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COMPUTER PROGRAMS FOR THE ESTIMATION OF SELECTED CLIMATIC VARIABLES AND OF VALUES OF PRINCIPAL COMPONENTS EXPRESSING VARIATION IN CLIMATE, FOR ANY SITE IN GREAT BRITAIN.

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PDP8 - OS8 PROGRAM SPECIFICATION

PREC and PREV Prediction of values of principal components and of the main variables of climate for any site in Great Britain.

1. Summary

Multiple regression equations are used in 2 suites of 3 linked programs to estimate 3-monthly mean values of a selection of 6 principal components and/or a selection of 6 main variables of climate for any site in Great Britain from 14 site variables. Predictions are output to a new disk file, and are listed with values of grid easting and northing.

2. Introduction

A principal component analysis of climatological data has been described for Great Britain based on 3-monthly mean values of 21 variables for 68 stations for the years 1960-69 inclusive (White, in prep.). The first 5 components each accounted for a significant proportion of the variation, and the cumulative percentage variation represented was 90.8%. The variables with the greatest weighting in each of the first 6 components were dry bulb screen temperature at 0900 hrs (°C), rainfall (mm), visibility at 0900 hrs (coded 0-9), wind direction at 0900 hrs (degrees), total snow depth at 0900 hrs (cm) and windspeed at 0900 hrs (m/s).

In the paper referred to predictive equations are given for the estimation of 3-monthly mean values of the first 5 components and of the 5 variables with the greatest weighting in each, from 14 site variables. Since analysis of variance showed annual differences to be unimportant as a source of variation compared with quarters of the year and stations, the results of the study will apply satisfactorily over a longer period of time.

These 2 suites of programs written in Fortran 2 use the predictive equations to estimate all or a selection of the values of the components (in PREC) and variables (in PREV) for any site in Great Britain, except that zero values are returned for the fifth component and for snow depth for the third quarter, there being no snow in summer. All four 3-monthly mean values are output for any component/variable selected.

The sixth component and windspeed are included, which were not associated with a significant part of the variability within the climatic variables. They may however account for a significant part of variation in response by organisms.

The program should be readily translatable into any other programming language to suit any other computer. The breakdown of the program into 2 suites of 3 segments was necessitated by the limitation in the memory of the PDP-8 computer in OS8 mode of 64 symbols, constants in the equations being stored as symbols.

3. Files required

3.1 Program tapes. For estimating values of components:- PREC, PREC2, PREC3.

3.2 Data file

The 14 site variables should be stored in a regular matrix without set no's or other markers, in continuous string A6 format, on dectape or disc, in a file with any name. The same data file serves both program suites. See separate list describing the variables.

4. Operating Instructions

These are virtually identical for the 2 suites, so are described for PREC. Where differences occur in PREV, these are indicated.

4.1 Loading:

The main program should be loaded from the HSR as follows:

.R PIP ↵
* PREC < PTR: ↵ (or PREV)
Press any key to read
Repeat for subroutines .
CTRL-C ↵

4.2 Compiling Programs:

```
.R FORT ↵
* PREC <PREC ↵     (or PREV)
CTRL-C ↵
.
```

Repeat for subroutines, keeping the same name for compiled versions as for the originals.

4.3 Compiling data file:-

The data may be stored in continuous string A6 format in a disc file DATA.DA by various means depending on the source of the data. Supposing that data has been produced in E16.6 format in TSS8 (time sharing) mode, it may be read via the HSR using the program READ1. This program should be loaded and compiled as above, and run as follows:

```
. R LOADER ↵
READ1/I/O/G ↵
ENTER NO. OF SETS AND VARIABLES IN I4 FORMAT
  10  14 ↵
ENTER OUTPUT DEVICE AND FILENAME IN A6 FORMAT
SYS @@@ DATA @@ ↵
.
```

Alternatively the data can be read as free-format paper tape in OS8 mode using programs VAFF and FREEV.

4.4 Running:

See sample printouts attached.

5. Output

Predictions are listed after site no., grid E and grid N. Values are output to a new disk file DOUT.DA in continuous string A6 format, without the additional site information.

6. Method

The multiple regression equations have been derived by the step-up method. For further information see White (in prep.). More accurate equations can be supplied on request. These use only the first 3 significant digits in each stored value. For the variables, the mean of the residuals is between 0.0022 and 21.7% of the observed mean. For the components, whose mean is automatically standardised to zero for 4 quarters the means of the residuals vary from 0.025 to the rather meaningless value of 977% of the observed means.

7. Limitations

Predictions can be made for up to 2047 sites.

8. Reference

White, E. J. (in prep.). The reduction of climatological data for Great Britain for ecological purposes.

