Department of Pesticide Regulation

Mary-Ann Warmerdam
Director

MEMORANDUM

Arnold Schwarzenegger
Governor

TO: Randy Segawa
Environmental Program Manager I
Environmental Monitoring Branch

FROM: Bruce Johnson, Ph.D.
Research Scientist III
Environmental Monitoring Branch
916-324-4106

Original signed by

DATE: July 29, 2009

SUBJECT: SUMMARY OF METEOROLOGICAL DATA FROM SELECTED REGIONS

In prioritizing possible communities for long term air monitoring for pesticides, selection priority will probably be given to those communities which might expect for various reasons to experience higher pesticide air concentrations. All other factors being equal, one component which determines air concentrations is meteorology. Generally, persistent wind directions and lower wind speeds lead to higher downwind air concentrations from pesticide applications. Stability conditions also play a role, though the role is more complex than wind persistence. In part, stability conditions are based on wind speed. As a contribution to the ongoing prioritization process, you requested that I provide estimates similar to those in the Department of Pesticide Regulation’s Environmental Justice Project (2005, Figures 2 and 3) which describe wind speeds and wind directions for selected regions: specifically, San Joaquin Valley (SJV), North Central Coast (NCC), Salton Sea (SS), Sacramento Valley (SV) and Ventura County (VENT).

Methods

The California Irrigation Management Information System (CIMIS) Web site provides hourly meteorological data from some 210 stations located in agricultural areas of California. The CIMIS Web site provides station information, including latitude and longitude. Using geospatial analysis the latitude and longitude information was used to classify the stations into their respective air basins (Rosemary Neal, personal communication). I downloaded multiple years of data from 37 stations. Stations were located in selected California regions (Figure 1). Downloaded data included station number, date, hour, solar radiation (ly/day), net radiation (ly/day), air temperature (^{o}F), wind speed (MPH), wind direction (0-360^{o}), standard deviation of wind direction (0-360^{o}), precipitation (in).

The total years of downloaded hourly meteorological data was 351 (Table 1). This included 40 years from Mojave Desert, which was not included in the final summary. The selection of years and stations was not a complete set of what was available from CIMIS for each region. The initial downloads were restricted to active stations which had 10 years of data from 1999 to 2008. However, it was necessary in VENT to include smaller year ranges and inactive stations in order to acquire sufficient data. The downloaded data consisted of NCC 70 years, SJV 124 years, SS 40 years, SV 50 years and VENT 27 years. All downloaded data files started with January 1 and ended on December 31. The downloaded files begin with a three-digit station code used in Figure 1 and on the CIMIS Web site.

CIMIS data downloaded as 'CSV' is generally both fixed format and comma separated. CIMIS provides quality control characters which characterize the validity of the data in each field. When data is missing, the affected field is shortened and '—' (double dash) is inserted. In order to create strictly fixed format files, I wrote a FORTRAN program which located instances of missing values and expanded the affected fields out to the full field size (PADDER2.FOR, Appendix 1). An earlier attempt to obtain fixed formatting by using Excel to save these files as "PRN" files failed because: (1) the fixed formatting varied from one file to another and (2) Excel evidently analyzes the first few hundred lines to determine a formatting and this led to problems in the second half of the data where dates consisted of two digit months and two digit days and Excel had not left enough room. The advantage to fixed formatting is that the file can be more readily utilized by a variety of future programs.

After processing the files to produce fixed format, I wrote a FORTRAN program (AIRCONCIM3.FOR, Appendix 2) to process each file to summarize the following information: (1) count of wind speeds in 1 m/s increments up to 7 m/s with the final bin being 7+ m/s and (2) count of wind directions in 45^o sectors with 337.5 to 360 and 0 to 22.5 being the "North" bin (N), 22.5 to 67.5 being the "Northeast" bin (NE), and so on around the circle finishing with 292.5 to 337.5 being the "Northwest" bin (NW). This program did not utilize any data where the QC indicated anything other than valid data. In the CIMIS data sets valid data is indicated by an asterisk symbol. AIRCONCIM3.FOR output summary data for each file into a fixed format file for subsequent analysis.

The summary file revealed that Station #5 (Shafter, Kern County, and SJV) did not measure wind direction. Thus the SJV wind direction data is based on 114 years, while the wind speed data for SJV is based on 124 years.

The fraction of usable hours for each file for each of wind speed and wind direction parameters was determined. Based on usable hours, for each file the fraction of hourly wind speeds in each bin was determined. For each region the average bin fraction was determined over the files belonging in that region. For usable wind direction data, the maximum fraction of wind direction for each file was determined and the average of these maximum fractions was determined for each region. Averages were determined using each file as the unit. Differences in size of data files were ignored. The resulting file summaries were analyzed using both Excel pivot tables and BMDP (BMDP1D 1993).

Results

A large percentage of the speed data was usable. The fraction of usable speed hours averaged 98.6 percent (%). The lowest fraction was VENT with 97.7% usable speed hours. At the lowest speed category, VENT exhibited the highest fraction with 25% of the measured wind speeds at less than 1 m/s (Figure 2). The next highest was SV with 22%. In the next category from 1 to 2 m/s, SS Sea was highest at 43% with SJV second at 39%. It is difficult to quantify the impact of more low wind speed hours at 0 to 1 m/s and 1 to 2 m/s. In modeling terms, wind speeds can affect the concentration both as the denominator in the Gaussian plume equation and as a determinant of the stability category. As a denominator, lower wind speeds produce higher concentrations. With regard to stability class determinations, however, the effect of wind speeds varies between night and day. During daytime with strong solar insolation, lower wind speeds lead to more vertical atmospheric instability, which leads to lower downwind air concentrations (U.S. EPA 2000, Table 6-3 Key to the Pasquill Stability Categories). Conversely, at night, lower wind speed lead to more stable conditions with higher associated concentrations.

The fraction of usable direction hours exceeded 99% for all basins. The highest directional fraction occurred with VENT with 32% of the directions in the same 45^o sector (Figure 3). The next highest was SJV with 30%. The small magnitude of the difference suggests that wind direction persistence will not lead to great differences between the basins.

Conclusion

The differences between regions in terms of low wind speeds and persistence of wind direction based on a total of 311 years of hourly wind speed and direction data from the CIMIS air monitoring network yield inconclusive results for assessing likely impact on long term air pesticide concentrations.

Acknowledgment
Thanks to Rosemary Neal for help with assigning the CIMIS station to regions and for generating Figure 1.

References

Department of Pesticide Regulation. 2005. Environmental Justice Pilot Project Objectives, Pesticides, and Community. June 2005. <http://www.cdpr.ca.gov/docs/envjust/pilot_proj/ej_candidate_discussion_final.pdf>.

