A COMPUTER PROGRAM TO ANAYLZE DIFFERENCES IN SIMULTANEOUS WIND SPEED AND DIRECTION MEASUREMENTS AT SEVERAL STATIONS

by

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A COMPUTER PROGRAM TO ANALYZE DIFFERENCES IN SIMULTANEOUS WIND SPEED AND DIRECTION MEASUREMENTS AT SERVAL STATIONS

INTRODUCTION

Every day thousands of meteorological observations are made across Canada and the United States for the purpose of calculating forest fire danger. Generally the instruments are located in open areas adjacent to an administrative office. This office may be a ranger station, a sawmill, an airport, a fire tower; in fact it may be any permanently manned structure involved in the administration or use of a forested area.

For the majority of meteorological observations such as temperature, rainfall and relative humidity it is not difficult to find a clearing of sufficient size so that the instruments are unaffected by adjacent obstructions. In the case of wind measurements, however, the influence of obstructions such as buildings and trees can be felt for a distance of several times the height of the obstruction on the downwind side. Hills and valleys can also greatly affect surface wind speed and direction. In predominately forested areas there are few sites available other than airports which are completely open for considerable distances in all directions. If nothing else, the office buildings themselves have some effect on wind speeds when they are upwind from the anemometer.

While anemometers are generally exposed in the largest space available, no two open areas are identical. As the size of the clearing becomes smaller wind speed in the clearing is also reduced. Furthermore, clearings are rarely perfectly round so that the reduction in velocity varies as the wind direction changes.

Aside from not having a sufficiently large clearing, many other problems with regard to anemometer exposure present themselves. When a number of independent organizations are providing weather observations for a central agency, it is not likely that mast heights will be uniform for all of the organizations, or possibly even within an organization. Furthermore, due to budget constraints aneometers are frequently mounted on the roofs of buildings, which causes a number of additional problems not associated with masts. On the other hand, an anemometer located at a fire tower which is on a high exposed site may have readings somewhat in excess of those measured at lower elevation airports.

All of these considerations and many others make it nearly impossible to define a standard exposure for anemometers which are used for fire danger rating purposes. Without a standard exposure, there is no way to compare wind observations at two different stations. Of greater importance with respect to fire control personnel is the fact that as wind speed increases, fire danger increases also. Furthermore, the increase in fire danger with increasing wind speed is exponential, (Simard, 1968 a,b) which means that the rate of increase is faster at high wind speeds than low. Therefore if two stations record different wind speeds they will have different fire dangers. For the purpose of calculating an area forest fire danger, it is necessary to know whether the differences in wind speed and hence fire danger at a number of stations are real or simply caused by variations in anemometer exposure.

DISCUSSION

In an effort to solve the above mentioned problem, the computer program "WIND" was developed to statistically compare wind observations at a number of different stations. The basic assumption is that airport winds are a valid measure of the overall surface winds. There are provisions, however, for comparing observations at up to five airports at one time.

In fact, ideally the airport observations should first be compared with geostrophic wind measurements at 2,000 to 5,000 ft. above the surface. This will determine whether or not measurements made at an individual airport are in fact representative of the general wind flow patterns. To do this, simply substitute the geostrophic winds for airport winds and airport winds for sheltered stations and follow the procedures described in this paper for comparing surface stations. This two step procedure will allow the comparsion of sheltered station winds with a true standard value.

Using the airport winds as a base, the program compares the wind speed and direction as measured at any number of non-airport stations. The average wind speed and wind speed ratios of the two stations are computed individually in eight directions. The standard deviation, standard error of the mean and significance of the difference between the average wind speeds at the two stations is also computed for each direction.

With the data provided by the program, one can adjust wind observations at the sheltered station so that they are comparable to the observations at the airport without the difficulties of attempting to determine the effect of the particular orientation of

the station or the clearing size. The measurement at the sheltered station is simply divided by the average ratio between the two. To adjust the airport winds to those measured at the sheltered station, one simply multiplies the ratio times the airport winds.

In practice, if there are a number of stations to be considered each day and little time available for computation, a simple table could be prepared for each station showing station wind measurements and adjusted values for each direction. Prior to preparation of the table, the significance of the difference between means should be examined to determine whether or not there is in fact an actual difference between wind speeds at the two stations in each direction. For example, in the sample problem considering Caribou and Bristol , the values of t which are presented on page 27 indicate that at the 95 per cent level of confidence no conclusion about the difference between the stations can be drawn when the winds blow from the Northeast (Samples 1 and 9), East (Samples 2 and 10), or North (Samples 8 and 16). Therefore there would be no reason to adjust winds from these three directions. It should be noted however that the difference from the Northeast is significant at about the 75 per cent level of confidence, and the small sample size (9 observations) warrants further analysis with additional data and consideration for inclusion in the adjustment table.

A second simplification can be achieved if the significance of the difference between the ratios in each direction is examined. Wherever the ratios are approximately equal, a number of directions could be placed in one class as long as there is no significant difference. For example, the six directions left (including Northeast) could be placed in three groups with negligible additional error. If they were placed in only two groups, the extreme wind speed ratios in each group would be significantly different. Thus, Northwest and Northeast could have the same adjustment, Southeast and West would be placed together, and finally South and Southwest would be placed in one group. This is illustrated in Figure 1.

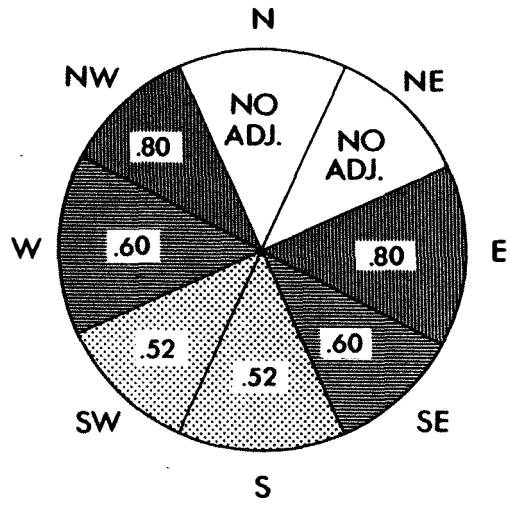

FIGURE 1. Diagram of Adjustment Factors for each Direction in the Sample Program.

It can be seen in Figure 1. that the greatest adjustment is required when winds blow from the South and Southwest, with the amount of adjustment gradually decreasing to zero when winds blow from the North and Northeast. Since the purpose of this paper is to discuss the application and use of the computer program, no attempt will be made to explain the reasons behind the wind speed ratio pattern which is illustrated in Figure 1.

In addition to the direct application for fire danger computations, the data provided by the program allows a number of questions to be answered with regard to wind measurements. For example: (1) Does the wind tend to blow harder from certain directions than others? Is this difference significant? (2) Do two stations have identical exposures? (3) How variable are the wind speeds? (4) Is there any significant shift in direction between the two stations?

The program also analyzes wind direction differences between two stations. The purpose of this is to determine whether or not there are statistically significant shifts in direction caused by the particular orientation of the sheltered station. The statistical output is the same as for wind speed. Looking again at Caribou and Bristol it can be seen in the 2nd table on page 29 that there is a marked tendency for East and Southeast winds to be shifted to the South at Bristol. North winds are shifted to the West. From the t values presented on page 29, it can be seen that in five directions (East, Southeast, West, Northwest, and North) the shift is significant at the 99 per cent level of confidence. The shift from Southwest is significant at the 95 per cent level of confidence. No conclusion can be drawn with respect to Northeast and South.

In conclusion, this program provides the basic data necessary for adjusting wind speeds from a number of stations to a standard value. This allows for the preparation of valid area fire danger forecasts. The data also enables two or more stations to be compared with each other to determine their similarities and differences with respect to wind speed and direction measurements.

USE OF THE PROGRAM

1. GENERAL

This program is written in Fortran IVG language and requires 96K of core storage.

The approximate execution time on the IBM 360-65 may be determined by the following formula:

$$T = .08(N-1)! + .08n + .02(N-1) + .07$$

Where:

T = Time in minutes

N = Number of open stations

n = Number of sheltered stations

As a rule of thumb, it requires about 0.1 minutes per comparsion. Note that all open stations are compared with each other - hence the need for a limit of five.

2. LOADING SEQUENCE AND INPUT DATA

Before the job is submitted, the data deck must be in the proper sequence. The data deck is made up of two sections. The first section can contain from one to five stations, each station containing up to 100 cards, with five observations of wind direction and speed on each card. All stations in this section are compared to each other, averaged, and the average compared to each station in the second section. If the first section contains only one station, then it is compared directly to each station in the second section. The second section, unlike the first, can contain any number of stations but again a maximum size of 100 cards per station is mandatory. The first card of each station must be a name card containing the name of the station or a blank card if names are not used.

Similarly, the first card of the data deck itself must be the data control card through which the user stipulates the restrictions he wishes to apply to the program. It is also of vital importance that the order of data for each station be correct. It is up to the user to ascertain that the proper data items of one station correspond to the data items of the other station. The function of the program is to match each pair of observations (one from each station) sequentially, i.e. the first observation of the first station vs. the first observation of the second station, the second observation of first station vs. the second observation of the second station, etc.

a) DATA CONTROL CARD

This must be the first card of the data deck. It is used to supply the system with the necessary information for processing the data.

Column	Description
1-7	Not required (could be used to name the card).
8-11	Card code number -- always 9999.
12-19	Not used.
20	The number of stations in the first section of the data deck. The number must not exceed five. If this column is blank or zero, it is assumed there is one station in this section.
21-23	The number of numerical data cards per station, excluding the station name card. Each station must contain the same number of data cards and this number must not exceed 100.
24-26	The angle of deviation of the direction -- can be 45°, 90° or 180°. If these columns are blank, the default option is 45°. Any pair of observations which have a difference in direction greater than the stipulated angle will be rejected for the wind speed analysis routine. Only zero directions are rejected for direction analysis.
27	Any character in this column will suppress the listing of 'Zero Direction and/or Speed'.
28	Any character in this column will suppress the listing of the wind speeds.
29	Any character in this column will suppress the listing of the wind direction classification.
30	When the second section of the data deck contains no stations, a character must be inserted in this column. If there are stations in the second section, this column must remain blank.
31-33	These columns must always be blank, as they are used by the program.
34-80	Not used.

b) STATION NAME CARD

This card contains the name of the station. It must appear in front of the numerical data cards for the station. In the case where no station name is required by the user, a blank card must be inserted in place of the name card.

Column	Description
1-30	Station name
31-80	Not used.

c) STATION AVERAGE NAME CARD

This card has the same format as the station name card. On it the user can supply a name for the computed average of the stations in the first section of the data deck or leave it blank if he does not wish to use a name. Regardless of whether or not a name has been used, this card must appear immediately following the last station in this section when there is at least one station in the second section. (For card format, see station name card.)

d) DATA CARDS

Columns	
1	Not used.
2-21	Five wind direction and speed observations, of four columns length each, according to the following format: 1st column - blank. 2nd column - wind direction (0-8). 3rd & 4th columns - wind speed (00-99)

A sample of the data would look like:

```
5 817 108 814 416 507
5 410 306 312 508 607
```

The 5 in column 1 was used to denote the month for convenience. A nine in the direction column causes the pair of observations to be rejected.

