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NOAA Technical Memorandum ERL ARL-43

PROGRAM DESCRIPTIONS

Supplement to

MESOSCALE WIND FIELDS AND TRANSPORT ESTIMATES

DETERMINED FROM A NETWORK OF WIND TOWERS

L. L. Wendell

Air Resources Laboratories
Idaho Falls, Idaho
May 1974

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ABSTRACT

A computer program has been developed to analyze objectively two-dimensional wind data from a mesoscale network of stations. The result is a graphic display of the network wind field at any particular time and a plot of computed air trajectories as a function of time and point of origin. A brief description, a list of input variables, and program listings for the computer program are provided.

PROGRAM DESCRIPTIONS

Supplement to

MESOSCALE WIND FIELDS AND TRANSPORT ESTIMATES DETERMINED FROM A NETWORK OF WIND TOWERS[1]

L. L. Wendell[2]

I. INTRODUCTION

The purpose of this memorandum is to provide brief descriptions, lists of input variables, and program listings for the computer programs used to generate the wind field and trajectory plots in previous publications (Wendell, 1970, 1972). The programs were developed for a research project, but have general application where appropriate data are available. They have been designed with a fair amount of flexibility, in that the interpolation scheme may be easily replaced or modified without altering the graphical display portion at all.

The graphic portions of these programs are written for output to microfilm, specifically through an Integrated Graphics System (IGS) software package designed for the Stromberg-Carlson 4060 microfilm unit (Brown et al., 1968). The plot instructions may be changed to work on CALCOMP paper plotters, but computer output to microfilm (COM) seems to be the future trend and offers tremendous advantages in economy and convenience. The plot sections of both programs have been written to provide a considerable external control over scaling and placement of plots on the film.

The descriptive portion of this write-up is, of necessity, far from comprehensive. The computational discussions appear in the references cited. It is presumed that the detailed description of the input variables and the program listings will provide enough information for the use or modification of these programs for particular needs or computer systems.

II. DISPLAY OF WIND FIELDS

A. General Description

This program consists of a main driving routine (RNGRDG) and six subroutines. Figure 1 depicts a conceptural flow diagram of the wind field display computer program and provides a broad overview. The routine RNGRDG reads the wind network data from tape or disc and computes

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[1]Research carried out under the sponsorship of the Atomic Energy Commission, Division of Reactor Research and Development.

[2]Presently affiliated with Battelle Pacific Northwest Laboratories, Richland, Wash.

the random-to-grid interpolated values of the horizontal velocity components at each grid point of a regularly spaced grid. For each grid point the subroutine ASCND orders the 10 closest surrounding wind stations in ascending order according to the squares of the distances of the stations from each grid point. This subroutine is called only once for any single program run, and the lists of station subscripts and squared distances for all grid points are saved for repeated use in the interpolation scheme. These two arrays, N3 (10, 14, 17) and R3 (10, 14, 17), are the largest ones in the program, and a larger grid than 14 by 17 might cause storage problems on small computers. If this is the case the searching process can be repeated with each analysis and the two arrays eliminated, sacrificing some economy in the interpolation scheme.

The logic of the interpolation scheme (Wendell, 1970, 1972) represents a small fraction of the main program (statements 49 through 895). The major portion of the program consists of data location, preparation, and editing. For example, a wind direction which has had 500° added to it indicates a direction variation over 90° during the averaging period and is specially identified on the plot, as are missing data and calm winds.

The measured winds and interpolated winds are prepared for plotting in subroutine CSTREM. They are scaled and, if necessary, modified for a rotated grid orientation. CSTREM is the only subroutine which reads any card data. It reads, on a first-call basis only, the data which specify the size and number of plots and their positioning for each page. The grid boundaries are generated in CSTREM as well as the date-time group labeling through a call to subroutine STENCL. Subroutine SITE may be used to add characteristic features to the plot such as significant contour lines, boundaries, and station locations. The measured winds are plotted through subroutine WNDARW, and the interpolated winds are plotted from subroutine STREM2. Examples of the wind field plots are shown in figure 2. The definitions of the symbols are given in table 1.

B. Input of Wind Data

The version of the program described in this memorandum is designed to accept wind data as averaged speed and direction with averaging periods of 1 hour or less. The data are read, 1 day per record, from tape or disc into a two-dimensional array, IWD (M, N), where M is the number of averaging periods (maps) per day and N is the number of data entries per averaging period. IWD (1, 1) contains a four-digit designation for the month and day of each record. The first two digits indicate the month, and the second two digits indicate the day. The wind data for each station are also read as a four-digit word; the first pair of digits are direction in tens of degrees, and the second pair are speed in appropriate units.

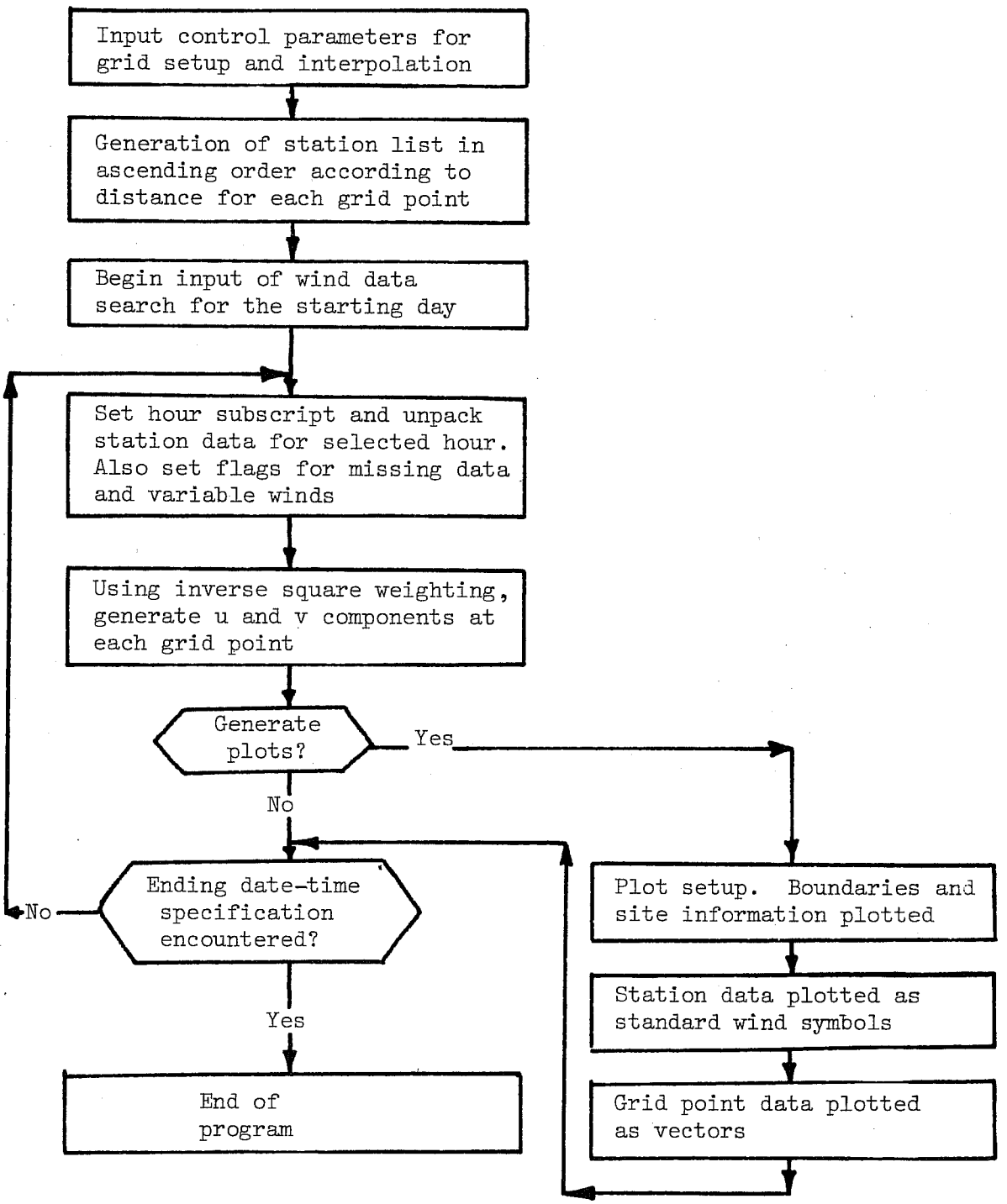

Figure 1. Conceptual flow chart for RNGRDG computer code.

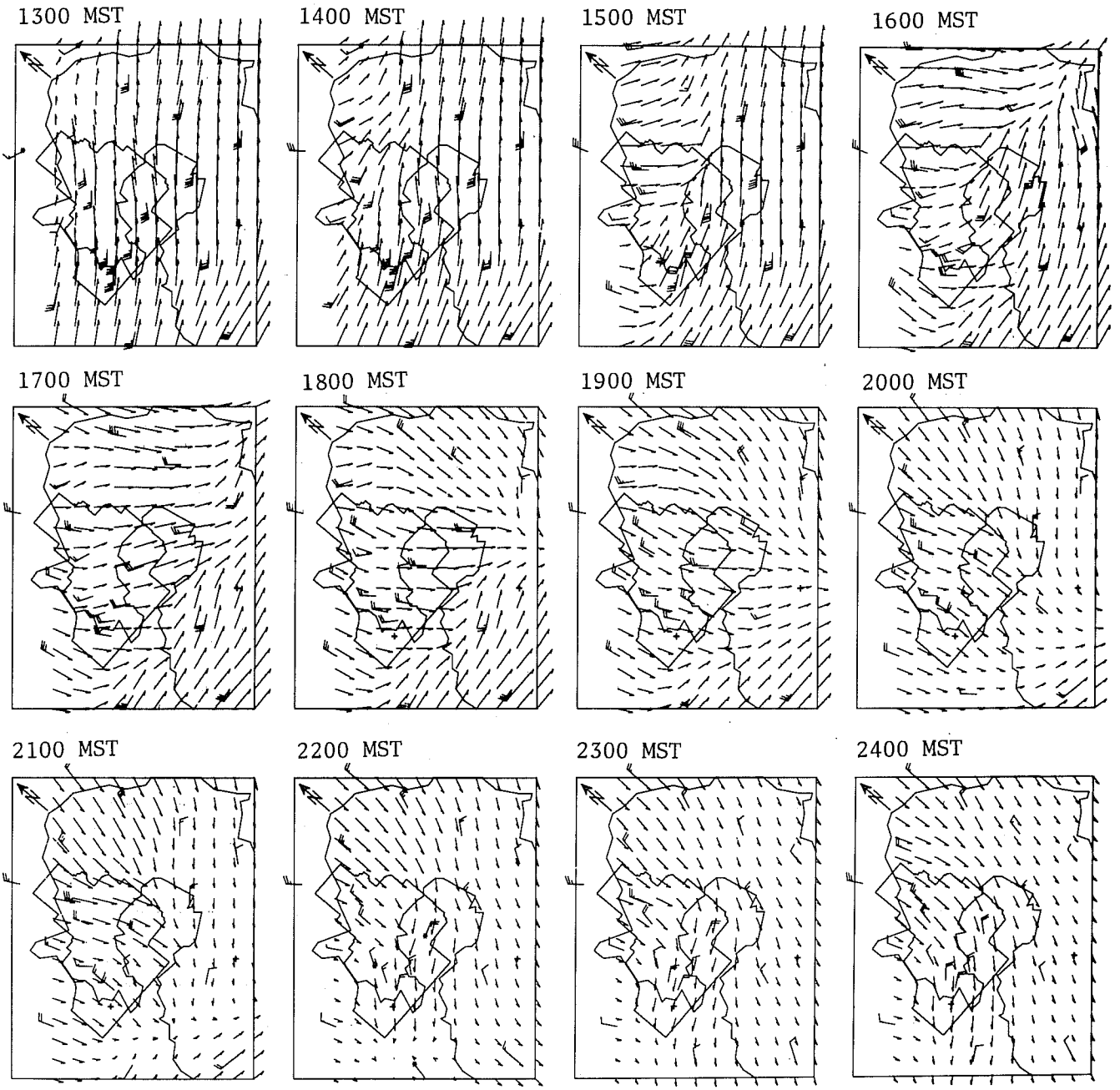

Figure 2. Examples of wind field plots during a frontal passage from the northwest. The wind data from each station are plotted in standard form and the interpolated winds are plotted as vectors. (See table 1 for details.)

