APPENDIX B

A MAGNETIC TAPE OF THE COMPUTER PROGRAMS USED FOR THIS REPORT ALONG WITH EXPLANATIONS AND INSTRUCTIONS COMPRISE APPENDIX B
The tape contains FORTRAN programs constituting the hydrodynamic features model, the dispersion model and a plotting routine. The Hydraulics Laboratory used the following parameters to create the tape.

- Tracks: 9
- Record Format: Fixed Block
- Block Length: 6160 Bytes
- Record Length: 30 Bytes
- Density: 6250 BPI
- Labels: IBM Standard

A map of the tape follows.

Files 1, 2, 3, and 4 contain programs needed to prepare the data for use in the hydrodynamic features model. Files 5, 6, 7, and 8 represent the hydrodynamic features model, and files 9, 10, and 11 contain the dispersion model. File 12 comprises a Gould 5100 Electrostatic Plotter routine which can plot grid and element geometry, water surface elevation, velocity vectors and concentrations. The program files are a size convenient for storage in interactive terminal files.

The Hydraulics Laboratory user's instructions and sample job control used by the Hydraulics Laboratory for the two models and the plotting program on the University of Florida's Amdahl 470 V/6-II under OS MVS/SE and JES2/NJE system control also follow.
The program is designed to run without overlays. All arrays have object time dimensions and thus only the actual dimensions in the main program need to be changed. The variables used to determine the correct dimensions must be specified in main program. They are:

- MAXNOD: maximum number of nodes that program must handle
- MAXEL: " " elements that program must handle
- MAXL: " " nodes per land boundary
- MAXO: " " " ocean "
- MAXBWH: " band width. The program will print out the required bandwidth. Usually MAXBWH = .1·MAXNOD.
- MAXBWR: 2·MAXBWH
- MAXBEL: maximum number of element sides in total boundary
- MAXHBN: maximum number of prescribed surface elevation nodes
- MAXQBN: " " " " flow nodes
- MAXHTC: " " " half tide curves times two

The dimensions should be assigned as follows:

```
DIMENSION TITLE(20) , TEXT1(2,2) , TEXT2(2,2) , TEXT3(2,2) ,
1 ICON(MAXEL,3) , A(MAXEL,3) , B(MAXEL,3) , AREA(MAXEL) , NELM(MAXEL) ,
2 NEXT(MAXNOD) , NINT(MAXNOD) , XORD(MAXNOD) , YORD(MAXNOD) , DEPTH(MAXNOD) ,
3 NBC(MAXNOD) ,
4 H(MAXNOD) , Q(2*MAXNOD) , HPREV(MAXNOD) , QPREV(2*MAXNOD) ,
5 SYSH(MAXNOD) , SYSFQ(2*MAXNOD) ,
6 SYSBH(2*MAXHBN) , MAXBWH) , SYSBM(2*MAXQBN) , MAXBWR) , NBN(MAXHBN) ,
7 NQN(MAXQBN) , MNVN(10) ,
8 HB(MAXHBN) , ALAG(MAXHBN) , QB(MAXQBN) , QDANG(MAXQBN) , TAUWY(MAXNOD) ,
9 TAUWY(MAXNOD) ,
10 PSPLUS(MAXNOD) , CPF(MAXEL) , EDWX(MAXEL) , EDWY(MAXEL) , NILM(MAXEL) ,
11 NBN(3*MAXBEL) ,
12 EDVY(MAXEL) , HTC(MAXHEL) , MAXHT) , IPNT(MAXHBN) , NFLUX(30) , FLUX(30) ,
13 VS(MAXHEL) ,

DIMENSION ETA(MAXNOD) , UM(MAXNOD) , VM(MAXNOD) , ETAPRV(MAXNOD) , DELRO(MAXNOD) ,
1 NNILN(3) , ICONL(3,MAXL) , NxMENP(3) , ICONB(1,MAXO) , DISCHS(MAXO) , CBDIS(4)
```

For special tidal and wind forcing the subroutines STETAB and WINDS can be modified.

