

Appendix II

LISTING OF THE TIDE LIBRARY AND SUPPORT PROGRAMS AND FILES

A. Puget Sound Tide Files

1. TIDDAT2 - contains the tide grid location and station data with integer array dimensioned (223, 223) of ILOC (see description in text), and an integer array dimensioned (7,760) of ISTA (see text). The following FORTRAN sequence will read this file:

```
      DO 200 I=1,223
      READ(3,100) (ILOC(I,J),J=1,223)
100  FORMAT(1X,25I3)
200  CONTINUE

      N=5
      LIM1=1
      LIM2=N
      DO 600 I=1,152
      READ(3,500) ((ISTA(K,L),K=1,7),L=LIM1,LIM2)
500  FORMAT(1X,5(3I3,3I1,I3))
      LIM1=LIM2+1
      LIM2=LIM2+N
600  CONTINUE
```

Where the file containing TIDDAT2 is assigned to device number 3.

231-99-99000 70231-99-99800 10231-99-99200 320231341-99360 20241-99-99000 0340
231221241432 30221-99-99000 50111-99-99000 82151-99-99500 0280151-99-99000 0230
221-99-99000 45211211161622 60211-99-99000 78161161211334 70211-99-99000 69
311211-99330 54311211-99330 0310321-99-99400 205321-99-99300 58321-99-99100 150
321-99-99200 150321-99-99900 205321-99-99000 95211311-99220 231211311-99110 312
211311-99330 130211311-99550 85301211-99460 80301-99-99000 59291221281433 60
291-99-99000 60301-99-99000 80311301381262 95311301381433 105321311-99820 130
321311-99330 215331-99-99000 145331-99-99000 160331-99-99000 195331-99-99800 125
331-99-99500 150331-99-99200 150331-99-99100 220321311-99550 60311-99-99000 95
301311381334 115391-99-99000 60411-99-99000 65401-99-99000 45401-99-99000 32
331-99-99000 130381-99-99000 130381781-99550 110311781-99460 85781-99-99000 90
341-99-99000 120781-99-99000 130351351351334138781-99-99000 130381351-99280 130
381781351433 120381351-99640 130381-99-99000 195401-99-99900 25401-99-99000 25
261-99-99000 30251-99-99000 0340251-99-99800 0310561251-99330 0330261251-99550 0
261281-99550 35191-99-99000 40281-99-99000 40271-99-99000 0330271251-99620 310
271-99-99000 280431-99-99000 0345431-99-99300 0310421781-99210 90431421421433 350
431-99-99800 28421-99-99000 20421-99-99000 7291281421433 42421448-99550 90
441-99-99000 89441-99-99800 105441411421433 60441441441334 30441441-99730 17
411-99-99000 52441411-99550 35441441-99550 4441-99-99000 12451-99-99000 0
441451451433 10471-99-99000 15481-99-99000 20451-99-99000 20451-99-99000 310
-99-99-99000 360321311-99330 125451-99-99000 25451-99-99000 20471-99-99000 5
901-99-99000 205901-99-99200 180901-99-99600 205901-99-99900 330891891901433 0
891-99-99000 10471-99-99800 50481471-99550 345471-99-99000 15451-99-99000 290
451-99-99600 290495490-99640 20491-99-99000 20481-99-99000 0481-99-99000 315
481-99-99500 2891-99-99000 270521-99-99800 40521-99-99000 0491-99-99900 70
491-99-99000 40501-99-99900 90501501-99640 95501-99-99800 130501-99-99400 160
501-99-99300 120501-99-99100 120501-99-99000 5501-99-99000 40511-99-99400 120
511-99-99600 0511-99-99000 15511-99-99000 0320511-99-99000 45511-99-99000 90
501531-99640 60590-99-99300 100521521-99550 0861891-99550 0891-99-99400 250
861-99-99000 0350861-99-99500 0320861-99-99200 0350881-99-99000 80521-99-99000 50
521-99-99000 15561551540334 0551-99-99000 0310531-99-99000 55501531-99210 60
541531-99550 0350590-99-99300 25541-99-99300 0350541-99-99000 0325541-99-99000 320
561-99-99000 0305561 99-99000 0320571-99-99000 0300571-99-99000 0355571-99-99000 320
591601-99330 90611-99-99000 0591-99-99600 0280591581-99550 0340591-99-99000 340
581-99-99000 0325541-99-99000 0315631-99-99000 0325631-99-99000 0325651-99-99200 45
651-99-99200 0315651-99-99000 0312651-99-99800 0330651-99-99200 30651-99-99300 3
651691-99320 0335661651671343 02661-99-99000 0325661671-99820 0315681-99-99000 310
701-99-99000 0310701691671343 0318691-99-99000 0300691651-99730 0301691651-99210 345
651691-99230 0345671-99-99000 0305541-99-99100 20531-99-99100 30531-99-99100 60
501-99-99100 100501-99-99900 90181-99-99000 0330781241-99550 0338781241-99450 340
771781771323 0305771781771333 0350771771-99440 0355771771-99340 58771771-99550 336
771771781333 0280771771-99330 90771771-99550 0771771781343 0330771771-99450 315
771771761343 46771771-99440 0320771771-99440 0315771771-99440 14771771761443 62
771771761224 0347771771761334 028761771771433 0310761-99-99800 90761-99-99900 350
771771761343 0105761-99-99900 0325761-99-99000 24761-99-99000 67761761-99640 55
761761-99550 55711-99-99900 0310711-99-99800 0310711-99-99000 0311711-99-99000 320
711701-99550 0320541-99-99100 0230781-99-99000 0318521-99-99800 0290871-99-99000 100
631-99-99000 0325631-99-99000 0330561-99-99000 0310791-99-99800 0126660-99-99000 355
831-99-99200 0310831-99-99000 5831-99-99300 10831-99-99300 50821-99-99600 50
821-99-99000 30811821-99730 0315811-99-99000 0330811-99-99200 0230821821-99660 55
851821-99550 15851-99-99800 0300811-99-99000 0305851-99-99000 0280841-99-99000 250
841-99-99000 0300841851-99110 0350841-99-99700 0260781-99-99000 0791-99-99000 57
791-99-99000 0117761791791343 80761751791234 95761-99-99000 90751-99-99000 35
761751-99110 135761-99-99000 56741-99-99000 20751601-99440 58601-99-99000 66
601791-99110 42621-99-99000 0295731731-99550 0358721-99-99000 36721-99-99000 10
721-99-99200 295761-99-99000 85761-99-99800 0306-99-99-99000 0821-99-99000 0
791-99-99000 75761-99-99000 0128731-99-99000 42581-99-99000 0340861-99-99000 280
761-99-99000 40721-99-99000 40801-99-99000 0330611-99-99900 0878935934811140
990878-99730 160990878-99730 0180990878-99730 0225990878-99730 0310990-99-99000 360
990-99-99000 60935930-99820 0100935930-99910 35935930-99820 0145878935-99640 60
878935-99460 150930935-99730 0165878930-99370 0180930-99-99000 0205878931-99330 190
87893293144 2180878-99-99000 0145878934-99460 0150878934-99370 0180878934-99280 210
934-99-99000 0230934-99-99000 0180934-99-99000 0170934-99-99900 0140934-99-99900 150
934-99-99000 0155934-99-99000 0155934-99-99000 0180934-99-99000 0230934-99-99300 170
931932-99550 160931932-99640 0240931932-99640 0150931932-99540 0225931932-99440 0330

936931-99550175938939381343135936931-99640140936931932622130936931932622150
936931932622170936931932622180936931-99110240937936-99640140937-99-99000180
381943-99440 60381943-99440 90943381-99820145943381-99820135943-99-99000140
943952-99280160951-99-99000 90952-99-99000170951944-99730 45944-99-99000 30
781-99-99000 20781947-99550340781-99-99800355781-99-99300300781-99-99300330
948-99-99000330948-99-99000300947949-99550315948-99-99000330948-99-99000330
949-99-99000290949-99-99800190949-99-99800340952-99-99000180952-99-99700225
952-99-99800135952-99-99800180954-99-99000200954-99-99000220962954-99630325
962954-99530350962954-99530 45962954-99430135962954-99630180962954-99220320
962-99-99000210962-99-99000190962-99-99000220962-99-99800320962-99-99900350
962-99-99800270125962-99910355125962-99910315954-99-99000200937936-99730230
937936-99730180937936-99620170937936-99510210937936-99620260 60-99-99000220
60-99-99000200 60-99-99000190 60 65-99640210 65-99-99000180 65-99-99000260
65-99-99800225 65-99-99800245 65-99-99700345 65-99-99600 0410-99-99000355
410-99-99800 30410-99-99000 45410-99-99000 50410-99-99000360410-99-99800340
410-99-99800 0410-99-99800 20410-99-99800 45410-99-99100120410-99-99000320
966-99-99000170966-99-99900140966-99-99800220966-99-99000160966956-99430195
966956-99330245966956-99330300966956-99330260956-99-99000225966956-99550170
966956-99640270966956-99550185956-99-99000180956-99-99000190956781-99550230
781-99-99000335781-99-99000270781-99-99000230185-99-99000220185-99-99000235
185-99-99800230195-99-99000340200195-99550285200-99-99900340200-99-99400180
200-99-99000280200-99-99400325200-99-99800315200-99-99600 15781-99-99700345
120-99-99800355120-99-99000345120-99-99000340351-99-99000165351-99-99000205
351-99-99900210265-99-99000270265-99-99000310265-99-99200 0270-99-99000295
270-99-99000210270305-99410 20270305-99440195270-99-99400155270-99-99400270
270-99-99200320270-99-99200210270-99-99200135270-99-99200 90270-99-99200 30
270-99-99100145270-99-99100 90280270-99210 40280270-99210140280-99-99500270
280-99-99500330280351-99730210280351-99730225285-99-99000195290-99-99000200
977-99-99900285977-99-99000235305-99-99000210977-99-99000185305-99-99200 0
977-99-99000215290-99-99300240976-99-99000265976978-99820315978-99-99000325
978980-99730300978979-99730270978979-99640210978-99-99200180980-99-99000335
980-99-99000 25980-99-99000350980-99-99000 20980-99-99300 10980-99-99400 10
980-99-99500 15980-99-99400 15980-99-99500 20980-99-99400 10980-99-99200 0
980981-99330 0981-99-99000220981-99-99000245981-99-99800185981-99-99800190
365-99-99000260365-99-99000270370-99-99000270370-99-99000335370-99-99300 0
350-99-99000325340-99-99000345981355-99430220355-99-99000320981355-99320190
981355-99110215979355-99540 5340-99-99000240979-99-99000240979-99-99000240
979-99-99800190979-99-99800215979-99-99600170979-99-99400240979-99-99200240
979-99-99400180979-99-99200 0 65-99-99000235 65-99-99200220 65 70-99910245
65 70-99820230 70 65-99640215 70-99-99000220 70-99-99000200 70-99-99900225
70-99-99800205 70 75-99350115 75-99-99000 60 75-99-99000 60 75-99-99800 65
75-99-99200 50956959-99550170956-99-99000240956-99-99000260956-99-99800225
956-99-99800190956205-99330125956205-99330 85205-99-99600335205-99-99500320
205-99-99000150956205-99640190160-99-99000160956205-99530205959956960811215
956205-99420230959351-99460150959205164222180959351-99550180959205964116205
959-99-99000140946-99-99700155967351959811195964-99-99000190967-99-99000170
963964-99440330967-99-99600150963964-99440190967-99-99400150963964-99550240
967-99-99600160961220-99240 40967961-99730130220961-99820 15967961-99420140
220-99-99000340967961-99730 90963-99-99000300961-99-99000180961-99-99800230
961963-99440270961963-99110140430-99-99000 80430-99-99800160430-99-99400 30

2. ILOC2 - contains the tide location matrix in a binary (mass storage) format. It will not be reproduced here.
3. ISTA2 - contains the tide station array in a binary (mass storage) format. It will not be reproduced here.
4. MASTOR1 - contains the FORTRAN program for creating ILOC2 and ISTA2 from the information stored in TIDDAT2. This routine needs to be rerun for changes to TIDDAT2, such as for adding data to a new region or modifying existing assignments. There are no calculations made by this program. It merely reads TIDDAT2, opens the mass storage files, fills the files, and closes the files. The tape unit assignments on the program card are discussed under RUNMAS2. Changes to the number of stations or active family groups would be the most likely modification to this routine. This would involve changing the array sizes of JINDEX, ISTAT, IC, IDIR and do loop limits on DO-600 and DO-800. If M is the number of family groups, then

```
DIMENSION JINDEX(M+1),ISTAT(3,M),IC(3,M),IDIR(M)
DO 600 I=1,INTEGER((M-1)/5)+1
CALL OPENMS(2,JINDEX,M+1,0)
DO 800 KEY=1,M
```

```
PROGRAM MASTOR1(TAPE1,TAPE2,TAPE3,OUTPUT,TAPE6=OUTPUT)
DIMENSION INDEX(224),ILOCAT(223,223),IDUM1(223),IDUM2(7),
1JINDEX(761),ISTAT(3,760),IC(3,760),IDIR(760)
C READ LOCATION ARRAY.
DO 200 I=1,223
READ(3,100) (ILOCAT(I,J),J=1,223)
100 FORMAT(1X,25I3)
200 CONTINUE
C MAKE MASS STORAGE LOCATION ARRAY.
CALL OPENMS(1,INDEX,224,0)
DO 400 J=1,223
DO 300 I=1,223
IDUM1(I)=ILOCAT(I,J)
300 CONTINUE
CALL WRITMS(1,IDUM1,223,J)
400 CONTINUE
CALL CLOSMS(1)
C READ STATION INFORMATION ARRAYS.
N=5
LIM1=1
LIM2=N
DO 600 I=1,152
READ(3,500)((ISTAT(K,L),K=1,3),(IC(K,L),K=1,3),IDIR(L),
1L=LIM1,LIM2)
500 FORMAT (1X,5(3I3,3I1,I3))
LIM1=LIM2+1
LIM2=LIM2+N
600 CONTINUE
C MAKE MASS STORAGE RECORDS OF STATION INFO.
CALL OPENMS(2,JINDEX,761,0)
DO 800 KEY=1,760
DO 700 I=1,3
IDUM2(I)=ISTAT(I,KEY)
IDUM2(I+3)=IC(I,KEY)
700 CONTINUE
IDUM2(7)=IDIR(KEY)
CALL WRITMS (2,IDUM2,7,KEY)
800 CONTINUE
CALL CLOSMS(2)
STOP
END
```


5. RUNMAS2 - is a procedure file (NOS operating system, CDC mainframe) which will properly execute the mass storage manipulation between TIDDAT2 and ILOC2 and ISTA2 via the FORTRAN program MASTOR1. The tape unit assignments include the binary output files on tapes 1 and 2 and the card image input file on unit 3.

```
PURGE,ISTA2.  
PURGE,ILOC2.  
DEFINE(TAPE1=ILOC2)  
DEFINE(TAPE2=ISTA2)  
GET(TAPE3=TIDDAT2)  
GET(MASTOR1)  
FTN(I=MASTOR1,R=3,OPT=0)  
LGO.
```

6. PSTIDE3 - is the card image version of the tide library. The details of the routines TIDES, STATS, TIMER, SPEED, JULIAN, AND LOCALE are discussed in the text. Changes to the number of family groups would require changes in subroutine TIDES in the dimension of KEY2 only. If M is the number of family groups, then in TIDES

```
INTEGER KEY2(M+1)
CALL OPENMS(3,KEY2,M+1,0).
```

Changes in the number of stations in the data base would require changes in subroutine STATS in the dimension of STNS, STABL1, and STABL4 and in the limits of data statements for the same arrays. If N is the number of stations in the data base, then in subroutine STATS

```
INTEGER STNS(N)
REAL STABL1(N*5), STABL4(N*5)
DATA(STNS(I),I=1,N)/.../
DATA(STABL1(I),I=683,N*5)/.../
DATA(STABL4(I),I=761,N*5)/.../
DATA NSTAT/N/.
```

Changes in the number of constituents to be summed would require changes in subroutine STATS in the dimension of arrays STABL1, STABL2, STABL3, and STABL4 and in the appropriate data statements. If L is the number of constituents to be summed over, then in STATS

```
REAL STABL1(N*L), STABL2(L)
      STABL3(L), STABL4(N*L)
DATA(STABL1(I),I=683,N*L)/.../
DATA(STABL2(I),I=1,L)/.../
DATA(STABL3(I),I=1,L)/.../
DATA(STABL4(I),I=761,N*L)/.../
DATA NCONST/L/
```


where care must be taken in ordering the new constituents in the large arrays STABL1 and STABL4.

