NASA TECHNICAL MEMORANDUM

NASA TM X-58071
October 1971

A UNIVAC 1108 COMPUTER PROGRAM FOR USE WITH WORLDWIDE CLOUD-COVER DISTRIBUTION DATA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

NASA TM X-58071

A UNIVAC 1108 COMPUTER PROGRAM FOR USE WITH WORLDWIDE CLOUD-COVER DISTRIBUTION DATA

Kirby D. Kyle
Manned Spacecraft Center
Houston, Texas

ABSTRACT

A computer program which implements the use of worldwide cloud-cover distribution data is discussed. This program was prepared for use on the NASA Manned Spacecraft Center Univac 1108 computer.

A UNIVAC 1108 COMPUTER PROGRAM FOR USE WITH WORLDWIDE CLOUD-COVER DISTRIBUTION DATA

By Kirby D. Kyle
Manned Spacecraft Center

SUMMARY

Worldwide cloud-cover distribution data have been obtained for use in mission planning for aircraft and spacecraft missions on which earth resources remote sensing measurements are made or landmarks are used as navigation aids. To use these data, it was necessary to develop the computer program described in this report. This program, for use with the Univac 1108 computer, provides a method of (1) storing the cloud-cover statistical data permanently and (2) retrieving the data readily.

INTRODUCTION

Worldwide cloud-cover distribution data (ref. 1) were collected and supplied to the NASA Manned Spacecraft Center (MSC). Cloud-cover statistical data are important in mission planning for aircraft and spacecraft missions on which earth resources remote sensing is conducted or landmarks are used as navigation aids. These data consist of "unconditional" cloud-cover probabilities for specific times of day (designated in local standard time (l. s. t.)) over standard areas located by single points; each point is specified by a latitude and a longitude designation. "Conditional" probabilities in terms of 24 hours or 200 nautical miles are also given by the computer program. However, the conditional probabilities can be used at times and distances other than 24 hours or 200 nautical miles. The conditional probabilities are predictions based on the unconditional (or absolute) probabilities given for a specific point at a specific time. The conditional probabilities are for either time into the future or distances away from the specific point. It is extremely important that it be understood that these statistical data should never be used for real-time weather forecasting, because the applicable atmospheric dynamics are not accounted for in the statistical data.

The Univac 1108 computer program discussed in this report was provided to implement use of the data in preparation for missions, such as the following, that include remote sensing experiments.

1. For each Apollo lunar mission, an earth-orbit contingency mission is planned in the event an abort of the lunar portion of the mission, without the necessity for an

immediate return of the crew, should occur. These contingency earth-orbit missions would use the cameras on board the spacecraft for earth resources photography and therefore are cloud-cover sensitive.

2. The Skylab mission to be launched in April 1973 will carry five sensors for earth resources remote sensing measurements. These measurements will be made in the visible, infrared, and microwave regions of the spectrum. These sensors will be used by the flight crews for a total of 140 days during 1973. Since several hundred targets may be established, the long-range mission planning, using cloud-cover statistical data, is essential to the success of the mission. In the mission planning, these data are correlated with other considerations such as orbital ground track, sun elevation angle, and crew activities.

To use the cloud-cover statistical data, it was necessary to search the data an indefinite number of times in order to recall a specific block of the data. The most efficient method of conducting this data search was found to be the use of the random recall capability of the high-speed-drum storage facility. However, data cannot be stored permanently on the high-speed-drum facility; therefore, it was necessary to provide a capability for rapid transfer of the data from permanent storage to the high-speed drum. This requirement was satisfied by the preparation of a computer program to transfer the cloud-cover statistical data from punched cards to magnetic tape on which the data are stored permanently and are readily transferred to the high-speed drum.

The computer program was written in the FORTRAN V language with the addition of the MSC computer system subroutines MREAD, MWRITE, RINIT, RREAD, and RWRITE for the Univac 1108 computer. Compatibility with other computer systems depends on the availability of a high-speed drum and the ability of the computer system to read and produce binary magnetic tapes with a capacity of 38 and 90 words per "record" (increment of information).

Three appendixes are included in this report. Appendixes A and B each contain (1) illustrations of the flow diagrams and (2) computer printout listings of the computer program and subroutines discussed in this report. Appendix C contains a description of the magnetic tape storage used with the program. An alternative to the method of retrieving the data by use of the high-speed drum is also described.

Copies of the cards for this computer program are available upon request from David E. Pitts, mail code TF321, Manned Spacecraft Center, Houston, Texas 77058. Requests for copies of the data on magnetic tape will be honored if the requests are accompanied by blank magnetic tapes.

WORLDWIDE CLOUD-COVER DATA DESCRIPTION

Two decks of cards contain all the input data necessary to use the worldwide cloud-cover statistical data (ref. 1). The first deck contains climatological (map) region numbers and boundaries. The second deck contains cloud-cover statistical data, compiled for each of 12 months, for each of the 29 map regions.

Data for the first deck are extracted from the map in figure 1 in the following manner. Boundaries of each region fall on even-numbered latitudes and longitudes. The area between 70° S and 70° N is divided into 70 swaths at odd-numbered latitudes which extend from 0° to 360° eastward from the Greenwich meridian. The areas above 70° N and below 70° S require another logic, since one region number defines the entire area. Scanning eastward from the Greenwich meridian along each swath, the number of the region previously encountered and the value of its terminating longitude (integral numbers between 0 and 360) are recorded and punched on cards. The maximum number of terminating longitudes in one swath is 19. Two cards are used to catalog one swath even though data for some swaths do not extend into the second card. The card setup is illustrated in figure 2.

The second deck, containing the cloud-cover statistical data, is illustrated in figure 3. Figure 4 illustrates the setup for the individual cards containing the statistical data. As shown, the data on the cards are organized in three matrices, the first being the unconditional probabilities for five cloud categories and eight local times. The second matrix contains the 24-hour (temporal) statistical data, and the third matrix contains the 200-nautical-mile (spatial) statistical data.

Approximately 75 percent of the cloud-cover data were expressed in tenths of sky cover; the remainder was expressed in eighths. Cloud-cover category designation is as follows:

Category	Tenths	Eighths
1	0	0
2	1, 2, 3	1, 2
3	4, 5	3, 4
4	6, 7, 8, 9	5, 6, 7
5	10	8

Note that the intervals are unequal in size and that the categorization in tenths differs only slightly from that in eighths.

DATA TRANSFER PROGRAM

The Data Transfer Program transfers only the region number and the terminating longitude of the map region block to magnetic tape. The transfer is made one swath at a time so that the swath number can be used as an index, for data recall, for an array of points of entry to a high-speed drum. Similarly, only the probabilities of the cloud-cover probability data block are transferred. This data block is transferred one region at a time (data from five cards) month by month from month 1 to month 12. The month number and the region number are used as indexes for a two-dimensional array of points of entry to a high-speed drum. The number denoting the cloud-cover category is not transferred and must be generated by the processing program. The remaining numbers that appear as data on the cards are used to arrange the data card deck properly, but are unnecessary for the computational processing and are not transferred to magnetic tape. The flow diagram and computer printout listing for the Data Transfer Program are given in appendix A.

DATA RECALL SUBROUTINE SET

In addition to the Data Transfer Program, two subroutines are used. Subroutine CLOUD is the data-manipulating program. Subroutine DRUMST, which is called by subroutine CLOUD, transfers the tabular cloud-cover statistical data from magnetic tape to a high-speed drum. Subroutine DRUMST is called only once for each loading of the subroutine. The flow diagrams and computer printout listings for subroutines CLOUD and DRUMST are given in appendix B.

To call subroutine DRUMST, subroutine CLOUD sets all parameters. The calling statement for subroutine CLOUD is

```
CALL CLOUD(MONTH, HOUR, PLAT, PLONG, UPROB, TPROB,
      SPROB, SCPROB, SCALE, ISCALE)
```

where MONTH is the month of the year from 1 to 12; HOUR is the time of day l. s. t. in the range -24.0 to +48.0 hours at the point specified by PLAT and PLONG; PLAT is the latitude in the range -90.0° to $+90.0^\circ$ with north latitudes positive and south latitudes negative; PLONG is the longitude in the range -180.0° to $+180.0^\circ$ with longitudes east of the Greenwich meridian positive and longitudes west negative; UPROB, TPROB, SPROB, and SCPROB are vectors for storing the probabilities (UPROB (five elements), unconditional; TPROB (5×5 array of elements), 24-hour time conditional; SPROB (5×5 array of elements), 200-nautical-mile space conditional; SCPROB (5×5 array of elements), scaled conditional (time or space)); SCALE is the scale factor for scaling the conditional probabilities, given in hours for time scaling and in nautical miles for space scaling; and ISCALE is a control variable which indicates either the type of scaling to be done or that no scaling is to be done. That is

$$\text{ISCALE} = \begin{cases} 1; \text{ time scaling} \\ 2; \text{ space scaling} \\ 3; \text{ no scaling} \end{cases}$$

If ISCALE is not assigned a value of either 1, 2, or 3, it is assigned the value 3 when subroutine CLOUD is entered, so that the computer will not call for an error termination of the run.

The data that must be supplied to subroutine CLOUD are supplied by means of the variables MONTH, HOUR, PLAT, PLONG, SCALE, and ISCALE in the calling statement. Subroutine CLOUD outputs the unconditional, the 24-hour time conditional, and the 200-nautical-mile space conditional probabilities. The scaled conditional probabilities also are output if scaling for times other than 24 hours or for distances other than 200 nautical miles occurs.

CONCLUDING REMARKS

The worldwide cloud-cover distribution data discussed in this report were obtained for use in mission planning for aircraft and spacecraft missions on which earth resources remote sensing measurements are made or landmarks are used as navigation aids. A computer program, for use with the Univac 1108 computer, was developed so that the cloud-cover statistical data can be permanently stored and readily retrieved.

Manned Spacecraft Center
National Aeronautics and Space Administration
Houston, Texas, October 5, 1971
160-75-03-01-72

REFERENCE

1. Sherr, Paul E.; Glaser, Arnold H.; Barnes, James C.; and Willand, James H.: World-Wide Cloud Cover Distributions for Use in Computer Simulations. NASA CR-61226, 1968.

