ANALYZING HISTORICAL METEOROLOGICAL DATA FOR AIR QUALITY ANALYSES

by

William A. Carpenter
Faculty Research Scientist

Ronald L. Heisler
Systems Analyst

and

Samuel F. Curling
Environmental Specialist

(The opinions, findings, and conclusions expressed in this report are those of the authors and not necessarily those of the sponsoring agencies.)

Virginia Highway & Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways & Transportation and the University of Virginia)

In Cooperation with the U. S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

June 1979
VHTRC 79-R54

3272

ENVIRONMENTAL RESEARCH ADVISORY COMMITTEE

SUMMARY

The Research Council, in cooperation with the Data Processing and Environmental Quality Divisions, developed a set of three computer programs for analyzing historical meteorological data. These programs significantly improve the Department's ability to analyze and employ historical meteorological data. They are computationally efficient and require significantly less computer time than the currently used programs. They also allow the user to compute atmospheric stability categories by either of two recognized algorithms, and admit the processing of temperature data as well as wind data. These programs have been designed to aggregate and then analyze meteorological data on a season and hour-of-day basis.

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INTRODUCTION

The methods and computer programs[1] currently employed by the Department to analyze historical meteorological data [2,3] require large amounts of computer processing time, produce a voluminous output, sometimes have confusing inputs, and offer only restricted capabilities. To replace these tools, the Research Council, in cooperation with the Data Processing and Environmental Quality Divisions, has developed a set of three computer programs which represent a significant improvement in the science of analyzing and employing historical meteorological data.

The specific objectives of this developmental effort have all been met. In particular, the lengthy outputs currently used to summarize meteorological information by season, hour of day, stability class, wind speed, and wind direction have been replaced by a concise set of statistics which effectively characterize the meteorology. Furthermore, since this meteorological summary is to be used computationally in computer programs designed to evaluate the environmental impact of proposed highways, it is logically arranged and stored on computer tapes to be used as inputs to such environmental analysis programs. The new computer programs are also computationally efficient and require significantly less computer processing time than the currently used program. The new programs allow the user to analyze stability categories by either the Pasquill method[4], or both the Turner and Pasquill methods[4], allow the user to process temperature data as well as wind data and to do so by categorizing the year by season and hour of day.

The new package consists of three programs: PWTHRDCT, PWCLASS, and PNORMAL. The first program, PWTHRDCT, processes original meteorological data tapes to eliminate incorrect, incomplete, or otherwise unusable records and produce a condensed tape which subsequently can be processed efficiently. The second program, PWCLASS, uses the output tape from PWTHRDCT as input. It determines atmospheric stability classes and outputs a tape containing the wind, stability, and temperature data. The final program, PNORMAL, uses the output tape from PWCLASS as input. It determines the mean and standard deviation of the temperature, and the mean vector and covariance matrix of the Cartesian wind vector conditioned on stability class for each of 96 time periods. The output of PNORMAL is designed for input to an environmental analysis program that is the subject of another report[5]. The programs PWTHRDCT, PWCLASS, and PNORMAL, their inputs, outputs, and specifications are described below.

PWTHRDCT

The system's first program, PWTHRDCT, inputs one historical meteorological data tape and one parameter card. The program compares the station numbers on the parameter card with those on the tape. If they are not equal, the program stops. For each hour of data, the program tests for invalid values in the ceiling, wind direction, wind speed, and temperature fields, and replaces any invalid data with "-99". When the wind direction is valid, it is converted to degrees clockwise (CW) from North, with North itself being 360 degrees. (Zero degrees represents 0.0 m/s wind speed.) The four sky conditions are resolved into one value by using the highest value of the four. The data for each hour are output to a tape in the following format:

1) Columns 1-6, date of the observation (year/month/day),
2) Columns 7-8, hour of observation,
3) Columns 9-12, the ceiling value,
4) Columns 13-16, the wind direction in degrees CW from North,
5) Columns 17-20, the wind speed in knots,
6) Columns 21-24, the dry bulb temperature in degrees Fahrenheit, and
7) Columns 25-26, the sky condition.

The format for the input parameter card is:

1) Columns 1-5, the station number,
2) Columns 6-9, the tape's starting date (month/year),
3) Columns 10-13, the tape's ending date (month/year),
4) Columns 14-17, the station latitude in degrees and minutes, and
5) Columns 18-37, a 20 byte station description.

The parameter card fields are written on the output tape as the first two records, the first 17 bytes in the first record and the description in the second. The two dates and the description in the parameter card are used only to label the data.

A listing of PWTHRDCT and its associated documentation is given in Appendix A. The program is written in COBOL and implemented on the Department's IBM 370-148.2M,VS-1 computer.

PWCLASS

The system's second program, PWCLASS, inputs the tape produced by PWTHRDCT and a parameter card. A "1" is entered in column 1 of the parameter card when the user wants the program to compute both the Pasquill and Turner classes; otherwise, a "0" is entered in column 1 and only the Pasquill classes are computed.

The program skips all data points that show "-99" in the wind direction or speed fields, and the computations for determining the Turner stability classes are not performed when the ceiling field equals "-99". (Stability classes are computed according to the logic which is explained in detail in the program's comments.) In addition to determining stability class, PWCLASS converts the wind speed to meters per second, and determines the X and Y components of the wind vector. The valid data for each hour are output to a tape in the following format:

1) Columns 1- 6, the date of the observation (year/month/day),
2) Columns 7- 8, the hour of the observation,
3) Columns 9-11, the wind direction in degrees CW from North,
4) Columns 12-16, the radial wind speed in meters/sec,
5) Columns 17-22, the X component of the wind vector in meters/sec,

6) Columns 23-28, the Y component of the wind vector in meters/sec,
7) Columns 29-32, the dry bulb temperature in degrees Fahrenheit,
8) Columns 33, Turner's class for this observation, which equals 1-6 for classes A-F, respectively, and equals "0" when this class is not computed, and
9) Column 34, Pasquill's class for this observation, which equals 1-5 for classes A-E, respectively.

The format for the parameter card is:

1) Column 1, a "1" if both Turner and Pasquill classes are to be computed, and a "0" if only the Pasquill class is to be computed.

A listing of PWCLASS and its associated documentation is given in Appendix B. The program is written in FORTRAN IV and implemented on the Department's IBM 370-148.2M,VS1 computer.

PNORMAL

The system's final program, PNORMAL, uses the tape produced by PWCLASS as its only input. PNORMAL analyzes this tape to produce the meteorological statistics which summarize the data on the input tape. These data are analyzed in groups defined by season, hour of day, and atmospheric stability. There are 96 categories by season and hour of day (where here the four "seasons" are defined relative to the six months a year each of Daylight Saving and Standard Time). These time categories are defined as follows.

Time Periods	Months	Time
1 to 24	11,12, 1	00:00 to 01:00 ST to 23:00 to 24:00 ST
25 to 48	2, 3, 4	00:00 to 01:00 ST to 23:00 to 24:00 ST
49 to 72	5, 6, 7	00:00 to 01:00 DST to 23:00 to 24:00 DST

Time Periods	Months	Time
73 to 96	8, 9, 10	00:00 to 01:00 DST to 23:00 to 24:00 DST

Within each of these 96 time periods, the data are also categorized by the five atmospheric stability classes.

PNORMAL groups the input data into these 480 = 5 × 96 categories and determines for each category the covariance matrix and the means of the Cartesian wind vectors and the mean, max, min, and standard deviation of the temperature. (See reference (5) for an explanation of the sufficiency of these statistics.) The temperature statistics are output directly to the line printer so that they may be used to determine emission estimates for each of the time periods. These emission estimates would then be used as inputs (by time period) to an air quality impact analysis program as in reference (5).

The 480 = 5 × 96 output records containing the meteorological summary statistics are output as unformatted records with stability class incrementing from 1 to 5 within each of the 96 time periods. Each output record is a type real vector STATOT (Dimension 6). STATOT (1) = number of observations for the stability class and time period. STATOT (2) = the mean of the X components of the wind vectors. STATOT (3) = the mean of the Y components of the wind vectors. STATOT (4) = the variance of the X components of the wind vectors. STATOT (5) = the covariance of the X and Y components of the wind vectors. STATOT (6) = the variance of the Y components of the wind vectors.

APPLICATIONS

Temporal variations in meteorological parameters are significant factors in the determination of air quality levels. Previous computer programs developed to analyze meteorology for highway air quality analyses did not provide the temporal resolution necessary for analyzing pollutants with hourly averaging times. This problem, combined with the stipulation that certain levels were not to be exceeded more than once a year, resulted in the utilization of "worst case" meteorological assumptions in the design of air quality analyses.

The three programs fulfill the need for hourly meteorological data. Utilizing historical meteorological records from the National Climatic Center, a statistically valid profile of meteorology can be obtained.

The development of these three programs presents new opportunities in the statistical analysis of air quality. They represent new capabilities for analysis of hourly parameters in determining pollutant levels. Although developed for use in determining highway related air quality, the programs may be useful in other applications. The programs might be utilized for providing input to computer programs, similar to that in reference (5), which may be designed to evaluate point source air quality impacts and projections for the attainment and maintenance of standards in non-attainment areas.

COST

Approximate costs of the programs PWTHRDCT, PWCLASS, and PNORMAL are $22, $68, and $13 (6, 29, and 4 minutes of CPU), respectively. These estimates are based on processing ten years of historical data from the National Climatic Center on the computer systems the programs were implemented on.

RECOMMENDATIONS

The computer programs PWTHRDCT, PWCLASS, and PNORMAL represent a significant advancement in processing and utilization of meteorological data for environmental analysis. The Department should use the programs in conjunction with the PROBCO1 program[5] for performing air quality analyses of the impacts of proposed highways on carbon monoxide levels.

The Department should support research in identifying relationships between roadside and airport meteorology. Careful consideration should be made in the selection of weather station data to represent meteorology. Considerations should include but not necessarily be limited to influences of distance, topography, land use, and exposure of meteorological equipment.

The Department should encourage further development in the use of historical meteorological data and statistical programs in analyzing air quality pollutant levels.

REFERENCES

1. Farrockhrooz, M., Program WNDROS, Material and Research Department, California Division of Highways, Sacramento, California.