BMDP1D–Simple Data Description. Release 8. 1993. Statistical Solutions Ltd., 8 South Bank, Crosse's Green, Cork, Ireland.

U.S. EPA. 2000. Meteorological monitoring guidance for regulatory modeling applications. U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711 EPA-454/R-99-005 February 2000.

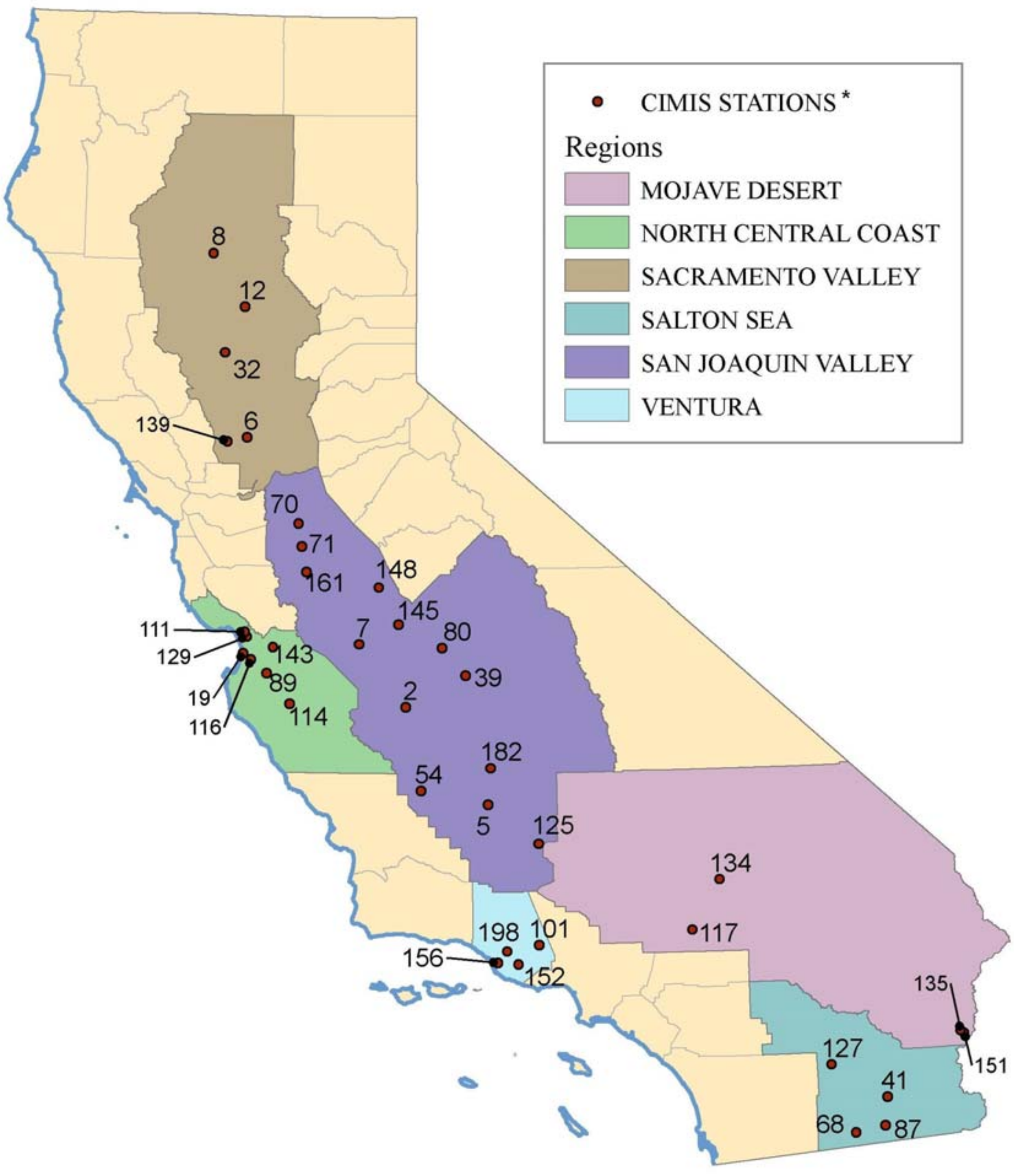
Table 1. Data inventory downloaded from CIMIS. Region acronyms are SJV=San Joaquin Valley, SV=Sacramento Valley, NCC=North Central Coast, SS=Salton Sea, MD= Mojave Desert (not analyzed), VENT=Ventura County

Filename	County	Station Number	Region	Start Year	End Year	Number of Years
002ciF19992003.csv	Fresno	002	SJV	1999	2003	5
002ciF20042008.csv	Fresno	002	SJV	2004	2008	5
005ciF19992003.csv	Kern	005	SJV	1999	2003	5
005ciF20042008.csv	Kern	005	SJV	2004	2008	5
006ciF19992003.csv	Yolo	006	SV	1999	2003	5
006ciF20042008.csv	Yolo	006	SV	2004	2008	5
007ciF19992003.csv	Fresno	007	SJV	1999	2003	5
007ciF20042008.csv	Fresno	007	SJV	2004	2008	5
008ciF19992003.csv	Tehama	008	SV	1999	2003	5
008ciF20042008.csv	Tehama	008	SV	2004	2008	5
012ciF19992003.csv	Butte	012	SV	1999	2003	5
012ciF20042008.csv	Butte	012	SV	2004	2008	5
019ciF19992003.csv	Monterey	019	NCC	1999	2003	5
019ciF20042008.csv	Monterey	019	NCC	2004	2008	5
032ciF19992003.csv	Colusa	032	SV	1999	2003	5
032ciF20042008.csv	Colusa	032	SV	2004	2008	5
039ciF19992003.csv	Fresno	039	SJV	1999	2003	5
039ciF20042008.csv	Fresno	039	SJV	2004	2008	5
041ciF19992003.csv	Imperial	041	SS	1999	2003	5
041ciF20042008.csv	Imperial	041	SS	2004	2008	5
054ciF19992003.csv	Kern	054	SJV	1999	2003	5
054ciF20042008.csv	Kern	054	SJV	2004	2008	5
068ciF19992003.csv	Imperial	068	SS	1999	2003	5
068ciF20042008.csv	Imperial	068	SS	2004	2008	5
070ciF19992003.csv	San Joaquin	070	SJV	1999	2003	5
070ciF20042008.csv	San Joaquin	070	SJV	2004	2008	5
071ciF19992003.csv	Stanislaus	071	SJV	1999	2003	5
071ciF20042008.csv	Stanislaus	071	SJV	2004	2008	5
080ciF19992003.csv	Fresno	080	SJV	1999	2003	5
080ciF20042008.csv	Fresno	080	SJV	2004	2008	5
087ciF19992003.csv	Imperial	087	SS	1999	2003	5
087ciF20042008.csv	Imperial	087	SS	2004	2008	5

