NOAA Western Region Computer Programs and
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DEPARTMENT OF COMMERCE
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THE SWAB (SPECTRAL WAVE AND BAR) PROGRAM

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Salt Lake City, Utah
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noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / National Weather Service

PREFACE

This Western Region publication series is considered as a subset of our Technical Memorandum series. This series will be devoted exclusively to the exchange of information on and documentation of computer programs and related subjects. This series was initiated because it did not seem appropriate to publish computer program papers as Technical Memoranda; yet, we wanted to share this type of information with all Western Region forecasters in a systematic way. Another reason was our concern that in the developing AFOS-era there will be unnecessary and wasteful duplication of effort in writing computer programs in National Weather Service (NWS). Documentation and exchange of ideas and programs envisioned in this series hopefully will reduce such duplication. We also believe that by publishing the programming work of our forecasters, we will stimulate others to use these programs or develop their own programs to take advantage of the computing capabilities AFOS makes available.

We solicit computer-oriented papers and computer programs from forecasters for us to publish in this series. Simple and short programs should not be prejudged as unsuitable.

The great potential of the AFOS-era is strongly related to local computer facilities permitting meteorologists to practice in a more scientific environment. It is our hope that this new series will help in developing this potential into reality.

NOAA Western Region Computer Programs and Problems NWS WRCP

1 Standard Format for Computer Series. June 1979.
2 AFOS Crop and Soil Information Report Program. Ken Mielke, July 1979.
3 Decoder for Significant Level Transmission of Raobs. John Jannuzzi, August 1979.
4 Precipitable Water Estimate. Elizabeth Morse, October 1979.
5 Utah Recreational Temperature Program. Kenneth M. Labas, November 1979.
6 Normal Maximum/Minimum Temperature Program for Montana. Kenneth Mielke, December 1979.
7 Plotting of Ocean Wave Energy Spectral Data. John R. Zimmerman, December 1979.
8 Raob Plot and Analysis Routines. John Jannuzzi, January 1980.

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Service
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THE SWAB PROGRAM

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I. General Information

A. Summary:

The SWAB (Spectral Wave and Bar) program allows the wave forecast technique developed by the School of Oceanography at Oregon State University to be used in AFOS. The program is essentially a revised and condensed version of a FORTRAN IV program written by Dr. David Enfield, a 1974 graduate of Oregon State University (OSU). Variables describing the history of one, two, or three fetchs are used by SWAB to produce a forecast out to 48 hours of significant wave height and period at a given point. This forecast, along with data from the National Ocean Survey's Tidal Current Tables, is used to predict bar conditions at a time of maximum ebb current at several locales. The wave forecast method of Pierson, Neumann, and James is the basis for SWAB. An AFOS Procedure, entitled "SWAB", manages the machine functions needed to run the program.

B. Environment:

SWAB is designed to run in the background of a Data General Eclipse S-230 minicomputer. The program is completely compatible with AFOS. The language used to write SWAB is the Data General version of FORTRAN IV.

C. References:

Pierson, W., G. Neumann, and R. James, 1955: Practical Methods for Observing and Forecasting Ocean Waves by Means of Wave Spectra and Statistics. U. S. Navy Hydrographic Office, Pub. No. 603, 284 pp.

School of Oceanography, Oregon State University 1973 (Revised Sept. 1977): Operations Manual Semi-Automated Wave Forecasting System. NOAA Sea Grant No. 04-3-158-4, OSU Marine Science Center, Newport, Oregon, 94 pp. (Note: This NWS WRCP is intended to serve as a supplement to the OSU manual.)

Shields, Gordon C. and Gerald B. Burdwell, 1970: Western Region Sea State and Surf Forecaster's Manual. ESSA Technical Memorandum WBTM WR-51, 68 pp.

Tidal Current Tables (Present Year)--Pacific Coast of North America and Asia. U. S. Department of Commerce, NOS, 250 pp (approx.).

II. Application

A. Complete Program Description:

The need for timely and accurate wave forecasts should be obvious. Such forecasts are provided by SWAB. Because of SWAB, most of the features of Dr. Enfield's program can be accessed through AFOS, rather than relying on a time-share hook-up to OSU.

Program input is supplied by the forecaster and data files stored in the minicomputer. Fetch history data are entered into SWAB by means of an AFOS preformat. Randomly organized RDOS files supply NOS tidal current data and coefficients based on wave verification statistics. The real-time clock and calendar are the sources of date/time group information.

SWAB solves the Pierson-Neumann-James equations as interpreted by Dr. Enfield. These equations are commonplace in literature describing the Pierson-Neumann-James theory and, hence, will not be repeated here.

An elaborate branching routine determines the generation distance associated with each frequency increment and time step. The duration of each fetch component is a by-product of the routine.

SWAB uses the fetch-duration data, and other variables describing each fetch history, to construct an array of wave energy reaching the forecast point. An element of this array is denoted by E(i,j) where _i_ represents the forecast period and _j_ the frequency increment. Routines of varying length are used to construct the energy array: the number of steps and equations used are determined by the duration of wave-generating winds, the boundary conditions imposed on each fetch, and the number and types of fetchs used.

The forecast significant wave height and wave period, denoted by H1/3 and PER, respectively, are defined by the following equations:

$$H1/3_i = 2.83 \left[\sum_{j=1}^{17} E(i,j)\right]^{0.5} \qquad i=1,9 \qquad (1)$$

and

$$PER_i = \left[\sum_{j=1}^{17} E(i,j) / \sum_{j=1}^{17} \{E(i,j)\cdot[0.01j+0.03]^2\}\right]^{0.5} \qquad i=1,9. \qquad (2)$$

The results of equations (1) and (2) are, in turn, used as predictors (symbolized by X) in equations of the form,

$$Y(i) = A1 + A2X + A3X^2 \qquad i=1,9 \qquad (3)$$

where the coefficients are the results of the verification of wave forecasts.

The adjusted forecasts of significant wave height and period resulting from the repeated use of equation (3) are stored in a randomly organized RDOS file. These forecasts are also used as input to help solve the equations which forecast bar conditions.

The principal bar equations solved by SWAB are shown below:

$$A = \left[(1\text{-}4VB)/(3.03TDEEP) \right]^{0.5} \tag{4}$$

$$LBAR = LD \left[(1+A)/2 \right]^{2} \tag{5}$$

$$HBAR = HD \left[2/A(1+A) \right]^{0.5} \tag{6}$$

$$HBREAK = 0.09LBAR \tag{7}$$

where:

HBAR is the wave height on the bar due to the ebb current;

HBREAK is the breaking height of the bar wave;

HD is the deep water wave height;

LBAR is the wave length due to the ebb current;

LD is the deep water wave length;

TDEEP is the deep water period;

and VB is the ebb current velocity.

Forecast bar conditions at five locations within 100 nautical miles of the forecast point at a time of maximum ebb current are stored in a randomly organized RDOS file.

No special routines are used by the program.

B. Machine Requirements:

The executable save files consume 78 blocks of disk storage. However, less than 16K of core is required to execute SWAB because of the use of the CHAIN routine. The SWAB program files are listed below:

NAME & TYPE	WORD SIZE	FILE CONTENTS
Input File:		
MWOSUFETCH	2560-4608	Fetch history and ebb-current data.
Data Files Used for Input:		
MWOSUSBHB	187	Coefficients for
MWOSUSBSF	187	EKA and SFO areas.
Executable Save Files:		
MWOSUSWL1.SV	12288	Main program (1 of 3).
MWOSUSWL2.SV	13824	Main program (2 of 3).
MWOSUSWL3.SV	13824	Main program (3 of 3).
Temporary Data Files:		
MWOSUDTG	9	Date/Time group.
MWOSUHOLD.01	19	Ebb current information.
MWOSUHOLD.02	132	Date information.
MWOSUHOLD.03	204	Fetch history.
MWOSUHOLD.04	1564	Energy array.
Output Files:		
MWOSUSBAR.<HB or SF>	985	Bar forecast.
MWOSUSWV.<HB or SF>	834	Wave forecast.