E. J. White
22nd June, 1977

Appendices

SITE VARIABLES REQUIRED IN INPUT FILE

1	GRIE	Grid Easting (1 km) from 1/63360 or 1/50000 scale Ordnance Survey maps to 3 figures.
2	GRIN	Grid Northing (1 km) to 3 figures.
3	DFS	Distance from sea (km) (to the nearest point on the coast), if to an estuary to the point where it is at least 10 km wide, from 1/625000 scale Ordnance Survey maps.
4	ELEV	Elevation (m) from 1/63360 or 1/50000 Ordnance Survey maps.
5	ASP	Aspect (degrees from true north) within 1 km square around site: if this area was flat a wider area was examined including direction of river flow, to avoid a zero value if possible. (See foot note).
6	SLOW	Slope to west (degrees) positive, negative if to east. For example, 25 ft. rise in 600 feet horizontally = slope of 1 in 24. Tangent = 0.0417, Angle = 2.4 degrees.
7	SLOS	Slope to south (degrees) positive, negative if to north. It is possible for SLOW and SLOS to have values greater than zero, when ASP = Ø.Ø.
8	VERT	Vertically convex/concave (over or under 180 degrees),
9	HOR	Horizontally convex/concave (over or under 180 degrees).
10	ELE4	The sum of the difference in elevation (m) from the station to the highest point, or to the lowest point if this value is greater, up to 10 km away, in the NW, NE, SW and SE quadrants.
11	DFSW	Distance from sea due west (km), from 1/625000 scale Ordnance Survey map.
12	DFSE	Distance from sea due east (km).
13	HEW	Highest elevation to the west (m) plus or minus 2 degrees, from 1/625000 scale Ordnance Survey Physical map.
14	HEE	Highest elevation to the east (m) plus or minus 2 degrees.