Table 1. Continued

089ciF19992003.csv	Monterey	089	NCC	1999	2003	5
089ciF20042008.csv	Monterey	089	NCC	2004	2008	5
111ciF19992003.csv	Santa Cruz	111	NCC	1999	2003	5
111ciF20042008.csv	Santa Cruz	111	NCC	2004	2008	5
114ciF19992003.csv	Monterey	114	NCC	1999	2003	5
114ciF20042008.csv	Monterey	114	NCC	2004	2008	5
116ciF19992003.csv	Monterey	116	NCC	1999	2003	5
116ciF20042008.csv	Monterey	116	NCC	2004	2008	5
117ciF19992003.csv	San Bernardino	117	MD	1999	2003	5
117ciF20042008.csv	San Bernardino	117	MD	2004	2008	5
125ciF19992003.csv	Kern	125	SJV	1999	2003	5
125ciF20042008.csv	Kern	125	SJV	2004	2008	5
127ciF19992003.csv	Imperial	127	SS	1999	2003	5
127ciF20042008.csv	Imperial	127	SS	2004	2008	5
129ciF19992003.csv	Monterey	129	NCC	1999	2003	5
129ciF20042008.csv	Monterey	129	NCC	2004	2008	5
134ciF19992003.csv	San Bernardino	134	MD	1999	2003	5
134ciF20042008.csv	San Bernardino	134	MD	2004	2008	5
135ciF19992003.csv	Riverside	135	MD	1999	2003	5
135ciF20042008.csv	Riverside	135	MD	2004	2008	5
139ciF19992003.csv	Solano	139	SV	1999	2003	5
139ciF20042008.csv	Solano	139	SV	2004	2008	5
143ciF19992003.csv	San Benito	143	NCC	1999	2003	5
143ciF20042008.csv	San Benito	143	NCC	2004	2008	5
145ciF19992003.csv	Madera	145	SJV	1999	2003	5
145ciF20042008.csv	Madera	145	SJV	2004	2008	5
148ciF19992003.csv	Merced	148	SJV	1999	2003	5
148ciF20042008.csv	Merced	148	SJV	2004	2008	5
151ciF19992003.csv	Riverside	151	MD	1999	2003	5
151ciF20042008.csv	Riverside	151	MD	2004	2008	5
161ciF20002003.csv	Stanislaus	161	SJV	2000	2003	4
161ciF20042008.csv	Stanislaus	161	SJV	2004	2008	5
182ciF20042008.csv	Tulare	182	SJV	2004	2008	5
101ciF19962000.csv	Ventura	101	VENT	1996	2000	5
101ciF20012004.csv	Ventura	101	VENT	2001	2004	4
152ciF20012005.csv	Ventura	152	VENT	2001	2005	5
152ciF20062008.csv	Ventura	152	VENT	2006	2008	3
156ciF20022006.csv	Ventura	156	VENT	2002	2006	5
156ciF20072008.csv	Ventura	156	VENT	2007	2008	2
198ciF20062008.csv	Ventura	198	VENT	2006	2008	3

Figure 1. Geographic Locations of CIMIS Stations



* Only stations listed in this report.

Map Created by Rosemary Neal - 6/30/09

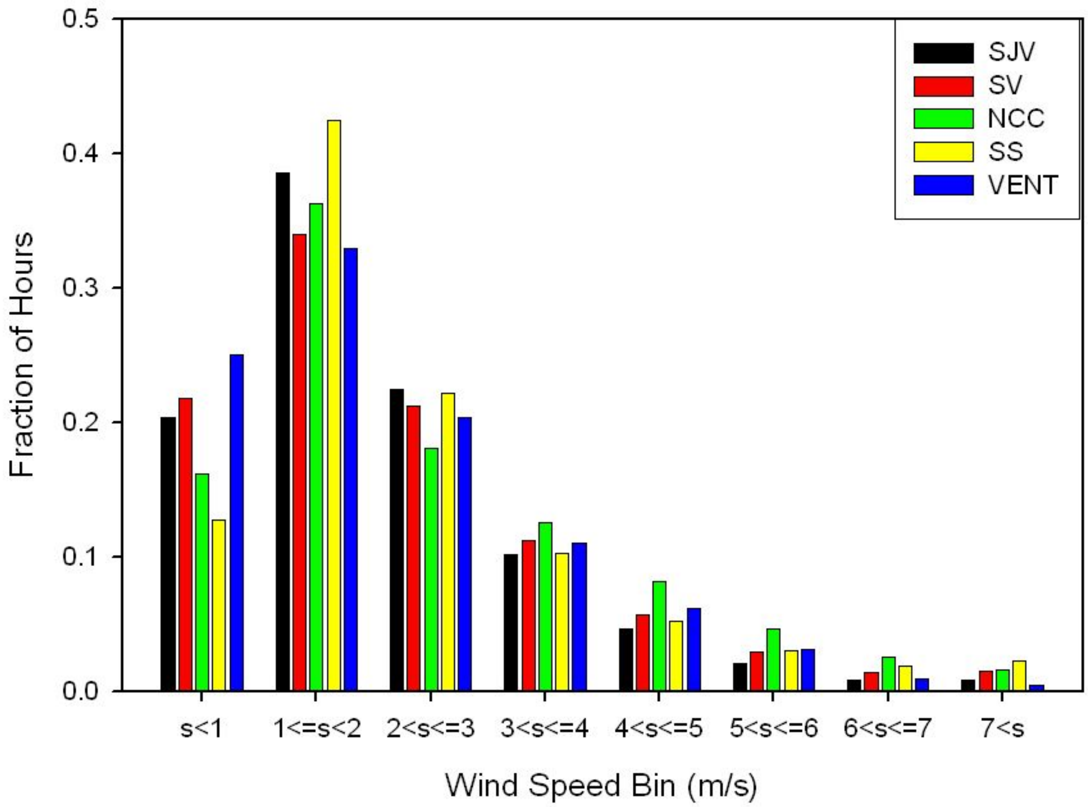


Figure 2. Distribution of wind speeds amongst selected regions.

