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ENVPREDRSCHFAC COMPUTER PROGRAMMING NOTE  
JULY 1973

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OCEAN CLIMATOLOGY EXTRACTION AND  
ADJUSTMENT PROGRAM FOR THE  
MEDITERRANEAN

PROGRAM SOVEL

11 Jul 73

10 BY  
TAIVO/LAEVASTU

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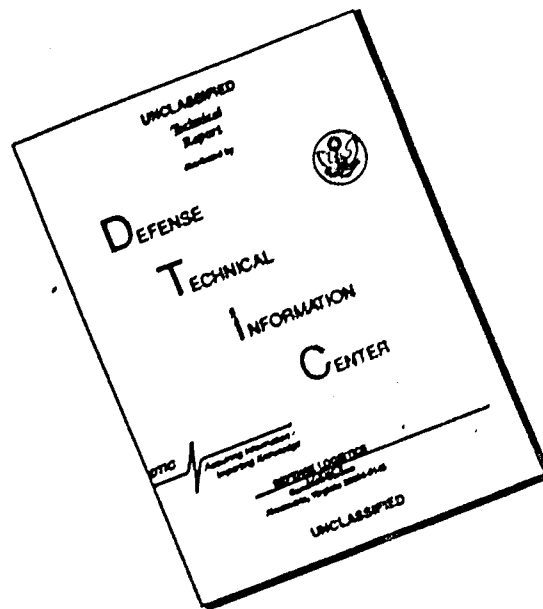


ENVIRONMENTAL PREDICTION RESEARCH FACILITY  
NAVAL POSTGRADUATE SCHOOL  
MONTEREY, CALIFORNIA 93940

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## 1. INTRODUCTION

SOVEL was written as part of the Ocean Thermal Structure Analysis package for Fleet Weather Central, Rota, Spain. Its primary purpose is to extract the temperature and salinity levels (by one-degree squares) in desired locations from an ocean climatology tape. It takes the corresponding analyzed sea-surface temperature and the mixed layer depth at given locations which are read from input cards and adjusts the upper standard levels to these parameters. An additional feature of the program is the adjustment of the temperature and salinity gradients below the mixed layer depth. These gradients can be sharp indeed in the Mediterranean. Their sharpness varies with various parameters and seasons and this variation has been taken directly into consideration with this program.

The program outputs are (a) the interpolated ocean (salinity and temperature) climatology (optional); (b) the tabulated adjusted ocean climatology (salinity and temperature) and sound speed (Figure 1); and (c) graphical printing of the above parameters (Figure 2).

The subroutines MEDCLM and INTRP were written by Mr. Roger Bauer and the climatology tape was also prepared by him. The program will run on any CDC computer (CDC 1604, 3100, 6500, etc.) with FORTRAN IV or FORTRAN Extended compiler.

- a -

|       |       |        |         |  |
|-------|-------|--------|---------|--|
| DATE  | 12    | 15     |         |  |
| LAT.  | 40.0N | LONG.  | 6.0E    |  |
| DEPTH | TEMP. | SALIN. | VELOC.  |  |
| 1     | 15.90 | 37.67  | 1513.50 |  |
| 30    | 15.90 | 37.67  | 1513.98 |  |
| 60    | 15.90 | 37.67  | 1514.47 |  |
| 80    | 15.90 | 37.67  | 1514.80 |  |
| 91    | 15.43 | 37.71  | 1513.59 |  |
| 103   | 14.96 | 37.76  | 1512.35 |  |
| 125   | 14.02 | 38.09  | 1510.13 |  |
| 150   | 13.38 | 38.17  | 1508.55 |  |
| 200   | 13.06 | 38.27  | 1508.44 |  |
| 250   | 13.07 | 38.36  | 1509.41 |  |
| 300   | 13.12 | 38.42  | 1510.47 |  |
| 400   | 13.17 | 38.46  | 1512.34 |  |
| 500   | 13.14 | 38.45  | 1513.88 |  |
| 600   | 13.07 | 38.45  | 1515.30 |  |
| 700   | 13.01 | 38.43  | 1516.73 |  |
| 800   | 12.96 | 38.43  | 1518.22 |  |
| 900   | 12.95 | 38.42  | 1519.84 |  |
| 1000  | 12.94 | 38.42  | 1521.46 |  |
| 1200  | 12.94 | 38.40  | 1524.77 |  |
| 1500  | 12.96 | 38.40  | 1529.85 |  |

Figure 1. Example of tabular printout of salinity, temperature and sound speed profile.

