10	9	5	3	2	1		
	29	13	13	44	16	14	14	14	20	22	24	25	21	25	23	49	50	99	44	95	86	17	150			
8	52		1	-2	-5	-4	9	13	14	-1	1	7	13	2		-11	-6	-21		29	56	67	210	180		
N=	26	26	26	26	26	26	26	26	26	26	26	26	26	26	25	24	23	23	21	19	12	6	2	1		
	172	24	23	19	19	25	28	33	26	23	27	41	39	41	62	81	100	167	184	192	176	252	270			
9	4	7	6	4	5	16	16	18	23	30	7	23	20	44	57	54	70	78	50	44	35	222	330	320		
N=	17	17	17	17	17	17	17	17	17	17	17	17	17	15	15	15	15	13	12	11	8	4	1	1		
	32	28	22	29	51	55	49	44	45	42	38	45	58	67	79	66	53	110	74	108	148	139				
10	21	13	1	-19	-51	-63	-79	-100	-114	-109	-138	-146	-153	-203	-151	-123	-153	-110	-14	-159	-129	60				
N=	13	13	13	13	13	13	13	13	13	12	12	12	11	11	11	10	9	8	6	2	1	1				
	34	47	49	69	71	101	111	129	121	129	100	94	104	81	115	185	130	220	276	120						
11	-43	-50	-65	-76	-90	-116	-146	-155	-187	-212	-188	-181	-205	-217	-283	-161	-263	-122	66	5	-54	-459				
N=	17	17	17	17	17	17	17	17	16	16	16	16	16	16	16	15	14	10	8	6	2	1				
	84	94	99	99	95	121	137	160	159	175	174	198	183	397	411	227	359	167	279	233	175					
12	-19	-11	-9	-50	-115	-171	-227	-266	-326	-375	-477	-501	-537	-387	-339	-285	-335	-274	-176	-78	-13	-102	70			
N=	12	12	12	12	12	13	14	14	15	15	14	14	14	12	10	10	10	10	9	7	6	3	2			
	126	94	94	107	152	190	224	280	355	393	406	471	524	501	417	363	427	391	288	179	211	40	330			

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR CHURCHILL

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 59 LONGITUDE 94 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-14	-40	-59	-76	-90	-104	-109	-115	-115	-119	-109	-90	-75	-44	-54	-21	-20	-4	-17	-69	-163	-238	-437	-399		
N=	28	28	44	44	45	45	45	45	45	45	45	45	45	45	44	44	43	39	29	21	19	14	5	1		
	65	87	91	92	124	139	156	172	198	222	238	239	243	263	295	288	270	247	259	230	242	271	259			
2	-115	-59	-82	-78	-79	-88	-75	-72	-52	-39	-31	-3	3	19	7	37	27	-17	-42	-87	-113	-234	-529	-329		
N=	19	19	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	25	22	17	14	10	7	1		
	96	343	76	84	94	99	110	133	148	164	189	199	226	240	244	236	212	156	140	205	192	115	151			
3	-27	-33	-30	-36	-45	-53	-50	-63	-72	-72	-65	-48	-53	-58	-43	-41	-23	-27	13	62	19	-103	-146			
N=	22	22	29	29	29	29	29	29	29	29	29	29	29	29	29	29	27	25	22	18	14	7	1			
	33	59	51	55	61	73	76	101	120	126	132	146	157	165	182	179	209	202	215	217	190	158	207			
4	-52	-99	-8	-10	-9	2	8	1	13	21	35	23	31	35	20	29	36	17	14	1	-24	8	-189			
N=	14	14	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	20	19	16	11	6	1			
	68	216	35	45	43	46	55	50	56	52	58	53	62	63	56	77	87	88	77	92	129	170	94			
5	-11	-8	-5	7	4	8	4	3	9	10	7	26	20	9	23	35	28	48	46	39	45	28	-154			
N=	12	12	24	25	25	25	25	25	25	25	25	25	25	25	25	24	25	25	24	21	17	4	2			
	17	39	18	27	22	40	40	30	50	35	40	41	47	35	51	63	81	111	70	103	107	66	115			
6	-23	-23	-7	-4	5	12	14	17	22	24	20	14	10	8	19	12	64	86	60	76	49	-52	-394			
N=	7	7	12	13	13	13	13	13	13	13	13	13	13	13	13	13	12	12	12	10	8	4	1			
	26	21	12	14	21	15	26	20	29	14	21	36	42	33	49	104	73	59	69	48	82	128				
7	-3	-7	1	7	4	14	12	19	18	4	-3	21	24	14	12	16	65	66	88	56	50	-3				
N=	8	8	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	12	10	5				
	26	18	19	20	16	25	26	22	26	24	36	45	48	36	34	43	40	65	63	91	104	62				
8	-17	4	-8	3		-3	7	4	10	14	4	8	20	11	15	18	34	25	36	31	-18	-49	-76	-139		
N=	9	9	23	24	26	26	26	26	26	26	26	26	26	26	26	26	26	26	25	23	18	6	3	1		
	30	36	17	21	19	20	22	23	32	28	30	55	60	57	63	71	76	80	83	87	121	106	40			
9	-57	-90	-13	-0	4	5	15	19	26	33	38	26	36	27	26	34	41	45	21	20	24	-6	-67	-389		
N=	9	9	27	28	28	28	28	28	28	28	28	28	27	27	27	27	27	27	25	25	19	10	5	1		
	65	130	29	22	23	31	33	45	42	44	43	54	66	80	70	60	77	63	67	77	76	122	140			
10	-40	-28	-26	-29	-23	-18	-27	-13	-19	-14	-7	12	8	18	15	40	46	37	56	73	29	-40	-114	-254		
N=	22	22	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	24	20	17	8	2		
	68	62	34	45	53	54	70	77	87	76	104	99	126	123	128	152	179	158	159	148	197	132	221	165		
11	-24	-57	-55	-67	-78	-93	-114	-124	-128	-129	-115	-112	-104	-104	-103	-77	-48	-81	-96	-105	-249	-347	-532	-469		
N=	30	30	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	45	44	39	33	18	8	2		
	71	132	93	102	108	106	116	111	106	108	116	111	119	121	142	159	194	209	198	184	232	252	253	160		
12	-82	-69	-134	-166	-209	-224	-234	-254	-263	-257	-255	-208	-190	-176	-138	-118	-82	-42	-48	-92	-154	-258	-378	-179		
N=	37	38	51	52	53	53	53	54	54	54	54	54	54	54	54	54	53	52	50	42	33	22	8	2		
	83	247	117	135	157	178	206	237	254	302	304	320	316	334	332	315	323	283	260	244	206	239	272	80		