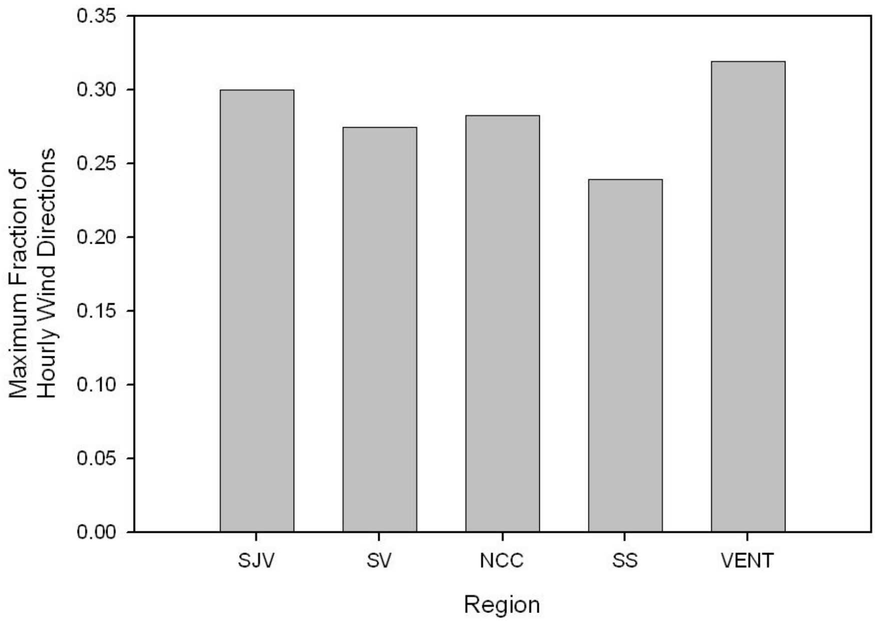


Figure 3. Average maximum fraction wind direction.