# GRAPHIC DISPLAY OF TEMPERATURE, SALINITY, AND VELOCITY CHANGE WITH DEPTH

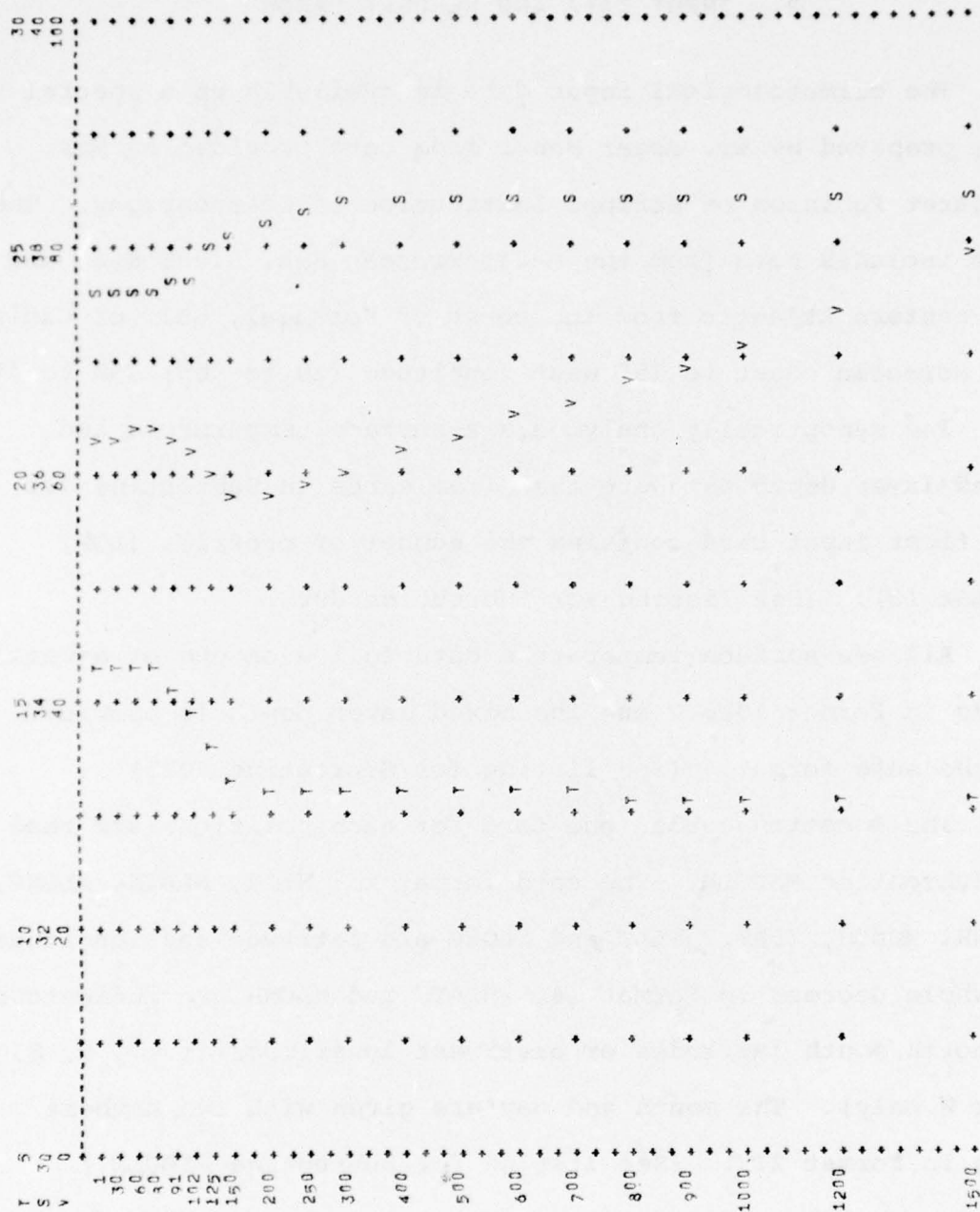


Figure 2. Example of graphical printing of a temperature, salinity and sound speed profile.

## 2. INPUT DATA AND REQUEST CARDS

The climatological input data is available on a special tape prepared by Mr. Roger Bauer from data provided by Mrs. Margaret Robinson of Scripps Institution of Oceanography. The tape includes data from the Mediterranean Sea, Black Sea, and the eastern Atlantic from the coast of Portugal, Gulf of Cadiz and Moroccan coast to 15° west longitude (20 to 50N; 15W to 45E).

The synoptically analyzed sea-surface temperature and mixed layer depth data are read from cards in Subroutine J02. The first input card contains the number of profiles (LOP, Format I3). (See listing for Subroutine J02.)

All sea-surface temperature data follow on one or several cards in Format 10F6.2 and the mixed layer depth is provided in the same format. (See listing for Subroutine J02.)

The location cards (one card for each position) are read in Subroutine MEDCLM. The card format is: NLAT, NLATH, NLONG, NLONH, MONTH, IDAY. NLAT and NLONG are latitude and longitudes in whole degrees in Format I4. NLATH and NLONH are indicators of north/south latitudes or east/west longitudes (i.e., N, S, E or W only). The month and day are given with two numbers each in Format 2I2. (See listing for Subroutine MEDCLM.)

### 3. LIST OF ESSENTIAL ABBREVIATIONS IN THE PROGRAM

|        |                                                                                                                    |
|--------|--------------------------------------------------------------------------------------------------------------------|
| ALAT   | Latitude of the profile                                                                                            |
| ALONG  | Longitude of the desired profile                                                                                   |
| DEDE   | Depth in kilometers                                                                                                |
| DEP    | Depth of the levels in meters                                                                                      |
| DEPTH  | Depth of a given level in upper layers (above<br>150 m)                                                            |
| DEPTH2 | Depth of a given level in lower layers                                                                             |
| EDP    | An additional depth counter in sorting of<br>the values of a profile                                               |
| ICNT   | A counter for records per page                                                                                     |
| KE     | A counter for the number of levels in a profile                                                                    |
| LINE   | Number of characters in a line in printing a<br>program                                                            |
| LLM    | A counter                                                                                                          |
| LO     | A counter for the number of profiles under<br>computation                                                          |
| LOP    | The number of profiles requested by the program                                                                    |
| ND     | The number of values for lower layers for which<br>annual mean values of salinity and temperature<br>are available |
| NLATH  | Indicator for north or south latitude                                                                              |
| NLONH  | Indicator east or west of longitude                                                                                |
| NNN    | A counter                                                                                                          |

|       |                                                |
|-------|------------------------------------------------|
| NS    | The number of levels in upper layers           |
| NUM   | A counter                                      |
| PLD   | Mixed layer depth in meters                    |
| SAL   | Salinity in 0/00                               |
| SALTD | Salinity at a given level in lower layers      |
| SALTS | Salinity at a given level in upper layers      |
| SDEP  | An intermediate storage for depth values       |
| SSAL  | An intermediate storage for salinity values    |
| SST   | Sea surface temperature in degree Celcius      |
| STEMP | An intermediate storage for temperature values |
| TEMP  | Temperature in degrees Celcius                 |
| TEMPD | Temperature at a given level in lower layers   |
| TEMPS | Temperature at a given level in upper layers   |
| VEL   | Sound velocity meters per second               |
| VOS   | An intermediate computation of sound speed     |
| VOP   |                                                |
| VOT   |                                                |
| VSI   |                                                |