2. Kerby, E. G., "Sources of Virginia Meteorological and Air Quality Data for Use in Highway Air Quality Analyses with Comments on their Usefulness", Virginia Highway and Transportation Research Council, Charlottesville, Virginia, VHTRC 75-R42, April 1975.

3. Changery, M. J., Hodge, W. T., Ramsdell, J. V., "Index-Summarized Wind Data", BNWL-2220 WIND-11, Battelle Pacific Northwest Laboratories, Richland, Washington, September, 1977.

4. Carpenter, W. A., Clemeña, G. G., and Lunglhofer, W. R., "Supportive Data and Methods for the Evaluation of AIRPOL-4", Virginia Highway & Transportation Research Council, Charlottesville, Virginia, VHTRC 75-R57, May 1975.

5. Carpenter, W. A., "An Upper Bound on the Probability that Highway Line Sources Will Violate the One-Hour NAAQS For CO", Virginia Highway & Transportation Research Council, Charlottesville, Virginia, VHTRC 79-R53, June 1979.

APPENDIX A

PROGRAM PWTHRDCT


```
RUN NO. 7096    DATE  03/02/79    TIME  1352         LISTING OF MODULE RHWTHRED                PAGE   1

DESCRIPTION          WEATHER DATA REDUCTION PGM

MASTER FILE          SYS1.LIBRARY
ADDED TO MASTER      08/30/78
LAST DATE COPIED       NONE
LAST UPDATE          09/20/78  1723

PASSWORD             MKVX
PROGRAMMER           RONHEISLER
PROC PARAMETER       $NOJCL

IDENTIFICATION DIVISION.
PROGRAM-ID. PWEATHER.
DATE-COMPILED.
REMARKS. PROGRAM WHICH IS FIRST IN THE SYSTEM INPUTS ONE HISTORICAL
*    METEOROLOGICAL DATA TAPE AND ONE PARAMETER CARD.  THE PROGRAM
*    TESTS FOR INVALID DATA, CONVERTS THE WIND DIRECTION TO DEGREES
*    AND RESOLVES THE FOUR SKY CONDITIONS INTO ONE.  EACH HOUR OF
*    DATA IS OUTPUTED ONE PER RECORD.  THE PARAMETER CARD INPUT IS
*    WRITTEN ON THE OUTPUT TAPE AS THE FIRST TWO RECORDS; THE
*    STATION NUMBER IS COMPARED TO THE NUMBER IN THE METEOROLOGICAL
*    TAPE AND THE PROGRAM IS ENDED WHEN THEY DO NOT COMPARE.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
OBJECT-COMPUTER. IBM-370.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
    SELECT INTAPE ASSIGN TO UT-S-TAPEIN.
    SELECT OUTFLE ASSIGN TO UT-S-TAPEOUT.
    SELECT CARDFL ASSIGN TO UR-S-CARD.
DATA DIVISION.
FILE SECTION.
FD  INTAPE LABEL RECORDS ARE STANDARD
      BLOCK CONTAINS 0 RECORDS.
01  INPUT-REC.
    02 FILLER PIC X(4).
    02 I-STAT-NO PIC X(5).
    02 I-DATE.
       04 I-YR  PIC 99.
       04 I-MO  PIC 99.
       04 I-DAY PIC 99.
    02 I-REST OCCURS 6 TIMES.
       04 I-HR PIC 99.
       04 FILLER PIC X.
       04 I-A-CHT.
          06 I-CHT PIC 999.
       04 FILLER PIC X(4).
       04 I-A-DIR.
          06 I-WDIR PIC 99.
       04 I-A-SPD.
          06 I-NUM-SPD PIC 99.                          09/20/78
          06 I-ALP-SPD PIC S9.                          09/20/78
       04 I-WSPD REDEFINES I-A-SPD PIC S999.            09/20/78
```

```
           04 I-A-TEMP.
              06 I-NUM-TEMP PIC 99.                                    09/20/78
              06 I-ALP-TEMP PIC S9.                                    09/20/78
           04 I-TEMP REDEFINES I-A-TEMP PIC S999.                      09/20/78
           04 FILLER PIC X(20).
           04 I-A-SKY OCCURS 4 TIMES.
              06 I-SKY PIC 9.
           04 FILLER PIC X(32).
           04 I-R-DIR PIC 99.
           04 FILLER PIC X(4).
*
FD  OUTFLE LABEL RECORDS ARE STANDARD
      BLOCK CONTAINS 0 RECORDS.
01  OUT-REC PIC X(26).
*
FD  CARDFL LABEL RECORDS ARE OMITTED.
01  CARD-REC.
        02 C-SPECS.
           04 C-STAT PIC X(5).
           04 C-S-DATE PIC X(4).
           04 C-E-DATE PIC X(4).
           04 C-STAT-LAT PIC X(4).
        02 C-DESC PIC X(20).
        02 FILLER PIC X(43).
*
WORKING-STORAGE SECTION.
77  SUB PIC S99 COMP.
77  NUM PIC S99 COMP.
77  T-SKY PIC 99.
*
01  O-DATA.
        02 O-DATE PIC X(6).
        02 O-HR PIC XX.
        02 O-CHT PIC ---9.
        02 O-WDIR PIC ---9.
        02 O-WSPD PIC ---9.
        02 O-TEMP PIC ---9.
        02 O-SCON PIC XX.
*
01  SKY-COND.
        02 FILLER PIC XX VALUE '00'.
        02 FILLER PIC XX VALUE '03'.
        02 FILLER PIC XX VALUE '03'.
        02 FILLER PIC XX VALUE '03'.
        02 FILLER PIC XX VALUE '07'.
        02 FILLER PIC XX VALUE '07'.
        02 FILLER PIC XX VALUE '07'.
        02 FILLER PIC XX VALUE '10'.
        02 FILLER PIC XX VALUE '10'.
*
        02 FILLER PIC XX VALUE '10'.
01  SKY-TAB REDEFINES SKY-COND.
        02 SKY-NO PIC XX OCCURS 10 TIMES.
*
```

```
000970 01  TAPE-HEADER.
000980     02 O-DESC PIC X(20).
000990*
001000 01  WIND-TABLE.
001010     02 W1  PIC 999 VALUE 0.
001020     02 W2  PIC 999 VALUE 360.
001030     02 W3  PIC 999 VALUE 23.
001040     02 W4  PIC 999 VALUE 45.
001050     02 W5  PIC 999 VALUE 68.
001060     02 W6  PIC 999 VALUE 90.
001070     02 W7  PIC 999 VALUE 113.
001080     02 W8  PIC 999 VALUE 135.
001090     02 W9  PIC 999 VALUE 158.
001100     02 W10 PIC 999 VALUE 180.
001110     02 W11 PIC 999 VALUE 203.
001120     02 W12 PIC 999 VALUE 225.
001130     02 W13 PIC 999 VALUE 248.
001140     02 W14 PIC 999 VALUE 270.
001150     02 W15 PIC 999 VALUE 293.
001160     02 W16 PIC 999 VALUE 315.
001170 01  WIND-TAB REDEFINES WIND-TABLE.
001180     02 WIND PIC 999 OCCURS 16 TIMES.
001190*
001200 01  SEPARATE-WDIR.
001210     02 S-WDIR PIC 9 OCCURS 2 TIMES.
001220*
001230*
001240 PROCEDURE DIVISION.
001250     OPEN INPUT INTAPE.
001260     OPEN INPUT CARDFL.
001270     OPEN OUTPUT OUTFLE.
001280     READ INTAPE AT END GO TO END-PROGRAM.
001290*        READ PARAMETER CARD
001300*            C-STAT = STATION NO.
001310*            C-S-DATE = TAPE'S STARTING DATE
001320*            C-E-DATE = TAPE'S END DATE
001330*            C-STAT-LAT = STATION LATITUDE
001340*            C-DESC = TAPE DESCRIPTION
001350     READ CARDFL AT END GO TO END-PROGRAM.
001360     IF C-STAT = I-STAT-NO NEXT SENTENCE                          09/20/78
001370         ELSE DISPLAY 'STATION NOS. NOT EQUAL, TAPE STATION NO. ' 09/20/78
001380              I-STAT-NO, GO TO END-PROGRAM.                       09/20/78
001390*        WRITE TAPE HEADER RECORDS (2)
001400     MOVE C-SPECS TO O-DESC.
001410     WRITE OUT-REC FROM TAPE-HEADER.
001420     MOVE C-DESC TO O-DESC.
001430     WRITE OUT-REC FROM TAPE-HEADER.
001440     CLOSE CARDFL.
001450     GO TO MOVE-DATA.
001460*
001470*        READ 6 HOURS OF WEATHER DATA
001480*
001490 READ-TAPE.
001500     READ INTAPE AT END GO TO END-PROGRAM.
```

```
*
MOVE-DATA.
     IF I-DATE NUMERIC NEXT SENTENCE                                         09/20/78
         ELSE MOVE -99 TO O-CHT, O-WDIR, O-WSPD, O-TEMP                      09/20/78
              PERFORM DUMMY-REC-PARA VARYING SUB FROM 1 BY 1                 09/20/78
                  UNTIL SUB GREATER THAN 6                                   09/20/78
              GO TO READ-TAPE.                                               09/20/78
     MOVE I-DATE TO O-DATE.
     MOVE ZEROS TO SUB.
*
         WRITE ONE HOUR OF DATA
*            O-DATE = DATE, YR/MO/DAY
*            O-HR = HOUR
*            O-CHT = CEILING
*            O-WDIR = WIND DIRECTION
*            O-WSPD = WIND SPEED
*            O-TEMP = TEMPERATURE (F)
*            O-SCON = SKY CONDITION
*
HOUR-LOOP.
     ADD 1 TO SUB.
     IF I-HR (SUB) NUMERIC NEXT SENTENCE                                     09/20/78
         ELSE MOVE 99 TO O-HR                                                09/20/78
              MOVE -99 TO O-CHT, O-WDIR, O-WSPD, O-TEMP                      09/20/78
              GO TO HOUR-LOOP-WRITE.                                         09/20/78
     MOVE I-HR (SUB) TO O-HR.
     IF I-A-CHT (SUB) NOT NUMERIC MOVE -99 TO O-CHT
         ELSE MOVE I-CHT (SUB) TO O-CHT.
     IF I-A-DIR (SUB) NOT NUMERIC MOVE -99 TO O-WDIR
*
*    BEGINNING JAN. 1, 1964 WIND DIRECTIONS WERE REPORTED IN TENS
*    OF DEGREES, BASED ON 36 POINT COMPASS.  PREVIOUS TO 1964 THE
*    WIND DIRECTIONS WERE BASED ON A 16 POINT COMPASS.
*  CONVERT THE WIND DIRECTION CODE TO DEGREES USING THE APPROPRIATE
*  INPUT FIELD. USE 360 FOR NORTH & ZERO FOR CALM.
*
         ELSE IF I-YR GREATER THAN 63
           MULTIPLY I-R-DIR (SUB) BY 10 GIVING O-WDIR
         ELSE IF I-WDIR (SUB) = 0 MOVE WIND (1) TO O-WDIR
         ELSE IF I-WDIR (SUB) = 18 MOVE 338 TO O-WDIR
         ELSE MOVE I-WDIR (SUB) TO SEPARATE-WDIR
           ADD S-WDIR (1) S-WDIR (2) GIVING NUM
           MOVE WIND (NUM) TO O-WDIR.
     IF I-NUM-SPD (SUB) NUMERIC AND I-ALP-SPD (SUB) NUMERIC                  09/20/78
             MOVE I-WSPD (SUB) TO O-WSPD                                     09/20/78
         ELSE MOVE -99 TO O-WSPD, O-WDIR.                                    09/20/78
     IF I-NUM-TEMP (SUB) NUMERIC AND I-ALP-TEMP (SUB) NUMERIC                09/20/78
             MOVE I-TEMP (SUB) TO O-TEMP                                     09/20/78
         ELSE MOVE -99 TO O-TEMP.                                            09/20/78
     MOVE ZERO TO T-SKY NUM.
*
SKY-LOOP.
     ADD 1 TO NUM.
     IF I-A-SKY (SUB, NUM) NUMERIC NEXT SENTENCE  ELSE                       09/08/78
```

```
           IF I-A-SKY (SUB, NUM) = '-' MOVE 9 TO I-SKY (SUB, NUM)          09/06/78
                ELSE MOVE 2 TO I-SKY (SUB, NUM).                           09/06/78
      IF I-SKY (SUB, NUM) GREATER THAN T-SKY MOVE I-SKY (SUB, NUM)
           TO T-SKY.
      IF NUM LESS THAN 4 GO TO SKY-LOOP.
*
      ADD 1 TO T-SKY.
      MOVE SKY-NO (T-SKY) TO O-SCON.
*                                                                          09/20/78
 HOUR-LOOP-WRITE.                                                          09/20/78
      WRITE OUT-REC FROM O-DATA.
      IF SUB LESS THAN 6 GO TO HOUR-LOOP.
      GO TO READ-TAPE.
*
*
 END-PROGRAM.
      DISPLAY 'PROCESSING OF WEATHER TAPE COMPLETED'.                      09/20/78
      CLOSE INTAPE.
      CLOSE OUTFLE.
      STOP RUN.
*                                                                          09/20/78
*     PERFORMED PARAGRAPH FOR INPUT RECORDS WITH NON-NUMERIC DATES         09/20/78
*                                                                          09/20/78
 DUMMY-REC-PARA.                                                           09/20/78
      MOVE I-HR (SUB) TO O-HR.                                             09/20/78
      WRITE OUT-REC FROM O-DATA.                                           09/20/78
```