Table 1. Definitions of Symbols Used in Wind Field Plots

Symbols at wind stations

Symbol	Definition
Standard shaft and barb	Wind direction and speed. (Each barb represents 10 mi/hr.)
*	A direction change of 90° or greater during the averaging hour.
+	Missing data.
0	Calm.

Symbols at gridpoints

Symbol	Definition
. .	Wind speed and direction. (Distance between grid points represents 25 mi/hr.)
→	$2<\|V\|$ 5 mi/hr.
-	$\|V\|<2$ mi/hr.
0	Calm.

C. Card Input

Card input for main program

(All integer variables must be right justified; all floating point variables should be entered with the decimal included.)

Card	Columns (or format)	Variables	Description
1	1-64	ITLE	Title for printout identification only.
2	1-4	SC1	Scale factor for plot layout of grid and station network (reduces grid units to inches.
2	5-8	SC2	Scale factor for length of interpolated velocity vectors (length in inches= velocity/SC2).
2	9-12	SH	Length in inches of arrowhead on velocity vectors.
2	13-16	DS	Length in inches of the shaft on the standard wind symbol.
3	1-5	NP	Number of wind stations in the network.
3	6-10	NSX	Column subscript for left boundary (for NSX = 1, X = 0).
3	11-15	NSY	Column subscript for lower boundary (for NSY = 1, Y = 0).
3	16-20	NFX	Column subscript for right boundary (for NFX = n, X = n-1).
3	21-25	NFY	Column subscript for top boundary (for NFY = m, Y = m-1).
3	26-30	KSTR	Plot interpolated wind vectors at grid points? (1 - yes, 0 - no).
3	31-35	KDATA	Plot anything at all? (1 - yes, 0 - no).
3	36-40	KPRINT	Print the raw and interpolated data? (1 - yes, 0 - no).
3	41-45	KVORT	Dummy - divergence and vorticity subroutine not available in this version.
3	46-50	KPASS	Number of maps (time frames) to pass between analyses and/or plots.

Card input for main program (cont.)

Card	Columns (or format)	Variables	Description
3	51-55	NSTL	Minimum number of stations to use in any interpolation.
3	56-60	MPH	Number of maps (time frames) per hour.
3	61-65	KXGU	Are input station coordinates in grid units? (1 - yes, 0 - no).
3	66-70	NDAT	Number of data entries per scan from grid network.
4	1-5	INPT	Type of input for wind data (1 - tape, 0 - disc).
5	1-10	RTE	Number of degrees to rotate grid clockwise from north.
5	11-20	RCH	Maximum radius in grid units within which all stations are to be used in an interpolation for a given grid point.
5	21-30	DBGP	Number of length units between grid points. (If KXGU = 0, then X = X/DBGP; this provides the option of using grid or length units for station locations).
6	16 F5.0	X(I)	(I = 1, NP), X-coordinates of wind station locations.
7	16 F5.0	Y(I)	(I = 1, NP), Y-coordinates of wind station locations.
8	16 F5.0	COR(I)	(I = 1, NP), wind direction correction in degrees, if needed, for any wind stations.
9	16 F5.2	CONFAC(I)	(I = 1, NP), variable used to adjust all wind velocities to some predetermined level (user must supply a logarithmically determined constant for each station; use 1.0 for no adjustment.
10	16(1XA4)	NAMST(I)	(I = 1, NP), 4-character names for each station.
11	31I2	ISKIP(I)	(I = 1, NDAT), control parameters used to select data from history tapes ISKP(I) = 1, Ith value used; ISKP(I)=0, value is skipped.
12	16A4	KMON(I)	(I = 1, 12), 4-character words for the names of the months.

Card input for main program (cont.)

Card	Columns (or format)	Variables	Description
13	1-2	YEAR	2-digit indicator of the year of the data used.
13	5-10	MAPS	Upper limit on number of maps (time frames) to be analyzed.
14	1-5	MS	Month in which map series begins.
14	6-10	IDS	Day in which map series begins.
14	11-15	IHS	Starting time frame (time frames are numbered from 1 to N, where N = 24*MPH).
14	16-20	ML	Month in which last time frame occurs.
14	21-25	IDL	Day in which last time frame occurs.
14	26-30	IHL	Number of last time frame.
14	31-35	KNTHR	Is there another series of analyses and/or plots to follow? (1 - yes, 0 - no.)
14	36-40	KREC	Read a new record before starting next series.
14	41-45	KREW	Rewind to beginning of data before starting next series.
14	46-50	KFRM	Start plots on a new page for next series.

Card input for CSTREM subroutine

(These data are read only on the first call and need not be repeated.)

1	1-5	NPPF	Number of grid pictures per 8" x 11-1/2" print.
1	6-10	LPG	Number of grid pictures per frame (1 print will hold almost 2 full frames).
1	11-20	XSBJ	Dimension of X-subject space in inches.
1	21-30	YSBJ	Dimension of Y-subject space in inches.
1	31-40	XNOR	Location in grid units of north arrow in X-direction.
1	41-50	YNOR	Location in grid units of north arrow in Y-direction.

Card input for CSTREM subroutine (cont.)

Card	Columns (or format)	Variables	Description
1	51-55	KNAR	Will a north arrow be plotted? (1 - yes, 0 - no.)
2	8F10.0	XOR(I)	X-coordinates in inches of the origins of the individual grid plots (I=1, NPPF).
3	8F10.0	YOR(I)	Y-coordinates in inches of the origins of the individual grid plots (I = 1, NPPF).

For each subsequent set of plots, in the same run, only a card like 14 need be provided.

III. WIND-FIELD-DERIVED TRAJECTORIES

A. General Description

This program consists of a main driving program (MSTJ4G) and five subroutines. Figure 3 depicts a conceptual flow diagram of this computer program for generation of wind-field-derived trajectories. The main program uses the wind fields provided by subroutine RNGD7G to produce, kinematically, trajectories of hypothetical particles released singly or serially from a specified release point. The logic for plotting these trajectories is contained in the main program, but may be bypassed if plots are not desired. The plots are placed on the film with the same flexibility of format as the wind field plots in RNGRDG. A sample plot is shown in figure 4. Each plot is for a serial release of one particle per hour for 12 hours, with each particle followed for 24 hours after its release or until it leaves the grid. The trajectories are numbered consecutively at their end points, and letters are plotted along each trajectory to show location at particular times. Like letters form approximate plume centerlines.

The program may be used to produce a long string of plots for consecutive time periods or a series of plots for randomly selected time periods. The latter option was included for diagrams comparing trajectories derived from wind fields with those derived from source wind only (Wendell, 1972). For any run configuration requiring backspacing or rewinding in the wind data string, there is an option allowing transfer of a certain portion of the data string on the initial input device (tape or disc) to a faster access device (disc or drum).

B. Input of Wind Data

The data records from the wind network are read in by subroutine RNGD7G in exactly the same way and under the same format as in RNGRDG described above. Because the IBM 360-75 can generate approximately 30 wind fields in a second, there is no advantage in having the wind fields already generated and stored on a separate input device.

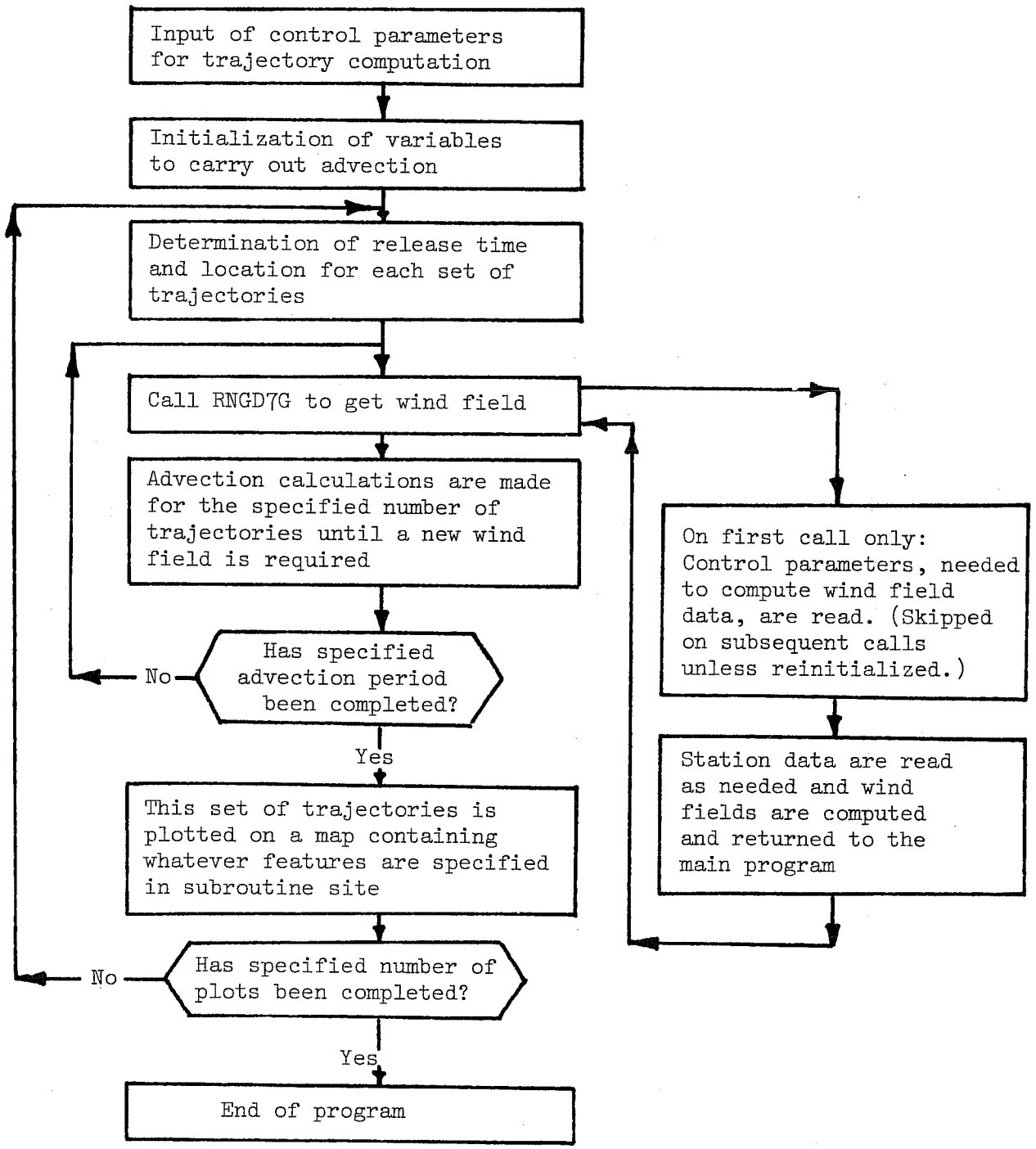

Figure 3. Conceptual flow chart for MSTJ4G computer code.