#### 4. SUMMARY OF ROUTINES BY FUNCTION

- SOVEL            This is a control program which sets the counters LO (the number of profiles) and KE (the number of levels in any given profile). It calls several subroutines and checks at the end that all desired profiles have been computed.
- JO2             This subroutine reads from the cards the number of profiles required in the particular computation, and the sea-surface temperature and the mixed layer depth for each profile. Calls Subroutine MEDCLM.
- JO3             This subroutine computes the sound speed for each level in each profile. The latest version of the sound speed computation formula from SACLANT (NATO) ASW Research Center, La Spezia, Italy is used.<sup>1</sup>
- JO4             This subroutine first prints, in tabular form, the month, day, latitude, longitude and the depth, temperature, salinity and sound speed for each profile. Thereafter, the values are graphically printed out for checking and eventual subjective correction. (See Figures 1 and 2)

---

<sup>1</sup>Leroy, C. C. Development of simple equations for accurate and more realistic calculation of the speed of sound in sea water. SACLANT ASW Res. Centr. Technical Report 128, 1968.

SOR            This subroutine sorts the various levels in the profile after additional levels have been inserted below the mixed layer depth by Subroutine GRAD

GRAD           This subroutine adjusts the temperature and salinity gradients below the mixed layer depth and adds additional levels, if so required.

MEDCLM        This subroutine extracts climatological data from a special ocean climatology tape. The tape is sorted from north to south and west to east. Data to be printed is selected on the basis of a request card (locations on the card must be in the same order as the tape). The coordinate system used in sorting the tape is as follows: Longitudes are sorted starting with 0° east and ending with 0° west. Latitudes are sorted with all data from a given latitude appearing before any data from the next southern latitude.

## 5. LISTINGS OF PROGRAMS AND SUBROUTINES

Listings for each of the programs and subroutines are presented in the same order in which they are summarized in section 4.

# PROGRAM SOVEL

3200 FORTRAN (3,0)/RTS

05/25/73

```

PROGRAM SOVEL
DIMENSION TEMP(23),DEP(23),SAL(23),VEL(23),SST(25),PLD(25),EDP(25,
16),LINE(110),SDEP(32),STEMP(32),SSAL(32),NNN(25)
COMMON TEMP,DEP,SAL,VEL,SST,PLD,EDP,LINE,SDEP,STEMP,SSAL,NNN,NUM,L
10P,LT,LO,V7,KE,KEP,NUC,NLAT,NLATN,NLONG,NLONH,MONTH,IDAY
LO=1
KE=1
3 CALL JO2
CALL GRAN
CALL SOR
CALL JO3
CALL JO4
LO=LO+1
IF (LOP-LO)5,3,3
5 STOP
END

```

R  
9

## CONTROL PROGRAM

18  
20

# SUBROUTINE J02

3200 FORTRAN (3,0)/RTS

05/25/73

```

SUBROUTINE J02
  DIMENSION TEMP(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), EUP(25,
21 16), LINE(110), SDEP(32), STEMP(32), SSAL(32), NNN(25)
  COMMON TEMP, DEP, SAL, VEL, SST, PLD, EDP, LINE, SDEP, STEMP, SSAL, NNN, NUM, L
  10P, LT, LO, VO, KE, KEP, NUC, NLAT, NLATH, NLONG, NLOH, MONTH, IDAY
  C J02 READING OF VALUES
26
  C MAX 20 PROFILES, 27 DEPTHS EACH,
  C NUM IS NUMBER OF DEPTHS IN THE PROFILE
  C LOP IS NUMBER OF PROFILES
  C POC IS PROFILE NAME
  C DEP DEPTH IN METERS
  C TEMP IS TEMPERATURE IN DEGREES C
  C SAL IS SALINITY IN PROFILE
  C ALAT IS LATITUDE OF THE PROFILE
  C LTS IS TEMP. SCALE IN PLOTTING
  C LTS =10 THEN 0 TO 10 DEG, IF LTS=4 THEN 0 TO 25 DEG.
  C SST IS IN CENTIGRADE
  C PLD IS THE MIXED LAYER DEPTH IN METERS
  21 FORMAT(I3)
  23 FORMAT(10F6,2)
  IF(LO=1)40,40,28
  40 VO=1492.9
  READ 21, LOP
  READ 23, (SST(I), I=1, LOP) } Reading the number of profiles
  READ 23, (PLD(I), I=1, LOP) } and SST and MLD for these
                             } profiles.
  28 CONTINUE
  CALL MEDCLM ← Calling subroutine for extraction
  RETURN      of climatology from tape.
  END