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR PRIMROSE

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 55 LONGITUDE 110 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	-67	-77	-90	-86	-93	-82	-82	-93	-83	-88	-89	-66	-83	-80	-59	-55	-52	-53	-75	32	5	37	245			
N=	27	27	27	27	27	27	27	27	27	26	26	26	24	22	21	21	21	19	18	16	11	4	4			
	78	83	99	103	103	116	134	152	187	220	233	264	266	269	276	302	326	322	287	178	134	139	274			
2	-45	-53	-56	-63	-66	-71	-88	-65	-60	-43	-23	-23	-42	-47	-38	-30	-19	-24	32	73	135	139	226	207	403	443
N=	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	24	24	19	13	7	7	4	3	3
	51	56	63	61	69	74	93	96	108	128	150	180	234	257	275	301	294	281	282	209	195	250	281	171	256	213
3	-17	-12	-14	-26	-26	-34	-44	-46	-46	-57	-57	-50	-50	-28	10	34	58	67	108	155	278	310	293	380	710	
N=	20	20	20	20	20	20	20	20	20	21	21	21	20	20	20	19	19	18	17	11	8	6	3	2	1	
	31	44	39	40	42	52	57	67	93	101	111	107	151	132	104	147	147	172	159	142	161	129	167	60		
4	11	26	24	13	16	27	35	20	25	32	30	20	36	61	67	66	75	80	96	101	150	166	174	246	314	462
N=	22	22	22	22	22	22	22	22	22	22	22	22	21	21	21	21	20	20	20	18	16	11	9	7	7	4
	54	56	64	51	67	72	72	77	64	70	80	82	75	78	65	61	77	98	90	95	137	172	82	93	110	66
5	-12	-7	8	21	10	14	11	12	11	25	-2	11	12	8	27	31	38	65	92	85	117	130	212	222	385	340
N=	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	27	26	26	24	24	16	12	8	4	2	1
	35	28	20	46	25	21	28	29	27	48	47	42	46	46	44	62	61	85	97	124	80	121	105	152	175	
6	-40	-11	-9	-3	4	12	12	14	19	22	36	32	18	33	68	52	58	72	94	93	127	89	137	230	360	
N=	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	8	8	7	3	2	1	
	57	39	14	20	21	28	21	34	20	65	22	30	57	43	64	54	53	59	54	91	82	41	59	100		
7	1		8	6	13	12	6	29	28	21	-7	37	27	14	6	46	111	80	79	97	60	241	196	326	422	
N=	13	13	13	13	13	13	13	13	13	13	13	13	12	10	10	9	8	7	7	7	7	7	5	5	4	
	43	27	17	16	24	20	24	32	29	31	30	30	43	79	67	60	90	67	61	62	138	190	69	108	210	
8	11	11	3	11	16	7	16	2	16	18	23	60	56	25	17	62	90	105	103	122	149	202	215	257	275	620
N=	27	28	28	28	28	28	28	28	28	28	28	28	28	27	27	27	26	26	26	24	22	20	15	12	4	2
	49	49	22	21	21	27	31	50	27	32	45	67	67	55	64	62	104	89	100	92	126	177	205	133	155	250
9	-9	14	11	1	14	6	18	20	34	39	45	46	68	53	56	56	62	114	120	88	116	91	213	222	400	530
N=	22	22	22	22	22	22	22	22	22	21	21	21	21	21	20	19	18	16	16	16	14	10	7	5	3	2
	44	54	44	37	40	24	22	40	37	39	45	72	65	62	65	66	92	131	80	118	122	49	209	102	73	180
10	-14	-25	-21	-15	-37	-40	-50	-61	-56	-14	-23	-17	-16		15	63	34	57	72	101	106	145	164	205	315	
N=	15	15	15	16	16	16	16	16	16	16	16	16	17	17	17	16	16	16	14	14	12	11	7	2	2	
	56	41	48	46	52	51	50	53	54	115	95	89	70	76	86	70	129	151	220	158	213	230	123	15	55	
11		-9	-27	-30	-46	-43	-58	-54	-78	-74	-98	-86	-76	-79	-50	29	-7	7	87	41	54	45	120	-29	30	230
N=	14	14	14	14	14	14	14	14	14	15	15	15	14	14	14	13	13	13	11	8	5	4	2	1	1	1
	59	49	64	67	72	79	75	70	103	118	130	146	154	165	168	174	207	285	158	244	143	105	110			
12	-50	-78	-102	-38	-145	-166	-209	-218	-206	-183	-239	-211	-171	-149	-179	-150	-161	-188	-184	-91	-21	167	315	160		
N=	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	8	7	6	6	4	3	2	2		
	75	79	136	271	134	144	170	176	177	188	201	152	160	134	174	264	280	291	216	273	428	352	445	120		

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR VOLGOGRAD

PERIOD OF RECORD 1/65 TO 12/70 LATITUDE 49 LONGITUDE -45 (M/SEC TIMES TEN)

MONTH/LEVEL						30KM					40KM					50KM					60KM					70KM
1	25	44	41	56	50	65	44	65	-11	-15	11	104	190	88	-44	-13	16	20	-389	-519						
N=	13	13	13	13	13	13	13	13	13	13	13	12	12	12	10	10	5	3	1	1						
	87	84	118	114	102	111	130	141	151	165	149	128	274	255	205	246	91	171								
2	-31	-18	-21	-9	17	54	41	41	33	28	47	61	58	21	34	66	-24	-32								
N=	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	3								
	52	48	62	52	53	73	61	60	80	113	137	143	207	307	249	168	134	133								
3	8	-21	21	-42	-18	-12	3	-11	-33	-20	-30	-35	-176	-203	-99	-27	70	193								
N=	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	3								
	9	43	27	53	40	35	40	39	61	96	86	132	326	307	247	235	252	184								
4	-12	-19	-27	-26	-36	2	-24	-3	-20	12	22	64	75	18	17	43	78	72	130							
N=	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	12	9	6	2							
	76	71	73	60	64	83	64	97	74	56	82	139	158	150	178	166	153	111	170							
5	15	-0	-10	-14	20	3	57	5	-10	-24	32	49	41	2	-7	18	83	147								
N=	11	11	11	11	11	11	11	10	10	10	9	9	9	9	9	8	6	3								
	50	61	44	50	33	75	68	70	71	57	88	87	95	79	157	163	65	31								
6	19	28	2	-0	35	16	-17	-20	26	-20	61	194	165	-64	-157	-52	-87	-35	-12	200						
N=	10	10	10	10	10	10	10	10	10	10	9	9	8	8	6	6	5	5	3	1						
	57	54	45	53	68	76	48	32	93	119	254	251	237	269	267	198	86	52	97							
7	1	8	5	-13	23	-21	-26	-21	14	-28	-43	-71	-33	-85	-67	-5	99	105	214	170						
N=	14	14	14	14	14	14	14	14	14	14	14	14	14	13	11	11	10	9	5	1						
	28	28	38	77	106	143	133	157	142	118	96	142	174	223	276	263	209	209	205							
8	30	18	35	28	42	40	43	40	52	85	67	57	52	-99	-109	-109										
N=	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1										
	36	23	34	26	37	26	11	57	102	131	88	37	111													
9	-4	-9	2	3	8	12	23	44	50	40	33	42	16	2	36	23	-39	-55	10							
N=	11	11	11	11	11	11	11	11	11	11	11	11	11	9	9	9	5	5	2							
	40	54	64	72	80	77	42	35	56	62	49	125	148	129	118	100	79	115	80							
10	-23	-0	-16	10	19	56	12	79	48	13	9	11	55	99	109	111	52	15	160	40						
N=	18	15	15	16	16	16	16	16	16	16	15	15	14	14	13	13	9	8	2	1						
	49	108	94	71	83	91	83	107	92	143	147	127	113	167	216	252	265	244	200							
11	-12	-11	-28	-3	4	1	-16	-10	49	97	68	-7	37	59	-5	74	-69	-163	-124	-24	145					
N=	17	17	17	17	17	17	17	17	17	17	16	16	16	16	15	14	9	7	2	2	2					
	92	97	88	72	94	76	162	98	162	224	235	189	322	435	494	310	321	381	145	85	15					
12	35	53	58	66	90	128	94	104	120	128	103	21	-107	-117	-46	-13	-1	-1	43	10	140	290	420			
N=	16	16	16	16	16	16	16	16	16	16	16	15	15	15	14	11	10	8	3	1	1	1	1			
	108	83	101	124	124	124	152	148	175	234	270	243	210	208	219	215	212	185	105							