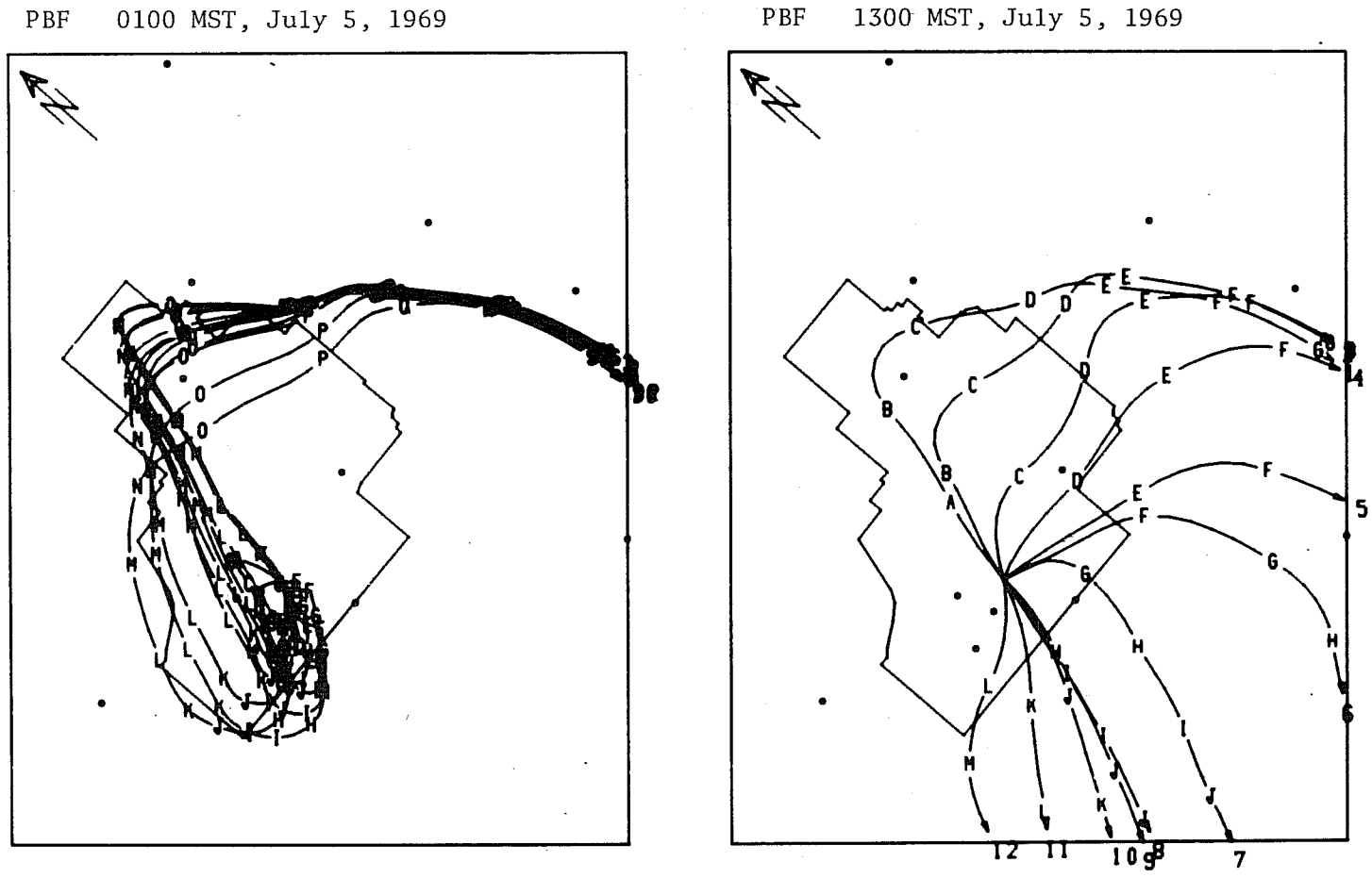

Figure 4. Trajectories of hypothetical particles released hourly and transported by a time series of objectively interpolated wind fields. The numbers at the ends of the trajectories indicate the order of release, and the letters along the trajectories represent hourly positions.

C. Card Input

Card input data for main program

(All integer variables must be right justified; all floating point variables should be entered with the decimal included.)

Card	Columns	Variables	Description
1	1-4	SC1	Scale factor for plot layout of grid and station network (reduces grid units to inches).
1	5-8	DTIME	Time in hours or (decimal fraction of an hour) between letters on trajectories.
1	9-12	RTE	Number of degrees of clockwise rotation of grid.
1	13-16	SH	Length in inches of arrowheads on ends of trajectories.
2	1-5	KLST	Type of advecting winds (0 - wind field, n - subscript of station to be used for single station winds).
2	6-10	NSX	Column subscript for left boundary (for NSX = 1, X = 0).
2	11-15	NSY	Column subscript for lower boundary (for NSY = 1, Y = 0).
2	16-20	NFX	Column subscript for right boundary (for NFX = n, X = n-1).
2	21-25	NFY	Column subscript for top boundary (for NFY = m, Y = m-1).
2	26-30	KPLOT	Plot the computed trajectories? (1 = yes, 0 = no).
2	31-35	KSPL	Dummy.
2	36-40	II1	Subscript of starting time for first advection period.
2	41-45	II2	Subscript of starting time for second advection period.
2	46-50	KRECL	Dummy in this version.

Card input data for main program (cont.)

Card	Columns	Variables	Description
2	51-55	KCON	Consecutive or selected trajectory plots? (1 - consecutive, 0 - selected--if 0, II1 and II2 need not be specified.)
3	1-5	NSITES	Number of trajectory series to be generated.
3	6-10	NTRAJ	Number of trajectories to be generated in each series.
3	11-15	NTIME	Dummy in this version.
3	16-20	NCOM	Dummy in this version.
3	21-25	KHOUR	Number of hours of total advection time after the initial release for the series.
3	26-30	KSPH	Number of advection steps between maps.
3	31-35	LTIME	Limit on number of hours of advection of each trajectory in a series.
3	36-40	NDTRN	Number of days of data to be transferred from disc to drum.
3	41-45	KENDP	Print end points for the trajectories in each series? (1 - yes, 0 - no.)
3	46-50	MPH	Number of maps per hour in wind network data.
3	51-55	MBGP	Number of length units (miles, km, etc.) between grid points for wind interpolation.
3	56-60	MSBT	Number of maps between "particle" releases.
4	80A1	ISY(I)	(I - 1, 40), letters to be plotted at specified intervals along the trajectories.
5	14A1	KTLE	3-character identifier for release point.
6	1-5	XST	X-coordinate of release point.
6	6-10	YST	Y-coordinate of release point.
6	11-15	TINK	Number of advection steps past starting map for initial release.
6	16-19	IRLSE	3-character name of release location.

Card input data for main program (cont.)

Card	Columns	Variables	Description
			(The following data are read from the main program if plots are desired. They come after the date read on the first call to RNGD7G.)
7	1-5	NPPF	Number of plots per page (for one or two frames of microfilm).
7	6-10	LPG	Number of plots on first frame. If 1 page of plots requires only one frame set, LPG>NPPF.
7	11-20	XSBJ	Subject space size in X-direction (inches).
7	21-30	YSBJ	Subject space size in Y-direction (inches).
7	31-35	XNOR	X-grid coordinate location of north arrow center.
7	36-40	YNOR	Y-grid coordinate location of north arrow center.
7	41-45	THLN	Thickness of trajectory lines.
7	46-50	HT	Height of titling letters.
7	51-55	HL	Height of letters along trajectory.
7	56-60	HN	Height of numbers at end of trajectories.
7	61-65	KVEL	Are vector characters to be used? (1 - yes, 0 - no.)
7	66-70	THBD	Thickness of boundary lines.
8	8F10.0	XOR(I)	X-coordinates in inches of the origins of the individual plots.
9	8F10.0	YOR(I)	Y-coordinates in inches of the origins of the individual plots.

If selected trajectory plots are desired (KCON = 0, a data card like 13 is required for each plot.

Card input data for subroutine RNGD7G (cont.)

Card	Columns	Variables	Description
	(All but card 13 are read on the first call only.)		
1	16A4	ITLE(I)	(I = 1, 16), title for wind field printout.
2	1-5	NP	Number of wind stations in the network.
2	6-10	NSX	Same as in main.
2	11-15	NSY	Same as in main.
2	16-20	NFX	Same as in main.
2	21-25	NFY	Same as in main.
2	26-30	KSTR	Dummy for this version.
2	31-35	KDATA	Dummy for this version.
2	36-40	KPRINT	Dummy for this version
2	41-45	KVORT	Dummy for this version.
2	46-50	NSTL	Minimum number of stations to use in the interpolation to a grid point.
2	51-55	NDAT	Number of station entries to be read from the data record.
2	56-60	MBGP	Number of length units between grid points.
3	1-5	INPT	Method of wind data input. (1 - tape, 0 - disc.)
4	1-10	RTE	Number of degrees to rotate grid from N-S, E-W orientation.
4	11-20	RCH	Maximum radius in grid units within which all stations are to be used in an interpolation for a given grid point.
5	(16F5.2)	X(I)	(I = 1, NP), X-coordinates, in length units, of wind station locations.

Card input data for subroutine RNGD7G (cont.)

Card	Columns	Variables	Description
6	(16F5.2)	Y(I)	(I = 1, NP), Y-coordinates, in length units, of wind station locations.
7	(16F5.2)	COR(I)	(I = 1, NP), wind direction correction in degrees if needed for any of the wind stations.
8	(16F5.2)	CONFAC(I)	(I = 1, NP), variable used to adjust all wind velocities to some predetermined level (user supplies a logarithmically determined constant for each station, 1 - no adjustment).
9	16(1XA4)	NAMST(I)	(I = 1, NP), four-character name for each station.
10	31I2	ISKIP(I)	(I = 1, NDAT), control parameter to select data from the history tapes ISKIP(I) = 1, Ith value is used; ISKIP(I) = 0, Ith value is not used.
11	16A4	KMON(I)	(I = 1, 12), four-character month identifier.
12	A4	YEAR	Two-digit indicator of the year the wind data were recorded.
12	I6	MAPS	Upper limit on number of maps (time frames) to be analyzed.
13	1-5	MS	Month in which map series begins.
13	6-10	IDS	Day in which map series begins.
13	11-15	IHS	Starting time frame (time frames are numbered 1-N, where N = 24*MPH).
13	16-20	K1ST	Wind field or single station analysis? (0 - wind field, n - use data for nth station only for advection.)
13	21-25	KRW	Start at beginning of data set? (1 - yes, 0 - no.)
13	26-30	KTL5	Four-character word for title (col. 27 is for last digit in year; 28-30 are for 1 to 3 characters of plot identification, i.e., WF or SS).

IV. REFERENCES

Brown, G. D., C. H. Bush, and R. A. Berman (1968): Integrated graphics system for the S-C4060: 1. Users manual, Memorandum RM5660-PR, prepared for the U. S. Air Force by the Rand Corp., Santa Monica, Calif., December 1968, 118 pp.

Wendell, L. L. (1970): A preliminary examination of mesoscale wind fields and transport determined from a network of wind towers, NOAA Tech. Memo. ERLTM-ARL 25, U. S. Dept. of Commerce, Air Resources Laboratories, Silver Spring, Md., 27 pp.+ appendixes.

Wendell, L. L. (1972): Mesoscale wind fields and transport estimates determined from a network of wind towers, Mon. Wea. Review 100 (7): 565-578.

APPENDIX A.