N.B. In the case of SLOW, SLOS, VERT and HOR hills providing a verticle angle of 6 degrees (tan $>$ 0.105) at the site were used. If no hills were large enough and near enough to do this, the local slope was used, within the 1 km square around the site.

```
C         TO PREDICT VALUES OF 1ST 6 PRINCIPAL COMPONENTS OF
C         CLIMATIC VARIABLES FOR ANY LOCATION IN
C         GREAT BRITIAN. E.J.WHITE. 12.7.77.PDP8-OS8 FORTRAN2
C         FOR EACH QUARTER OF THE YEAR.
C         OUTPUT PC(X1) EXPRESSES TEMP,PC(X2) DRYNESS,PC(X3) VISIBILITY
C         PC(X4) WINDINESS,PC(X5) SNOW DEPTH,PC(X6) WINDINESS.
C         WHEN X=NO. OF QUARTER
C         INPUT & OUTPUT DATA IN CONTINUOUS STRING A6 FORMAT
C         OUTPUTS LISTING & DATA IN FILE. PREC
          COMMON MPC,PC
          DIMENSION MPC(6),PC(46),MC(6)
          WRITE(1,106)
 106      FORMAT('ENTER DEVICE & INPUT FILENAME IN A6 FORMAT')
          READ(1,107)AI,BI
 107      FORMAT(2A6)
          WRITE(1,108)
 108      FORMAT('ENTER DEVICE & OUPUT FILENAME IN A6 FORMAT')
          READ(1,107)AO,BO
          WRITE(1,105)
 105      FORMAT('ENTER NO. OF SITES IN I4 FORMAT')
          READ(1,103)NS
 103      FORMAT(I4)
          WRITE(1,100)
 100      FORMAT('ENTER NO. OF COMPONENTS TO BE PREDICTED IN I1')
          READ(1,99)NPC
          WRITE(1,102)
 102      FORMAT('ENTER SELECTION OF COMPONENTS REQUIRED IN I1 FORMAT')
          DO 10 J=1,NPC
          READ(1,99)MC(J)
 99       FORMAT(I1)
 10       CONTINUE
          MM=1
          DO 60 J=1,6
          IF(MC(MM)-J)14,13,14
 13       MPC(J)=MC(MM)
          MM=MM+1
          GO TO 60
 14       MPC(J)=0
          GO TO 60
 60       CONTINUE
C
          CALL IOPEN(AI,BI)
          CALL OOPEN(AO,BO)
          DO 30 K=1,NS
          READ(4,109)GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,HOR,ELE4,DFSW,
          1DFSE,HEW,HEE,
 109      FORMAT(14A6)
          WRITE(1,231)K,GRIE,GRIN
 231      FORMAT('SITE NO., GRID E & GRID N =',I4,1X,2(F6.0,1X))
          SWNE=0.0890*GRIE+0.0442*GRIN-56.2
          SENW=-0.0447*GRIE+0.0889*GRIN-23.8
C
          DO 40 L=1,6
          CALL PREC2(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
          1HOR,ELE4,DFSW,DFSE,HEW,HEE,L)
 4        CALL PREC3(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
          1HOR,ELE4,DFSW,DFSE,HEW,HEE,L)
 40       CONTINUE
          WRITE(1,110)
 110      FORMAT()
 30       CONTINUE
          CALL OCLOSE
          WRITE(1,124)
 124      FORMAT('END OF JOB')
          STOP
          END
```

```
      SUBROUTINE PREC2(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
     1HOR,ELE4,DFSW,DFSE,HEW,HEE,L)
      COMMON MPC,PC
      DIMENSION MPC(6),PC(46)
C     CALCULATE COMPONENT 1
      IF(MPC(L)-1)28,1,2
1     PC(11)=-0.00746*ELEV+0.0206*SLOS-1.35*ALOG(SWNE+50.0)-0.122*
     1ALOG(HEE+1.0)+1.81
      PC(21)=-0.00216*GRIN-0.00548*ELEV+0.0154*SLOW
     1-0.000269*HEE-0.13*ALOG(SENW+50.0)+4.15
      PC(31)=-0.00509*ELEV+0.0186*SLOW-0.0238*SENW
     1+0.00196*DFSE-0.000632*HEE-0.0346*ALOG(DFS+1.0)
     2-0.395*ALOG(SENW+50.0)-0.156*ALOG(DFSE+1.0)
     3+0.0593*ALOG(HEE+1.0)+6.68
      PC(41)=-0.000902*GRIN-0.00466*ELEV-0.440*ALOG(GRIN)-0.239*ALOG
     1(DFS+1.0)+1.47
      WRITE(1,110)
110   FORMAT('COMPONENT 1')
      WRITE(1,111)PC(11),PC(21),PC(31),PC(41)
      WRITE(4,112)PC(11),PC(21),PC(31),PC(41),
111   FORMAT(4(F9.3,1X))
112   FORMAT(4A6)
C     CALCULATE COMPONENT 2
2     IF(MPC(L)-2)28,22,3
22    PC(12)=0.0306*SWNE-0.000950*HEE+1.06
      PC(22)=-0.00251*HOR+0.0204*SWNE-0.00121*HEE-0.0995*ALOG
     1(HEW+1.0)+2.795