APPENDIX B

PROGRAM PWCLASS

```
RUN NO. 7096    DATE  03/02/79    TIME  1352          LISTING OF MODULE RHCLCOMP                    PAGE   1

DESCRIPTION          TURNER & PASQUILL CLASS COMPUT

MASTER FILE          SYS1.LIBRARY
ADDED TO MASTER      01/04/78
LAST DATE COPIED       NONE
LAST UPDATE          09/20/78  1323

PASSWORD             FGDX
PROGRAMMER           RONHEISLER
PROC PARAMETER       $NOJCL

C************************************************************************         01/23/78
C*                                                                      *         01/23/78
C*                                                                      *         01/23/78
C*              SSS     CCCC   L        AAAA    SSS     SSS             *         01/23/78
C*             S   S   C    C  L       A    A  S   S   S   S            *         01/23/78
C*              S      C       L       A    A   S       S               *         01/23/78
C*               S     C       L       AAAAAA    S       S              *         01/23/78
C*                S    C       L       A    A     S       S             *         01/23/78
C*             S   S   C    C  L       A    A  S   S   S   S            *         01/23/78
C*              SSS     CCCC   LLLLLL  A    A   SSS     SSS             *         01/23/78
C*                                                                      *         01/23/78
C*                                                                      *         01/23/78
C************************************************************************         01/23/78
C                                                                                 01/23/78
C                                                                                 01/23/78
C      VARIABLES OF TAPE HEADER RECORDS                                           01/25/78
C      --------------------------------                                           01/25/78
C                                                                                 01/23/78
C      ISTAT -- INTEGER (I5) -- INPUT & OUTPUT, COLUMNS 1-5                       01/25/78
C          WEATHER TAPE STATION NUMBER                                            01/23/78
C                                                                                 01/23/78
C      IDATE -- INTEGER, SUBSCRIPTED (2I2) -- INPUT & OUTPUT, COLS. 6-9           01/25/78
C          DATE IN 1ST TAPE RECORD, IDATE(1) = MONTH & IDATE(2) = YEAR            01/23/78
C                                                                                 01/23/78
C      EDATE -- INTEGER, SUBSCRIPTED (2I2) -- INPUT & OUTPUT, COLS. 10-13         01/25/78
C          DATE IN LAST TAPE RECORD, EDATE(1) = MONTH & EDATE(2) = YEAR           01/23/78
C                                                                                 01/23/78
C      IDEG & IMIN -- INTEGER (I2) -- INPUT & OUTPUT, COLS. 14-15 & 16-17         01/25/78
C          STATION LATITUDE IN DEGREES, IDEG, AND MINUTES, IMIN                   01/23/78
C                                                                                 01/23/78
C      DESC -- ALPHA (5A4) -- INPUT & OUTPUT, COLUMNS 1-20                        01/25/78
C                                                                                 01/23/78
C                                                                                 01/23/78
C      INPUT & OUTPUT VARIABLES OF HOURLY DATA                                    01/23/78
C      ---------------------------------------                                    01/25/78
C                                                                                 01/23/78
C      TYR -- ALPHA (A2) -- INPUT & OUTPUT, COLUMNS 1-2 -- YEAR                   01/23/78
C                                                                                 01/23/78
C      TMO -- INTEGER (I2) -- INPUT & OUTPUT, COLUMNS 3-4 -- MONTH                01/23/78
C                                                                                 01/23/78
C      TDAY -- ALPHA (A2) -- INPUT & OUTPUT, COLUMNS 5-6 -- DAY                   01/23/78
C                                                                                 01/23/78
```

```
C     THR -- INTEGER (I2) -- INPUT & OUTPUT, COLUMNS 7-8                          01/23/78
C         HOUR, 00-23 VALID                                                       01/23/78
C                                                                                 01/23/78
C     TCHT -- INTEGER (I4) -- INPUT, COLUMNS 9-12                                 01/23/78
C         CEILING IN HUNDREDS OF FEET                                             01/23/78
C                                                                                 01/23/78
C     TWDIR -- INTEGER (I4) -- INPUT, COLS. 13-16, & OUTPUT, COLS. 9-11           08/25/78
C         WIND DIRECTION IN DEGREES                                               01/23/78
C                                                                                 01/23/78
C     TWSPD -- INTEGER (I4) -- INPUT, COLUMNS 17-20                               08/25/78
C         WIND SPEED IN KNOTS                                                     01/23/78
C                                                                                 01/23/78
C     TTEMP -- ALPHA (A4) -- INPUT, COLS. 21-24, & OUTPUT, COLS. 27-30            08/25/78
C         DRY BULB TEMPERATURE IN WHOLE DEGREES FAHRENHEIT                        01/23/78
C                                                                                 01/23/78
C     TSCON -- INTEGER (I2) -- INPUT, COLUMNS 25-26                               08/25/78
C         SKY CONDITIONS OR CLOUD COVER                                           01/23/78
C                                                                                 01/23/78
C     SPEED -- REAL (F5.2) -- OUTPUT, COLUMNS 12-16                               01/25/78
C         WIND SPEED IN METERS PER SECOND (CONVERTED FROM TWSPD)                  01/25/78
C                                                                                 01/23/78
C     X -- REAL, F5.2 -- OUTPUT, COLUMNS 17-21                                    01/25/78
C         EQUAL TO COS(WDIR) * SPEED, WHERE WDIR = WIND DIRECTION                 01/25/78
C         RELATIVE TO EAST = 0 DEG.                                               01/25/78
C                                                                                 01/25/78
C     Y -- REAL, F5.2 -- OUTPUT, COLUMNS 22-26                                    01/25/78
C         EQUAL TO SIN(WDIR) * SPEED, WHERE WDIR = WIND DIRECTION                 01/25/78
C         RELATIVE TO EAST = 0 DEG.                                               01/25/78
C                                                                                 01/25/78
C     TURCL -- INTEGER (I2) -- OUTPUT, COLUMN 31                                  01/25/78
C         COMPUTED TURNER STABILITY CLASS                                         01/23/78
C                                                                                 01/23/78
C     PASCL -- INTEGER (I2) -- OUTPUT, COLUMN 32                                  01/25/78
C         COMPUTED PASQUILL STABILITY CLASS                                       01/23/78
C                                                                                 01/23/78
C     TIND -- INTEGER, (I1) -- INPUT (FILE 5), COLUMN 1                           01/25/78
C         TURNER INDICATOR (0 = COMPUTE ONLY PASQUILL'S CLASS,                    01/25/78
C         1 = COMPUTE BOTH PASQUILL'S AND TURNER'S CLASS)                         01/25/78
C                                                                                 01/25/78
C                                                                                 01/25/78
C     COMPUTED VARIABLES                                                          01/25/78
C     ------------------                                                          01/25/78
C                                                                                 01/25/78
C     PHI -- REAL -- STATION LATITUDE IN RADIANS                                  01/23/78
C     SINPHI -- REAL -- SIN OF STATION LATITUDE                                   01/23/78
C     COSPHI -- REAL -- COS OF STATION LATITUDE                                   01/23/78
C                                                                                 01/23/78
C     DAYNO -- INTEGER -- DAY OF THE YEAR COUNTER                                 01/23/78
C                                                                                 01/23/78
C     ND -- INTEGER -- DAY & NIGHT COUNTER ( 1 = DAY, 0 = NIGHT)                  01/23/78
C                                                                                 01/23/78
C     PROD -- REAL -- USED IN COMPUTING SOLAR ALTITUDE (ALPHA),                   01/23/78
C         ALSO EQUAL TO SIN OF ALPHA                                              01/23/78
C                                                                                 01/23/78
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C     ALPHA -- REAL -- SOLAR ALTITUDE IN RADIANS, EQUAL TO ARCSIN(PROD)     01/23/78
C                                                                           01/23/78
C     ANGLE -- REAL -- ALPHA CONVERTED TO DEGREES                           01/23/78
C                                                                           01/23/78
C     IP -- REAL -- COMPUTED IN PASQUILL CLASS COMPUTATIONS                 01/23/78
C                                                                           01/23/78
C     IROW -- INTEGER -- WIND SPEED + 1, USED AS FIRST INDEX TO THE         01/23/78
C         ARRAYS TURNCL & PASQDT                                            01/23/78
C                                                                           01/23/78
C     RIS -- INTEGER -- RELATIVE INSOLATION STRENGTH, USED AS SECOND        01/23/78
C         INDEX TO THE ARRAY PASQDT                                         01/23/78
C         1 = STRONG, 2 = MODERATE, 3 = SLIGHT                              01/23/78
C                                                                           01/23/78
C     NRI -- INTEGER -- NET RADIATION INDEX, 1 TO 7 VALID                   01/23/78
C         USED AS SECOND INDEX TO THE ARRAY TURNCL                          01/23/78
C                                                                           01/23/78
C     ICN -- INTEGER -- ISOLATION CLASS NUMBER, DETERMINED BY VALUE OF      01/23/78
C         ALPHA AND USED IN COMPUTING TURNER'S CLASS                        01/23/78
C                                                                           01/23/78
C     WDIR -- REAL -- WIND DIRECTION IN RADIANS RELATIVE TO EAST = 0 DEG.   01/25/78
C         (CONVERTION OF TWDIR WHICH IS RELATIVE TO NORTH = 0 DEG.)         01/25/78
C                                                                           01/25/78
C                                                                           01/23/78
C     DATA STATEMENT VARIABLES                                              01/23/78
C     -----------------------                                               01/25/78
C                                                                           01/23/78
C     DS -- REAL, SUBSCRIPTED 1-366 -- EQUIVALENCED TO ARRAYS DS1 & DS2     01/23/78
C         SIN VALUES OF THE ANGLE DELTA FOR EACH DAY OF THE YEAR            01/23/78
C                                                                           01/23/78
C     DC -- REAL, SUBSCRIPTED 1-366 -- EQUIVALENCED TO DC1 & DC2            01/23/78
C         COS VALUES OF ANGLE DELTA FOR EACH DAY OF THE YEAR                01/23/78
C                                                                           01/23/78