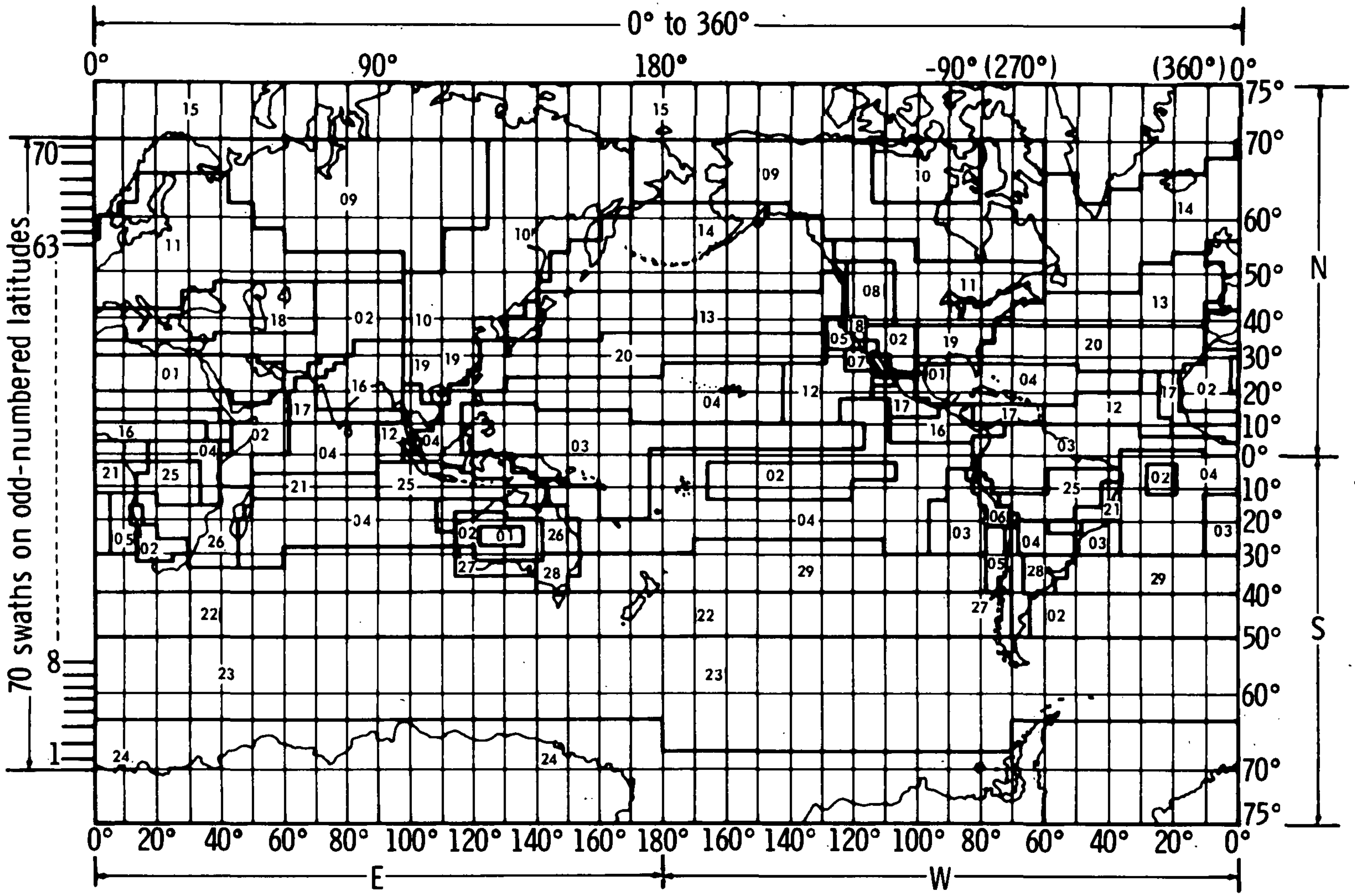


Figure 1. - Map region designation.

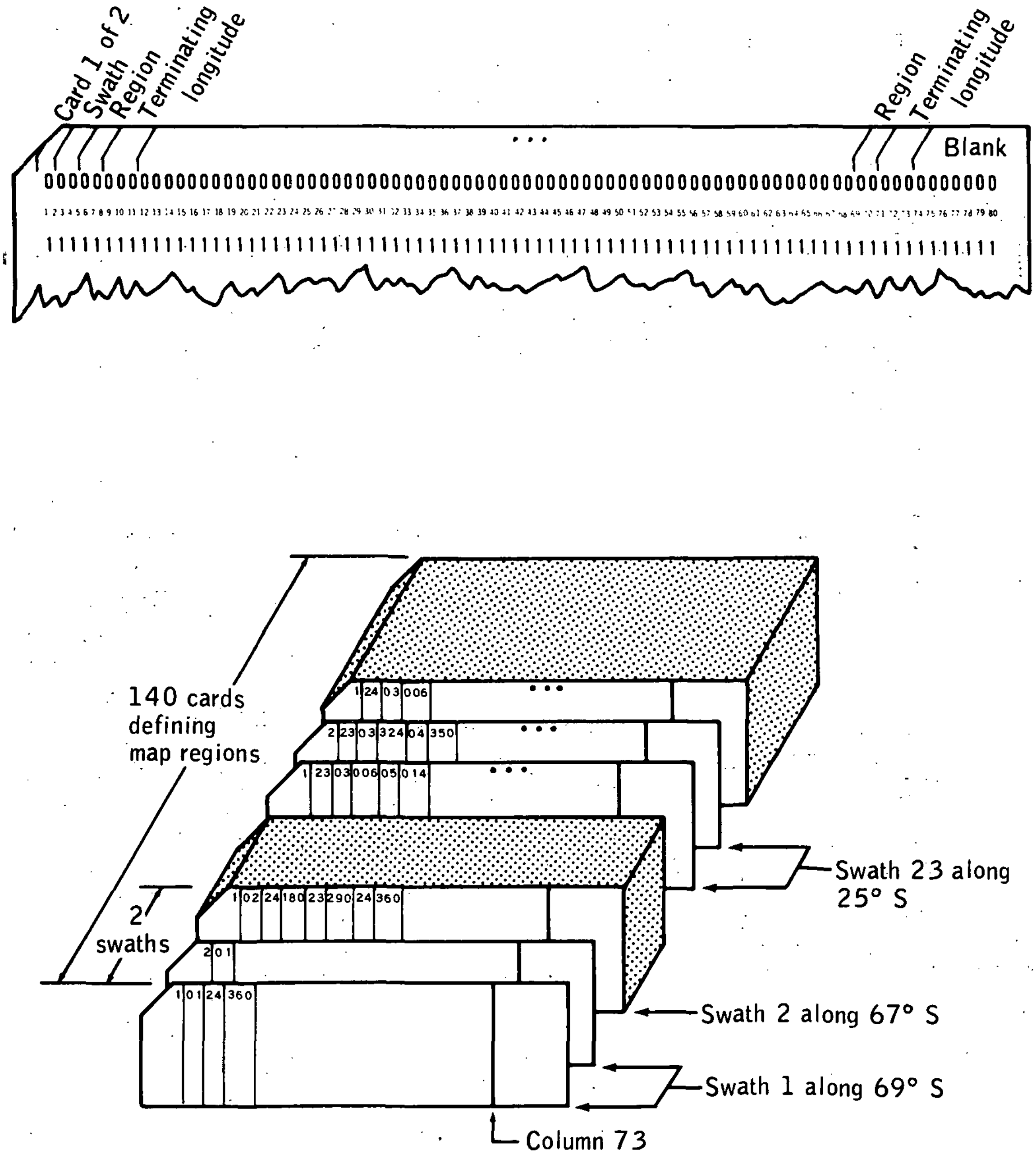


Figure 2. - Data card setup for definition of climatic regions.

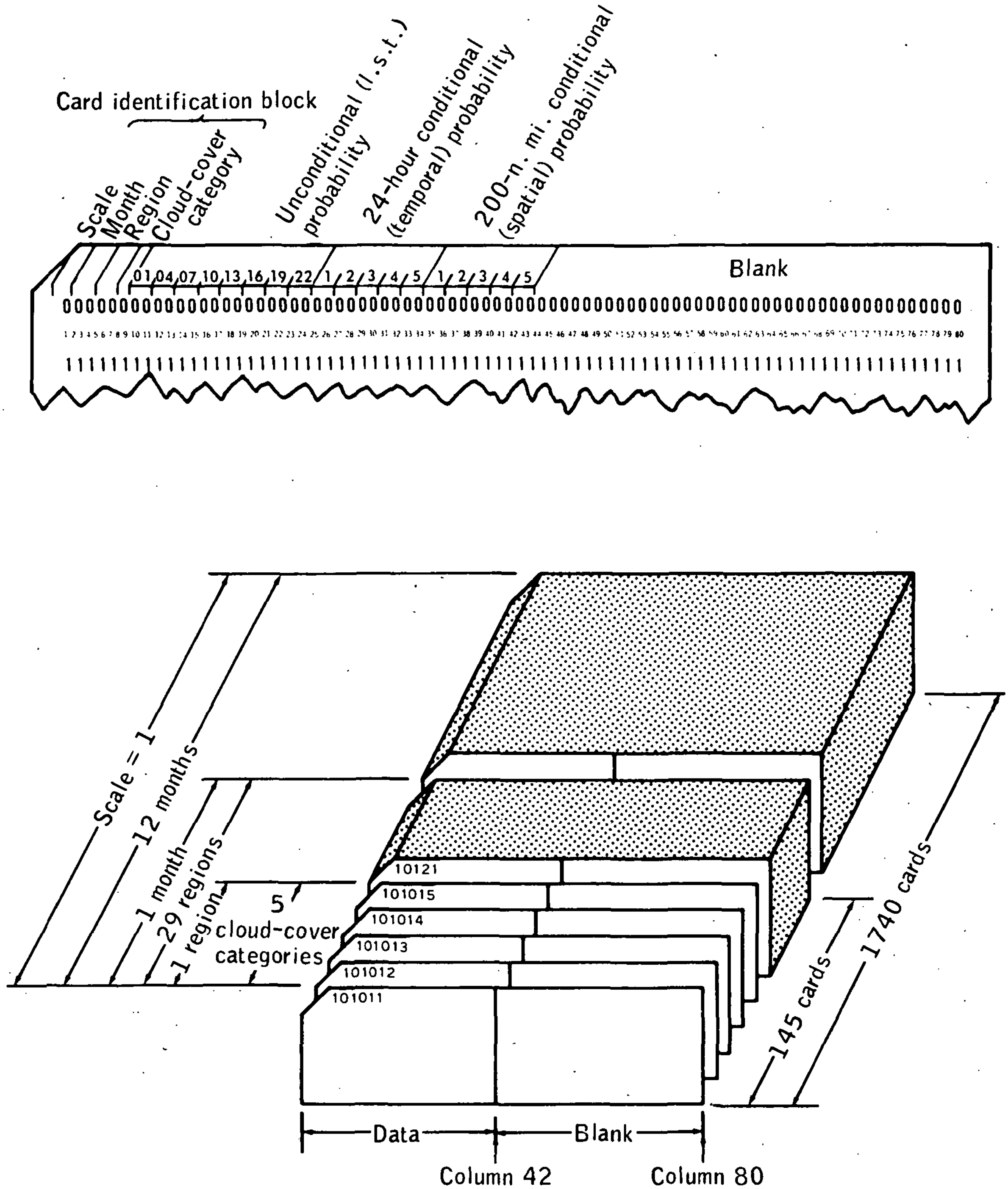


Figure 3. - Data card setup for cloud-cover statistical data.