3. DESCRIPTION OF PROGRAM

The program is composed of a main program and eight subroutines: CALCU, AVRAGE, SETDIR, DEGREE, ZVALUE, SETUP, SDEV and TFRM. The following section briefly explains the function of each.

The main program reads all the data cards including the data control card. It checks these cards for errors and moves the data into storage, making it available for later use. This program also controls the sequence of operations. Depending upon the information on the data control card, the main program decides what procedures must be invoked in order to process the data.

Subroutine CALCU compares and analyzes the data according to the stipulations of the data control card. The selected observations are set up in two - eight column matricies; one matrix for wind direction and one for speed for each station.

Subroutine AVRAGE accumulates and averages the data of all the stations in the first section of the data deck and lists the average under the name supplied by the user on the 'station average name card'.

Subroutine SETDIR rearranges and prepares the wind direction arrays for processing by subroutines SDEV, DEGREE and ZVALUE respectively.

Subroutine SETUP rearranges the wind speed array formats for entry into subroutines SDEV and TFRM.

Subroutine SDEV calculates the standard deviation of both the wind direction and speed arrays using the following equation from Freund (1960):

(1)
$$\sigma = \sqrt{\frac{n \sum x_i^2 - (\sum x_i)^2}{n(n-1)}}$$

This subroutine also calculates the number of observations per sample, the sample mean value, and the standard error of the mean; the latter with equation (2).

(2)
$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Subroutine TFRM calculates the significance of the difference between the means of the wind speeds using the following equations from Freund (1960):

For $(n_1 + n_2)/2 > 30$

(3)
$$z = \frac{x_1 - \bar{x}_2}{\sqrt{\frac{(\sigma_1)^2}{n_1} + \frac{(\sigma_2)^2}{n_2}}}$$

For $(n_1 + n_2)/2 < 30$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1)(\sigma_1)^2 + (n_2 - 1)(\sigma_2)^2}{(n_1 + n_2) - 2}} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad (4)$$

Subroutine ZVALUE calculates the significance of the difference between the means of the wind directions. Using equations (3) and (4).

Subroutine DEGREE converts values of wind direction obtained from subroutine SDEV to degrees. The representation of this data in degrees makes the direction analysis more easily interpretable by the user.

4. ERROR INDICATORS AND MESSAGES

The program has built-in checks which list messages when certain errors occur in the station data or the data control card. The acutal error messages are self-explanatory and are produced when:

1) The data control card is missing or incorrectly specified.

2) The number of records per station is incorrect.

3) Erroneous reading of a data card.

4) Missing station name card.

5) Data overflow.

The majority of these errors cause an abnormal termination. The error must then be corrected and the job rerun.

5. OUTPUT AND PRECISION

Three of the output listings are optional:

1. Zero direction and/or speed,
2. Wind speed classification,
3. Wind direction classification.

Their listing can be suppressed by inserting any alphanumeric character in the proper column of the data control card.

a) Zero direction and/or speed listing.

The program disregards any pair of observations where one or more of the data items are missing. It also disregards zero wind directions and/or speeds. The zero values are listed, however, with the corresponding direction and speed of the other station.

b) Wind speed classification and ratios listing.

Wind speeds of both stations are listed, together with the speed ratios. The data from each of these stations are listed under the corresponding station name, and the ratios are listed under the title 'Wind Speed Ratios'. Each station, including the ratios, are listed in eight columns, each column being a particular direction.

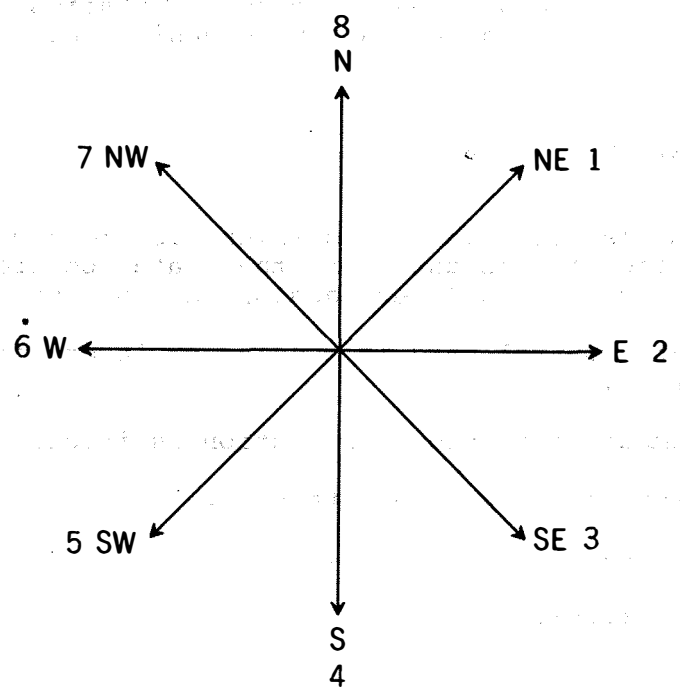

FIGURE 2. Diagram of Numerical Values Associated with each Wind Direction.

Also listed across the top of the page are the numbers 1 to 24 for easier reference to subsequent listings.

The choice of column in which to list the wind speeds and ratios is based on the directions of the observations at the secondary station. For example, if the direction of an observation of the secondary station were 2, then the wind speed of that station would be placed in column 2; similarly, the corresponding wind speed of the primary station and the ratio would be placed in column 2 of their respective tables, regardless of the direction at the primary station.

The ratio is calculated by dividing the wind speed of the primary station into the corresponding speed of the secondary station. The resulting ratio is then rounded to two decimal places. At the end of each list of wind speeds appears the numbers 99 or 99.00. These numbers are necessary for programming purposes and have no effect on the results.

c) Wind speed analysis listing.

Using the listing of the speeds described in section (b) above, the program now lists the number of observations per sample, the first observation of each sample, the sample mean value, the standard deviation and the standard error of the mean. The resulting values appear in double precision accuracy. The samples are numbered under Sample No. from 1 to 24.

d) The significance of the difference between the means listing.

The final analysis of the wind speeds is a computation of the significance of the difference between sample means. The numbers to the left of each equal sign are the sample numbers. The double precision number on the right is the significance of the difference between the means of these samples (value of t). All the samples are sequentially compared with each other.

e) Wind direction classification listing.

The directions, from 1 to 8, of the primary station in the comparison are listed across the top of the page. The directions of the other station are then listed under each corresponding direction of the first station. The name of the station whose 8 directions are listed across the top of the page appear to the right of these directions.

This is a reversal of the procedure used to determine the proper column for the speed analysis. In the wind speed analysis the object is to determine the ratio for the direction which prevails at the forestry station. In the present case, the object is to determine the shift in direction at the forestry station relative to the airport.

When a pair of wind directions are 180° apart, the shift is always assumed to be in a counterclockwise direction for winds blowing from Southwest through North. For winds blowing from Northeast through South, the shift is always assumed to be clockwise. This may introduce a slight bias since it is not possible to determine which way the winds are shifted. If, on the other hand, the direction of shift were alternated for each pair of observations which are 180° apart, the average of these adjusted values would indicate zero shift rather than 180°. Also, the standard deviation of the wind direction would be artificially increased. Since the number of pairs which are 180° apart will normally be a very small proportion of the total sample, this should not introduce any appreciable error.

Similar to the listing of the wind speeds, the number 99 appears at the end of each column. This signifies the end of the data for that column and has no bearing on any of the values listed. The directions listed in all but columns 4 and 5 have been adjusted to bring them numerically closer to the corresponding direction of the primary station listed across the top of the table, using the following procedure:

In column 1 the number 8 is subtracted from all directions greater than or equal to 6. In column 2, the number 8 is subtracted from directions greater than or equal to 7, and in column 3 from direction 8. In column 6 the number 8 is added to direction 1. In column 7 the number 8 is added to all directions less than or equal to 2, and in column 8, 8 is added to directions less than or equal to 3.

f) Analysis of the wind direction listing.

This listing is represented in the same format as the one described in Section (c) above. This is an analysis of the wind directions, also in double precision accuracy. Note that the first observation is the adjusted value which is listed in the first row of the wind direction classification listing (e) and not necessarily the actual value in the data itself.

g) Directions in degrees listing.

The results of Section (f) above are converted to degrees, by multiplying each of the values by 45. The values in degrees are then listed in the same format as (f), with the exception that the second column contains the average difference in degrees between the two stations.

h) Listing of the significance of the difference between the means of the directions. (value of t)

The sample numbers appear on the left of the equal sign and the difference between the means on the right. Double precision accuracy is used.