The "SWAB" AFOS procedures also make use of disk storage. The RDOS files used by the "SWAB" procedure are as follows:

NAME	WORD SIZE	PURPOSE OF FILE
MWOSUSI01	755	Description of procedure.
MWOSUSI02	1007	Preformat completion instructions.
MWOSUSI03	1007	SWAB program information.
MWOSUSRUN	139	Runs SWAB program; creates needed output files.
MWOSUSDEL	73	Deletes I/O files and temporary data files created by SWAB.
MWOSUSI04	503	End of procedure message which shows AFOS data base locations of SWAB output.

The run time varies according to the number and type of fetchs used as input: the range is from 21 to 50 seconds, the average being 30 seconds. The "SWAB" AFOS procedure reserves 90 seconds for run time, just in case foreground is swamped with user requests.

Channels 20 through 25, inclusive, are used at one time or another by SWAB.

C. Structure of Software:

SWAB is actually three separate FORTRAN IV programs that appear to function as one main program. These three programs are linked together by calls to the CHAIN command: when CHAIN is invoked, the core image of the currently executing program is overwritten by the program whose filename is referenced in the CHAIN command message.

Each program in SWAB is designed to perform a major function of the OSU wave forecast technique: the first program, whose FORTRAN IV filename is MWOSUSWL1.FR, places the ebb current data and fetch histories into temporary "hold" files in addition to performing some simple calculations; the second program--MWOSUSWL2.FR--performs the generation distance routine and constructs the array of wave energy reaching the forecast point; program three--MWOSUSWL3.FR--creates the two output files which contains forecasts of significant wave data and bar conditions.

SWAB makes frequent calls to subroutines. Most of the subroutines are designed to handle redundant tasks peculiar to SWAB; however, the subroutine that determines the date/time group is designed for use in other programs.

The FORTRAN IV files for each subroutine are found in Section III, Part E (Complete Program Listing). A short description of each subroutine follows.

Subroutine CDATE serves as an encoder. CDATE converts a time represented by month, day, and hour to absolute time, i.e., the number of hours since 00Z January 1st. Several calls to CDATE are made by MWOSUSWL1.SV during the construction of the temporary data files containing ebb current and fetch history data.

Subroutine DVAR determines values for dependent variables that appear in two routines used to build the wave energy array. DVAR is called during the execution of MWOSUSWL2.SV.

Subroutine MDH is a decoder. MDH converts absolute time to its corresponding month, day, and hour. It is used by MWOSUSWL3.SV in providing forecast times to the output messages.

Subroutine ZERO sets all elements of a 10x17 array to zero. It is used to initialize the arrays of wave energy and fetch element duration. ZERO is called during the execution of MWOSUSWL2.SV.

Subroutine DIG provides date/time group information to an output message header by interrogating the real-time calendar and clock. DIG is called by MWOSUSWL3.SV when the output files are formatted.

D. Data Base:

The files used in connection with SWAB are contained in a list found in Section II, Part B (Machine Requirements). A description of the SWAB data files follow.

MWOSUFETCH is an RDOS file created by entering data into an AFOS preformat via an ADM keyboard. In accordance with instructions given in the body of the preformat, ebb current data are entered into the first page of the preformat while fetch histories are entered on succeeding pages. The preformat is shown in Figure 1.

Input data files MWOSUSBHB and MWOSUSBSF contain the coefficients needed to solve equation (3). These files also contain coefficients for the time and velocity of the ebb current at the forecast point and four nearby points. Each forecast point is identified by a file element containing the name of the station. File MWOSUSBHB contains these data for the northern coast of California (where the entrance of Humboldt Bay is the forecast point). MWOSUSBSF contains similar data for the central coast of California (the Golden Gate entrance being the forecast point). Both files are shown in Figures 2a and 2b.

The temporary data files created by SWAB hold data created by one program for use in another program that is CHAINed into core. These files are deleted at the conclusion of the SWAB run by a command in the "SWAB" AFOS procedure. Examples of these temporary files are shown in Figures 3a - 3e, inclusive.

The output files for the wave forecast (MWOSUSWV.<HB or SF> where HB stands for Humboldt Bay and SF denotes the Golden Gate) and bar forecast (MWOSUSBAR.<HB or SF>) are created by MWOSUSWL3.SV. A command in the "SWAB" AFOS procedure deletes these files after their contents have been stored in the AFOS data base. Examples of the output files are shown in Figures 4 and 5.

III. <u>Procedures</u>

A. Initiation of Program:

B. Input Required:

C. Output:

Assuming that the "SWAB" AFOS procedure is governing the machine functions needed to run the program, the operations of SWAB will now be described. Part G of this Section displays the files used by the "SWAB" procedure and a listing of procedure steps.

The SWAB procedure is initiated by typing "SWAB" on an ADM keyboard, then striking the [ENTER] key. An information file (MWOSUSIØ1-- Figure G2) is subsequently displayed on the ADM screen. The next keyboard command ([I] followed by [ENTER]) will bring forth an ADM display (filename MWOSUSIØ2--Figure G3) which lists the keyboard functions needed to enter forecaster input into SWAB. At this point, the forecaster retrieves the preformat (Figure 1), completes the header block, then inserts the information per instructions. The proper format is provided by the brackets in the preformat. The completed message is stored in the AFOS data base by striking [ENTER]. The next procedure command ([D], followed by [ENTER]) displays the input message for review, prior to its move into the RDOS environment. The input message can be edited at this point if errors in data entry are found. A sample input message is shown in Figure G4.

The actual execution of the SWAB program is started by typing [R], the [ENTER] on the ADM keyboard. Several things happen following this command:

1. The input message is moved from the AFOS data base into the RDOS environment.

2. Another information file (MWOSUSIØ3--Figure G5) is displayed on the ADM screen.

3. An indirect command (@DPOF:MWOSUSRUN@) is given which causes the following CLI commands to be executed:

```
DIR DPOF;CRAND MWOSUS<BAR.<HB,SF>,WV.<HB,SF>>;^
MWOSUSWL1;APPEND SFOOMRBAR MWOSUSBAR.<HB,SF>;^
APPEND SFOOMRSWV MWOSUSWV.<HB,SF>; DIR DPO
```

4. A 90-second pause is placed in the procedure in order to give SWAB plenty of runtime.

At the end of the 90-second pause, the SWAB output files (SFOOMRSWV and SFOOMRBAR) are stored in the AFOS data base. The output messages, examples of which are shown in Figures G6 and G7, are displayed on the ADM screen. In addition, copies of the output messages are printed on the PPM for use by the forecaster.

Another indirect command (@DPOF:MWOSUSDEL@) deletes all unnecessary files created during the procedure. The contents of MWOSUSDEL are as follows:

```
DIR DPOF;DELETE (MWOSU-.- MWOSUS***/N^
MWOSUSWL-.-/N,SFOOMR***);DIR DPO
```

An end-of-procedure file (MWOSUSI04--Figure G8) displayed on the ADM screen marks the end of "SWAB" AFOS procedure. The AFOS data base locations for the output from SWAB are shown in the file contents.

D. Cautions or Restrictions on Program Use:

When the two SWAB output files are moved from the RDOS environment into the AFOS data base, two END OF FILE error messages are printed on the dasher. As of this writing, no apparent harm is done to AFOS by such transactions.