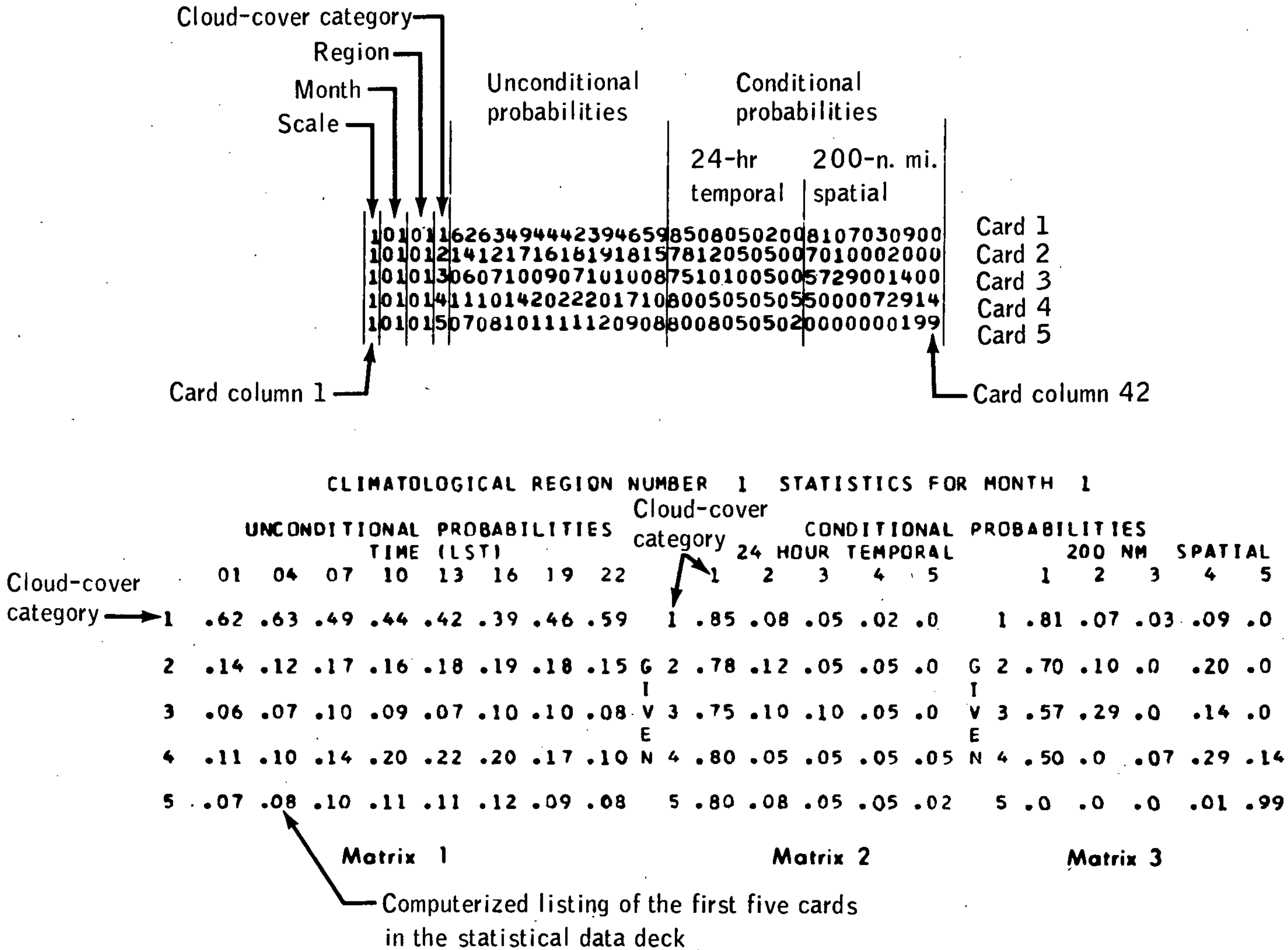
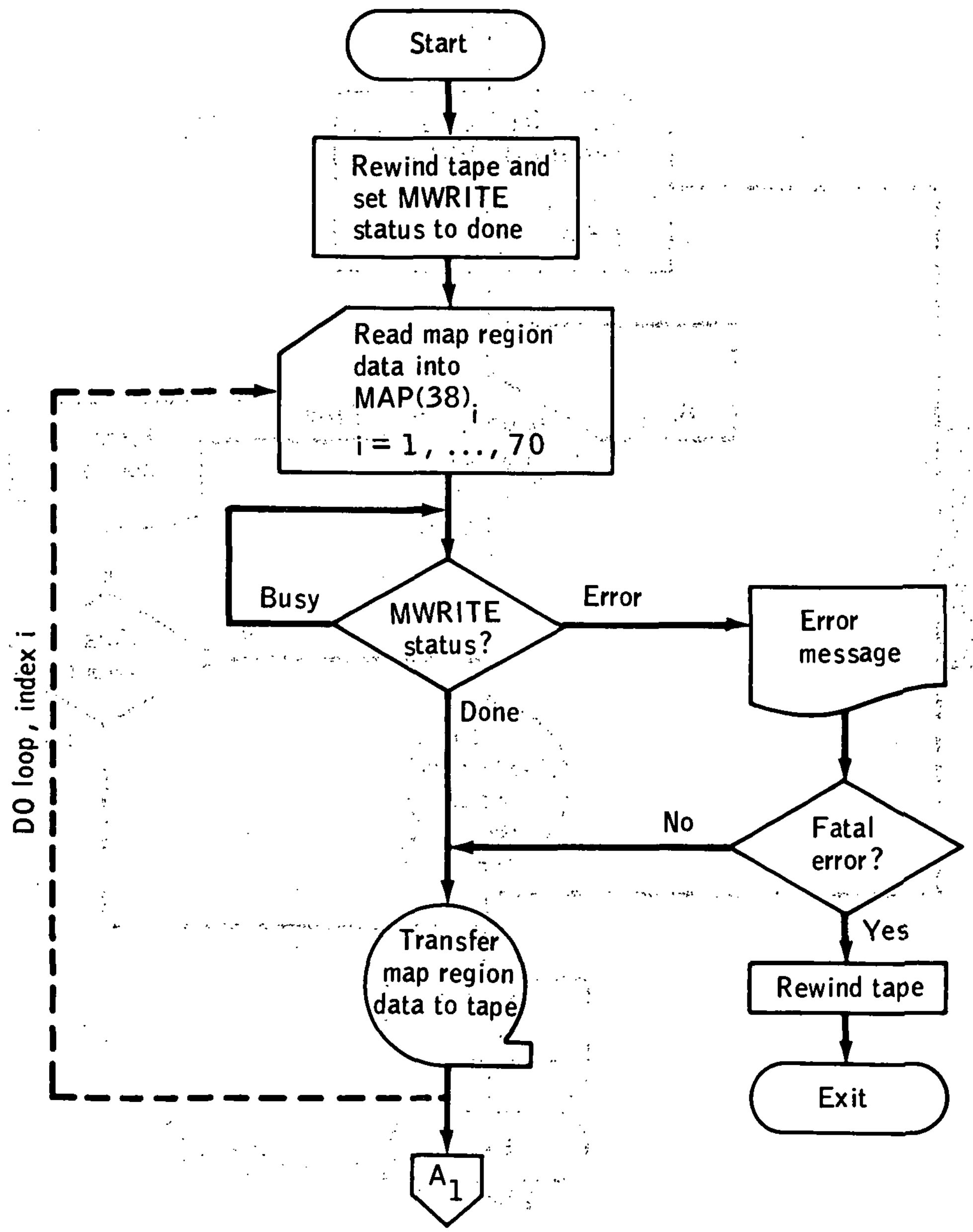


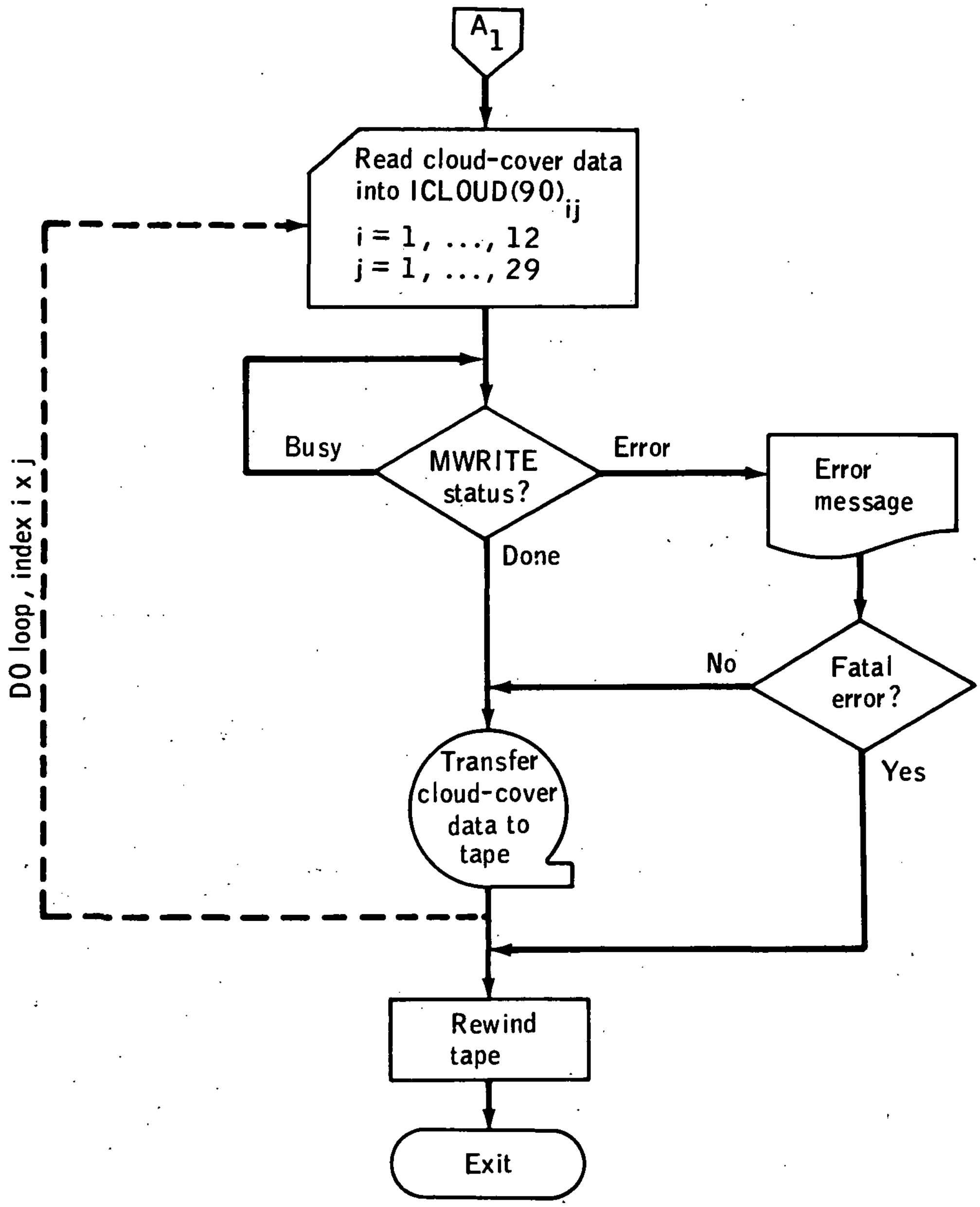
Figure 4. - Individual punched-card setup for cloud-cover statistical data.