References

1. Freund, J.E., 1961, Modern Elementary Statistics, 2nd Ed., Prentice - Hall, Inc., Englewood Cliffs, N.J.

2. Simard, A.J., 1968a, Initial Report - Relative Spread Index F.F.R.I. Information Leaflet, April 1968

3. Simard, A.J., 1968b, Relative Spread Index, Progress Report No.2. F.F.R.I. Information Leaflet, July 1968

APPENDIX I PROGRAM LISTING

```
FORTRAN IV G LEVEL 1, MOD 0           MAIN

C**** THIS PROGRAM CLASSIFIES, COMPARES AND ANALYSES WIND DIRECTIONS AND
C**** SPEEDS OF TWO OR MORE STATIONS.
C****
C****
C****                        PROGRAMMED BY J. M. VALENZUELA
C****
C****
CCC1        DIMENSION WS(5),W(5,5CC),BLC(5),BLW(5),TITLE(5,15),CAVE(5CC),
           1WAVE(5CC)
CCC2        INTEGER DI(5),D(5,5CC)
C**** MAIN DATA CONTROL CARD READ AND CHECKED.
CCC3        READ(1,9,ERR=114) NCTL,NCP,NRCS,NANGLE,P1,P2,P3,EST,BLCI,BLWS
CCC4      9 FORMAT (7X,I4,8X,I1,2I3,5A1,A2)
CCC5        IF (NCTL.NE.9999)GO TO 114
CCC6        IF(NCP.GT.5.OR.NRCS.GT.1CC)GO TO 200
C**** NUMBER OF OBSERVATIONS PER STATION DETERMINED.
CCC7        II=5*NRCS
CCC8        WRITE(3,555) II,NCP
CCC9      555 FORMAT (1X,'II= ',I3,1CX,'NCP= ',I1)
CC1C        K=1
CC11        KF=C
CC12      333 IF(KF.EQ.1)GO TO 71
CC13        GO TO 88
C**** THE FOLLOWING FOUR STATEMENTS CHECK FOR:
C****                              1-CORRECT NUMBER OF OBSERVATIONS,
C****                              2-MORE THAN ONE OPEN STATION,
C****                              3-AN OPEN STATION HAS BEEN READ,
C****                              4-A SHELTERED STATION HAS BEEN READ.
CC14        4 IF(II.NE.I)GO TO 11C
CC15        IF(NCP.LE.1)GO TO (66,99),K
CC16        IF(KF.EQ.2)GO TO 99
CC17        IF(K.EQ.NCP)GO TO 5
CC18       66 K=K+1
CC19        GO TO 88
C**** FROM STATEMENT 71 TO 74 IS THE ROUTINE PERFORMED AFTER READING THE
C**** LAST OPEN STATION AND BEFORE READING THE FIRST SHELTERED STATION.
CC2C       71 KF=2
C**** WHEN ONLY OPEN STATIONS ARE USED THE FOLLOWING STATEMENT IS EXECUTED.
CC21        IF(EST.NE.BLCI)GO TO 5CC
CC22        K=2
CC23        CALL AVRAGE (D,K,KF,II,NCP,CAVE,WAVE)
C**** THE STATION NAME AND NUMBER IS READ.
CC24        READ (1,74,ERR=119,END=5CC) (TITLE(1,KL),KL=1,15)
CC25       74 FORMAT (15A2)
CC26       88 READ (1,74,ERR=119,END=5CC) (TITLE(K,KL),KL=1,15)
CC27        I=C
CC28        DO 10 L=1,NRCS
C**** THE STATION DATA IS READ, FIVE ITEMS PER RECORD.
```

```
      3 READ(1,2,ERR=7C,END=500) (BLD(J),BLW(J),J=1,5),(DI(N),WS(N),N=1,5)
      2 FORMAT (1X,5(1X,A1,A2),T3,5(I1,F2.0,1X))
C**** THE FOLLOWING ROUTINE, TO STATEMENT 10, STORES ALL DATA ITEMS INTO
C**** THEIR CORRESPONDING ARRAYS.
        DO 10 J=1,5
        IF(BLDI.EQ.BLD(J).OR.BLW(J).EQ.BLWS)GO TO 20
        IF(DI(J).GT.8)GO TO 30
   12   I=I+1
        D(K,I)  =DI(J)
        W(K,I)  =WS(J)
        GO TO 10
   30   I=I+1
        D(K,I)=-1
        W(K,I)=-1.0
   10   CONTINUE
        GO TO 4
C**** ALL THE OPEN STATIONS HAVING BEEN READ, KF IS SET TO 1.
    5   KF=1
C**** A CALL IS MADE TO SUBROUTINE AVRAGE TO ACCUMULATE ALL THE DIRECTIONS
C**** AND SPEEDS OF THE OPEN STATIONS.
        IF(FS1.NE.BLDI)GO TO 97
        CALL AVRAGE (D,W,KF,II,NOP,DAVE,WAVE)
   97   IF(NOP.GT.2)GO TO 98
   99   M=1
        N=2
        CALL CALCL (TITLE,D,W,II,NOP,KF,M,N,IK,NANGLE,BLDI,P1,P2,P3)
        IF(II.EQ.0)GO TO 300
        GO TO 333
C**** SUBROUTINE CALCL IS CALLED TO BEGIN THE COMPUTATION OF THE DATA.
   98   NM=NOP-1
        DO 60 M=1,NM
        MP=M+1
        DO 60 N=MP,NOP
        CALL CALCL (TITLE,D,W,II,NOP,KF,M,N,IK,NANGLE,BLDI,P1,P2,P3)
        IF(II.EQ.0)GO TO 300
   60   CONTINUE
        GO TO 333
C**** THE FOLLOWING ROUTINES ARE ERROR CHECKS.
   70   WRITE(3,11)
   11   FORMAT(25X,'READ ERROR')
        GO TO 500
  110   WRITE(3,111) (TITLE(K,KL),KL=1,15)
  111   FORMAT ('0CARDS UNEQUAL PER STATION'//,1X,'CURRENT STATION IS ',
       115A2)
        GO TO 500
  114   WRITE(3,116)
  116   FORMAT (1X,'$$$$$THERE IS AN ERROR IN THE SUPERVISING CONTROL CARD
       1IN FRONT OF THE DATA DECK$$$$$')
        GO TO 500
  300   WRITE(3,117)
  117   FORMAT (25X,'DATA OVERFLOW')
        GO TO 500
  113   WRITE (3,118)
  118   FORMAT (25X,'ERROR IN STATION NAME CARD')
        GO TO 500
  200   WRITE(3,201)
  201   FORMAT (25X,'THE MAXIMUM NUMBER OF STATIONS IN THE FIRST SECTION A
       1ND/OR'/'CARDS PER STATION HAS BEEN EXCEEDED ON THE DATA CONTROL CA
       2RD.'/////20X,'$$$$$AN ABNORMAL TERMINATION HAS RESULTED$$$$$')
  500   CALL EXIT
        END
```

```
FORTRAN IV G LEVEL 1, MOD 0            CALCL

0001            SUBROUTINE CALCL (TITLE,D,W,II,NOB,KF,M,N,IK,NANGLE,BLDI,P1,P2,P3)
              C**** THIS SUBROUTINE CLASSIFIES THE WIND SPEEDS AND DIRECTIONS IN THEIR
              C**** CORRESPONDING ARRAYS AND CALLS UPON OTHER SUBROUTINES FOR FURTHER
              C**** COMPUTATIONS.
              C****
              C****
0002            REAL RT(300,8),TITLE(5,15),W(5,500)
0003            INTEGER DIR(300,8),        IN(8),JN(8),D(5,500),  FW(300,8),DW(30
               10,8),A
0004          222 IK=0
0005              KJ=0
0006              IP=0
0007              DO 112 MM=1,300
0008              DO 112 LL=1,8
0009              DIR(MM,LL)=99
0010              FW(MM,LL)=99
0011              DW(MM,LL)=99
0012              RT(MM,LL)=99.0
0013          112 CONTINUE
0014              DO 60 JJ=1,8
0015              IN(JJ)=0
0016              JN(JJ)=0
0017           60 CONTINUE
0018           99 DO 20 L=1,II
              C**** CHECKS FOR ZEROS OR BLANKS IN EITHER WIND DIRECTION AND/OR SPEED.
0019           73 IF(D(M,L).EQ.-1.OR.D(N,L).EQ.-1)GO TO 20
0020              IF(W(M,L).EQ.-1.0.OR.W(N,L).EQ.-1.0)GO TO 20
0021              IF(D(M,L).EQ.0.OR.D(N,L).EQ.0)GO TO 25
0022              IF(W(M,L).EQ.0.0.OR.W(N,L).EQ.0.0)GO TO 25
              C**** THE FOLLOWING ROUTINE, TO STATEMENT 65, ALLOCATES ALL SHELTERED
              C**** DIRECTIONS UNDER THE CORRESPONDING OPEN DIRECTIONS. THE ROUTINE
              C**** ALSO BRINGS THE SHELTERED DIRECTIONS NUMERICALLY CLOSER TO THE
              C**** OPEN DIRECTIONS.
0023              KK=D(M,L)
0024              JN(KK)=JN(KK)+1
0025              KJ=JN(KK)
0026              IF(KK.LT.4.OR.KK.GT.5)GO TO 61
0027           63 DIR(KJ,KK)=D(N,L)
0028              GO TO 26
0029           61 IF(KK.GE.6)GO TO 62
0030              IF(D(N,L) .GE.(KK+5))GO TO 64
0031              GO TO 63
0032           64 DIR(KJ,KK)=D(N,L)-8
0033              GO TO 26
0034           62 IF(D(N,L).LE.(KK-5))GO TO 65
0035              GO TO 63
0036           65 DIR(KJ,KK)=D(N,L)+8
              C**** THE FOLLOWING ROUTINE COMPARES THE WIND SPEEDS AND CALCULATES THE
              C**** RATIOS LISTING EVERYTHING UNDER THE CORRESPONDING SHELTERED DIRECTION.
0037           26 A=D(M,L)-D(N,L)
0038              IF (A)13,15,14
0039           13 A=-A
0040           14 IF(A.EQ.1)GO TO 15
0041              IF(NANGLE-90)75,76,15
0042           76 IF(A.EQ.2)GO TO 15
0043              IF(A.EQ.6)GO TO 15
0044           75 IF(A.NE.7)GO TO 20
0045           15 KD= D(N,L)
```

```
0046              IN(KD)=IN(KD)+1
0047              IA=IN(KD)
0048              EW(IA,KD)=W(M,L)
0049              CW(IA,KD)=W(M,L)
                C**** CALCULATION OF RATIO.
0050              RT(IA,KD)=((W(M,L)  /W(M,L)   +0.005))
0051              GO TO 20
                C**** ZERO DIRECTION AND/OR SPEED IS LISTED.
0052             25 IF(BLDI.NE.B1)GO TO 20
0053                IF(IK.GT.0)GO TO 23
0054                WRITE(3,24) (TITLE(M,J),J=1,15),(TITLE(M,J),J=1,15)
0055             24 FORMAT ('1ZERO DIRECTION AND/OR SPEED'//,1X,15A2,10X,15A2/
                   1,6X,'D  MPH',35X,'D  MPH')
0056                IK=1
0057             23 WRITE (3,21)  D(M,L),W(M,L),D(M,L),W(M,L)
0058             21 FORMAT (6X,I1,1X,F4.0,35X,I1,1X,F4.0)
0059             20 CONTINUE
0060                IF(BLDI.NE.B2)GO TO 120
                C**** SPEEDS AND RATIOS ARE LISTED.
0061              7 WRITE(3,31) (TITLE(M,J),J=1,15),(TITLE(M,J),J=1,15)
0062             31 FORMAT ('1',11X,15A2,4X,15A2,13X,'WIND SPEED RATIOS'//)
0063                WRITE(3,32) (J,J=1,8),(J1,J1=1,8),(J2,J2=1,8)
0064             32 FORMAT (2(5X,8(2X,I1,1X)),5X,8(3X,I1,2X)/)
0065                WRITE(3,33) (J3,J3=1,24)
0066             33 FORMAT (2(5X,8(1X,I2,1X)),5X,8(2X,I2,2X)//)
0067             41 IB=IB+1
0068                IF(IB.GT.II)GO TO 301
0069                KN=0
                C**** CHECK FOR THE FINAL PRINT-LINE OF THE LISTING.
0070                DO 50 J=1,8
0071                IF(EW(IB,J).EQ.99)KN=KN+1
0072                IF(CW(IB,J).EQ.99)KN=KN+1
0073                IF(RT(IB,J).EQ.99.0)KN=KN+1
0074             50 CONTINUE
0075                WRITE(3,8) (EW(IB,J),J=1,8),(CW(IB,J1),J1=1,8),(RT(IB,J2),J2=1,8)
0076              8 FORMAT (2(5X,8(I3,1X)),6X,8(F5.2,1X))
0077                IF(KN.LT.24)GO TO 41
0078            120 CALL SETUP(EW,CW,RT)
0079                IF(BLDI.NE.B2)GO TO 300
0080                WRITE(3,34) (J,J=1,8),(TITLE(M,J),J=1,15)
0081             34 FORMAT  ('1',45X,'CLASSIFICATION OF DIRECTIONS'//42X,8(2X,I2,1X),1
                   10X,15A2//)
0082            100 DO 43 L=1,150
0083                KN=0
0084                DO 42 J=1,8
0085                IF(DIR(L,J).EQ.99)KN=KN+1
0086             42 CONTINUE
                C**** SPECIFIED DIRECTIONS ARE CLASSIFIED AND LISTED UNDER THE CORRESPONDING
                C**** OPEN DIRECTION.
0087                WRITE(3,35) (DIR(L,J),J=1,8)
0088             35 FORMAT (42X,8(2X,I2,1X))
0089                IF(KN.GE.8)GO TO 300
0090             43 CONTINUE
0091            300 CALL SETDIR (DIR,TITLE,M,N)
0092                GO TO 302
0093            301 II=0
0094            302 CONTINUE
0095                RETURN
0096                END
```

```
FORTRAN IV G LEVEL 1, MOD C              AVRAGE

0001                  SUBROUTINE AVRAGE (D,W,KF,II,NOP,DAVE,WAVE)
                C**** THIS SUBROUTINE COMPUTES THE AVERAGE OF THE OPEN STATIONS USED AND
                C**** MAKES THE RESULTS AVAILABLE FOR COMPARISON WITH THE FORESTRY STATIONS.
                C****
                C****
0002                  INTEGER D(5,500)
0003                  REAL     W(5,500),DAVE(500),WAVE(500)
0004                  OP=NOP
                C**** WHEN KF=2 ALL THE VALUES FOR THE OPEN STATIONS HAVE BEEN ACCUMULATED
                C**** AND THE AVERAGE IS NOW TO BE COMPUTED.
0005                  IF(KF.EQ.2)GO TO 2
0006                  DO 5 J=1,500