C     TURNCL -- INTEGER, SUBSCRIPTED 1-13 & 1-7                             01/23/78
C         TURNER'S ATMOSPHERIC STABILITY CLASSES WITH 1-6 REPRESENTING      01/23/78
C         CLASSES A-F, RESPECTIVELY, FOR DAYTIME & NIGHTTIME                01/23/78
C                                                                           01/23/78
C     PASQDT -- INTEGER, SUBSCRIPTED 1-15 & 1-3                             01/23/78
C         PASQUILL'S ATMOSPHERIC STABILITY CLASSES FOR DAYTIME WITH         01/23/78
C         1-5 REPRESENTING CLASSES A-E, RESPECTIVELY                        01/23/78
C                                                                           01/23/78
C     SUNRIZ -- REAL, SUBSCRIPTED 1-12                                      01/23/78
C         MONTHLY AVERAGE SUNRISE AT RICHMOND,VA (EASTERN STANDARD TIME)    01/23/78
C                                                                           01/23/78
C     SUNSET -- REAL, SUBSCRIPTED 1-12                                      01/23/78
C         MONTHLY AVERAGE SUNSET AT RICHMOND, VA (E.S.T.)                   01/23/78
C                                                                           01/23/78
C     HRCOS -- REAL, SUBSCRIPTED 1-24                                       01/23/78
C         VALUES OF THE EQUATION COS((12-H)/(2*PI)), H = HOUR OF DAY        01/23/78
C         THESE VALUES ARE USED IN COMPUTING THE SOLAR ALTITUDE (ALPHA)     01/23/78
C                                                                           01/23/78
C     NODAYS -- INTEGER, SUBSCRIPTED 1-12                                   01/23/78
C         DAYS OF YEAR THAT HAVE PRECEDED EACH MONTH, INCLUDING FIRST       01/23/78
C         DAY OF CURRENT MONTH, IS USED TO START DAY COUNTER ON SAME DAY    01/23/78
C         OF THE YEAR AS THE TAPE'S FIRST RECORD (SOME TAPES DO NOT         01/23/78
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C        START ON JANUARY 1).                                                01/23/78
C                                                                            01/25/78
C***********************************************************************     01/25/78
C                                                                            01/23/78
C                                                                            01/25/78
C                      TURNER'S METHOD                                       01/25/78
C                      ---------------                                       01/25/78
C                                                                            01/25/78
C   I.  DETERMINE THE NET RADIATION INDEX, NRI, AS FOLLOWS (NOTE: THE        08/25/78
C         ACTUAL VALUES OF THE VARIABLES NRI & ICN ARE -2 TO 4 & 1 TO 4,     08/25/78
C         RESPECTIVELY.  THE PROGRAM USES 1 TO 7 & 4 TO 7 TO AVOID           08/25/78
C         ADDING 3 TO OBTAIN THE INDEX VALUES) :                             08/25/78
C                                                                            01/25/78
C     1.  IF TOTAL CLOUD COVER, TSCON, = 10/10 AND CEILING, TCHT,            01/25/78
C           IS LESS THAN 7,000 FEET, NRI = 3 (DAY OR NIGHT)                  01/25/78
C                                                                            01/25/78
C     2.  NIGHTTIME                                                          01/25/78
C         A.  IF TOTAL CLOUD COVER LESS THAN OR = 4/10, NRI = 1              01/25/78
C         B.  IF TOTAL CLOUD COVER GREATER THAN 4/10, NRI = 2                01/25/78
C                                                                            01/25/78
C     3.  DAYTIME                                                            01/25/78
C                                                                            01/25/78
C         A.  DETERMINE THE SOLAR ALTITUDE, ALPHA, FROM                      01/25/78
C                                                                            01/25/78
C          A = ARCSIN(SIN B * SIN C + COS((12-H)/2*PI) * COS B * COS C)      01/25/78
C                                                                   (1)      01/25/78
C     AND                                                                    01/25/78
C          B = ARCTAN (-TAN 23.5 * COS (2*PI*(N+10)/365))           (2)      01/25/78
C     WHERE                                                                  01/25/78
C          A IS ALPHA                                                        01/25/78
C          B IS DELTA                                                        01/25/78
C          C IS THE STATION LATITUDE, PHI                                    01/25/78
C          H IS THE HOUR OF THE DAY (MILITARY TIME)                          01/25/78
C          N IS THE NUMBER OF DAYS SINCE JANUARY 1                           01/25/78
C                                                                            01/25/78
C         B.  DETERMINE ISOLATION CLASS NUMBER, ICN, FROM THIS TABLE:        01/25/78
C                                                                            01/25/78
C           SOLAR ALTITUDE             INSOLATION     INSOLATION             01/25/78
C              (ALPHA)                               CLASS NUMBER            01/25/78
C           -----------------------------------------------------            01/25/78
C            0 .LE. ALPHA .LE. 15         WEAK             4                 08/25/78
C                                                                            08/25/78
C           15 .LT. ALPHA .LE. 35        SLIGHT            5                 08/25/78
C                                                                            08/25/78
C           35 .LT. ALPHA .LE. 60       MODERATE           6                 08/25/79
C                                                                            08/25/78
C           60 .LT. ALPHA .LE. 90        STRONG            7                 08/25/78
C                                                                            01/25/78
C                                                                            01/25/78
C         C.  IF TOTAL CLOUD COVER .LE. 5/10, NRI = ICN.                     01/25/78
C                                                                            01/25/78
C         D.  IF TOTAL CLOUD COVER .GT. 5/10 DETERMINE NRI AS FOLLOWS:       01/25/78
C                                                                            01/25/78
C           1.  IF CEILING .LT. 7,000 FEET, NRI = ICN - 2.                   01/25/78
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C           2.  IF 7,000 .LE. CEILING .LT. 16,000 FEET, NRI = ICN - 1.   002050        01/25/78
C           3.  IF TOTAL CLOUD COVER IS 10/10, NRI = ICN - 1             002060        01/25/78
C               (THIS APPLIES ONLY TO CEILINGS .GE. 7,000, SINCE         002070        01/25/78
C               10/10 BELOW 7,000 FT. IS COVERED ABOVE WITH NRI = 3.)    002080        01/25/78
C           4.  IF STEPS 1, 2 AND 3 ARE NOT APPLICABLE, NRI = ICN.       002090        01/25/78
C           5.  IF NRI .LT. 4, LET NRI = 4.                              002100        01/25/78
C                                                                        002110        01/25/78
C  II.  DETERMINE STABILITY CLASS FROM THE FOLLOWING TABLE:              002120        01/25/78
C                                                                        002130        01/25/78
C         WIND SPEED          |        NET RADIATION INDEX               002140        01/25/78
C           (KNOTS)           |  1    2    3    4    5    6    7         002150        01/25/78
C         -----------------------------------------------------          002160        01/25/78
C          0 .LE. WS .LT. 2   |  F    F    D    C    B    A    A         002170        01/25/78
C                             |                                          002180        01/25/78
C          2 .LE. WS .LT. 4   |  F    F    D    C    B    B    A         002190        01/25/78
C                             |                                          002200        01/25/78
C          4 .LE. WS .LT. 6   |  F    E    D    D    C    B    A         002210        01/25/78
C                             |                                          002220        01/25/78
C          6 .LE. WS .LT. 7   |  F    E    D    D    C    B    B         002230        01/25/78
C                             |                                          002240        01/25/78
C          7 .LE. WS .LT. 8   |  E    D    D    D    C    B    B         002250        01/25/78
C                             |                                          002260        01/25/78
C          8 .LE. WS .LT. 10  |  E    D    D    D    C    C    B         002270        01/25/78
C                             |                                          002280        01/25/78
C         10 .LE. WS .LT. 11  |  E    D    D    D    D    C    C         002290        01/25/78
C                             |                                          002300        01/25/78
C         11 .LE. WS .LT. 12  |  D    D    D    D    D    C    C         002310        01/25/78
C                             |                                          002320        01/25/78
C         12 .LE. WS          |  D    D    D    D    D    D    C         002330        01/25/78
C                                                                        002340        01/25/78
C                                                                        002350        01/25/78
C                                                                        002360        01/25/78
C                   PASQUILL'S METHOD                                    002370        01/25/78
C                   -----------------                                    002380        01/25/78
C                                                                        002390        01/25/78
C   I.  NIGHTTIME                                                        002400        01/25/78
C                                                                        002410        08/25/78
C         DETERMINE STABILITY CLASS FROM THE FOLLOWING TABLE:            002420        01/25/78
C                                                                        002430        01/25/78
C         WIND SPEED         |         CLOUD COVER                       002440        01/25/78
C           (KNOTS)          |  CC .GE. 5/10    CC .LT. 5/10             002450        01/25/78
C         -------------------|-------------------------------            002460        01/25/78
C         0 .LE. WS .LE. 3   |       E                E                  002470        01/25/78
C                            |                                           002480        01/25/78
C         3 .LT. WS .LE. 6   |       D                E                  002490        01/25/78
C                            |                                           002500        01/25/78
C         6 .LT. WS          |       D                D                  002510        01/25/78
C                                                                        002520        01/25/78
C                                                                        002530        01/25/78
C  II.  DAYTIME                                                          002540        01/25/78
C                                                                        002550        01/25/78
C       1.  DETERMINE INSOLATION PROPORTIONALITY, IP, AS FOLLOWS:        002560        01/25/78
C                                                                        002570        01/25/78
C           A.  DETERMINE THE SOLAR ALTITUDE, ALPHA, FROM EQUATIONS      002580        01/25/78
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C              1 AND 2 IN THE TURNER SECTION.                          01/25/78