E. Complete Program Listing:

```
TYPE MWOSUSWL1.FR
C ** OREGON STATE UNIVERSITY WAVE PREDICTION PROGRAM - PART 1 OF 3 **
C ***** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/23/79 ******
      DIMENSION IMDY(3)
      COMMON/FD1/AS2(3),DADS(3),D1(3),DFR1(3),DFR2(3),DUR(3)
      COMMON/FD2/TMC(3),TOB(3),U(3),VF1(3),VF2(3),K(3),N(3)
      COMMON/BLK/MON(13,2)
C INITIALIZE VARIABLES...
      DATA MON/1,2,3,4,5,6,7,8,9,10,11,12,13,0,31,59,90,120,151,181
     1,212,243,273,304,334,365/AS2/3*0./DADS/3*0./D1/3*0./DFR1
     2/3*0./DFR2/3*0./DUR/3*0./TMC/3*0./TOB/3*0./U/3*0./VF1
     3/3*0./VF2/3*0./K/3*1/N/3*0/
C OPEN THE FILE CONTAINING EBB TIDE AND FETCH PARAMETERS...
      CALL OPEN(20,"MWOSUFETCH",1,IER,4535)
      READ(20,1)IDFP,NEM,NED,NEH,VEBB,ILEAP,NIM,NID,NIH
    1 FORMAT(////////60X,I1//////23X,I2,8X,I2,23X,I2/58X,F3.1
     1//////////46X,I1/36X,I2,8X,I2,15X,I2)
      IF(NIM.EQ.12.AND.NEM.EQ.1)NEM=13
      CALL CDATE(NEM,NED,NEH,TEBB)
      CALL CDATE(NIM,NID,NIH,TI)
C LEAP YEAR ROUTINE...
      IF(TI.LT.1176..AND.TI.GT.1656.)GO TO 2
      DO 100 I=3,13
         MON(I,2)=MON(I,2)+ILEAP
  100 CONTINUE
      IF(TI.LT.1416..OR.NIM.EQ.2)GO TO 2
      TI=TI+FLOAT(ILEAP)*24.
      TEBB=TEBB+FLOAT(ILEAP)*24.
C WRITE DATA INTO "HOLD" FILES FOR USE IN FUTURE PARTS OF THE PROGRAM...
    2 CALL OPEN(21,"MWOSUHOLD.01",3,IER,19)
      WRITE(21,3)TEBB,TI,VEBB,IDFP
    3 FORMAT(1X,2F6.0,F4.1,I2)
      CALL OPEN(22,"MWOSUHOLD.02",3,IER,132)
      WRITE(22,4)((MON(I,J),I=1,13),J=1,2)
    4 FORMAT(1X,13I5)
      CALL OPEN(23,"MWOSUHOLD.03",3,IER,204)
```

Program MWOSUSWL1.FR -- Page 1 of 2.

```
      DO 200 NF=1,3
C INPUT FETCH DATA...
      READ(20,5)NTM,NTD,NTH,IU,ID,IDF1,IDF2,IFL1,IFL2,AS1,AS2(NF),L
    5 FORMAT(36X,I2,8X,I2,15X,I2/46X,I2/46X,I2//21X,I4,13X,I4/
     1/21X,I4,13X,I4//21X,F4.2,13X,F4.2//68X,I1)
      U(NF)=IU
      DUR(NF)=ID
      DFR1(NF)=IDF1
      DFR2(NF)=IDF2
      FL1=IFL1
      FL2=IFL2
      TII=TI
      IF(NTM.EQ.12.AND.NIM.EQ.1)TII=TI+8760
      CALL CDATE(NTM,NTD,NTH,TT)
      IF(L.EQ.0)GO TO 10
      IF(NF.LE.2)GO TO 7
      READ(20,6)NCM,NCD,NCH
    6 FORMAT(/36X,I2,8X,I2,15X,I2)
      GO TO 9
    7 READ(20,8)NCM,NCD,NCH,N(NF)
    8 FORMAT(/36X,I2,8X,I2,15X,I2/46X,I1)
    9 IF(NTM.EQ.12.AND.NCM.EQ.1)NCM=13
      CALL CDATE(NCM,NCD,NCH,TMC(NF))
      GO TO 12
   10 IF(NF.GT.2)GO TO 12
      READ(20,11)N(NF)
   11 FORMAT(//46X,I1)
   12 VF2(NF)=((DFR1(NF)+FL1)-(DFR2(NF)+FL2))/DUR(NF)
      IF(TMC(NF).NE.0.)GO TO 13
      VF1(NF)=(DFR1(NF)-DFR2(NF))/DUR(NF)
      GO TO 14
   13 TMC(NF)=TMC(NF)-TT
      VF1(NF)=DFR1(NF)/TMC(NF)
   14 D1(NF)=DFR1(NF)+FL1
      DADS(NF)=(AS2(NF)-AS1)/(D1(NF)-DFR2(NF))
      TOB(NF)=TII-TT
      IF(NF.GT.2.OR.N(NF).EQ.0)GO TO 16
      NF=NF+1
      READ(20,15)K(NF)
   15 FORMAT(////////64X,I1)
      NF=NF-1
  200 CONTINUE
   16 WRITE(23,17)((AS2(NF),DADS(NF),D1(NF),DFR1(NF),DFR2(NF),DUR(NF)
     1,TMC(NF),TOB(NF),U(NF),VF1(NF),VF2(NF),N(NF),K(NF)),NF=1,3)
   17 FORMAT(F6.2,F11.8,3F6.0,F4.0,F6.0,F5.0,F4.0,2F5.1,2I2)
      CALL RESET
C CALL THE NEXT PART OF THE PROGRAM INTO CORE...
      CALL CHAIN("MWOSUSWL2.SV",IER)
      END
```

Program MWOSUSWL1.FR -- Page 2 of 2.

```
TYPE MWOSUSWL2.FR
C ** OREGON STATE UNIVERSITY WAVE PREDICTION PROGRAM - PART 2 OF 3 **
C ****** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/21/79 *****
      DIMENSION D(10,17),E(10,17),U(3)
C INITIALIZE VARIABLES...
      CALL ZERO(D)
      CALL ZERO(E)
      PI2=6.2831853
C OPEN THE INPUT FILE...
      CALL OPEN(20,"MWOSUHOLD.03",1,IER,204)
      DO 100 II=1,3
         I=II
         IM=I-1
         READ(20,1)AS2,DADS,D1,DFR1,DFR2,DUR,TMC,TOB,U(I),VF1,VF2,
     1   NI,KI
    1    FORMAT(F5.2,F11.8,3F6.0,F4.0,F6.0,F5.0,F4.0,2F5.1,2I2)
         IF(KI.EQ.1)U1=U(I)
         IF(I.LT.2)GO TO 3
         IF(KI.EQ.1)GO TO 2
         U1=U(IM)
         GO TO 3
    2    CALL ZERO(D)
    3    DO 200 JJ=1,10
            J=JJ
            DO 300 K=1,17
               FRQ=FLOAT(K)*0.01+0.03
```

Program MWOSUSWL2.FR -- Page 1 of 4.

```
C THE ROUTINE WHICH DETERMINES THE GENERATION DISTANCE ASSOCIATED
C WITH THE K-TH FREQUENCY AND J-TH FORECAST STARTS HERE AND CON-
C TINUES THROUGH STATEMENT 28.
        CG=1.515/FRQ
        DG=CG*TOB
        T1=(DFR1-DG)/(VF1-CG)
        T2=(D1-DG)/(VF2-CG)
        TP=DUR
        IF(TMC.NE.0.)TP=TMC
        IF(CG.GT.VF2.AND.T2.GT.DUR)GO TO 300
        IF(CG.LT.VF1.AND.T1.GT.TP)GO TO 39
        IF(CG.GT.VF1.AND.T1.LT.0.)GO TO 39
        IF(CG.LT.VF2.AND.T2.LT.0.)GO TO 300
        IF(TMC.EQ.0.)GO TO 10
        IF(TOB.GE.TMC.AND.TOB.LE.DUR)GO TO 25
 10     IF(CG.LE.VF2.OR.CG.GE.VF1)GO TO 15
        IF(T1.GE.0.0.OR.T2.GE.0.)GO TO 13
 11     T2=DUR
 12     T1=0.
        GO TO 28
 13     IF(T1.GE.0.)GO TO 14
        T1=DUR
        GO TO 28
 14     IF(T2.LT.0.)T2=DUR
        GO TO 28
 15     IF(CG.LE.VF1.OR.CG.GE.VF2)GO TO 18
        IF(T1.GT.DUR.AND.T2.GT.DUR)GO TO 11
        IF(T1.GT.DUR)GO TO 12
        IF(T2.GT.DUR)T2=0.
        GO TO 28
 18     IF(CG.LE.VF1.OR.CG.LE.VF2)GO TO 22
        IF(T1.LE.DUR.OR.T2.GE.0.)GO TO 20
        T1=DUR
 19     T2=0.
        GO TO 28
 20     IF(T2.LT.0.)GO TO 19
        IF(T1.GT.DUR)T1=DUR
        GO TO 28
 22     IF(T1.LT.0.0.AND.T2.GT.0.)GO TO 11
        IF(T1.LT.0.)GO TO 12
        IF(T2.GT.DUR)T2=DUR
        GO TO 28
 25     IF(T1.GE.TOB.OR.T1.LE.0.)GO TO 26
        T2=TOB
        GO TO 28
 26     IF(T2.GE.TOB.OR.T2.LE.0.)GO TO 27
        T1=TOB
        GO TO 28
 27     T1=TOB
        T2=0.
 28     DRTN=ABS(T1-T2)
```