0007                  DAVE(J)=0.0
0008                  WAVE(J)=0.0
0009                5 CONTINUE
                C**** WIND DIRECTIONS AND SPEEDS ARE ACCUMULATED.
0010                  DO 10 K=1,NOP
0011                  DO 10 L=1,II
0012                  IF(D(K,L).EQ.-1.OR.W(K,L).EQ.-1.0)GO TO 10
0013                  DAVE(L)=DAVE(L)+D(K,L)
0014                  WAVE(L)=WAVE(L)+W(K,L)
0015               10 CONTINUE
0016                  RETURN
                C**** THE AVERAGE IS COMPUTED.
0017                2 DO 20 L=1,II
0018                  IF(DAVE(L).LE.0.0.OR.WAVE(L).LE.0.0)GO TO 3
0019                  D(1,L)=DAVE(L)/OP+0.5
0020                  W(1,L)=WAVE(L)/OP+0.5
0021                  GO TO 20
0022                3 D(1,L)=-1
0023                  W(1,L)=-1.0
0024               20 CONTINUE
0025                  RETURN
0026                  END


FORTRAN IV G LEVEL 1, MOD C              SETDIR

0001                  SUBROUTINE SETDIR (DIR,TITLE,M1,N1)
                C**** THIS SUBROUTINE MAKES WIND DIRECTIONS AVAILABLE FOR USE BY
                C**** SUBROUTINES SDEV, DEGREE AND ZVALUE.
                C****
                C****
0002                  DIMENSION TITLE(5,15)
0003                  INTEGER DIR(300,8),NE(30)
0004                  DOUBLE PRECISION X(30),XM(30),STD(30),STE(30),SC(30),SX(30),SXS(30
                     1),FX(30),Z(30),TM
0005                  TM=99.0
0006                  I=0
0007                  K1=0
0008                  IM=1
0009                  IN=1
0010                  N=8
0011                2 L=0
0012                  I=I+1
0013                  DO 1 K=1,N
0014                  X(K)=DIR(I,K)
0015                  IF(X(K).EQ.99.0)L=L+1
0016                1 CONTINUE
0017                  CALL SDEV(X,K1,IM,N,TM,STD,XM,STE,SC,SX,SXS,FX,NE)
0018                  IF(L.GE.8)GO TO 3
0019                  GO TO 2
0020                3 IM=2
0021                  CALL SDEV(X,K1,IM,N,TM,STD,XM,STE,SC,SX,SXS,FX,NE)
0022                  CALL DEGREE  (N,XM,STD,STE,TITLE,M1,N1)
0023                  CALL ZVALUE  (N,SC,XM,STD,Z)
0024                  RETURN
0025                  END
```

```
FORTRAN IV G LEVEL 1, MOD 0            SETUP

0001                SUBROUTINE SETUP (FW,OW,RT)
                C**** THIS SUBROUTINE MAKES WIND SPEEDS AVAILABLE FOR USE BY SUBROUTINES
                C**** SDEV AND TERM.
                C****
                C****
0002                DOUBLE PRECISION X(30),XM(30),STD(30),STE(30),SC(30),SX(30),SXS(30
               1),FX(30),V(30),TN
0003                INTEGER FW(300,8),OW(300,8),NE(30)
0004                REAL RT(300,8)
0005                TN=99.0
0006                KT=0
0007                IM=1
0008                IN=1
0009                NT=0
0010                N=24
0011                J=0
0012             25 J=J+1
0013                J1=0
0014                J2=0
0015                J3=0
0016                L=0
0017                DO 99 K=1,N
0018                IF (K.GE.9.AND.K.LE.16)GO TO 97
0019                IF (K.GE.17)GO TO 98
0020                J1=J1+1
0021                X(K)=FW(J,J1)
0022                GO TO 96
0023             97 J2=J2+1
0024                X(K)=OW(J,J2)
0025                GO TO 96
0026             98 J3=J3+1
0027                X(K)=RT(J,J3)
0028             96 IF(X(K).EQ.99.0)L=L+1
0029                IF(X(K).GT.0.0)GO TO 99
0030                WRITE(3,1) J
0031              1 FORMAT (1X,'X(K) HAS COME UP WITH A VALUE OF ZERO. THE VALUE OF
               1J=',I2)
0032                NT=NT+1
0033                IF (NT.EQ.20)GO TO 32
0034             99 CONTINUE
0035                CALL SDEV(X,KT,IN,N,TN,STD,XM,STE,SC,SX,SXS,FX,NE)
0036                IF(L.GE.24)GO TO 150
0037                GO TO 25
0038            150 IN=2
0039                CALL SDEV(X,KT,IN,N,TN,STD,XM,STE,SC,SX,SXS,FX,NE)
0040                CALL TERM(N,SC,XM,STD,V,IM)
0041             32 CONTINUE
0042                RETURN
0043                END
```

```
FORTRAN IV G LEVEL 1, MOD 0             SDEV

0001                SUBROUTINE SDEV(X,KT,IN,N,TN,STD,XM,STE,SC,SX,SXS,FX,NE)
                C**** THIS SUBROUTINE CALCULATES THE SAMPLE MEAN VALUE, STANDARD DEVIATION
                C**** AND STANDARD ERROR OF THE MEAN.
                C****
                C****
0002                DOUBLE PRECISION X(30),XM(30),STD(30),STE(30),SC(30),SX(30),SXS(30
                   1),FX(30),TN
0003                INTEGER NE(30),KN(30)
0004                  1 FORMAT('1SAMPLE NO.',4X,'NO. OF OBSERVATIONS',5X,'FIRST OBSERVATIO
                   1N',5X,'SAMPLE MEAN VALUE',5X,'STANDARD DEVIATION',3X,'STANDARD ERR
                   2OR OF MEAN'//)
0005                  2 FORMAT(4X,I4,14X,I5,6X,4(7X,D15.8)/)
                C**** KT IS USED TO INDICATE THE SIZE OF EACH ARRAY.
0006                KT=KT+1
                C**** THE PAGE HEADING IS WRITTEN.
0007                IF(KT.EQ.1)WRITE(3,1)
0008                DO 200 K=1,N
0009                IF(IN.EQ.2)GO TO 40
0010                IF(KT.GT.1)GO TO 20
                C**** THE FIRST OBSERVATION OF EACH ARRAY IS STORED AND THE ARRAYS USED
                C**** FOR ACCUMULATION ARE CLEARED.
0011                FX(K)=X(K)
0012                SX(K)=0.0
0013                SXS(K)=0.0
                C**** NE IS AN INDICATOR USED TO SIGNIFY THE END OF THE PARTICULAR ARRAY
                C**** IT IS ASSOCIATED WITH.
0014                NE(K)=0
0015              20 IF(NE(K).EQ.1)GO TO 200
0016                IF(X(K).NE.TN)GO TO 30
0017                SC(K)=KT-1
0018                NE(K)=1
0019                GO TO 200
                C**** ACCUMULATION OF EACH ARRAY.
0020              30 SX(K)=SX(K)+X(K)
0021                SXS(K)=SXS(K)+X(K)**2
0022                GO TO 200
0023              40 IF(SX(K).EQ.0.0.OR.SXS(K).EQ.0.0)GO TO 41
0024                IF(SC(K).GT.1.0)GO TO 43
0025                KN(K)=1
0026                GO TO 44
                C**** CALCULATION OF THE MEAN.
0027              43 XM(K)=SX(K)/SC(K)
                C**** CALCULATION OF THE STANDARD DEVIATION.
0028                STD(K)=DSQRT((SC(K)*SXS(K)-SX(K)**2)/(SC(K)*(SC(K)-1.0)))
                C**** CALCULATION OF THE STANDARD ERROR OF THE MEAN.
0029                STE(K)=STD(K)/DSQRT(SC(K))
0030                KN(K)=SC(K)
0031                GO TO 42
0032              41 KN(K)=0
0033              44 XM(K)=0.0
0034                STD(K)=0.0
0035                STE(K)=0.0
0036              42 WRITE(3,2) K,KN(K),FX(K),XM(K),STD(K),STE(K)
0037             200 CONTINUE
0038                RETURN
0039                END
```

```
FORTRAN IV G LEVEL 1, MOD 0            TFRM

 0001               SUBROUTINE TFRM(N,SC,XM,STD,V,IM)
                   C**** THIS SUBROUTINE CALCULATES THE SIGNIFICANCE OF THE DIFFERENCE
                   C**** BETWEEN THE MEANS.
                   C****
                   C****
 0002                 DOUBLE PRECISION SC(30),XM(30),STD(30),V(30),A,B,C,D
 0003                1 FORMAT('1',47X,'SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS'//)
 0004                2 FORMAT(5(1X,2I3,1X,'=',1X,D16.8))
 0005                  WRITE(3,1)
 0006                  M=N-1
 0007                  DO13 K=1,M
 0008                  I=K+1
 0009                  DO100 J=I,N
 0010                  IF(SC(K).GT.1.0.AND.SC(J).GT.1.0)GO TO 9
 0011                  V(J)=0.0
 0012                  GO TO 100
 0013                9 IF(IM-2)10,11,12
 0014               10 A=(SC(K)+SC(J))/2.0
 0015                  IF(A.LE.30.)GO TO 12
 0016               11 V(J)=(XM(K)-XM(J))/DSQRT(STD(K)**2/SC(K)+STD(J)**2/SC(J))
 0017                  GO TO 100
 0018               12 B=XM(K)-XM(J)
 0019                  C=((SC(K)-1.0)*STD(K)**2+(SC(J)-1.0)*STD(J)**2)/(SC(K)+SC(J)-2.0)
 0020                  D=1.C/SC(K)+1.0/SC(J)
 0021                  V(J)=B/(DSQRT(C)*DSQRT(D))
 0022              100 CONTINUE
 0023               13 WRITE(3,2)(K,J,V(J),J=I,N)
 0024              200 CONTINUE
 0025                  RETURN
 0026                  END
```

```
FORTRAN IV G LEVEL 1, MOD 0            ZVALUE

 0001               SUBROUTINE ZVALUE (N,SC,XM,STD,Z)
                   C**** THIS SUBROUTINE CALCULATES THE SIGNIFICANCE OF THE DIFFERENCE
                   C**** BETWEEN THE MEANS OF THE DIRECTIONS.
                   C****
                   C****
 0002                 DOUBLE PRECISION SC(30),XM(30),STD(30),Z(30),A
 0003                  WRITE (3,1)
 0004                1 FORMAT('1',10X,'SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS'/
                     126X,'DIRECTIONS'//,15X'SAMPLE NO.'//)
 0005                  DO 20 J=1,N
 0006                  A=J
 0007                  IF(STD(J).EQ.0.0)GO TO 3
 0008                  IF(SC(J).LE.0.0)GO TO 3
 0009                  Z(J)=(A-XM(J))/(DSQRT(STD(J)**2/SC(J)))
 0010                  GO TO 20
 0011                3 Z(J)=0.0
 0012               20 CONTINUE
 0013               10 WRITE(3,2)   (J,Z(J),J=1,N)
 0014                2 FORMAT(20X,I3,' = ',D16.8)
 0015                  RETURN
 0016                  END
```

```
FORTRAN IV G LEVEL 1, MOD 0             DEGREE

0001            SUBROUTINE DEGREE  (N,XM,STD,STE,TITLE,M1,M1)
                C**** THIS SUBROUTINE CONVERTS THE RESULTS OF THE DIRECTION ANALYSIS
                C**** PERFORMED BY SDEV TO DEGREES, FOR MORE MEANINGFUL RESULTS.
                C****
                C****
0002            DIMENSION TITLE(5,15)
0003            DOUBLE PRECISION        XM(30),STD(30),STE(30)
0004            NANGLE=45
0005            WRITE(3,3) NANGLE,(TITLE(M1,K),K=1,15),(TITLE(M1,K),K=1,15)
0006          3 FORMAT (/////50X,'DIRECTION ANALYSIS IN DEGREES (',I3,')'//1X,
               1'SAMPLE NO.',32X,'DIFFERENCE',8X,'SAMPLE MEAN VALUE',5X,'STANDARD
               2DEVIATION',3X,'STANDARD ERROR OF MEAN'/1X,15A2,39X,15A2//)
0007            DO 2 J=1,N
0008            X=XM(J)
0009            S=STD(J)
0010            ST=STE(J)
0011            IF(X.EQ.0.0)F=0.0
0012            ANGLE=NANGLE
0013            A=J
0014            IF(X.EQ.0.0)GO TO 4
0015            F=(X-A)*ANGLE+0.05
0016            X=X*ANGLE+0.05
0017          4 IF(S.EQ.0.0)GO TO 5
0018            S=S*ANGLE+0.05
0019          5 IF(ST.EQ.0.0)GO TO 6
0020            ST=ST*ANGLE+0.05
0021          6 JA=J*NANGLE
0022            WRITE(3,1)JA,F,X,S,ST
0023          1 FORMAT (4X,I4,25X,4(10X,F8.1,4X)/)
0024          2 CONTINUE
0025            END
```