PROGRAM LISTINGS FOR RNGRDG AND SUBROUTINES

```
C*****PROGRAM RNGRDG
C       NP - NUMBER OF WIND STATIONS
C       NSX - STARTING VALUE FOR X
C       NSY - STARTING VALUE FOR Y
C       KPASS - NO. MAPS AND PLOTS BYPASSED
C       RTE - ROTATION OF ARTS ON GRID
C       RCH - RADIUS OF CIRCLE ENCLOSING DATA VALUES FOR INTERPOLATION
C       DX - SPACING OF GRID POINTS IN X-DIRECTION
C       DY - SPACING OF GRID POINTS IN Y-DIRECTION
C       DT - INCREMENTS OF TIME IN HOURS
C       DS - LENGTH OF SHAFT ON WIND ARROW
C       H - GRID INTERVAL IN MILES
C       X - X COORDINATE OF STATION
C       Y - YCOORDINATE OF STATION
C       ITLE - TITLE OF PLOT
C       DIR - DIRECTION OF WIND AT STATION
C       SPD - VELOCITY OF WIND AT STATION
C       COR(I) - CORRECTION  (WHOLE DEGREES) AT STATION (I)
C       NAMST - NAMES OF THE STATIONS
C       CONFAC - CONVERSION FACTOR TO CHANGE WIND SPEED TO THE 100 FT LEVE
C*****MPD - MAPS PER DAY
C*****MPH - MAPS PER HOUR
C**** DBGP - MILES BETWEEN GRID POINTS
C**** KXGU - STATION LOCATION UNITS, 1-GRID UNITS, 0-MILES
        DIMENSION DIR(50), SPD(50), U(50), V(50), X(50), Y(50), UG(20,20),
       1VG(20,20), ITLE(16),R3(10,14,17),N3(10,14,17),RT(30),NSB(30)
        DIMENSION D(31),   S(31),   LFLAG(25),COR(25)    ,NSV(20,20)
       1,CONFAC(25),NAMST(30)
        DIMENSION ISKIP(31),I1(3),I2(3),IRRAY1   (31),IRRAY2   (31),
       1 KMON(12),GI(200)
        REAL*8 TME
C       INTEGER*2 IWD(72,10)
        INTEGER*2 IWD(48,20)
        CALL TIMSET
        READ 200, ITLE
  200 FORMAT(16A4)
        READ 14, SC1,SC2,SH,DS
   14 FORMAT (20F4.0)
        SC2=1./SC2
        KNR=0
        READ 11, NP, NSX, NSY, NFX, NFY, KSTR, KDATA, KPRINT,KVORT,KPASS,
       1NSTL,MPH,KXGU,NDAT
        READ 11,INPT
   11 FORMAT (16I5)
        READ 12, RTE, RCH,DBGP
   12 FORMAT (8F10.0)
        READ 10, (X(I), I=1,NP)
   10 FORMAT(16F5.0)
        READ 10, (Y(I), I=1,NP)
        READ 10, (COR(I),I=1,NP)
        RCH=RCH**2
        READ 40,(CONFAC(I),I=1,NP)
   40 FORMAT (16F5.2)
        FMGP=DBGP
        IF(KXGU.EQ.1) GO TO 645
        DO 640 I=1,NP
        X(I)=X(I)/FMGP
```

```
  640 Y(I)=Y(I)/FMGP
  645 MPD=24*MPH
      IDT=60/MPH
      CF1=CONFAC(1)
      CF2=CONFAC(2)
      CF4=CONFAC(4)
      READ 45,(NAMST(I),I=1,NP)
   45 FORMAT (16(1XA4))
      READ 71,   (ISKIP(I),I=1,NDAT)
   71 FORMAT (31I2)
      READ 200,(KMON(I),I=1,12)
      READ 42,YEAR,MAPS
   42 FORMAT (A4,I6)
      PRINT 19,(ITLE(I),I=1,16)
   19 FORMAT (1H1,16A4)
      PRINT 6666,(NAMST(I),I=1,NP)
 6666 FORMAT (1H04X25(1XA4))
      PRINT 630,(X(I),I=1,NP)
  630 FORMAT ('0 X =',25F5.1)
      PRINT 635,(Y(I),I=1,NP)
  635 FORMAT ('0 Y =',25F5.1)
      PRINT 44,(CONFAC(I),I=1,NP)
   44 FORMAT ('0CF =',25F5.2)
      KMAP=0
      KMOD=0
      JBY=KPASS
      KMS=13
C*****SECTION FOR SETTING UP STATION ARRAY FOR EACH GRID POINT
      XG=NSX-1
      DO 730 I=NSX,NFX
      YG=NSY-1
      DO 720 J=NSY,NFY
      DO 705 L=1,NP
      NSB(L)=L
  705 RT(L)=(X(L)-XG)**2+(Y(L)-YG)**2
      CALL ASCND(RT,NSB,NP)
      DO 706 L=1,10
      R3(L,I,J)=RT(L)
  706 N3(L,I,J)=NSB(L)
  720 YG=YG+1.
  730 XG=XG+1.
      NPP=NP+1
      P18=3.1415927/180.
      IS=1
  780 READ 11,MS,IDS,IHS,ML,IDL,IHL,KNTHR,KREC,KREW,KFRM
C**** KNTHR; ANOTHER SERIES OF MAPS TO FOLLOW THIS ONE
C**** KREC; READ ANOTHER RECORD, 1-YES, 0-NO
      IF(KREW.EQ.1) REWIND 8
C**** KREW; START AT BEGINNING? 1-YES, 0-NO
C**** KFRM; START PLOTS ON A NEW FRAME? 1-YES, 0-NO
      KNR=0
      KDS=IHS*MPH
      IHL=IHL*MPH
      IF(KREC.EQ.0) GO TO 1312
  800 NTATE=0
      ICNT=0
      IF(INPT.EQ.1) GO TO 805
```

```
      READ (8) IWD
      GO TO 5
  805 CALL BUFFER (8,IWD,1488,NTATE,ICNT)
      CALL DELAY(8,0,0,NTATE,ICNT)
      IF (NTATE.NE.3) GO TO 5
      PRINT 50
   50 FORMAT(' END OF FILE READ ON THE INPUT UNIT')
      GO TO 503
    5 MON=IWD(1,1)/100
      IDAY=IWD(1,1)-MON*100
      IF(KNR.GT.0) GO TO 1312
      IF (MON.LT.MS) GO TO 800
      IF (IDAY.LT.IDS) GO TO 800
      KNR=1
 1312 DO 64III=KDS,MPD
      CALL TIMEL(TME)
      JBY=JBY+1
      IF (JBY.LE.KPASS) GO TO 899
      JBY=0
      M=0
      DO 210 J=1,NDAT
      IRRAY1  (J)=0.
      IRRAY2  (J)=0.
      IF (ISKIP (J).EQ.0) GO TO 210
      M=M+1
      IRRAY1(M)=IWD(III,J)/100
      IRRAY2(M)=IWD(III,J)-IRRAY1(M)*100
  210 CONTINUE
  300 CONTINUE
      DO 60 J=1,M
      D(  J)=IRRAY1(  J)
   60 S(  J)=IRRAY2(  J)
C*****END STATION ARRAY SECTION
      JI=0
      MHR=III/MPH
      MMN=(III-MHR*MPH)*IDT
      MHR=MHR*100+MMN
      JJ=D(1)+.1
      JK=S(1)+.1
      IF (KPRINT.EQ.0) GO TO 1501
 1399 PRINT 66,MHR,JK,KMON(JJ),YEAR,ITLE
   66 FORMAT (1H1I5,' MST',I3,2A4,5X16A4)
      PRINT 1401,(NAMST(I),I=1,NP)
 1401 FORMAT (1H010X23(1XA4))
 1400 PRINT 1500, (D(     KS),KS=1,NPP)
      PRINT 1502, (S(     KS),KS=1,NPP)
 1500 FORMAT(1HOF10.0,23F5.0)
 1502 FORMAT(1H F10.0,23F5.0)
 1501 DO 1317 IN=2,NPP
      JI=JI+1
      DIN=D(IN)
      SII=S(IN)
      IF (DIN - 89.       ) 1315,1314,1314
 1314 LFLAG(JI)=1
      U(JI)=0.0
      V(JI)=0.0
      GO TO 1317
```