Appendix 1. Listing of PADDER2.FOR

```
C     Last change:  BJ    5 Jun 2009    3:48 pm
      PROGRAM PADDER2
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C090605LATER, VERSION 2 WILL USE A LIST OF FILES TO PROCESS
C THE FILENAMES ARE ..\NNNCIMY1Y1Y2Y2.CSV
C THE OUTPUT FILENAMES WILL BE NNNCIFY1Y1Y2Y2.CSV, WHERE THE M IS CHANGED TO F
C TO DENOTE THAT THE FILE HAS BEEN REFORMATTED AS A FIXED FORMAT FILE (IN OTHER WORDS
C THE PROBLEM WITH ANY "--"S HAS BEEN TAKEN CARE OF.
C
C 090605 I TESTED THIS PROGRAM USING TEST.IN WHICH CONTAINED SEVERAL
C LINES WITH MULTPLE INSTANCES OF -- AND IT RAN OK
C THIS PROGRAM OR PROBABLY EVENTUALLY SUBROUTINE IS TO
C TAKE THE CSV FILES FROM CIMIS AND LOOK FOR INSTANCES
C OF --.  THEN ON THOSE LINES WHERE -- OCCURS, TO PADD OUT
C THE FIELD SO THAT THE COMMAS WILL LINE UP AND THE FORMAT
C WILL BE FIXED.  UNFORTUNATELY THE NEW CIMIS FORMAT USES
C -- TO INDICATE MISSING VALUES AND THE FORMAT THEN CHANGES
C I NEED FIXED FORMAT, EVEN WITH THE COMMAS IN ORDER TO MORE
C EASILIY DO THE STUFF I NEED TO DO.
C
C THE KEY ELEMENTS TO THIS ARE THE SIZE OF EACH OF THE FIELDS
C WHEN THERE IS NO -- AND THE USE OF THE INTRINSIC INDEX FUNCTION
C WHICH LOOKS FOR THE FIRST INSTANCE OF A SUBSTRING WITHIN
C A STRING
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C HERE IS AN EXTRACT OF A DELICIOUS SITUATION WITH MORE THAN ONE INSTANCE OF --
C1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
C1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
C0002,02/11/1999,0500,042,*,   -7,*,  -47,*,   32.6,*,    2.3,*,  105.7,*,   31.5,*,    0.00
C0002,02/11/1999,0600,042,*,   -4,*,  -46,*,   32.2,*,    3.0,*,  199.7,*,   58.9,*,    0.00
C0002,02/11/1999,0700,042,*,   -3,*,--,M,--,*,    4.3,*,  176.8,*,   34.0,*,    0.00
C0002,02/11/1999,0800,042,M,--,M,--,M,--,*,    4.5,*,  155.6,*,   58.7,*,    0.00
C0002,02/11/1999,0900,042,M,--,M,--,M,--,*,    5.7,*,  125.9,*,   60.0,*,    0.00
C0002,02/11/1999,1000,042,S,--,Q,--,S,--,*,    4.9,*,  114.0,*,   58.7,Q,    0.00
C 1:4 STATION NUMBER               41:41 COMMA              73:73 COMMA
C 5:5 COMMA                       42:42 AIRTEMP QC         74:80 STDEV WIND DIR
C 6:15  DATE                      43:43 COMMA              81:81 COMMA
C16:16 COMMA                      44:50 AIRTEMP            82:82 QC PRECIP
C17:20  HOUR                      51:51 COMMA              83:83 COMMA
C21:21  COMMA                     52:52 WIND SPEED QC      84:91 PRECIP
C22:24  JULIAN DAY                53:53 COMMA
C25:25  COMMA                     54:60 WINDSPEED
C26:26  SOLRAD QC CODE            61:61 COMMA
C27:27  COMMA                     62:62 WINDDIR QC CODE
C28:32  SOLRAD                    63:63 COMMA
C33:33 COMMA                      64:70 WINDDIR
C34:34 NETRAD QC CODE             71:71 COMMA
C35:35  COMMA                     72:72 STDEV WINDDIR QC
C36:40  NETRAD
C
C SIZE OF THE DATA FIELDS
C SOLRAD  5         WINDSPEED 7       PRECIP 8  (2 DECIMAL PLACES)
C NETRAD  5         WINDDIR   7
C AIRTEMP 7         STDEV     7
C
C START WITH GAME PLAN AS FOLLOWS:
C FOR EACH RECORD, CHECK POSITION OF COMMAS
```

```
C IF THERE IS A COMMA IN THE WRONG POSITION, THEN LOOK FOR --
C IF DON'T FIND --, THEN STOP ERROR
C IF FIND --, THEN PAD OUT THAT FIELD AND START PROCESS FROM RIGHT HAND SIDE OF THAT FIELD FOR
C REST OF STRING, AS CAN BE SEEN ABOVE, THERE WILL BE MULTIPLE INSTANCES OF -- IN SAME RECORD
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      IMPLICIT NONE
      CHARACTER*120 LINE
      CHARACTER*200 POSTLINE
      INTEGER L1,L2,P,NB,FLDLEN(7)
      INTEGER FLDNUM
      INTEGER GETFLD
      INTEGER ADDBL,N,KN
      INTEGER FLDSTART(7) !FIELD COMMA STARTING POSITIONS IN PROPERLY FORMATTED LINE
      DATA FLDSTART/27,35,43,53,63,73,83/
      INTEGER COUNT
      INTEGER LASTFIELD  !THIS KEEP TRACK OF THE LAST FIELD THAT GOT ADJUSTED
      DATA FLDLEN/5,5,7,7,7,7,8/  !FIELD LENGTHS
      CHARACTER*40 FIN,FOUT
      INTEGER BIGLEN

      OPEN(UNIT=10,STATUS='OLD',FILE='FILELIST.DAT') !CONTAINS LIST OF FILES TO PROCESS
888    CONTINUE  !START OF OPENING NEXT FILE TO PROCESS
       READ(10,890,END=99999)FIN
890     FORMAT(A40)
       BIGLEN=LEN_TRIM(FIN)
       !FORMAT SHOULD BE ..\NNNCIMY1Y1Y2Y2.CSV
       FOUT(1:BIGLEN-3)=FIN(4:BIGLEN)  !STRIP OFF PARENT DIRECTORY DESIGNATOR
       FOUT(6:6)='F'  !CHANGE M TO F
       OPEN(UNIT=1,STATUS='OLD',FILE=FIN)
       OPEN(UNIT=2,STATUS='UNKNOWN',FILE=FOUT)
      COUNT=0

1      CONTINUE
       LASTFIELD=0  !SET THIS TO ZERO WHEN STARTING NEW LINE
       READ(1,100,END=1000)LINE
100     FORMAT(A120)
       COUNT=COUNT+1
2       L1=LEN_TRIM(LINE)
       IF(LASTFIELD.EQ.0)THEN
C         P=INDEX(LINE,'--')
        N=1
       ELSE
C         P=INDEX(LINE(FLDSTART(LASTFIELD):L1),'--') !START SEARCH AFTER PREVIOUS INSTANCE OF -- BECAUSE THAT
ONE IS ALREADY TAKEN CARE OF
        N=FLDSTART(LASTFIELD+1)
       ENDIF
       KN=MAX(1,N)