C                                                                      01/25/78
C          B.  DETERMINE IP FROM                                       01/25/78
C                                                                      01/25/78
C                IP = (1 - 0.5 * F) * SIN A                            01/25/78
C             WHERE                                                    01/25/78
C                F IS THE FRACTION OF SKY COVERED BY CLOUDS            01/25/78
C                A IS THE SOLAR ALTITUDE FROM EQUATIONS 1 AND 2.       01/25/78
C                                                                      01/25/78
C      2.  DETERMINE RELATIVE ISOLATION STRENGTH, RIS, AS FOLLOWS:     01/25/78
C                                                                      01/25/78
C          A.  RIS = STRONG IF 0.67 .LT. IP .LE. 1.0                   01/25/78
C          B.  RIS = MODERATE IF 0.33 .LT. IP .LE. 0.67                01/25/78
C          C.  RIS = SLIGHT IF 0.0 .LE. IP .LE. 0.33                   01/25/78
C                                                                      01/25/78
C      3.  DETERMINE STABILITY CLASS FROM THE FOLLOWING TABLE:         01/25/78
C                                                                      01/25/78
C          WIND SPEED          | RELATIVE INSOLATION STRENGTH          01/25/78
C            (KNOTS)           |  STRONG   MODERATE   SLIGHT           01/25/78
C          --------------------|-----------------------------          01/25/78
C           0 .LE. WS .LE. 3   |    A         B         B              01/25/78
C                              |                                       01/25/78
C           3 .LT. WS .LE. 6   |    A         B         C              01/25/78
C                              |                                       01/25/78
C           6 .LT. WS .LE. 10  |    B         C         C              01/25/78
C                              |                                       01/25/78
C          10 .LT. WS .LE. 13  |    C         C         D              01/25/78
C                              |                                       01/25/78
C          13 .LT. WS          |    C         D         D              01/25/78
C                                                                      01/25/78
C                                                                      01/25/78
C*********************************************************************  01/25/78
C                                                                      08/28/78
      REAL DS(366),DC(366),HRCOS(24),IP                                01/23/78
      REAL DS1(240),DS2(126),DC1(280),DC2(86),SUNRIZ(12),SUNSET(12)    01/06/78
C                                                                      08/28/78
      INTEGER TURNCL(13,7),PASQDT(15,3),NODAYS(12),RIS                 01/06/78
      INTEGER DESC(5),DAYNO,TCHT,TWDIR,TWSPD,TTEMP
C                                                                      08/28/78
      INTEGER*2 IDATE(2),EDATE(2),TSCON,THR,TYR,TMO,TDAY,TURCL,PASCL
      INTEGER*2 IDEG,IMIN,ND,END,TIND                                  08/25/78
C                                                                      08/28/78
C                                                                      08/28/78
      DATA DS1 / -.394,-.393,-.392,-.39,-.389,-.388,-.386,-.384,-.383, 01/06/78
     - -.381,-.379,-.377,-.375,-.372,-.37,-.368,-.365,-.362,-.36,-.357,
     - -.354,-.351,-.347,-.344,-.341,-.337,-.334,-.33,-.326,-.322,-.318,
     - -.314,-.31,-.306,-.301,-.297,-.292,-.288,-.283,-.278,-.273,-.268,
     - -.263,-.257,-.252,-.246,-.241,-.235,-.229,-.224,-.218,-.212,
     - -.206,-.199,-.193,-.187,-.18,-.174,-.167,-.161,-.154,-.147,-.14,
     - -.133,-.126,-.119,-.112,-.105,-.098,-.091,-.084,-.076,-.069,-.062
     -,-.054,-.047,-.04,-.032,-.025,-.017,-.01,-.002,.005,.013,.02,.028,
     - .035,.043,.05,.057,.065,.072,.079,.087,.094,.101,.108,.115,.122,
     - .129,.136,.143,.15,.157,.163,.17,.176,.183,.189,.196,.202,.208,
     - .214,.22,.226,.232,.237,.243,.249,.254,.259,.265,.27,.275,.28,
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     - .285,.289,.294,.299,.303,.308,.312,.316,.32,.324,.328,.332,.335,
     - .339,.342,.346,.349,.352,.355,.358,.361,.363,.366,.369,.371,.373,
     - .375,.378,.38,.382,.383,.385,.387,.388,.39,.391,.392,.393,.394,
     - .395,.396,2*.397,3*.398,4*.399,3*.398,2*.397,.396,.395,.394,.393,
     - .392,.391,.39,.388,.387,.385,.384,.382,.38,.378,.376,.374,.371,
     - .369,.367,.364,.361,.358,.355,.352,.349,.346,.343,.339,.336,.332,
     - .329,.325,.321,.317,.313,.308,.304,.3,.295,.29,.286,.281,.276,
     - .271,.266,.26,.255,.25,.244,.239,.233,.227,.221,.215,.209,.203,
     - .197,.191,.184,.178 /
C                                                                            08/28/78
      DATA DS2 / .171,.165,.158,.151,.144,.138,.131,.124,.117,               01/06/78
     - .11,.102,.095,.088,.081,.073,.066,.059,.051,.044,.037,.029,.022,
     - .014,.007,-.001,-.008,-.016,-.023,-.031,-.038,-.046,-.053,-.06,
     - -.068,-.075,-.082,-.09,-.097,-.104,-.111,-.118,-.125,-.132,-.139,
     - -.146,-.153,-.159,-.166,-.173,-.179,-.186,-.192,-.198,-.204,-.21,
     - -.217,-.222,-.228,-.234,-.24,-.245,-.251,-.256,-.262,-.267,-.272,
     - -.277,-.282,-.287,-.291,-.296,-.301,-.305,-.309,-.313,-.318,-.322
     -,-.326,-.329,-.333,-.337,-.34,-.344,-.347,-.35,-.353,-.356,-.359,
     - -.362,-.364,-.367,-.37,-.372,-.374,-.376,-.378,-.38,-.382,-.384,
     - -.386,-.387,-.389,-.39,-.391,-.393,-.394,2*-.395,-.396,2*-.397,
     - 2*-.398,5*-.399,3*-.398,-.397,2*-.396,-.395,-.394 /
C                                                                            08/28/78
      DATA DC1 / .919,2*.92,2*.921,2*.922,.923,.924,2*.925,.926,.927,        01/06/78
     - .928,.929,.930,.931,.932,.933,.934,.935,.937,.938,.939,.94,.941,
     - .943,.944,.945,.947,.948,.949,.951,.952,.954,.955,.956,.958,.959,
     - .961,.962,.963,.965,.966,.968,.969,.971,.972,.973,.975,.976,.977,
     - .979,.98,.981,.982,.984,.985,.986,.987,.988,.989,.99,.991,.992,
     - .993,2*.994,.995,2*.996,.997,2*.998,4*.999,8*1.0,3*.999,2*.998,
     - 2*.997,2*.996,.995,.994,.993,2*.992,.991,.99,.989,.988,.987,.985,
     - .984,.983,.982,.981,.979,.978,.977,.975,.974,.973,.971,.97,.969,
     - .967,.966,.964,.963,.961,.96,.959,.957,.956,.954,.953,.952,.95,
     - .949,.947,.946,.945,.943,.942,.941,.94,.938,.937,.936,.935,.934,
     - .933,.932,.931,.93,.929,.928,.927,.926,.925,2*.924,.923,2*.922,
     - .921,2*.92,3*.919,4*.918,9*.917,3*.918,3*.919,2*.92,2*.921,.922,
     - 2*.923,.924,.925,.926,.927,2*.928,.929,.93,.931,.932,.934,.935,
     - .936,.937,.938,.939,.941,.942,.943,.945,.946,.947,.949,.95,.951,
     - .953,.954,.956,.957,.958,.96,.961,.963,.964,.966,.967,.968,.97,
     - .971,.973,.974,.975,.977,.978,.979,.98,.982,.983,.984,.985,.986,
     - .987,.989,2*.99,.991,.992,.993,.994,2*.995,.996,2*.997,2*.998,
     - 3*.999,9*1.0,3*.999,2*.998,2*.997,.996,2*.995,.994 /
C                                                                            08/28/78
      DATA DC2 / .993,.992,.991,.99,.989,.988,.987,.986,.985,.984,.983,      01/06/78
     - .981,.98,.979,.978,.976,.975,.974,.972,.971,.969,.968,.967,.965,
     - .964,.962,.961,.959,.958,.957,.955,.954,.952,.951,.95,.948,.947,
     - .946,.944,.943,.942,.94,.939,.938,.937,.936,.934,.933,.932,.931,
     - .93,.929,.928,.927,2*.926,.925,.924,2*.923,.922,2*.921,2*.92,
     - 3*.919,3*.918,9*.917,4*.918,2*.919 /
C                                                                            08/28/78
C                                                                            08/28/78
      DATA TURNCL / 7*6, 4*5, 2*4, 4*6, 3*5, 6*4, 13*4, 4*3, 9*4, 4*2,
     - 6*3, 3*4, 2*1, 6*2, 4*3, 4, 6*1, 4*2, 3*3 /
C                                                                            08/28/78
      DATA PASQDT / 7*1, 4*2, 4*3, 7*2, 7*3, 4, 4*2, 7*3, 4*4 /
C                                                                            08/28/78
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      DATA SUNRIZ / 7.5, 7.0, 6.25, 5.5, 5.0, 4.75, 5.0, 5.5, 5.75,
     -  6.25,6.75, 7.25 /
      DATA SUNSET / 17.25, 17.75, 18.25, 18.75, 19.25, 2*19.5, 19.0,        01/09/78
     - 18.25, 17.5, 2*17.0 /                                                 01/09/78
C                                                                            08/28/78
      DATA HRCOS / -0.333, -0.18, -0.022, .137, .293, .441, .577, .699,     01/06/78
     - .804, .888, .95, .987, 1.0, .987, .95, .888, .804, .699, .557,       01/06/78
     - .441, .293, .137, -0.022, -0.18 /                                     01/06/78
C                                                                            08/28/78
      DATA NODAYS / 1,32,60, 91,121,152, 182,213,244, 274,305,355 /         01/06/78
      DATA END / '31' /                                                      01/23/78
C                                                                            08/28/78
      EQUIVALENCE (DS(1),DS1(1)),(DS(241),DS2(1)),(DC(1),DC1(1)),           01/06/78
     -  (DC(281),DC2(1))                                                     01/06/78
C
C
      READ(5,150,END=900) TIND                                               01/25/78
  150 FORMAT(I1)                                                             01/25/78
C
C        READ FIRST 2 RECORDS WITH DATA SPECIFICATIONS
C
      READ(1,100,END=900) ISTAT,IDATE,EDATE,IDEG,IMIN,DESC
  100 FORMAT(I5,4I2,2I2 / 5A4)
C
C        CONVERT STATION LATITUDE ANGLE TO RADIANS
C        1 DEGREE = .01745329 RADIANS
C        1 MINUTE = .00029089 RADIANS
C
      PHI = IDEG * .01745329 + IMIN * .00029089                             01/06/78
      SINPHI = SIN(PHI)                                                      01/06/78
      COSPHI = COS(PHI)                                                      01/06/78
C
C        MULTIPLY SIN & COS OF STATION LATITUDE WITH SIN & COS
C            CONSTANTS FOR THE ANGLE DELTA WHERE
C            DELTA = ARCTAN ( -TAN 23.5 * COS (2*PI*(N+10)/365) ),
C              N IS THE NUMBER DAYS SINCE JANUARY 1
C
      DO 10 I=1,366
      DS(I) = DS(I) * SINPHI                                                 01/06/78
   10 DC(I) = DC(I) * COSPHI                                                 01/06/78
      WRITE(2,200) ISTAT,IDATE,EDATE,IDEG,IMIN,DESC
  200 FORMAT(I5,6I2,15X/ 5A4,12X)                                            01/25/78
      I= IDATE(1)
C                                                                            01/06/78
C        DETERMINE NUMBER OF DAYS INTO YEAR WHERE TAPE STARTS                01/06/78
      DAYNO = NODAYS(I)
      IF(I .LT. 3) GO TO 11
C                                                                            01/06/78
C        TEST FOR LEAP YEAR                                                  01/06/78
      S = (IDATE(2) + 300) / 4.
      R = INT(S)
      T = S - R
C                                                                            01/06/78
C        IF T = 0, ADD 1 DAY FOR LEAP YEAR                                   01/06/78
```

```
      IF(T .EQ. 0.) DAYNO = DAYNO + 1
   11 CONTINUE
C                                                                          01/06/78
C        LOOP COMPUTES TURNER & PASQUILL CLASSES FOR ALL HOURS OF 1 DAY    01/06/78
C                                                                          01/06/78
      DO 40 I=1,24
      READ(1,110,END=900) TYR,TMO,TDAY,THR,TCHT,TWDIR,TWSPD,TTEMP,TSCON    08/25/78
  110 FORMAT(A2,I2,A2,I2,I4,I4,I4,A4,I2)                                   08/25/78
C                                                                          08/25/78
C         IF TWDIR IS MINUS, ONE OR MORE FIELDS HAS INVALID DATA.          08/25/78
C              CLASSES CAN NOT BE COMPUTED FOR THIS HOUR - SKIP RECORD.    08/25/78