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR WALLOPS

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 38 LONGITUDE 76 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	31	34	33	30	20	16	17	-0	-3	20	38	69	104	99	115	125	188	149	104	74	107	126	111	150		
N=	27	27	29	32	32	32	33	34	34	34	34	34	34	34	34	32	29	28	25	21	11	8	4	1		
	66	63	61	64	55	40	39	55	64	91	136	174	214	239	279	259	227	187	183	186	171	167	60			
2	13	22	32	44	50	40	39	24	-4	-8	17	54	112	143	159	134	131	145	139	139	58	10				
N=	15	15	16	18	18	18	18	18	18	18	18	18	18	17	17	17	17	13	11	7	5	1				
	36	34	34	40	34	36	48	48	61	71	89	79	95	90	109	99	115	128	125	110	103					
3	27	25	26	25	24	20	16	11	-1	-0	23	44	82	102	130	113	101	114	106	62	26	67	62			
N=	27	27	27	29	29	29	29	29	29	29	29	29	29	28	28	26	25	24	21	14	10	3	2			
	41	31	25	32	29	39	31	43	56	63	85	100	86	98	95	85	97	99	105	95	103	68	32			
4	-13	4	7	12	20	26	25	20	19	24	29	32	45	52	51	57	72	96	101	97	65	67	110			
N=	31	32	32	33	33	33	33	33	32	32	32	32	32	32	32	32	31	28	25	23	15	5	3			
	34	25	26	29	38	54	53	40	51	55	63	77	72	70	66	61	72	75	84	101	78	46	110			
5	-0		2	10	2	12	12	9		-11	-5	14	25	42	54	54	44	46	48	5	-24	3	38	30		
N=	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	28	24	23	18	5	3	1		
	21	21	19	23	29	24	28	30	27	36	34	42	46	49	51	54	43	72	79	81	110	125	38			
6	1	5	7	11	4	5	7	10	10	5	11	22	37	54	63	58	46	28	25	29	29	-13		70	145	
N=	35	35	35	35	35	35	35	35	35	35	35	35	15	35	35	35	35	34	29	24	17	10	7	5	2	
	18	17	19	20	23	22	33	38	30	27	36	40	43	46	41	52	60	65	63	76	71	67	45	138	55	
7	-1	2	5	7	9	14	10	16	11	3	19	20	27	49	55	53	55	34	41	36	26	9	160			
N=	31	31	31	31	31	31	31	31	31	31	31	30	10	30	30	30	30	26	24	22	19	7	3			
	19	20	16	21	21	22	32	30	33	40	39	40	50	42	44	56	62	73	62	90	135	198	43			
8		1	6	2		9	8	1	12	9	9	5	27	55	71	68	44	42	48	38	-38	-19	90	-9	-29	
N=	36	36	36	36	36	36	36	35	35	35	35	35	35	35	34	34	33	31	23	18	8	4	1	1	1	
	20	17	17	19	28	24	22	28	32	45	38	46	53	60	53	64	69	79	94	113	120	142				
9	-2	3	2	6	1	1	10	7	7	-3	10	20	32	36	51	39	65	83	49	48	50	68	56	10		
N=	31	31	31	31	31	31	31	31	31	31	31	31	31	31	30	30	27	26	20	15	9	3	2	1		
	23	22	16	18	15	20	32	32	31	42	37	45	53	52	41	48	70	73	94	76	88	56	14			
10	1	4	8	21	30	36	46	50	28	16	32	59	56	83	86	72	59	84	52	30	28	-19	15	48		
N=	27	27	27	27	27	27	27	27	27	27	27	26	24	24	24	24	24	22	20	16	8	4	2	1		
	24	23	35	34	42	53	68	80	70	61	57	68	75	77	67	92	68	77	87	90	98	35	95			
11	27	17	28	25	37	39	38	30	30	38	74	116	170	170	186	184	175	198	122	111	10	-18	-54	-76	-104	-174
N=	26	26	27	27	27	27	27	27	27	27	27	27	27	27	27	26	25	20	18	11	10	4	2	2	1	1
	44	53	29	32	38	45	60	65	60	59	72	89	91	129	113	94	115	215	142	78	85	86	15	37		
12	-10	-5	-9	-8	7	27	53	64	61	61	71	129	174	244	257	251	219	204	162	102	113	140	140			
N=	17	17	17	19	19	19	19	19	19	19	19	19	19	19	18	18	16	15	15	8	6	3	1			
	31	47	39	64	66	68	68	97	74	86	98	123	124	135	164	162	201	192	166	144	152	78				