Changing the base date of the tide calculations would require modifying the contents of two arrays in subroutine STATS, namely STABL4 (phases) and BDATE (base date). Both would be changed by altering the contents while maintaining the same number of words in each array's data statement definition. Subroutine TIMER is not affected structurally by changes in the base date.

Adding an independent direction specification for ebb would require changes in subroutine TIDES including modifying the dimensions of ISTA and introducing a new variable DIR2. If ebb direction were specified, then the following would be changed

```

COMMON/TIDDAT/DIR1,DIR2,RAD
INTEGER ISTA(8)
CALL READMS(3,ISTA,8,INDEX)
DIR1=FLOAT(ISTA(7))
DIR2=FLOAT(ISTA(8))
ANG=DIR1
IF(CUR.LT.Ø.) ANG=DIR2

```

where the underlined portions are the changes or additions.

Instead of specifying an independent direction for ebb it may be desirable to include the entire elliptic nature of tide current by specifying major and minor axis amplitude and phase arrays in STATS and the additional summand capabilities in TIDES. All old NOS tide stations would need to be purged from the existing arrays because minor axis amplitude and phase information are not available for them.

```

SUBROUTINE TIDES(I,J,DATE,U,V)
C   I,J ARE THE CO-ORDINATES OF THE GRID BOX UNDER CONSIDERATION.
C   DATE IS THE JULIAN TIME INFORMATION SEC,MIN,HR,JULDAY,YR (GMT).
C   U,V ARE THE SURFACE TIDAL VELOCITY COMPONENTS ASSOCIATED WITH I,J.
C   U,V ARE RETURNED IN CM/SEC. DUMMY VALUES OF 999.0 ARE RETURNED
C   IF I OR J IS NOT OVER WATER.
C   THE COMMON STATEMENT TIDDAT CONTAINING REAL VARIABLE DIR
C   CAN BE USED BY THE CALLING ROUTINE TO GIVE INFORMATION ABOUT
C   DIRECTION AT FLOOD (OCEANOGRAPHIC CONVENTION) IN BOX I,J.
C   IF REQUIRED.
COMMON/TIDDAT/DIR,PAD
INTEGER DATE(5),IS(3), ILOC(223),KEY1(224),KEY2(761),ISTA(7)
REAL C(3)

C
DATA PI/3.141592654/
DATA ICALL/-1/
U=0.
V=0.
DIR=999.

C
IF(ICALL.GT.0) GOTO 25
CALL OPENMS(1,KEY1,224,0)
CALL OPENMS(3,KEY2,761,0)
ICALL=1
25 CONTINUE
CALL READMS(1,ILOC,223,J)
INDEX=ILOC(1)

C
IF (INDEX.LE.0) GO TO 300
C   THIS CARD CHANGES A GMT TIME TO LOCAL TIME FOR PURPOSES OF
C   COMPUTING TIDAL CONSTITUENTS.
C   THE TIME WILL BE RESET TO GMT BEFORE RETURNING TO THE MAIN PROGRAM.
DATE(3)=DATE(3) - 8
CALL READMS(3,ISTA,7,INDEX)
DO 50 K=1,3
C(K)=FLOAT(ISTA(K+3))/10.0
IS(K)=ISTA(K)
50 CONTINUE
DIR=FLOAT(ISTA(7))

C
IF (C(1).LE.0.) C(1)=1.0
DO 200 K=1,3
IF(IS(K).LE.0) GO TO 100
CALL STATS(DATE,IS(K),CUR,ITEST)
IF (ITEST.GE.2) GO TO 100
ANG = DIR
IF (CUR.LT.0.) ANG = DIR - 180.
RAD = ANG/180.0*PI
U = U +C(K)*ABS(CUR)*SIN(RAD)
V = V +C(K)*ABS(CUR)*COS(RAD)
100 CONTINUE
200 CONTINUE
DATE(3)=DATE(3) + 8
RETURN
300 CONTINUE
U = 9999.
V = 9999.
RETURN
END

```


SUBROUTINE STATS(DATE, STN, CURENT, IERR)

C IERR IS AN INTEGER INDICATOR OF THE SUCCESS OF THE SEARCH FOR
C THE STATION NUMBER. ONE(1)=SUCCESS, TWO(2)=FAILURE.
C CURENT IS THE MAGNITUDE OF THE CURRENT. IF CURENT IS POSITIVE
C THEN THE DIRECTION IS FLOOD, AND IF CURENT IS NEGATIVE THEN THE
C DIRECTION IS EBB.

C STN IS THE STATION NUMBER TO BE CONSIDERED.
C DATE IS THE JULIAN DATE AND TIME INFORMATION.

C THE STABL ARRAYS, 1 THRU 4, CONTAIN INFORMATION OF AMPLITUDE,
C FACTORIZATION, FREQUENCY, AND PHASE RESPECTIVELY OF EACH OF
C NCONST NUMBER OF TIDAL CONSTITUENTS FOR EACH REFERENCE STATION.
C TO BE MACHINE INDEPENDENT, THE ARRAYS WERE MADE ONE DIMENSIONAL
C BY THE ALGORITHM- INDEX = NCONST*(STATION NUMBER-1)+CONSTITUENT
C NUMBER. THESE ARRAYS ARE FORMED ON THE EPOCH BASIS OF THE BASE
C DATE, BDATE. IF BDATE IS CHANGED, THEN THE PHASE INFORMATION
C CONTAINED IN STABL 4 MUST BE CHANGED.

C THE ORDER OF THE CONSTITUENTS USED IN THIS EXAMPLE IS--
C M2, S2, N2, K1, O1.

INTEGER STN, STNPR, SINS(157), DATE(5), BDATE(5), TOP, BOT
REAL STABL1(785), STABL2(5), STABL3(5), STABL4(785)
DATA(SINS(I), I=1,157)/11,15,21,31,41,51,60,61,65,70,71,75,81,
191,101,111,120,121,125,131,141,151,161,171,181,185,191,195,200,
1201,205,211,220,221,231,240,241,251,261,265,270,271,280,281,
1290,291,301,305,311,321,331,340,341,350,351,355,361,365,370,371,
1381,391,401,410,411,421,430,431,441,451,461,470,471,481,491,501,
1511,521,531,541,551,561,571,581,591,601,611,621,631,641,651,660,
1661,671,681,691,701,711,721,731,741,751,761,771,781,791,801,811,
1815,821,831,841,851,861,871,878,881,891,901,930,931,932,934,935,
1936,937,938,939,940,943,944,945,947,948,949,950,951,952,954,955,
1956,959,960,961,962,963,964,965,966,967,976,977,978,979,980,981,
1990/

C
DATA(STABL1(I), I=1,229)/
136.4,9.4,7.0,21.6,9.8,91.4,21.5,18.8,39.6,19.7,12.8,11.3,3.6,11.4,
13.7,41.8,10.7,12.0,25.1,10.9,41.8,4.1,8.1,23.1,14.0,42.7,9.8,8.2,
130.7,19.1,24.183,8.963,4.696,11.531,4.900,40.0,9.1,9.5,28.9,12.7,
124.183,8.963,4.696,11.531,4.900,16.979,6.385,3.305,8.953,2.900,
147.3,12.0,11.2,32.7,18.4,10.658,4.994,2.305,6.613,2.900,46.1,9.6,
18.9,30.2,18.0,61.0,14.8,16.5,40.7,18.7,64.5,19.1,12.6,32.5,25.5,
167.5,18.6,13.1,38.1,20.7,15.075,4.258,3.312,7.981,4.812,72.7,16.6,
113.0,38.2,22.2,20.221,5.996,4.214,7.705,5.127,74.4,21.0,16.3,44.9,
124.2,96.7,14.6,18.8,66.1,41.1,3.6,2.4,0.7,6.4,4.7,50.2,15.3,9.7,
124.9,10.8,55.8,17.4,14.0,44.6,19.7,41.4,12.4,8.0,22.2,14.2,34.149,
18.517,6.673,15.961,9.624,20.6,6.8,5.1,9.3,6.2,45.418,11.356,8.831,
121.281,12.832,45.418,11.356,8.831,21.281,12.832,47.3,11.7,9.2,
123.7,21.9,22.767,5.678,4.416,10.641,6.416,48.9,13.3,9.5,26.1,19.8,
130.515,6.449,5.773,16.208,6.786,63.7,17.3,12.4,45.5,20.3,99.6,
113.2,18.9,34.8,30.7,140.3,32.4,27.2,45.3,31.0,45.9,9.2,8.9,15.3,
18.6,67.0,16.6,21.1,38.8,22.7,75.2,17.6,14.6,47.3,29.5,70.859,
116.479,13.726,27.690,13.132,30.515,6.449,5.773,16.208,6.786,
163.773,14.831,12.353,24.921,11.819,12.1,3.3,2.5,9.8,7.4,47.242,
110.987,9.151,18.461,8.755,29.2,5.6,5.7,23.0,6.7,31.2,9.3,6.0,16.3/
DATA(STABL1(I), I=230,469)/
111.6,30.354,8.082,5.904,14.500,8.307,37.2,9.8,7.2,20.5,11.8,46.4,
110.8,9.0,19.8,13.3,45.8,13.3,8.9,18.6,15.6,18.125,4.103,3.520,

15.613,1.038,3.0,2.6,0.6,6.2,3.7,54.637,14.548,10.627,26.100,
 114.953,90.9,23.2,16.8,33.9,10.7,30.354,8.082,5.904,14.500,8.307,
 1152.0,31.6,29.5,52.6,31.1,60.708,16.164,11.808,29.000,16.614,
 154.637,14.548,10.627,26.100,14.953,47.3,13.8,9.2,15.4,8.6,87.3,
 120.9,16.9,30.4,17.8,35.0,7.8,6.7,19.9,11.7,55.2,12.1,13.1,33.8,
 115.4,10.515,2.549,2.039,5.942,4.843,20.1,5.5,3.9,12.9,6.3,29.8,
 17.0,5.8,22.1,12.3,34.6,10.4,6.7,13.2,6.6,92.2,29.0,16.2,23.0,11.7,
 149.8,13.8,9.7,17.7,12.0,53.8,13.0,10.4,41.0,27.4,23.8,4.5,4.6,
 114.8,7.1,40.3,8.3,7.8,27.6,17.6,63.2,19.0,12.2,39.8,17.9,58.3,
 118.9,11.4,33.6,16.3,86.6,20.8,16.8,68.8,29.9,107.0,26.7,20.7,77.0,
 136.5,130.1,30.3,25.2,71.3,34.6,98.0,26.5,19.0,68.0,31.6,99.2,28.6,
 119.3,78.2,36.5,12.7,2.8,2.1,16.3,8.5,13.1,5.6,2.5,9.2,7.9,27.6,
 18.5,5.3,18.2,7.4,47.4,14.5,12.3,43.0,28.2,45.8,10.1,8.9,23.0,10.8,
 130.6,10.4,5.9,38.6,19.9,23.7,5.6,4.5,14.4,6.6,50.3,12.2,10.8,52.9,
 123.6,53.7,11.5,10.4,38.0,12.0,34.4,10.1,6.7,35.7,13.3,34.5,9.9,
 16.7,22.2,12.0,18.0,4.2,4.3,17.2,9.4,22.2,6.3,4.3,17.4,9.7,117.8,
 128.2,24.4,48.1,24.6,32.7,7.9,6.3,36.1,18.6,33.4,6.4,14.3,18.0/
 DATA(STABL1(I),I=470,682)/
 110.2,31.9,7.6,8.6,16.1,9.0,34.1,10.4,6.5,24.6,14.6,42.8,9.2,9.7,
 122.4,8.0,36.4,11.5,7.1,23.4,10.1,78.1,19.9,17.8,45.8,26.0,52.2,
 111.8,6.3,34.9,18.1,58.5,7.4,28.3,22.5,13.3,54.3,18.2,10.5,37.3,
 117.4,52.4,10.3,10.3,37.0,22.6,68.8,19.2,15.1,47.5,33.5,
 168.7,17.4,19.5,60.7,33.9,46.2,11.5,11.0,24.2,11.7,36.2,7.5,7.1,
 18.7,4.3,57.7,16.8,11.1,17.7,14.9,45.7,10.8,9.4,19.8,9.8,51.8,
 113.0,10.1,16.5,5.4,117.8,28.2,24.2,48.8,25.4,47.7,10.2,9.2,21.7,
 113.1,41.9,9.5,8.1,18.6,6.9,6.4,1.4,1.2,4.5,2.2,46.6,7.0,9.0,20.1,
 143.5,87.3,13,25.3,90.16,905,26.069,15.540,70.0,16.1,13.6,35.0,19.1,
 143.5,14.6,8.4,31.5,15.0,111.1,24.9,21.6,48.3,22.7,47.282,13.824,
 19.160,15.360,8.606,87.275,20.851,16.912,30.365,17.769,91.413,
 129.289,17.806,47.614,23.881,29.813,5.960,5.597,12.968,4.329,
 135.131,6.655,6.856,7.056,11.798,31.387,11.541,6.087,17.852,7.240,
 124.183,8.963,4.696,11.531,4.900,77.570,19.375,14.899,29.973,
 116.318,92.206,23.815,17.917,42.650,19.723,103.735,24.014,20.127,
 140.469,20.244,47.311,12.986,9.173,16.470,10.407,14.845,4.142,
 12.880,7.284,3.056,15.446,5.643,2.983,6.996,3.338,15.773,5.244,
 13.080,7.683,3.038,4.162,1.028,0.813,1.889,0.228,10.515,2.549,
 12.039,5.942,4.843,11.178,2.668,2.168,10.364,3.830,27.774,10.208/
 DATA(STABL1(I),I=683,785)/
 15.444,5.971,3.726,16.805,4.875,3.317,11.972,5.971,13.477,3.653,
 12.638,6.340,4.147,34.149,8.517,6.623,15.961,9.624,14.753,4.043,
 14.324,4.463,3.510,4.463,2.782,0.868,1.230,1.390,20.356,4.379,
 13.934,8.591,4.130,13.753,3.970,2.698,10.975,7.748,43.442,11.993,
 18.429,15.419,10.247,19.372,4.042,3.748,10.031,9.051,30.515,6.449,
 15.773,16.208,6.786,103.504,25.185,20.076,31.438,25.643,21.603,
 16.025,4.191,10.474,7.257,11.661,3.046,2.220,7.297,3.489,70.859,
 116.479,13.726,27.690,13.132,19.019,4.713,3.705,9.166,3.476,19.356,
 15.119,3.689,9.438,5.387,83.573,21.214,15.199,26.772,12.215,
 118.125,4.103,3.520,5.613,1.038,30.354,8.082,5.904,14.500,8.307,
 1178.494,18.766,15.221,27.329,15.922/

C
 C THIS DATA STATEMENT CONTAINS INFORMATION ON THE 18 YEAR CYCLE
 C FOR THE LUNAR NODES FOR EACH OF THE NCONST NUMBER OF TIDAL
 C CONSTITUENTS.