MODIFIED LOOP 210. WILL SKIP SELECTED STA'S

```
DO 210 J=1, NDAT
IF(ISKIP(J).EQ.0) GO TO 217
IRRAY1(J)= IWD(III,J)/100
IRRAY2(J)= IWD(III,J) - IRRAY1(J) *100
GO TO 210
217 IRRAY1(J)=99
210 CONTINUE
```

```
 1315 IF (SII - 89.     ) 1316,1314,1314
 1316 LFLAG(JI)=0
      IF (DIN.LE.36) GO TO 1320
      LFLAG (JI)=2
      DIN=DIN-50.
 1320 DIR(JI)=      DIN *10. +CDR(JI)
      SPD(JI)=      SII *CONFAC(JI)
 1317 CONTINUE
 1319 KSR=0
      DO 15 I=1,NP
      IF (LFLAG(I)-1) 1318,15,1318
 1318 DR=DIR(I)-RTE
      ANG=(270-DR)*P18
      U(I)=SPD(I)*COS(ANG)
      V(I)=SPD(I)*SIN(ANG)
   15 CONTINUE
      IF (KPRINT.EQ.0) GO TO 49
      PRINT 16
   16 FORMAT (1HO,' U AND V COMPONENTS')
      PRINT 17,(U(I),I=1,NP)
      PRINT 17,(V(I),I=1,NP)
   17 FORMAT (1H 11X23F5.1)
      PRINT 18
   18 FORMAT ('0  NO. OF STATIONS IN INT.')
C*****INTERPOLATION SECTION BEGIN
   49 DO 895 I=NSX,NFX
      DO 890 J=NSY,NFY
      SNU=0.0
      SNV=0.0
      SND=0.0
      NS=0
      DO 870 L=1,10
      LS = N3(L,I,J)
      RS = R3(L,I,J)
      IF (LFLAG(LS).EQ.1) GO TO 870
      IF (RS.LE.1.E-15) GO TO 850
      IF (NS.LT.NSTL) GO TO 820
      IF (RS.GT.RCH) GO TO 875
  820 RSI=1./RS
      SNU=SNU+U(LS)*RSI
      SNV=SNV+V(LS)*RSI
      SND=SND+RSI
      NS=NS+1
      GO TO 870
  850 UG(I,J)=U(LS)
      VG(I,J)=V(LS)
      NSV(I,J)=1
      GO TO 890
  870 CONTINUE
  875 UG(I,J)=SNU/SND
      VG(I,J)=SNV/SND
      NSV(I,J)=NS
  890 CONTINUE
  895 CONTINUE
      CALL TIMEL(TME)
      TM1=TME
C*****INTERPOLATION SECTION END
```

```
      IF (KPRINT) 555,555,58
   58 DO 898 I=NSX,NFX
  898 PRINT 36,(NSV(I,J),J=NSY,NFY)
   36 FORMAT (1H ,20I5)
      PRINT 57,TME
   57 FORMAT ('0 TIME =',F8.3,'  SECS')
      PRINT 51
      DO 52 I=NSX,NFX
   52 PRINT 53, (UG(I,J), J=NSY,NFY)
      PRINT 54
      DO 55 I=NSX,NFX
   55 PRINT 53, (VG(I,J), J=NSY,NFY)
   51 FORMAT (25HOINTERPOLATED VALUES OF U/)
   54 FORMAT (25HOINTERPOLATED VALUES OF V/)
   53 FORMAT (1H , 18F7.2)
  555 IF (KDATA) 29,29,26
   26 CALL CSTREM (UG,VG,NSX,NSY,NFX,NFY,ITLE,SPD,DIR,X,Y,DS,KSTR,NP,RTE
     1,SC1,SC2,SH,LFLAG,MHR,JK,JJ,YEAR,KMOD,GI,KFRM)
      CALL TIMEL(TME)
      IF(KPRINT.EQ.1) GO TO 29
  559 FORMAT (2H1 )
      PRINT 560,MHR,JK,KMON(JJ),YEAR,TM1,TME
  560 FORMAT (1H ,I5,' MST',I3,2A4,'  TMC = 'F6.3,'  TMP = 'F6.3)
      KMS=KMON(JJ)
   29 CONTINUE
      CONFAC(1)=CF1
      CONFAC(2)=CF2
      CONFAC(4)=CF4
  899 KMAP=KMAP+1
      IF (KMAP.GE.MAPS) GO TO 503
      IF(MON.LT.ML) GO TO 64
      IF (IDAY.LT.IDL) GO TO 64
      IF (III.GE.IHL) GO TO 503
   64 CONTINUE
      KDS=1
      GO TO 800
  503 IF(KNTHR.EQ.1) GO TO 780
      PRINT 501
  501 FORMAT(7H1FINISH)
      CALL PAGEG (GI,0,0,1)
      CALL EXITG (GI)
      STOP
      END
```

```
      SUBROUTINE ASCND (X,N,NP)
      DIMENSION X(30),N(30)
      NP1=NP-1
      DO 50 I=1,NP1
      KI=0
      DO 40 K=1,NP1
      IF(X(K+1).GT.X(K)) GO TO 40
      KI=K+1
      TMP=X(K)
      NTMP=N(K)
      X(K)=X(KI)
      N(K)=N(KI)
      X(KI)=TMP
      N(KI)=NTMP
   40 CONTINUE
      IF (KI.EQ.0) GO TO 60
   50 CONTINUE
   60 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE STNCL (INUM,ISTN,KT,KU,IWD)
      DIMENSION I2S(4)
      DATA I2S/1,256,65536,16777216/
C**** LT=TENS DIGIT, LU=UNITS DIGIT
      LT=INUM/10
   20 LU=INUM-LT*10
  502 IIN=LT*I2S(KT)+LU*I2S(KU)
      IWD=IOR(IIN,ISTN)
      RETURN
      END
```

```
      SUBROUTINE CSTREM (U,V,NSX,NSY,NFX,NFY,ITLE,SPD,DIR,X,Y,DS,KSTR,
     1NP,RTE,SC1,SC2,SH,LFLAG,MHR,JK,MON,YEAR,KMOD,GI,KFRM)
      DIMENSION DIR(50),SPD(50),X(50),Y(50),U(20,20),V(20,20),ITLE(16)
     1,LFLAG(25),M(21),GI(200),XMIN(30),YMIN(30),XMAX(30),YMAX(30)
      DIMENSION XSV(30),YSV(30),XOR(30),YOR(30),IST(4),XN(9),YN(9),XP(9)
     1,YP(9),LTLE(4)
      DATA IST/ZF0F0F0F0,Z40FCF061,ZF0F061F6,ZF9404040/
      DATA XN/0.0,0.0,-.2,0.0,0.2,-.2,-.2,0.2,0.2/
      DATA YN/-1.0,1.0,0.5,0.7,0.5,-.3,0.3,-.3,0.3/
      IF(KMOD.GT.0) GO TO 2715
      P18=3.1415927/180.
      KSTE=0
      KMOD=1
      CALL MODESG (GI,0)
      CALL OBJCTG(GI,0.0,0.0,1.3333,1.0)
      CALL SETSMG (GI,93,1.)
      CALL SETSMG(GI,16,60.)
      CALL SETSMG (GI,45,0.75)
      CALL SETSMG (GI,30,0.5)
      CALL SETSMG(GI,83,70.)
      CALL PAGEG (GI,0,0,1)
C**** L=PICTURE COUNTER
      L=0
      BXF=FLOAT(NFX-1)*SC1
      BYF=FLOAT(NFY-1)*SC1
      BTY=BYF+0.5*SC1
      READ 15,(IST(I),I=1,4)
   15 FORMAT (8(2X,Z8))
C**** KNAR - NORTH ARROW OPTION
      READ 10,NPPF,LPG,XSBJ,YSBJ,XNOR,YNOR,KNAR
   10 FORMAT (2I5,4F10.0,I5)
      READ 12, (XOR(I),I=1,NPPF)
      READ 12, (YOR(I),I=1,NPPF)
   12 FORMAT (8F10.0)
      DO 30 I=1,NPPF
      XMIN(I)=-XOR(I)
      YMIN(I)=-YOR(I)
      XMAX(I)=XSBJ+XMIN(I)
      YMAX(I)=YSBJ+YMIN(I)
   30 CONTINUE
      LTLE(4)=IST(4)
      ANG=-RTE*P18
      SN=SIN(ANG)
      CS=COS(ANG)
      DO 50 I=1,9
      XP(I)=(XN(I)*CS+YN(I)*SN+XNOR)*SC1
      YP(I)=(YN(I)*CS-XN(I)*SN+YNOR)*SC1
   50 CONTINUE
      DO 40 I=1,NP
      XSV(I)=X(I)*SC1
   40 YSV(I)=Y(I)*SC1
 2715 IF(KFRM.EQ.0) GO TO 2716
      CALL PAGEG (GI,0,0,1)
      L=0
      KFRM=0
      PRINT 3000
 3000 FORMAT ('0 NEW PAGE')
```

```
      CALL SUBJEG (GI,XMIN(L),YMIN(L),XMAX(L),YMAX(L))
 2716 L=L+1
  510 KHR=MHR/100
      KMN=MHR-KHR*100
      CALL STNCL(KHR,IST(1),4,3,LTLE(1))
      CALL STNCL(KMN,LTLE(1),2,1,LTLE(1))
      CALL STNCL(MON,IST(2),3,2,LTLE(2))
      CALL STNCL(JK,IST(3),4,3,LTLE(3))
      CALL LEGNDG(GI,0.2,BTY,16,LTLE)
      CALL LINESG (GI,0,0.0,0.0)
      CALL LINESG (GI,1,BXF,0.0)
      CALL LINESG (GI,1,BXF,BYF)
      CALL LINESG (GI,1,0.0,BYF)
      CALL LINESG (GI,1,0.0,0.0)
      IF(KNAR.EQ.0) GO TO 66
      CALL LINESG(GI,0,XP(1),YP(1))
      DO 60 I=2,5
   60 CALL LINESG(GI,1,XP(I),YP(I))
      CALL LINESG(GI,1,XP(2),YP(2))
      CALL LINESG(GI,0,XP(6),YP(6))
      DO 65 I=7,9
   65 CALL LINESG(GI,1,XP(I),YP(I))
C  66 CALL SITE (SC1,GI,KSTE)
   66 CALL SITE (GI,SC1,KSTE)
      DO 2 I=1,NP
      XS=XSV(I)
      YS=YSV(I)
      IF (LFLAG(I)-1) 1,6,5
    6 CALL LEGNDG (GI,XS,YS,1,1H+)
      GO TO 2
    5 CALL LEGNDG (GI,XS,YS,1,1H*)
    1 DR=DIR(I)-RTE
      CALL WNDARW (SPD(I),DR,XS,YS,DS,P18,GI)
    2 CONTINUE
      IF (KSTR) 4,4,3
    3 CALL STREM2 (U,V,NSX,NSY,NFX,NFY,SC1,SC2,SH,GI)
    4 IF(L.EQ.LPG) CALL PAGEG (GI,0,0,1)
      IF(L.LT.NPPF) GO TO 550
      L=0
      CALL PAGEG (GI,0,0,1)
      PRINT 3000
  550 RETURN
      END
```

```
      SUBROUTINE WNDARW (V,D,X,Y,DS,P18,GI)
      DIMENSION GI(200)
      CALL LINESG (GI,0,X,Y)
      IF(V.GT.0.5) GO TO 5
      CALL CIRARG (GI,X,Y,0.08,0.0,360.)
      GO TO 40
    5 ANG=(270-D)*P18
      C=COS (ANG)
      S=SIN (ANG)
      DX=DS*C
      DY=DS*S
      X1=X-DX
      Y1=Y-DY
      CALL LINESG (GI,1,X1,Y1)
      DB=.5*DS
      DC=DB*.94
      DL=DB*.34
      CC=DC*C
      CS=DC*S
      KV=V/10.
      DX1=.15*DX
      DY1=.15*DY
      DX2=2.*DX1
      DY2=2.*DY1
      XPS=X1
      YPS=Y1
      XPF=X1-DL*C-CS
      YPF=Y1-DL*S+CC
      IF(KV) 30,30,10
   10 LV=KV/5
      IF (LV) 25,25,15
   15 DO 16 L=1,LV
      CALL LINESG (GI,1,XPF,YPF)
      XPS=XPS+DX2
      YPS=YPS+DY2
      XPF=XPF+DX2
      YPF=YPF+DY2
   16 CALL LINESG (GI,1,XPS,YPS)
      XPS=XPS+DX1
      YPS=YPS+DY1
      XPF=XPF+DX1
      YPF=YPF+DY1
      NV=KV-LV*5
      IF(NV.LE.0) GO TO 30
      GO TO 27
   25 NV=KV
   27 DO 20 K=1,NV
      CALL LINESG (GI,0,XPS,YPS)
      CALL LINESG (GI,1,XPF,YPF)
      XPS=XPS+DX1
      YPS=YPS+DY1
      XPF=XPF+DX1
   20 YPF=YPF+DY1
   30 EX=V-FLOAT (KV*10)
       IF(EX-.5) 40, 40, 35
   35 EX=.1*EX
      XPF=XPS+EX*(XPF-XPS)
```

```
      YPF=YPS+EX*(YPF-YPS)
      BL=SQRT((XPF-XPS)**2+(YPF-YPS)**2)
      IF(BL.LT.0.26) GO TO 55
      PRINT 50,X,Y,V,KV,EX,BL
   50 FORMAT (' X='F6.2,3X'Y='F6.2,3X'V='F6.2,3X'KV='I3,3X'EX='F6.2,3X
     1'BL='F6.2)
   55 CALL LINESG (GI,0,XPS,YPS)
      CALL LINESG (GI,1,XPF,YPF)
   40 RETURN
      END
```

```
      SUBROUTINE STREM2 (U,V,NSX,NSY,NFX,NFY,SC1,SC2,SH,GI)
      DIMENSION U(20,20),V(20,20),GI(200)
      DX=1.*SC1
      DY=1.*SC1
      XS=SC1*FLOAT (NSX-1)
      Y=SC1*FLOAT (NSY-1)
      XF=(NFX-NSX  )*DX+XS
      K=1
      DASH=.35*SH
      NFX1=NFX+NSX
      DO 50 J=NSY,NFY
      IF (K.EQ.1) X=XS
      IF (K.EQ.2) X=XF
      DO 60 I=NSX,NFX
      IF (K.NE.2) GO TO 35
      L=NFX1-I
      GO TO 37
   35 L=I
   37  IF(U(L,J)) 40,43,40
   43 IF (V(L,J)) 40,45,40
   40 X1=U(L,J)*SC2
      Y1=V(L,J)*SC2
      X2=X + X1
      Y2=Y + Y1
      DEM=SQRT (X1*X1 + Y1*Y1)
      IF(DEM.LT.0.005) GO TO 45
      S=Y1/DEM
      C=X1/DEM
      YY=Y2-SH*S
      XX=X2-SH*C
      CC=C*DASH
      CS=S*DASH
      CALL LINESG (GI,0,X,Y)
      IF(DEM.LT.0.04) GO TO 44
      CALL LINESG (GI,1,X2,Y2)
      CALL LINESG (GI,1,XX+CS,YY-CC)
      IF(DEM.GT.0.11) GO TO 45
      CALL LINESG (GI,0,XX-CS,YY+CC)
   44 CALL LINESG (GI,1,X2,Y2)
   45 IF (K.EQ.1) X=X+DX
      IF (K.EQ.2) X=X-DX
   60 CONTINUE
      Y=Y+DY
      IF (K.NE.1) GO TO 55
      K=2
      GO TO 50
   55 K=1
   50 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SITE (GI,SCF,KSTE)
      DIMENSION X(47),Y(47),GI(200),XT(12),YT(12),XTS(12),YTS(12)
     1,XA(9),YA(9)
      DATA    X/4.51,7.78,6.75,6.82,7.60,7.50,7.55,7.42,7.45,7.42,7.47,
     1 6.88,6.92,5.55,5.35,4.80,4.57,4.52,4.48,4.05,3.71,3.73,3.65,3.72,
     2 3.44,3.33,3.25,3.13,3.05,3.00,2.28,1.04,2.30,2.06,3.05,2.91,2.98,
     3 2.70,2.92,2.48,3.10,3.18,3.14,3.03,3.02,2.91,4.51/
      DATA    Y/2.04,5.83,6.70,6.88,7.82,7.93,8.00,8.12,8.15,8.19,8.28,
     1 8.76,8.80,9.96,9.70,10.17,10.11,10.05,10.08,9.60,9.90,9.94,10.00,
     2 10.09,10.32,10.18,10.24,10.10,10.17,10.10,10.70,9.23,8.17,7.88,
     3 7.04,6.90,6.84,6.51,6.32,5.78,4.83,4.57,4.22,3.73,3.53,3.40,2.04/
      DATA XT/1.77,4.75,6.70,5.10,4.40,6.45,3.38,12.00,11.00,8.15,3.10,
     1 3.55/
      DATA YT/2.70,3.70,4.60,4.40,4.70,7.08,8.85,5.80,10.50,11.80,14.80,
     1 10.68/
      DATA XA/3.9,4.5,5.3,2.4,4.7,5.7,1.2,3.0,6.2/
      DATA YA/6.6,6.9,7.1,9.9,10.2,10.7,13.8,14.9,13.9/
      IF(KSTE.EQ.1) GO TO 35
      KSTE=1
      DO 5 I=1,9
      XA(I)=XA(I)*SCF
    5 YA(I)=YA(I)*SCF
      DO 25 I=1,47
      X(I)=SCF*X(I)
   25 Y(I)=Y(I)*SCF
      DO 30 I=1,12
      XTS(I)=XT(I)*SCF
   30 YTS(I)=YT(I)*SCF
   35 CALL LINESG (GI,0,X(1),Y(1))
      DO 40 I=2,47
   40 CALL LINESG (GI,1,X(I),Y(I))
      CALL POINTG (GI,12,XTS,YTS)
   10 DO 15 I=1,3
      IJ=(I-1)*3+1
      CALL LINESG (GI,0,XA(IJ),YA(IJ))
      DO 14 J=1,2
      K=IJ+J
      CALL LINESG (GI,1,XA(K),YA(K))
   14 CONTINUE
   15 CONTINUE
      RETURN
      END
```

APPENDIX B.