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR PT.MUGU

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 34 LONGITUDE 119 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-19	-9	-11	-1	7	8	7	10	9		-2	-7	-8	8	36	69	76	74	60	41	-61		130	90	60	170
N=	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48	48	48	44	42	36	21	5	2	2	1	1
	34	39	31	42	55	64	62	80	85	101	121	161	183	205	204	199	189	190	207	197	218	197	50	30		
2	-7	-2	-11	-4	-3	-1	4	28	18	10	2	12	41	59	73	58	53	72	72	85	13	-74	-9		30	-94
N=	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	42	38	36	30	20	6	2	2	2	2
	38	94	24	29	35	42	49	75	73	74	103	120	142	143	129	133	124	114	106	120	173	145	40	30	90	235
3	-18	-3	5	11	16	13	15	39	45	45	52	65	86	113	109	109	135	143	160	106	34	-34	120	55	-59	-134
N=	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	42	41	38	35	33	17	6	2	2	2	2
	42	38	25	26	34	42	51	63	63	73	73	74	88	97	111	120	110	113	122	123	122	150	110	15	90	105
4	18	14	6	6	4	-5	4	6	8	-7	-15	3	38	41	61	49	41	33	71	62	23	-1	24		-49	-23
N=	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	52	52	49	46	44	31	10	7	5	5	5
	69	34	21	23	32	43	48	57	58	67	74	87	84	83	71	79	73	79	80	100	106	106	129	86	65	57
5	7	-2	4	11	6	10	16	14	5	5	8	-3	15	53	70	69	48	34	50	47	17	-13	-84	20	40	80
N=	55	55	55	55	55	55	55	55	55	55	55	55	54	54	54	53	53	46	36	29	13	5	2	2	2	2
	32	32	20	24	26	32	36	33	32	41	39	42	44	51	56	45	65	45	67	113	120	99	295	80	70	10
6	13	5	2	5	5	3	10	16	11	6	-2	1	27	46	43	53	66	64	45	3	18	86	-42	110	350	330
N=	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	51	42	38	34	21	12	7	3	2	1	1
7	16	11	7	7	-1		14	15	12	4	-1	-0	12	37	50	59	73	70	22	-48	-32	6	54	135	210	227
N=	58	58	58	58	58	~~64~~	58	58	58	58	58	58	58	58	58	57	53	49	45	36	19	11	7	6	4	4
	37	33	18	25	26	31	28	30	36	42	45	53	58	47	59	61	69	78	102	141	188	128	123	80	70	83
8	13	2	1	5	2	5	17	14	7	7	-1	-1	11	18	51	68	68	47	54	28	-11	-60	63	40	-59	
N=	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	41	39	33	18	8	3	3	3	3
	31	27	14	17	23	24	28	28	32	37	43	41	51	67	79	72	82	76	94	82	128	169	74	43	114	73
9	-1	-5		-0	-0	1	17	20	8	4	-17	3	12	29	29	19	42	45	13	13	-9	5	43	67	32	-17
N=	41	41	41	41	41	41	41	41	41	41	41	41	41	41	40	40	38	35	32	25	14	4	3	3	3	3
	31	26	21	20	19	22	24	28	28	38	35	56	53	54	47	62	73	61	56	79	81	23	65	146	118	110
10	5	-7	-1		-0	2	26	36	39	34	15	8	11	32	61	89	92	98	108	81	62	-5	67	100	70	-66
N=	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	51	48	46	46	44	22	8	3	3	3	3
	33	76	19	24	29	33	43	53	58	63	67	58	61	69	84	90	96	100	99	115	140	122	154	130	114	99
11	-13	7	-5	5		12	10	18	37	34	16	11	16	24	63	72	72	91	83	28	-40	-87	-64	-112	-6	30
N=	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	30	30	27	27	20	6	4	3	3	3
	46	102	39	36	47	54	52	47	64	68	76	65	61	77	89	115	132	134	141	151	144	73	85	217	171	120
12	-9	-2	-16	-35	-31	-37	-42	-32	-19	-28	-18	23	60	97	135	145	136	128	141	146	78	61	187	147	-16	-162
N=	67	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	46	45	42	38	23	7	3	3	3	3
	34	47	29	34	46	61	75	96	119	131	143	173	186	197	190	185	169	154	159	199	206	275	131	216	210	218

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR WSMR

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 32 LONGITUDE 107 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	38	17	3	15	22	23	25	30	6	-11	21	39	57	63	98	113	71	120	94	56	97	58	-22	43	-132	-54
N=	45	45	45	46	46	46	46	46	46	46	46	46	46	46	45	45	45	44	41	40	39	31	22	20	16	9
	224	136	39	45	50	64	69	83	93	82	107	122	150	177	199	189	163	146	186	220	193	215	262	216	146	110
2	10	5	-1	14	5	1	7	34	3	-9	-20	7	39	45	51	48	100	42	57	78	98	31	11	-17	-88	-263
N=	40	40	40	40	40	40	40	40	40	40	40	40	40	40	38	37	37	37	36	33	30	25	18	12	5	4
	44	49	56	52	61	53	54	93	96	108	116	116	122	131	128	146	141	165	150	170	135	181	198	118	230	179
3	5	15	18	25	29	11	21	19	18		11	35	63	102	101	136	116	151	145	116	132	93	94	-12	-176	-199
N=	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	35	34	30	29	23	16	12	7	3	2
	62	54	45	41	19	45	56	76	73	107	104	94	94	108	103	102	85	129	129	145	157	148	134	213	31	40
4	8	9	4	12	21	7	9	3	11	-7	-16	20	41	31	53	51	52	31	56	106	81	73	31	23	16	-29
N=	50	50	50	50	50	50	50	50	50	50	50	50	50	50	49	49	48	47	46	40	37	35	29	14	9	1
	58	41	35	31	42	43	54	66	62	85	100	136	166	89	94	116	116	93	162	150	143	126	129	112	138	206
5	3	4	3	7	4	7	23	13	3	9	-4	6	15	43	54	44	49	72	46	36	14	55	38	-104	-217	-54
N=	46	46	46	47	47	47	47	47	47	47	47	47	47	47	47	47	46	46	46	42	36	32	20	10	9	4
	36	36	25	37	39	37	41	44	41	34	47	52	65	70	82	109	75	103	82	94	104	95	142	152	123	268
6	14	2	6	9	5	19	16	-3	26	6		-6	21	33	40	44	59	52	28	36	36	39	-17		54	-46
N=	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	40	40	40	40	40	36	26	21	15	9	6
	22	25	27	33	39	33	32	45	33	46	53	56	50	74	65	65	90	85	117	122	134	169	134	249	252	223
7	10	11	-0	6	-1	16	15	12	18	4	-6	20	51	44	37	39	49	67	35	36	56	80	13	35	-16	43
N=	39	39	39	39	39	39	39	39	39	39	39	39	39	38	38	38	37	37	34	32	28	21	18	13	11	8
	20	24	29	30	33	40	36	51	36	51	65	61	71	80	66	92	68	114	111	118	165	186	248	253	192	255
8	7	-1	8	-1	3	3	16	17	14	6	26	-15	31	66	75	91	86	42	40	28	29	41	6	-35	-67	20
N=	37	37	37	37	38	38	38	38	38	38	38	38	37	37	36	36	35	34	31	28	24	15	11	9	4	2
	24	19	24	67	35	46	35	39	51	56	89	66	89	66	99	117	112	141	91	152	138	127	114	159	247	20
9	9	-2	13	7	-18	-0	37	25	-6	-12	6	17	7	27	65	40	69	53	92	44	100	160	155	98	-59	-82
N=	52	52	52	53	53	53	53	53	53	53	53	53	53	53	53	53	51	47	43	43	39	33	23	14	5	2
	26	31	31	33	177	99	38	46	52	48	57	64	70	80	84	83	106	102	118	132	468	724	832	583	132	52
10	13	4	-10	8		19	34	39	40	25	2	4	64	92	103	97	97	99	87	74	81	42	55	-14	19	-73
N=	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	36	35	32	30	29	26	18	11	7	5
	40	28	114	33	41	39	53	49	66	66	59	57	90	68	99	105	100	121	133	102	162	252	136	150	125	180
11	-1	1	12	14	16	21	44	42	56	40	16	40	69	105	130	162	196	185	147	163	177	116	113	123	-19	370
N=	40	40	40	40	40	40	40	40	40	40	39	39	39	39	39	39	36	36	35	34	25	18	14	8	4	2
	37	43	58	43	46	68	66	83	75	78	68	70	97	102	89	92	162	165	167	159	205	172	130	155	178	220
12	20	-6	-25	228	-16	-12	-12	16	29	22	15	74	122	169	157	192	196	198	213	229	230	161	140	352	224	12
N=	39	39	39	40	40	40	40	40	40	40	40	40	40	38	38	38	37	37	35	31	27	24	12	6	5	5
	53	33	49	1564	59	72	92	108	116	126	202	199	191	196	204	198	194	187	242	167	155	173	191	284	138	157