ALTER DIMENSIONS IN SUBROUTINE FORCEO
CARD GROUP 1  Parameters and Options. One Card (1015)

INRNM = 1

NCML = number of elements

NMNP = number of node points

IBFRIC =
  = 1, Variable bottom friction coefficient, values to be read for each element, see card group 4
  = 2, constant bottom friction coefficient, value of first element used, see card group 4

IDEPTH =
  = 1, variable depth, values to be read for each node, see card group 3
  = 2, constant depth, value of first node used, see card group 3

IEDVIS =
  = 1, variable viscosity coefficient, value as for IBFRIC
  = 2, constant viscosity coefficient

IKIND =
  = 1, variable wind stress
  = 2, constant wind stress

INPUTH =
  = 1, ETA set to zero, (cold start)
  = 2, ETA to be read in, (not start)

INPUTQ =
  = 1, Q set to zero, (cold start)
  = 2, Q to be read in, (not start)

ICNVEC =
  = 1, Convective terms ignored
  = 2, Convective terms included

KSTART = time step at which output will begin to be written on disc

KSTPR = interval (in time steps) between output to disc of velocities

KDISC = Not used

IMWS =
  = 1, Subroutine SETMWS is called to establish MWS
  = 2, mean low water is same as datum

ITMC =
  = 1, Tides specified with half tide curves
  = 2, Tides sinusoidal

INRM = Mode, 1 = reference datum when IMWS = 1

CARD GROUP 2  Title. One Card (20A4)

CARD GROUP 3  Modal Information. NMNP Cards (C16, 7F10.3)

I = 1, NMNP, 1

NEXT(I) = external node number. NEXT(I) should be input so that NBAND, the bandwidth is minimized
\text{MBAND} = \max \text{imum over all elements } (i = 1, MNT) \text{ of } 1 \text{ plus maximum internal node number of element } i \text{ minus the minimum internal node number of element } i, \text{ where the internal node number, NINT}(i), \text{ is determined by the ordering during read in: } NINT(\text{NEXT}(i)) = i, i = 1, \text{ MNP}.

\text{NBC}(i) \quad \text{node code}
\begin{align*}
= 0 & \text{ internal node} \\
= 1 & \text{ prescribed normal flow} \\
= 2 & \text{ prescribed height} \\
= 3 & \text{ prescribed height and normal flow} \\
= 4 & \text{ prescribed normal and tangential flow (\(\geq 0\))} \\
= 5 & \text{ prescribed height and both flows} \\
= 6 & \text{ source/sink node} \\
= 7 & \text{ source/sink node with prescribed normal flow} \\
= 8 & \text{ source/sink node with both flows set to zero}
\end{align*}

\text{XORD}(i) \quad x - \text{coordinate}
\text{YORD}(i) \quad y - \text{coordinate}

\text{DEPTH}(i) \quad \text{bottom depth referred to datum (usually MLW). Positive if bottom is below datum, negative if above.}

\text{DUM1} \quad \text{dummy variables used to input prescribed values according to NBC as described below:}
\text{DUM2} \quad \text{if not used}
\text{DUM3} \quad \text{DUM1 = UB, DUM2 = OBAN}.
\text{DUM4} \quad \text{DUM1 = WR, DUM2 = ALAC}.
\text{DUM1 = WR, DUM2 = ALAC, DUM3 = OB, DUM4 = QBANG}
\text{DUM1 = WR, DUM2 = BANG}
\text{DUM1 = UB, DUM2 = ALAC, DUM3 = OB, DUM4 = QBANG}
\text{DUM1 = FLUX}
\text{DUM1 = FLUX, DUM2 = OB, DUM3 = ORANG}
\text{DUM1 = FLUX}

\text{where: } \text{ OB is local } x \text{ flow}
\text{ QBANG is the angle from } x \text{-axis to outward normal at node. The direction of the normal is determined by requiring net flow across adjoining segments to vanish.}
CARD GROUP 4  Element Data.  NML cards, (10, 4F10.0)
I = 1, NML, 1
NELM(I) external element number
ICON (1,1) external node numbers e1, e2, e3 in sense from x
toward y.
ICON (1,2) 
ICON (1,3) 
CF(I) bottom friction coefficient, note: if CF(1) > 1. and CFC < 1.
then CF(1) = 1. is taken as Manning's
n throughout.