APPENDIX A

DATA TRANSFER PROGRAM

Flow Diagram





A1
Read cloud-cover data into ICLOUD(90)ij
i = 1, ..., 12
j = 1, ..., 29
DO loop, index i x j
Busy
MWRITE status?
Error
Error message
Done
No
Fatal error?
Yes
Transfer cloud-cover data to tape
Rewind tape
Exit

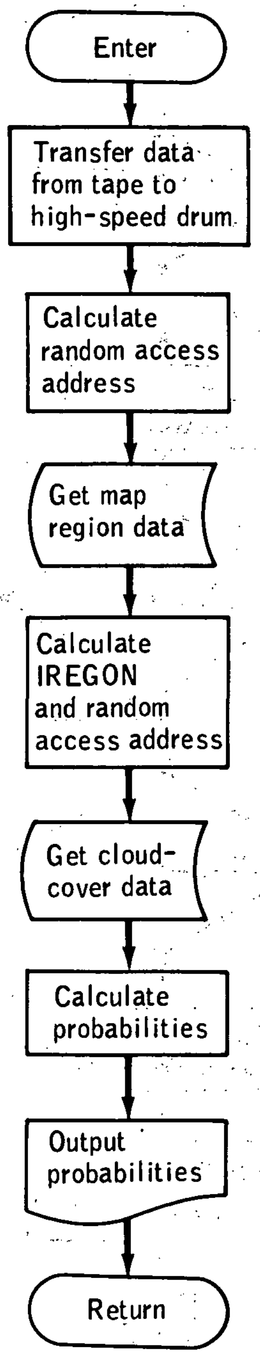
Computer Printout

```
      DIMENSION MAP(38),MAP2(38),ICLOUD(90),IICLOD(90)
      REWIND 1
      ISTAT=0
      DO 10 I=1,70
      READ(5,500) ISWTH1,(MAP(J),J=1,28)
      READ(5,501) ISWTH2, (MAP(J),J=29,38)
    4 JSTAT=ISTAT+1
      GO TO (8,4,5,6,7,7,7,7,7 ), JSTAT
    5 WRITE (6,803) IK,ISWTH3, ISWTH4, (MAP2(J),J=1,38)
      GO TO 999
    6 WRITE (6,801) IK,ISWTH3, ISWTH4, (MAP2(J), J=1,38)
      ISTAT=0
      GO TO 8
    7 WRITE (6,809) ISTAT, IK
      GO TO 999
    8 DO 9 K=1,38
    9 MAP2(K) =MAP(K)
      ISWTH3= ISWTH1
      ISWTH4= ISWTH2
      IK=I
   10 CALL  MWRITE(1,1,MAP2(1),38, ISTAT)
      DO 90  KIRBY=1,12
      DO 90 KYLE=1,29
      READ(5,502) (ICLOUD(II),II=1,90)
   34 JSTAT=ISTAT+1
      GO TO (38,34,35,36,37,37,37,37,37 ),JSTAT
   35 WRITE(6,802) KD,KK, (IICLOD(II),II=1,90)
      GO TO 999
   36 WRITE(6,803) KD,KK,(IICLOD(II),II=1,90)
      ISTAT=0
      GO TO 38
   37 WRITE(6,809) ISTAT,KD,KK
      GO TO 999
   38 DO 80 JK=1,90
   80 IICLOD(JK)= ICLOUD(JK)
      KD=KIRBY
      KK=KYLE
   90 CALL  MWRITE(1,1,IICLOD(1),90,ISTAT)
  500 FORMAT(1X,I2,14(I2,I3))
  501 FORMAT(1X,I2,5(I2,I3))
  800 FORMAT(1X,'EOT MARK SENSED WITH I = ',I3,'  SWTH = ',2I3,'  AND MA
     1P DATA BEING',/,28I4,/,10I4)
  801 FORMAT (1X,'PARITY ERROR WRITTEN WITH I = ',I3,'  SWTH = ',2I3,'
     1AND MAP DATA BEING',/,28I4,/,10I4)
  502 FORMAT (6X,18I2,4(/,6X,18I2))
  802 FORMAT (1X,'EOT MARK SENSED WITH MONTH = ',I3,'  REGION = ',I3,'
     1AND CLOUD DATA BEING',5(/,6X,18I3))
  803 FORMAT (1X,'PARITY ERROR WRITTEN WITH MONTH = ',I3,'  REGION = ',I
     13,'  AND CLOUD DATA BEING',5(/,6X,18I3))
  900 FORMAT (1X,'GOOD RUN UNLESS PARITY ERROR.')
  901 FORMAT (1X,'TAPE NOT LONG ENOUGH TO STORE ALL DATA. BREAK INTO 2
     1TAPES AND TRY AGAIN.',/,1X,'PROGRAMMER KILLS JOB.')
  809 FORMAT (1X,'ILLEGAL STATUS',I4,' ON LOOP ',2I3)
      WRITE (6,900)
      GO TO 998
  999 WRITE (6,901)
      GO TO 997
  998 CONTINUE
      ENDFILE 1
  997 REWIND 1
      CALL EXIT
      END
```