PROGRAM LISTINGS FOR MSTJ4G AND SUBROUTINES

```
C*****PROGRAM MSTJ4G
      DIMENSION UU(14,17),VV(14,17),U(14,17),V(14,17),US(2),VS(2),ITLE(1
     14)
      DIMENSION DX(2,20),DY(2,20),XG(2,20),YG(2,20),XGS(13,200),YGS(13,2
     100),KL(20),KB(20) ,ISY(40),FL(50),KTLE(5),LTLE(8),IST(8)
      DIMENSION GI(200),XN(9),YN(9),XQ(9),YQ(9),XOR(20),YOR(20),XMIN(20)
     1,YMIN(20),XMAX(20),YMAX(20),XEND(20),YEND(20)
      INTEGER*2 IWD(72,12)
      DATA IST/ZF0F0FCF0,Z40F0F061,ZFCFC61F7,ZF1404040,Z40F0F0F0,
     1 ZF04CFCFC,Z61F0F061,ZF6F94040/
      DATA XN/0.0,0.0,-.2,0.0,0.2,-.2,-.2,0.2,0.2/
      DATA YN/-1.0,1.0,0.5,0.7,0.5,-.3,0.3,-.3,0.3/
      EXTERNAL FONT2
      LTLE(5)=IST(4)
      REAL*8 TME
      CALL TIMSET
C     XST - X VALUE AT BEGINNING OF TRAJECTORY
C     YST - Y VALUE AT BEGINNING OF TRAJECTORY
C     SH - PROJECTION OF ARROW HEAD ON SHAFT
      NU=1
      KN=0
      KJ=0
      STIME=0.
      KBKSP=0
      KMCD=0
      KSTE=0
      KOBJ=1
      KERM=1
      READ 404, SC1,DTIME,RTE,SH
  404 FORMAT(20F4.0)
      SCF=SC1
      READ 10,  KIST,NSX,NSY,NFX,NFY,KPLOT,KSPL,II1,II2,KRECL,KCON
  403 FORMAT(8F10.0)
      READ 10,NSITES, NTRAJ,NTIME ,NCOM,KHOUR,KSPH,LTIME,NDTRN,KENDP
     1,MPH,MBGP,MSBT
C**** NDTRN-NUMBER OF RECORDS TO TRANSFER TO DRUM
C**** KENDP - PRINT TRAJECTORY END POINTS,1-YES, 0-NO
C**** KSPH NUMBER OF TIME STEPS BETWEEN MAPS
C**** MPH NUMBER OF MAPS PER HOUR
C*****MBGP - MILES BETWEEN GRID POINTS
C**** MSBT - TIME STEPS BETWEEN RELEASES
   10 FORMAT (16I5)
      CALL TIMEL(TME)
      DO 350 I=1,NDTRN
      READ (10) IWD
      WRITE (8) IWD
  350 CONTINUE
      REWIND 8
      CALL TIMEL(TME)
      PRINT 351,NDTRN,TME
  351 FORMAT ('0 TIME TO TRANSFER',I5,' RECORDS TO DRUM WAS',F8.3,'SECON
     1DS')
      READ 450, (ISY(I),I=1,40)
  450 FORMAT(80A1)
  405 FORMAT(16F5.0)
      DT=1./FLOAT(KSPH)
C**** DTT=TIME INTERVAL BETWEEN SYMBOLS IN MINUTES
```

```
      BT=1./FLOAT(KSPH*MPH)
C**** -TIME STEP FOR ADVECTION IN FRACTION OF AN HOUR
      KSPP=KSPH*MPH
      LTIME=LTIME*KSPP+1
      MPDT=60/MPH
      FMPDT=MPDT
      DTT=DTIME*60.
      DTM=FMPDT*DT
      V7=0.0
      U7=0.0
      C7=0.
      CSF=1.
      FMGP=MBGP
      H=MBGP
      ITJL=24*MPH
      KLAST=0
      KY=(NFY-NSY)*2
      KX=(NFX-NSX)*2
      BDX=FLOAT(NFX-1)*SC1
      BDY=FLOAT(NFY-1)*SC1
      XMX1=BDX+.5
      YMX1=BDY+.5
      KHMPH=KHOUR*MPH
      XMN1= XMX1-8.0
      IIC=0
      IMS=13
      P18=3.1415927/180.
      KKK=0
C     IF (NTIME) 407,407,406
C 406 READ 405, DR7,S7,H7
C     READ 405, (FL(KKK),KKK=1,NTIME)
C     DEM=H7-5000.
C     ANG=(270.-(DR7-49.))*P18
C     U7=S7*COS (ANG)
C     V7=S7*SIN (ANG)
C**** MPKP- CONTROL PARAMETER WHICH HOLDS A RECOR FOR ANOTHER PARTICLE
  407 READ 100, KTLE
      READ 1405,XST,YST,TINK,IRLSE
 1405 FORMAT (3F5.0,A4)
      XST=XST/FMGP
      YST=YST/FMGP
      LTLE(1)=KTLE(1)
      DO 150 IIN=1,NSITES
      CALL TIMEL (TME)
      STIME=STIME+TME
      MPKP=0
      KSP=0
      N1=0
      IF(IIC.EQ.1) GO TO 506
      III=II1*MPH
      KDS=III
      IIC=1
      GO TO 408
  506 III=II2*MPH
      KDS=III
      IIC=0
  408 ITRJ=III+KHMPH
```

```
C       IF(ITRJ.EQ.ITJL) MPKP=1
        III=III-1
   98   NTR=1
   99   TINK=TINK*DT
  100   FORMAT(14A4)
        FAC=DTM/(H*60.)
        XS=NSX-1
        XL=NFX-1
        YS=NSY-1
        YL=NFY-1
        DO 89 I=1,NTRAJ
        XG(1,I)=XST
        YG(1,I)=YST
        YGS(I,1)=YST
        XGS(I,1)=XST
        KL(I)=0
   89   KB(I)=1
C**** IHCUR-THE STEP COUNTER, KHOUR IS THE TOTAL NUMBER OF STEPS
        IHCUR=0
  104   IHOUR=IHOUR+1
        IF (IHCUR-1) 105,105,106
  105   CALL RNGD7G(KN,KJ,U,V,III,IDAY,MON,YEAR,KIST,MPKP,KNR,MPH,LTL5)
        IDSV=IDAY
        IH1=III/MPH
        KHR=IH1
        MMN=(III-IH1*MPH)*MPDT
        KMN=MMN
        IH1=IH1*100+MMN
        IM1=MON
        ID1=IDAY
        IMK=MON
        GO TO 111
  106   DO 411 I=NSX,NFX
        DO 411 J=NSY,NFY
        U(I,J)=UU(I,J)
  411   V(I,J)=VV(I,J)
  111   CALL RNGD7G(KN,KJ,UU,VV,III,IDAY,MON,YEAR,KIST,MPKP,KNR,MPH,LTL5)
        IMC=MON
        IF(IHCUR.LT.KHMPH) GO TO 1116
        IH3=III/MPH
        MMN=(III-IH3*MPH)*MPDT
        IH3=IH3*100+MMN
        IM3=MON
        ID3=IDAY
 1116   NHOUR=(IHOUR-1)/MSBT+1
        IF(NHOUR.NE.NTRAJ) GO TO 160
        N1=N1+1
        IF(N1.LT.3) GO TO 160
        IH2=III/MPH
        MMN=(III-IH2*MPH)*MPDT
        IH2=IH2*100+MMN
        IM2=MON
        ID2=IDAY
  160   IF(NHOUR.LE.NTRAJ) GO TO 1117
        NHOUR=NTRAJ
        IF(III.NE.1) GO TO 1117
        IF (IIC.EQ.0) GO TO 1117
```

```
C***** ONLY PARTICLES FROM EARLY RELEASE INTO NEXT DAY WILL CAUSE BACKSP
C***** THEREFORE HOLD ADVECTION PERIOD UNDER 24 HOURS
      KBKSP=1
C     PRINT 1105, III,IDAY,IHOUR,KBKSP,NTRAJ
 1105 FORMAT (1H ,10I5)
 1117 KLK=1
C     PRINT 9917,IHOUR,NHOUR,KHMPH,NTRAJ,III
C9917 FORMAT (' IHOUR=',I4,'  NHOUR=',I4,3I5)
      DO 44 K=1,NHOUR
      KS=0
      TINC=TINK
      IF(KL(K)) 601,601,44
  601 KLK=0
  101 DO 430 M=1,2
      FM=M
      C2= (TINC + (FM-1.) * DT)/ DTIME
      C1=1.0-C2
      I=XG(M,K)+1.05
      IF(I.LT.NSX) GO TO 29
      J=YG(M,K)+1.05
      IF(J.LT.NSY) GO TO 29
      FI=I-1
      FJ=J-1
      RX=XG(M,K)-FI
      RY=YG(M,K)-FJ
      I1=I+1
      IF(I1.GT.NFX) GO TO 29
      J1=J+1
      IF(J1.GT.NFY) GO TO 29
      RX1=1.-RX
      RY1=1.-RY
      A=RX1*RY1
      B=RY*RX1
      C=RX*RY
      D=RX*RY1
      CST=A*(C1*U(I,J)+C2*UU(I,J))
      CST=CST+B*(C1*U(I,J1)+C2*UU(I,J1))
      CST=CST+C*(C1*U(I1,J1)+C2*UU(I1,J1))
      CST=CST+D*(C1*U(I1,J)+C2*UU(I1,J))
      UCST=CST
C**** CST=CST*CSF+C7*U7          FOR INTERPOLATION WITH AN UPPER WIND
      US(M)=CST
      CST=A*(C1*V(I,J)+C2*VV(I,J))
      CST=CST+B*(C1*V(I,J1)+C2*VV(I,J1))
      CST=CST+C*(C1*V(I1,J1)+C2*VV(I1,J1))
      CST=CST+D*(C1*V(I1,J)+C2*VV(I1,J))
      VCST=CST
C**** CST=CST*CSF+C7*V7          FOR INTERPOLATION WITH AN UPPER WIND
      VS(M)=CST
      DX(M,K)=US(M)*FAC
      DY(M,K)=VS(M)*FAC
      IF (M-2) 34,43,34
   34 MM=M+1
      XG(MM,K)=XG(M,K)+DX(M,K)
      YG(MM,K)=YG(M,K)+DY(M,K)
   43 CONTINUE
C  43 IF (NTIME) 430,430,1124
```

```
C1124 IF (M-2) 1125,430,430
C1125 KKK=KKK+1
C     CS=(H7-FL(KKK))/DEM
C     C7=(FL(KKK)-5000.)/DEM
C     IF (CS) 1119,1119,430
C1119 CS=0.
C     C7=1.
  430 CONTINUE
      KS=KS+1
      TINC=TINC+DT
      KB(K)=KB(K)+1
      IT=KB(K)
      ITL=IT-1
      XGS(K,IT)=XGS(K,ITL)+.5*(DX(1,K)+DX(2,K))
      YGS(K,IT)=YGS(K,ITL)+.5*(DY(1,K)+DY(2,K))
      IF(IT.GE.LTIME) GO TO 29
      XG(1,K)=XGS(K,IT)
      YG(1,K)=YGS(K,IT)
  997 FORMAT(1X2I5,2F10.5)
C     IF (NTIME) 1127,1127,1126
C1126 IF (KKK-NTIME) 1127,271,271
 1127 IF(KS-KSPH) 101,44,44
   29 KL(K)=1
   44 CONTINUE
C     KSP=KSP+KSPH
C     IF(KSP.LT.KSPP) GO TO 475
C     KSP=0
C     PRINT 455,NHOUR
  455 FORMAT (' TRAJECTORY POSITIONS FOR HOUR ',I3)
C     DO 460 K=1,NHOUR
C     K3=KB(K)
C     K2=K3-5
C 460 PRINT 470,K2,K3,(XGS(K,KE),YGS(K,KE),KE=K2,K3)
  470 FORMAT (1H ,I3,' THRU',I4,6(2F6.2,2X))
  475 IF(KLK.EQ.0) GO TO 2700