       P=INDEX(LINE(KN:L1),'--')
       IF(P.GT.0)THEN  !WE HAVE A HIT, PROCESS THE LINE
        P=P+KN
        !FLDNUM=GETFLD(P) !FLDNUM IS NUMBER OF FIELD THAT CONTAINS --
        FLDNUM=GETFLD(P+1) !FLDNUM IS NUMBER OF FIELD THAT CONTAINS -- ,MUST ADD 1 BECAUSE START LOOKING
AT COMMA
        ADDBL=FLDLEN(FLDNUM)-2  !NUMBER OF BLANKS TO PREPAD TO FIELD
        CALL SUBPAD(LINE,L1,P-2,ADDBL,POSTLINE,L2) !INSERT THE BLANKS
C         WRITE(6,999)L1,P,KN,FLDNUM,FLDLEN(FLDNUM),LINE(1:91),
C    1              ADDBL,POSTLINE,L2
C999       FORMAT(1X,5I10,/1X,A91/1X,I4,/1X,A91,/1X,I4)
        IF (L2.GT.120) THEN
         WRITE(6,120)L2
```

```
120        FORMAT(1X,I4,'L2 TOO LARGE > 120 ')
          STOP
         ENDIF

         L1=L2
         LINE(1:L2)=POSTLINE(1:L2)
         LASTFIELD=FLDNUM
         GOTO2  !CHECK FOR ANOTHER INSTANCE OF --
       ENDIF
       !LINE SHOULD NOW BE PROPERLY FORMATTED, CHECK THE LAST COMMA TO BE SURE
       IF(LINE(83:83).NE.',')THEN
        WRITE(6,200)LINE(1:90)
200      FORMAT(1X,A90)
        WRITE(6,201)
201      FORMAT(1X,'LAST COMMA IN WRONG POSITION')
        STOP
       ENDIF
       WRITE(2,300)LINE(1:91)
300     FORMAT(A91)
       GOTO1
1000   CONTINUE
      WRITE(6,1100)COUNT,FIN(1:21)
1100   FORMAT(1X,I5,' LINES PROCESSED IN FILE ',A21,'...')
      CLOSE(1)
      CLOSE(2)
      GOTO888
99999  CLOSE(10)
      STOP
      END PROGRAM
      INTEGER FUNCTION GETFLD(K)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C DETERMINES WHICH FIELD THE -- APPEARS, K IS THE
C FIRST POSITION IN LINE OF THE --
C
C 1:4 STATION NUMBER          41:41 COMMA           73:73 COMMA
C 5:5 COMMA                   42:42 AIRTEMP QC      74:80 STDEV WIND DIR
C 6:15  DATE                  43:43 COMMA           81:81 COMMA
C16:16 COMMA                  44:50 AIRTEMP         82:82 QC PRECIP
C17:20  HOUR                  51:51 COMMA           83:83 COMMA
C21:21  COMMA                 52:52 WIND SPEED QC   84:91 PRECIP
C22:24  JULIAN DAY            53:53 COMMA
C25:25  COMMA                 54:60 WINDSPEED
C26:26  SOLRAD QC CODE        61:61 COMMA
C27:27  COMMA                 62:62 WINDDIR QC CODE
C28:32  SOLRAD                63:63 COMMA
C33:33 COMMA                  64:70 WINDDIR
C34:34 NETRAD QC CODE         71:71 COMMA
C35:35  COMMA                 72:72 STDEV WINDDIR QC
C36:40  NETRAD
C
C SIZE OF THE DATA FIELDS
C SOLRAD  5      WINDSPEED 7      PRECIP 8  (2 DECIMAL PLACES)
C NETRAD  5      WINDDIR   7
C AIRTEMP 7      STDEV     7
C
      IMPLICIT NONE
      INTEGER FDEFS(2,7)
      DATA FDEFS/28,32,36,40,44,50,56,60,64,70,74,80,84,91/ !START AND END POINTS OF NUMERICAL FIELDS
      INTEGER K,I
      IF(K.LT.28)THEN
```

```
        WRITE(6,100)
100       FORMAT(1X,'ERROR GETFLD, "--" APPEARS BEFORE FIRST FIELD')
        STOP
       ELSEIF (K.GT.91)THEN
        WRITE(6,200)
200       FORMAT(1X,'ERROR GETFLD, "--" APPEARS AFTER LAST FIELD')
        STOP
       ENDIF
       DO I=1,7
        IF(K.GE.FDEFS(1,I).AND.K.LE.FDEFS(2,I))THEN
         GETFLD=I
        ENDIF
       END DO
       RETURN
       END
       SUBROUTINE SUBPAD(LINE,L1,P,NB,POSTLINE,L2)
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C 090605 I TESTED THIS SUBROUTINE IN PROGRAM TSUBPAD.FOR
C THIS SUBROUTINE INSERTBS NB BLANKS INTO 'LINE' AT STARTING AT POSIITON P+1
C L1 IS THE INPUT LENGTH OF LINE (LEN_TRIM SENSE)
C
CTHIS SUBROUTINE IS DEPENDING HEAVILY ON THE ACCURACY OF L1, THE LENGTH OF LINE
CTHIS SUBROUTINE INSERTS NB BLANKS INTO
CLINE STARTING AT POSITION P+1 AND RETURNS
       !REMANUFACTURED LINE IN POSTLINE
       !LINE IS INPUT LINE
       !L1 IS LENGTH OF INPUT LINE
       !P IS POSITION TO INSERT (INSERTION STARTS AT P+1)
       !NB IS NUMBER OF BLANKS TO INSERT
       !POSTLINE IS RETURNED LINE
       !L2 IS LENGTH OF RETURNED LINE
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
       IMPLICIT NONE
       CHARACTER*120 LINE
       CHARACTER*200 POSTLINE
       CHARACTER*200 DUMLINE !TEMPORARY STORAGE OF LINE
       INTEGER L1,P,NB,L2
       INTEGER I,J,K

       !INITIALIZE POSTLINE AND DUMLINE TO BLANKS
       DO I=1,200
        POSTLINE(I:I)=' '
       END DO
       DUMLINE(1:200)=POSTLINE(1:200)
       K=LEN_TRIM(LINE)
       IF(K.NE.L1)THEN
        WRITE(6,100)K,L1
100      FORMAT(1X,'ERROR IN SUBPAD: LINE LENGTH DISAGREEMENT',
    1            /1X,2I8)
        STOP
       ENDIF
       IF(NB+L1.GT.200)THEN
        WRITE(6,55)NB+L1
55      FORMAT(1X,'RESULTING LINE LENGTH TOOBIG: TSUBPAD',I5)
        STOP
       ENDIF
       POSTLINE(1:P)=LINE(1:P) !BEGIN BUILDING POSTLINE
       DUMLINE(1:L1-P)=LINE(P+1:L1)  !STORE PORTION OF LINE AFTER P, DUMLINE HAS L1-P CHARACTERS
       DO I=1,NB
        POSTLINE(P+I:P+I)=' '  !INSERT NB BLANKS INTO LINE
       END DO
```

```
POSTLINE(P+NB+1:L1+NB)=DUMLINE(1:L1-P)  !ADD BACK THE REST OF THE LINE
L2=L1+NB !RETURN THE SIZE OF POSTLINE
RETURN
END SUBROUTINE
```