APPENDIX II
SAMPLE PROBLEM

It is desired to run a wind direction and speed analysis of four stations: 1 - Caribou, 2 - Bristol, 3 - Plaster Rock, 4 - Houlton.

Stations (1) and (2) are to be compared to each other before being averaged and the average compared to stations (3) and (4) individually. Stations (1) and (2) must therefore be placed in the first section of the data deck followed by a 'station average name card' and station (3) and (4). There are 99 cards per station and the angle to be used is 45°. The data control card can now be made up and inserted in front of station (1), as in figure 3.

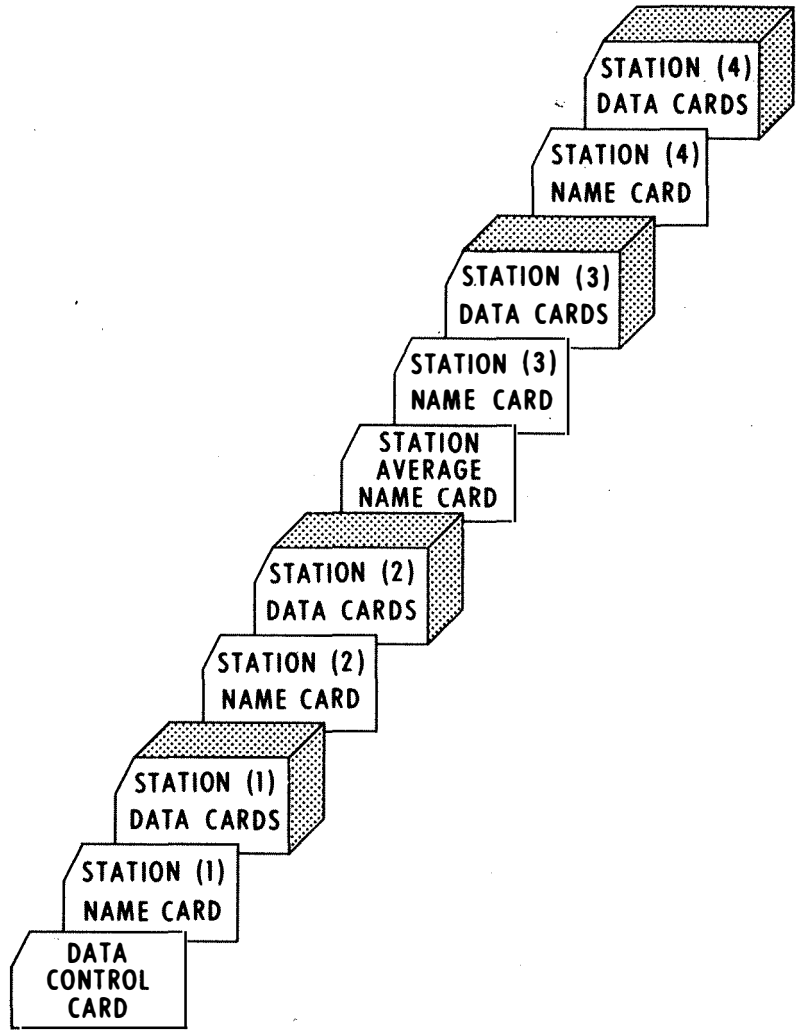

FIGURE 3. Card Sequence for Wind Analysis Program.

ZERO DIRECTION AND/OR SPEED

STATION	CABLE 0	STATION	BRISTOL
	MPH	0	MPH
1	7.	0	0.0
0	0.0	4	2.
0	0.0	5	2.
0	0.0	2	1?.
5	6.	0	0.0
0	0.0	0	0.0
0	0.0	5	1.
5	8.	0	0.0
0	0.0	5	2.
0	0.0	4	4.
0	0.0	7	2.
0	0.0	4	4.
0	0.0	6	5.
0	0.0	4	2.
0	0.0	6	2.
2	6.	0	0.0
0	0.0	4	2.
4	7.	0	0.0
0	0.0	5	7.
0	0.0	6	7.
0	0.0	7	8.

STATION CARIBOU								STATION BRISTOL								WIND SPEED RATIOS							
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
8	4	7	7	15	17	15	19	4	2	2	4	3	15	15	12	0.50	0.50	0.29	0.58	0.20	0.89	1.00	0.64
12	5	8	9	10	22	8	12	7	3	2	2	10	20	7	15	0.59	0.60	0.25	0.23	1.00	0.91	0.88	1.25
23	8	10	13	13	16	5	5	12	15	8	10	4	11	4	4	0.53	1.88	0.80	0.77	0.31	0.69	0.80	0.80
11	14	6	15	19	14	18	19	16	15	2	7	5	8	9	12	1.46	1.08	0.34	0.47	0.27	0.58	0.50	0.64
18	4	6	14	15	11	10	15	12	4	7	4	5	2	4	12	0.67	1.00	1.17	0.29	0.34	0.19	0.40	0.80
8	5	7	6	20	10	5	8	2	9	4	2	3	2	4	8	0.25	1.80	0.58	0.34	0.15	0.20	0.80	1.00
18	99	10	10	9	18	19	10	13	99	3	4	2	4	8	10	0.73	99.00	0.30	0.40	0.23	0.23	0.43	1.00
10	99	9	20	8	10	12	7	9	99	8	8	1	8	12	4	0.90	99.00	0.89	0.40	0.13	0.80	1.00	0.58
6	99	10	21	15	12	5	14	8	99	5	12	3	4	4	12	1.34	99.00	0.50	0.58	0.20	0.34	0.80	0.86
99	99	11	8	14	11	25	8	99	99	8	8	6	3	12	4	99.00	99.00	0.73	1.00	0.43	0.28	0.48	0.50
99	99	9	9	16	4	9	14	99	99	12	4	4	2	18	15	99.00	99.00	1.34	0.45	0.25	0.50	2.00	1.08
99	99	9	5	5	25	16	18	99	99	3	6	3	17	8	9	99.00	99.00	0.34	1.20	0.60	0.68	0.50	0.50
99	99	10	10	11	20	10	14	99	99	4	2	4	4	8	14	99.00	99.00	0.40	0.20	0.37	0.20	0.80	1.00
99	99	10	10	8	10	12	18	99	99	1	1	3	5	10	15	99.00	99.00	0.10	0.10	0.38	0.50	0.84	0.84
99	99	7	10	13	13	22	7	99	99	4	1	4	4	10	12	99.00	99.00	0.58	0.10	0.31	0.31	0.46	1.72
99	99	3	8	17	5	16	4	99	99	4	3	8	4	10	5	99.00	99.00	1.34	0.38	0.48	0.80	0.63	1.25
99	99	13	8	12	14	10	20	99	99	4	5	8	5	4	20	99.00	99.00	0.31	0.63	0.67	0.36	0.40	1.00
99	99	6	3	3	12	18	10	99	99	1	3	5	17	12	8	99.00	99.00	0.17	1.00	1.67	1.42	0.67	0.80
99	99	7	6	12	11	9	13	99	99	2	5	5	4	7	4	99.00	99.00	0.29	0.84	0.42	0.37	0.78	0.31
99	99	15	12	8	4	7	12	99	99	8	12	8	2	3	9	99.00	99.00	0.54	1.00	1.00	0.50	0.43	0.75
99	99	12	9	12	12	16	9	99	99	3	1	9	10	11	17	99.00	99.00	0.25	0.12	0.75	0.84	0.69	1.89
99	99	7	11	8	6	5	11	99	99	7	2	3	2	11	10	99.00	99.00	1.00	0.19	0.38	0.34	2.20	0.91
99	99	99	12	11	10	20	5	99	99	99	4	4	7	25	15	99.00	99.00	99.00	0.34	0.37	0.70	1.25	3.00
99	99	99	8	12	20	19	12	99	99	99	4	3	12	15	15	99.00	99.00	99.00	0.50	0.25	0.60	0.79	1.25
99	99	99	7	10	18	14	9	99	99	99	2	8	10	9	7	99.00	99.00	99.00	0.29	0.80	0.56	0.65	0.78
99	99	99	7	22	9	6	99	99	99	99	3	4	5	5	99	99.00	99.00	99.00	0.43	0.19	0.56	0.84	99.00
99	99	99	8	19	18	20	99	99	99	99	2	12	12	8	99	99.00	99.00	99.00	0.25	0.64	0.67	0.40	99.00
99	99	99	9	4	24	9	99	99	99	99	5	8	17	8	99	99.00	99.00	99.00	0.56	2.00	0.71	0.89	99.00
99	99	99	18	8	9	21	99	99	99	99	8	2	11	12	99	99.00	99.00	99.00	0.45	0.25	1.23	0.58	99.00
99	99	99	8	11	8	8	99	99	99	99	5	5	7	7	99	99.00	99.00	99.00	0.63	0.46	0.88	0.88	99.00
99	99	99	16	7	16	8	99	99	99	99	3	4	3	5	99	99.00	99.00	99.00	0.19	0.58	0.19	0.63	99.00
99	99	99	8	6	3	17	99	99	99	99	3	5	4	12	99	99.00	99.00	99.00	0.38	0.84	1.34	0.71	99.00
99	99	99	7	11	8	10	99	99	99	99	1	6	5	10	99	99.00	99.00	99.00	0.15	0.55	0.63	1.00	99.00
99	99	99	4	8	6	17	99	99	99	99	2	3	3	8	99	99.00	99.00	99.00	0.50	0.38	0.50	0.48	99.00