```

# SUBROUTINE J03

3200 FORTRAN (3.0)/RTS

05/25/73

```

SUBROUTINE J03
  DIMENSION TEMP(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), EDP(25,
16), LINE(110), SDEP(12), STEMP(32), SSAL(32), NNN(25)
  COMMON TEMP, DEP, SAL, VEL, SST, PLD, EDP, LINE, SDEP, STEMP, SSAL, NNN, NUM, L
10P, LT, LD, VO, KE, KEP, NUC, NLAT, NLATH, NLONG, NLONH, MONTH, IDAY
C J03 COMPUTATION
  ALAT = FLOAT((NLAT-5)/10)
  DO 30 I=1, KEP
    IF (DEP(I)-1.) 500, 500, 501
    500 DEP(I) = 1.
    501 DEDE = DEP(I)/1000.
    VOT = 3*(TEMP(I)-10.)-0.006*(ABS(TEMP(I)-10.)**2)-0.04*(ABS(
1TEMP(I)-18.)**2)+1.2*(SAL(I)-35.)-0.01*((TEMP(I)-18.)*(SAL(I)-35.)
2)+DEP(I)/61.
    VOP=0.1*ABS(DEDE)**2+(0.0002*ABS(DEDE)**2)*(ABS(TEMP(I)-18.)
1**2)+(0.1*DEDE*ALAT)/90.
    VOS = 2.0E-7*TEMP(I)*(ABS(TEMP(I)-10.)**4)
    VSI = 0.0015*(ABS(SAL(I)-35.)**2)*(1-DEDE )
30 VEL(I)=VO+VOT +VOP +VOS +VSI
  RETURN
END

```

COMPUTATION OF  
SOUND SPEED

## SUBROUTINE J04

3200 FORTRAN (3.0)/RTS

05/25/73

```

SUBROUTINE J04
  INTEGER XFIXF
  DIMENSION TEMP(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), EDP(25,
16), LINE(110), SDEP(32), STEMP(32), SSAL(32), NNN(25)
  COMMON TEMP, DEP, SAL, VEL, SST, PLD, EDP, LINE, SDEP, STEMP, SSAL, NNN, NUM, L
10P, LT, LO, VJ, KE, KEP, NUC, NLAT, NLATH, NLONG, NLONH, MONTH, IDAY
  ALAT = FLOATF((NLAT-5)/10)
  ALONG = FLOATF((NLONG-5)/10)
C F04 PRINTING OF VALUES
42 FORMAT (25X, 5HDEPTH, 6X, 5HTEMP, 6X, 4HSALIN, 6X, 6HVELOC, /)
43 FORMAT (25X, F5.0, 6X, F5.2, 6X, F5.2, 6X, F7.2)
251 FORMAT(25X, 4HLAT, F7.1, A2, 4X, 5HLONG, F7.1, A2, /)
253 FORMAT(1H1, 25X, 4HDATE, 16, 4X, 16, /)
  KKE=KE
  PRINT 253, MONTH, IDAY
  PRINT 251, ALAT, NLATH, ALONG, NLONH
  PRINT 42
  PRINT 43, (DEP(I), TEMP(I), SAL(I), VEL(I), I=KE, KEP)
C GRAPHING OF VALUES
50 FORMAT (1H1, 20X, 75H GRAPHIC DISPLAY OF TEMPERATURE, SALINITY, AND
1VELOCITY CHANGE WITH DEPTH, /)
261 FORMAT(15X, 1HT, 3X, 1H5, 18X, 2H10, 18X, 2H15, 18X, 2H20, 18X, 2H25, 18X, 2H30
1)
52 FORMAT(15X, 1HS, 2X, 2H30, 18X, 2H32, 18X, 2H34, 18X, 2H36, 18X, 2H38, 18X,
12H40)
53 FORMAT(15X, 1HV, 3X, 1H0, 18X, 2H20, 18X, 2H40, 18X, 2H60, 18X, 2H80, 17X,
13H100)
  PRINT 50
  PRINT 261
  PRINT 52
  PRINT 53
  IT=1HT
  IS=1HS
  IV=1HV
  IX=1HX
  IY=1HY
  IBLANK=1H
  IP=1H+
  IM=1H-
  IZ=1HZ
  DO 64 I=1, 100
64 LINE(I)=IM
  DO 66 I=10, 100, 10
66 LINE(I)=IP
  PRINT 113, (LINE(I), I=1, 100)
113 FORMAT(19X, 1H+, 100A1)
  DO 68 I=1, 99
68 LINE(I)=IBLANK
71 I=KE
  IF(DEP(I)-150, )75, 75, 72
72 DEUI=DEP(I)-DEP(I-1)
  IF(DEP(I)-1500, )730, 730, 720
720 KL=XFIXF(DEUI/100.)
  GO TO 740
730 KL=XFIXF(DEUI/50.)
740 KAK=1
73 PRINT 200, (LINE(L), L=1, 99)
200 FORMAT(19X, 1H+, 99A1, 1H+)
  IF(KAK=KL)74, 75, 75
74 KAK=KAK+1