Appendix 2. Listing of AIRCONCIM3.FOR

```
C    Last change:  BJ   25 Jun 2009   11:42 am
      PROGRAM AIRMONCIM3
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
c 090612 VERSION 3 WILL DETERMINE BIN FREQUENCIES FOR THE SPEED AS WAS DONE IN THE
C EARLIER ANALYSIS FOR THE EJ PROJECT TO SELECT PARLIER. LOOKS LIKE THE PREVIOUS WORK
C TOOK BINS OF 0-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7 AND 7 AND GREATER METERS/SECOND
C
C 090609 - HAD TO SOLVE PROBLEM WHERE SUM OF SECTORS IN ANGLES BINS LESS THAN TOTAL GOOD DIRECTION
C RECORDS.  IT TURNED OUT THAT MY LINKER SWITCHES DID not (THAT'S RIGHT, "NOT") INCLUDE ARRAY CHECKING
C SOMEHOW MY LINKER SWITCHES WERE ALL GONE. AND, WHEN THE DIRECTION WAS 337.5, GUESS WHAT, THE INDEX
C FOR THE COUNTING ARRAY BECAME 9 AND EVEN THOUGH THE ARRAY WAS SIZE 8, BECAUSE ARRAY BOUND
CHECKING
C WAS TURNED OFF, THERE WAS NO ERROR.  SO, I ADDED THE LINKER SWITCHES THAT I KNOW AND LOVE AND ALSO
C ADDED A LINE TO THE WIND DIRECTION PROCESSING TO CHECK FOR K=9 AND IF SO, MAKE IT 8 SO IT GETS
C ASSIGNED TO NW, WHICH WILL BE CONSISTENT WITH THESCHEME OF THE UPPER BOUND ANGLE BEINC INCLUDED
INTHE
C BINA ND THE LOWER BOUND ANGLE NOT.
C
C 090609 - LATER STILL VERSION 2.  I HAVE PROCESSED THE CIMIS FILES WITH PADDER2.FOR, IN ORDER TO FIX
C THE FORMAT BY PADDING OUT WHEN THERE ARE MISSING VALUES.  SO, I HAVE ABANDONED THE IDEA OF USING 'PRN'
FILES
C FOR REASONS DISCUSSED BELOW. AND WILL USE THE CSV FORMAT, THOUGH IT IS NOW ALSO A FIXED FORMAT AS
OUTLINED BELOW
C THE PROGRAM IS MODIFIED TO ACCOMMODATE THE FILE FORMATTING
C
C I TESTED THIS PROGRAMN AGAINST 2 SMALL FILES IN SUBDIRECTORY TESTAIR, BOTH FILES WERE ANALYZED
CORRECTLY
C I MANUALLY ANALYZED AND COMPARED AND LOOKS OK, SO READY TO ROLL
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C 090604-LATER-VERSION 2 WILL GET A LIST OF FILES AS INPUT, EACH FILE WILL BE OPENED
C PROCESSED AND THE RESULTS WILL BE ADDED TO A FIXED FILE DATABASE TYPE FILE, WHICH
C I CAN THEN POP INTO EXCEL FOR SUMMARIZATION
C
C THE DATABASE WILL CONTAIN
C STATION NUMBER, FILE NAME, TOTAL RECORDS (INCLUDING BAD ONES), # VALID WIND SPEED
C RECORDS, # VALID WIND SPEED RECORDS CALMS, #VALID WIND SPEED RECORDS NOT CALMS,
C # VALID WIND DIRECTION RECORDS, THEN 8 COUNTS OF WIND DIRECTIONS FROM NORTH (-22.5,22.5)
C NORTHEAST (22.5,67.5), EAST (67.5, 112.5), ETC.,
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C 090604 I TESTED AIRMONCIM1 ON TEST.TXT AND IT SEEMS TO BE
C READING THE WIND SPEEDS/DIRECTIONS CORRECTLY
C NEXT STEP, IN VERSION 2, WILL BE TO
C DETERMINE FRACTION OF CALMS, AND ASSIGN WIND DIRECTION
C TO ONE OF 8 SECTORS
C
C TO PROCESS THE MANY CIMIS FILES TO GET WIND SPEED
C AND PERSISTENCE INFORMATION FOR USE WITH THE
C AIR MONITORING NETWORK
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C THIS VERSION IS SIMPLY TO ASSURE THAT THE VALUES ARE BEING
C READ CORRECTLY, TO TEST READING
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC CURRENT CIMIS FILE FORMAT AND INCLUDES FIXING MISSING
VALUE RECORDS WITH PADDER2.FOR
C       1       2       3       4       5       6       7       8       9
```

```
C12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
c0002,01/01/1999,0100,001,*,   -1,*,  -59,*,   43.2,*,    6.8,*,   27.5,*,   14.3,*,    0.00
c0002,01/01/1999,0200,001,*,   -5,*,  -59,*,   42.0,*,    4.9,*,   22.8,*,   42.3,*,    0.00
c0002,01/01/1999,0300,001,*,    0,*,  -59,*,   41.8,*,    4.3,*,  232.8,*,   39.9,*,    0.00
c0002,01/01/1999,0400,001,*,   -1,*,  -59,*,   43.7,*,    5.8,*,  238.2,*,   33.7,*,    0.00
C
C WIND SPEED QA: 52       C  THESE DESIGNATIONS RELATED TO THE FOUR LINES LISTED JUST ABOVE THIS COMMENT
C WIND SPEED   : 54:60    C  AND HENCE ARE THE DESIGNATIONS THAT ARE NOW IMPLEMENTED IN THIS PROGRAM
C WIND DIR QA  : 62       C
C WIND DIR     : 64:70    C
C
C NOTE ON THE FOLLOWING FORMAT (LISTED BELOW 'PRN' FORMAT), WHICH I AM NO LONGER USING.
C    THE ORIGINAL IDEA OF USING THE PRN FORMAT WAS THAT IT SEEMED TO PROVIDE A FIXED FORMAT
C    FROM EXCEL THAT I COULD THEN TURN AROUND AND USE AS INPUT INTO THESE FORTRAN PROGRAMS
C    HOWEVER, 3 PROBLEMS CROPPED UP.
C
C    PROBLEM #1: THE FORMAT IS EVIDENTLY FIXED BY ANALYSIS OF THE FIRST 'N' RECORDS
C              WHERE 'N' IS UNKNOWN. CONSEQUENTLY, WHEN THE DATES, FOR EXAMPLE, REACHED OCTOBER
C              10, THEN THE YEAR GOT TRUNCATED BECAUSE GOOD OLD EXCEL ONLY LEFT ENOUGH SPACE
C              FOR 1+2+4, NOT 2+2+4.
C    PROBLEM #2: THE FORMAT WAS NOT FIXED BETWEEN FILES, WHEN EXCEL SAVES A FILE AS PRN
C              THE FIXING OF THE FORMAT IS DEPENDENT ON THAT FILE AND THUS IT CAN ARRIVE AT DIFFERENT
C              DECISIONS ABOUT HOW TO FORMAT DIFFERENT FILES
C    PROBLEM #3: CIMIS DATA CONTAINS '--' FOR MISSING VALUES AND THE REMAINDER OF THE RECORD IS
C              SHIFTED OVER TO THE LEFT BY THE NUMBER OF SPACES THAT OTHERWISE WOULD HAVE BEEN
C              IN THAT FIELD.  ALSO, THERE CAN BE MULTIPLE MISSING VALUES IN A RECORD.  TO DEAL
C              WITH THIS ISSUE, I WROTE THE PROGRAM CALLED PADDER2.FOR.  I RAN ALL OF THE NNNCIMY1Y1Y2Y2.CSV
C              FILES THROUGH PADDER2 AND CREATED THE CORRESPONDING SERIES OF NNNCIFY1Y1Y2Y2.CSV (NOTE CIM-
>CIF).
C              THE ABOVE FORMAT IS OUTPUT FROM THE PADDER2.FOR.  BASICALLY THIS FORMAT IS THE FORMAT
C              OF CONTEMPORARY CIMIS OUTPUT, EXCEPT THAT RECORDS CONTAINING MISSING VALUES HAVE HAD THE
C              FIELD WITH MISSING VALUES PADDED OUT WITH SPACES IN ORDER TO RESTORE THE FIXED FORMATTING.
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC OLD PRN FORMAT THAT I NO LONGER USE, SAVED FOR HISTORICAL PURPOSES...
CCCCCCCCCC
CCCC EXTRACT FROM STATION 2 CONTAINS SOME NUMBERS WITHOUT DECIMALS                    CC
C THIS FILE WAS CREATED BY USING EXCEL AND SAVING FILE AS "PRN" FILE                  CC
C NOTE THAT THE LEADING 0S IN STATION id ARE OMITTED FROM PRN FILE, BUT               CC
C FORMATTING APPEARS TO BE FIXED FORMAT, WHICH IS GOOD!                               CC
C2 8/7/2000 800220*  850* 470*   72.1* 6.8*327.1*14.3*   0                            CC