Program MWOSUSWL2.FR -- Page 2 of 4.

```
      TTT=T1
      IF(T2.GT.T1)TTT=T2
      DS=CG*(TOB-TTT)-DFR2
      AS=AS2-DADS*DS
      IF(AS.LT.0.05)AS=0.05
C GO TO 29 IF THIS FETCH IS A CONTINUATION OF A PREVIOUS FETCH...
      IF(KI.EQ.0)GO TO 29
      D(J,K)=DRTN
      GO TO 36
 29   IF(U(I).LE.U1)GO TO 35
C IF THE WIND INCREASES IN THE CONTINUATION FETCH, FIND THE GENERA-
C TION DISTANCE NEEDED TO GENERATE THE INCOMING ENERGY AT THE NEW
C WIND SPEED.  THE ROUTINE TO DO THIS EXTENDS THROUGH STATEMENT 34...
      S1=E(J,K)/0.666
      U2=U(I)/1.94
      F=D(J,K)/FRQ*2805.
      IF(F.GE.0.00001.OR.S1.GE.0.001)GO TO 30
      D(J,K)=0.
      GO TO 35
 30   W=FRQ*PI2
      FAC=(7.09E-08)*(W**4)*U2**2.221
      FCRIT=FAC**(-1./0.889)
      DO 103 L=1,20
 31      IF(F.LE.FCRIT)GO TO 32
         F=F*0.1
         GO TO 31
 32      CALL DVAR(F,W,WM4,U2,S2)
         DS=S1-S2
         IF(ABS(DS).LT.0.01)GO TO 34
         DSDF=(0.889*WM4/W**4-0.4165)*S2/F
         DF=DS/DSDF
         DFM=-DF
         IF(DFM.LE.F)GO TO 33
         F=F*0.5
         GO TO 103
 33      F=F+DF
103   CONTINUE
 34   D(J,K)=F*FRQ/2805.
 35   D(J,K)=D(J,K)+DRTN
```

Program MWOSUSWL2.FR -- Page 3 of 4.

```
C DETERMINE THE GENERATED BAND ENERGY LEAVING THE CURRENT FETCH.
C ALSO, CONVERT SPEEDS AND DISTANCES TO (FT/SEC) AND (FT) REPECTIVELY.
C THE ROUTINE TO DO THESE THINGS EXTENDS TO THE STEP JUST AHEAD
C OF STATEMENT 300...
  36            UI=U(I)/1.94
                F=D(J,K)/FRQ*2805.
                DE=0.
                IF(F.LT.0.00001)GO TO 37
                W=FRQ*PI2
                DW=0.01*PI2
                CALL DVAR(F,W,WM4,UI,S)
                DE=S*DW*10.7
  37            IF(KI.EQ.0)GO TO 38
                E(J,K)=E(J,K)+AS*DE
                GO TO 300
  38            ASDE=AS*DE
                IF(E(J,K).LE.ASDE)E(J,K)=ASDE
 300          CONTINUE
  39          TOB=TOB+6.
 200        CONTINUE
            IF(NI.EQ.0)GO TO 40
 100  CONTINUE
C WRITE THE DERIVED ENERGIES INTO A "HOLD" FILE...
  40  CALL OPEN(21,"MWOSUHOLD.04",3,IER,1564)
      WRITE(21,41)((E(I,J),I=1,10),J=1,17)
  41  FORMAT(1X,5F9.2)
      CALL RESET
C CALL THE NEXT PART OF THE PROGRAM INTO CORE...
      CALL CHAIN("MWOSUSWL3.SV",IER)
      END
R
```

Program MWOSUSWL2.FR -- Page 4 of 4.

```
TYPE MWOSUSWL3.FR
C ** OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM - PART 3 OF 3 *
C ****** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/21/79 *****
      DIMENSION E(10,17),HT(10),PD(10),ID(3),NAME(20,5)
      DIMENSION AH(3),AP(3),TFAC(5),VFAC(5),XT(10)
C OPEN INPUT FILES CONTAINING DATA COMPILED IN THE EARILER PARTS OF
C THE PROGRAM...
      CALL OPEN(20,"MWOSUHOLD.01",1,IER,19)
      READ(20,1)TEBB,TI,VEBB,IDFP
    1 FORMAT(2F6.0,F4.1,I2)
      CALL OPEN(21,"MWOSUHOLD.04",1,IER,1564)
      READ(21,2)((E(I,J),I=1,10),J=1,17)
    2 FORMAT(5F9.2)
C DETERMINE THE CURRENT DATE/TIME GROUP...
      CALL DTG(ID(1),ID(2),ID(3))
C OPEN THE PROPER I/O FILES...
      IF(IDFP-1)3,3,4
    3 CALL OPEN(22,"MWOSUSWV.HB",3,IER,834)
      CALL OPEN(23,"MWOSUSBHB",1,IER,187)
      CALL OPEN(24,"MWOSUSBAR.HB",3,IER,985)
      GO TO 5
    4 CALL OPEN(22,"MWOSUSWV.SF",3,IER,834)
      CALL OPEN(23,"MWOSUSBSF",1,IER,187)
      CALL OPEN(24,"MWOSUSBAR.SF",3,IER,985)
    5 READ(23,6)(((NAME(I,J),I=1,20),TFAC(J),VFAC(J)),J=1,3)
     1,(AH(K),K=1,3),(AP(L),L=1,3)
     2,(((NAME(I,J),I=1,20),TFAC(J),VFAC(J)),J=4,5)
    6 FORMAT(20A1,F4.0,F4.1/20A1,F4.0,F4.1/20A1,F4.0,F4.1
     1,2(F6.1,F7.2,F8.3)/20A1,F4.0,F4.1/20A1,F4.0,F4.1)
C WRITE THE HEADER FOR THE "SIGNIFICANT WAVE HEIGHT/WAVE PERIOD"
C MESSAGE...
      WRITE(22,7)(ID(I),I=1,3),(NAME(J,3),J=1,20)
    7 FORMAT(1H0,"SFOCHGOSU          EWOUS00 KSFO ",3A2/
     1/8X,"FORECAST OF SIGNIFICANT WAVE HEIGHT AND WAVE PERIOD"
     2/24X,20A1//17X,"MON  DAY  HR.   SIG. HT.   PERIOD"
     3/26X,"(GMT)     (FT)       (SEC)"/)
      DO 100 II=1,10
         I=II
C COMPILE THE SUMS...
         FSUM=0.
         SUM=0.
         HT(I)=0.0
         PD(I)=0.0
         DO 200 J=1,17
            SUM=SUM+E(I,J)
            RJ=J
            FRQ=RJ*0.01+0.03
            FSUM=FSUM+E(I,J)*FRQ*FRQ
  200    CONTINUE
```