      PC(32)=0.0016*GRIE-0.00155*HEE-0.996
      PC(42)=0.0314*SWNE-0.0013*HEE-0.554
      WRITE(1,113)
113   FORMAT('COMPONENT 2')
      WRITE(1,111)PC(12),PC(22),PC(32),PC(42)
      WRITE(4,112)PC(12),PC(22),PC(32),PC(42),
C     CALCULATE COMPONENT 3
3     IF(MPC(L)-3)28,4,28
4     PC(13)=0.00441*ELEV+0.0452*SLOW+0.0418*SENW+0.00326*DFSE-
     10.000828*HEW-0.570*ALOG(GRIN)-0.624*ALOG(DFSE+1.0)+0.337*
     2ALOG(HEE+1.0)+3.96
      PC(23)=0.0465*SLOW+0.0206*SENW-0.000727*HEW+0.264*ALOG
     1(ELEV)-0.270*ALOG(DFSE+1.0)+0.205*ALOG(HEE+1.0)-0.183
      PC(33)=0.0441*SLOW+0.0281*SENW-0.000988*HEW+0.275*ALOG(ELEV)
     1-0.278
      PC(43)=0.0049*ELEV+0.00147*ASP+0.0413*SLOW+0.0927*SWNE+
     10.00471*DFSE-0.000743*HEW-4.87*ALOG(GRIE)-1.09*ALOG
     2(SENW+50.0)-0.582*ALOG(DFSE+1.0)+0.189*ALOG(HEE+1.0)+33.3
      WRITE(1,114)
114   FORMAT('COMPONENT 3')
      WRITE(1,111)PC(13),PC(23),PC(33),PC(43)
      WRITE(4,112)PC(13),PC(23),PC(33),PC(43),
28    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE PREC3(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
     1HOR,ELE4,DFSW,DFSE,HEW,HEE,L)
      COMMON MPC,PC
      DIMENSION MPC(6),PC(46)
C     CALCULATE COMPONENT 4
5     IF(MPC(L)-4)28,6,7
6     PC(14)=-0.00360*ELEV+0.0234*VERT+0.000766*ELE4+0.240*ALOG
     1(DFSE+1.0)-5.24
      PC(24)=0.000457*ELE4+0.171*ALOG(DFS+1.0)-0.117
      PC(34)=0.000459*ELE4-0.00395*DFSE+0.327*ALOG(DFSE+1.0)-1.42
      PC(44)=0.000336*ELE4+0.201*ALOG(HEE+1.0)-1.56
      WRITE(1,115)
115   FORMAT('COMPONENT 4')
      WRITE(1,111)PC(14),PC(24),PC(34),PC(44)
      WRITE(4,112)PC(14),PC(24),PC(34),PC(44),
111   FORMAT(4(F9.3,1X))
112   FORMAT(4A6)
C     CALCULATE COMPONENT 5
7     IF(MPC(L)-5)28,8,9
8     PC(15)=0.0102*ELEV-0.0296*VERT+0.00439*HOR-0.000395*ELE4
     1+1.32*ALOG(GRIE)+0.131*ALOG(HEE+1.0)-4.18
      PC(25)=0.105*ALOG(DFS+1.0)-0.148
      PC(35)=0.0
      PC(45)=0.00867*DFS+0.00232*ELEV-0.00865*SENW-1.08
      WRITE(1,116)
116   FORMAT('COMPONENT 5')
      WRITE(1,111)PC(15),PC(25),PC(35),PC(45)
      WRITE(4,112)PC(15),PC(25),PC(35),PC(45),
C     CALCULATE COMPONENT 6
9     IF(MPC(L)-6)28,10,28
10    PC(16)=0.0104*GRIE+0.0262*VERT+0.000315*DFSW+0.000964*
     1HEE-2.89*ALOG(GRIE)-0.402*ALOG(DFSW+1.0)+9.83
      PC(26)=-0.00233*ASP+0.0180*VERT+0.00114*HEE-0.160*ALOG
     1(DFSE+1.0)-0.133*ALOG(HEW+1.0)-1.61
      PC(36)=-0.00222*ASP+0.0197*VERT-0.00117*DFSE
     1+0.00168*HEE-0.123*ALOG(HEW+1.0)-0.127*ALOG
     2(HEE+1.0)-2.48
      PC(46)=-0.00152*ASP-0.0363*SLOW-0.0326*SENW-0.000253*
     1ELE4-0.00301*DFSE-0.000301*HEW+0.00184*HEE+0.655*
     2ALOG(GRIN)-0.294*ALOG(DFSW+1.0)-2.34
      WRITE(1,117)
117   FORMAT('COMPONENT 6')
      WRITE(1,111)PC(16),PC(26),PC(36),PC(46)
      WRITE(4,112)PC(16),PC(26),PC(36),PC(46),
28    CONTINUE
      RETURN
      END
```

```
 R LOADER↓
*PREC,PREC2,PREC3/I/O/G↓

ENTER DEVICE & INPUT FILENAME IN A6 FORMAT
SYS@@@DAT14@↓
ENTER DEVICE & OUPUT FILENAME IN A6 FORMAT
SYS@@@DOUT@@↓
ENTER NO. OF SITES IN I4 FORMAT
...3↓
ENTER NO. OF COMPONENTS TO BE PREDICTED IN I1
2↓
ENTER SELECTION OF COMPONENTS REQUIRED IN I1 FORMAT
1↓
2↓
SITE NO., GRID E & GRID N =    1    265.    372.
COMPONENT 1
   -3.809      2.603      4.778     -1.554
COMPONENT 2
    0.578      1.281     -1.358     -1.213

SITE NO., GRID E & GRID N =    2    480.    143.
COMPONENT 1
   -5.023      2.623      4.082     -2.294
COMPONENT 2
    0.781      1.365     -0.684     -0.936

SITE NO., GRID E & GRID N =    3    238.    623.
COMPONENT 1
   -4.634      1.850      4.316     -2.561
COMPONENT 2
    0.355      0.961     -1.765     -1.519

END OF JOB
```