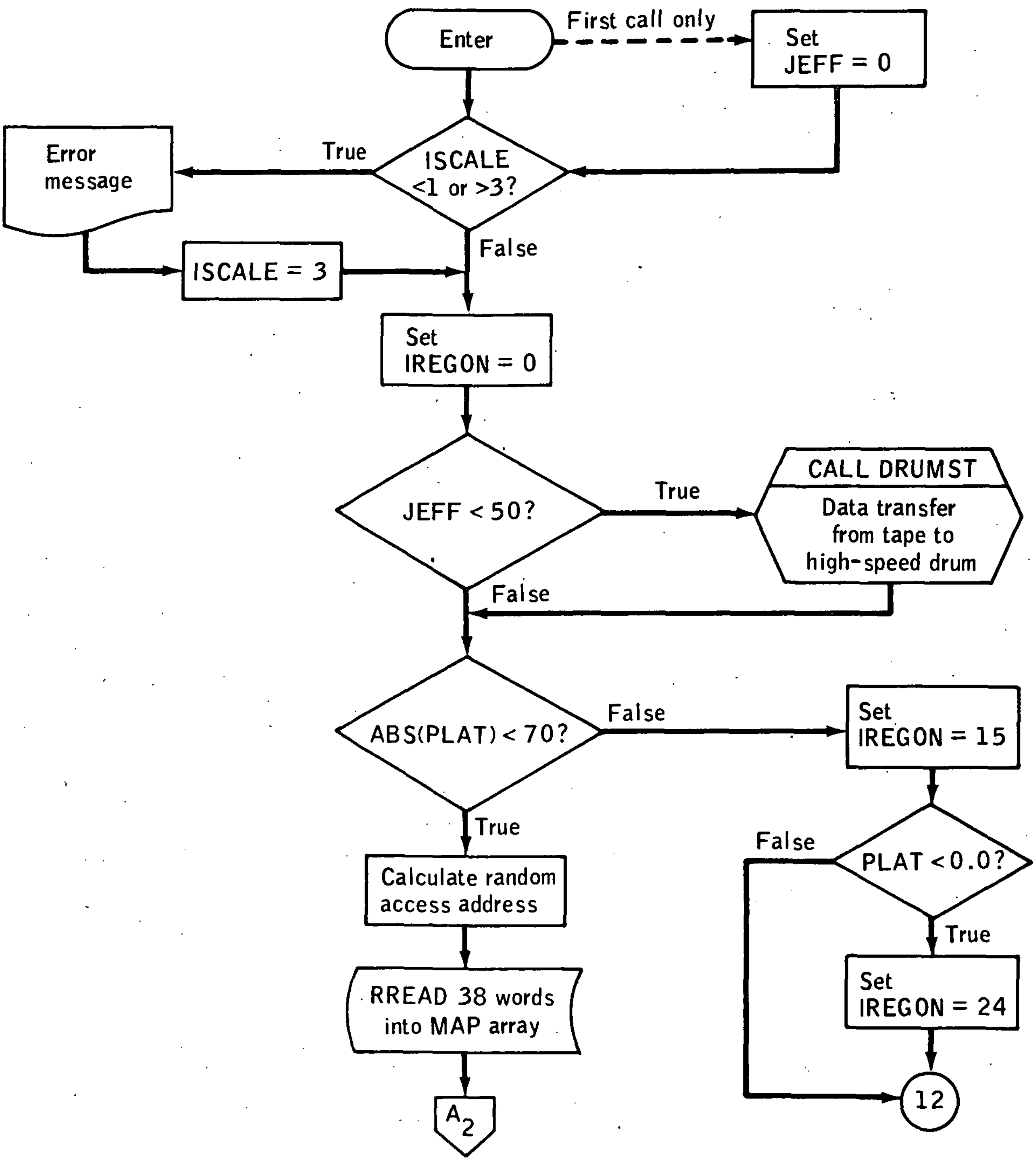
APPENDIX B

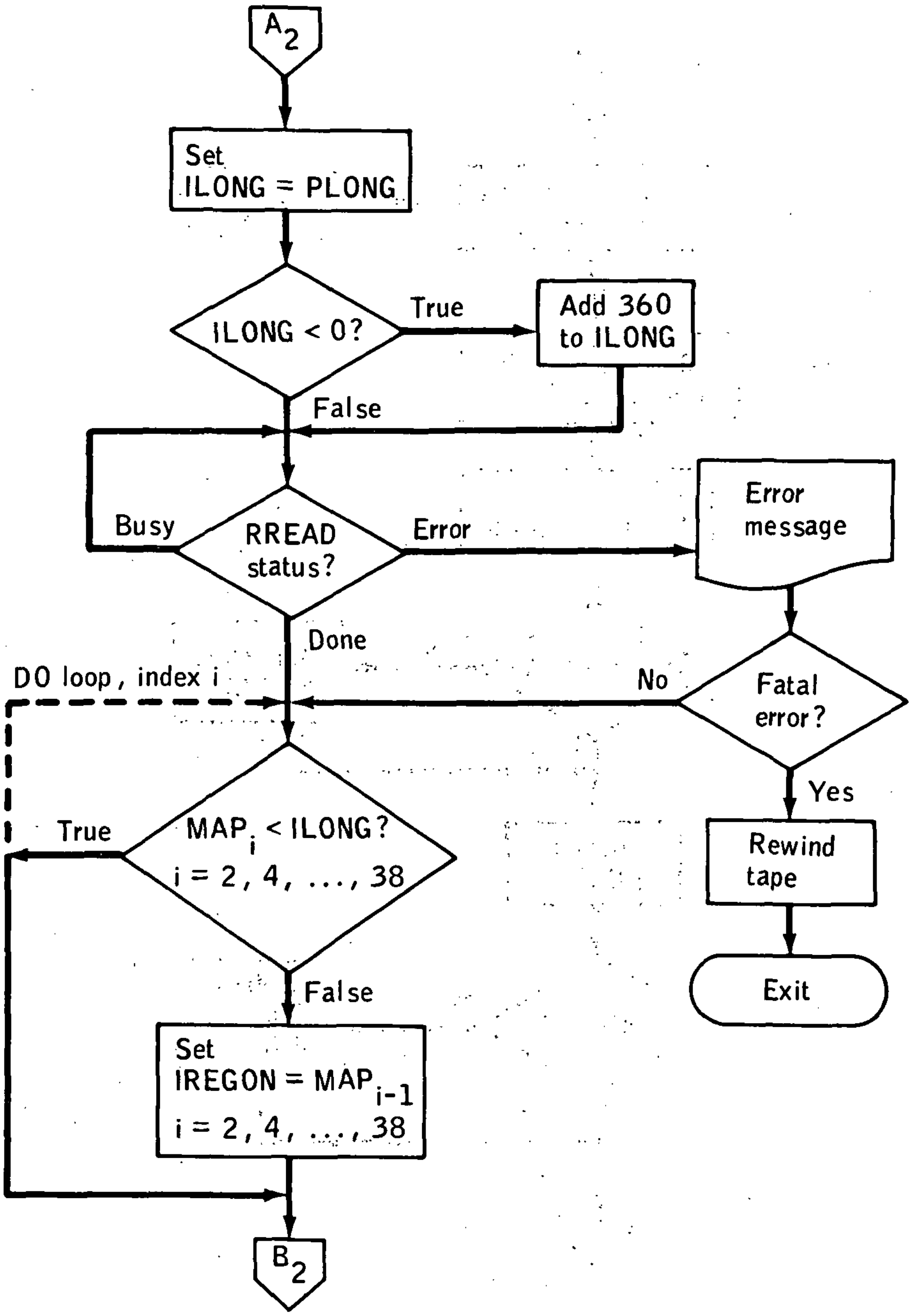
DATA RECALL SUBROUTINE SET

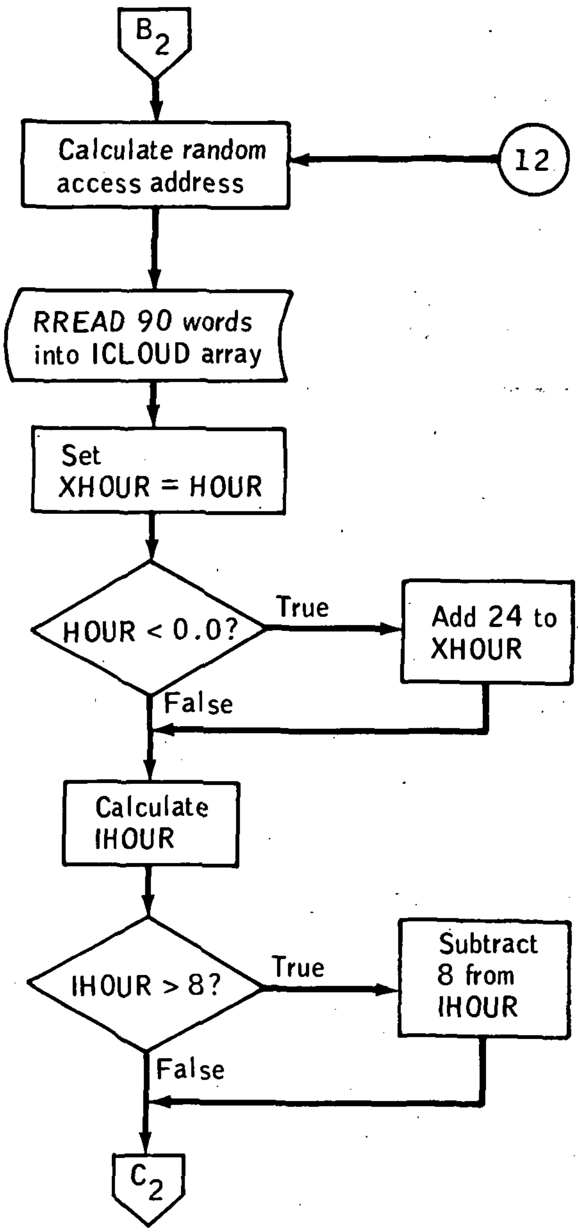
Subroutine Set Block Flow Diagram

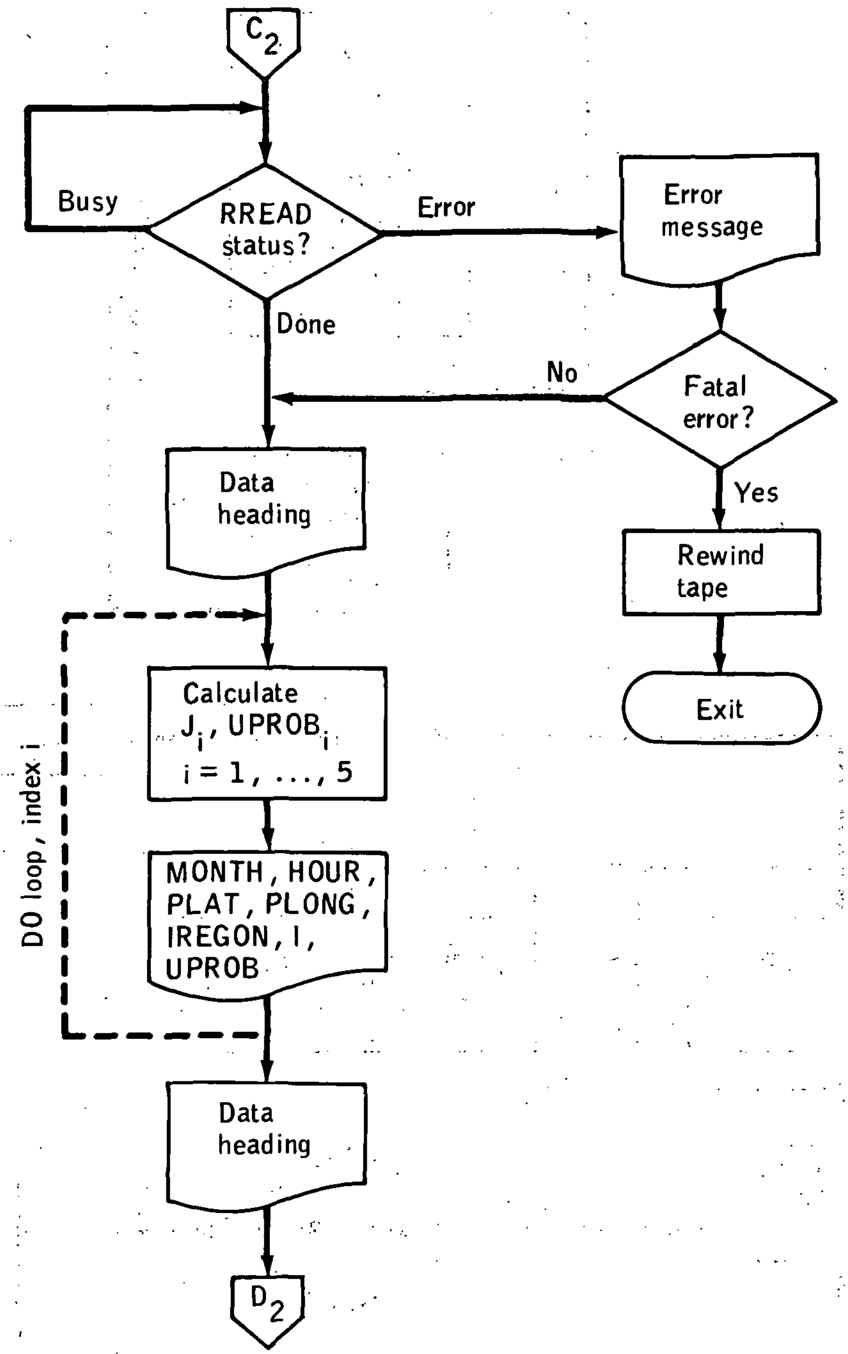


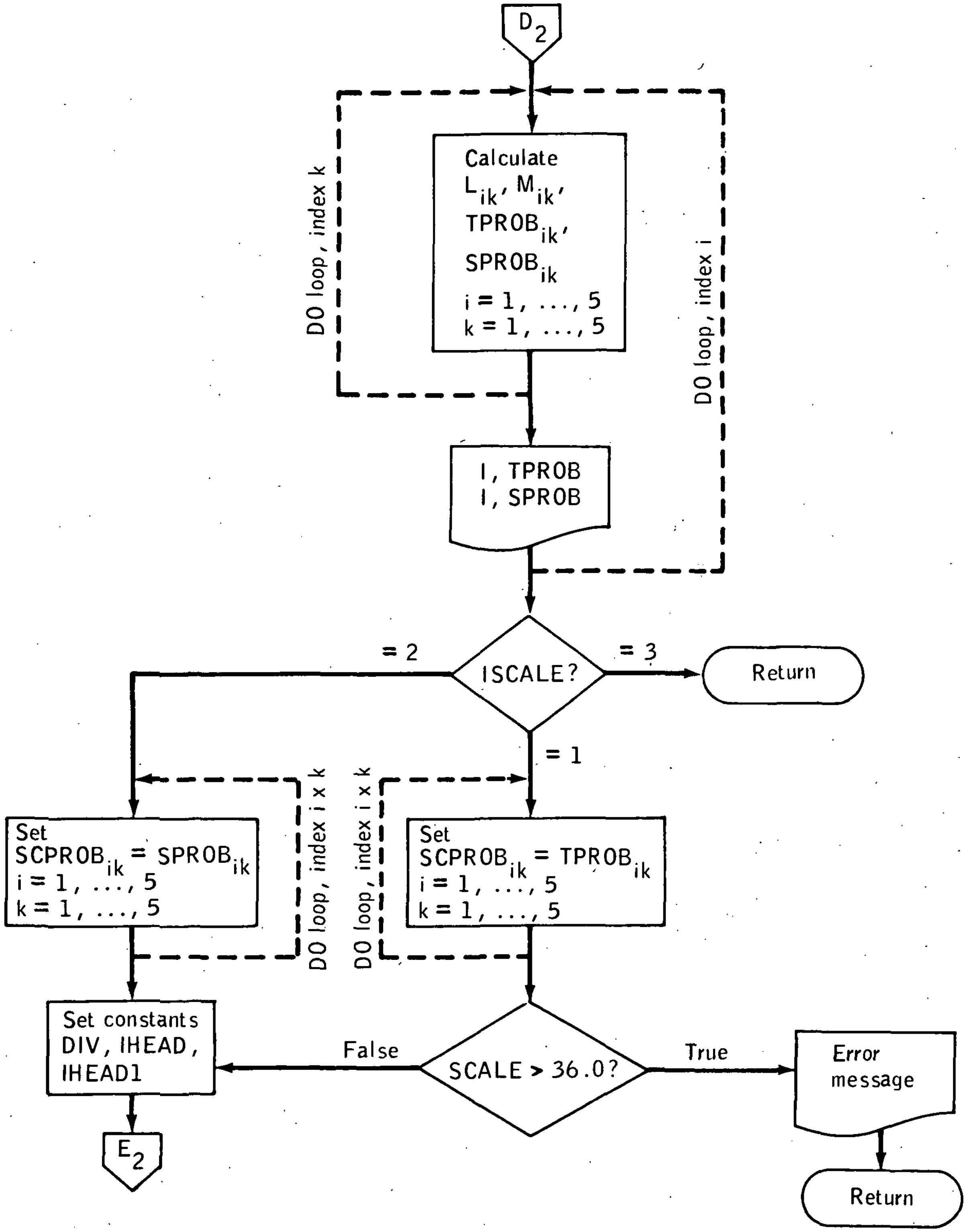
Subroutine CLOUD Flow Diagram

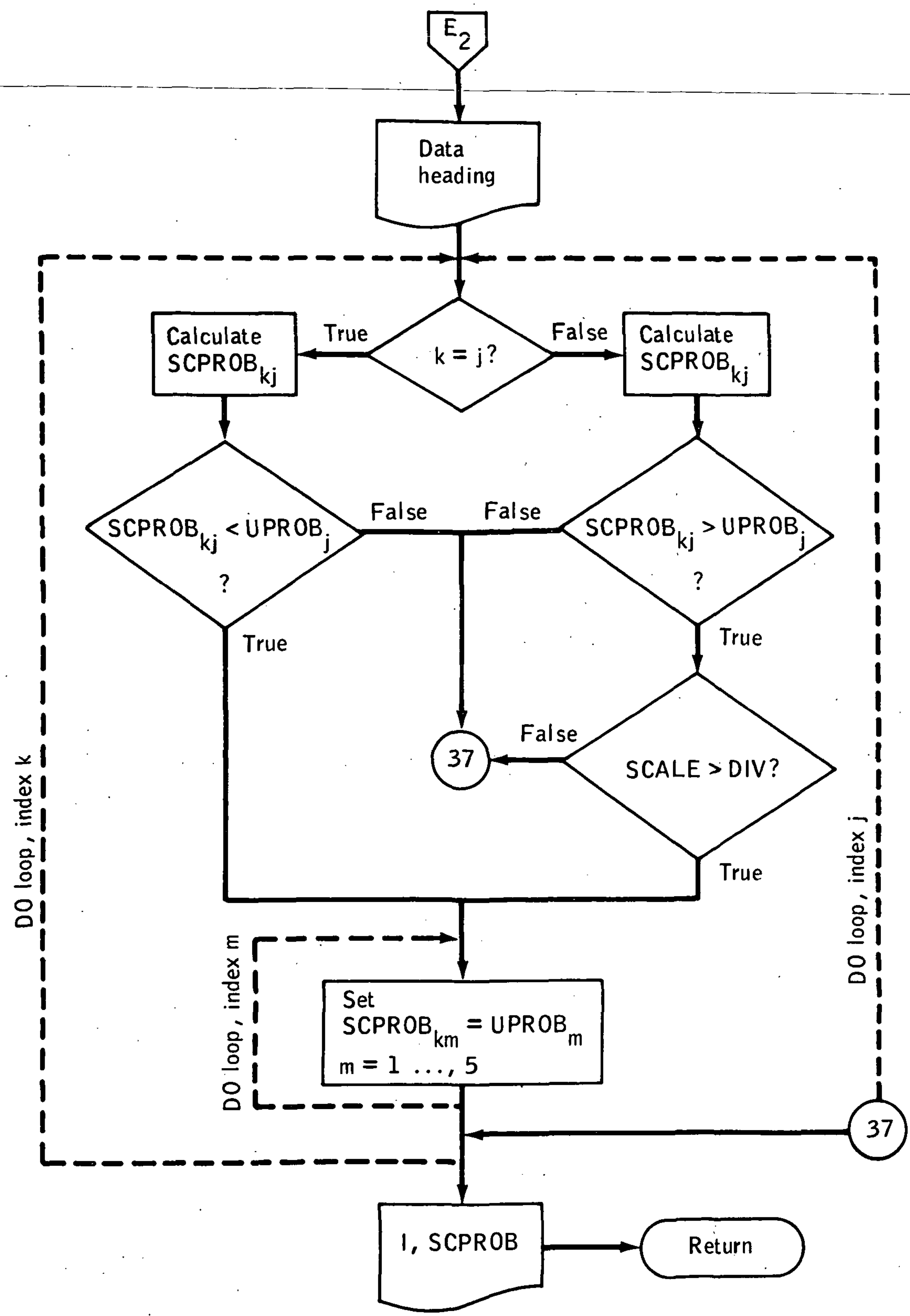



A2
Set
ILONG = PLONG
ILONG < 0?
True
Add 360
to ILONG
False
Busy
RREAD
status?
Error
Error
message
Done
DO loop, index i
No
Fatal
error?
Yes
Rewind
tape
Exit
True
MAPi < ILONG?
i = 2, 4, ..., 38
False
Set
IREGON = MAPi-1
i = 2, 4, ..., 38
B2


B2
Calculate random access address
12
RREAD 90 words into ICLOUD array
Set XHOUR = HOUR
HOUR < 0.0?
True
Add 24 to XHOUR
False
Calculate IHOUR
IHOUR > 8?
True
Subtract 8 from IHOUR
False
C2


C2
Busy
RREAD status?
Error
Error message
Done
No
Fatal error?
Yes