Program WSOSUSWL3.FR -- Page 1 of 3.

```
      IF(FSUM.LE.0.0.OR.SUM.LT.0.001)GO TO 8
C DETERMINE THE SIGNIFICANT WAVE HEIGHT (H1/3) AT TIME "I"...
      HS=2.83*SQRT(SUM)
C DETERMINE THE DEEP WATER WAVE PERIOD AT TIME "I"...
      PER=SQRT(SUM/FSUM)
C MINIMIZE THE BIAS OF "HS" AND "PER" BY MAKING THESE TERMS PREDICTORS
C IN REGRESSION EQUATIONS WHOSE COEFFICIENTS WERE OBTAINED FROM
C VERIFICATION STATISTICS...
      HT(I)=AH(1)+HS*(AH(2)+HS*AH(3))
      PD(I)=AP(1)+PER*(AP(2)+PER*AP(3))
C CREATE A TIME ARRAY FOR THE PORTION OF THIS PROGRAM WHICH DEALS
C WITH EBB CURRENT EFFECTS...
    8 RIM1=I-1
      XT(I)=TI+RIM1*6.
      CALL MDH(XT(I),NTM,NTD,NTH)
      IF(PD(I).GT.18.)PD(I)=18.
      IF(HT(I).GE.2.)GO TO 10
      WRITE(22,9)NTM,NTD,NTH
    9 FORMAT(14X,3I5,7X,"---",7X,"---")
      GO TO 100
   10 IF(I.GT.9)GO TO 100
      WRITE(22,11)NTM,NTD,NTH,HT(I),PD(I)
   11 FORMAT(14X,3I5,2F10.1)
  100 CONTINUE
C WRITE A "CAUTION TO THE FORECASTER" MESSAGE AT THE END OF THE
C "SIGNIFICANT WAVE HEIGHT/WAVE PERIOD" MESSAGE...
      WRITE(22,12)
   12 FORMAT(/9X,"OCCASIONAL WAVES TO TWICE THE FORECAST HEIGHT"
     1/9X,"AND 1/10TH OF THE WAVES TO 1.3 TIMES THE FORECAST"
     2/9X,"HEIGHT SHOULD BE EXPECTED."/)
C CONVERT THE TIME OF MAXIMUM EBB CURRENT FROM PST TO GMT...
      TEBB=TEBB+8.
C WRITE THE HEADER FOR THE "EBB CURRENT EFFECTS" MESSAGE...
      WRITE(24,13)(ID(I),I=1,3)
   13 FORMAT(1H0,"SFOCHGBAR           EWOUS KSF000 ",3A2/
     1/30X,"EBB CURRENT EFFECTS"
     2/16X,"(BASED ON MAXIMUM EBB CURRENT AT THE GOLDEN GATE"
     3/27X,"DURING THE NEXT 36 HOURS)"/
     4/7X,"STATION",11X,"TIME OF MAX  DEEP WATER DATA",5X,"BAR DATA"
     5/25X,"EBB CURRENT   WAVE  WAVE",6X,"WAVE   WAVE"
     6/28X,"(GMT)",8X,"HT    PD",8X,"HT   BREAKING?"
     7/26X,"MO DA HR",6X,"(FT)  (SEC)",5X,"(FT)"/)
```

Program MWOSUSWL3.FR -- Page 2 of 3.

```
      DO 300 L=1,5
         TB=TEBB+TFAC(L)
         VB=VEBB*VFAC(L)
         DO 400 MM=1,9
            M=MM
            M1=M+1
            IF(TB.GE.XT(M).AND.TB.LT.XT(M1))GO TO 14
  400    CONTINUE
C DETERMINE THE DEEP WATER WAVE HEIGHT AT TIME "TB"...
   14    HDEEP=(HT(M1)-HT(M))/6.*(TB-XT(M))+HT(M)
C DETERMINE THE DEEP WATER WAVE PERIOD AT TIME "TB"...
         TDEEP=(PD(M1)-PD(M))/6.*(TB-XT(M))+PD(M)
         HBAR=0.
         SBAR=0.
         IF(TDEEP.LE.0.)GO TO 15
         A=SQRT(1.-4.*VB/(3.03*TDEEP))
         XLDEEP=5.12*TDEEP*TDEEP
         B=1.+A
         XLBAR=XLDEEP*B*B/4.
         B1=2./(A*B)
C DETERMINE THE WAVE HEIGHT ON THE BAR AT STATION "L"...
         HBAR=HDEEP*SQRT(B1)
C DETERMINE THE WAVE STEEPNESS ON THE BAR AT STATION "L"...
         SBAR=HBAR/XLBAR
         GO TO 17
   15    WRITE(24,16)(NAME(I,L),I=1,20)
   16    FORMAT(4X,20A1,"  BAR WAVE HEIGHT IS UNDEFINED")
         GO TO 300
   17    IF(HBAR.EQ.0.)GO TO 300
         HBREAK=XLBAR*0.09
         IF(SBAR.GT.0.09)GO TO 18
         IBC1=" N"
         IBC2="O "
         GO TO 19
   18    IBC1=" Y"
         IBC2="ES"
C CONVERT ABSOLUTE HOURS (GMT) TO THE MONTH,DAY AND HOUR (GMT)...
   19    CALL MDH(TB,NMO,NDA,NHR)
         WRITE(24,20)(NAME(I,L),I=1,20),NMO,NDA,NHR,HDEEP,TDEEP,HBAR
     1   ,IBC1,IBC2
   20    FORMAT(4X,20A1,1X,3I3,F10.1,F6.1,F10.1,4X,2A2)
  300 CONTINUE
C WRITE DISCLAIMER STATEMENT INTO THE "EBB CURRENT EFFECTS" MESSAGE...
      WRITE(24,21)
   21 FORMAT(/"      NOTE:  IF THE LINE FROM THE CENTER OF THE PRIMARY
     1 FETCH"/"      TO THE FORECAST POINT MAKES AN ANGLE OF LESS THAN
     2 60 DEGREES"/"       WITH THE COAST, DISREGARD THE ABOVE RESULTS."/)
      CALL RESET
      STOP
      END
R
```

Program MWOSUSWL3.FR -- Page 3 of 3.

```
TYPE MWOSUDATE.FR
C  OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM -- SUBROUTINE CDATE
C  ***** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/21/79 ******
C
C  CONVERTS THE MONTH, DAY AND HOUR TO THE NUMBER OF HOURS SINCE
C  00Z JAN 1.
C
      SUBROUTINE CDATE(NM,ND,NH,XD)
      COMMON/BLK/MON(13,2)
      DO 100 I=1,13
         IF(NM.EQ.MON(I,1))GO TO 1
  100 CONTINUE
    1 JD=ND+MON(I,2)-1
      XD=NH+JD*24
      RETURN
      END
R
```

Subroutine CDATE.

```
TYPE MWOSUDVAR.FR
C  * OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM -- SUBROUTINE DVAR *
C  ******* MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/14/79 *******
C
C  COMPUTES REPETITIVE TERMS IN ROUTINES DESIGNED TO DESCRIBE THE APPARENT
C  RANDOM STATE OF A WIND DEVELOPED SEA.
C
      SUBROUTINE DVAR(F,W,WM4,U,S)
      SS=14.8*F**(-0.4165)*U**0.833
      WM4=6.6E06*F**(-0.889)*U**(-2.221)
      W4=W**4
      W5=W**5
      W6=-WM4/W4
      IF(W6.LT.-121.30)W6=-121.30
      S=SS*EXP(W6)/W5
      RETURN
      END
R
```

Subroutine DVAR.

```
TYPE MWOSUMDH.FR
C  OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM -- SUBROUTINE MDH
C  **** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/20/79 *****
C
C  CONVERTS THE NUMBER OF HOURS (GMT) SINCE 00Z JAN 1 TO THE MONTH, DAY
C  AND HOUR.
C
      SUBROUTINE MDH(XT,NM,ND,NH)
      DIMENSION MON(13,2)
      CALL OPEN(25,"MWOSUHOLD.02",1,IER,132)
      READ(25,1)((MON(I1,J1),I1=1,13),J1=1,2)
    1 FORMAT(13I5)
      NT=XT
      IF(NT.GE.8760)NT=NT-8760
      DO 100 II=1,12
         I=II
         IP1=I+1
         MA=MON(I,2)
         MB=MON(IP1,2)
         JD=NT/24+1
         NH=NT-(JD-1)*24
         IF(JD.GT.MA.AND.JD.LE.MB)GO TO 2
  100 CONTINUE
    2 ND=JD-MON(I,2)
      NM=I
      CALL CLOSE(25,IER)
      RETURN
      END
R
```

Subroutine MDH.

```
TYPE MWOSUZERO.FR
C  OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM -- SUBROUTINE ZERO
C  ***** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/14/79 *****
C
C  SETS ALL ELEMENTS OF A 10X17 ARRAY TO ZERO.
C
      SUBROUTINE ZERO(X)
      DIMENSION X(10,17)
      DO 100 M=1,10
         DO 100 N=1,17
            X(M,N)=0.
  100 CONTINUE
      RETURN
      END
R
```