      IF(TWDIR .LT. 0)  GO TO 40                                           08/25/78
C                                                                          01/06/78
C        DETERMINE PASQUILL'S STABILITY CLASS FOR THIS HOUR                01/06/78
C                                                                          01/06/78
    1 IF(THR .GT. SUNRIZ(TMO)+1 .AND. THR .LT. SUNSET(TMO)-1) GO TO 5
C                                                                          01/06/78
C        NIGHTTIME :  IF WIND SPEED > 6 , CLASS = D (4)                    01/06/78
C                     IF WIND SPEED .LE. 3 , CLASS = E (5)                 01/06/78
C                     3 < WIND SPEED .LE. 6 AND CLOUD COVER .GE. 5/10      01/06/78
C                          CLASS = D ELSE CLASS = E                        01/06/78
C                                                                          01/06/78
      ND = 0                                                               01/06/78
      IF(TWSPD .GT. 6) GO TO 4
      IF(TWSPD .GT. 3) GO TO 3
    2 PASCL = 5
      GO TO 9
    3 IF(TSCON .LT. 5) GO TO 2
    4 PASCL = 4
      GO TO 9
C                                                                          01/06/78
    5 CONTINUE
C                                                                          01/06/78
C        DAYTIME : DETERMINE SOLAR ALTITUDE, ALPHA, FROM FOLLOWING         01/06/78
C                  EQUATIONS :                                             01/06/78
C     ALPHA = ARCSIN(SIN A * SIN B + COS((12-H)/(2*PI)) * COS A * COS B)   01/25/78
C             WHERE A IS THE ANGLE DELTA (PREVIOUSLY COMPUTED)             01/06/78
C                   B IS THE STATION LATITUDE                              01/06/78
C                   H IS THE HOUR (MILITARY TIME)                          01/06/79
C        PRODUCTS OF THE SIN & COS ANGLES ARE IN ARRAYS DS & DC AND        01/06/78
C            THE ARRAY HRCOS CONTAINS THE COS((12-H)/(2*PI)) VALUES        01/25/78
C                                                                          01/06/78
      J = THR + 1                                                          01/06/78
      PROD = DS(DAYNO) + HRCOS(J) * DC(DAYNO)                              01/06/78
      ND = 1                                                               01/06/78
C                                                                          01/06/78
C        COMPUTE IP = (1-0.5 * F) * SIN A                                  01/06/78
C            WHERE   F = FRACTION OF SKY COVERED BY CLOUDS (TSCON)         01/06/78
C                    A = SOLAR ALTITUDE (ALPHA)                            01/06/78
C        NOTE :  PROD = SIN(ALPHA)                                         01/23/78
C                                                                          01/25/78
      F = TSCON / 10.                                                      01/23/78
      IP = (1.0 - 0.5 * F) * PROD                                          01/23/78
C                                                                          01/06/78
```

```
C        DETERMINE RELATIVE INSOLATION STRENGTH, RIS, AS FOLLOWS :        004750   01/06/78
C              RIS = STRONG (1) IF 0.67 < IP .LE. 1.0                      004760   01/06/78
C              RIS = MODERATE (2) IF 0.33 < IP .LE. 0.67                   004770   01/06/78
C              RIS = SLIGHT (3) IF 0.0 .LE. IP .LE. 0.33                   004780   01/06/78
C        USE RIS VALUE (1-3) AS COLUMN VALUE OF PASQUILL CLASS ARRAY       004790   01/06/78
C                                                                          004800   01/25/78
      IF(IP .GT. .67) GO TO 6                                              004810
      IF(IP .GT. .33) GO TO 7                                              004820
      RIS = 3                                                              004830
      GO TO 8                                                              004840
    6 RIS = 1                                                              004850
      GO TO 8                                                              004860
    7 RIS = 2                                                              004870
C                                                                          004880   01/06/78
C        DETERMINE ROW VALUE OF PASQUILL CLASS ARRAY USING WIND SPEED      004890   01/06/78
    8 IROW = TWSPD + 1                                                     004900
      IF(IROW .GT. 15) IROW = 15                                           004910
      PASCL = PASQDT(IROW,RIS)                                             004920
C                                                                          004930   01/25/78
C        IF TIND = 1, COMPUTE TURNER'S CLASS                               004940   01/25/78
    9 IF(TIND .EQ. 0) GO TO 17                                             004950   08/25/78
C                                                                          004960   01/06/78
C        DETERMINE TURNER'S STABILITY CLASS FOR THIS HOUR                  004970   01/06/78
C                                                                          004980   01/06/78
      IF(TCHT .GT. -1) GO TO 14                                            004990   08/25/78
C                                                                          005000   01/06/78
C        CEILING HEIGHT VALUE WAS INVALID, TURNER'S CLASS                  005010   01/06/78
C            CAN NOT BE COMPUTED                                           005020   01/06/78
   17 TURCL = 0                                                            005030   08/25/78
      GO TO 31                                                             005040
C                                                                          005050   08/25/78
   14 CONTINUE                                                             005060
      IF(TSCON .LT. 10) GO TO 15                                           005070
      IF(TCHT .GE. 70) GO TO 15                                            005080   01/06/78
      TURCL =4                                                             005090   01/23/78
      GO TO 31                                                             005100   01/23/78
C                                                                          005110   01/06/78
   15 IF(ND .EQ. 1) GO TO 20                                               005120   01/06/78
C                                                                          005130
C        NIGHT TIME : IF CLOUD COVER > 4/10 , NRI = -1 (VALUE USED IS 2,  005140
C            COLUMN INDEX OF THE ARRAY) ELSE NRI = -2 (VALUE USED IS 1)    005150
C                                                                          005160
      IROW = TWSPD + 1                                                     005170   01/09/78
      IF(TSCON .GT. 4) GO TO 16                                            005180
      NRI = 1                                                              005190
      GO TO 30                                                             005200
   16 NRI = 2                                                              005210
      GO TO 30                                                             005220
C                                                                          005230
C        DAYTIME HOUR                                                      005240
   20 CONTINUE                                                             005250
C                                                                          005260
C        ALPHA IS IN RADIANS, CONVERT TO DEGREES                           005270
C        1 DEGREE = .01745329 RADIANS                                      005280
```

```
C
      ALPHA = ARSIN(PROD)                                                   01/23/78
      ANGLE = ALPHA / .01745329
C                                                                           01/25/78
C        DETERMINE ISOLATION CLASS NUMBER, ICN                              01/06/78
      IF(ANGLE .GT. 35.) GO TO 21
      IF(ANGLE .GT. 15.) GO TO 23
      ICN = 4
      GO TO 25
   21 IF(ANGLE .GT. 60.) GO TO 22
      ICN = 6
      GO TO 25
   22 ICN = 7
      GO TO 25
   23 ICN = 5
C                                                                           01/06/78
C        IF CLOUD COVER .LE. 5/10, NRI = ICN                                01/25/78
   25 IF(TSCON .LE. 5) GO TO 29                                             01/23/78
C                                                                           01/25/78
C        IF CEILING < 7,000 FEET, NRI = ICN - 2                             01/25/78
   26 IF(TCHT .GE. 70) GO TO 27
      NRI = ICN - 2
      GO TO 28
C                                                                           01/25/78
C        IF 7,000 .LE. CEILING < 16,000 FEET OR CLOUD COVER = 10/10         01/25/78
C          NRI = ICN -1, OTHERWISE NRI = ICN                                01/25/78
   27 IF(TCHT .LT. 160 .OR. TSCON .EQ. 10) GO TO 24                         01/06/78
   29 NRI = ICN                                                             01/06/78
      GO TO 30
   24 NRI = ICN - 1                                                         01/06/78
   28 IF(NRI .LT. 4) NRI = 4                                                01/06/78
   30 CONTINUE                                                              01/06/78
      IF(IROW .GT. 13) IROW = 13
      TURCL = TURNCL(IROW,NRI)
   31 CONTINUE                                                              01/25/78
C                                                                           01/25/78
C        CONVERT TWSPD TO METERS/SEC (1 KNOT = .5144 M/SEC)                 01/25/78
      SPEED = TWSPD * .5144                                                 01/25/78
      IF(TWDIR .NE. 0) GO TO 34                                             08/25/78
C          X & Y = 0 WHEN WIND IS CALM                                      08/25/78
      X = 0                                                                 08/25/78
      Y = 0                                                                 08/25/78
      GO TO 32                                                              08/25/78
   34 CONTINUE                                                              08/25/78
C                                                                           01/25/78
C        CONVERT TWDIR TO WDIR WHICH IS RELATIVE TO EAST = 0 DEG.           01/25/78
      WDIR = AMOD(450.-TWDIR, 360.)                                         01/25/78
C                                                                           01/25/78
C        USE WDIR CONVERTED TO RADIANS TO COMPUTE X & Y VECTORS             01/25/78
      WDIR = WDIR * 0.0174533                                               01/25/78
      X = COS(WDIR) * SPEED                                                 01/25/78
      Y = SIN(WDIR) * SPEED                                                 01/25/78
   32 WRITE(2,210) TYR,TMO,TDAY,THR,TWDIR,SPEED,X,Y,TTEMP,TURCL,PASCL       01/25/78
  210 FORMAT(A2,I2,A2,I2,I3,F5.2,2F6.2,A4,2I1)                              08/25/78
```

```
    40 CONTINUE
 C                                                                 01/06/78
       IF(DAYNO .LT. 365) GO TO 35                                 01/23/78
       IF(TDAY .EQ. END) DAYNO = 0                                 01/23/78
    35 CONTINUE                                                    01/23/78
       DAYNO = DAYNO + 1                                           01/06/78
       GO TO 11                                                    01/06/78
   900 CONTINUE
       WRITE(6,220) ISTAT                                          09/20/78
   220 FORMAT('1PROCESSING OF TAPE FOR STATION NO. ',I5,' IS COMPLETED')   09/20/78
       STOP
       END
```