```

70

75

78

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83

84

Printing of  
D, T, S, V in  
tabular  
form

Graphing of  
D, T, S, V  
by printer

# SUBROUTINE J04 (continued)

```

      GO TO 73
C     TEMPERATURE
      75 DO 210 L=10,100,10
      210 LINE(L)=IP
           J=XFIXF(TEMP(I)*4,)-20
           IF(J)82,82,83
      82 J=1
      83 IF(J-100)85,84,84
      84 J=99
      85 LINE(J)=IT
C     SALINITY
           M=XFIXF(SAL(I)*10,-300,
           IF(M)92,92,93
      92 M=1
      93 IF(M-100)95,94,94
      94 M=99
      95 IF(M-J)97,96,97
      96 LINE(M)=IX
           GO TO 100
      97 LINE(M)=IS
C     VELOCITY
      100 JJ=XFIXF(VEL(I)-1450)
           IF(JJ)102,102,103
      102 JJ=1
      103 IF(JJ-100)105,104,104
      104 JJ=99
      105 IF(JJ-M)108,106,108
      106 LINE(JJ)=IY
           GO TO 110
      108 LINE(JJ)=IV
      110 IF(J-JJ)114,112,114
      112 LINE(J)=IZ
           IF(DEP(I))400,400,114
      400 DEP(I)=1.
      114 IDEP=XFIXF(DEP(I))
           PRINT 310, IDEP, (LINE(I), I=1,99)
      310 FORMAT(10X, I8, 1X, 1H+.99A1, 1H+)
           DO 333 I=1,99
      333 LINE(I)=IBLANK
           KE=KE+1
           IF(KE-KEP)71,71,345
      345 KE=KKE
           RETURN
           END

```

Graphing  
by printer

## SUBROUTINE SOR

3200 FORTRAN (3.0)/RTS

05/25/73

```

SUBROUTINE SOR
  DIMENSION TEMP(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), ELP(25,
16), LINE(110), SDEP(32), STEMP(32), SSAL(32), NNN(25)
  COMMON TEMP, DEP, SAL, VEL, SST, PLD, EDP, LINE, SDEP, STEMP, SSAL, NNN, NUM, L
10P, LT, LO, VO, KE, KEP, NUC, NLAT, NLATH, NLONG, NLOH, MONTH, IDAY
  LU=0
  IF (EDP(LO,2)=100,)3,4,4
2  NNN(LO)=NUM+2
  GO TO 8
3  IF (EDP(LO,5))5,5,6
5  NNN(LO)=NUM+3
  GO TO 8
6  IF (NUC=1)17,16,17
16 NNN(LO)=NUM+3
  GO TO 8
17 NNN(LO)=NUM+4
8  KKE=KE
  NNN=KKE+NNN(LO)-1
  KEP=NNN
  LLM=NNN(LO)
  DO 105 I=1,LLM
    IF (I-1)11,11,12
11  SDEP(I)=0,1
    STEMP(I)=SST(LO)
    KE=KE+1
    GO TO 105
12  IF (LU=1)14,40,13
13  IF (LU=3)40,70,40
14  IF (DEP(KE)=PLD(LO)) 15,21,20
15  IF (DEP(KE+1)=PLD(LO))24,23,22
20  SSAL(I-1)=SAL(KE-1)
    SDEP(I)=PLD(LO)
    STEMP(I)=SST(LO)
    SSAL(I)=SAL(KE-1)
    LU=1
    GO TO 105
21  SSAL(I-1)=(SAL(KE-1)+SAL(KE))/2,
    SSAL(I)=SSAL(I-1)
    SDEP(I)=PLD(LO)
    STEMP(I)=SST(LO)
    LU=1
    KE=KE+1
    GO TO 105
22  SSAL(I-1)=(SAL(KE-1)+SAL(KE))/2,
    SSAL(I)=SSAL(I-1)
    STEMP(I)=SST(LO)
    SDEP(I)=DEP(I)
    SDEP(I+1)=PLD(LO)
    STEMP(I+1)=STEMP(I)
    SSAL(I+1)=SSAL(I)
    KE=KE+1
    I=I+1
    LU=1
    GO TO 105
23  SSAL(I-1)=(SAL(KE-1)+SAL(KE)+SAL(KE+1))/3,
    SSAL(I)=SSAL(I-1)
    SSAL(I+1)=SSAL(I)
    STEMP(I)=SST(LO)
    STEMP(I+1)=SST(LO)
    SDEP(I)=DEP(KE)

```

SORTING OF T, S VALUES IN  
CORRECT DEPTH SEQUENCE

SUBROUTINE SOR (continued)

```

      SDEP(I+1)=PLD(L0)
      I=I+1
      KE=KE+2
      LU=1
      GO TO 105
24  SSAL(I+1)=(SAL(KE-1)+SAL(KE)+SAL(KE+1))/3.
      SSAL(I)=SSAL(I-1)
      SSAL(I+1)=SSAL(I)
      STEMP(I)=SST(L0)
      STEMP(I+1)=SST(L0)
      STEMP(I+2)=SST(L0)
      SSAL(I+2)=SSAL(I)
      SDEP(I)=DEP(KE)
      SDEP(I+1)=DEP(KE+1)
      SDEP(I+2)=PLD(L0)
      IF(DEP(KE+2)-PLD(L0))28,26,25
25  KE=KE+2
      GO TO 27
26  KE=KE+3
27  I=I+2
      LU=1
      GO TO 105
28  SDEP(I+2)=DEP(KE+2)
      STEMP(I+3)=SST(L0)
      SSAL(I+3)=SSAL(I)
      SDEP(I+3)=PLD(L0)
      IF(DEP(KE+3)-PLD(L0))32,30,29
29  KE=KE+3
      GO TO 31
30  KE=KE+4
31  I=I+3
      LU=1
      GO TO 105
32  SSAL(I+1)=(SAL(KE-1)+SAL(KE)+SAL(KE+1)+SAL(KE+2)+SAL(KE+3))/5.
      SSAL(I)=SSAL(I-1)
      SSAL(I+1)=SSAL(I)
      SSAL(I+2)=SSAL(I)
      SSAL(I+3)=SSAL(I)
      SSAL(I+4)=SSAL(I)
      STEMP(I+4)=SST(L0)
      SDEP(I+3)=DEP(KE+3)
      IF(DEP(KE+4)-PLD(L0))36,34,33
33  SDEP(I+4)=PLD(L0)
      KE=KE+4
      GO TO 35
34  SDEP(I+4)=DEP(KE+4)
      KE=KE+5
35  I=I+4
      LU=1
      GO TO 105
36  SDEP(I+4)=DEP(KE+4)
      SSAL(I+5)=SSAL(I+4)
      STEMP(I+5)=SST(L0)
      IF(PLD(L0)-200.)362,361,361
361 PLD(L0)=200.
362 SDEP(I+5)=PLD(L0)
      IF(DEP(KE+5)-PLD(L0))38,38,37
37  KE=KE+5
      GO TO 39
38  KE=KE+6
39  I=I+5
      LU=1