Subroutine ZERO.

```
TYPE MWSBRDTG.FR
C _OREGON STATE UNIVERISTY WAVE PREDICTION PROGRAM -- SUBROUTINE DTG
C  **** MORRIS S. WEBB, JR.; WSFO, SAN FRANCISCO, CA; 12/20/79 *****
C
C  INTERROGATES THE REAL TIME CLOCK AND CALENDAR AND DETERMINES THE
C  DATE/TIME GROUP.
C
      SUBROUTINE DTG(I1,I2,I3)
      DIMENSION IHM(3),MDY(3)
      CALL OPEN(25,"MWOSUDTG",3,IER,9)
      CALL DATE(MDY,IER)
      CALL TIME(IHM,IER)
      IDY=MDY(2)+100
      IHRMIN=10000+100*IHM(1)+IHM(2)
      WRITE(25,1)IDY,IHRMIN
    1 FORMAT(1X,I3,I5)
      CALL CLOSE(25,IER)
      CALL OPEN(25,"MWOSUDTG",1,IER,9)
      READ(25,2)I1,I2,I3
    2 FORMAT(1X,A2,1X,2A2)
      CALL CLOSE(25,IER)
      RETURN
      END
R
```

Subroutine DTG.

```
WOUS00 KSFO 190038

INPUT PREFORMAT FOR THE OREGON STATE UNIVERISTY WAVE FORECAST SYSTEM
                         EBB TIDE PARAMETERS
                            PAGE 1 OF 4

  1.   THE FORECAST POINT IS:
       1.   HUMBOLT BAY ENTRANCE (1), OR
       2.   SAN FRANCISCO BAY ENTRANCE (GOLDEN GATE) (2) ... [←]

  2.   FROM THE TIDAL CURRENT TABLES PUBLISHED BY THE NATIONAL
       OCEAN SURVEY, WHAT IS THE TIME AND VELOCITY OF THE MAXIMUM
       EBB TIDE AT THE GOLDEN GATE DURING THE NEXT 36 HOURS?

          TIME:  MONTH [0←]  DAY [0←]  NEAREST HOUR (PST) [0←]
          VELOCITY OF THE MAXIMUM EBB CURRENT (KT): ..... [←.←]

  AFTER ANSWERING THE QUESTIONS ON THIS PAGE, STRIKE THE "NEXT PAGE"
  KEY THEN ENTER THE FETCH PARAMETERS:

                                                                    [_]
                             ......
                             ......
INPUT PREFORMAT FOR THE OREGON STATE UNIVERSITY WAVE FORECAST SYSTEM
                  FETCH PARAMETERS -- PAGE 2 OF 4
  1.   IS THIS A LEAP YEAR? (0=NO; 1=YES) ... [←]
  2.   TIME OF THE FORECAST:  MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
  3.   TIME FETCH STARTED: .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
  4.   MEAN WIND SPEED IN THE FETCH (KT): ... [←←]
  5.   DURATION OF THE FETCH (HRS): ......... [0←]
  6.   DISTANCE FROM THE FRONT OF THE FETCH TO THE FORECAST POINT (NM):
          A. INITIAL [00←←]  B. FINAL [00←←]
  7.   FETCH LENGTH (NM):
          A. INITIAL [00←←]  B. FINAL [00←←]
  8.   SPREADING FACTOR OF THE FETCH:
          A. INITIAL [0.←_]  B. FINAL [0.←_]
  9.   NOTE THE VALID TIME OF THE LAST MAP USED TO MAKE THIS FORECAST.
          WILL THE FETCH REACH THE COAST BEFORE THEN? (0=NO; 1=YES) [←]
 10.   IF THE ANSWER TO ITEM 9 IS "YES" (1), WHEN WILL THE FETCH
          REACH THE COAST? .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
 11.   INPUT ANOTHER FETCH? (0=NO; 1=YES) ... [←]
       IF THE ANSWER TO ITEM 11 IS "YES" (1), PROCEED TO PAGE 3;
       IF THE ANSWER TO ITEM 11 IS "NO" (0), STRIKE THE "ENTER" KEY
       THEN PERFORM THE NEXT STEP IN THE PROCEDURE.
                                                                    [_]
                             ......
```

Figure 1. Preformat Used to Enter Forecaster Input into the SWAB Program (page 1 of 2).

```
                          ......
INPUT PREFORMAT FOR THE OREGON STATE UNIVERSITY WAVE FORECAST SYSTEM
                  FETCH PARAMETERS -- PAGE 3 OF 4
12.  IS THIS FETCH:  A CONTINUATION OF THE PREVIOUS FETCH (0)
                     OR A BRAND NEW FETCH (1)? .............. [←]
13.  TIME FETCH STARTED: .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
14.  MEAN WIND SPEED IN THE FETCH (KT): ... [←←]
15.  DURATION OF THE FETCH (HRS): ......... [0←]
16.  DISTANCE FROM THE FRONT OF THE FETCH TO THE FORECAST POINT (NM):
       A. INITIAL [00←←]  B. FINAL [00←←]
17.  FETCH LENGTH (NM):
       A. INITIAL [00←←]  B. FINAL [00←←]
18.  SPREADING FACTOR OF THE FETCH:
       A. INITIAL [0.←←]  B. FINAL [0.←←]
19.  NOTE THE VALID TIME OF THE LAST MAP USED TO MAKE THIS FORECAST.
       WILL THE FETCH REACH THE COAST BEFORE THEN? (0=NO; 1=YES) [←]
20   IF THE ANSWER TO ITEM 19 IS "YES" (1), WHEN WILL THE FETCH
       REACH THE COAST? .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
21.  INPUT ANOTHER FETCH? (0=NO; 1=YES) ... [←]
     IF THE ANSWER TO ITEM 21 IS "YES" (1), PROCEED TO PAGE 4
     IF THE ANSWER TO ITEM 21 IS "NO" (0), STRIKE THE "ENTER" KEY
     THEN PERFORM THE NEXT STEP IN THE PROCEDURE.
                                                                    [_]
                          ......
                          ......
INPUT PREFORMAT FOR THE OREGON STATE UNIVERSITY WAVE FORECAST SYSTEM
                  FETCH PARAMETERS -- PAGE 4 OF 4
22.  IS THIS FETCH:  A CONTINUATION OF A PREVIOUS FETCH (0)
                     OR A BRAND NEW FETCH (1)? .............. [←]
23.  TIME FETCH STARTED: .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]
24.  MEAN WIND SPEED IN THE FETCH (KT): ... [←←]
25.  DURATION OF THE FETCH (HRS): ......... [0←]
26.  DISTANCE FROM THE FRONT OF THE FETCH TO THE FORECAST POINT (NM):
       A. INITIAL [00←←]  B. FINAL [00←←]
27.  FETCH LENGTH (NM):
       A. INITIAL [00←←]  B. FINAL [00←←]
28.  SPREADING FACTOR OF THE FETCH:
       A. INITIAL [0.←←]  B. FINAL [0.←←]
29.  NOTE THE VALID TIME OF THE LAST MAP USED TO MAKE THIS FORECAST.
       WILL THE FETCH REACH THE COAST BEFORE THEN? (0=NO; 1=YES) [←]
30.  IF THE ANSWER TO ITEM 29 IS "YES" (1), WHEN WILL THE FETCH
       REACH THE COAST? .. MONTH [0←]  DAY [0←]  HOUR (GMT) [0←]

FINIS
                                                                    [_]
```

Figure 1. (Page 2 of 2.)

```
                          TFAC(L)      AH(1)  AH(2)    AH(3)   AP(1)   AP(2)   AP(3)
TYPE MWOSUSBHB
ST. GEORGE REEF             -1. 0.3
TRINIDAD HEAD               -1. 0.3
HUMBOLT BAY ENTRANCE        -1. 0.6     2.2    0.88    0.000    -.5    1.30    0.000
TABLE BLUFF LIGHT           -1. 0.3
POINT DELGADA               -2. 0.3
R
   NAME(I,J)                VFAC(L)
```

Figure 2a. Input Data File for the North Coast of California.

```
                          TFAC(L)      AH(1)  AH(2)    AH(3)   AP(1)   AP(2)   AP(3)
TYPE MWOSUSBSF
POINT ARENA                 -2. 0.3
POINT REYES                 -1. 0.3
S. F. BAY ENTRANCE           0. 1.0     2.2    0.88    0.000    -.5    1.30    0.000
POINT LOBOS                 -1. 0.5
POINT SUR                   -1. 0.2
R
   NAME(I,J)                VFAC(L)
```