DATA(STABL2(I),I=1,5)/ 1.0375,1.0000,1.0375,0.9845,0.8120/

C
 C THIS DATA STATEMENT CONTAINS INFORMATION ON THE FREQUENCY OF
 C NCONST NUMBER OF TIDAL CONSTITUENTS-- $2 \cdot \pi / \text{PERIOD}(\text{HOURS})$.

DATA(STABL3(I),I=1,5)/.50586797,.52359877,.49636640,.26251671,
1 .24335125/

C
C THIS DATA STATEMENT CONTAINS INFORMATION ON THE PHASE OR EPOCHS OF
C VARIOUS TIDAL CONSTITUENTS. THEY ARE COMPUTED BY THE TECHNIQUE
C OUTLINED IN THE MANUAL OF HARMONIC ANALYSIS AND PREDICTION OF
C TIDES. THEY ARE BASED ON THE DATE OF 1 JANUARY 1978.

DATA(STABL 4(I),I=1,95)/

1 2.49233017, 5.48033385, 3.83274304, 4.73856892, 2.08217780,
1 2.36315624, 4.81232596, 4.37804636, 5.20442603, 2.18527413,
1 2.30074395, .08726646, 3.18697121, 4.77347550, 2.37888377,
1 2.59704993, 5.07890812, 4.25162206, 5.13999465, 2.29161731,
1 2.84139602, 5.82939970, 4.26907535, 5.36688745, 2.44869694,
1 2.45742359, 4.85201532, 4.14690230, 5.00036831, 1.82037841,
1 2.57231861, 5.03236020, 4.59023380, 5.31269500, 2.28412984,
1 2.38761042, 4.88692191, 4.02472926, 5.05272819, 2.55341670,
1 2.82235448, 5.29126234, 4.83550450, 5.43931862, 2.40433067,
1 2.83832424, 5.30812222, 4.85102048, 5.44750422, 2.41185304,
1 2.57959663, 5.06145483, 4.46106157, 5.17490123, 2.51851011,
1 2.85518412, 5.32555806, 4.86725662, 5.45652757, 2.41996882,
1 2.47487688, 4.92182849, 4.21671547, 5.01782160, 2.39633706,
1 2.24798408, 4.74729557, 4.09454243, 5.10508806, 2.23925743,
1 2.21307749, 4.95673508, 4.07708913, 4.54658270, 1.57603231,
1 2.75412956, 5.14872129, 4.47851486, 5.29707428, 2.57086999,
1 2.78657523, 5.25401701, 4.80054556, 5.42062615, 2.38726135,
1 2.30034395, 4.83456203, 4.35634181, 4.94800843, 2.08217780,
1 2.78599927, 5.25344106, 4.79996960, 5.42034689, 2.38696464/

DATA(STABL 4(I),I=96,190)/

1 2.14326432, 4.53785606, 4.16435560, 4.98291502, 2.16944426,
1 2.31779725, 4.66002910, 4.07708913, 4.47676953, 1.83783170,
1 1.70693201, 3.75245789, 3.60585024, 5.45415391, 4.10675973,
1 2.73667627, 5.06145483, 4.51342145, 5.64614013, 2.44869694,
1 2.38761042, 4.72984227, 4.14690230, 4.82583538, 1.90764487,
1 2.68431639, 5.04400154, 4.44360828, 5.94284610, 3.70533400,
1 2.02719992, 4.46804289, 4.05541214, 5.02658316, 2.02194648,
1 3.17300858, 5.60250690, 5.03702022, .16580628, 2.81521608,
1 2.02662396, 4.46746693, 4.05481873, 5.02628645, 2.02164977,
1 1.98272893, 4.42208837, 4.01170909, 5.00352736, 2.00049638,
1 2.23053078, 4.60766923, 3.97236938, 5.57632696, 3.07701547,
1 2.08963035, 4.24115009, 4.20812845, 4.99459127, 2.19663649,
1 3.52207443, 0.00000000, 5.07192681, .18325957, 2.46615023,
1 2.04805661, 4.54715867, 4.49825453, 5.14800572, 2.33889827,
1 2.05599786, 4.66002910, 3.67566341, 5.17490123, 2.18689755,
1 3.15555529, 5.70722665, 4.77522083, .11344640, 3.00720230,
1 2.20911361, 4.36157761, 4.32872339, 5.06631824, 2.25660568,
1 2.92866249, 5.16617459, 4.84503400, 5.87303293, 1.89019158,
1 2.35270383, 4.86946861, 4.32143523, 5.13999465, 2.53596340/

DATA(STABL 4(I),I=191,285)/

1 2.23053078, 4.52040276, 4.04218255, 5.29707428, 2.43124365,
1 2.97205137, 5.15453325, 5.07386412, 5.45253076, 2.62106565,
1 2.75889430, 4.93404580, 4.86472131, 5.34199906, 2.51849265,
1 2.10835774, 3.47320521, 4.89739388, 4.94800843, 2.60577657,
1 1.96024909, 4.10733570, 4.08112084, 4.93298115, 2.13434568,
1 1.96873140, 4.52040276, 3.62330353, 5.00036831, 1.97745804,
1 2.21086092, 4.36681379, 4.32698537, 5.05759766, 2.25486067,
1 2.12581103, 4.48549618, 3.83274304, 4.86074197, 2.01236463,
1 2.43997029, 4.85201532, 4.14690230, 5.15744794, 2.44869694,

1 2.88310939, 5.06262421, 5.02138207, 5.40645407, 2.57816546,
 1 2.84139602, 5.16617459, 4.63559449, 5.03527489, 2.20435085,
 1 2.64940980, 5.06145483, 4.39124840, 5.76931318, 2.69304304,
 1 3.05093553, 5.35816080, 3.97236938, 5.38434074, 3.67042742,
 1 2.96093362, 5.14348531, 5.06281618, 5.44701552, 2.61553296,
 1 3.29518163, 5.34070751, 5.28136632, 5.07018148, 2.58832328,
 1 2.41234173, 4.57567735, 4.52448683, 5.16231742, 2.35160427,
 1 2.70176968, 5.06145483, 4.47851486, 5.24471440, 2.51851011,
 1 2.53880829, 4.70657704, 4.64857974, 5.22794180, 2.41242899,
 1 2.92866249, 5.25344105, 4.72286096, 5.66359342, 2.18689755/

DATA(STABL 4(I),I=286,380)/

1 1.77826361, 2.36375176, 3.90227695, 4.83330540, 2.04653817,
 1 1.56514146, 2.58425666, 3.69313415, 4.72888235, 1.94398262,
 1 2.89375590, 5.48033385, 4.54832803, 5.83812635, 2.93738913,
 1 2.99847566, 5.86430629, 4.51342145, 5.87303293, 3.04210889,
 1 2.28289066, 4.78220215, 4.14690230, 5.20980782, 2.30907060,
 1 1.79419847, 4.69493569, 3.25678438, 4.68620904, 1.68075207,
 1 1.69227124, 2.16188698, 3.72681900, 4.85271346, 1.86087005,
 1 1.77674518, 4.38077642, 3.36150414, 4.93055514, 1.62839219,
 1 2.38761042, 5.04400154, 3.97236938, 5.12254136, 2.48360353,
 1 3.50065617, 6.07199883, 5.79479873, 6.05242843, 3.29507571,
 1 2.78903615, 5.28834763, 4.49596815, .11344640, 3.40862803,
 1 2.03854457, 4.41568301, 3.79783645, 4.82583538, 2.25671072,
 1 1.84655835, 4.50294947, 3.44877060, 4.58148929, 1.89019158,
 1 2.61450322, 4.81710874, 4.56578132, 5.22726111, 2.97229572,
 1 2.16620764, 4.38848465, 4.39053709, 4.92269231, 1.88608714,
 1 2.00363798, 4.46804289, 4.16435560, 4.84328867, 1.89019158,
 1 1.84655835, 4.29350996, 3.57094365, 4.77347550, 1.82037841,
 1 1.96873140, 4.38077642, 3.71056999, 4.96546172, 2.04727121,
 1 2.37015712, 4.85201532, 4.05963584, 5.33198087, 2.46615023/

DATA(STABL 4(I),I=381,475)/

1 2.02109127, 4.48549618, 3.72802328, 5.01782160, 2.09963109,
 1 1.91637152, 4.31096325, 3.67566341, 4.87819526, 2.06472451,
 1 1.35786616, 4.18879021, 2.08741379, 4.59894258, 1.92509817,
 1 1.96873140, 4.52040276, 3.64075682, 4.45931624, 1.94255146,
 1 1.77674518, 3.99680399, 3.60585024, 4.94800843, 1.99491134,
 1 1.61966555, 4.06661716, 3.72802328, 4.73856892, 1.89019158,
 1 2.07345115, 4.18879021, 3.95491609, 5.05272819, 2.65813645,
 1 1.60221225, 3.78736448, 3.44877060, 4.58148929, 2.16944426,
 1 2.16071761, 4.29350996, 4.25162206, 5.08763477, 1.12224671,
 1 1.37531945, 3.71755131, 3.32659755, 4.47676953, 1.64584548,
 1 1.89891823, 4.39822972, 3.62330353, 4.96546172, 2.08217780,
 1 1.96873140, 4.27605667, 3.76292987, 4.91310185, 2.20435085,
 1 1.93382481, 4.45058959, 3.60585024, 4.91310185, 2.34397719,
 1 1.81165176, 4.17133691, 4.04218255, 4.59894258, 2.01236463,
 1 1.81165176, 4.01425728, 3.67566341, 4.59894258, 1.85528500,
 1 2.54421654, 5.37735838, 4.34966733, 5.51312215, 2.56378337,
 1 1.61966555, 3.99680399, 3.27423768, 4.65130246, 2.09963109,
 1 2.28289066, 4.50294947, 4.25162206, 4.72111563, 2.06472451,
 1 2.02109127, 4.55530935, 4.19926218, 5.24471440, 2.36143048/

DATA(STABL 4(I),I=476,570)/

1 1.84655835, 4.22369679, 3.58839694, 4.89564855, 2.02981792,
 1 2.10835774, 4.66002910, 3.79783645, 4.96546172, 2.32652389,
 1 2.10835774, 4.69493569, 3.76292987, 5.19235453, 2.39633706,
 1 2.00363798, 4.52040276, 4.09454243, 5.03527489, 2.08217780,
 1 1.77674518, 4.18879021, 3.32659755, 5.07018148, 2.39633706,
 1 1.98618469, 4.57276264, 3.81528975, 5.29707428, 2.83266938,

1 1.81165176, 4.24115008, 3.53603707, 4.87819526, 1.97745804,
 1 2.00363798, 4.99164166, 3.95491609, 4.61639587, 1.31423293,
 1 2.02109127, 4.50294947, 4.12944901, 4.80838209, 2.04727121,
 1 1.60221225, 4.25860338, 3.74547658, 4.63384916, 1.90764487,
 1 1.68947872, 3.89208423, 3.25678438, 4.45931624, 1.12224671,
 1 2.52723676, 5.51524044, 4.00727596, 4.54658270, 3.63552083,
 1 2.31779725, 5.06145483, 3.88510292, 5.47160721, 2.83266938,
 1 2.60937545, 5.07599845, 4.62426556, 5.32753563, 2.30838374,
 1 2.50978346, 5.00909495, 4.18180889, 5.27962099, 1.71565865,
 1 2.61450322, 5.44542727, 4.40870169, 5.57632696, 2.60577657,
 1 2.38761042, 4.69493569, 4.18180889, 5.45415391, 2.55341670,
 1 2.47487688, 4.99164166, 4.14670230, 5.36688745, 2.09963109,
 1 2.63195651, 6.12610568, 4.58323462, 5.89048623, 2.57086999/

DATA(STABL 4(I),I=571,665)/

1 2.96356907, 5.37561410, 4.70540766, 5.40179404, 2.65813645,
 1 2.85017503, 5.29923849, 4.57946471, 4.87014929, 1.78144011,
 1 2.92866249, 5.44542727, 4.60068791, 5.47160721, 2.79776279,
 1 2.19562420, 4.41568301, 4.02472926, 4.93055514, 2.02981792,
 1 2.92866249, 5.34070751, 4.65304779, 5.48906050, 2.74540291,
 1 2.93236258, 5.25403446, 4.73008662, 5.66460571, 2.19117361,
 1 2.89975983, 5.48052584, 4.54572749, 5.84098397, 2.93887266,
 1 2.22777316, 4.66488112, 3.95791805, 5.01944476, 2.43855658,
 1 .55712729, 3.41510320, 2.09038085, 3.69688661, .73129296,
 1 .49359657, 5.90657816, 2.30400915, 4.88589216, 2.80518044,
 1 2.55015293, 5.19320974, 4.17044679, 4.91795386, 1.58491604,
 1 .69499011, 5.04138355, 3.08753981, 5.13254209, .61611868,
 1 2.35404774, 4.83709276, 4.04324720, 5.15085060, 2.25866549,
 1 2.43333804, 4.82573066, 4.16596130, 5.30852364, 2.39406814,
 1 2.72822887, 5.08251350, 4.49584598, 5.51719521, 2.73770601,
 1 .93802721, 4.93769353, 3.51237040, .14395476, 1.54346447,
 1 2.22773826, 4.98450326, 3.78040061, 5.00782086, 2.56469152,
 1 2.39216573, 4.56265718, 4.25490328, 5.10253988, 2.32921170,
 1 2.49601282, 4.94514609, 4.18685289, 4.99850081, 1.69701854/

DATA(STABL 4(I),I=666,760)/

1 2.71992111, 4.27837796, 4.97822008, 4.11738879, .35454619,
 1 2.42008827, 5.18989361, 4.23025923, 5.12821368, 2.47201454,
 1 2.45829625, 4.76392855, 4.25361173, 5.75293683, 1.45633763,
 1 3.24217598, 5.57379623, 4.98467780, 6.01258946, .52546628,
 1 2.71121191, 4.87802073, 4.54146889, 4.75567315, 2.27517631,
 1 2.51686950, 4.18983740, 4.71385978, 5.02005562, 1.85259719,
 1 2.60657943, 5.09342926, 4.30241114, 5.42055633, 2.86024558,
 1 2.20986609, 4.45233492, 4.18289099, 5.07035601, 1.11449745,
 1 2.39293367, 5.29480535, 2.18597253, 6.27341146, 1.32028922,
 1 2.26018393, 4.23022432, 4.17926071, 5.88792059, 2.26840443,
 1 2.57095725, 5.22589975, 4.17233175, 4.84477220, 2.29767360,
 1 2.77722027, 4.60060064, 4.82953548, 5.33341204, 2.37261804,
 1 2.64000248, 4.93652416, 4.42444456, 6.18010616, 3.00248991,
 1 1.40385558, 3.96376490, 3.12462805, 4.28574325, .55084337,
 1 2.26733978, 4.59384622, 4.05216583, 5.28885378, 2.44473504,
 1 2.18895704, 4.82820903, 3.81090897, 5.15598186, 1.97541601,
 1 2.06676654, 4.37964196, 3.81755867, 5.40964802, 3.12084069,
 1 2.24868221, 4.60201436, 4.01706726, 4.99090862, 2.22075694,
 1 2.10181275, 4.54729829, 3.80727868, 5.03010872, 2.20679431/