Data heading
Rewind tape
Exit
DO loop, index i
Calculate J_i, $UPROB_i$ $i = 1, ..., 5$
MONTH, HOUR, PLAT, PLONG, IREGON, I, UPROB
Data heading
D2


D2
Calculate
L_{ik}, M_{ik},
$TPROB_{ik}$,
$SPROB_{ik}$
i = 1, ..., 5
k = 1, ..., 5
DO loop, index k
DO loop, index i
I, TPROB
I, SPROB
ISCALE?
= 2
= 3
= 1
Return
Set
$SCPROB_{ik} = SPROB_{ik}$
i = 1, ..., 5
k = 1, ..., 5
DO loop, index i x k
DO loop, index i x k
Set
$SCPROB_{ik} = TPROB_{ik}$
i = 1, ..., 5
k = 1, ..., 5
Set constants
DIV, IHEAD,
IHEAD1
False
SCALE > 36.0?
True
Error
message
Return
E2

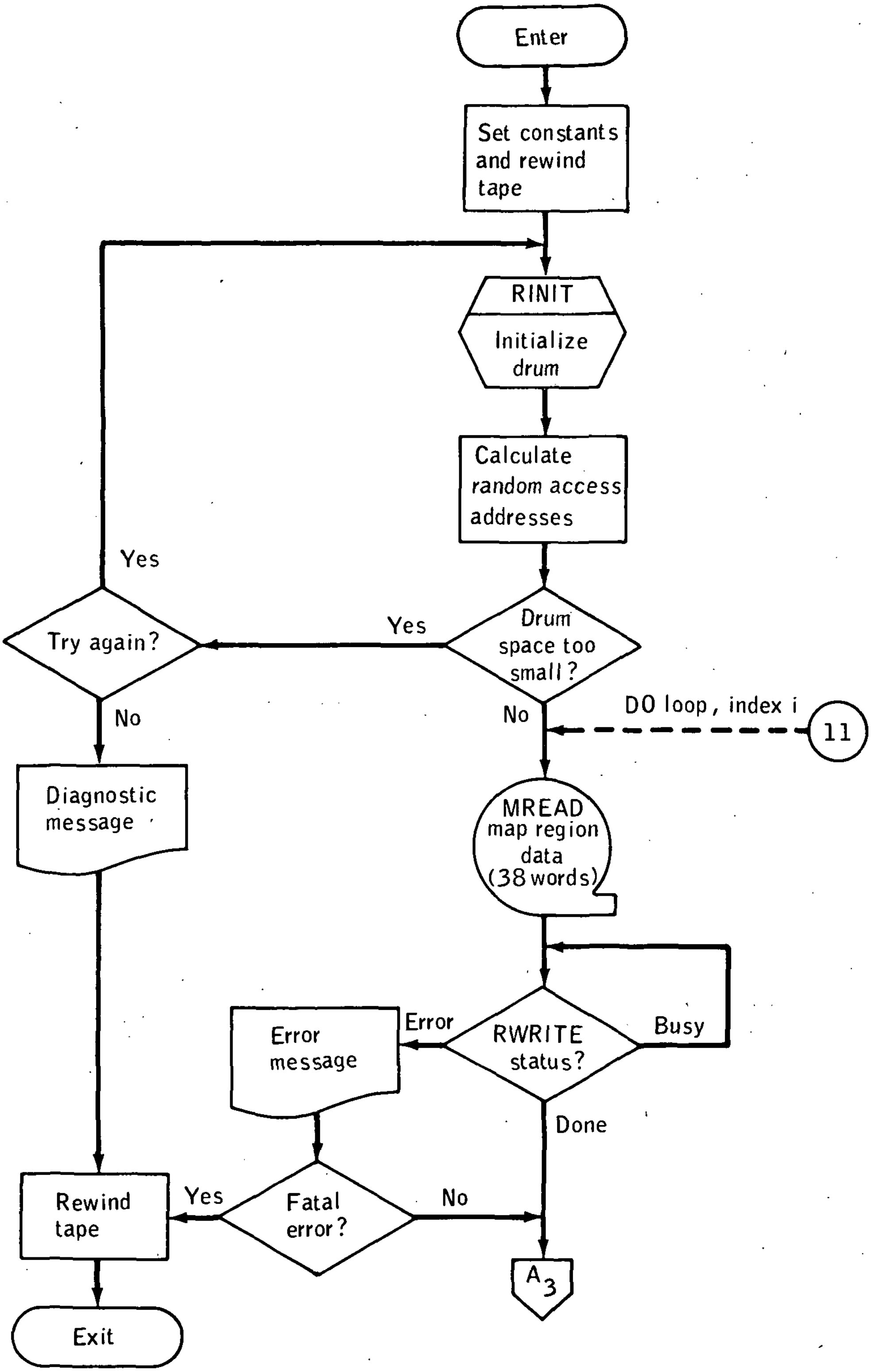

E2
Data heading
k = j?
True
False
Calculate SCPROBkj
Calculate SCPROBkj
SCPROBkj < UPROBj ?
SCPROBkj > UPROBj ?
False
False
True
True
SCALE > DIV?
False
True
37
Set SCPROBkm = UPROBm m = 1 ..., 5
DO loop, index m
DO loop, index k
DO loop, index j
37
I, SCPROB
Return