Figure 2b. Input Data File for the Central Coast of California.

```
TYPE MWOSUDTG
11511825
R
```

Figure 3a. Sample of the Temporary Data File MWOSUDTG.

```
TYPE MWOSUHOLD.01
 1046. 1020. 5.0 2
R
```

Figure 3b. Sample of the Temporary Data File MWOSUHOLD.Ø1.

```
TYPE MWOSUHOLD.02
    1    2    3    4    5    6    7    8    9   10   11   12   13
    0   31   60   91  121  152  182  213  244  274  305  335  366
R
```

Figure 3c. Sample of the Temporary Data File MWOSUHOLD.Ø2.

```
TYPE MWOSUHOLD.03
 0.23 0.00000000 2050. 1750.  600. 57.   0.  72.  32.  20.2 21.1 1 1
 0.32 0.00031111  850.  600.  400. 33.   0,  15.  32.   6.1  3.0 0 0
 0.00 0.00000000    0.    0.    0.  0.   0.   0.   0.   0.0  0.0 0 1
R
```

Figure 3d. Sample of the Temporary Data File MWOSUHOLD.Ø3.

```
TYPE MWOSUHOLD.04
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00
   0.33     0.22     0.01     0.00     0.01
   0.00     0.00     0.00     0.00     0.00
   0.13     1.49     1.75     0.26     0.19
   0.26     0.16     0.00     0.00     0.00
   0.00     0.00     1.39     1.81     0.96
   0.75     0.89     0.37     0.02     0.00
   0.00     0.00     0.00     0.92     1.27
   1.34     1.41     0.92     0.47     0.03
   0.00     0.00     0.00     0.00     0.78
   0.88     0.90     0.94     0.86     0.46
   0.00     0.00     0.00     0.00     0.00
   0.62     0.63     0.62     0.59     0.55
   0.00     0.00     0.00     0.00     0.00
   0.29     0.47     0.45     0.44     0.41
   0.00     0.00     0.00     0.00     0.00
   0.00     0.35     0.34     0.32     0.30
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.27     0.25     0.23
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.20     0.20     0.18
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.17     0.14
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.12
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.11
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00
   0.00     0.00     0.00     0.00     0.00

R
```

Figure 3e. Sample of the Temporary Data File MWOSUHOLD.Ø4.

```
TYPE MWOSUSWV.HB

SFOCHGOSU          EWOUS00 KSFO 210218

     FORECAST OF SIGNIFICANT WAVE HEIGHT AND WAVE PERIOD
                     HUMBOLT BAY ENTRANCE

               MON  DAY  HR.    SIG. HT.  PERIOD
                         (GMT)   (FT)      (SEC)

                3   10   12      ---       ---
                3   10   18      ---       ---
                3   11    0      5.1      18.0
                3   11    6     10.2      18.0
                3   11   12     12.3      16.7
                3   11   18     12.8      14.4
                3   12    0     12.4      12.6
                3   12    6     11.6      11.4
                3   12   12     10.5      10.6

       OCCASIONAL WAVES TO TWICE THE FORECAST HEIGHT
       AND 1/10TH OF THE WAVES TO 1.3 TIMES THE FORECAST
       HEIGHT SHOULD BE EXPECTED.
```

Figure 4. Sample of the Output File Containing Wave Forecast Data.

```
TYPE MWOSUSBAR.HB

SFOCHGBAR          EWOUS KSF000 210218

                          EBB CURRENT EFFECTS
             (BASED ON MAXIMUM EBB CURRENT AT THE GOLDEN GATE
                        DURING THE NEXT 36 HOURS)

   STATION              TIME OF MAX  DEEP WATER DATA     BAR DATA
                        EBB CURRENT   WAVE  WAVE       WAVE    WAVE
                           (GMT)       HT    PD         HT   BREAKING?
                        MO DA HR      (FT)  (SEC)      (FT)

 ST. GEORGE REEF         3 11  2      6.8   18.0       7.0     NO
 TRINIDAD HEAD           3 11  2      6.8   18.0       7.0     NO
 HUMBOLT BAY ENTRANCE    3 11  2      6.8   18.0       7.2     NO
 TABLE BLUFF LIGHT       3 11  2      6.8   18.0       7.0     NO
 POINT DELGADA           3 11  1      5.9   18.0       6.1     NO

 NOTE:  IF THE LINE FROM THE CENTER OF THE PRIMARY FETCH
 TO THE FORECAST POINT MAKES AN ANGLE OF LESS THAN 60 DEGREES
 WITH THE COAST, DISREGARD THE ABOVE RESULTS.
```

Figure 5. Sample of the Output File Containing Bar Forecast Data.

```
SFOPCD021
WOUS00 KSFO 221936
  DISPLAY    MODE  ACC/OV     COMMAND
   (1-4)     (D/M) (R/A/O)    (ANY COMMAND; LAST LINE MUST BE END OR "NAME")
  -------    ----- -------    -----------------------------------------------
01  1         D       R         DSP:DP0F:MWOSUSI01
02                              WCHR I
03  1         D       R         DSP:DP0F:MWOSUSI02
04                              WCHR D
05  1         D       R         SFOOMRSWB
06                              WCHR R
07                              SAVE:SFOOMRSWB DP0F:MWOSUFETCH
08                              PAUSE 05
09  1         D       R         DSP:DP0F:MWOSUSI03
10                              PAUSE 01
11                              RUN:@DP0F:MWOSUSRUN@
12                              PAUSE 90
13                              STORE:DP0F:SFOOMRSWV SFOOMRWAV
14                              PAUSE 05
15                              STORE:DP0F:SFOOMRBAR SFOOMRBAR
16                              PAUSE 05
17  1         D       R         SFOOMRWAV
18                              PAUSE 01

                                                                       PAGE 01

  DISPLAY    MODE  ACC/OV     COMMAND
   (1-4)     (D/M) (R/A/O)    (ANY COMMAND; LAST LINE MUST BE END OR "NAME")
  -------    ----- -------    -----------------------------------------------
19                              PRNT:
20                              PAUSE 10
21  1         D       R         SFOOMRBAR
22                              PAUSE 01
23                              PRNT:
24                              PAUSE 10
25                              RUN:@DP0F:MWOSUSDEL@
26                              PAUSE 07
27  1         D       R         DSP:DP0F:MWOSUSI04
28                              END
29
30
31
32
33
34
35
36
37
38

                                                                       PAGE 02
```

Figure G1. List of Steps and Console Commands in the "SWAB" AFOS Procedure.

```
WOUS00 KSFO 050641

GREETINGS!  WELCOME TO THE "SWAB" (SPECTRAL WAVE AND BAR)
PROCEDURE -- THE PROCEDURE WHICH PROVIDES A FORECAST OF
VARIOUS PARAMETERS PERTAINING TO DEEP WATER WAVES AND BAR
WAVES AT SELECTED POINTS ALONG THE NORTHERN CALIFORNIA COAST.

THE PROCEDURE IS DESIGNED TO RUN FROM THE CONSOLE IN THE
MARINE ROOM (I.E., AN "A" CONSOLE).  IT IS ASSUMED THAT THE
"FETCH HISTORY/COMPUTER INPUT TABULATION" FORM HAS BEEN
COMPLETED PRIOR TO STARTING THIS PROCEDURE.

THE "OPERATIONS MANUAL -- SEMI-AUTOMATED WAVE FORECASTING
SYSTEM", DEVELOPED BY DR. DAVID ENFIELD OF OREGON STATE UNIV.
IS THE SOURCE BOOK FOR THIS TECHNIQUE.

                                                      PAGE 01
```

Figure G2. Contents of the MWOSUSIØ1 Disk File -- Obtained by Procedure Step 1.

```
WOUS00 KSFO 221944

   1.  AFTER READING THE INSTRUCTIONS ON THIS PAGE, TYPE,
   M:005, THEN STRIKE THE [ENTER] KEY.  (THE HEADER BLOCK
   SHOULD APPEAR ON THE SCREEN).

   2.  COMPLETE THE HEADER BLOCK AS FOLLOWS:
               PRODUCT CATEGORY     [OMR]
               PRODUCT DESIGNATOR   [SWB]
               ADDRESSEE            [000]
       MOVE THE CURSOR TO THE BOTTOM OF THE HEADER BLOCK THEN
       STRIKE [ENTER].  (THE INPUT PREFORMAT SHOULD APPEAR ON
       THE SCREEN).

   3.  COMPLETE THE PREFORMAT THEN STRIKE [ENTER].  (THE
       MESSAGE, "PRODUCT SFOOMRSWB STORED", SHOULD APPEAR ON
       THE SCREEN).

   4.  AFTER STEP 3 IS COMPLETED, TYPE THE LETTER "D", THEN
       STRIKE [ENTER] TO CONTINUE THE PROCEDURE.

                                                      PAGE 01
```