DATA(STABL 4(I),I=761,785)/

1 2.00452810, 4.30258567, 3.78242520, 4.43980346, 1.67617931,
 1 2.54652265, 4.84164807, 4.61957237, 3.53385540, .71790628,
 1 2.01185848, 4.44912352, 3.73352107, 5.19101062, 3.15288493,

```
1 1.59777912, 4.05988019, 3.31760911, 4.60812301, 1.91792486,  
1 1.81351926, 4.24696204, 3.84567592, 4.91571985, 1.91909423/
```

```
C  
C IF MORE REFERENCE STATIONS ARE ADDED TO THE STNS LIST OR IF THE  
C 1 NUMBER OF CONSTITUENTS TO BE SUMMED OVER IS CHANGED, THEN THE  
C 1 FOLLOWING DATA CARD MUST BE CHANGED.  
C DATA NCONST,NSTAT/5,157/
```

```
C  
DATA RDATE/0,0,0,1,78/  
IERR = 2  
BOT=1  
TOP=NSTAT  
50 IF(BOT.GT.TOP) GO TO 200  
STNBR=(BOT+TOP)/2  
IF(STN.LE.STNS(STNBR)) GO TO 75  
BOT=STNBR+1  
GO TO 50  
75 CONTINUE  
IF(STN.GE.STNS(STNBR)) GO TO 100  
TOP=STNBR-1  
GO TO 50  
100 CONTINUE  
CALL TIMER(RDATE,DATE,TIME)  
INDEX = NCONST * (STNBR-1) + 1  
CURRENT=SPEED(STABL1(INDEX),STABL2(1),STABL3(1),STABL4(INDEX),TIME,  
INCONST)  
IERR = 1  
200 CONTINUE  
RETURN  
END
```



```
SUBROUTINE TIMER(BDATE,DATE,TIME)
C THIS SUBROUTINE CALCULATES THE NUMBER OF HOURS BETWEEN TWO
C JULIAN DATES AND TIMES
C BDATE IS AN INTEGER ARRAY OF THE JULIAN DATE AND TIME OF THE
C BEGINNING OF THE CHOSEN EPOCH.
C DATE IS AN INTEGER ARRAY OF THE CURRENT JULIAN DATE AND TIME.
C THE ORDER OF BOTH BDATE AND DATE ARE=SEC,MIN,HOURL,DAY,YEAR.
C CARE SHOULD BE TAKEN THAT BDATE AND DATE REFER TO THE SAME TIME
C ZONE.TIME IS THE NUMBER OF HOURS ELAPSED BETWEEN BDATE AND DATE.
C TIME IS POSITIVE IF BDATE PRECEEDS DATE AND NEGATIVE IF DATE
C PRECEEDS BDATE. TIME IS RETURNED AS A REAL VARIABLE.
C THE ROUTINE WILL RUN MOST CHEAPLY IF BDATE IS CHOSEN CLOSE TO THE
C EXPECTED VALUES OF DATE. THIS ROUTINE IS VALID FOR DATES BETWEEN
C 1 JANUARY 1901 AND 31 DECEMBER 1999. AN IF-TEST FOR THE CENTURY
C WOULD BE NEEDED FOR VALIDITY BEYOND THESE LIMITS.
INTEGER BDATE(5),DATE(5),DIFF(5)
DO 100 I=1,5
DIFF(I)= DATE(I) - BDATE(I)
100 CONTINUE
TIME = FLOAT(DIFF(1)+DIFF(2)*60)/3600.+
1FLOAT(DIFF(3)+(DIFF(4)+DIFF(5)*365)*24)
N = IABS(DIFF(5))
IF(TIME.GT.0)GOTO 200
IYR = DATE(5)
IF(DATE(4).LE.60)GOTO 300
IYR = IYR+1
N = N-1
GOTO 300
200 IYR = BDATE(5)
IF(DATE(4).LE.60)GOTO 300
N = N+1
300 CONTINUE
IF(N.LE.0)GOTO 500
DO 400 I=1,N
IF(MOD(IYR,4).EQ.0) TIME = TIME+24.
IYR = IYR+1
400 CONTINUE
500 CONTINUE
RETURN
END
```

```
REAL FUNCTION SPEED(AMP,FAC,FREQ,PHAS,T,N)
C      SPEED IS MAGNITUDE OF CURRENT RETURNED BY THE FUNCTION.
C      AMP IS MAXIMUM SPEED FOR EACH CONSTITUENT.
C      FAC IS FACTOR FOR REDUCING MEAN AMPLITUDE TO YEAR OF
C      PREDICTION FOR EACH CONSTITUENT.
C      FREQ IS PHASE SPEED OF EACH CONSTITUENT.
C      PHAS IS VALUE OF EQUILIBRIUM ARGUMENT MINUS THE EPOCH FOR
C      EACH CONSTITUENT.
C      T IS THE TIME SINCE SOME INITIAL EPOCH.
C      N IS THE NUMBER OF CONSTITUENTS TO BE SUMMED.
DIMENSION AMP(N),FAC(N),FREQ(N),PHAS(N)
SPEED=0.00
DO 100 I=1,N
SPEED = SPEED+AMP(I)*FAC(I)*COS(FREQ(I)*T+PHAS(I))
100 CONTINUE
RETURN
END
```



```
SUBROUTINE JULIAN (MM,MD,MY,JULDAY)
C THIS SUBROUTINE CALCULATES THE NUMBER OF DAYS
C ELAPSED SINCE JANUARY 1. THE INPUTS ARE
C MONTH(MM),DAY(MD),AND YEAR(MY).THE
C OUTPUT IS THE JULIAN DAY(JULDAY). THE ROUTINE
C IS VALID FOR ALL YEARS OTHER THAN EVEN CENTURIES.
DIMENSION INCREM(12)
DATA INCREM/0,31,59,90,120,151,181,212,243,273,304,334/
JULDAY=MD+INCREM(MM)
IF (MOD(MY,4).EQ.0.AND.MM.GT.2) JULDAY = JULDAY + 1
RETURN
END
```

```
SUBROUTINE LOCALE(LAT, LONG, I, J)
```

```
C
C THIS SUBROUTINE CHOOSES THE APPROPRIATE BOX
C CO-ORDINATES FOR A REGULAR GRID (NBOXNS BY NBOXEW)
C WITH GIVEN LATITUDE AND LONGITUDE LIMITS (NLAT,
C SLAT, WLONG, ELONG). THE SIGN CONVENTION GIVES A
C LOWER LEFTHAND CORNER BOX CO-ORDINATES (1,1) FOR
C THE NORTHWESTERN QUARTER SPHERE THE INCREMENTAL
C WIDTH AND HEIGHT OF THE BOXES IS ONLY COMPUTED
C THE FIRST CALL AFTER COMPILATION. IF GRID CHANGES
C ARE EXPECTED MID-PROGRAM, THEN THIS FEATURE MUST
C BE CHANGED.
```

```
C
REAL NLAT, LAT, LONG
DATA SLAT, NLAT, WLONG, ELONG / 47.0, 49.0, 125.166667,
1122.166667 /
DATA NBOXNS, NBOXEW / 223, 223 /
DATA KK / -1 /
```

```
C
C THIS SECTION COMPUTES THE INCREMENTAL BOX
C SIZES THE FIRST CALL ONLY.
```

```
C
IF (KK.GT.0) GO TO 100
DBOXNS=(NLAT-SLAT)/FLOAT(NBOXNS)
DBOXEW=(WLONG-ELONG)/FLOAT(NBOXEW)
KK=1
100 CONTINUE
```

```
C
C THE BOX CO-ORDINATES ARE CHOSEN EACH CALL.
```

```
C
I=INT((WLONG-LONG)/DBOXEW) + 1
J=INT((LAT-SLAT)/DBOXNS) + 1
RETURN
END
```


7. PSTIDE - contains the tide library in the binary library format. It will not be reproduced here. It can be generated from PSTIDE3 through standard library commands. For the NOS operating system on CDC mainframe, the interactive commands are as follows:

```
GET,PSTIDE3.
```

```
FTN,I=PSTIDE3,L=0.
```

```
LIBGEN.
```

```
REPLACE(ULIB=PSTIDE)
```

8. PLOTMAP - contains a FORTRAN routine which plots the flood direction for each defined grid point in the tide model and draws the proper background. This is meant to provide a visual check on the assignments both for the defined area and for the flood directions themselves. This procedure relies on ILOC2 and ISTA2 data files but not the tide library itself. The tape unit assignments are discussed under RUNPMAP.

```

PROGRAM PLOTMAP(TAPE1,TAPE2,TAPE3,OUTPUT,TAPE6=OUTPUT,TAPE99)
INTEGER ILOC(223),KEY1(224),KEY2(761),ISTA(7)
DATA PI/3.141592654/
DATA SCALE/1.137331839/
DIR=-999.
CALL OPENMS(1,KEY1,224,0)
CALL OPENMS(3,KEY2,761,0)
CALL PLOTS
CALL FACTOR(.8)
DO 1000 J=1,223
CALL READMS(1,ILOC,223,J)
DO 900 I=1,223
INDEX=ILOC(I)
IF(INDEX.LE.0) GO TO 800
IF(INDEX.GT.760)WRITE(6,100)INDEX,I,J
100 FORMAT(1X,9HBAD INDEX,3I5)
IF(INDEX.GT.760) GO TO 800
CALL READMS(3,ISTA,7,INDEX)
DIR=(FLOAT(ISTA(7))/180.0)*PI
Y=(FLOAT(I))*SCALE
Y=(FLOAT(J))*SCALE
XX=SIN(DIR)*SCALE+Y
YY=COS(DIR)*SCALE+Y
CALL SPAROW(X,Y,XX,YY)
100 CONTINUE
900 CONTINUE
1000 CONTINUE
CALL COAST
CALL PLOT(0.,0.,999)
END
SUBROUTINE SPAROW(X,Y,XX,YY)
C THIS ROUTINE DRAWS ARROWS WITH CALCOMP
C OR SIMILAR PLOT PACKAGE ROUTINES WHEN
C THE TAIL OF THE ARROW IS (X,Y) AND THE
C HEAD IS (XX,YY). THE VARIABLES FACTOR
C AND ANGLE MAY BE ADJUSTED IN A DATA
C STATEMENT TO CHANGE THE PROPORTION OF
C THE ARROWS. IF CLOSED ARROW HEADS ARE
C DESTRED THEN CHANGE THE SEQUENCE OF
C THE CALLS TO PLOT TO -
      CALL PLOT (XX,YY,3)
      CALL PLOT (X1,Y1,2)
      CALL PLOT (X2,Y2,2)
      CALL PLOT (XX,YY,2)
DATA FACTOR,ANGLE/0.25,.26179938/
DATA PIBY2/1.57079633/
CALL PLOT (X,Y,3)
CALL PLOT(XX,YY,2)
DX=X-XX
DY=Y-YY
IF(DX.EQ.0.) GO TO 200
ALPHA=ATAN2(DY,DX)
100 CONTINUE
GAMMA1=ALPHA+ANGLE
GAMMA2=ALPHA-ANGLE
DIST=FACTOR*SQRT(DX**2+DY**2)
X1=XX+DIST*COS(GAMMA1)
Y1=YY+DIST*SIN(GAMMA1)
X2=XX+DIST*COS(GAMMA2)
Y2=YY+DIST*SIN(GAMMA2)
CALL PLOT (X1,Y1,2)
CALL PLOT (XX,YY,3)
CALL PLOT (X2,Y2,2)
RETURN

```



```

200 ALPHA=PIBY2
   IF(DY.LT.0.) ALPHA=-PIBY2
   GO TO 100
   END
   SUBROUTINE COAST
   DATA UNITX/.551/,UNITY/.551/,XADD/0./,YADD/0./,
1 XMIN/0.0/,YMIN/0.0/
   M=0
   NEOF=0
C   DRAW RECTANLE
   X0=.8203047
   Y0=2.1845704
   XU=.8552113
   YU=2.1322106
C   CALL GRID(0.,0.,.551,.551,.56,.56)
   CALL PLOT(0.,0.,3)
   CALL PLOTVAL(XU,Y0,X,Y,X0,Y0)
   CALL PLOT(X,Y,2)
   CALL PLOTVAL(XU,YU,X,Y,X0,Y0)
   CALL PLOT(X,Y,2)
   CALL PLOTVAL(X0,YU,X,Y,X0,Y0)
   CALL PLOT(X,Y,2)
   CALL PLOT(0.,0.,2)
C   PLOT BACKGROUND
200 READ(2)RLAT,RLONG,IFLAG
   IF(EOF(2))20,30
   20 IF(NEOF.GE.1)GOTO 300
   M=M+1
   NEOF=1
   WRITE(6,1100)M
1100 FORMAT(* PLOTTING COMPLETED FILE *,I3/)
   GOTO 200
   30 NEOF=0
   RLONG=ABS(RLONG)*.0174533
   RLAT=RLAT*.0174533
C   CHECK FOR WITHIN AREA
   IF(RLAT.LE.XU.AND.RLAT.GE.X0)GOTO 35
   GOTO 200
   35 IF(RLONG.LE.Y0.AND.RLONG.GE.YU)GOTO 37
   GOTO 200
   37 CONTINUE
   CALL PLOTVAL(RLAT,RLONG,XX,YY,X0,Y0)
   IF(IFLAG.EQ.1)IFLAG=2
   CALL PLOT(XX,YY,IFLAG)
   GOTO 200
300 CONTINUE
   RETURN
   END
   SUBROUTINE PLOTVAL(A,B,C,D,E,F)
   XS=586.8624403
   YS=880.2919792
   XADD=0.
   YADD=0.
   D=(A-E)*YS+YADD
   C=(F-B)*XS+XADD
   RETURN
   END

```

9. RUNPMAP - is a procedure file (NOS operating system, CDC mainframe) which will execute the CALCOMP plot program described under PLOTMAP. Tape unit 2 can be assigned any sequential file of latitude and longitude pairs of coastline data (in radians) flagged with integers indicating the endpoints of line segments compatible with CALCOMP notation. Tape units 1 and 3 are reserved for the tide data arrays and a CALCOMP or comparable plotting library is required.

```
ATTACH(TAPE1=ILOC2)
ATTACH(TAPE3=ISTA2)
ATTACH(TAPE2=PUGSD/UN=CMF)
GET(CCLIB/UN=WFH)
GET.PLOTMAP.
FTN(I=PLOTMAP,R=3,OPT=0)
LDSET(LIB=CCLIB)
L60.
```


10. PSTIME - contains the FORTRAN program TIME which uses the tide library to generate time series of tide velocities at a point. To modify the program to run alternate cases, the two data statements

```
DATA DATE/0,0,0,63,76/
```

```
DATA NSTEP,I,1,/360,202,70/
```

can be modified. DATE is an integer array of second, minute, hour, Julian day, and 2-digit year of the start of the calculation. NSTEP is the number of hourly time steps desired in the time series. I and J are the longitudinal and latitudinal tide grid locations of the position. If I, J are not known, a call to subroutine LOCATE in the tide library can be inserted after the data statement. Assignments of the unit numbers on the program card are shown in the discussion of file RUNPSTM. It should be noted that this program exercises all structural elements of the tide library and tide data files except subroutines LOCATE and JULIAN which were added to the library as user services.

```
PROGRAM TIME(TAPE1,TAPE2,TAPE3,OUTPUT,TAPE6=OUTPUT)
```

```
C
C      THIS ROUTINE MAKES TIME SERIES OF TIDE
C      VELOCITIES AT POSITION (I,J) AND BEGINNING AT
C      TIME DATE(5), WHERE I IS THE EAST-WEST
C      BOX NUMBER AND J IS THE NORTH-SOUTH BOX
C      NUMBER OF THE TIDE MODEL GRID AND DATE
C      IS A JULIAN DATE ARRAY (SEC.,MIN.,HOUR,
C      JULIAN DAY,YEAR). IF (I,J) ARE NOT KNOWN,
C      SUBROUTINE LOCALE (LAT,LONG,I,J) CAN BE
C      CALLED FROM THE TIDE LIBRARY.
C      THIS ROUTINE MAKES HOURLY TIME STEPS FOR
C      NSTEP HOURS. THE ROUTINE IS DESIGNED PRIMARILY
C      FOR CHECKING THE MODELS FUNCTION
```

```
INTEGER DATE(5)
COMMON/TIDDAT/DIR,RAD
DATA DATE/0,0,0,63,76/
DATA NSTEP,I,J/360,202,70/
WRITE(6,25) NSTEP,I,J
WRITE(2,25) NSTEP,I,J
25 FORMAT(1X,3I5)
```

```
C
DO 300 ISTEP = 1,NSTEP
CALL TIDES(I,J,DATE,U,V)
IF (ISTEP.GT.1) GOTO 75
IF(DIR.LT.0..OR.DIR.GT.360.) DIR=999.
WRITE(6,50) DIR,DATE
WRITE(2,50) DIR
50 FORMAT(1X,F10.2,5I5)
75 CONTINUE
WRITE(6,100) I,J,DATE,U,V
100 FORMAT(20X,7I5,2F10.2)
WRITE(2,200) U, V
200 FORMAT(1X,2F10.2)
DATE(3) = DATE(3) + 1
IF (DATE(3).GE.24) DATE(3) = 0
IF (DATE(3).LE.0) DATE(4) = DATE(4) + 1
300 CONTINUE
```

```
C
ENDFILE 2
END
```