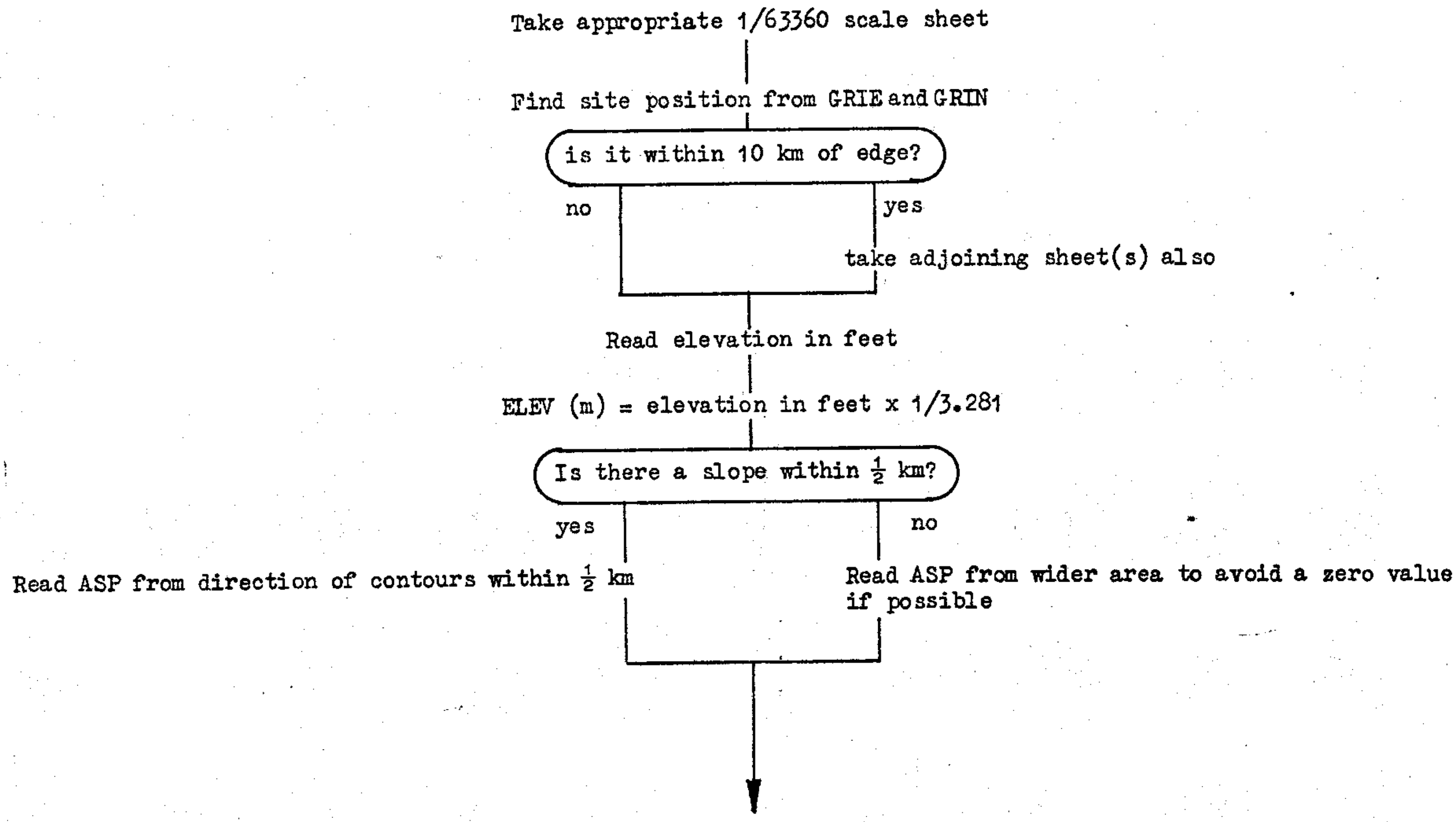
```
C       TO PREDICT VALUES OF
C       6 MAIN CLIMATIC VARIABLES FOR ANY LOCATION IN
C       GREAT BRITIAN. E.J.WHITE. 12.7.77.PDP8-OS8 FORTRAN2
C       FOR EACH QUARTER OF THE YEAR.
C       CV(X1)=DRY BULB TEMP,CV(X2)=RAINFALL,CV(X3)=VISIBILITY
C       CV(X4)=WIND DIRECTION,CV(X5)=SNOW DEPTH,CV(X6)=WINDSPEED.
C       WHEN X=NO. OF QUARTER
C       INPUT & OUTPUT DATA IN CONTINUOUS STRING A6 FORMAT
C       OUTPUTS LISTING & DATA IN FILE. PREV
        COMMON MCV,CV
        DIMENSION MCV(6),CV(46),MV(6)
        WRITE(1,106)
106     FORMAT('ENTER DEVICE & INPUT FILENAME IN A6 FORMAT')
        READ(1,107)AI,BI
107     FORMAT(2A6)
        WRITE(1,108)
108     FORMAT('ENTER DEVICE & OUPUT FILENAME IN A6 FORMAT')
        READ(1,107)AO,BO
        WRITE(1,105)
105     FORMAT('ENTER NO. OF SITES IN I4 FORMAT')
        READ(1,103)NS
103     FORMAT(I4)
        WRITE(1,100)
100     FORMAT('ENTER NO. OF VARIABLES TO BE PREDICTED IN I1 FORMAT')
        READ(1,99)NCV
        WRITE(1,104)
104     FORMAT('ENTER SELECTION OF VARIABLES REQUIRED IN I1 FORMAT')
        DO 20 J=1,NCV
        READ(1,99)MV(J)
99      FORMAT(I1)
20      CONTINUE
        MM=1
        DO 70 J=1,6
        IF(MV(MM)-J)16,15,16
15      MCV(J)=MV(MM)
        MM=MM+1
        GO TO 70
16      MCV(J)=0
        GO TO 70
70      CONTINUE
C
        CALL IOPEN(AI,BI)
        CALL OOPEN(AO,BO)
        DO 30 K=1,NS
        READ(4,109)GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,HOR,ELE4,DFSW,
        1DFSE,HEW,HEE,
109     FORMAT(14A6)
        WRITE(1,231)K,GRIE,GRIN
231     FORMAT('SITE NO., GRID E & GRID N =',I4,1X,2(F6.0,1X))
        SWNE=0.0890*GRIE+0.0442*GRIN-56.2
        SENW=-0.0447*GRIE+0.0889*GRIN-23.8
C
        DO 50 M=1,6
        CALL PREV2(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
        1HOR,ELE4,DFSW,DFSE,HEW,HEE,M)
        CALL PREV3(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
        1HOR,ELE4,DFSW,DFSE,HEW,HEE,M)
50      CONTINUE
        WRITE(1,110)
110     FORMAT()
30      CONTINUE
        CALL OCLOSE
        WRITE(1,124)
124     FORMAT('END OF JOB')
        STOP
        END
```