C***** ALL PARTICLES OFF GRID.  ADVECTION TERMINATING
      IH3=III/MPH
      MMN=(III-IH3*MPH)*MPDT
      IH3=IH3*100+MMN
      IM3=MON
      ID3=IDAY
      IF(IH3.EQ.24) KJ=0
      GO TO 271
 2700 TINK=0.0
      IF (IHOUR.LT.KHMPH) GO TO 104
  271 ISTR=0
      IF(KBKSP.EQ.0) GO TO 2702
      KJ=1
      BACKSPACE 8
      BACKSPACE 8
      KBKSP=0
      PRINT 2706
 2705 FORMAT (' BACKSPACED  TWO RECORD(S)')
 2702 CALL TIMEL (TME)
      STIME=STIME+TME
      TMC=TME
      IF(IMC.EQ.IMK) GO TO 2705
```

```
      IF(IIC.EQ.1) GO TO 2705
      IF(IHCUR.GT.84) GO TO 2705
      KLAST=1
      IMK=IMC
 2705 IF(IIN.EQ.NSITES) KLAST=1
      IF(KRECL.EQ.0) GO TO 2708
C     CALL RECLI(NTRAJ,KX,KY,KB,XST,YST,XS,YS,XGS,YGS,KLAST,DT,IRLSE)
 2708 CALL TIMEL(TME)
      STIME=STIME+TME
      TMR=TME
C     SCALE THE DATA POINTS
      IF(KENDP.EQ.0) GO TO 2709
      DO 326 KE=1,NTRAJ
      K1=KB(KE)
      XEND(KE)=XGS(KE,K1)
  326 YEND(KE)=YGS(KE,K1)
 2709 IF(KPLOT.EQ.0) GO TO 280
 2710 DO 274 II=1,NHOUR
      NN=KB(II)
      IF (NN-1) 274,274,272
  272 DO 273 JJ=1,NN
      XGS(II,JJ)=XGS(II,JJ)*SCF
  273 YGS(II,JJ)=YGS(II,JJ)*SCF
  274 CONTINUE
      IF(KMOD.GT.0) GO TO 2715
      CALL MODESG (GI,0)
      CALL VECIG (GI,FONT2,0)
      CALL SETSMG(GI,93,1.)
      CALL SETSMG (GI,16,60.)
      KMOD=1
      CALL OBJCTG(GI,0.0,0.0,1.3333,1.0)
      CALL PAGEG (GI,0,0,1)
C**** L=PICTURE COUNTER
      L=0
      READ 11,NPPF,LPG,XSBJ,YSBJ,XNOR,YNOR,THLN,HT,HL,HN,KVEC,THBD
   11 FORMAT (2I5,2F10.0,6F5.0,I5,F5.0)
      READ 12, (XOR(I),I=1,NPPF)
      READ 12, (YOR(I),I=1,NPPF)
   12 FORMAT (8F10.0)
      CALL SETSMG (GI,45,HT)
      DO 30 I=1,NPPF
      XMIN(I)=-XOR(I)
      YMIN(I)=-YOR(I)
      XMAX(I)=XSBJ+XMIN(I)
      YMAX(I)=YSBJ+YMIN(I)
   30 CONTINUE
      ANG=-RTE*P18
      SN=SIN(ANG)
      CS=COS(ANG)
      DO 50 I=1,9
      YQ(I)=(YN(I)*CS-XN(I)*SN+YNOR)*SC1
      XQ(I)=(XN(I)*CS+YN(I)*SN+XNOR)*SC1
   50 CONTINUE
 2715 L=L+1
      CALL SETSMG (GI,30,THBD)
      CALL SUBJEG (GI,XMIN(L),YMIN(L),XMAX(L),YMAX(L))
      CALL STNCL (KHR,IST(1),4,3,LTLE(2))
```

```
      CALL STNCL (IM1,IST(2),3,2,LTLE(3))
      CALL STNCL (IDI,IST(3),4,3,LTLE(4))
      LTLE(5)=LTL5
      CALL LEGNDG (GI,0.0,YMX1,20,LTLE)
      PRINT 9050,(LTLE(I),I=1,5)
 9050 FORMAT (1HO,5A4)
      CALL LINESG (GI,0,0.0,BDY)
      CALL LINESG (GI,1,0.0,0.0)
      CALL LINESG (GI,1,BDX,0.0)
      CALL LINESG (GI,1,BDX,BDY)
      CALL LINESG (GI,1,0.0,BDY)
      CALL LINESG(GI,0,XQ(1),YQ(1))
      DO 60 I=2,5
   60 CALL LINESG(GI,1,XQ(I),YQ(I))
      CALL LINESG(GI,1,XQ(2),YQ(2))
      CALL LINESG(GI,0,XQ(6),YQ(6))
      DO 65 I=7,9
   65 CALL LINESG(GI,1,XQ(I),YQ(I))
      CALL SITE (GI,SCF,KSTE,MBGP)
      CALL SETSMG (GI,30,THLN)
      IF(KVEC.EQ.0) GO TO 520
      CALL SETSMG (GI,51,1.)
  520 DO 279 II=1,NHOUR
      CALL SETSMG (GI,45,HL)
      ISTR=ISTR+1
      NN=KB(II)
      IF (NN-1) 279,279,275
  275 CALL LINESG (GI,0,XGS(II,1),YGS(II,1))
      CT=BT+BT*0.5
      ISK=ISTR
      JJ=1
 2276 JJ=JJ+1
      CT=CT+BT
      CALL LINESG (GI,1,XGS(II,JJ),YGS(II,JJ))
      IF (CT-DTIME) 277,2749,2749
 2749 IF (JJ-NN) 2750,276,276
 2750 JJ1=JJ+1
      XD=XGS(II,JJ1)-XGS(II,JJ)
      YD=YGS(II,JJ1)-YGS(II,JJ)
      DS=SQRT (XD**2+YD**2)
      IF(DS-0.12) 3030,3020,3020
 3020 FR=0.12/DS
      XP=XGS(II,JJ1)-XD*FR
      YP=YGS(II,JJ1)-YD*FR
      CALL LINESG (GI,1,XP,YP)
 3030 JJ=JJ+1
      XP=XGS(II,JJ)
      YP=YGS(II,JJ)
      CALL LEGNDG (GI,XP,YP,1,ISY(ISK))
      IF (JJ-NN)3035,276,276
 3035 JJ1=JJ+1
      XD=XGS(II,JJ1)-XGS(II,JJ)
      YD=YGS(II,JJ1)-YGS(II,JJ)
      DS=SQRT (XD**2+YD**2)
      IF(DS-.12) 3050,3040,3040
 3040 FR=0.12/DS
      XP=XGS(II,JJ)+XD*FR
```

```
      YP=YGS(II,JJ)+YD*FR
      CALL LINESG (GI,0,XP,YP)
      GO TO 2278
 3050 CALL LINESG (GI,0,XGS(II,JJ1),YGS(II,JJ1))
 2278 ISK=ISK+1
      CT=BT+BT*0.5
  277 IF(JJ-NN) 2276,276,276
  276 N1=JJ-1
      Y1=YGS(II,JJ)-YGS(II,N1)
      X1=XGS(II,JJ)-XGS(II,N1)
      CALL ARROW (XGS(II,JJ),YGS(II,JJ),X1,Y1,SH,GI)
      DS=SQRT (X1**2+Y1**2)
      IF(DS.LT.0.000001) DS=0.000001
      FR=0.20/DS
      XP=XGS(II,JJ)+X1*FR
      YP=YGS(II,JJ)+Y1*FR
      IFMT=1+II/10
C***** THIS IS VALID ONLY IF THERE ARE LESS THAN 20 TRAJECTORIES
      IF(IFMT.LE.1) GO TO 580
      IF(X1.GT.0.) GO TO 580
      AX1=ABS(X1)
      AY1=ABS(Y1)
      IF(AX1.LT.AY1) GO TO 580
      XP=XP+X1*FR
      YP=YP+Y1*FR
  580 CALL SETSMG (GI,45,HN)
      CALL NUMBRG (GI,XP,YP,IFMT,II)
  279 CONTINUE
      CALL SETSMG (GI,45,HT)
      IF(KVEC.EQ.0) GO TO 280
      CALL SETSMG (GI,51,0.)
  280 CALL TIMEL(TME)
      STIME=STIME+TME
      TMP=TME
      IF(IMC.NE.IMS) PRINT 310
  310 FORMAT(2H1 )
      PRINT 320,IRLSE,IH1,IM1,ID1,YEAR,IH2,IM2,ID2,YEAR,IH3,IM3,ID3,YEAR
     1 ,TMC,TMP,TMR
  320 FORMAT (' RLSE PT.',A4,' FROM ',I4,I3,'/',I2,'/',A3,' TO ',I4,
     1I3,'/',I2,'/',A3,' ADVECTED THRU ',I4,I3,'/',I2,'/',A3,'TMC= ',
     2F6.3,' TMP =',F6.3,' TMR= ',F6.3)
      IMS=IMC
      IF(KCON.EQ.1) GO TO 324
      KNR=0
      KJ=1
  324 IF(KENDP.EQ.0) GO TO 325
      PRINT 327,(KB(KE),KE=1,NTRAJ)
  327 FORMAT (1H ,20I6)
      PRINT 328,(XEND(KE),KE=1,NTRAJ)
      PRINT 328,(YEND(KE),KE=1,NTRAJ)
  328 FORMAT (1H ,20F6.2)
  325 IF(KPLOT.EQ.0) GO TO 150
      IF(L.EQ.LPG) CALL PAGEG (GI,0,0,1)
      IF(L.LT.NPPF) GO TO 150
      L=0
      CALL PAGEG (GI,0,0,1)
  150 CONTINUE
```

```
      IF(KPLOT.EQ.0) GO TO 385
      CALL PAGEG (GI,C,0,1)
      CALL EXITG (GI)
  385 PRINT 390,STIME
  390 FORMAT('0 TOTAL CPU TIME= ',F8.3,' SECONDS')
      STOP
      END



      SUBROUTINE STNCL (INUM,ISTN,KT,KU,IWD)
      DIMENSION I2S(4)
      DATA I2S/1,256,65536,16777216/
C**** LT=TENS DIGIT, LU=UNITS DIGIT
      LT=INUM/10
   20 LU=INUM-LT*10
  502 IIN=LT*I2S(KT)+LU*I2S(KU)
      IWD=IOR(IIN,ISTN)
      RETURN
      END



      SUBROUTINE ARROW (X,Y,X1,Y1,SH,GI)
      DIMENSION GI(200)
      ARG=X1**2+Y1**2
      IF(ARG.LT.0.000001) GO TO 3
      DEN=SQRT(ARG)
      S=Y1/DEN
      C=X1/DEN
      CALL LINESG (GI,0,X,Y)
      XX=X-SH*C
      YY=Y-SH*S
      DASH=.25*SH
      CC=C*DASH
      CS=S*DASH
      IF(XX+CS) 1,3,1
    1 IF(YY-CC) 2,3,2
    2 CALL LINESG (GI,1,XX+CS,YY-CC)
      CALL LINESG (GI,0,XX-CS,YY+CC)
      CALL LINESG (GI,1,X,Y)
    3 RETURN
      END
```

```
      SUBROUTINE SITE (GI,SCL,KSTE,MBGP)
      DIMENSION X(21),Y(21),GI(200),XC(100),YC(100),XS(9),YS(9)
      DATA X/26.5,26.6,29.0,29.0,30.5,30.5,28.0,24.5,23.0,23.0,24.0,
     1 24.0,22.0,20.0,20.0,21.0,21.7,22.6,24.0,24.0,26.5/
      DATA Y/40.7,37.0,37.0,35.5,35.0,34.0,29.0,29.0,30.0,31.3,32.5,
     1 34.0,34.0,36.0,37.7,37.7,36.8,36.8,39.0,40.7,40.7/
      DATA XS/1.0,0.2,5.7,52.3,32.4,54.0,54.5,27.5,28.2/
      DATA YS/5.1,35.9,76.6,77.3,61.4,37.2,0.2,22.8,40.2/
      KCON=0
      IF(KSTE.EQ.1) GO TO 35
      SCF=SCL
      KSTE=1
   10 FORMAT (15I5)
      SCF=SCF/FLOAT(MBGP)
      DO 25 I=1,21
      X(I)=SCF*X(I)
   25 Y(I)=Y(I)*SCF
      DO 26 I=1,9
      XS(I)=XS(I)*SCF
   26 YS(I)=YS(I)*SCF
   35 CALL LINESG (GI,0,X(1),Y(1))