11. RUNPSTM - contains a card image procedure file which will correctly execute PSTIME on a CDC mainframe with a NOS operating system. Note that tape units 1 and 3 are the tide location and station arrays in binary form described previously and PSTIDE is the tide library in compiled library format. The time series output of tide currents on tape unit 2 can be used to generate a plot, if desired.

```
GET(PSTIDE)
GET,PSTIME.
ATTACH(TAPE1=ILOC2)
ATTACH(TAPE3=ISTA2)
FTN(I=PSTIME,R=3,OPT=0,PL=10000)
LDSET(LIB=PSTIDE)
LGO.
REPLACE(TAPE2=OUTPSTM)
```

12. OUTPSTM - is a sequential data file of a time series of U, V components of the predicted tide velocity generated by running PSTIME. This can be attached by PSTPLOT to create a time plot of tide velocities at a point. An example of the file will not be reproduced here, but may be read as follows

```
      INTEGER DATE(5)
      READ(12,25) NSTEP,I,J
25    FORMAT(1X,3I5)
      READ(12,50) DIRECT,DATE
50    FORMAT(1X,F10.2,5I5)
      DO 200 ISTEP=1,NSTEP
      READ(12,100) U,V
100   FORMAT(1X,2F10.2)
200   CONTINUE
```

Where NSTEP is the number of hourly U, V pairs, I and J are the tide grid location of the point, DIRECT is the direction of the current at flood (decimal degrees true, oceanographic convention), and DATE is an integer 5-word array of seconds, minutes, hour, Julian day, and 2-digit year indicating the start of the series.

13. PSTPLOT - contains a FORTRAN program called PLOTIM which will discern and draw a time series CALCOMP plot of tide current data for a single location. The I, J grid location and start time will also be labeled in the lower left-hand corner of the plot. The routine was designed to be compatible with PSTIME described above via OUTPSTM. The tape unit assignments are discussed under RUNPSPT.


```
PROGRAM PLOTIM(INPUT,OUTPUT,TAPE99,TAPE12,TAPE5=INPUT,TAPE6=
*OUTPUT)
```

```
C
C     THIS ROUTINE MAKES CALCOMP PLOTS OF TIME
C     SERIES OF TIDE VELOCITIES COMPATABLE WITH
C     PROGRAM TIME IN FILE PSTIME.
C
```

```
INTEGER DATE(5)
DATA TINCH,VINCH,TMAX,VMAX/12.,8.,360.,200./
READ(12,25) NSTEP,I,J
25 FORMAT(1X,3I5)
READ(12,50) DIRECT,DATE
50 FORMAT(1X,F10.2,5I5)
IF(FLOAT(NSTEP).LT.TMAX) TMAX=FLOAT(NSTEP)
TSCALE=TINCH/TMAX
DT=1./TSCALE
VSCALE=VINCH/VMAX
DV=1./VSCALE
VSTART=VMAX/2.
TSTART=VINCH/2.
```

```
C
CALL PLOTS
CALL AXIS(0.,0.,12HTIME (HOURS),-18,TINCH,0.,0.,DT)
CALL AXIS(0.-TSTART,26HEBB-VELOCITY(CM/SEC)-FLOOD,26,VINCH,90.,
*-VSTART,DV)
CALL SYMBOL (0.,-4.5,0.14,1HI,0.,1)
CALL NUMBER(999.,-4.5,0.14,FLOAT(I),0.,0)
CALL SYMBOL(999.,-4.5,0.14,1HJ,0.,1)
CALL NUMBER(999.,-4.5,0.14,FLOAT(J),0.,0)
CALL NUMBER(0.,-4.75,0.14,FLOAT(DATE(3)),0.,0)
CALL NUMBER(999.,-4.75,0.14,FLOAT(DATE(4)),0.,0)
CALL NUMBER(999.,-4.75,0.14,FLOAT(DATE(5)),0.,0)
N=3
K=INT(TMAX)
```

```
C
DO 200 ISTEP=1,K
READ(12,100)U,V
100 FORMAT(1X,2F10.2)
IF(U.EQ.0.)GOTO 150
ANGLE=ATAN2(V,U)*180./3.14159
IF(ANGLE.LT.0.) ANGLE=ANGLE+360.
SIGN=1.
IF(ABS(ANGLE-DIRECT).GT.90) SIGN=-1.
X=FLOAT(ISTEP)*TSCALE
Y=SQRT(U**2+V**2)*VSCALE*SIGN
GO TO 175
150 CONTINUE
Y = V*VSCALE
175 CONTINUE
X=FLOAT(ISTEP)*TSCALE
CALL PLOT(X,Y,N)
N=2
200 CONTINUE
```

```
C
CALL PLOT(0.,0.,999)
END
```

14. RUNPSPT - is a procedure file (NOS operating system, CDC mainframe) to create a Calcomp plot using the data file OUTPSTM, the FORTRAN program PSTPLOT, and a Calcomp library. Tape 12 is the input data file assignment.

```
GET.PSTPLOT.  
GET(TAPE12=OUTIME4)  
GET(CCLIB/UN=PMELIB)  
FTN(I=PSTPLOT,R=3,OPT=0)  
LDSET(LIB=CCLIB)  
LGO.
```


B. Puget Sound Wind Files

1. PUGDATA - contains 8 card image data files of wind speed and direction including PUGSE1, PUGSE2, PUGS, PUGSW, PUGW, PUGNW, PUGN, PUGSB. Seven of these are for six different geographic orientations of the wind field with one case (SE) having stronger (SE2) and weaker (SE1) subcases. The eighth field is a sea breeze (SB) case. The generation of these fields is described in Overland and Hitchman (1979) and Pease, et al.(1979). These fields may be retrieved independently from this file by GTR commands on the NOS operating system or comparable file retrieval mechanism on other systems, although since the file is card image it may be read sequentially also. An example of the operating commands are

```
GET,PUGDATA
```

```
GTR(PUGDATA,TAPE1)TEXT/PUGSE1
```

The format of the data within the files is

```
READ(1,100)HEADER
100 FORMAT(A6)
200 CONTINUE
IF(EOF(1))500,300
300 READ(1,400)(I(N),J(N),IDIR(N),ISPEED(N),N=1,7)
400 FORMAT(7(4I2,2X))
GO TO 200
500 CONTINUE
```

Where I, J is the wind grid location, IDIR is the direction of the wind (degrees true divided by 10, oceanographic convention), and ISPEED is the magnitude of the wind velocity (MS^{-1}). Note that wind grid locations are not identical to tide grid locations. The wind grid is (56,56) over the same area that the tide grid is (223,223).

PUGSET

41 321 1	42 321 1	43 321 1	40 421 1	41 421 1	42 421 1	43 421 1
44 418 0	45 418 0	46 426 1	47 425 1	48 421 1	40 521 1	41 521 1
42 522 1	43 522 1	44 521 1	45 524 1	46 524 1	47 520 1	48 521 1
39 618 0	40 622 1	41 622 1	42 621 1	43 621 1	44 622 1	45 618 0
46 624 1	47 623 1	48 623 2	49 621 1	40 721 1	42 718 0	43 717 1
44 717 1	46 718 0	47 716 1	48 715 1	49 721 2	42 818 0	43 818 0
44 820 1	46 816 1	47 818 0	48 818 0	49 821 1	51 821 1	52 821 1
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34511707	36511707	37511707	38511807	39511707	40511707	41511707
42511707	43511807	44511807	45511707	46511807	29521607	30521707
32521507	33521607	34521607	36521607	37521707	38521707	39521707
40521807	41521707	42521807	43521707	44521807	45521807	46521807
29531707	30531707	32531707	33531707	36531707	37531707	38531707
39531707	40531807	41531807	42531807	43531807	44531807	45531707
31541707	32541607	33541607	34541607	35541707	36541707	37541707
38541807	39541707	40541807	41541807	42541807	43541807	44541707
45541807	30551607	31551707	32551707	33551707	34551707	35551707
36551707	37551707	38551707	39551707	40551807	41551807	42551807
43551807	44551707	45551707	46551807	47551707	48551707	49551707

33561707 34561707 35561707 36561707 37561707 38561707 39561707
40561707 41561807 42561807 43561807 44561707 45561707 00000000

PUGSB

41 2 8 3	42 2 8 3	43 2 8 3	41 3 8 3	42 3 8 3	43 3 8 3	40 410 3
41 4 9 3	42 4 9 3	43 4 9 3	44 4 9 3	45 4 9 3	46 4 9 3	47 4 9 3
41 5 8 3	42 5 8 3	43 5 9 3	44 5 9 4	45 5 9 4	46 5 9 4	47 5 9 4
48 510 4	39 6 9 3	40 6 9 3	41 6 8 3	42 6 8 3	43 6 8 3	44 6 9 4
45 6 9 4	46 6 9 4	47 6 9 4	48 6 9 4	3 7 8 3	40 7 8 3	42 7 8 3
44 7 8 3	46 7 9 4	47 7 9 4	48 7 9 4	49 7 9 4	42 8 8 3	43 8 8 3
44 8 9 3	45 8 9 4	46 8 9 4	47 8 9 4	48 8 9 4	49 8 9 4	51 811 4
52 813 4	43 9 8 3	44 9 8 3	46 9 10 4	47 910 4	49 910 4	50 911 4
51 912 4	52 913 4	441010 3	4510 9 4	461010 4	471011 4	491010 4
501011 4	511011 4	521013 4	531013 4	381110 3	3911 9 3	4011 9 3
4111 9 3	4211 9 3	441110 4	471110 4	481110 4	491110 4	501111 4
511112 4	521114 4	531114 4	381211 3	391211 3	421211 3	431211 3
491210 4	501211 4	511212 4	521213 4	531214 4	3 1312 3	401312 3
491314 4	501312 4	511314 4	521314 4	531314 4	391412 3	401412 3
501414 4	511414 4	521414 4	531414 4	401512 3	411512 3	471515 3
491514 4	501514 4	511514 4	521514 4	401614 3	411615 3	471615 3
481614 3	491615 4	501615 4	511615 4	521615 4	411715 3	421715 3
471715 3	481715 3	491715 4	501715 4	511715 4	521715 4	531715 4
411815 3	421815 3	431815 3	471814 3	481815 3	491815 4	501815 4
511815 4	521815 4	531817 4	421915 3	431917 3	441917 4	451917 4
481916 3	491916 4	501916 4	511916 4	521 16 4	432017 3	442016 3
452017 4	472017 4	482017 4	492017 4	502017 4	512016 4	522016 4
432117 3	442117 4	452117 4	472117 4	482117 4	492117 4	502117 4
512117 5	522117 5	432217 3	442217 4	452217 3	462217 3	512217 5
522218 5	432317 3	442317 3	452317 3	462317 3	472318 3	502317 5
512317 5	522318 5	442417 3	472417 3	482417 4	492417 4	502417 5
512418 5	522418 5	532418 5	472517 4	482517 4	4 2517 4	502517 4
512518 5	522518 5	532518 5	472617 4	482617 4	492617 5	502617 4
512617 4	522617 4	522618 4	472716 4	482717 5	492718 5	502718 4
512717 4	532717 4	542717 4	432815 4	442814 4	462817 4	472817 4
482818 5	492818 5	502818 4	532817 4	542817 4	552817 4	412912 4
432915 4	442915 4	462915 4	472916 4	482917 4	4 2 13 5	502917 5
532914 4	542916 4	552917 4	403012 4	413012 4	423013 4	433016 4
513016 4	523016 4	533017 4	543017 4	403112 4	413111 4	423113 4
433114 4	443114 4	453114 4	463114 4	473114 4	483114 4	493115 4
503115 4	513115 4	523116 4	533116 4	293211 5	303211 5	313210 5
323210 5	333210 5	343210 5	353211 5	363210 5	373210 5	393211 5
403212 5	413212 4	423211 4	433211 4	443212 4	463213 4	473215 4
483216 4	493216 4	503216 4	523213 4	223311 5	233311 5	243311 5
253311 5	263311 5	273311 5	283311 5	293311 5	303311 5	313311 5
323311 5	333311 5	343311 5	353311 5	363311 5	373311 5	383312 5
393312 4	403312 4	413312 4	423312 4	433312 4	443312 4	453312 4
463313 4	473313 4	483313 4	493313 4	513314 4	523315 4	213413 6
223412 6	233411 6	243411 6	253411 6	263410 6	273410 6	2834 9 6
2934 9 6	3034 9 6	3134 9 6	3234 6	333410 6	343410 5	353410 5
363411 5	373411 5	383412 5	393411 4	403412 4	413412 4	423412 4
433413 3	443412 3	453412 4	463412 4	483412 4	493412 4	513413 4
193512 6	203512 7	213512 7	223512 7	233511 7	243511 6	253511 6
263510 6	273510 6	2835 9 6	2935 9 6	3035 9 6	3135 9 6	3235 9 6
3335 9 6	3435 9 5	353510 5	363510 5	373510 5	383511 5	393511 4
403511 4	413512 4	423512 4	433511 3	443512 3	453511 3	463511 3
473511 3	483511 4	493512 4	163612 6	173612 6	183612 6	193612 7
203612 7	213612 7	223612 7	233611 7	243611 7	253611 6	263610 6
273610 6	283610 6	2936 9 6	3036 9 6	3136 8 6	3236 8 6	3336 9 6
3436 9 5	3536 9 5	3636 9 5	3736 9 5	3836 4	393610 4	403610 4
413610 4	423610 4	433610 4	443610 3	453610 3	463610 3	483610 3
493610 3	503611 3	513611 3	637 7 3	737 6 3	837 6 3	37 7 3
143710 4	153710 6	163711 6	173711 6	183711 6	193712 7	203711 7
213711 7	223711 7	233711 7	243711 7	253710 6	263710 6	2737 6
2837 9 6	2937 8 6	3037 8 6	3137 8 6	3237 8 6	3337 8 6	3437 8 5
3537 8 5	3637 9 5	3737 9 5	3837 9 4	3937 4	4037 4	4137 9 4
4237 9 4	4337 9 4	4437 9 4	4537 9 3	4637 9 3	4837 9 3	4937 9 3
503710 3	513710 3	638 7 3	738 7 3	838 8 3	38 8 3	1238 4
1338 8 3	1438 8 3	1538 8 3	1638 8 3	1738 8 3	1838 8 3	1938 8 3