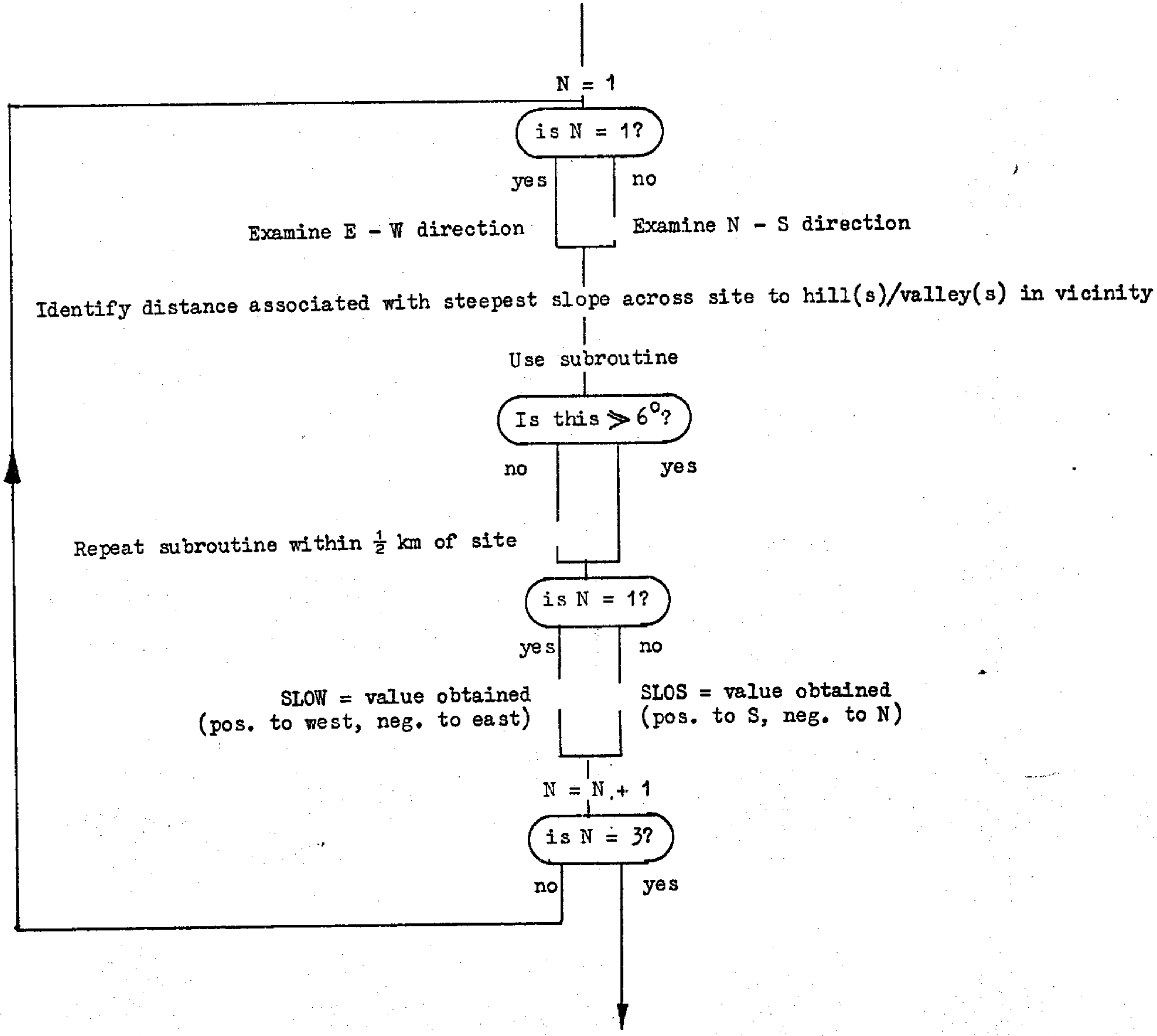
```
      SUBROUTINE PREV2(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
     1HOR,ELE4,DFSW,DFSE,HEW,HEE,M)
      COMMON MCV,CV
      DIMENSION MCV(6),CV(46)
C     CALCULATE DRY BULB TEMP
      IF(MCV(M)-1)28,11,12
11    CV(11)=-0.00757*ELEV+0.0334*SLOS+0.00153*HOR-1.63*ALOG
     1(SWNE+50.0)-0.235*ALOG(SENW+50.0)-0.106*ALOG(DFSE+1.0)
     2+11.6
      CV(21)=-0.00747*ELEV+0.0226*SLOW-0.0290*SENW+0.128*ALOG
     1(DFS+1.0)+11.4
      CV(31)=-0.00713*ELEV+0.0206*SLOW-0.0365*SENW-0.144*ALOG
     1(SENW+50.0)+0.0684*ALOG(DFSW+1.0)+15.2
      CV(41)=-0.00598*ELEV+0.0320*SLOS+0.00199*HOR-0.980*ALOG
     1(GRIN)-0.203*ALOG(DFS+1.0)-0.0787*ALOG(DFSW+1.0)+13.3
      WRITE(1,118)
118   FORMAT('DRY BULB TEMP')
      WRITE(1,111)CV(11),CV(21),CV(31),CV(41)
      WRITE(4,112)CV(11),CV(21),CV(31),CV(41),
111   FORMAT(4(F9.3,1X))
112   FORMAT(4A6)
C     CALCULATE RAINFALL
12    IF(MCV(M)-2)28,13,14
13    CV(12)=0.000929*GRIE+0.000325*ELEV+0.0000397*ELE4
     1-0.467*ALOG(GRIE)+2.56
      CV(22)=0.000433*GRIE+0.000261*ELEV+0.000162*HOR
     1+0.0000171*ELE4+0.0000396*HEE-0.222*ALOG(GRIE)+1.28
      CV(32)=0.000321*ELEV-0.00308*SENW+0.00000885*HEE-0.416
     1*ALOG(GRIE)+0.285*ALOG(SWNE+50.0)+1.59
      CV(42)=0.00185*GRIE+0.000397*ELEV+0.0000439*ELE4
     1-0.000348*DFSW-0.743*ALOG(GRIE)+3.95
      WRITE(1,119)
119   FORMAT('RAINFALL')
      WRITE(1,111)CV(12),CV(22),CV(32),CV(42)
      WRITE(4,112)CV(12),CV(22),CV(32),CV(42),
C     CALCULATE VISIBILITY
14    IF(MCV(M)-3)28,15,28
15    CV(13)=-0.00207*HOR+0.0353*SENW-0.661*ALOG(GRIN)
     1-0.0776*ALOG(DFSE+1.0)+10.6
      CV(23)=0.0262*SLOW+0.0199*SENW-0.356*ALOG(GRIN)
     1+8.71
      CV(33)=-0.00209*HOR+0.0260*SENW-0.000468*HEE-0.505
     1*ALOG(GRIN)+10.1
      CV(43)=-0.00250*HOR+0.0494*SENW+0.00335*DFSE-0.000855*
     1HEW-0.863*ALOG(GRIN)+0.188*ALOG(DFSW+1.0)-0.263*
     2ALOG(DFSE+1.0)+11.9
      WRITE(1,120)
120   FORMAT('VISIBILITY')
      WRITE(1,111)CV(13),CV(23),CV(33),CV(43)
      WRITE(4,112)CV(13),CV(23),CV(33),CV(43),
28    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE PREV3(GRIE,GRIN,DFS,ELEV,ASP,SLOW,SLOS,VERT,
     1HOR,ELE4,DFSW,DFSE,HEW,HEE,M)
      COMMON MCV,CV
      DIMENSION MCV(6),CV(46)
C     CALCULATE WIND DIRECTION
      IF(MCV(M)-4)28,17,18
17    CV(14)=-0.380*VERT+0.0145*HEW-0.0363*HEE+255.0
      CV(24)=0.0397*ASP-0.0229*HEE+198.0
      CV(34)=0.0373*ASP-0.475*VERT-0.00971*ELE4-0.0246
     1*HEE+299.0
      CV(44)=-0.407*VERT+0.0168*HEW-0.0285*HEE-2.26*ALOG
     1(HEE+1.0)+272.0
      WRITE(1,121)
121   FORMAT('WIND DIRECTION')
      WRITE(1,111)CV(14),CV(24),CV(34),CV(44)
      WRITE(4,112)CV(14),CV(24),CV(34),CV(44),
111   FORMAT(4(F9.3,1X))
112   FORMAT(4A6)
C     CALCULATE SNOW DEPTH
18    IF(MCV(M)-5)28,19,21
19    CV(15)=0.00896*ELEV+0.0206*SWNE+0.327
      CV(25)=0.000854*ELEV+0.00759*SLOW+0.000908*ELE4
     1-0.000184*HEE-0.0129*ALOG(HEW+1.0)+0.0238
      CV(35)=0.0
      CV(45)=0.000816*GRIN+0.0036*ELEV-0.000707*HOR
     1-0.122*ALOG(ELEV)-0.188*ALOG(SENW+50.0)+0.876
      IF(CV(45))1,2,2
1     CV(45)=0.0
2     WRITE(1,122)
122   FORMAT('SNOW DEPTH')
      WRITE(1,111)CV(15),CV(25),CV(35),CV(45)
      WRITE(4,112)CV(15),CV(25),CV(35),CV(45),
C     CALCULATE WINDSPEED
21    IF(MCV(M)-6)28,22,28
22    CV(16)=0.0575*SLOS-0.000856*ELE4+0.445*ALOG(GRIN)
     1-0.347*ALOG(DFSW+1.0)-0.739*ALOG(DFSE+1.0)+0.436
     2*ALOG(HEE+1.0)+4.94
      CV(26)=0.0602*SLOS-0.00068*ELE4-0.66*ALOG(DFSE+1.0)
     1+0.467*ALOG(HEE+1.0)+5.27
      CV(36)=-0.000361*ELE4+0.476*ALOG(GRIN)+0.232*ALOG
     1(ELEV)-0.274*ALOG(DFSE+1.0)-0.214*ALOG(HEW+1.0)+2.96
      CV(46)=0.00653*DFSW+0.364*ALOG(GRIN)+0.263*ALOG(ELEV)
     1-0.838*ALOG(DFSW+1.0)-0.322*ALOG(DFSE+1.0)+5.07
      WRITE(1,123)
123   FORMAT('WINDSPEED')
      WRITE(1,111)CV(16),CV(26),CV(36),CV(46)
      WRITE(4,112)CV(16),CV(26),CV(36),CV(46),
28    CONTINUE
      RETURN
      END
```