99	99	99	25	5	9	11	99	99	99	99	10	3	7	7	99	99.00	99.00	99.00	0.40	0.60	0.78	0.64	99.00
99	99	99	7	14	8	12	99	99	99	99	4	8	4	15	99	99.00	99.00	99.00	0.58	0.58	0.50	1.25	99.00
99	99	99	15	9	4	10	99	99	99	99	4	3	2	10	99	99.00	99.00	99.00	0.27	0.34	0.50	1.00	99.00
99	99	99	6	14	11	20	99	99	99	99	3	4	4	7	99	99.00	99.00	99.00	0.50	0.29	0.37	0.35	99.00
99	99	99	10	10	4	24	99	99	99	99	4	2	3	12	99	99.00	99.00	99.00	0.40	0.20	0.75	0.50	99.00
99	99	99	8	4	12	15	99	99	99	99	3	4	4	15	99	99.00	99.00	99.00	0.38	1.00	0.34	1.00	99.00
99	99	99	12	14	11	12	99	99	99	99	7	4	5	4	99	99.00	99.00	99.00	0.59	0.29	0.46	0.34	99.00
99	99	99	16	18	10	10	99	99	99	99	7	4	4	15	99	99.00	99.00	99.00	0.44	0.23	0.40	1.50	99.00
99	99	99	6	5	17	8	99	99	99	99	8	1	4	3	99	99.00	99.00	99.00	1.34	0.20	0.24	0.38	99.00
99	99	99	13	9	8	13	99	99	99	99	6	4	10	8	99	99.00	99.00	99.00	0.47	0.45	1.25	0.62	99.00
99	99	99	7	10	7	7	99	99	99	99	2	4	2	15	99	99.00	99.00	99.00	0.29	0.40	0.29	2.15	99.00
99	99	99	8	3	3	15	99	99	99	99	2	4	1	6	99	99.00	99.00	99.00	0.25	1.34	0.34	0.40	99.00
99	99	99	17	10	8	15	99	99	99	99	8	2	4	7	99	99.00	99.00	99.00	0.48	0.20	0.50	0.47	99.00
99	99	99	15	7	5	7	99	99	99	99	15	1	4	13	99	99.00	99.00	99.00	1.00	0.15	0.80	1.86	99.00
99	99	99	11	14	6	11	99	99	99	99	7	4	4	12	99	99.00	99.00	99.00	0.64	0.29	0.67	1.10	99.00
99	99	99	14	13	12	10	99	99	99	99	5	3	7	7	99	99.00	99.00	99.00	0.36	0.24	0.59	0.70	99.00
99	99	99	10	4	4	13	99	99	99	99	8	3	3	18	99	99.00	99.00	99.00	0.80	0.75	0.75	1.39	99.00
99	99	99	8	17	6	15	99	99	99	99	8	1	1	17	99	99.00	99.00	99.00	1.00	0.06	0.17	1.14	99.00
99	99	99	17	13	11	10	99	99	99	99	1	9	6	15	99	99.00	99.00	99.00	0.06	0.70	0.55	1.50	99.00
99	99	99	8	12	12	20	99	99	99	99	6	12	4	13	99	99.00	99.00	99.00	0.75	1.00	0.34	0.65	99.00
99	99	99	12	10	11	15	99	99	99	99	9	7	3	8	99	99.00	99.00	99.00	0.75	0.70	0.28	0.54	99.00
99	99	99	99	20	20	12	99	99	99	99	99	8	4	8	99	99.00	99.00	99.00	99.00	0.40	0.20	0.67	99.00
99	99	99	99	18	8	9	99	99	99	99	99	14	3	10	99	99.00	99.00	99.00	99.00	0.78	0.38	1.12	99.00
99	99	99	99	7	8	4	99	99	99	99	99	7	5	6	99	99.00	99.00	99.00	99.00	1.00	0.63	1.50	99.00
99	99	99	99	17	7	10	99	99	99	99	99	12	6	8	99	99.00	99.00	99.00	99.00	0.71	0.86	0.80	99.00
99	99	99	99	5	19	99	99	99	99	99	99	6	8	99	99	99.00	99.00	99.00	99.00	1.20	0.43	99.00	99.00
99	99	99	99	8	9	99	99	99	99	99	99	8	12	99	99	99.00	99.00	99.00	99.00	1.00	1.34	99.00	99.00
99	99	99	99	99	7	99	99	99	99	99	99	99	2	99	99	99.00	99.00	99.00	99.00	99.00	0.29	99.00	99.00
99	99	99	99	99	14	99	99	99	99	99	99	99	10	99	99	99.00	99.00	99.00	99.00	99.00	0.72	99.00	99.00
99	99	99	99	99	12	99	99	99	99	99	99	99	9	99	99	99.00	99.00	99.00	99.00	99.00	0.75	99.00	99.00
99	99	99	99	99	14	99	99	99	99	99	99	99	18	99	99	99.00	99.00	99.00	99.00	99.00	1.29	99.00	99.00
99	99	99	99	99	16	99	99	99	99	99	99	99	12	99	99	99.00	99.00	99.00	99.00	99.00	0.75	99.00	99.00
99	99	99	99	99	3	99	99	99	99	99	99	99	9	99	99	99.00	99.00	99.00	99.00	99.00	3.00	99.00	99.00
99	99	99	99	99	8	99	99	99	99	99	99	99	7	99	99	99.00	99.00	99.00	99.00	99.00	0.88	99.00	99.00
99	99	99	99	99	7	99	99	99	99	99	99	99	4	99	99	99.00	99.00	99.00	99.00	99.00	0.58	99.00	99.00
99	99	99	99	99	11	99	99	99	99	99	99	99	4	99	99	99.00	99.00	99.00	99.00	99.00	0.37	99.00	99.00
99	99	99	99	99	11	99	99	99	99	99	99	99	7	99	99	99.00	99.00	99.00	99.00	99.00	0.64	99.00	99.00
99	99	99	99	99	15	99	99	99	99	99	99	99	7	99	99	99.00	99.00	99.00	99.00	99.00	0.47	99.00	99.00
99	99	99	99	99	15	99	99	99	99	99	99	99	7	99	99	99.00	99.00	99.00	99.00	99.00	0.47	99.00	99.00
99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	9	0.80000000D 01	0.12666667D 02	0.57227616D 01	0.19075872D 01
2	6	0.40000000D 01	0.66666667D 01	0.38815804D 01	0.15846486D 01
3	22	0.70000000D 01	0.87272727D 01	0.26935871D 01	0.57427469D 00
4	55	0.70000000D 01	0.10563636D 02	0.44752970D 01	0.60344892D 00
5	61	0.15000000D 02	0.11180328D 02	0.47028651D 01	0.60214017D 00
6	73	0.17000000D 02	0.11082192D 02	0.51794289D 01	0.60620630D 00
7	59	0.15000000D 02	0.12694915D 02	0.51837087D 01	0.67486139D 00
8	25	0.19000000D 02	0.11720000D 02	0.46772499D 01	0.93544998D 00
9	9	0.40000000D 01	0.92222222D 01	0.44938229D 01	0.14979410D 01
10	6	0.20000000D 01	0.80000000D 01	0.59329588D 01	0.24221203D 01
11	22	0.20000000D 01	0.46363636D 01	0.28875011D 01	0.61561729D 00
12	55	0.40000000D 01	0.50000000D 01	0.31739682D 01	0.42797778D 00
13	61	0.30000000D 01	0.51147541D 01	0.29726439D 01	0.38060806D 00
14	73	0.15000000D 02	0.64246575D 01	0.43935490D 01	0.51422601D 00
15	59	0.15000000D 02	0.97288136D 01	0.43976111D 01	0.57252020D 00
16	25	0.12000000D 02	0.10720000D 02	0.44955534D 01	0.89911067D 00
17	9	0.50500000D 00	0.77520418D 00	0.39616630D 00	0.13205543D 00
18	6	0.50500000D 00	0.11460707D 01	0.58332105D 00	0.23813982D 00
19	22	0.29071426D 00	0.57036975D 00	0.37314650D 00	0.79555101D-01
20	55	0.57642853D 00	0.50511151D 00	0.29079610D 00	0.39210939D-01
21	61	0.20499998D 00	0.54186887D 00	0.38316625D 00	0.49059412D-01
22	73	0.88735288D 00	0.62363365D 00	0.41048885D 00	0.48044091D-01
23	59	0.10049992D 01	0.85243387D 00	0.44553115D 00	0.58003215D-01
24	25	0.63657892D 00	0.10087686D 01	0.54830534D 00	0.10966107D 00