```

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SUBROUTINE SOR (continued)

```

      GO TO 105
40  IF (EDP(L0,1))70,70,41
41  IF (EDP(L0,2)-100.)42,44,44
42  IF (EDP(L0,5))43,43,45
43  SDEP(I)=EDP(L0,1)
    SDEP(I+1)=EDP(L0,3)
    STEMP(I)=EDP(L0,2)
    STEMP(I+1)=EDP(L0,4)
    SDI=(SSAL(I-1)-SAL(KE))/4.
    SSAL(I)=SSAL(I-1)-SDI
    SSAL(I+1)=SSAL(I-1)-2.*SDI
    I=I+1
    LU=3
    GO TO 105
44  SDEP(I)=EDP(L0,1)
    SDEP(I+1)=EDP(L0,3)
    SDEP(I+2)=EDP(L0,5)
    STEMP(I)=EDP(L0,2)-100.
    STEMP(I+1)=EDP(L0,4)
    STEMP(I+2)=EDP(L0,6)
    SDI=(SSAL(I-1)-SAL(KE))/4.
    SSAL(I)=SSAL(I-1)-SDI
    SSAL(I+1)=SSAL(I-1)-2.*SDI
    SSAL(I+2)=SSAL(I-1)-3.*SDI
    I=I+1
    KE=KE+1
    LU=3
    GO TO 105
45  SDEP(I)=EDP(L0,1)
    SDEP(I+1)=EDP(L0,3)
    SDEP(I+2)=EDP(L0,5)
    STEMP(I)=EDP(L0,2)
    STEMP(I+1)=EDP(L0,4)
    STEMP(I+2)=EDP(L0,6)
    SDI=(SSAL(I-1)-SAL(KE))/4.
    SSAL(I)=SSAL(I-1)-SDI
    SSAL(I+1)=SSAL(I-1)-2.*SDI
    SSAL(I+2)=SSAL(I-1)-3.*SDI
    I=I+2
    LU=3
    GO TO 105
70  SDEP(I)=DEP(KE)
    IF (STEMP(I-1)+0.05-TEMP(KE))310,311,311
310 STEMP(I)=STEMP(I-1)+0.05
    GO TO 312
311 STEMP(I)=TEMP(KE)
312 IF (SSAL(I-1)-0.25-SAL(KE))314,314,313
313 IF (I-2)314,314,401
401 IF (KE+2-LLM)402,402,314
402 SSAL(I)=(SSAL(I-2)+SAL(KE+2))/2.
    GO TO 315
314 SSAL(I)=SAL(KE)
315 KE=KE+1
105 CONTINUE
    KE=KKE
    L=1
    DO 201 I=KE,VMV
      TEMP(I)=STEMP(L)
      DEP(I)=SDEP(L)
      SAL(I)=SSAL(L)
      L=L+1
201 CONTINUE
    RETURN
    END

```

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# SUBROUTINE GRAD

1200 FORTRAN (1, 1) 1975

12/25/73

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SUBROUTINE GRAD
  DIMENSION TE(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), EDP(25),
  1 L(11), SHP(12), TEMPI(32), SSAL(32), NNVT(25)
  COMMON TEND, DEP, SAL, VEL, SST, PLD, EDP, INE, SDE, STIMP, SSAL, NNVT, L
  1 OP, LT, L1, VO, KE, KEP, NUC, NLAT, NLATH, LONG, NLONG, MONTH, IDAY
  J=LJ
  NUC=0
  DO 115 I=KEP+4EP
    IF (DEP(I)-PLD(I))3,40,115
  40 NUC=1
  3 IF (DEP(I+1)-PLD(I))115,41,4
  41 NUC=1
  4 IF (DEP(I)+20.-PLD(I))16,6,5
  5 IF (DEP(I)+10.-PLD(I))13,25,25
  C BETWEEN LEVEL BELOW AND OLD SMALL DISTANCE
  6 IF (PLD(I)-90.)17,8,8
  7 IF (SST(I)-18.)19,8,9
  8 DIF=(SST(I)-TEMP(I+2))/4.
    IF (DIF+0.1)80,80,81
  80 IF (SAL(I-1)-SAL(I))83,82,82
  82 DIF=0.
    GO TO A1
  83 DIF=-0.08
  81 DDF=(DEP(I+2)-PLD(I))/4.
    EDP(J,1)=PLD(J)+DDF
    EDP(J,3)=PLD(J)+2.*DDF
    EDP(J,5)=PLD(J)+3.*DDF
    EDP(J,2)=SST(J)+DIF+100.
    EDP(J,4)=SST(J)+2.*DIF
    EDP(J,6)=SST(J)+3.*DIF
    GO TO 115
  9 DIF=(SST(J)-TEMP(I+2))/4.
    IF (DIF+0.1)90,90,91
  90 IF (SAL(I-1)-SAL(I))93,92,92
  92 DIF=0.
    GO TO 91
  93 DIF=-0.08
  91 DDF=(DEP(I+2)-PLD(I))/4.
    EDP(J,1)=PLD(J)+DDF
    EDP(J,3)=PLD(J)+2.*DDF
    EDP(J,5)=PLD(J)+3.*DDF
    IF (DIF)120,120,121
  120 DIF=0.
    GO TO 11
  121 IF (DIF-4.)10,10,11
  10 EDP(J,2)=SST(J)+2.*100.
    EDP(J,4)=SST(J)+2.*DIF
    EDP(J,6)=SST(J)+2.*DIF
    GO TO 11
  11 EDP(J,2)=SST(J)+DIF+100.
    EDP(J,4)=SST(J)+2.*DIF
    EDP(J,6)=SST(J)+3.*DIF
    GO TO 11
  C BETWEEN LEVEL ABOVE AND OLD SMALL DISTANCE.
  25 IF (PLD(I)-90.)28,26,26
  26 IF (SST(I)-18.)27,27,28
  27 DDF=(DEP(I+1)-PLD(I))/4.
    EDP(J,1)=PLD(J)+DDF
    EDP(J,3)=PLD(J)+2.*DDF
    EDP(J,5)=PLD(J)+3.*DDF