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR KENNEDY

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 28 LONGITUDE 81 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	8	3	5	5	14	12	18	-14	-26	-8	3	8	34	44	48	50	50	67	82	143	158	108	95	70	55	25
N=	47	47	47	48	49	49	49	49	49	49	49	49	49	49	48	46	45	44	37	34	25	13	8	5	4	4
	39	37	35	31	50	55	54	56	65	71	83	110	127	140	150	146	129	125	124	129	148	173	171	138	68	157
2	8	3	14	36	37	40	38	2	-16	-11	-0	18	29	40	55	42	37	44	73	87	137	124	145	-199	-134	170
N=	40	40	40	41	41	41	41	41	42	42	41	41	41	41	41	40	40	40	39	28	22	8	4	2	2	2
	38	44	33	37	49	67	66	51	57	71	76	58	69	91	96	90	85	100	104	115	125	179	139	40	5	180
3	8	-16	-20	-7	-1	9	7	-0	-7	-13	-2	1	11	39	67	76	67	73	75	98	184	164	-7	-92	-82	-39
N=	22	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	21	21	18	15	11	5	4	4	3	3
	29	26	26	26	29	25	32	46	48	63	74	68	72	68	62	65	82	99	105	85	99	69	80	103	77	113
4	-22	-11	-0	8	30	26	4	5	6	-3	16	11	7	20	17	5	4	22	57	47	79	82	95	60	103	-191
N=	23	23	23	23	25	25	25	25	25	25	25	25	25	25	25	25	25	25	23	19	16	5	4	3	2	2
	34	28	27	23	35	43	51	53	57	74	60	50	67	63	69	47	56	58	52	74	93	95	57	73	167	3
5	-7	-2		2	7	2	11	12	3	-4	2	-2	-7	7	9	49	59	55	53	51	26	2	8	105	59	-199
N=	16	16	16	16	19	19	19	19	19	19	19	19	19	19	19	19	18	18	15	14	9	5	5	4	5	5
	20	23	28	16	21	24	23	25	30	43	42	47	51	48	66	58	54	56	74	77	99	88	72	66	27	169
6	-0	7		29	34	42	50	38	35	34	11	10	39	64	81	85	71	47	21	4		11	-26	-53	147	192
N=	25	25	25	26	27	27	27	27	27	27	27	27	27	27	27	27	26	26	26	24	15	6	5	5	5	5
	25	24	22	152	165	190	172	164	172	193	166	169	171	78	85	101	141	150	83	94	116	188	191	122	115	54
7	-1	15	6	-11	-12	-2	3	4	-8	7	2	-20	-15	12	33	56	78	84	93	51	65	16	107	203	170	-54
N=	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	41	41	41	38	30	16	9	4	4	4	4
	21	29	27	21	24	28	96	32	35	48	48	60	77	72	73	66	70	99	91	133	148	209	71	190	295	240
8	-7	15	4	-11	-17	-7	18	7	-5	7	7	-13	-18	-5	48	70	83	75	43	46	18	65	3	-127	50	-119
N=	36	36	36	36	37	37	37	17	17	37	37	37	37	37	36	35	35	35	33	27	15	9	5	5	3	2
	19	24	25	26	21	24	28	31	40	49	41	52	65	74	68	85	165	143	114	115	111	103	151	113	137	
9		[illegible]	-2	-4	-9	-7	13	19	-8	-19	-7	3	-1	18	20	12	18	61	56	33	22	21	40	51	-59	-99
N=	34	36	36	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	34	10	22	9	7	6	6	5
	14	23	26	19	27	29	34	35	34	50	62	60	55	58	63	72	73	66	96	72	119	104	117	124	121	149
10	7	-6	-13	1	1	-1	10	13	-2	-4	-5	14	18	24	36	11	11	42	11	-11	-0	1	-7	140	-56	545
N=	31	31	31	31	32	32	33	33	33	31	33	33	33	33	32	32	32	32	28	22	16	11	6	2	2	2
	30	87	29	22	24	12	34	46	47	58	58	62	59	63	71	70	69	65	70	67	105	109	56	10	275	485
11	12	1	-3	3	13	16	30	36	20	20	35	70	113	126	148	119	134	134	120	116	92	46	35	159	113	46
N=	35	35	35	36	36	36	36	36	35	35	36	36	37	37	37	36	35	33	30	27	19	14	8	7	7	7
	33	35	31	30	29	38	37	42	49	59	65	62	75	92	119	112	93	95	84	120	150	151	157	147	164	164
12	-3	-16	-4	7	24	47	74	66	65	40	55	76	91	113	98	96	104	111	113	89	90	50	19	85	103	44
N=	36	36	36	36	36	36	36	36	36	36	36	36	36	36	33	32	31	31	30	27	18	8	7	7	7	7
	30	24	24	19	32	47	68	67	86	81	108	138	164	166	145	129	131	128	136	154	178	222	241	256	188	179