C2 8/7/2000 900220* 1230* 723*   75.7* 6.8*322.3*21.9*   0                            CC
C2 8/7/20001000220* 1551* 942*   79.9* 5.3* 15.2*30.7*   0                            CC
C2 8/7/20001100220* 1749*1090*   83.4* 3.8* 71.6*40.9*   0                            CC
C12345678901234567890123456789012345678901234567890123456789012345678                 CC
C                                                                 CC
C WIND SPEED IS 38-41 (MAY OR MAY NOT HAVE DECIMAL)       C                            CC
C WIND SPEED QC IS 37                              C AS DISCUSSED ABOVE THIS COLUMN DESIGNATION IS CC
C WIND DIRECTION IS 43-47, MAY OR MAY NOT HAVE DECIMAL     C UNRELIABLE FOR PRN FILES, SEE ABOVE FOR NEW
ANDC
C WIND DIRECTION QC IS 42                          C CORRECT DESIGNATION              CC
C                                                                 CC
C SO FIELDS APPEAR TO BE FORMATTED HOWEVER,                                           CC
C FOR FUTURE WORK NOTE THE FOLLLOWING:                                                CC
C WHEN THE DATE IS nn/nn/nnnn, THEN THE LAST DIGIT OF YEAR IS DROPPED!!               CC
C ALSO LEADING ZEROS IN STATION NUMBER ARE DROPPED                                    CC
C BUT IT DOES APPEAR THAT THE FIELDS FOLLOWING THE DATE STAY STABLE                   CC
C (BASED ON VISUALLY SCANNING ABOUT 5 YEARS OF ONE SITE)                              CC
C SO FOR THIS EXERCISE I WILL ONLY USE DATA WHICH HAS '*' AS                          CC
C QUALITY CODE                                                          CC
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCC

      IMPLICIT NONE
      INTEGER LK,L,I,K,COUNTS,COUNTD,COUNTL  !COUNT SPEED, COUNT WIND DIRECTION, LINES
      INTEGER COUNTF  !NUMBER OF FILES PROCESSED

C      INTEGER CALMS,NONCALMS

      INTEGER DIRS(8) !ARRAY OF COUNTS 1=NN, 2=NE, 3=WW PROCEED CLOCKWISE
      INTEGER SPEEDS(8) !ARRAY OF COUNTS FOR SPEED BINS 0-1,1-2,2-3, ETC UP TO 7 OR GREATER
      CHARACTER*80 FLD
      CHARACTER*1 QC
      CHARACTER*91 LINE
      CHARACTER*40 FIN  !NAME OF INPUT FILE TO PROCESS
      REAL WS,WDIR  !WIND SPEED, WIND DIRECTION, OBVIOUSLY
      REAL DIRTMP

      COUNTF=0
      OPEN(UNIT=2,STATUS='OLD',FILE='CIFFILES.IN') !CONTAINS LIST OF FILES TO PROCESS
      OPEN(UNIT=3,STATUS='UNKNOWN',FILE='WINDSD_DB3.OUT') !CONTAINS OUTPUT DATABASE WIND SPEED, DIR,
DATABASE


CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC NEXT FILE TO OPEN LOOP
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

5000    CONTINUE
       READ(2,5100,END=10000)FIN
5100     FORMAT(A18)
       OPEN(UNIT=1,STATUS='OLD',FILE=FIN)  !NOTE: FILENAMES ARE NNNCIFY1Y1Y2Y2.PRN WITH LEADING ZEROS ON
STATION NUMBER
                                  !THE INPUT FILES HAVE BEEN PROCESSED WITH PADDER2.FOR TO PAD OUT FIELDS WITH
                                  !MISSING VALUES '--', SO THAT THE FILES ARE NOW FIXED FORMAT
        COUNTF=COUNTF+1
        COUNTS=0
        COUNTD=0
        COUNTL=0
C         CALMS=0
C         NONCALMS=0
        DO I=1,8
         DIRS(I)=0  !RESET DIRECTION COUNTER
         SPEEDS(I)=0
        END DO

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  READING RECORDS LOOP WITHIN EACH FILE
CCCCCCCCCCCCCCCCCC

1        READ(1,100,END=1000)LINE
100       FORMAT(A91)
        COUNTL=COUNTL+1

C        WIND SPEED PROCESSING

        QC(1:1)=LINE(52:52)
        CALL BLUSH(FLD,10)
        WS=-1.
        IF(QC.EQ.'*')THEN !ONLY PROCESS IF THE QC CODE IS A '*'
          COUNTS=COUNTS+1
```

```
          CALL BLUSH(FLD,10)
          FLD(1:7)=LINE(54:60)  !THIS IS WIND SPEED IN MILES PER HOUR
          READ(FLD(1:7),110,ERR=55000)WS  !SHOULD NEVER GET ERROR ON READ, IF DO, THEN WANT TO KNOW ABOUT IT
110         FORMAT(F7.0)

          WS=WS/2.24  !CONVERT MPH TO METERS PER SECOND
          LK=1+INT(WS)
          LK=MIN(LK,8)
          SPEEDS(LK)=SPEEDS(LK)+1

        ENDIF

C        WIND DIRECTION PROCESSING

        QC(1:1)=LINE(62:62)
        CALL BLUSH(FLD,10)
        WDIR=-1.
        IF(QC(1:1).EQ.'*')THEN
          COUNTD=COUNTD+1
          CALL BLUSH(FLD,10)
          FLD(1:7)=LINE(64:70)
          READ(FLD(1:7),120,ERR=55000)WDIR   !SHOULD NEVER GET ERROR ON READ, IF DO, THEN WANT TO KNOW ABOUT
IT
120         FORMAT(F7.0)
          IF((WDIR.GT.337.5 .AND. WDIR.LE.360.).OR.
    1          (WDIR.GE.0.0 .AND. WDIR.LE.22.5))THEN
            DIRS(1)=DIRS(1)+1
          ELSE
             DIRTMP=WDIR+22.5
             K=1+INT(DIRTMP/45.)
             IF(K.EQ.9)THEN  !THIS NECESSARY FOR CASE WHEN WDIR=375.5, K GETS SET TO 9
              K=8
             ENDIF
             DIRS(K)=DIRS(K)+1
          ENDIF
       ENDIF
C        WRITE(6,200)LINE(1:59),WS,WDIR
C200      FORMAT(A59,1X,F8.1,1X,F8.1)      NNNCIMY1Y1Y2Y2.PRN
       GOTO1

C       END OF RECORD READ LOOP

1000     CONTINUE
C STATION NUMBER, FILE NAME, TOTAL RECORDS (INCLUDING BAD ONES), # VALID WIND SPEED
C RECORDS, 8 BINS FROM 0-1,1-2, 7+, # VALID WIND DIRECTION RECORDS,
C THEN 8 COUNTS OF WIND DIRECTIONS FROM NORTH (-22.5,22.5)
C NORTHEAST (22.5,67.5), EAST (67.5, 112.5), ETC.,
       WRITE(6,1100)FIN(1:18),FIN(1:3),COUNTL,COUNTS,(SPEEDS(L),L=1,8)
    1              ,COUNTD,(DIRS(I),I=1,8)
       WRITE(3,1100)FIN(1:18),FIN(1:3),COUNTL,COUNTS,(SPEEDS(L),L=1,8)
    1              ,COUNTD,(DIRS(I),I=1,8)
1100     FORMAT(1X,A18,1X,A3,1X,19I6)
       CLOSE(1)
       GOTO5000

C       END OF FILE READ LOOP

10000    CONTINUE
       WRITE(6,10010)COUNTF
10010    FORMAT(1X,'A TOTAL OF ',I3,' FILES PROCESSED')
       STOP
```

```
55000    CONTINUE  !THIS LINE REACHED IF THERE WAS A READ ERROR, THIS SHOULDN'T HAPPEN, SO NEED TO FIGURE IT
OUT
         WRITE(6,55100)LINE
         WRITE(3,55100)LINE
55100    FORMAT(A91)
         WRITE(6,55200)
55200    FORMAT(1X,'READ ERROR, NEEDS ATTENTION ')
         STOP
         END
         SUBROUTINE BLUSH(CCC,N)
         IMPLICIT NONE
         INTEGER I,N
         CHARACTER CCC*80
         DO I=1,N
            CCC(I:I)=' '
         END DO
         RETURN
         END SUBROUTINE
```