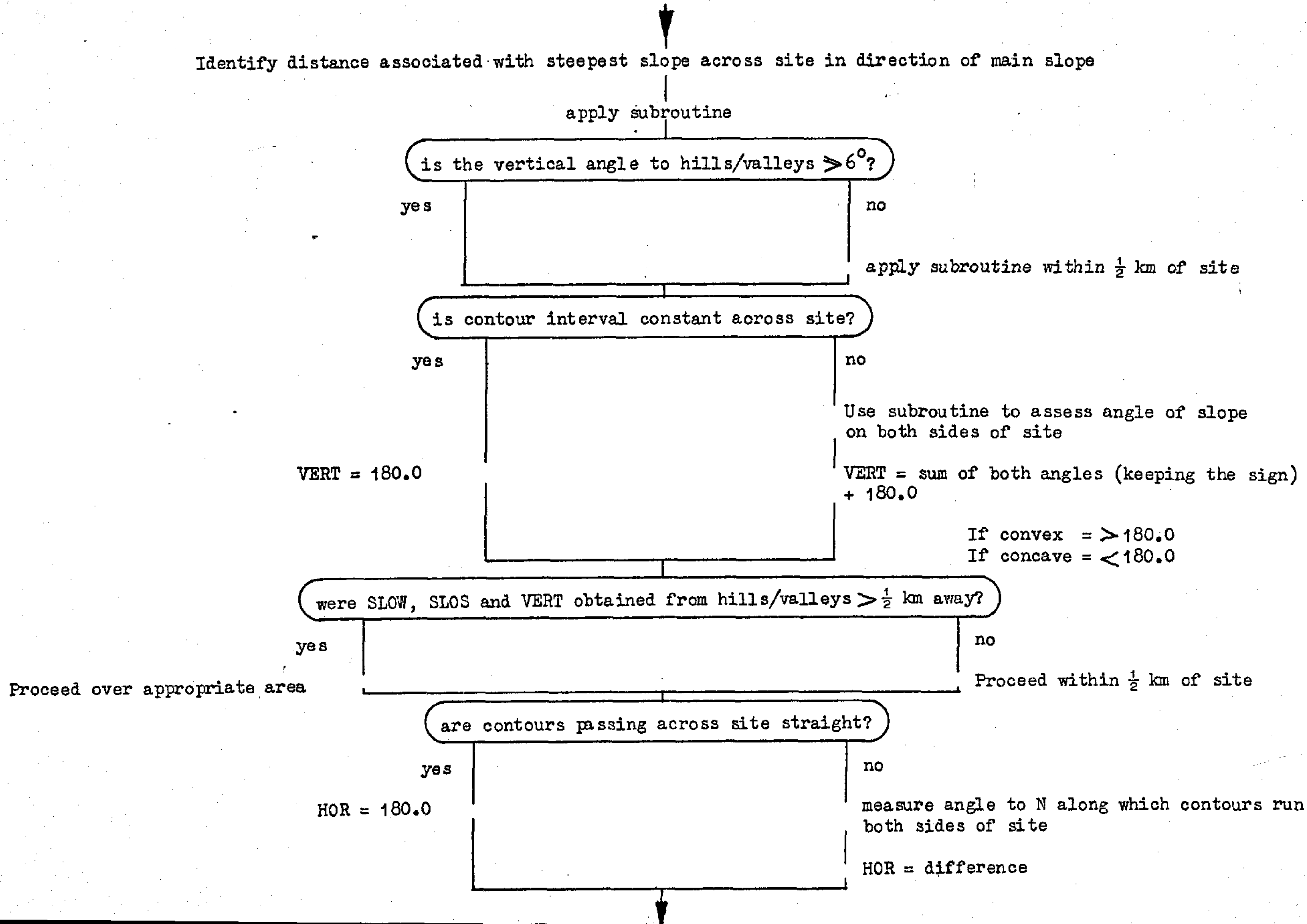
```
R LOADER↲
*PREV,PREV2,PREV3/I/O/G↲

ENTER DEVICE & INPUT FILENAME IN A6 FORMAT
SYS@@@DAT14@↲
ENTER DEVICE & OUPUT FILENAME IN A6 FORMAT
SYS@@@DOUT@@↲
ENTER NO. OF SITES IN I4 FORMAT
   2↲
ENTER NO. OF VARIABLES TO BE PREDICTED IN I1 FORMAT
6↲
ENTER SELECTION OF VARIABLES REQUIRED IN I1 FORMAT
1↲
2↲
3↲
4↲
5↲
6↲
SITE NO., GRID E & GRID N =   1   265.    372.
DRY BULB TEMP
    4.743    11.266    14.747     8.339
RAINFALL
    0.293     0.248     0.394     0.387
VISIBILITY
    5.874     6.603     6.497     6.407
WIND DIRECTION
  179.761   199.491   204.844   182.711
SNOW DEPTH
    0.488     0.000     0.000     0.029
WINDSPEED
    4.553     4.563     3.134     3.435

SITE NO., GRID E & GRID N =   2   480.    143.
DRY BULB TEMP
    3.176    11.031    14.191     6.899
RAINFALL
    0.170     0.192     0.176     0.225
VISIBILITY
    6.557     6.943     7.080     6.937
WIND DIRECTION
  183.468   191.267   203.829   186.244
SNOW DEPTH
    1.357     0.000     0.000    -0.035
WINDSPEED
    3.797     4.435     3.615     3.466

END OF JOB
```