APPENDIX C

PROGRAM PNORMAL

```
PROGRAM NORMAL      73/172  TS                    FTN 4.6+452       05/04/79  10.13.56        PAGE     1

          PROGRAM NORMAL(INPUT,OUTPUT,TAPE4,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8)
C
C
C         THIS PROGRAM EDITS A MET DATA TAPE, AND PRODUCES A MET FILE ON
C         WHICH THE PARAMETERS OF THE METEOROLOGICAL DISTRIBUTION FOR EACH
C         STABILITY CLASS AND TIME PERIOD ARE KEPT.  THERE IS NO CARD INPUT
C         TO NORMAL.  THE ONLY INPUT IS TAPE8 PRODUCED BY PWCLASS.
C         THIS PROGRAM IS WRITTEN TO USE THE PASQUILLE DETERMINED
C         STABILITY CLASS PARAMETER.  IF IT IS DESIRED TO USE THE TURNER
C         PARAMETER, FORMAT 8000 MUST BE (2(2X,I2),8X,2F6.2,I4,2X,I1), AND
C         THE COMPUTATION OF N (FOLLOWING LABELED STATEMENT 102 AND
C         PRECEEDING STATEMENT 902) MUST USE A MULTIPLIER OF 6 RATHER THAN 5.
C         NOTE AS USED IN THIS PROGRAM A *TIME PERIOD* IS THE SET OF ALL
C         HOURS WHICH ARE ELEMENTS OF A DESIGNATED SEASON AND HOURS OF DAY.
C
C
C
          DIMENSION MONTH(4), HOURS(2,24)
C
          INTEGER C,H,INDEX(12),M,N,NUM(480),T,TP
          INTEGER MD,TPS,HR
C
          REAL   COVXY(480),MAX(480),MEAN(480),MEANX(480),MEANY(480),
         -MIN(480),MT,MX,MY,TITLE(8),ST,STATOT(6),VAR(480),VARX(480),
         -VARY(480),VX,VY,VXY,X,Y
C
C
C         C        INTEGER SCALAR -- INPUT.
C                  STABILITY CLASS INDEX.
C
C         COVXY    REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C                  THE SUM OF X*Y INDEXED BY TP/SC CATAGORY.
C
C         H        INTEGER SCALAR -- INPUT.
C                  HOUR OF DAY DESIGNATOR.
C
C         HOURS    ALPHA ARRAY -- DATA
C                  HOUR DESIGNATOR
C
C         HR       INTEGER SCALAR -- CALCULATED
C                  HOUR DESIGNATOR
C
C         HS       ALPHA SCALAR -- CALCULATED
C                  STANDARD TIME DESIGNATOR
C
C         INDEX    INTEGER ARRAY -- DIMENSION 12 -- DATA.
C                  USED TO DETERMINE THE TIME PERIOD CATEGORIES.
C                  TIME PERIODS ARE ONE-HOUR CLOCK TIMES OVER SEASONS
C                  COMPOSED OF MONTHS (11,12,1), (2,3,4), (5,6,7), AND
C                  (8,9,10). MONTHS (5,6,7,8,9,10) ARE DAYLIGHT
C                  SAVING TIME.  INDEX(M) GIVES THE TIME PERIOD DESIGNATION
C                  OF THE FIRST HOUR OF THE DAY FOR MONTH M.
C
C         M        INTEGER SCALAR -- INPUT.
C                  MONTH DESIGNATOR.
C
C         MAX      REAL ARRAY -- DIMENSION 480 -- CALCULATED.
```

```
C             THE MAXIMUM TEMPERATURE INDEXED BY TP/SC CATEGORY.
C
C     MD      INTEGER SCALAR -- CALCULATED
C             MONTH DESIGNATOR
C
C     MEAN    REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE SUM OF T INDEXED BY TP/SC CATEGORY.
C
C     MEANX   REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE SUM OF X INDEXED BY TP/SC CATEGORY.
C
C     MEANY   REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE SUM OF Y INDEXED BY TP/SC CATEGORY.
C
C     MIN     REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE MINIMUM TEMPERATURE INDEXED BY TP/SC CATEGORY.
C
C     MONTH   ALPHA ARRAY -- DATA
C             MONTH DESIGNATOR
C
C     MT      REAL SCALAR -- CALCULATED.
C             THE MEAN T.
C
C     MX      REAL SCALAR -- CALCULATED.
C             THE MEAN X
C
C     MY      REAL SCALAR -- CALCULATED.
C             THE MEAN Y.
C
C     N       INTEGER SCALAR -- CALCULATED.
C             AN INDEXING VARIABLE.
C
C     NUM     INTEGER ARRAY -- DIMENSION 480 -- CALCULATED.
C             NUMBER OF OBSERVATIONS FOR TIME PERIOD TP AND CLASS C.
C
C     ST      REAL SCALAR -- CALCULATED.
C             THE STANDARD DEVIATION OF TEMPERATURE.
C
C     STATOT  REAL ARRAY -- DIMENSION 6 -- CALCULATED.
C             THE METEOROLOGICAL STATISTICS OUTPUT VECTOR.
C
C     T       INTEGER SCALAR -- INPUT.
C             TEMPERATURE IN DEGREES FAHRENHEIT.
C
C     TITLE   REAL ARRAY -- DIMENSION 8 -- INPUT.
C             ALPHABETIC DESCRIPTION OF METEOROLOGICAL DATA SET.
C
C     TP      INTEGER SCALAR -- CALCULATED.
C             THE TIME PERIOD DESIGNATOR.
C
C     VAR     REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE SUM OF T**2 INDEXED BY TP/SC CATEGORY.
C
C     VARX    REAL ARRAY -- DIMENSION 480 -- CALCULATED.
C             THE SUM OF X**2 INDEXED BY TP/SC CATEGORY.
C
C     VARY    REAL ARRAY -- DIMENSION 480 -- CALCULATED.
```

```
C              THE SUM OF Y**2 INDEXED BY TP/SC CATEGORY.
C
C     VX       REAL SCALAR -- CALCULATED.
C              THE VAR(X).
C
C     VY       REAL SCALAR -- CALCULATED.
C              THE VAR(Y).
C
C     VX       REAL SCALAR -- CALCULATED.
C              THE COV(X,Y)
C
C     X        REAL SCALAR -- INPUT.
C              THE WIND SPEED IN X-DIRECTION IN METERS/SEC.
C
C     Y        REAL SCALAR -- INPUT.
C              THE WIND SPEED IN Y-DIRECTION IN METERS/SEC.
C
C     THE TIME PERIODS IN THIS PROGRAM ARE DEFINED AS FOLLOWS:
C              (NOTE 24:00 = 0:00)
C
C              TP         MONTHS       TIME
C              --         ------       ---
C