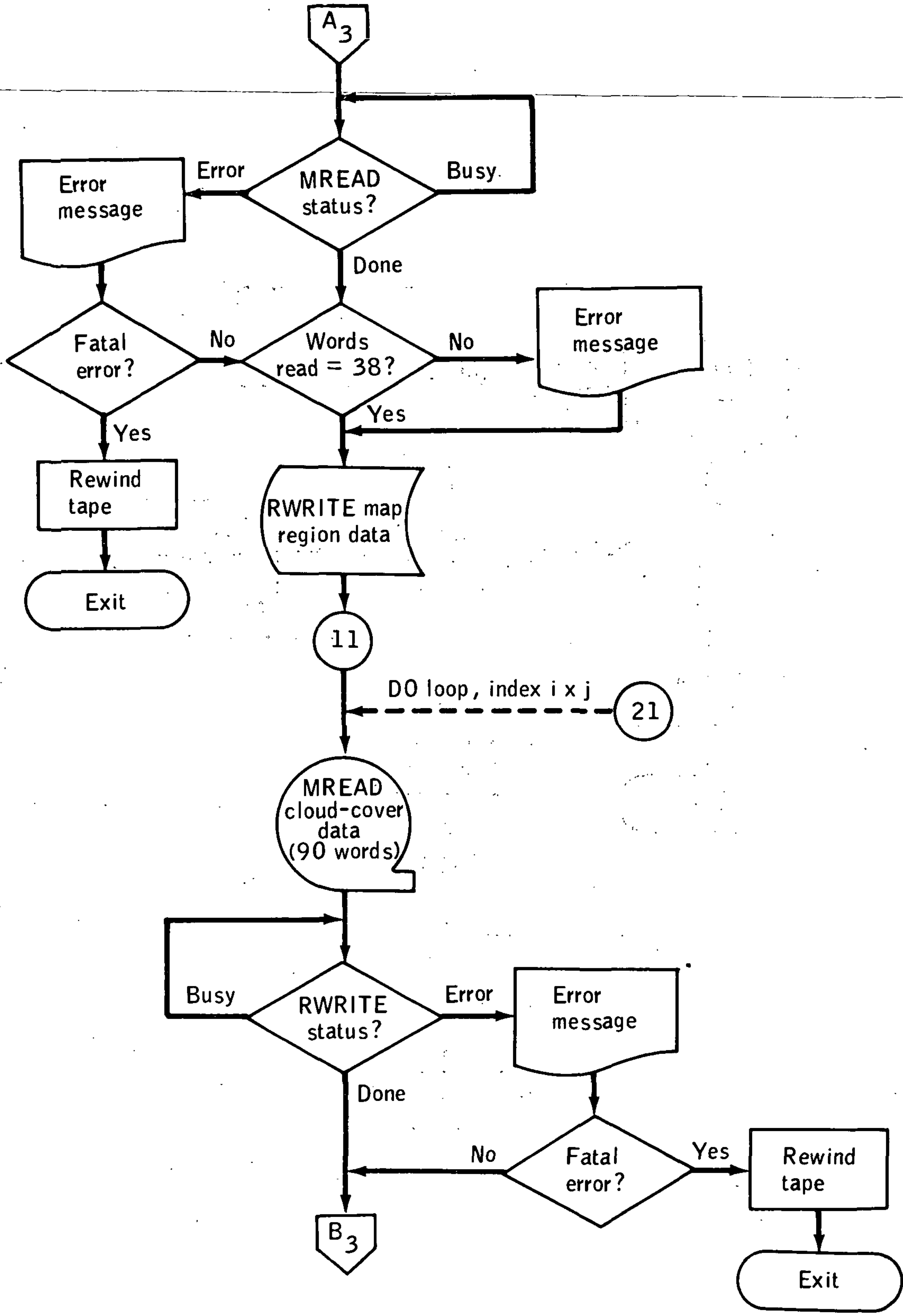
Subroutine CLOUD Computer Printout

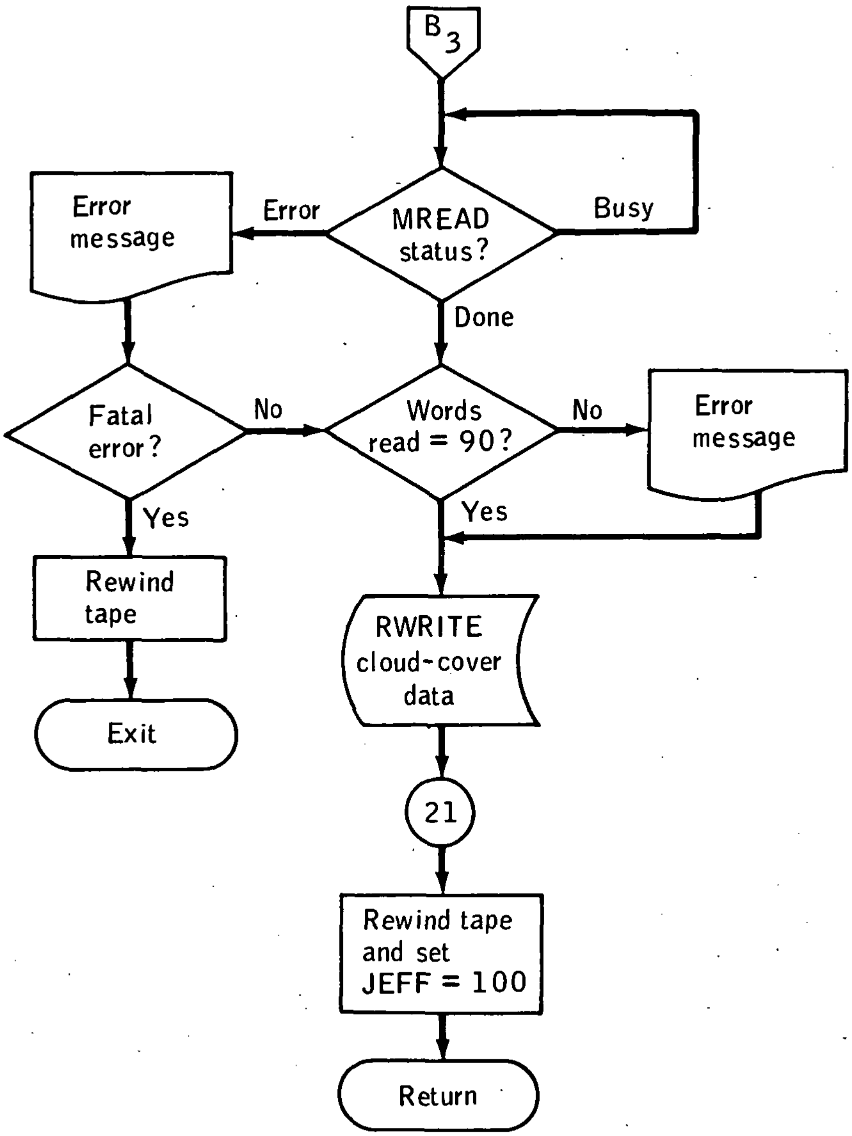
```
      SUBROUTINE CLOUD(MONTH,HOUR,PLAT,PLONG,UPROB,TPROB,SPROB,SCPROB,SC
     1ALE,ISCALE)
      DIMENSION MAPAD(70),MORGAD(12,29),MAP(38),ICLOUD(90),UPROB(5),TPRO
     1B(5,5),SPROB(5,5),SCPROB(5,5)
      DATA JEFF/0/
      IF (ISCALE .LT. 1 .OR. ISCALE .GT. 3) GO TO 5
      GO TO 4
    5 WRITE(6,707) ISCALE
      ISCALE=3
    4 IREGON=0
  707 FORMAT(///,' ISCALE =',I4,' NOT ALLOWED.  SET ISCALE = 3.')
      IF (JEFF.LT.50)CALL DRUMST(MAPAD,MORGAD,MAP,ICLOUD,JEFF)
      IF (ABS(PLAT) .GE. 70.0) GO TO 11
    1 ILAT=(PLAT+71.0)/2.0+0.5
      NADDR=MAPAD(ILAT)
      CALL RREAD(NADDR,MAP(1),38,ISTAT)
      ILONG=PLONG
      IF(ILONG.LT.0)ILONG=ILONG+360
      IF (ISTAT.GT.1) GO TO 998
    2 IF(ISTAT)998,3,2
    3 DO 7 I=2,38,2
      IF(MAP(I).LT.ILONG) GO TO 7
      IREGON=MAP(I-1 )
      GO TO 12
    7 CONTINUE
      GO TO 12
   11 IREGON=15
      IF(PLAT.LT.0.0) IREGON=24
   12 NADDR=MORGAD(MONTH,IREGON)
      CALL RREAD(NADDR,ICLOUD(1),90,ISTAT)
      XHOUR=HOUR
      IF (HOUR.LT.0.0) XHOUR=HOUR+24.
      IHOUR=(XHOUR+0.5)/3.0+1.0
      IF(IHOUR.GT.8)IHOUR=IHOUR-8
      IF (ISTAT.GT.1) GO TO 998
   14 IF(ISTAT)998,13,14
   13 WRITE(6,700)
      DO 17 I=1,5
      J=(I-1)*18+IHOUR
      UPROB(I)=ICLOUD(J)/100.
   17 WRITE(6,701) MONTH,HOUR,PLAT,PLONG,IREGON,I,UPROB(I)
      WRITE(6,703)
      DO 19 I=1,5
      DO 18 K=1,5
      L=(I-1)*18+9+(K-1)
      M=(I-1)*18+14+(K-1)
      TPROB(I,K)=ICLOUD(L)
      TPROB(I,K)=TPROB(I,K)/100.
      SPROB(I,K)=ICLOUD(M)
   18 SPROB(I,K)=SPROB(I,K)/100.
   19 WRITE(6,702) I,(TPROB(I,KK),KK=1,5),I,(SPROB(I,JJ),JJ=1,5)
      GO TO (30,31,32), ISCALE
   30 DO 33 I=1,5
      DO 33 K=1,5
   33 SCPROB(I,K)=TPROB(I,K)
      DIV=24.0
      IF (SCALE .GT. 36.0) GO TO 42
      IHEAD=6H  TIME
      IHEAD1=6H HRS.
      WRITE(6,704) IHEAD,SCALE,IHEAD1
      GO TO 34
   31 DO 35 I=1,5
      DO 35 K=1,5
   35 SCPROB(I,K)=SPROB(I,K)
      DIV=200.0
      IHEAD=6H SPACE
      IHEAD1=6H NM.
      WRITE(6,704) IHEAD,SCALE,IHEAD1
   34 DO 36 K=1,5
      DO 37 J=1,5
```

```
          IF (K .EQ. J) GO TO 38
          SCPROB(K,J)=SCALE*SCPROB(K,J)/DIV
          IF (SCPROB(K,J) .GT. UPROB(J) .AND. SCALE .GT. DIV) GO TO 39
          GO TO 37
   38     SCPROB(K,J)=1.-SCALE*(1.-SCPROB(K,J))/DIV
          IF (SCPROB(K,J) .LT. UPROB(J)) GO TO 39
   37     CONTINUE
          GO TO 36
   39     DO 40 M=1,5
   40     SCPROB(K,M)=UPROB(M)
   36     CONTINUE
          WRITF(6,705) (I,(SCPROB(I,J),J=1,5),I=1,5)
          GO TO 32
   42     WRITE(6,706)
   32     RETURN
  704     FORMAT(////,'    SCALED',A6,' CONDITIONAL PROBABILITIES',//,'  SCAL
         1E FACTOR IS',F9.2,A6,/, '  GIVEN    PROBABILITY OF OBSERVING CATEG
         2ORY',/,' CATEGORY      1       2       3       4       5',/)
  705     FORMAT(I6,3X,5F7.2)
  706     FORMAT(//,' PROBABILITIES ARE NOT TIME CONDITIONAL OVER 36 HOURS.
         1 USE UNCONDITIONAL PROBABILITIES PREVIOUSLY OUTPUT.')
  998     WRITE(6,750) NADDR,MONTH
          RETURN
  700     FORMAT(1H1, ' UNCONDITIONAL PROBABITITES OF OBSERVING CLOUD COVERA
         1GE FOR EACH CLOUD CATEGORY', //,2X,'MONTH   HOUR      LAT      LONG
         2   REGION  CATEGORY  PROBABILITY',/)
  701     FORMAT(2X,I3,3F9.2,I7,I8,8X,F5.2)
  702     FORMAT(1X,'/',I6,'     /',F6.2,4F7.2,'  /',I6,'     /',F6.2,4F7.2,'
         1 /')
  703     FORMAT(////, ' /',12X,'24-HOUR TIME CONDITIONAL',11X,'/',10X,'200
         1NM SPATIAL CONDITIONAL',/,' /',47X,'/',47X,'/',/,' /',47X,'/',47X,
         2'/',/,                         ' /  GIVEN   / PROBABILITY OF OBSERVI
         3NG CATEGORY  /  GIVEN   / PROBABILITY OF OBSERVING CATEGORY  /',/,
         4' / CATEGORY /     1       2       3       4       5   / CATEGORY /
         51      2       3       4       5   /',/,' /',10X,'/',36X,'/',10X,'/',
         636X,'/')
  750     FORMAT(1X,'ILLEGAL ADDRESS',I15,' MONTH IS ',I3,' HOUR IS ',F7.3)
          END
```