Figure G3. Contents of the MWOSUSIØ2 Disk File -- Obtained by Procedure Step 3.

```
************************************************************************************
ARCHIVE COPY:
      ⊏⊐⊐⊐

WOUS00 KSFO 211749

  INPUT PREFORMAT FOR THE OREGON STATE UNIVERISTY WAVE FORECAST SYSTEM
                       EBB TIDE PARAMETERS
                          PAGE 1 OF 4

   1.  THE FORECAST POINT IS:
       1.  HUMBOLT BAY ENTRANCE (1), OR
       2.  SAN FRANCISCO BAY ENTRANCE (GOLDEN GATE) (2) ...  2

   2.  FROM THE TIDAL CURRENT TABLES PUBLISHED BY THE NATIONAL
       OCEAN SURVEY, WHAT IS THE TIME AND VELOCITY OF THE MAXIMUM
       EBB TIDE AT THE GOLDEN GATE DURING THE NEXT 36 HOURS?

          TIME:  MONTH  03  DAY  02   NEAREST HOUR (PST)  16
          VELOCITY OF THE MAXIMUM EBB CURRENT (KT): .....  4.1

   AFTER ANSWERING THE QUESTIONS ON THIS PAGE, STRIKE THE "NEXT PAGE"
   KEY THEN ENTER THE FETCH PARAMETERS:


                              ......
                              ......
  INPUT PREFORMAT FOR THE OREGON STATE UNIVERSITY WAVE FORECAST SYSTEM
                   FETCH PARAMETERS -- PAGE 2 OF 4
   1.  IS THIS A LEAP YEAR? (0=NO; 1=YES) ...  0
   2.  TIME OF THE FORECAST:  MONTH  03   DAY  01   HOUR (GMT)  21
   3.  TIME FETCH STARTED: .. MONTH  02   DAY  28   HOUR (GMT)  15
   4.  MEAN WIND SPEED IN THE FETCH (KT): ...  28
   5.  DURATION OF THE FETCH (HRS): .........  30
   6.  DISTANCE FROM THE FRONT OF THE FETCH TO THE FORECAST POINT (NM):
          A. INITIAL  0500   B. FINAL  0000
   7.  FETCH LENGTH (NM):
          A. INITIAL  0150   B. FINAL  0250
   8.  SPREADING FACTOR OF THE FETCH:
          A. INITIAL  0.30   B. FINAL  1.00
   9.  NOTE THE VALID TIME OF THE LAST MAP USED TO MAKE THIS FORECAST.
          WILL THE FETCH REACH THE COAST BEFORE THEN? (0=NO; 1=YES)  1
  10.  IF THE ANSWER TO ITEM 9 IS "YES" (1), WHEN WILL THE FETCH
          REACH THE COAST? .. MONTH  03   DAY  01   HOUR (GMT)  06
  11.  INPUT ANOTHER FETCH? (0=NO; 1=YES) ...  0
       IF THE ANSWER TO ITEM 11 IS "YES" (1), PROCEED TO PAGE 3;
       IF THE ANSWER TO ITEM 11 IS "NO" (0), STRIKE THE "ENTER" KEY
       THEN PERFORM THE NEXT STEP IN THE PROCEDURE.
                              ......
```

Figure G4. Sample Input Message -- Obtained by Procedure Steps 3 and 4.

```
WOUS00 KSFO 130015

THE "SWAB" PROGRAM IS BEING EXECUTED.  IT TAKES 45 TO 90
SECONDS TO RUN.  WHILE YOU ARE WAITING, REFER TO THE ITEMS
PRSENTED BELOW:
**************************************************************

1.  THE PROGRAM WILL NORMALLY GIVE A SWELL FORECAST, EXCEPT
FOR THOSE CASES WHEN THE FRONT OF THE FETCH REACHES THE COAST.
IN SUCH CASES, THE FORECAST WAVE HEIGHTS AND PERIODS WILL BE
FOR THE COMBINATION OF LOCAL WIND WAVES AND SWELL, (I.E., A
"COMBINED SEA").

2.  THE PROGRAM DOES NOT ACCEPT FETCHS THAT RECEDE FROM THE
FORECAST POINT, SINCE THE ANGULAR SPREADING FACTORS WILL BE
INTERPOLATED INCORRECTLY.

3.  PRINTED COPIES OF THE FORECASTS OF WAVE PARAMETERS FOR
BOTH DEEP WATER AND BAR CONDITIONS ARE BEING PRINTED ON
THE PRINT MODULE IN COMED.  YOU CAN PICK THEM UP ONCE THE
PROCEDURE IS COMPLETED.

**************************************************************
                                                       PAGE 01
```

Figure G5. Contents of the MWOSUSIØ3 Disk File -- Obtained by Procedure Step 9.

```
WOUS00 KSFO 211746
      FORECAST OF SIGNIFICANT WAVE HEIGHT AND WAVE PERIOD
                      S. F. BAY ENTRANCE
              MON  DAY  HR.   SIG. HT.   PERIOD
                        (GMT)   (FT)      (SEC)
               3    1   21      11.9      11.8
               3    2    3      10.4      11.0
               3    2    9       8.7       9.9
               3    2   15       6.8       8.6
               3    2   21       5.8       7.9
               3    3    3       5.1       7.5
               3    3    9       4.3       6.9
               3    3   15       3.9       6.6
               3    3   21       3.2       6.2
     OCCASIONAL WAVES TO TWICE THE FORECAST HEIGHT
     AND 1/10TH OF THE WAVES TO 1.3 TIMES THE FORECAST
     HEIGHT SHOULD BE EXPECTED.
                                                       PAGE 01
```

Figure G6. Sample ADM Display of Wave Forecast Data -- Obtained by Procedure Step 17. A Printed Copy of the ADM Display is Obtained by Procedure Step 19.

WOUS KSF000 211746

EBB CURRENT EFFECTS
(BASED ON MAXIMUM EBB CURRENT AT THE GOLDEN GATE
DURING THE NEXT 36 HOURS)

STATION	TIME OF MAX EBB CURRENT (GMT) MO	DA	HR	DEEP WATER DATA WAVE HT (FT)	WAVE PD (SEC)	BAR DATA WAVE HT (FT)	WAVE BREAKING?
POINT ARENA	3	2	22	5.7	7.8	6.2	NO
POINT REYES	3	2	23	5.6	7.8	6.1	NO
S. F. BAY ENTRANCE	3	3	0	5.5	7.7	8.4	NO
POINT LOBOS	3	2	23	5.6	7.8	6.5	NO
POINT SUR	3	2	23	5.6	7.8	5.9	NO

NOTE: IF THE LINE FROM THE CENTER OF THE PRIMARY FETCH TO THE FORECAST POINT MAKES AN ANGLE OF LESS THAN 60 DEGREES WITH THE COAST, DISREGARD THE ABOVE RESULTS.

PAGE 01

Figure G7. Sample ADM Display of Bar Forecast Data -- Obtained by Procedure Step 21. A Printed Copy of the ADM Display is Obtained by Procedure Step 23.

WOUS00 KSFO 221950

THIS MARKS THE END OF THE "SWAB" PROCEDURE.

THE FORECAST OF DEEP WATER WAVE HEIGHT AND PERIOD IS STORED UNDER THE HEADER (SFOOMRWAV).

THE FORECAST OF EBB CURRENT EFFECTS AT FIVE POINTS ALONG THE NORTHERN CALIFORNIA COAST IS STORED UNDER THE HEADER (SFOOMRBAR).

FINIS

PAGE 01

Figure G8. Contents of the MWOSUSIØ4 Disk File -- Obtained by Procedure Step 27.

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