203811 7	213811 7	223812 7	233811 7	243811 7	253811 6	263810 6
2738 9 6	2838 9 6	2938 9 6	3038 8 6	3138 8 6	3238 7 5	3338 8 6
3438 8 5	3538 8 5	3638 8 5	3738 8 5	3838 8 4	3 38 8 4	4038 8 4
4138 8 4	4238 8 4	4338 8 4	4438 8 4	4538 8 4	4638 8 3	4738 8 3
4838 8 3	4938 8 3	5038 8 3	63 7 3	73 7 3	83 8 3	3 8 3
1039 9 3	1139 9 4	1239 9 4	1339 9 4	1439 9 6	153910 6	163911 6
173911 7	183911 7	193911 7	203911 7	213911 7	223 11 7	233911 6
243910 6	253910 6	2639 9 6	2739 9 6	2839 8 6	2939 8 6	3039 7 5
3139 7 5	3239 7 5	3339 7 5	3439 7 5	3539 7 5	3639 7 5	3739 7 5
3839 7 5	3939 6 4	4039 7 4	4139 7 4	4239 7 4	4339 8 4	4439 8 4
4539 5 4	4639 5 4	4739 7 3	483 7 3	4939 7 3	640 7 3	740 7 3
840 7 3	940 8 3	1040 8 4	1140 8 4	1240 9 4	1340 9 5	144010 6
154010 6	164011 7	174011 8	184011 8	194011 7	204012 7	214011 6
224010 6	3240 6 5	3340 6 5	3440 7 4	3540 7 4	3640 6 4	3740 6 5
3840 5 5	3940 4 5	4040 5 4	4140 6 4	4240 6 4	4340 4 4	4440 6 4
4540 5 4	4640 4 4	4740 3 4	4840 7 4	4940 7 4	641 7 3	741 7 3
841 7 3	941 7 4	1041 8 4	1141 9 4	1241 9 5	1341 9 6	144110 6
154111 7	164111 8	174111 7	184111 7	194111 7	204112 6	3541 5 4
3641 5 4	3741 5 4	3841 5 5	3941 5 5	4041 5 4	4141 5 4	4241 5 4
4341 6 4	4441 6 4	4541 3 4	4641 2 4	474136 4	4741 5 4	642 7 3
742 7 3	842 7 4	942 8 4	1042 4	1142 9 4	1242 9 5	134210 6
144210 7	154210 7	164210 8	174210 7	3542 5 4	3642 1 4	3742 2 4
3842 4 5	3942 5 5	414235 5	424236 5	4442 4 4	454236 4	4642 3 4
4842 5 4	4942 5 4	5042 4 4	643 6 3	743 6 3	843 7 4	943 7 4
1043 7 4	1143 8 5	1243 9 6	1343 9 6	1443 9 7	1543 8	1643 9 8
3443 4 3	3543 4 3	364336 3	3743 2 4	384336 5	4143 4 5	4243 3 5
4443 4 4	454336 4	4643 1 4	4743 2 4	4843 3 4	4 43 5 4	5043 3 4
644 6 3	744 6 4	844 6 4	944 6 5	1044 7 6	1144 7 6	1244 8 6
1344 9 7	144410 8	3444 5 3	3544 4 3	3644 2 3	374436 4	384436 5
4044 3 4	4144 1 5	4244 1 5	4344 2 4	4444 2 4	454436 4	464436 4
474436 4	4844 2 4	4944 3 4	5044 3 4	645 6 4	745 6 4	845 7 4
945 7 5	3445 4 3	3545 5 3	3645 3 3	3745 1 4	384536 4	3945 4 4
4045 3 4	4145 3 4	4245 2 4	4345 1 4	4445 1 4	4545 1 4	4645 1 4
474536 4	4845 2 4	4945 2 4	5045 1 4	5145 1 4	646 6 4	746 6 4
846 6 5	3546 5 3	3646 4 3	3746 4 4	3846 4 4	3946 6 4	4046 5 4
4146 2 4	4246 2 4	4346 1 4	444634 4	4546 2 4	4646 1 4	4746 4 4
4846 4 4	4946 1 4	5046 1 4	5146 1 4	647 6 4	3547 5 3	3647 5 3
3747 6 3	3847 6 4	3947 5 4	4047 6 4	4147 5 4	4247 4 4	434736 4
4447 4 4	4547 4 4	4647 5 4	4747 4 4	4847 3 4	4 47 1 4	5047 1 4
3548 6 3	3648 7 3	3748 7 3	3848 7 4	3948 7 5	4048 8 5	4748 5 4
4148 7 5	4248 5 5	4348 5 5	4448 6 5	4548 5 5	4648 5 5	4848 4 4
4948 3 4	5048 1 4	3549 8 3	3649 8 3	3749 8 3	3849 8 4	3949 8 5
4049 8 5	4149 8 5	4249 8 5	4349 8 5	4449 8 5	4549 7 5	4649 7 5
4749 5 5	4849 4 4	4949 3 4	5049 2 4	3650 9 3	3750 9 3	3850 9 4
4650 7 5	4750 7 5	4950 2 4	5050 3 4	3651 9 4	3751 9 3	3851 9 4
3950 9 4	4050 9 4	4150 9 4	4250 9 5	4350 9 5	4450 9 5	4550 9 5
3951 9 4	4051 9 4	4151 9 4	4251 4	4351 4	4451 5	4551 5
4651 9 5	365210 4	3752 9 4	3852 9 4	3952 9 4	4052 9 4	4152 9 4
4252 9 4	4352 9 4	4452 9 5	4552 5	4652 5	375310 4	385310 4
395310 4	405310 4	415310 4	425310 4	4353 9 4	4453 9 4	4553 9 4
375411 4	385411 4	395410 4	405410 4	415410 4	425410 4	4354 4
4454 9 4	4554 9 4	375511 4	385510 4	395510 4	405510 4	415510 4
425510 4	435510 4	445510 4	455510 4	4655 9 4	375610 4	3856 9 4
3956 9 4	4056 9 4	4156 9 4	4256 9 4	4356 9 4	4456 9 4	4556 9 4
4656 9 4	0 018 0	0 018 0	0 018 0	0 018 0	0 018 0	0 018 0

2. PSWLOC - contains a wind location matrix in a binary (mass storage) format. It will not be reproduced here.
3. PSWVEL - contains the wind velocity fields in a binary (mass storage) format. It will not be reproduced here.
4. REMODEL - contains the FORTRAN program for creating PSWLOC and PSWVEL from the information stored in PUGDATA. This routine needs to be rerun for changes to PUGDATA, such as adding data to a new region or modifying existing field values. Except for unit conversions, there are no calculations made by this program. It merely reads PUGDATA, opens the mass storage files, fills the files, and closes the files. The tape unit assignments on the program card are discussed under RUNWMOD. Changes in the number of wind cases would be the most likely modification to this routine. This would involve adding tape unit numbers to the program card and changing various do-loop parameters. If M is the number of wind cases, then

```
PROGRAM REMODEL(TAPE11,...,TAPE(10+M),TAPE1,...)
DIMENSION VEL(2*M,2000),IDUM2(2*M)
DO 900 NTAPE= 11,(10+M)
KTAPE8 = KTAPE+M
DO 1200 L=1, 2*M
CALL WRITMS(2,IDUM2,2*M,K)
```

are the only changes.


```

PROGRAM REMODEL(TAPE11,TAPE12,TAPE13,TAPE14,TAPE15,TAPE16,
ITAPE17,TAPE18,TAPE1,TAPE2,OUTPUT,TAPE6=OUTPUT)
DIMENSION I(7),J(7),IDIR(7),ISPEED(7),ILOC(56,56)
DIMENSION VEL(16,2000),IDUM1(56),IDUM2(16),KEY1(57),KEY2(2001)
DATA PIRY18/.017453293/
INDEX=1
C ZERO OUT THE LOCATION ARRAY.
DO 50 II=1,56
DO 25 JJ=1,56
ILOC(II,JJ)=-99
25 CONTINUE
50 CONTINUE
DO 900 NTAPE=11,18
C CYCLE THROUGH EACH DATA SET.
KTAPE=NTAPE-10
KTAPE8=KTAPE+8
WRITE(6,100)KTAPE
100 FORMAT(1X,11HFILE NUMBER,13)
C READ ALL THE DATA IN ONE DATA SET.
READ(NTAPE,250) HEADER
200 CONTINUE
250 FORMAT(A6)
READ(NTAPE,300)(I(N),J(N),IDIR(N),ISPEED(N),N=1,7)
300 FORMAT(7(4I2,2X))
IF(EOF(NTAPE))700,400
400 CONTINUE
C FILE IN LOCATION AND VELOCITY ARRAY AS WE GO.
DO 600 K=1,7
IF(I(K).LE.0.OR.J(K).LE.0) GO TO 600
RAD=FLOAT(IDIR(K)*10)*PIRY18
SPEED=FLOAT(ISPEED(K))
IF(ILOC(I(K),J(K)).GT.0) GO TO 500
ILOC(I(K),J(K))=INDEX
INDEX=INDEX+1
500 CONTINUE
VEL(KTAPE,ILOC(I(K),J(K)))=SPEED
VEL(KTAPE8,ILOC(I(K),J(K)))=RAD
600 CONTINUE
GO TO 200
C
700 LINDEX=INDEX-1
WRITE(6,800) LINDEX
800 FORMAT(1X,16HLAST INDEX ADDED,15)
900 CONTINUE
C
C MAKE MASS STORAGE FILES.
C LOCATION ARRAY FIRST.
CALL OPENMS(1,KEY1,57,0)
DO 1100 JJ=1,56
DO 1000 II=1,56
IDUM1(II)=ILOC(II,JJ)
1000 CONTINUE
CALL WRITMS(1,IDUM1,56,JJ)
1100 CONTINUE
CALL CLOSMS(1)
C VELOCITY ARRAY SECOND.
CALL OPENMS(2,KEY2,INDEX,0)
DO 1300 K=1,LINDEX
DO 1200 L=1,16
IDUM2(L)=VEL(L,K)
1200 CONTINUE
CALL WRITMS(2,IDUM2,16,K)
1300 CONTINUE
CALL CLOSMS(2)
END

```

5. RUNWMOD - is a procedure file (NOS operating system, CDC mainframe) which will properly execute the mass storage manipulation between PUGDATA and PSWLOC and PSWVEL via the FORTRAN program REMODEL. The tape unit assignments include the binary output files on tapes 1 and 2 and the card image input files on units 11 through 18.

```
GET,PUGDATA.  
GTR(PUGDATA,TAPE11)TEXT/PUGSE1  
GTR(PUGDATA,TAPE12)TEXT/PUGSE2  
GTR(PUGDATA,TAPE13)TEXT/PUGS  
GTR(PUGDATA,TAPE14)TEXT/PUGSW  
GTR(PUGDATA,TAPE15)TEXT/PUGW  
GTR(PUGDATA,TAPE16)TEXT/PUGNW  
GTR(PUGDATA,TAPE17)TEXT/PUGN  
GTR(PUGDATA,TAPE18)TEXT/PUGSB  
PURGE,PSWLOC,PSWVEL.  
DEFINE(TAPE1=PSWLOC)  
DEFINE(TAPE2=PSWVEL)  
GET,REMODEL.  
FTN(I=REMODEL,R=3,OPT=0)  
LGO.
```


6. WINDS - is a card image FORTRAN version of a wind library including three subroutines: WINDS, LOCWIND, and WINDPAT. The purpose of this library is to provide easy ready access to the wind fields for a user specified trajectory or drifter model. All three routines are designed to be user-accessable and there are no direct functional dependencies among them. Subroutine WINDS acts as a look-up mechanism. Given I, J coordinates in the wind grid and a pattern number associated with some time period, the routine will return the wind speed (MS^{-1}) and direction (radians, oceanographic convention). Subroutine LOCWIND converts latitude and longitude (positive decimal degrees) into grid locations so that the wind I, J values can be transparent to the user. Subroutine WINDPAT is just a pattern sequence (in time) selector for up to 20 six-hour increments. The particular sequence in this version was used for the analysis of some 1978 data. Note that the pattern numbers in the data statement for variable IPAT must be manually supplied by the user prior to compiling the library. I recommend that any interested user redesign subroutine WINDPAT to read a time series of wind patterns from a user specified tape instead of editing and re-compiling the library for each application. The subprograms WINDS and LOCWIND are suitably more general.
- Changes in the number of patterns available would require changes in subroutine winds. If M is the number of wind cases, then

```
DIMENSION VEL(2*M)
CALL READMS(4,VEL,2*M,INDEX)
NCASE8=NCASE+M
```

are the only modifications.

The wind grid occupies the same region as the grid described in the text. The grid spacing differs, however. The wind grid is 56^2 cells where the tide grid is 223^2 cells. It was unfortunate that the tide grid base was not 224^2 , for then the two grids would have had easy integral multiples and both subroutine locale in the tide library and subroutine LOCWIND in the wind library would not have been necessary. The fact that 223 is a prime number introduced other difficulties as well, principally in formatting.

SUBROUTINE WINDS(I,J,NCASE,SPEED,RAD)

C I,J ARE THE CO-ORDINATES OF THE GRID BOX UNDER CONSIDERATION.
C NCASE IS THE WIND CASE NUMBER, 1 THRU 8 SE1(HIGH), SE2(LOW),
C S.SW,W.NW,N. AND SEA BREEZE. IN ORDER.
C SPEED,RAD ARE THE SURFACE WIND VELOCITY COMPONENTS ASSOCIATED WITH I,J.
C SPEED IS RETURNED IN M/SEC. DUMMY VALUES OF 999.0 ARE RETURNED
C IF I OR J IS NOT OVER WATER.
C RAD IS RETURNED IN RADIANS FROM NORTH IN AN OCEANOGRAPHIC
C SENSE.

DIMENSION ILOC(56),KEY1(57),KEY2(1050),VEL(16)

DATA ICALL/-1/

IF (ICALL.GT.0) GO TO 100
CALL OPENMS(2,KEY1,57,0)
CALL OPENMS(4,KEY2,1050,0)
ICALL=1

100 CONTINUE
CALL READMS(2,ILOC,56,J)
INDEX=ILOC(I)

IF (INDEX.LE.0) GO TO 200
CALL READMS(4,VEL,16,INDEX)

SPEED = VEL(NCASE)
NCASE8 = NCASE + 8
RAD = VEL(NCASE8)
RETURN

200 SPEED = 999.
RAD = 999.
RETURN
END

SUBROUTINE LOCWIND(LAT,LONG,I,J)

C THIS SUBROUTINE CHOOSES THE APPROPRIATE BOX
C CO-ORDINATES FOR A REGULAR GRID (NBOXNS BY NBOXEW)
C WITH GIVEN LATITUDE AND LONGITUDE LIMITS (NLAT,
C SLAT,WLONG,ELONG). THE SIGN CONVENTION GIVES A
C LOWER LEFTHAND CORNER BOX CO-ORDINATES(1,1) FOR
C THE NORTHWESTERN QUARTER SPHERE THE INCREMENTAL
C WIDTH AND HEIGHT OF THE BOXES IS ONLY COMPUTED
C THE FIRST CALL AFTER COMPILATION. IF GRID CHANGES
C ARE EXPECTED MID-PROGRAM. THEN THIS FEATURE MUST
C BE CHANGED.

REAL NLAT,LAT,LONG
DATA SLAT,NLAT,WLONG,ELONG/47.0,49.0,125.166667,
1122.166667/
DATA NBOXNS,NBOXEW/56,56/
DATA KK/-1/

C THIS SECTION COMPUTES THE INCREMENTAL BOX
C SIZES THE FIRST CALL ONLY.