Subroutine DRUMST Flow Diagram




A3
MREAD status?
Error
Busy
Error message
Done
Fatal error?
No
Words read = 38?
No
Error message
Yes
Yes
Rewind tape
RWRITE map region data
Exit
11
DO loop, index i x j
21
MREAD cloud-cover data (90 words)
Busy
RWRITE status?
Error
Error message
Done
No
Fatal error?
Yes
Rewind tape
B3
Exit



B3
MREAD status?
Error
Busy
Error message
Done
Fatal error?
No
Words read = 90?
No
Error message
Yes
Yes
Rewind tape
Exit
RWRITE cloud-cover data
21
Rewind tape and set JEFF = 100
Return

Subroutine DRUMST Computer Printout

```
      SUBROUTINE DRUMST(MAPAD,MORGAD,MAP,ICLOUD,JEFF)
      DIMENSION MAPAD(70),MORGAD(12,29),MAP(38),MAP1(38),ICLOUD(90),IICL
     1OD(90)
      NEED=33980
      KYLE=0
  100 CALL RINIT(IBADDR,NWDS)
      DO 98 K=1,70
   98 MAPAD(K)=IBADDR+(K-1)*38
      KYLE=KYLE+1
      DO 97 I=1,12
      DO 97 J=1,29
   97 MORGAD(I,J)=IBADDR+70*38+(I-1)*90*29+(J-1)*90
      IF (NEED.LE.NWDS) GO TO 99
      IF (NEED.GT.NWDS.AND. KYLE.LT.1000) GO TO 100
      WRITE (6,850)
  850 FORMAT(1X,'HIGH SPEED DRUM TOO SMALL TO RUN JOB.  KILL.')
      GO TO 998
   99 ISTAT=0
      ISTAT1=0
      REWIND 1
      DO 11 I=1,70
      CALL MREAD(1,1,MAP(1),38,ISTAT,LEN)
    4 JSTAT1=ISTAT1+1
      GO TO (8,4,5,7,7,7,7,7,7),JSTAT1
    5 WRITE(6,802)NADDR,(MAP1(J),J=1,38)
      GO TO 998
    7 WRITE(6,803)ISTAT1
      GO TO 998
    8 JSTAT=ISTAT+1
   14 GO TO (18,8,15,16,17,17,17,17,17), JSTAT
   15 WRITE(6,800) I,(MAP(J),J=1,38)
      GO TO 998
   16 WRITE(6,801) I,(MAP(J),J=1,38)
      ISTAT=0
      GO TO 18
   17 WRITE(6,803) ISTAT
      GO TO 998
   18 DO 10 J=1,38
   10 MAP1(J)=MAP(J)
      NADDR=MAPAD(I)
      IF (LEN .NE. 38) WRITE(6,851) LEN,I,JEFF,(MAP1(J),J=1,38)
   11 CALL RWRITE(NADDR,MAP1(1),38,ISTAT1)
      DO 21 I=1,12
      DO 21 J=1,29
      CALL MREAD(1,1,ICLOUD(1),90,ISTAT,LEN)
   24 JSTAT1=ISTAT1+1
      GO TO (28,24,25,27,27,27,27,27,27),JSTAT1
   25 WRITE(6,702) NADDR,(IICLOD(N),N=1,90)
      GO TO 998
   27 WRITE(6,703) ISTAT1
      GO TO 998
   28 JSTAT=ISTAT+1
   34 GO TO (38,28,35,36,37,37,37,37,37), JSTAT
   35 IF (I .NE. 12  .AND. J .NE. 29) GO TO 39
      ISTAT=0
      GO TO 38
   39 WRITE(6,700) I,J,(ICLOUD(N),N=1,90)
      GO TO 997
   36 WRITE(6,701) I,J,(ICLOUD(N),N=1,90)
      ISTAT=0
      GO TO 38
   37 WRITE(6,703) ISTAT
      GO TO 998
   38 DO 30 K=1,90
   30 IICLOD(K)=ICLOUD(K)
      IF (LEN .NE. 90) WRITE(6,851) LEN,I,J,(IICLOD(K),K=1,90)
      NADDR=MORGAD(I,J)
```

```
 21     CALL RWRITE(NADDR,IICLOD(1),90,ISTAT1)
 997    REWIND 1
        JEFF=100
        RETURN
 998    REWIND 1
        CALL EXIT
 800    FORMAT(1X,'EOF MARK READ ON I =',I3,' MAP DATA IS',/,28I4,/,10I4)
 801    FORMAT(1X,'PARITY ERROR READ ON I =',I3,' MAP DATA IS',/,28I4,/,10
       1I4)
 802    FORMAT(1X,'ILLEGAL ADDRESS',I15,' ON LOOP',I3,' MAP DATA IS',/,28I
       14,/,10I4)
 803    FORMAT(1X,'ILLEGAL STATUS',I3,' MAP DATA IS',/,28I4,/,10I4)
 851    FORMAT(1X,'WORDS READ ERROR  LEN =',I3,' LOOP =',2I3,/,' DATA IS '
       1,5(/,18I4))
 700    FORMAT(1X,'EOF MARK READ I =',I3,' J =',I3,' CD ST DATA IS',5(/,18
       1I4))
 701    FORMAT(1X,'PARITY ERROR READ I =',I3,' J =',I3,' CD ST DATA IS',5(
       1/,18I4))
 702    FORMAT(1X,'ILLEGAL ADDRESS',I15,' LOOP',2I3,' CD ST DATA IS',5(/,1
       18I4))
 70 3   FORMAT(1X,'ILLEGAL STATUS',I3,' CD ST DATA IS',5(/,18I4))
        END
```

APPENDIX C

DESCRIPTION OF MAGNETIC TAPE STORAGE AND AN ALTERNATE METHOD FOR DATA RETRIEVAL

Page Intentionally Left Blank

APPENDIX C

DESCRIPTION OF MAGNETIC TAPE STORAGE AND AN ALTERNATE METHOD FOR DATA RETRIEVAL

MAGNETIC TAPE STORAGE

The magnetic tape produced by the Data Transfer Program is a seven-track, 800-bit/in. binary tape which contains 418 records. The first 70 records of 38 words each describe the map regions. The next 348 records of 90 words each contain the tabular cloud-cover statistical data.

In subroutine CLOUD, the vectors MAPAD and MORGAD are used to store the high-speed-drum access addresses. The vector MAPAD stores the map region data addresses, and MORGAD stores the cloud-cover statistical data by month and region addresses. The notation $MAPAD_i$; $i = 1, \ldots, 70$ refers to the ith swath (fig. 1). The notation $MORGAD_{jk}$; $j = 1, \ldots, 12$; $k = 1, \ldots, 29$ refers to the data for the jth month and the kth region. In subroutine CLOUD, ILAT corresponds to i, MONTH corresponds to j, and IREGON corresponds to k.

ALTERNATE DATA RETRIEVAL METHOD

An alternate method to the use of the high-speed drum is a magnetic-tape-search routine. The magnetic tape record number is stored in the vectors MAPAD and MORGAD. The magnetic-tape-search method consists of beginning at the load point of the tape and then skipping the necessary number of records to position the tape at the required record of information. After the record has been read, the tape is rewound to the load point.

The following relationships must be used in order to position the tape and read the required record. The consecutive numbers 1 to 70 are stored in the 70-word vector MAPAD, and the consecutive numbers 71 to 418 are stored in the 348-word vector MORGAD. Therefore, MAPAD(ILAT) in subroutine CLOUD refers to one of the first 70 records on the tape. Similarly, MORGAD(MONTH, IREGON) refers to one of the last 348 records on the tape. Then, specifically, MAPAD (33) refers to the 33rd record, MORGAD(1, 2) refers to the 72nd record, MORGAD(7, 28) refers to the 272nd record, and MORGAD(11, 29) refers to the 389th record on the tape. The variable NADDR in subroutine CLOUD contains the number of the record to be read. The call to RREAD is replaced by statements to skip NADDR - 1 records and read the next record into one of the vectors MAP or ICLOUD, verifying that the first word of the record is read into the first word of the vector (i.e., MAP(1) or ICLOUD(1)). Finally, the call to DRUMST and the subroutine DRUMST are eliminated.

Retrieval of data by this magnetic-tape-search method is a slow process, and better methods do exist. However, the existing computer program, with few changes, can be used in the interim during which a more efficient alternate routine can be programed.