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR HAWAII

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 22 LONGITUDE 160 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-2	4	5	23	40	26	12	8	7	11	23	57	49	75	164	103	39	46	117	134	-45	3	-249	-279	-459	-499
N=	29	29	29	29	29	29	29	29	29	29	29	29	29	29	28	27	26	23	20	15	5	4	1	1	1	1
	24	30	29	28	40	59	74	99	91	89	80	107	117	133	204	163	135	156	150	165	124	189				
2	-16	-10	11	19	27	14	-4	-5	-3	-1	13	42	44	66	67	55	70	79	104	147	108	97	-7	-196	-152	-86
N=	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	43	40	36	30	26	15	9	5	3	3	3
	37	33	27	26	25	41	45	49	50	52	63	60	73	82	99	104	112	140	136	98	116	167	186	33	165	309
3	-14	-7	5	13	15	21	12	16	29	18	14	33	48	65	62	58	79	92	99	125	84	-8	-39	113	97	7
N=	46	46	46	46	46	46	46	46	46	46	46	46	46	46	45	45	44	41	38	23	12	8	6	1	1	1
	30	38	28	34	35	33	42	44	34	45	66	73	93	95	89	86	84	89	80	111	102	97	137	59	181	119
4	2	-0	9	14	5	16	6	-6	7	4	-3	14	36	59	62	54	46	70	93	79	50	43	-19	-110	-275	-290
N=	53	53	53	53	53	53	53	53	53	53	53	53	53	52	50	48	48	45	38	28	14	6	4	4	3	3
	28	24	22	28	32	33	33	47	58	62	55	55	52	50	64	70	85	69	80	88	98	177	37	152	207	285
5	4	3	7	5	2	14	11	3	3	1	3	31	44	68	74	73	74	55	96	84	111	140	17	20	-92	-379
N=	51	51	51	51	51	51	51	51	51	51	51	51	50	49	48	44	39	35	30	20	10	6	3	3	3	3
	37	31	21	23	33	30	39	40	40	37	46	51	44	48	58	58	59	86	76	76	92	136	79	79	82	22
6	3	8	9	13	16	7	10	10	9	9	4	15	39	53	56	60	67	61	64	88	86	61	23	-14	-34	-76
N=	47	47	47	47	47	47	47	47	47	47	47	46	46	42	39	37	36	31	24	21	10	7	4	4	4	4
	42	27	27	24	21	23	28	34	26	35	41	38	51	40	45	45	75	65	113	110	98	140	43	35	123	89
7	10	5	3	5	5	5	27	22	3	8	7	10	43	53	47	50	83	80	57	94	136	-29	-119	-24	-74	-109
N=	52	52	52	52	52	52	52	52	52	52	52	52	51	50	49	45	39	33	29	15	8	2	2	2	2	2
	29	28	24	23	23	28	29	30	34	37	44	40	45	56	63	61	73	88	96	99	114	130	60	45	85	30
8	11	6	5	9	5	9	15	22	16	5		-0	29	59	60	57	79	104	84	72	44	-18	-64	-119	-126	-224
N=	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	49	47	37	28	13	4	4	4	4	4
	33	29	23	20	25	28	28	28	33	38	38	50	56	61	74	81	84	100	91	86	94	78	146	194	139	144
9	9	7	8	6	12	10	20	15	7	8	10	-4	12	41	56	55	63	70	69	50	65	30	-74	110	184	222
N=	52	52	52	52	52	52	52	52	52	52	52	52	52	52	51	49	49	45	40	35	25	11	4	1	1	1
	30	24	22	22	23	27	29	35	38	41	47	42	54	59	63	67	54	71	76	88	91	94	68			
10	-7	-0	5	11	9	5	10	16	7	13	2	15	35	57	44	46	50	56	64	108	59	28	38	40	53	80
N=	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	44	41	37	35	29	16	9	5	1	1	1
	40	47	24	26	29	10	14	36	45	47	39	52	60	60	61	75	74	66	67	84	88	65	101	164	76	94
11	8	-14	-9	12	16	4	-7	-5	-2	-14	-9	16	43	59	84	83	77	72	65	111	138	168	175	145	-99	-249
N=	32	32	32	32	32	32	32	32	32	32	32	32	32	31	30	28	28	28	27	20	16	5	2	2	2	2
	32	48	37	29	31	34	35	34	33	50	60	54	54	61	86	89	93	88	101	99	101	102	85	95	140	90
12	-21	-2	6	17	19	3	-7	4	24	6	24	73	93	120	129	144	135	124	155	161	213	192	185	45	-14	-19
N=	42	42	42	42	42	42	42	42	42	42	42	42	42	42	41	40	39	39	31	25	15	5	2	2	2	2
	60	39	25	30	32	44	50	76	78	80	97	119	124	143	122	126	116	135	158	120	126	132	105	55	85	180

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR ANTIGUA

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 17 LONGITUDE 62 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	-5	-21	-2	11	8	-11	-28	-30	-24	-28	-0	33	59	25	88	102	82	53	73	190	120					
N=	21	21	21	21	21	21	21	21	21	21	21	20	20	19	16	16	15	13	8	4	2					
	26	35	29	34	37	29	31	43	58	93	47	73	62	72	58	117	113	127	135	90	20					
2	-10	-15	-14	11	19	8	-5	-11	-22	-7	-27	-3	24	25	52	37	46	56	95	107	40	130				
N=	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	18	18	15	12	9	5	1				
	37	41	32	20	43	41	46	46	44	36	72	61	70	51	107	100	129	102	91	80	69					
3	-17	-13	32	20	24	6	-1		-20	-39	-62	-28	-1	-4	3	12	46	51	72	63	125					
N=	18	18	18	18	18	18	18	18	18	18	18	18	16	14	12	11	9	7	5	3	2					
	28	30	156	26	24	30	32	34	43	40	43	40	45	73	74	73	89	61	71	107	55					
4	-1	-3	1	16	9	-2	4	1	-12	-30	-25	2	16	-7	18	34	55	45	88	40	70					
N=	13	13	13	14	14	14	14	14	14	14	14	13	13	13	12	12	12	11	5	1	1					
	32	29	28	23	19	33	37	37	36	61	52	49	62	57	77	50	76	84	81							
5	-2	18	10		-6	18	26	-2	-19	-12		-19	-19	7	39	59	78	61	51	60	155					
N=	14	14	14	14	14	14	14	14	14	14	14	14	14	13	13	13	12	12	12	8	2	1				
	13	62	14	21	23	31	32	41	47	41	43	53	30	54	65	44	60	61	52	69	35					
6	8	8	3	13			-3	6	21	19	29		9	38	58	66	60	10	-49	-39						
N=	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	7	5	4	1	1						
	13	20	30	16	23	21	30	27	103	75	73	25	78	81	44	51	42	34								
7	1	2	6	-1	6	4	6	-0	3	4	4	-3	-10	-20	16	85	88	82	82	58	90	10				
N=	18	18	18	18	18	18	18	18	18	18	18	17	17	14	14	13	11	9	5	4	1	1				
	24	33	15	18	34	27	33	42	42	44	56	45	53	64	55	65	51	58	44	37						
8	6	10	13	7	4	13	1	7	17	8	-13	3	11	18	43	94	72	68	29	43	50	190				
N=	16	16	16	16	16	16	16	16	16	16	16	16	15	13	13	12	12	12	11	3	1	1				
	18	23	24	20	28	17	25	32	18	42	49	46	59	59	50	67	81	83	84	17						
9	-8	-2	1	6	-11	2	19	9	-14	-20	-18	7	-1	19	18	30	48	25	15	14	55	60				
N=	17	17	17	17	17	17	17	17	17	17	17	17	17	16	14	14	14	13	8	5	2	1				
	13	33	26	15	54	27	32	28	40	52	50	55	63	62	60	72	56	73	72	85	25					
10	-3	-3	15	11	10	6	-19	-13	3	-1	-22	-26	-25	-9	10	28	9	16	28	44	-44	10				
N=	25	25	25	26	26	26	26	26	26	26	26	26	25	25	22	21	20	15	12	9	6	1				
	22	41	23	27	22	28	28	44	47	41	63	51	57	52	52	66	81	56	76	96	68					
11	-2	5	3	59	51	-7	-2	7	7	29	38	37	72	90	68	135	104	69	41	50						
N=	15	15	15	15	15	15	15	15	15	15	15	15	15	14	13	13	12	10	7	3						
	31	28	35	176	160	34	28	35	51	52	72	56	73	91	74	145	83	63	31	51						
12	-4	7	-0	22	18	9	11	40	41	45	34	26	26	30	58	66	96	131	126	182	75	100				
N=	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	12	12	9	9	6	2	1				
	34	26	16	54	20	25	37	57	47	53	76	71	70	40	59	69	85	100	48	133	65					