C              1          11,12,1      0:00 TO 1:00 ST
C              :::        :::          :::
C              24         11,12,1      23:00 TO 24:00 ST
C
C
C              25         2,3,4        0:00 TO 1:00 ST
C              :::        :::          :::
C              48         2,3,4        23:00 TO 24:00 ST
C
C
C              49         5,6,7        0:00 TO 1:00 DST (23:00 TO 24:00 ST)
C              :::        :::          :::
C              72         5,6,7        23:00 TO 24:00 DST (22:00 TO 23:00 ST)
C
C
C              73         8,9,10       0:00 TO 1:00 DST (23:00 TO 24:00 ST)
C              :::        :::          :::
C              96         8,9,10       23:00 TO 24:00 DST (22:00 TO 23:00 ST)
C
C
      DATA COVXY,VAR,VARX,VARY/1920*0.0/
      DATA INDEX/0,24,24,24,49,49,49,73,73,73,0,0/
      DATA MAX/480*-99.99/
      DATA MEAN,MEANX,MEANY/1440*0.0/
      DATA MIN/480*999.99/
      DATA NUM/480*0/
C
C
      HOURS(1,1)=10H 0:00 TO
      HOURS(2,1)=4H1:00
      HOURS(1,2)=10H 1:00 TO
      HOURS(2,2)=4H2:00
      HOURS(1,3)=10H 2:00 TO
      HOURS(2,3)=4H3:00
```

```
      HOURS(1,4)=10H 3:00 TO
      HOURS(2,4)=4H4:00
      HOURS(1,5)=10H 4:00 TO
      HOURS(2,5)=4H5:00
      HOURS(1,6)=10H 5:00 TO
      HOURS(2,6)=4H6:00
      HOURS(1,7)=10H 6:00 TO
      HOURS(2,7)=4H7:00
      HOURS(1,8)=10H 7:00 TO
      HOURS(2,8)=4H8:00
      HOURS(1,9)=10H 8:00 TO
      HOURS(2,9)=4H9:00
      HOURS(1,10)=10H 9:00 TO 1
      HOURS(2,10)=4H0:00
      HOURS(1,11)=10H10:00 TO 1
      HOURS(2,11)=4H1:00
      HOURS(1,12)=10H11:00 TO 1
      HOURS(2,12)=4H2:00
      HOURS(1,13)=10H12:00 TO 1
      HOURS(2,13)=4H3:00
      HOURS(1,14)=10H13:00 TO 1
      HOURS(2,14)=4H4:00
      HOURS(1,15)=10H14:00 TO 1
      HOURS(2,15)=4H5:00
      HOURS(1,16)=10H15:00 TO 1
      HOURS(2,16)=4H6:00
      HOURS(1,17)=10H16:00 TO 1
      HOURS(2,17)=4H7:00
      HOURS(1,18)=10H17:00 TO 1
      HOURS(2,18)=4H8:00
      HOURS(1,19)=10H18:00 TO 1
      HOURS(2,19)=4H9:00
      HOURS(1,20)=10H19:00 TO 2
      HOURS(2,20)=4H0:00
      HOURS(1,21)=10H20:00 TO 2
      HOURS(2,21)=4H1:00
      HOURS(1,22)=10H21:00 TO 2
      HOURS(2,22)=4H2:00
      HOURS(1,23)=10H22:00 TO 2
      HOURS(2,23)=4H3:00
      HOURS(1,24)=10H23:00 TO 2
      HOURS(2,24)=4H4:00
      MONTH(1)=8H11 TO  1
      MONTH(2)=8H 2 TO  4
      MONTH(3)=8H 5 TO  7
      MONTH(4)=8H 8 TO 10
C
 6004 FORMAT(1H0,4X,I2,9X,A8,7X,A10,A4,2X,A3,6X,I1,10X,I4,5X,4(3X,F6.2,
     +4X))
 6005 FORMAT(1H ,55X,I1,10X,I4,5X,4(3X,F6.2,4X))
 6008 FORMAT(1H1,T10,4A8/T10,4A8//49X,≠DATA GROUP STATISTICS≠//4X,≠TIME≠
     +,48X,≠STAB≠,8X,≠DATA≠,8X,≠MEAN≠,8X,≠STD.DEV.≠,7X,≠MIN≠,10X,≠MAX≠/
     +3X,≠PERIOD≠,8X,≠MONTHS≠,15X,≠HOURS≠,13X,≠CLASS≠,7X,≠POINTS≠,6X,
     +≠TEMP.F≠,8X,≠TEMP≠,9X,≠TEMP≠,9X,≠TEMP≠/)
C
 8000 FORMAT(2(2X,I2),8X,2F6.2,I4,1X,I1)
```

```
 8001 FORMAT(4A8)
C
C
C
C
C
C
C     WE PROCESS THE MET TAPE BY READING A RECORD, TAGGING IT BY TP
C     AND SC,AND GENERATING THE TP/SC MET DISTRIBUTION PARAMETERS.
C
C     THE FIRST TWO RECORDS ON THE TAPE (READ INTO TITLE) JUST CONTAIN
C     THE STATION NUMBER, START AND STOP DATES, LATITUDE OF STATION AND
C     AN ALPHA DESCRIPTION OF THE STATION.
C
  100 READ(8,8001) TITLE
C
C     READ THE MONTH, HOUR, VELOCITIES, TEMPERATURE AND STABILITY
C     CLASS FROM A RECORD.
C
  101 READ(8,8000) M,H,X,Y,T,C
      IF(EOF(8)) 900,102
C
C     TEST FOR INVALID MET DATA.
C
  102 IF(C .EQ. 0) GO TO 101
C
C     DETERMINE THE CATEGORY,N,THAT THIS RECORD BELONGS TO AND
C     CHECK FOR VALIDITY.
C
      IF(H.EQ.23 .AND. M.GE.5 .AND. M.LE.10) H=-1
      N=(INDEX(M)+H)*5+C
      IF(N.GT.480) GO TO 101
C
C     COMPUTE THE STATISTICS FOR INDEX N.
C     NOTE THAT T=-99 IMPLIES THAT THE TEMPERATURE WAS UNKNOWN.
C
      NUM(N)=NUM(N)+1
      IF(T .EQ. -99) T=MEAN(N)/NUM(N)
      IF(T .LT. MIN(N)) MIN(N)=T
      IF(T .GT. MAX(N)) MAX(N)=T
      MEAN(N)=MEAN(N)+T
      MEANX(N)=MEANX(N)+X
      MEANY(N)=MEANY(N)+Y
      VAR(N)=VAR(N)+T*T
      VARX(N)=VARX(N)+X*X
      VARY(N)=VARY(N)+Y*Y
      COVXY(N)=COVXY(N)+X*Y
C
      GO TO 101
C
C     THE INPUT TAPE HAS BEEN PROCESSED.
C     NOW OUTPUT STATISTICS.
C
  900 WRITE(6,6008) TITLE
      HS=3HSTD
      TPS=0
      DO 910 N=1,480
```

```
      I=NUM(N)
      STATOT(1)=I
      IF(I .EQ. 0) GO TO 902
      MT=MEAN(N)/I
      MX=MEANX(N)/I
      MY=MEANY(N)/I
      IF(I .EQ. 1) I=2
      ST=SQRT(AMAX1(I*(VAR(N)/I-MT*MT)/(I-1),1.0E-4))
      VX=AMAX1(I*(VARX(N)/I-MX*MX)/(I-1),1.0E-2)
      VY=AMAX1(I*(VARY(N)/I-MY*MY)/(I-1),1.0E-2)
      VXY=I*(COVXY(N)/I-MX*MY)/(I-1)
      IF(VX*VY .LE. VXY*VXY) VXY=SQRT(VX*VY)-1.0E-2
      STATOT(2)=MX
      STATOT(3)=MY
      STATOT(4)=VX
      STATOT(5)=VXY
      STATOT(6)=VY
      TP=(N-1)/5+1
      C=N-(TP-1)*5
      MD=(TP-1)/24+1
      HR=TP-(TP-1)/24*24
      IF(TP.GE.49) HS=3HDST
      IF(TP.EQ.TPS) GO TO 300
      TPS=TP
      WRITE(6,6004) TP,MONTH(MD),HOURS(1,HR),HOURS(2,HR),HS,C,I,MT,ST,
     +MIN(N),MAX(N)
      GO TO 902
  300 WRITE(6,6005) C,I,MT,ST,MIN(N),MAX(N)
  902 WRITE(4) STATOT
  910 CONTINUE
      STOP
      END
```

41000B CM STORAGE USED   1.453 SECONDS