IF (KK.GT.0) GO TO 100
DBOXNS=(NLAT-SLAT)/FLOAT(NBOXNS)
DBOXEW=(WLONG-ELONG)/FLOAT(NBOXEW)
KK=1

100 CONTINUE

THE BOX CO-ORDINATES ARE CHOSEN EACH CALL.

I=INT((WLONG-LONG)/DBOXEW) + 1
J=INT((LAT-SLAT)/DBOXNS) + 1

RETURN

```
END
SUBROUTINE WINDPAT(IHOUR,NCASE)
C THIS SUBROUTINE GIVES THE WIND PATTERN NUMBER FOR
C ANY GIVEN HOUR BETWEEN 00Z AUGUST 22,1978 AND 00Z
C AUGUST 27,1978.
C THE PATTERN SEQUENCE WAS CHOSEN BY J.E. OVERLAND
C AUGUST 7,1979,BASED ON NWS SURFACE PRESSURE ANALYSES
C AND RACE ROCKS WINDS.
C IHOUR IS THE HOURS ELAPSED SINCE 00Z AUG.22. 00Z AUG.27.
C IS HOUR 120.
C NCASE IS AN INTEGER 1 TO 7 CORRESPONDING TO SET1
C (HIGH),SE2(LOW),S,SW,W,NW,N.
DIMENSION IPAT(20)
DATA IPAT/6,5,5,5,5,2,2,3,3,3,3,4,4,5,5,3,3,4,4,4/
IF(IHOUR.GT.120) GO TO 200
IF(IHOUR.LE.0) GO TO 100
NCASE=IPAT((IHOUR-1)/6+1)
RETURN
100 NCASE=IPAT(1)
RETURN
200 NCASE=IPAT(20)
RETURN
END
```


7. WINDLIB - contains the wind library in the binary library format. It will not be reproduced here. It can be generated from WINDS through standard library commands. For the NOS operating system on CDC mainframe, the interactive commands are as follows:

GET,WINDS.

FTN,I=WINDS,L=0.

LIBGEN.

REPLACE(ULIB=WINDLIB)

8. WINDPIC - contains a FORTRAN routine which calls the wind library subprograms for the full range of their values. It was intended to test the function of the wind library and a portion of this routine was used in a modified form to draw the wind patterns displayed elsewhere. The tape unit assignments are discussed under RUNWIND.

```

PROGRAM WINDPIC(TAPE2,TAPE4,OUTPUT,TAPE6=OUTPUT)
DIMENSION U(56),V(56)
DATA SLONG,SLAT,RLONG,RLAT/.05357148,.03571429,
1125.19345,46.982143/
TEST CALL TO SUBROUTINE WINDS.

```

C
C

```

DO 600 K=1,2
WRITE(6,100) K
100 FORMAT(1X,9HWIND CASE,I3)
DO 500 I=1,56
WRITE(6,200) I
200 FORMAT(1X,17HEAST-WEST BOX(I),I4)
DO 300 J=1,56
CALL WINDS(I,J,K,U(J),V(J))
300 CONTINUE
WRITE(6,400)(J,U(J),V(J),J=1,56)
400 FORMAT(10X,5(I5,2F10,3))
500 CONTINUE
600 CONTINUE

```

C
C
C

```

TEST CALL TO SUBROUTINE WINDPAT.

DO 800 I=1,122
Ihour=I-1
CALL WINDPAT(Ihour,NCASE)
WRITE(6,700)Ihour,NCASE
700 FORMAT(20X,2I5)
800 CONTINUE

```

C
C
C

```

TEST CALL TO SUBROUTINE LOCWIND

DO 1100 I=1,56
DO 1000 J=1,56
RRLAT=RLAT+FLOAT(J)*SLAT
RRLONG=RLONG-FLOAT(I)*SLONG
CALL LOCWIND(RRLAT,RRLONG,II,JJ)
WRITE(6,900)RRLAT,RRLONG,II,JJ,I,J
900 FORMAT(10X,2F10,5,4I5)
1000 CONTINUE
1100 CONTINUE
END

```


9. RUNWIND - is a procedure file (NOS operating system, CDC mainframe) which will execute the FORTRAN program described under WINDPIC. Tape units 2 and 4 are reserved for the wind field arrays. Since the version of WINDPIC described above is for demonstration purposes, only default output to printer is used. It would be fairly simple to add a dummy output file for plot storage or other use.

```
ATTACH(TAPE2=PSWLOC)
ATTACH(TAPE4=PSWVEL)
GET,WINDLIB.
GET,WINDPIC.
FTN(I=WINDPIC,PL=10000,R=3,OPT=0)
LDSET(LIB=WINDLIB)
LGO.
```

C. Puget Sound Current Analyses

1. STRAIT1, STRAIT2, STRAIT3 - are card image velocity files corresponding to current stations 11, 12 and 13 described elsewhere from August, 1978. They will not be reproduced here. The format for retrieving velocity pairs from these files is

```
      READ(1,100)U,V
```

```
      100 FORMAT(15X,2F10.2)
```

There are no header cards.

2. CURANL2 - is a FORTRAN routine which compares current meter data from STRAITn files with data generated from calls to the tide library and generates an output file with (U,V) differences, (U,V) from current meter, and (U,V) from from the model. The actual differencing is done in a subroutine called NORMAL. This subroutine calculates the amount of the current meter velocity unaccounted for by the tide prediction and normalizes the result along the tide prediction axis. Thus (U,V) differences are not the usual east-west velocity components. U_{DIFF} is along the tide prediction axis or along the axis of hopefully best fit. V_{DIFF} is orthogonal to the prediction axis and is the portion of the tidal current that the model does not attempt to mimic. A sketch of the vector relations handled by NORMAL can be seen in Figure II-1, where U_1, V_1 would be some measured current and U_2, V_2 would be the modelled current. The tape unit assignments are discussed under RUNANAL, but note that for these cases tape 5 is not defaulted to input.
3. RUNANAL - is a procedure file (NOS operating system, CDC mainframe) which will execute the FORTRAN program described under CURANAL2. Tape units 1 and 3 are reserved for the tide data files. Tape unit 2 is used for the current meter input data described above. Unit 4 is used for the output files, here labeled as CURn files. To facilitate the analysis runs, input data was

assigned tape unit 5. Through dummy input files called STAn, input data included the number of time steps to be analyzed, the current meter station number (11, 12, or 13), the latitude and longitude (decimal degrees), the initial date of the current meter record to be analyzed, and the number of current meter records to be skipped before beginning the analysis. These items respectively were formatted I5, I2, F8.5, F9.5, 5I3, I5.

```

GET(TAPE5=STA13)
ATTACH(TAPE2=STRAIT3)
ATTACH(TAPE1=TLDC2)
ATTACH(TAPE3=ISTA2)
GET,PSTIDE.
GET,CURANL2.
FTN(I=CURANL2,R=3,OPT=0)
LDSET(LIB=PSTIDE)
LGO.
REPLACE(TAPE4=CUR13)

```

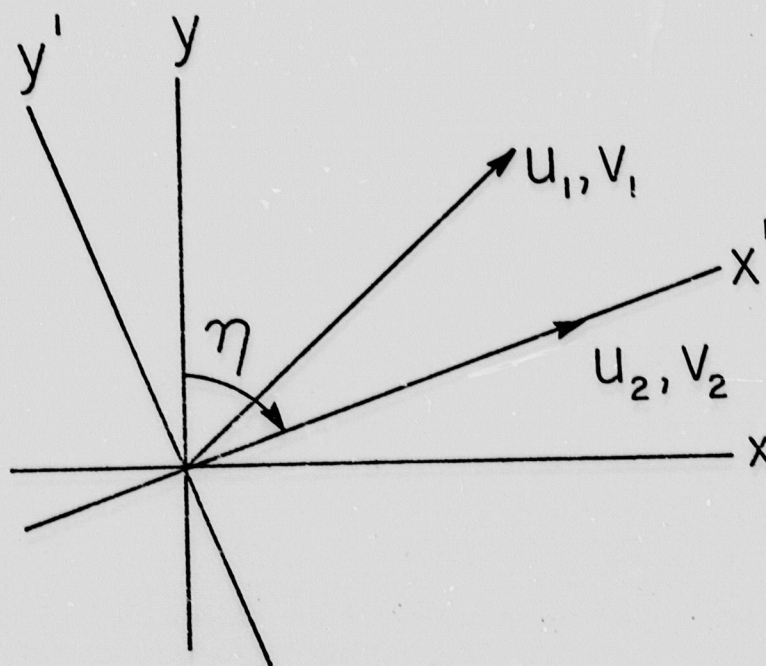


Figure II-1. Schematic diagram of vector relationships considered in subroutine NORMAL within Program CURANL2

```

PROGRAM CURANL2(TAPE1,TAPE2,TAPE3,TAPE4,TAPE5,OUTPUT,TAPE6=OUTPUT)
DIMENSION UBAR(8),VBAR(8)
INTEGER DATE(5)
COMMON/TIDDAT/DIR,RAD
DATA PI180/.0174532925/
READ (5,50) NTOTAL,NSTA,RLAT,RLONG,DATE,NSKIP
50 FORMAT (I5,I2,F8.5,F9.5,5I3,I5)
C LATITUDES AND LONGITUDES FOR HOLBROOKS CURRENT METERS.
C STRAIT1(STA.11)48D 13.0M,123D 05.5M
C STRAIT2(STA.12)48D 20.3M,122D 58.1M
C STRAIT3(STA.13)48D 14.1M,122D 57.4M
CALL LOCALE(RLAT,RLONG,I,J)
WRITE(6,100)NSTA,RLAT,RLONG,I,J
100 FORMAT(1X,3RHOLBROOK CURRENT METER STATION NUMBER,I3,/1X,
↑8PLATITUDE,F10.5,9HLONGITUDE,F10.5,/1X,10HTIDE MODEL I,I4,
↑2X,1HJ,I4)
WRITE (4,200) NTOTAL,NSTA,RLAT,RLONG,DATE
200 FORMAT (I5,I2,F8.5,F9.5,5I3)
IF (NSKIP.EQ.0) GO TO 550
DO 500 ISKIP = 1,NSKIP
READ(2,300)UHOL,VHOL
300 FORMAT(15X,2F10.2)
READ(2,300)UHOL,VHOL
DATE(3)=DATE(3)+1
IF (DATE(3).GE.24)DATE(4)=DATE(4)+1
IF (DATE(3).GE.24)DATE(3)=0
500 CONTINUE
550 CONTINUE
DO 700 NSTEP=1,NTOTAL
READ(2,300)UHOL,VHOL
CALL TIDES(I,J,DATE,UTIDE,VTIDE)
CALL NORMAL(RAD,UHOL,VHOL,UTIDE,VTIDE,UDIF,VDIF)
WRITE(6,600)NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE,RAD
WRITE(4,600)NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE
600 FORMAT(1X,I5,8F10.2)
READ(2,300)UHOL,VHOL
DATE(3)=DATE(3)+1
IF (DATE(3).GE.24)DATE(4)=DATE(4)+1
IF (DATE(3).GE.24)DATE(3)=0
700 CONTINUE
ENDFILE 4
END
SUBROUTINE NORMAL(ETA,U1,V1,U2,V2,UDIF,VDIF)
C
C THIS ROUTINE FINDS THE AMOUNT OF VECTOR (U1,V1) WHICH
C IS UNACCOUNTED FOR BY VECTOR (U2,V2). THE VECTOR
C DIFFERENCE IS ROTATED SO THAT UDIF LIES ALONG THE RAY
C DEFINED BY ETA (THIS RAY PASSES THROUGH (U2,V2)).
C THUS, VDIF IS ORTHOGONAL TO THE RAY AND TO THE VECTOR
C (U2,V2).
C ETA MUST BE IN RADIANS.
C
UNORM = SQRT(U2*U2 + V2*V2)
COSETA = COS(ETA)
SINETA = SIN(ETA)
C
UDIF = U1*SINETA + V1*COSETA - UNORM
VDIF = -U1*COSETA + V1*SINETA
C
RETURN
END

```


4. CUR1, CUR2, CUR3 - are card image velocity data files created by running CURANL2. The format of these files are as follows:

```
      READ(1,100)NTOTAL,NSTA,RLAT,RLONG,DATE
100  FORMAT(I5,I2,F8.5,F9.5,5I3)
      DO 300 I=1,NTOTAL
      READ(1,200)NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE
200  FORMAT(1X,I5,6F10.2)
300  CONTINUE
```

Where NTOTAL is the number of analyzed records, NSTA is the station number (11, 12, or 13), RLAT and RLONG are the latitude and longitude of the station in decimal degrees and DATE is the integer array of start time in GMT(S,M,H, J.D.,Y). UDIF and VDIF are described under CURANL2 and UHOL, VHOL and UTIDE, VTIDE are the current meter values and tide model values respectively. The files will not be reproduced here.

5. HOLPLOT - is a FORTRAN program which draws Calcomp stick plots of the three series of velocities contained in CURn files described above. Tape unit assignments are discussed under RUNHOLP.

```

PROGRAM HOLPLOT(TAPE1,TAPE99,OUTPUT,TAPE6=OUTPUT)
DIMENSION TITLE(4)
DATA TITLE/10HX AXIS IN .10HHOUR SINCE.10H 00Z 15 AU.10HGUST 1978
/
DATA YDIF,YHOL,YTIDE,SCALE/21.,12.,3.,.05/
CALL PLOTS
CALL FACTOR(.3)
REEL OFF FIRST PART OF FILE.
DO 200 I=1,720
READ(1,100)NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE
100 FORMAT(1X,I5,6F10.2)
200 CONTINUE
MAKE STICK PLOTS FOR NEXT 7.5DAYS OF DATA.
DO 300 I=1,180
READ(1,100)NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE
X=FLOAT(I)*.25
XX=X+UDIF*SCALE
YY=YDIF+VDIF*SCALE
CALL SPAROW(X,YDIF,XX,YY)
XX=X+UHOL*SCALE
YY=YHOL+VHOL*SCALE
CALL SPAROW(X,YHOL,XX,YY)
XX=X+UTIDE*SCALE
YY=YTIDE+VTIDE*SCALE
CALL SPAROW(X,YTIDE,XX,YY)
500 CONTINUE
CALL AXIS(0.,YDIF,9HRESIDUALS,-9,45.,0.,0.,4.)
CALL AXIS(0.,18.,6HCM/SEC,6,6.,90.,-60.,20.)
CALL AXIS(0.,YHOL,8HHOLBROOK,-8,45.,0.,0.,4.)
CALL AXIS(0.,9.,6HCM/SEC,6,6.,90.,-60.,20.)
CALL AXIS(0.,YTIDE,10HTIDE MODEL,-10,45.,0.,0.,4.)
CALL AXIS(0.,0.,6HCM/SEC,6,6.,90.,-60.,20.)
CALL SYMBOL(0.,26.,0.28,TITLE,0.,40)
CALL PLOT(0.,0.,999)
END
SUBROUTINE SPAROW(X,Y,XX,YY)
C THIS ROUTINE DRAWS ARROWS WITH CALCOMP
C OR SIMILAR PLOT PACKAGE ROUTINES WHEN
C THE TAIL OF THE ARROW IS (X,Y) AND THE
C HEAD IS (XX,YY). THE VARIABLES FACTOR
C AND ANGLE MAY BE ADJUSTED IN A DATA
C STATEMENT TO CHANGE THE PROPORTIONS OF
C THE ARROWS. IF CLOSED ARROW HEADS ARE
C DESIRED THEN CHANGE THE SEQUENCE OF
C THE CALLS TO PLOT TO -
      CALL PLOT (XX,YY,3)
      CALL PLOT (X1,Y1,2)
      CALL PLOT (X2,Y2,2)
      CALL PLOT (XX,YY,2)
DATA FACTOR,ANGLE/0.25,.26179938/
CALL PLOT(X,Y,3)
CALL PLOT(XX,YY,2)
DY=X-XX
DX=Y-YY
IF(DX.EQ.0.) GO TO 200
ALPHA=ATAN2(DY,DX)
100 CONTINUE
GAMMA1=ALPHA+ANGLE
GAMMA2=ALPHA-ANGLE
DIST=FACTOR*SQRT(DX**2+DY**2)
X1=XX+DIST*COS(GAMMA1)
Y1=YY+DIST*SIN(GAMMA1)
X2=XX+DIST*COS(GAMMA2)
Y2=YY+DIST*SIN(GAMMA2)

```



```

CALL PLOT (Y1,Y1,2)
CALL PLOT (XX,YY,3)
CALL PLOT (X2,Y2,2)
RETURN
200 ALPHA=1.57079633
IF(DY.LT.0.) ALPHA=-1.57079633
GO TO 100
END

```

- 7. HOLVECT - is a FORTRAN program which draws Calcomp progressive vector diagrams of difference velocities contained in CURn files described above. Tape unit assignments are discussed under RUNHOLV.

```

GET(TAPE1=CUR1)
GET(CCLIB/UN=PMELIB)
GET,HOLPLOT.
FTN(I=HOLPLOT,R=3,OPT=0)
LDSET(LIB=CCLIB)
LGO.