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR SHERMAN

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 9 LONGITUDE 80 (M/SEC TIMES TEN)

MONTH/LEVEL							30KM					40KM					50KM					60KM					70KM
1		-5	5	8	3	-11	-14	-7	-6	4	2	6	23	16	7	38	14	-19	-20	-14	-45	22	80	105	390		
	N=	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	13	7	5	2	2	1		
		22	47	19	28	22	30	34	42	55	56	58	70	97	78	91	68	91	87	75	132	140	200	225			
2		10	20	-2	5	-16	-24	-2	22	7	-17	13	35	25	-7		52	83	75	66	35	37					
	N=	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4	3					
		18	13	26	24	12	29	23	47	24	18	38	42	39	65	60	66	47	74	46	29	33					
3		-7	8	-1	8	10	-15		-11	44	-2	3	53	22	6	-7	6	34	68	84	76	-6	-19	15	70		
	N=	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2	2	2		
		27	43	15	12	49	23	23	37	37	73	32	50	47	35	29	36	86	80	65	40	72	50	75	160		
4		18	15	3	13	8	30	11	-19	3	32	27	19	-0	-0	22	33	26	59	80	29	6	70	390			
	N=	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	21	21	20	16	9	2	1			
		31	46	31	36	31	67	34	64	58	79	66	71	76	68	76	137	125	125	115	107	59	20				
5		8	-54	40	15	28	21	8	5	35	5	45	16	32	26	39	80	73	30	73	45	13	155				
	N=	29	29	29	29	29	29	29	29	29	29	29	29	29	29	28	28	27	26	24	16	8	4				
		30	224	59	36	67	64	48	67	62	54	54	57	53	56	55	77	116	128	70	104	77	144				
6		13	29	27	15	18	23	-4	-5	-57	27	28	46	56	60	70	106	62	121	128	44	35	207	10	80	-109	
	N=	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	34	34	33	31	26	17	7	2	2	1	
		31	119	32	50	37	45	88	65	321	108	80	89	97	84	105	95	234	150	256	205	173	378		130		
7			19	26	23	39	21	-1	11	1	29	25	30	27	38	67	100	75	136	90	77	89	49	321	190		
	N=	27	27	28	31	31	31	31	31	31	31	31	31	31	31	31	31	31	30	28	22	18	11	8	2		
		30	93	28	34	36	46	68	57	59	67	71	77	68	67	67	82	130	146	103	198	339	161	902	180		
8		8		16	20	20	19	-4	-6	5	36	29	10	28	49	69	46	66	70	46	67	92	6	167			
	N=	23	24	31	37	37	37	37	37	37	37	37	37	37	36	36	36	36	35	29	23	15	5	1			
		90	23	23	34	73	68	63	72	61	66	91	75	84	64	72	107	103	88	84	176	247	134	79			
9		5	13	12	20	12	16	-4	-7	15	13	11	-14	-13	5	19	17	33	19	57	22	16	5				
	N=	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	9	8	5	2	1			
		27	31	28	21	26	33	30	31	38	49	39	41	63	40	70	77	77	56	183	110	143	5				
10		7	9	9	24	23	19	-10	-12	9		-3	19	-15	-3	-16	13	47	41	93	151	47	165	20	70	280	
	N=	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	22	22	19	15	12	4	1	1	1	
		18	54	32	64	34	69	54	41	50	66	57	58	65	73	66	86	126	199	311	485	357	259				
11		4	17	31	13	30	8	4	13	10	25	2	19	35	44	13	18	-10	-23	12	60	12	15	153	10	200	
	N=	25	26	26	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	27	23	19	13	6	1	1	
		28	33	33	34	43	40	39	48	70	48	51	67	104	177	80	55	98	114	79	172	131	225	392			
12		-33	-2	10	49	11	2	-9	4	26	36	47	56	47	52	95	77	29	16	39	69	63	90	100			
	N=	26	26	26	27	28	28	28	28	28	28	28	28	28	28	27	27	27	25	25	20	15	4	2			
		68	97	42	127	38	63	53	84	57	66	65	88	103	141	113	113	139	117	184	154	293	107	100			

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR KWAJALEIN

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE 9 LONGITUDE 167 (M/SEC TIMES TEN)

MONTH/LEVEL							30KM					40KM					50KM					60KM					70KM
1		2	-10	18	4	3	4	14	-8		11	1	-2	19	78	73	13	30	22	-18	-100	-120	-104	-117			
	N=	23	23	23	23	23	23	23	23	23	23	23	23	21	23	22	22	22	21	21	18	13	8	4			
		28	70	32	26	27	34	45	34	37	56	54	54	83	71	113	159	187	159	116	103	109	104	148			
2		-7	-7	-0	-1	9	14	-4	-11	-11	-7	-3	-5	13	58	76	59	65	6	-33	-68	-100	-173	-214			
	N=	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	17	14	10	7	2			
		31	58	27	27	22	23	25	30	27	47	59	51	57	69	19	52	92	91	86	94	113	116	35			
3		-1	19	-1	7	18			-2	-4	32	26	19	-3	12	36	62	64	23	29	2	-4	-41	-239			
	N=	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	25	25	23	17	12	6	1			
		31	48	21	27	32	29	44	40	19	48	43	62	79	81	65	47	42	64	104	70	40	59				
4		106	156	41	4	6	8	4	-11	8	23	24	60	66	55	52	86	50	-5	-32	-56	-55	-79				
	N=	19	20	20	20	20	20	21	21	21	19	19	19	19	19	19	18	16	14	12	8	5	1				
		262	548	136	26	28	26	36	19	48	50	40	36	80	68	62	89	88	87	114	110	92	36				
5		3	-8	3	1	1	7	4	-13	-1	12	24	25	29	42	63	49	45	37	23	-14	-33	-124				
	N=	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	17	16	11	5	2				
		25	74	29	28	25	36	40	31	39	45	55	65	81	54	103	80	78	56	102	105	48	85				
6		3	6	-0	8	9	12	11	-8	-8	25	19	15	21	31	42	52	56	13	-40	-60	-69	-99				
	N=	20	20	20	20	20	20	21	21	21	21	21	21	21	21	21	21	20	20	19	16	8	1				
		17	43	27	25	21	22	38	20	30	46	41	64	64	65	49	76	93	95	113	102	78					
7		-2	16	6	2	14	4	6	7	7	11	-1	9	22	28	32	49	40	64	35	-27	-26	-189				
	N=	21	21	21	21	21	21	22	23	23	23	23	23	23	23	23	22	22	20	18	11	7	1				
		23	86	24	30	19	32	42	36	41	49	69	46	58	71	53	95	148	101	86	84	193					
8		-0	6	2	18	-4	-3	-6	-12	-16	3	12	28	22	46	43	51	66	39	17	-36	-77					
	N=	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	31	31	28	25	21	13					
		30	43	26	42	103	55	37	39	31	51	49	47	71	60	46	68	74	81	101	67	102					
9			-11	8	8	9	-1	-12	-5	6	12	5	17	33	14	16	22	56	61	23	-31	-104	-29				
	N=	33	33	33	33	33	33	33	33	33	33	33	33	33	32	32	32	32	31	30	22	12	1				
		25	137	26	43	25	31	28	31	39	40	43	47	72	51	56	57	75	75	71	90	64					
10		2	13		-0	2	-0	-1	-4	4	11	-5	-14	19	38	62	64	40	9	-5	12	-52	-51	-29	-69		
	N=	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	22	17	9	3	1		
		29	72	27	33	29	32	38	35	27	42	50	56	71	67	58	80	56	56	67	72	87	98	62			
11		9	-13	1	-2	2	8	-1	-4	2	-25	-8	13	43	21	28	6	23	27	31	23	9	15	-289			
	N=	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	11	9	9	4	1			
		25	70	36	39	23	29	23	28	65	31	43	46	54	75	41	53	41	54	51	61	94	36				
12		17	4	-5	7	9	3	8	5	2		-11	27	35	27	27	42	9	32	69	50	-21	-126	20			
	N=	22	22	22	22	22	22	22	22	22	22	22	22	22	22	21	20	20	18	18	18	12	4	3			
		23	53	33	29	26	32	54	55	67	78	88	87	107	118	87	81	112	127	99	74	104	61	64			