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SUBROUTINE GRAD (continued)

```
      DIF=(SST(J)-TEMP(I+1))/4.  
      IF(DIF+0.1)270,270,271  
270 IF(SAL(I-1)-SAL(I))273,272,272  
272 DIF=0.  
      GO TO 271  
273 DIF=-0.08  
271 EDP(J,2)=SST(J)-DIF-0.25*DIF  
      EDP(J,4)=EDP(J,2)-DIF-0.1*DIF  
      EDP(J,6)=EDP(J,4)-0.8*DIF  
      GO TO 115  
28 DDF=(DEP(I+1)-PLD(J))/4.  
      EDP(J,1)=PLD(J)+DDF  
      EDP(J,3)=PLD(J)+2.*DDF  
      EDP(J,5)=PLD(J)+3.*DDF  
      DIF=(SST(J)-TEMP(I+1))/4.  
      IF(DIF+0.1)280,280,281  
280 IF(SAL(I-1)-SAL(I))283,282,282  
282 DIF=0.  
      GO TO 281  
283 DIF=-0.08  
281 EDP(J,2)=SST(J)-DIF-0.3*DIF  
      EDP(J,4)=EDP(J,2)-DIF-0.1*DIF  
      EDP(J,6)=EDP(J,4)-0.7*DIF  
      GO TO 115  
C HLD APPROX. BETWEEN TWO LEVELS.  
35 DDF=(DEP(I+1)-PLD(J))/3.  
      EDP(J,1)=PLD(J)+DDF  
      EDP(J,3)=PLD(J)+2.*DDF  
      EDP(J,5)=0.  
      DIF=(SST(J)-TEMP(I+1))/3  
      EDP(J,2)=SST(J)-DIF-0.3*DIF  
      EDP(J,4)=EDP(J,2)-DIF  
115 CONTINUE  
      RETURN  
      END
```

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# SUBROUTINE MEDCLM

3200 FORTRAN (3.0)/RTS

05/25/73

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SUBROUTINE MEDCLM
PROGRAM MEDCLM RETRIEVES CLIMATOLOGY DATA FROM TAPE,
TAPE IS SORTED NORTH TO SOUTH, WEST TO EAST.
DATA TO BE PRINTED IS SELECTED ON BASIS OF REQUEST CARD.
REQUEST CARDS MUST BE IN SAME ORDER AS TAPE.

THE COORDINATE SYSTEM USED IN SORTING THE TAPE IS AS FOLLOWS
LONGITUDES ARE SORTED WEST TO EAST STARTING WITH 0E AND ENDING WITH 0W
LATITUDES ARE SORTED NORTH TO SOUTH WITH ALL DATA FOR A LATITUDE
APPEARING BEFORE ANY DATA FOR THE NEXT MORE SOUTHERN LATITUDE

DIMENSION TEMP(23), DEP(23), SAL(23), VEL(23), SST(25), PLD(25), EDP(25,
15), LINE(110), SDEP(32), STEMP(32), SSAL(32), NNN(25)
COMMON TEMP, DEP, SAL, VEL, SST, PLD, EDP, LINE, SDEP, STEMP, SSAL, NNN, NUM, L
10P, LT, LO, VO, KE, KEP, NUC, NLAT, NLATH, NLONG, NLOH, MONTH, IDAY
DIMENSION DEPTH(6), TEMPS(12,6), SALTS(6)
DIMENSION DEPH2(17), TEMPD(17), SALTD(17)