1	2 =	0.22348303D C1	1	3 =	0.26338397D 01	1	4 =	0.105111159D 01	1	5 =	0.743033E5D 00	1	6 =	0.7916D689D 00
1	7 =	-C.139606450-C1	1	8 =	0.49104973D 00	1	9 =	0.142013700 01	1	10 =	0.152543130 01	1	11 =	0.522753310 01
1	12 =	C.392155380 01	1	13 =	0.38823587C 01	1	14 =	0.315942080 01	1	15 =	0.1475C853D 01	1	16 =	C.103644550 01
1	17 =	C.62188878D C1	1	18 =	0.48533512C 01	1	19 =	0.101144560 02	1	20 =	0.63740136D 01	1	21 =	0.635399000 01
1	22 =	0.631122670 C1	1	23 =	0.61904248C 01	1	24 =	0.103394430 02						
2	3 =	-0.15118579D C1	2	4 =	-0.22982027C 01	2	5 =	-0.266262170 01	2	6 =	-0.2602507CD 01	2	7 =	-0.349997860 01
2	8 =	-C.2443C426D C1	2	9 =	-0.113588900 01	2	10 =	-0.460653440 00	2	11 =	0.142042170 01	2	12 =	0.101537790 01
2	13 =	C.95225963D 0C	2	14 =	0.145264020 00	2	15 =	-0.181740490 01	2	16 =	-0.202832420 01	2	17 =	0.460535470 01
2	18 =	C.344511350 C1	2	19 =	0.762953730 01	2	20 =	0.388708880 01	2	21 =	0.386323170 01	2	22 =	0.381173320 01
2	23 =	0.366664370 C1	2	24 =	0.737672980 01									
3	4 =	-C.22C4434CD C1	3	5 =	-0.294808500 01	3	6 =	-0.282015620 01	3	7 =	-0.447748E5D 01	3	8 =	-0.263865160 01
3	9 =	-C.38C19176D 00	3	10 =	0.444338960 00	3	11 =	0.485920590 01	3	12 =	0.520416360 01	3	13 =	0.524350350 01
3	14 =	C.298708650 C1	3	15 =	-0.123508660 01	3	16 =	-0.181125360 01	3	17 =	0.873188E6D 01	3	18 =	0.676208720 01
3	19 =	C.14C69473D C2	3	20 =	0.142842130 02	3	21 =	0.142017360 02	3	22 =	0.140619610 02	3	23 =	0.136432550 02
3	24 =	C.14C211610 C2												
4	5 =	-C.723408150 CC	4	6 =	-0.606243980 00	4	7 =	-0.235419460 01	4	8 =	-0.103877310 01	4	9 =	0.830636360 00
4	10 =	C.102703190 C1	4	11 =	0.687576430 01	4	12 =	0.752038080 01	4	13 =	0.763735450 01	4	14 =	0.522051410 01
4	15 =	C.10C36060D C1	4	16 =	-0.144400920 00	4	17 =	0.158458330 02	4	18 =	0.145167440 02	4	19 =	0.164181920 02
4	20 =	0.166333180 C2	4	21 =	0.165528700 02	4	22 =	0.164200290 02	4	23 =	0.16C190C3D 02	4	24 =	0.155786220 02
5	6 =	C.114854570 CC	5	7 =	-0.167461450 01	5	8 =	-0.485101840 00	5	9 =	0.121287370 01	5	10 =	0.127424920 01
5	11 =	C.759921130 C1	5	12 =	0.836603180 01	5	13 =	0.851493940 01	5	14 =	0.600589260 01	5	15 =	0.174697210 01
5	16 =	0.425396460 C0	5	17 =	0.168790860 02	5	18 =	0.154964210 02	5	19 =	0.174686C7D 02	5	20 =	0.176913190 02
5	21 =	C.176093540 C2	5	22 =	0.174764130 02	5	23 =	0.170729480 02	5	24 =	0.166189E90 02			
6	7 =	-C.177778830 C1	6	8 =	-0.572180030 00	6	9 =	0.115100270 01	6	10 =	0.123444270 01	6	11 =	0.746057550 01
6	12 =	C.819637560 C1	6	13 =	0.833691030 01	6	14 =	0.585904600 01	6	15 =	0.162309470 01	6	16 =	0.334007310 00
6	17 =	C.166128390 C2	6	18 =	0.152557390 02	6	19 =	0.171929180 02	6	20 =	0.174116C2D 02	6	21 =	0.173306920 02
6	22 =	C.171985450 C2	6	23 =	0.167983240 02	6	24 =	0.163517610 02						
7	8 =	C.845198430 CC	7	9 =	0.211370140 01	7	10 =	0.186722610 01	7	11 =	0.882193750 01	7	12 =	0.962916010 01
7	13 =	C.978349730 C1	7	14 =	0.739025590 01	7	15 =	0.335154390 01	7	16 =	0.175672C9D 01	7	17 =	0.173337230 02
7	18 =	C.161376610 C2	7	19 =	0.178424330 02	7	20 =	0.180322660 02	7	21 =	0.1796C815D 02	7	22 =	0.178418980 02
7	23 =	C.174835630 C2	7	24 =	0.170921820 02									
8	9 =	C.138717130 C1	8	10 =	0.166431420 01	8	11 =	0.614335070 01	8	12 =	0.653249220 01	8	13 =	0.654039510 01
8	14 =	C.496C64140 01	8	15 =	0.181554450 01	8	16 =	0.770721970 00	8	17 =	0.694255920 01	8	18 =	0.545759740 01
8	19 =	C.111351730 C2	8	20 =	0.119782450 02	8	21 =	0.119330700 02	8	22 =	0.118464490 02	8	23 =	0.115952060 02
8	24 =	C.113724760 C2												
9	10 =	C.455093330 CC	9	11 =	0.340160890 01	9	12 =	0.271023470 01	9	13 =	0.265762E9D 01	9	14 =	0.176642110 01
9	15 =	-C.315904270 CC	9	16 =	-0.857151940 00	9	17 =	0.561730000 01	9	18 =	0.432405540 01	9	19 =	0.918129380 01
9	20 =	C.581740260 C1	9	21 =	0.579175130 01	9	22 =	0.573732170 01	9	23 =	0.558334E0D 01	9	24 =	C.920033910 01
10	11 =	C.198743930 C1	10	12 =	0.121969040 01	10	13 =	0.117676670 01	10	14 =	0.636218CCD 00	10	15 =	-0.694619420 00
10	16 =	-C.125319550 C1	10	17 =	0.371234680 01	10	18 =	0.281614440 01	10	19 =	0.614932E0D 01	10	20 =	0.309394480 01
10	21 =	C.307854310 C1	10	22 =	0.304481810 01	10	23 =	0.295010850 01	10	24 =	0.611838150 01			
11	12 =	-C.484995550 CC	11	13 =	-0.660967680 00	11	14 =	-0.222943060 01	11	15 =	-0.6057446D 01	11	16 =	-0.543359030 01
11	17 =	C.395717330 01	11	18 =	0.290619610 01	11	19 =	0.655027470 01	11	20 =	0.669717E3D 01	11	21 =	0.663001980 01
11	22 =	C.649846200 C1	11	23 =	0.611945960 01	11	24 =	0.616533530 01						
12	13 =	-C.200360560 C0	12	14 =	-0.212945590 01	12	15 =	-0.661554130 01	12	16 =	-0.574427780 01	12	17 =	0.943270690 01
12	18 =	C.786884060 C1	12	19 =	0.101758280 02	12	20 =	0.104588170 02	12	21 =	0.103489E30 02	12	22 =	0.101618570 02
12	23 =	C.960328290 C1	12	24 =	0.903394680 01									
13	14 =	-C.204749690 01	13	15 =	-0.671146130 01	13	16 =	-0.574101150 01	13	17 =	0.107716920 02	13	18 =	0.883955100 01
13	19 =	C.116872240 C2	13	20 =	0.120474940 02	13	21 =	0.119161010 02	13	22 =	0.117069560 02	13	23 =	0.110708920 02
13	24 =	C.103E62690 C2												
14	15 =	-C.429361890 C1	14	16 =	-0.414698690 01	14	17 =	0.106410450 02	14	18 =	0.931474930 01	14	19 =	0.112508130 02
14	20 =	C.114782430 02	14	21 =	0.113883730 02	14	22 =	0.112321610 02	14	23 =	0.107678530 02	14	24 =	0.103005010 02
15	16 =	-C.929890650 C0	15	17 =	0.152388230 02	15	18 =	0.138415140 02	15	19 =	0.158444ECD 02	15	20 =	C.160730490 02
15	21 =	C.159879C80 C2	15	22 =	0.158479800 02	15	23 =	0.154250860 02	15	24 =	0.149590460 02			
16	17 =	C.652254810 C1	16	18 =	0.514049440 01	16	19 =	0.105437480 02	16	20 =	0.113503140 02	16	21 =	0.113034060 02
16	22 =	C.112132E40 C2	16	23 =	0.109520410 02	16	24 =	0.107214790 02						
17	18 =	-C.147544250 C1	17	19 =	0.136360020 01	17	20 =	0.196068990 01	17	21 =	0.165634130 01	17	22 =	C.107861290 01
17	23 =	-C.535452810 CC	17	24 =	-0.116779990 01									
18	19 =	C.296360680 C1	18	20 =	0.265576470 01	18	21 =	0.248498840 01	18	22 =	0.215049E5D 01	18	23 =	0.119801930 01
18	24 =	C.5446783CD C0												
19	20 =	C.735773650 00	19	21 =	0.304934030 00	19	22 =	-0.573119620 00	19	23 =	-0.2864904CD 01	19	24 =	-0.315939100 01
20	21 =	-C.585272390 CC	20	22 =	-0.191121680 01	20	23 =	-0.496080110 01	20	24 =	-0.432470340 01			
21	22 =	-C.115075560 C1	21	23 =	-0.408808100 01	21	24 =	-0.388646470 01						
22	23 =	-C.3C3784110 C1	22	24 =	-0.321686270 01									
23	24 =	-C.126019370 01												