FLOW DIAGRAM INDICATING STEPS TAKEN TO OBTAIN 14 SITE VARIABLES FROM ORDNANCE SURVEY MAPS





N = 1
is N = 1?
yes
no
Examine E - W direction
Examine N - S direction
Identify distance associated with steepest slope across site to hill(s)/valley(s) in vicinity
Use subroutine
Is this ≥ 6°?
no
yes
Repeat subroutine within ½ km of site
is N = 1?
yes
no
SLOW = value obtained
(pos. to west, neg. to east)
SLOS = value obtained
(pos. to S, neg. to N)
N = N + 1
is N = 3?
no
yes


Identify distance associated with steepest slope across site in direction of main slope
apply subroutine
is the vertical angle to hills/valleys $\geqslant 6^{o}$?
yes
no
apply subroutine within ½ km of site
is contour interval constant across site?
yes
no
Use subroutine to assess angle of slope on both sides of site
VERT = 180.0
VERT = sum of both angles (keeping the sign) + 180.0
If convex = > 180.0
If concave = < 180.0
were SLOW, SLOS and VERT obtained from hills/valleys > ½ km away?
yes
no
Proceed over appropriate area
Proceed within ½ km of site
are contours passing across site straight?
yes
no
HOR = 180.0
measure angle to N along which contours run both sides of site
HOR = difference

Place circular scale with radius = 1 km with centre on site

Note highest elevation in each quadrant (feet)

Calculate difference between highest elevations and elevation of site (in feet)

Examine lowest points in each quadrant (feet)

Calculate differences between lowest elevations and elevation of site (feet)

Summate 4 greatest differences per quadrant (feet)

ELE4 = summation x 1/3.281 (metres)

Place 10 x 10 grid over appropriate 100 x 100 km grid square on 1/625000 Ordnance Survey Physical map

DFS = distance (km) from site to nearest point on coast: if on an estuary, to the point where it is at least 10 km wide

DFSW = distance (km) from site to sea due west

DFSE = distance (km) from site to sea due east

HEW = highest spot height (m) to the west $\pm$ 2 degrees

HEE = highest spot height (m) to the east $\pm$ 2 degrees

End

Subroutine

Measure vertical interval from contours (feet)

Measure horizontal distance (yards)

Horizontal distance feet = horizontal distance (yards)/3.0

Tangent of slope = vertical (feet)/horizontal (feet)

Angle obtained from tangent tables

Return to main program