C
C INITIALIZE COUNTERS
C ICNT IS COUNTER FOR RECORDS PER PAGE.
C NLAT, NLATH ARE THE REQUESTED LATITUDE DESIGNATORS.
C SET LOGICAL UNITS FOR I/O, IR=CARD READER, IT=TAPE UNIT,
C JLAT=JLONG=0 $ IT=1
C READ A REQUEST CARD
C READ 1001, NLAT, JLATH, NLONG, NLOH, MONTH, IDAY
1000 FORMAT(I4, A1, I4, A1, 2I2)
C CHECK FOR THE LAST CARD
C IF (NLATH.EQ.1H ) STOP
C CHECK LATITUDE AND LONGITUDE
C MLAT=NLAT
C IF (NLATH.EQ.1HN) 21, 22
21 MLAT=-MLAT
22 MLAT=900+MLAT
C MLONG=NLONG $ IF (NLOH.EQ.1HW) 23, 24
23 MLONG=3600-NLONG
24 IF (MLAT-JLAT) 40, 30, 50
30 IF (MLONG-JLONG) 40, 100, 50
C CARD OUT OF SEQUENCE PRINT ERROR MESSAGE, READ NEXT CARD.
40 PRINT 1001, NLAT, NLATH, NLONG, NLOH, MONTH, IDAY
1001 FORMAT(22H CARD OUT OF SEQUENCE, 3X, I4, A1, I4, A1, 2I2)
C RETURN
C READ NEW TAPE RECORD, AND CHECK AGAINST REQUEST CARD
C
C 50 READ (IT, 1002) LAT, LATH, LONG, LOH, NS, NN,
1(DEPTH(1), (TEMP(S(J,1), J=1,12), SALTS(1), I=1,VS),
2(DEPH2(1), TEMPD(1), SALTD(1), I=1,ND)
1002 FORMAT(2(I4, A1), 2I5/6(F8, 2, 13F6, 2, 2X/), 17(F8, 2, 2I6, /))
BACKSPACE IT
NUM = NS + ND
KEP = NUM

C
C CHECK TAPE RECORD LAT AND LONG,
C JLAT = LAT $ IF (LATH.EQ.1HN) 51, 52
51 JLAT=-JLAT
52 JLAT=900+JLAT
C JLONG = LONG
C IF (LOH.EQ.1HW) 55, 25
55 JLONG=3600-JLONG $ GO TO 25
C NEED TAPE STATUS CHECK ON ABOVE TAPE I/O.
C

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SUBROUTINE MEDCLM (continued)

```
C      HAVE PROPER TAPE RECORD, WHICH PRINT REQUEST
100  CALL INTRP(10NTH,1DAY,TEMP5,TEMPD,'S,ND,TEMP)
      DO 400 I=1,NS
      DEP(I)=DEPTH(I)
400  SAL(I)=SALTS(I)
      IF(NS,GE,6)GO TO 411
      NS = NS +1
      DO 410 I=NS,23
410  DEP(I)=SAL(I)=TEMP(I)=0.
      RETURN
411  NDC=ND+6
      DO 500 I=7, NDC
      DEP(I)=DEPH2(I-6)
500  SAL(I)=SALTD(I-6)
      NDC=NDC+1
      DO 510 I= NDC,23
510  DEP(I)=SAL(I)=TEMP(I)=0.
      RETURN
      END
```

## SUBROUTINE INTRP

3200 FORTRAN (3.0)/HTS

05/25/73

```

SUBROUTINE INTRP(MONTH, IDAY, TEMPS, TEMPD, NS, ND, T)
  DIMENSION TEMPD(17), TEMPS(12,6), T(23), A(5), B(5), DAMTH(12),
  1, CO(12,5), SI(12,5)
  DATA(DAMTH=31.,28.,31.,30.,31.,30.,31.,31.,30.,31.,30.,31.),
  1(RAD30=.5235987755), (CO(1)=0.)
  C COMPUTE CONSTANTS USED IN HARMONIC ANALYSIS
  IF(CO(1).NE.0.) 150,90
  90 DO 100 I=1,12      & DO 100 K=1,5
    ANG=FLOAT(I-1)*RAD30+FLOAT(K)
    CO(I,K)=COSF(ANG)
  100 SI(I,K)=SINF(ANG)
  C FIND ANGLE IN ANNUAL CYCLE FOR THE GIVEN DAY
  150 ANG=((FLOAT(IDAY-15)-DAMTH(MONTH))/DAMTH(MONTH)+FLOAT(MONTH))*
  1RAD30
  C COMPUTE THE 12 HARMONIC TERMS AND THEN FIND THE TEMP ON THE GIVEN DAY
  DO 400 I=1,NS
    AO=A6=0.
    DO 160 K=1,5
      A(K)=B(K)=0.
      DO 160 J=1,12
        A(K)=A(K)+TEMPS(I,J)*CO(I,K)
  160 B(K)=B(K)+TEMPS(I,J)*SI(I,K)
      DO 200 J=1,12
        AO=AO+TEMPS(I,J)
        IF(I/2*2.EQ.I) 170,180
  170 A6=A6-TEMPS(I,J)
        GO TO 200
      180 A6=A6+TEMPS(I,J)
  200 CONTINUE
      T(J)=(AO+A6*COSF(ANG*6))/12.
      DO 240 I=1,5
        AN=ANG+FLOAT(I)
  240 T(J)=T(J)+(A(I)*COSF(AN)+B(I)*SINF(AN))/6.
        IF(J.EQ.1) 400,241
  241 IF(T(J).GT.T(J-1)) 245,400
  245 M=MONTH
        IF(IDAY.GT.15) 260,250
  250 M=M-1
        IF(M.GT.0) 260,255
  255 M=12
  260 IF(TEMPS(M,J).GT.TEMPS(M,J-1)) 400,270
  270 M=M+1
        IF(M.LT.12) 278,275
  275 M=1
  278 IF(TEMPS(M,J).GT.TEMPS(M,J-1)) 400,280
  280 T(J)=T(J-1)
  400 CONTINUE
      DO 420 I=1,10
  420 T(I+6)=TEMPD(I)
      DO 500 I=1,10
        IF(T(I+6).GT.T(6)) 450,510
  450 T(I+6)=T(6)
  C CHANGED I TO I+6 IF 420, 420+2,450
  500 CONTINUE
  510 RETURN
  END

```