CLASSIFICATION OF DIRECTIONS

1	2	3	4	5	6	7	8
4	4	5	4	5	6	7	6
2	6	4	4	4	7	4	8
4	4	4	2	4	8	7	8
2	2	4	4	5	4	6	6
2	2	4	5	4	6	7	8
1	2	6	4	5	5	6	8
1	6	5	3	6	6	6	8
3	6	4	5	6	5	8	8
1	2	2	4	4	4	8	6
4	3	4	4	6	4	6	5
1	4	4	4	4	6	8	7
3	6	6	4	6	5	6	9
1	3	4	4	4	6	6	6
-2	99	6	6	4	6	8	7
-2	99	2	2	4	4	8	6
2	99	4	2	3	5	6	3
-2	99	2	2	5	6	6	7
99	99	5	4	4	7	6	2
99	99	7	4	4	4	7	7
99	99	5	4	5	6	8	7
99	99	4	4	5	4	6	7
99	99	4	6	5	6	6	7
99	99	2	4	6	4	6	7
99	99	6	1	4	8	9	7
99	99	6	4	4	7	7	7
99	99	3	4	4	6	7	2
99	99	3	5	4	6	7	2
99	99	2	4	5	6	5	9
99	99	4	5	4	6	6	3
99	99	2	4	1	6	6	7
99	99	3	6	4	4	7	6
99	99	5	4	4	6	6	5
99	99	5	3	6	4	6	7
99	99	5	6	4	4	6	8
99	99	4	4	5	8	8	7
99	99	99	4	7	6	5	7
99	99	99	4	5	4	8	6
99	99	99	7	5	5	5	7
99	99	99	4	6	6	7	7
99	99	99	4	6	6	6	99
99	99	99	4	4	4	7	99
99	99	99	1	1	6	6	99
99	99	99	5	5	7	7	99
99	99	99	4	5	6	8	99
99	99	99	5	5	6	7	99

STATION CARIBOU

99	99	99	5	5	5	6	99
99	99	99	6	6	5	6	99
99	99	99	3	5	6	7	99
99	99	99	4	4	4	7	99
99	99	99	3	7	6	7	99
99	99	99	1	5	4	7	99
99	99	99	3	5	4	7	99
99	99	99	5	5	5	7	99
99	99	99	4	4	6	6	99
99	99	99	4	5	5	7	99
99	99	99	3	5	6	7	99
99	99	99	4	3	7	9	99
99	99	99	3	4	6	7	99
99	99	99	5	6	5	7	99
99	99	99	5	5	5	7	99
99	99	99	5	5	6	7	99
99	99	99	5	4	4	6	99
99	99	99	4	5	6	7	99
99	99	99	4	6	6	4	99
99	99	99	4	5	6	6	99
99	99	99	5	5	6	6	99
99	99	99	7	5	5	99	99
99	99	99	4	99	6	99	99
99	99	99	4	99	8	99	99
99	99	99	6	99	6	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	8	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	7	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	4	99	99
99	99	99	99	99	7	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	7	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	5	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	6	99	99
99	99	99	99	99	99	99	99

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	17	0.400000000 01	0.14705882D 01	0.19722337D 01	0.47833694D 00
2	13	0.400000000 01	0.38461538D 01	0.16756170D 01	0.46473254D 00
3	35	0.500000000 01	0.41428571D 01	0.13534891D 01	0.22878142D 00
4	70	0.400000000 01	0.41000000D 01	0.12294691D 01	0.14694966D 00
5	67	0.500000000 01	0.47014925D 01	0.10732975D 01	0.13112415D 00
6	95	0.600000000 01	0.56105263D 01	0.10446901D 01	0.10718294D 00
7	66	0.700000000 01	0.66363636D 01	0.98662383D 00	0.12144500D 00
8	39	0.600000000 01	0.64102564D 01	0.18023077D 01	0.28860210 00

DIRECTION ANALYSIS IN DEGREES (45)

SAMPLE NO. STATION	CARIBOU	DIFFERENCE	SAMPLE MEAN VALUE STATION	STANDARD DEVIATION BRISTOL	STANDARD ERROR OF MEAN
45		21.2	66.2	88.8	21.6
90		83.1	173.1	75.5	21.0
135		51.5	186.5	61.0	10.3
180		4.5	184.5	55.4	6.7
225		-13.4	211.6	48.3	6.0
270		-17.5	252.5	47.1	4.9
315		-16.3	298.7	44.4	5.5
360		-71.5	288.5	81.2	13.0

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS
DIRECTIONS

SAMPLE NO.

1 = -0.98380074D 00
2 = -0.39725083D 01
3 = -0.49954107D 01
4 = -0.68050514D 00
5 = 0.22765254D 01
6 = 0.36337283D 01
7 = 0.29942474D 01
8 = 0.55084631D 01

ZERO DIRECTION AND/OR SPEED

AVERAGE OF OPEN STATIONS		STATION	PLASTER ROCK
D	MPH	C	MPH
7	6.	0	0.0
5	11.	0	0.0
6	6.	0	0.0
2	1.	0	0.0

AVERAGE OF OPEN STATIONS								STATION	PLASTER ROCK							WIND SPEED RATIOS							
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
6	6	6	6	9	16	15	14	12	8	2	2	2	6	8	8	1.85	1.24	0.34	0.34	0.22	0.37	0.52	0.58
5	10	6	6	10	14	21	14	10	3	5	5	7	5	10	2	1.82	0.30	0.77	0.84	0.67	0.36	0.47	0.15
5	12	6	12	21	11	7	9	10	6	5	4	12	7	3	3	1.82	0.50	0.84	0.34	0.58	0.61	0.43	0.32
16	2	10	5	9	7	5	11	10	5	10	2	3	3	2	3	0.63	2.00	1.00	0.40	0.34	0.43	0.40	0.27

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	4	0.60000000D 01	0.80000000D 01	0.53541261D 01	0.26770631D 01
2	6	0.60000000D 01	0.61666667D 01	0.40207794D 01	0.16414763D 01
3	10	0.60000000D 01	0.74000000D 01	0.20655911D 01	0.65319726D 00

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS

1 2 =	0.62194307D 00	1 3 =	0.31499065D 00	1 4 =	0.21006523D 00	1 5 =	-0.96275069D-01	1 6 =	-0.16957947D 00
1 7 =	-0.13807388D 01	1 8 =	-0.23904572D 01	1 9 =	-0.91798509D 00	1 10 =	0.10374166D 01	1 11 =	0.16382348D 00
1 12 =	0.10865107D 01	1 13 =	0.79120547D 00	1 14 =	0.93204574D 00	1 15 =	0.62597402D 00	1 16 =	0.92313266D 00
1 17 =	0.24010270D 01	1 18 =	0.31760153D 01	1 19 =	0.43626854D 01	1 20 =	0.95150886D 01	1 21 =	0.26998513D 01
1 22 =	0.27186013D 01	1 23 =	0.97676055D 01	1 24 =	0.61310389D 01				

CLASSIFICATION OF DIRECTIONS

1	2	3	4	5	6	7	8	AVERAGE OF OPEN STATIONS
3	4	5	6	6	7	7	6	
3	3	3	4	6	7	6	8	
-1	0	6	4	6	8	7	8	

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	8	0.30000000D 01	0.50000000D 00	0.17728105D 01	0.62678317D 00
2	12	0.40000000D 01	0.21666667D 01	0.21248886D 01	0.61340250D 00
3	32	0.50000000D 01	0.44375000D 01	0.15849595D 01	0.28018391D 00

DIRECTION ANALYSIS IN DEGREES (45)

SAMPLE NO. AVERAGE OF OPEN STATIONS	DIFFERENCE	SAMPLE MEAN VALUE STATION	STANDARD DEVIATION PLASTER ROCK	STANDARD ERROR OF MEAN
45	-22.4	22.5	79.8	28.3
90	7.5	97.5	95.7	27.7

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS
DIRECTIONS

SAMPLE NO.

1 = 0.79772404D 00
2 = -0.27170849D 00
3 = -0.51305587D 01
4 = -0.67125925D 01

ZERO DIRECTION AND/OR SPEED

AVERAGE OF OPEN STATIONS		STATION HOULTON (MAINE)	
D	MPH	D	MPH
4	6.	0	0.0
6	6.	0	0.0
4	5.	0	0.0
6	5.	0	0.0

AVERAGE OF OPEN STATIONS								STATION HOULTON (MAINE)								WIND SPEED RATIOS							
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
14	6	4	6	9	16	15	16	14	8	8	8	10	12	15	12	1.00	1.24	2.00	1.24	1.06	0.73	0.97	0.75
6	10	4	6	10	14	21	14	12	8	4	6	10	9	15	10	1.85	0.80	1.00	1.00	0.96	0.65	0.70	0.72
5	4	6	6	21	15	6	14	12	8	12	10	20	6	10	10	2.19	1.78	1.85	1.67	0.96	0.39	1.54	0.72
3	12	4	12	9	11	7	12	5	12	4	14	10	12	9	11	1.43	1.00	1.00	1.17	1.12	1.05	1.29	0.88

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	6	0.14000000D 02	0.90000000D 01	0.52153619D 01	0.21291626D 01
2	11	0.60000000D 01	0.68181818D 01	0.59802706D 01	0.18031194D 01
3	21	0.40000000D 01	0.63333333D 01	0.23523038D 01	0.51331478D 00

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS

1 2 =	0.74939039D 00	1 3 =	0.18339475D 01	1 4 =	0.10027701D 01	1 5 =	0.85489448D-01	1 6 =	-0.43071894D-01
1 7 =	-0.99996274D 00	1 8 =	-0.17317467D 01	1 9 =	-0.38537625D 00	1 10 =	0.53692913D 00	1 11 =	0.64169675D 00
1 12 =	0.17778535D 00	1 13 =	-0.22884818D-01	1 14 =	-0.28884215D-01	1 15 =	-0.14270476D 00	1 16 =	-0.69727260D 00
1 17 =	0.35915487D 01	1 18 =	0.43485671D 01	1 19 =	0.70126848D 01	1 20 =	0.11383712D 02	1 21 =	0.37252665D 01
1 22 =	0.37276846D 01	1 23 =	0.38113521D 01	1 24 =	0.93042582D 01				

CLASSIFICATION OF DIRECTIONS

1	2	3	4	5	6	7	8	AVERAGE OF OPEN STATIONS
-2	4	3	3	6	6	7	8	
1	4	1	3	6	6	6	8	
-1	-1	4	3	5	6	7	8	

SAMPLE NO.	NO. OF OBSERVATIONS	FIRST OBSERVATION	SAMPLE MEAN VALUE	STANDARD DEVIATION	STANDARD ERROR OF MEAN
1	8	-0.20000000D 01	0.37500000D 00	0.14078860D 01	0.49776285D 00
2	17	0.40000000D 01	0.22941176D 01	0.16110829D 01	0.39074501D 00
3	35	0.30000000D 01	0.39428571D 01	0.15519031D 01	0.26231951D 00

DIRECTION ANALYSIS IN DEGREES (45)

SAMPLE NO. AVERAGE OF OPEN STATIONS	DIFFERENCE	SAMPLE MEAN VALUE STATION	STANDARD DEVIATION HOULTON (MAINE)	STANDARD ERROR OF MEAN
45	-28.1	16.9	63.4	22.4
90	13.3	103.3	72.5	17.6

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS
DIRECTIONS

SAMPLE NO.

1 = 0.12556180D 01
2 = -0.75270993D 00
3 = -0.35943081D 01
4 = -0.34668941D 01