```

- 6. RUNHOLP - is a procedure file (NOS operating system, CDC mainframe) which will execute the FORTRAN program described under HOLPLOT. Tape unit 1 is assigned to the input CURn file. A Calcomp library or comparable plotting system is necessary.

```

PROGRAM HOLVECT(TAPE1,TAPE99,OUTPUT,TAPE6=OUTPUT)
DATA STAT,SCALE,UMEAN,VMEAN/10HSTATION 11,.1,-69.44,-.06/
C MEAN CURRENT-STATION11/-20.73,-2.36/
C -STATION12/5.18,3.76/
C -STATION13/-24.54,11.62/
C SKIP BEGINNING RECORDS.
DO 200 I=1,720
READ(1,100)NSTEP,UDIF,VDIF
100 FORMAT(1X,I5,6F10.2)
200 CONTINUE
C DRAW PROGRESSIVE VECTOR.
CALL PLOTS
CALL FACTOR(.3)
X=15.
Y=15.
XX=UMEAN*SCALE + X
YY=VMEAN*SCALE + Y
CALL SPAROW(X,Y,XX,YY)
DO 300 I=1,180
X=XX
Y=YY
READ(1,100)NSTEP,UDIF,VDIF
XX=X+UDIF*SCALE
YY=Y+VDIF*SCALE
CALL SPAROW(X,Y,XX,YY)
300 CONTINUE
CALL AXIS(0.,15.,1H .1,30.,0.,-150.,10.)
CALL AXIS(15.,0.,1H .1,30.,90.,-150.,10.)
CALL SYMBOL(0.,32.,0.28,STAT,0.,10)
CALL PLOT(0.,0.,999)
END
SUBROUTINE SPAROW(X,Y,XX,YY)
C THIS ROUTINE DRAWS ARROWS WITH CALCOMP
C OR SIMILAR PLOT PACKAGE ROUTINES WHEN
C THE TAIL OF THE ARROW IS (X,Y) AND THE
C HEAD IS (XX,YY). THE VARIABLES FACTOR
C AND ANGLE MAY BE ADJUSTED IN A DATA
C STATEMENT TO CHANGE THE PROPORTIONS OF
C THE ARROWS. IF CLOSED ARROW HEADS ARE
C DESIRED THEN CHANGE THE SEQUENCE OF
C THE CALLS TO PLOT TO -
C CALL PLOT (XX,YY,3)
C CALL PLOT (X1,Y1,2)
C CALL PLOT (X2,Y2,2)
C CALL PLOT (XX,YY,2)
DATA FACTOR,ANGLE/0.25,.26179938/
CALL PLOT(X,Y,3)
CALL PLOT(XX,YY,2)
DX=X-XX
DY=Y-YY
IF(DX.EQ.0.) GO TO 200
ALPHA=ATAN2(DY,DX)
100 CONTINUE
GAMMA1=ALPHA+ANGLE
GAMMA2=ALPHA-ANGLE
DIST=FACTOR*SQRT(DX**2+DY**2)
X1=XX+DIST*COS(GAMMA1)
Y1=YY+DIST*SIN(GAMMA1)
X2=XX+DIST*COS(GAMMA2)
Y2=YY+DIST*SIN(GAMMA2)
CALL PLOT (X1,Y1,2)
CALL PLOT (XX,YY,3)

```



```
CALL PLDT (A2, I2, 2)  
RETURN  
200 ALPHA=1.57079633  
IF (DY.LT.0.) ALPHA=-1.57079633  
GO TO 100  
END
```

8. RUNHOLV - is a procedure file (NOS operating system, CDC mainframe) which will execute the FORTRAN program described under HOLVECT. Tape unit 1 is assigned to the input CURn file. A Calcomp library or comparable plotting system is necessary.

```
GET(TAPE1=CUR1)  
GET,HOLVECT.  
GET(CCLIB/UN=PMEL18)  
FIN(I=HOLVECT,R=3,OPT=0)  
LDSET(LIB=CCLIB)  
LGO.
```

9. DATASET - contains a FORTRAN program designed to reformat data from CURn files described above to files compatible with R2SPEC, a spectral analysis routine maintained by Carl Pearson in the Coastal Physics Group at PMEL. The routine makes no calculations, but strips off one of the time series of velocities from CURn. The tape unit assignments are discussed under RUNDATS.

PROGRAM DATASET (TAPE1,TAPE2,TAPE3,OUTPUT,TAPE6=OUTPUT)

```

C
C   THIS ROUTINE CREATES DATA SETS IN A FORMAT COMPATABLE WITH
C   CARL PEARSONS SPECTRAL ANALYSIS ROUTINE R2SPEC.
C
C   FOR THESE PURPOSES, THE MOORING NUMBER WILL RELATE TO
C   HOLBROOKS STATION NUMBER, THE METER DESIGNATION WILL BE
C   (METER) FOR HOLBROOKS DATA AND (MODEL) FOR THE TIDE MODEL
C   SERIES, IDP = 0 FOR ALL RUNS, IST WILL BE 781970000 FOR
C   AND IET WILL BE 782562300 FOR ALL RUNS, NDATS WILL BE 1440
C   FOR ALL RUNS, DT WILL BE 60 FOR ALL RUNS.
C
C       STATION      ALAT      ALONG
C           11      48.21667    123.09167
C           12      48.33833    122.96833
C           13      48.23500    122.95667
C
C   DIMENSION U(1440),V(1440)
C   DATA DT,IDP/60.,0/
C
C   READ(1,50) NDATS,MOOR,ALAT,ALONG
50  FORMAT(I5,I2,F8.5,F9.5)
C   READ(3,75) METER,IST,IET,NDATS,NSKIP
75  FORMAT(A5,2I9,2I5)
C
C   WRITE(2) MOOR,METER,IDP,IST,IET,NDATS,DT,ALAT,ALONG
C   IF (NSKIP.EQ.0) GOTO 90
C   DO 85 I= 1,NSKIP
C   READ(1,100) NSTEP
85  CONTINUE
90  CONTINUE
C   DO 200 I=1,NDATS
C   READ(1,100) NSTEP,UDIF,VDIF,UHOL,VHOL,UTIDE,VTIDE
100 FORMAT(IX,I5,6F10.2)
C   IF (METER.NE.5HMMETER) GOTO 110
C
C   U(I) = UHOL
C   V(I) = VHOL
C   GOTO 120
110 IF (METER.NE.5HMODEL) GOTO 115
C   U(I) = UTIDE
C   V(I) = VTIDE
C   GOTO 120
115 U(I) = UDIF
C   V(I) = VDIF
120 CONTINUE
C
C   200 CONTINUE
C
C   WRITE(2) (U(K),K=1,NDATS)
C   WRITE(2) (V(K),K=1,NDATS)
C
C   END

```


10. RUNDATS - is a procedure file (NOS operating system, CDC mainframe) which will execute the FORTRAN program described under DATASET. Tape unit 1 is assigned to the input file in the format CURn. Tape unit 2 is assigned to the output file in R2SPEC format. The R2SPEC files had various names of the format DIFn, MODELn, or METERN, depending on which time series was stripped off the CURn file. DATSn were dummy input files which contained information on the desired file type, some fixed start and stop times required by R2SPEC, the number of records to be stripped, and the number of records to be skipped at the beginning of the file. These variables had the format: A5,2I9,2I5.

```

GET(TAPE1=CUR11)
GET(TAPE3=DATS11)
GET,DATASET.
FTN(I=DATASET,R=3,OPT=0)
LGO.
REPLACE(TAPE2=DIF11)

```

11. SCATTER - contains a FORTRAN program designed to calculate variances, draw Calcomp scatter plots of velocity differences, and to integrate the variance through specific time intervals to deduce the error growth in time of our tide model predictions. The tape unit assignments are described under RUNSCAT.

```

PROGRAM SCATTER(TAPE1,TAPE2,OUTPUT,TAPE6=OUTPUT)
DIMENSION UDIF(2000),VDIF(2000)
DIMENSION XSTORE(100),YSTORE(100)

```

```

C
DATA DUMMY/0./

C
C      NTOTAL IS THE TOTAL NUMBER OF RECORDS TO BE READ
C      NSTA   IS THE STATION NUMBER W.R.T. THE CURRENT METER
C      RLAT,RLONG IS THE DECIMAL DEGREES LOCATION OF THE STATION
C
READ(1,100) NTOTAL,NSTA,RLAT,RLONG
100 FORMAT(I5,I2,F8.5,F9.5)

C
C      NSTEPS IS THE NUMBER OF DIVISIONS OF NTOTAL
C      NHOURS IS THE NUMBER OF TIME STEPS OVER WHICH SCATTER
C      IS OBSERVED(1,3,10).
C
READ(2,200) NSTEPS,NHOURS
200 FORMAT(2I5)

C
C      SCALE CONVERTS VELOCITY TO CALCOMP INCHES, TYPICALLY
C      SCALE = AXLE/(ABS(AMIN)*2.)
C      AXLE  IS THE LENGTH IN CALCOMP INCHES OF THE AXES
C      AMIN  IS THE MINIMUM VALUE OF VELOCITY ON THE AXES
C      AHEAD IS A LENGTH IN CALCOMP INCHES FOR POSITIONING
C      THE HEADER.
C      DS    IS THE INCREMENT CONVERSION OF VELOCITY TO CALCOMP
C      INCHES, DS=1./SCALE
C      ICHAR IS THE FIGURE CHOSEN FOR THE SCATTER PLOT FROM THE
C      CALCOMP LIST.
C
READ(2,300) SCALE,AXLE,AMIN,AHEAD,DS,ICHAR
300 FORMAT(5F10.4,I3)

C
INCRE1 = NTOTAL/NSTEPS
INCRE2 = INCRE1 - NHOURS

C
WRITE(6,1000) NSTEPS,NHOURS,SCALE,AXLE,AMIN,AHEAD,DS,ICHAR,
1 INCRE1,INCRE2,NTOTAL,NSTA,RLAT,RLONG
1000 FORMAT(10X,2I5,5F10.4,3I3,2I5,2F10.5)
UO = 0.
VO = 0.
FNH = FLOAT(NHOURS)
FN=FLOAT(NTOTAL)
DO 500 I=1,NTOTAL
READ(1,400) N, UDIF(I),VDIF(I)
400 FORMAT(1X,I5,6F10.2)
UO = UO + UDIF(I)
VO = VO + VDIF(I)
500 CONTINUE
UO = (UO/FN) * 0.036 * FNH
VO = (VO/FN) * 0.036 * FNH
UVAR = 0.
VVAR = 0.
DO 550 I= 1,NTOTAL
UVAR = UVAR + (UDIF(I) * 0.036 * FNH-UO)**2
VVAR = VVAR + (VDIF(I) * 0.036 * FNH-VO)**2
550 CONTINUE
UVAR = UVAR/FN
VVAR = VVAR/FN
WRITE(6,575) UO,VO,UVAR,VVAR
575 FORMAT(10X,6HU AVER,F10.2,10X,6HV AVER,F10.2,10X,5HU VAR,
1 F15.2,10X,5HV VAR,F15.2)

```



```

CALL PLOTS
FNS=FLOAT(NSTEPS)
XMEAN = 0.
YMEAN = 0.
A2 = AXLE/2.
CALL AXIS(A2,0.,1H ,1,AXLE,90.,AMIN,DS)
CALL AXIS(0.,A2,1H ,1,AXLE,0.,AMIN,DS)
CALL SYMBOL(0.,AHEAD,0.28,7HSTATION,0.,7)
STA = FLOAT(NSTA)
CALL NUMBER(999.,AHEAD,0.28,STA,0.,-1)

```

C

```

DO 700 I=1,NSTEPS
IR= INT(RANF(DUMMY)*INCRE2)
INDEX = (I-1)*INCRE1 + IR
XKM = 0.
YKM = 0.
X = A2
Y = A2
DO 600 J = 1,NHOURS
XKM = XKM + UDIF(INDEX+J-1)*.036
YKM = YKM + VDIF(INDEX+J-1)*.036

```

600 CONTINUE

```

X = XKM * SCALE + X
Y = YKM * SCALE + Y
CALL SYMBOL (X,Y,0.14,ICHAR,0.,-1)
XSTORE(I) = XKM
YSTORE(I) = YKM
XMEAN = XMEAN + XKM
YMEAN = YMEAN + YKM
WRITE(6,650)I,XKM,YKM

```

650 FORMAT(1X,5HHOUR ,I3,5X,2HX ,F10.2,5X,2HY ,F10.2)

700 CONTINUE

```

SIGXY = 0.
SIGXX = 0.
SIGYY = 0.
XMEAN = XMEAN/FNS
YMEAN = YMEAN/FNS
DO 800 I = 1,NSTEPS
SIGXX = SIGXX + (XSTORE(I)-XMEAN)**2
SIGYY = SIGYY + (YSTORE(I)-YMEAN)**2
SIGXY = SIGXY + (XSTORE(I)-XMEAN)*(YSTORE(I)-YMEAN)

```

800 CONTINUE

```

SIGXX = SIGXX/FNS
SIGYY = SIGYY/FNS
SIGXY = SIGXY/FNS
WRITE(6,900)SIGXX,SIGYY,SIGXY,XMEAN,YMEAN

```

900 FORMAT(1X,6HSIGXX ,F10.2,5X,6HSIGYY ,F10.2,5X,6HSIGXY ,F10.2,
* 5X,6HXMEAN ,F10.2,5X,6HYMEAN ,F10.2)

C

```

CALL PLOT(0.,0.,999)
END

```

12. RUNSCAT - is a procedure file (NOS operating system, CDC mainframe) which executes the FORTRAN program described under SCATTER. Tape unit 1 is assigned to the input file described under CURn. Tape unit 2 is a dummy input file used to facilitate making analysis runs. This file has two lines of the following format:

```

      READ(2,200)NSTEPS,NHOURS
200  FORMAT(2I5)
      READ(2,300)ISCALE,AXLE,AMIN,AHEAD,DS,ICHR
300  FORMAT(5F10.4,I3)

```

where NSTEPS is the number of records divided by the integration limits, NHOURS is the integration limit (1, 3, 10 hours), and the other variables pertain to scaling the Calcomp plot. A Calcomp or equivalent plotting library is required.

```

GET,TAPE1=CUR13,TAPE2=SCAT13.
GET,SCATTER.
GET(CCLIB/UN=WFH)
FTN(I=SCATTER,R=3,OPT=0)
LDSET(LIB=CCLIB)
LGO.

```