MONTHLY MEAN MERIDIONAL WIND, NUMBER OF OBSERVATIONS, AND STANDARD DEVIATIONS, 20 TO 70 KM, FOR ASCENSION

PERIOD OF RECORD 1/69 TO 12/71 LATITUDE -8 LONGITUDE 15 (M/SEC TIMES TEN)

MONTH/LEVEL					30KM					40KM					50KM					60KM					70KM
1	5	18	-3	-36	-10	2	-0	7	13	20	15	-14	-44	-75	-91	-92	-79	-57	9	35	42	50	-39	65	235	195
N=	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	28	28	27	26	17	11	6	3	2	2	2
	31	35	23	39	33	35	41	42	37	44	53	46	67	62	68	83	108	141	134	107	97	113	126	225	115	105
2	2	32	3	-22	-21	-6	-2		-0	3	18	16	-23	-38	-49	-69	-81	-58	-26	-10	-33	-93	-86	28	58	140
N=	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	27	27	23	19	11	7	4	4	4
	27	34	28	24	36	34	36	37	35	42	40	40	46	64	55	57	83	99	104	94	102	108	61	74	126	84
3	17	13	2	-25	-34	-19	7	1	15	-3	-13	13	28		-45	-68	-62	-60	-84	-156	-57	-21	-66	-239	-19	105
N=	21	21	21	21	21	21	21	21	21	21	21	20	20	20	20	20	19	16	12	6	5	5	3	2	2	2
	28	30	29	20	18	26	29	29	34	40	46	47	49	33	33	59	63	63	72	48	37	44	66	80	210	195
4	3	-0	7	-11	-21	-14	-5	29	30	4	6	32	31	1	-28	-26	-21	-3	20	41	-44	-139	-19	200	140	105
N=	22	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	22	21	14	8	2	1	1	2	2	2
	23	39	27	20	22	30	28	28	35	37	58	44	53	44	54	40	42	58	78	101	65			100	30	55
5	5		-8	-8	-17	-19	6	12	11	23	35	34	26	12	-1	-21	-36	-14	24	24	70	8	-112	-69	127	113
N=	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	22	21	16	5	5	3	3	3	3
	24	28	26	24	32	36	35	35	46	43	35	33	46	58	71	71	64	47	73	66	55	122	207	159	164	241
6	-2	1	-9	-12	-1	5	-9	-5	1	8	11	18	17	34	4	-18	-4	-21	-30	-15	-61	-199	-129	-89	-169	-99
N=	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	18	17	16	15	11	4	1	1	1	1	1
	23	23	20	20	21	42	34	38	31	41	39	57	61	61	73	65	79	73	79	61	82					
7	4	-1	-5	-14	-4	11	15	7	2	13	19	28	39	44	16	-22	-41	-29	-24	-15	36	96	74	167	188	70
N=	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	36	36	34	31	27	12	8	5	4	4	4
	23	27	26	22	24	32	32	32	35	37	54	61	59	68	78	69	68	84	98	121	98	64	85	83	108	83
8	14	9	-1	-22	-8	9	14	17	-0	3	19	30	36	31	8	-19	-30	-33	-11	17	61	97	172	320	-49	-219
N=	36	36	36	36	36	36	36	36	36	36	35	35	35	35	35	34	33	32	29	20	12	7	5	2	1	2
	48	40	44	27	26	33	35	32	40	53	59	58	79	74	62	68	74	66	80	108	137	196	214	120		200
9	9	17	1	-11	-22	-9	-0	10	-1	10	20	19	24	16	-10	-33	-49	-47	-26	14	37	26	2	3	-26	57
N=	34	34	34	34	34	34	34	34	34	34	34	34	34	34	33	33	33	33	32	28	22	10	6	4	3	3
	27	30	29	27	34	36	41	29	31	40	52	51	52	66	54	53	49	49	62	79	83	68	57	95	126	46
10	-1	1	6	-2	-20	-19	-10	-1	3	9	9	21	12	-13	-20	-27	-16	-20	-9	-4	-19	12	33	28	55	60
N=	34	34	34	35	35	35	35	35	35	35	35	35	34	34	33	33	31	29	23	15	6	5	4	4	4	4
	26	36	30	19	29	32	32	68	62	40	44	51	49	66	57	44	67	85	55	64	38	74	89	111	130	156
11	-2	-2	-3	6	-5	7	23	11	13	13	15	35	41	23		-12	-26	-30	-19	-14	300	-104	-67	55	32	67
N=	34	34	34	34	34	34	34	35	35	35	35	35	35	35	35	35	34	31	28	23	8	4	4	4	4	4
	28	31	31	103	71	79	84	86	72	81	54	163	234	235	242	248	272	279	274	293	1015	102	138	156	149	53
12	4	1	1	-25	-4	-6	-7	2	1	1	4	6	-7	-25	-39	-58	-71	-82	-81	-78	-58	-49	-57	-19	97	107
N=	27	27	27	27	27	27	27	27	27	27	27	27	26	26	26	26	26	26	23	21	12	6	4	3	3	3
	29	34	32	35	28	26	24	29	37	43	43	56	50	34	52	57	49	59	73	82	70	106	114	57	74	138