      DO 55 I=2,21
   55 CALL LINESG (GI,1,X(I),Y(I))
      DO 56 I=1,9
   56 CALL LEGNDG(GI,XS(I),YS(I),1,1H+)
      IF(KCON.EQ.0) GO TO 75
      CALL LINESG (GI,0,XC(1),YC(1))
      DO 65 I=2,KCON
   65 CALL LINESG (GI,1,XC(I),YC(I))
   75 RETURN
      END
```

```
      SUBROUTINE RNGD7G(KN,KJ,UG,VG,III,IDAY,MON,YEAR,KIST,MPKP,KNR,MPH,
     1KTL5)
C**** MPD - MAPS PER DAY
C     NP - NUMBER OF WIND STATIONS
C     NSX - STARTING VALUE FOR X
C     NSY - STARTING VALUE FOR Y
C     NFX - END VALUE FOR X
C     NFY - END VALUE FOR Y
C     KSTR - STREAMLINE ANALYSIS 1-YES 0-NO
C     KDATA - PLOTS FOR WIND FIELDS 1-YES 0-NO
C     KPRINT TO PRINT INTERPOLATED VALUES. 1-YES 0-NO
C     KVCRT - TO CALL VCRT 1-YES  0-NO
C     RTE - ROTATION OF NRTS ON GRID
C     RCH - RADIUS OF CIRCLE ENCLOSING DATA VALUES FOR INTERPOLATION
C     DX - SPACING OF GRID POINTS IN X-DIRECTION
C     DY - SPACING OF GRID POINTS IN Y-DIRECTION
C     DT - INCREMENTS OF TIME IN HOURS
C     DS - LENGTH OF SHAFT ON WIND ARROW
C     H - GRID INTERVAL IN MILES
C     X - X COORDINATE OF STATION
C     Y - YCOORDINATE OF STATION
C     ITLE - TITLE OF PLOT
C     DIR - DIRECTION OF WIND AT STATION
C     SPD - VELOCITY OF WIND AT STATION
C     COR(I) - CORRECTION  (WHOLE DEGREES) AT STATION (I)
C     NAMST - NAMES OF THE STATIONS
C     CONFAC - CONVERSION FACTOR TO CHANGE WIND SPEED TO THE 100 FT LEVE
C
      DIMENSION DIR(50), SPD(50), U(50), V(50), X(50), Y(50), UG(14,17),
     1VG(14,17), ITLE(16),R3(10,14,17),N3(10,14,17),RT(30),NSB(30)
      DIMENSION D(31),   S(31),   LFLAG(25),COR(25),
     1 CONFAC(25),NAMST(30)
      DIMENSION ISKIP(31),I1(3),I2(3),IRRAY1   (31),IRRAY2   (31),
     1           KMON(12)
      INTEGER*2 IWD(72,12)
      DATA I1,I2/2,3,5,2,4,1/
      IF (KJ.EQ.1) GO TO 790
      IF (KN.NE.0) GO TO 1313
      KNR=0
      READ 200, ITLE
  200 FORMAT(16A4)
      READ 11, NP, NSX, NSY, NFX, NFY, KSTR, KDATA, KPRINT,KVORT,NSTL,
     1 NDAT,MBGP
C*****NDAT - NUMBER OF DATA ENTRIES IN IWD
      READ 11,INPT
   11 FORMAT (16I5)
      READ 12, RTE, RCH
   12 FORMAT (8F10.0)
      READ 40, (X(I), I=1,NP)
   10 FORMAT(20F4.0)
      READ 40, (Y(I), I=1,NP)
      READ 40, (COR(I),I=1,NP)
      RCH=RCH**2
      READ 40,(CONFAC(I),I=1,NP)
   40 FORMAT (16F5.2)
      EMGP=MBGP
      DO 640 I=1,NP
```

```
      X(I)=X(I)/FMGP
  640 Y(I)=Y(I)/FMGP
      READ 45,(NAMST(I),I=1,NP)
   45 FORMAT (16(1XA4))
      READ 71,   (ISKIP(I),I=1,NDAT)
   71 FORMAT (31I2)
      READ 200,(KMON(I),I=1,12)
      READ 42,YEAR,MAPS
   42 FORMAT (A4,I6)
   19 FORMAT (1H1,16A4)
      PRINT 6666,(NAMST(I),I=1,NP)
 6666 FORMAT (1H04X22(1XA4))
      PRINT 630,(X(I),I=1,NP)
  630 FORMAT ('0 X =',22F5.1)
      PRINT 635,(Y(I),I=1,NP)
  635 FORMAT ('0 Y =',22F5.1)
      PRINT 44,(CONFAC(I),I=1,NP)
   44 FORMAT ('0CF =',22F5.2)
      MPD=24*MPH
      KMAP=0
      KN=1
      NPA=NP
      IF(NPA.GT.10) NPA=10
C*****SECTION FOR SETTING UP STATION ARRAY FOR EACH GRID POINT
      XG=NSX-1
      DO 730 I=NSX,NFX
      YG=NSY-1
      DO 720 J=NSY,NFY
      DO 705 L=1,NP
      NSB(L)=L
  705 RT(L)=(X(L)-XG)**2+(Y(L)-YG)**2
      CALL ASCND(RT,NSB,NP)
      DO 706 L=1,NPA
      R3(L,I,J)=RT(L)
  706 N3(L,I,J)=NSB(L)
  720 YG=YG+1.
  730 XG=XG+1.
      DO 735 L=1,NP
      U(L)=0.
  735 V(L)=0.
      NPP=NP+1
      P18=3.1415927/180.
      IS=1
  790 IF(KNR.EQ.1) GO TO 800
      READ 511,MS,IDS,IHS,K1ST,KRW,KTL5
  511 FORMAT (5I5,1XA4)
      III=IHS-1
      IF(KRW.EQ.0) GO TO 800
      REWIND 8
  800 NTATE=0
      ICNT=0
      IF(INPT.EQ.1) GO TO 805
  802 READ (8) IWD
      PRINT 9990,IWD(1,1),IWD(72,11),MS,IDS,III,KJ
 9990 FORMAT (1H ,6I7)
      GO TO 5
C 805 CALL BUFFER (8,IWD,1488,NTATE,ICNT)
```

```
C      CALL DELAY(8,0,0,NTATE,ICNT)
  805 CONTINUE
      IF (NTATE.NE.3) GO TO 5
      PRINT 50,IWD(24,1)
   50 FORMAT(' END OF FILE READ ON THE INPUT UNIT'10X,I5)
      STOP
    5 MON=IWD(1,1)/100
      IDAY=IWD(1,1)-MON*100
      IF(KNR.EQ.1) GO TO 1312
      IF (MON.LT.MS) GO TO 800
      IF (IDAY.LT.IDS) GO TO 800
 1312 KJ=0
      KNR=1
 1313 III=III+1
      M=0
      DO 210 J=1,NDAT
      IRRAY1  (J)=0.
      IRRAY2  (J)=0.
      IF (ISKIP (J).EQ.0) GO TO 210
      M=M+1
      IRRAY1(M)=IWD(III,J)/100
      IRRAY2(M)=IWD(III,J)-IRRAY1(M)*100
  210 CONTINUE
C     PRINT 1000,III,(IWD(III,J),J=1,NDAT)
 1000 FORMAT ('0 III= ',I3,5X,12I5)
  300 CONTINUE
      DO 60 J=1,M
      D(  J)=IRRAY1(  J)
   60 S(  J)=IRRAY2(  J)
C*****END STATION ARRAY SECTION
      JI=0
      MHR=III*100
      JJ=D(1)+.1
      JK=S(1)+.1
 1501 DO 1317 IN=2,NPP
      JI=JI+1
      DIN=D(IN)
      SII=S(IN)
      IF (DIN - 89.       ) 1315,1314,1314
 1314 LFLAG(JI)=1
C     U(JI)=0.0
C     V(JI)=0.0
      GO TO 1317
 1315 IF (SII - 89.     ) 1316,1314,1314
 1316 LFLAG(JI)=0
      IF (DIN.LE.36) GO TO 1320
      LFLAG (JI)=2
      DIN=DIN-50.
 1320 DIR(JI)=      DIN *10. +COR(JI)
      SPD(JI)=      SII *CONFAC(JI)
 1317 CONTINUE
 1319 KSR=0
      DO 15 I=1,NP
      IF (LFLAG(I)-1) 1318,15,1318
 1318 DR=DIR(I)-RTE
      ANG=(270.-DR)*P18
      U(I)=SPD(I)*COS(ANG)
```

```
      V(I)=SPD(I)*SIN(ANG)
   15 CONTINUE
C     PRINT 4050,(DIR(I),I=1,NP)
C     PRINT 4050,(SPD(I),I=1,NP)
 4050 FORMAT (1X23F5.1)
      IF(K1ST.GT.0) GO TO 900
C*****INTERPOLATION SECTION BEGIN
   49 DO 895 I=NSX,NFX
      DO 890 J=NSY,NFY
      SNU=0.0
      SNV=0.0
      SND=0.0
      NS=0
      DO 870 L=1,NPA
      LS = N3(L,I,J)
      RS = R3(L,I,J)
      IF (LFLAG(LS).EQ.1) GO TO 870
      IF (RS.LE.1.E-15) GO TO 850
      IF (NS.LT.NSTL) GO TO 820
      IF (RS.GT.RCH) GO TO 875
  820 RSI=1./RS
      SNU=SNU+U(LS)*RSI
      SNV=SNV+V(LS)*RSI
      SND=SND+RSI
      NS=NS+1
      GO TO 870
  850 UG(I,J)=U(LS)
      VG(I,J)=V(LS)
      GO TO 890
  870 CONTINUE
      IF(NS.GE.NSTL) GO TO 875
      PRINT 871,NS,I,J,III,IDAY,MON,YEAR
  871 FORMAT (' WARNING,ONLY ',I2,' STATIONS FOR I = ',I3,' J= 'I3,I4,
     1':00',I4,'/',I2,'/',A3)
  875 UG(I,J)=SNU/SND
      VG(I,J)=SNV/SND
  890 CONTINUE
  895 CONTINUE
      GO TO 950
C*****INTERPOLATION SECTION END
C**** SINGLE STATION ANALYSIS
  900 IF(LFLAG(K1ST).NE.1) GO TO 920
      PRINT 910,NAMST(K1ST),III,IDAY,MON,YEAR,U(K1ST),V(K1ST)
  910 FORMAT (1HC,A4,' MISSING AT 'I4,';00'I4,'/'I2,'/'A3,' SINGLE STATI
     1ON ANALYSIS CONTINUING WITH U,V= '2F6.2)
C     STOP
  920 DO 930 I=NSX,NFX
      DO 930 J=NSY,NFY
      UG(I,J)=U(K1ST)
  930 VG(I,J)=V(K1ST)
  950 KMAP=KMAP+1
      IF(KMAP.LE.MAPS)GO TO 825
      PRINT 830,MAPS
  830 FORMAT ('0 NUMBER OF MAPS REQUIRED EXCEEDS ' I5)
      STOP
  825 IF (III.LT.MPD) GO TO 896
      III=0
```

```
      KJ=1
  896 RETURN
      END
```

```
      SUBROUTINE ASCND (X,N,NP)
      DIMENSION X(20),N(20)
      NP1=NP-1
      DO 50 I=1,NP1
      KI=0
      DO 40 K=1,NP1
      IF(X(K+1).GT.X(K)) GO TO 40
      KI=K+1
      TMP=X(K)
      NTMP=N(K)
      X(K)=X(KI)
      N(K)=N(KI)
      X(KI)=TMP
      N(KI)=NTMP
   40 CONTINUE
      IF (KI.EQ.0) GO TO 60
   50 CONTINUE
   60 CONTINUE
      RETURN
      END
```