EDXX(I) 
EDYY(I) eddy viscosities
EDXY(I) 

CARD GROUP 5  System Properties. One Card (F10.0, F10.3, 3F10.0)
ALATT latitude north
OMEGA phase velocity of earth's rotation = 0.72722 x 10^-4 sec^-1
GRAVT gravitational acceleration (=9.81 m/sec^2)
PERIOD period of tide, (not used if INTC = 1)
DENSY average density of water

CARD GROUP 6. Integration Parameters. One Card (3F10.0, 110, F10.0, 2110)
STRATIM start time of integration
ENDTIM end time of integration
TINC time increment
NB external node number for which stability is checked
(0 = zero)
BOUND bound on height variation at node NB
IDT parameter to be used for variable time stepping, use
1 since this has not yet been implemented
NCUT hard copy output for every NCUT time steps
NMHTC max number of half tide curves + 1

CARD GROUP 7  Land Boundary Data. One Card (9110)
NMLB number of land boundaries
(NMLBN(1), 1 = 1, NMLB) number of nodes on each land boundary,
including first and last

B-5
Card group 8: Segment connectivity. One Card per Boundary (2014)
I = 1, NMLB
(ICONL(I,J), J = 1, NMLEN(I)) external node numbers on boundary
in sequential order such that area is to left of direction of advance

Card group 9: Ocean Boundary Data. One Card (8110)
NSEGMT number of ocean boundaries
(NMHNPB(I), I = 1, NSEGMT) number of height nodes on ocean
boundary, including first and last

Card group 10: Segment Connectivity. One Card per Boundary (2014)
I = 1, NSEGMT
(ICONB(I,J), J = 1, NMHNPB(I)) external node numbers on ocean
boundary in sequential order such that area is to left of
direction of advance

Card group 11: Boundary elements
First card (110)
NMBEL number of sides of total boundary

Next cards (2014)
NBN(I) I = 1, 3*NMBEL, element and two node numbers corresponding
to each side.

Card group 12: Wind information. One card (2F10.0)

WINDSP Wind speed in [m/sec]. Note: the wind drag
coefficient assumes WINDSP is in [m/sec].

WDIRC Wind direction (blowing from!) relative to x-axis
in degrees.

Card group 13: Mass storage file specifications. One card (8110)

IUNITQ = File unit number for discharges
NRECQ = Number of records in file IUNITQ
NSIZEQ = Record size in file IUNITQ
IPOINT = Record pointer in file IUNITQ (usually = 1)

(Ex. DEFINE FILE IUNITQ (NRECQ, NSIZEQ, U, IPOINT)
ICUNITH = File unit number for depths
NRECH = Number of records in file ICUNITH
NSIZEH = Record size in file ICUNITH
KPOINT = Record pointer in file ICUNITH (usually = 1)

(Ex. DEFINE FILE ICUNITH (NRECH, NSIZEH, U, KPOINT)

Only if
IHTC = 1 include data for each ocean boundary node in the sequence that
the boundary nodes appear in the group 3 cards consisting
of 2*(NMHTC) values. The first two values should be
zero. (SF10.0)
(I = 1, NMHN)
HTC(I,J) J = 1,2*(NMHTC) consist of pairs of amplitude
and time.

Only if
INPUTI = 2 include data for initial values of heights
( (NMNP - 1)/8 + 1) cards (SF10.0)
(ETA(I), I = 1, NMNP) initial surface elevations,
internal in node ordering.

Only if
INPUTQ = 2 include data for initial values of flows
((2*NMPN - 1)/8 + 1) cards (SF10.0)
(Q(I), I = 1, 2*NMPN) initial flows in pairs of x- and y-
components, internal node ordering.

Card group 14: Termination Card. One Card (16I5)

IVEXN = 0
Instead of termination card, which will stop the execution,
input for a new problem may be inserted (repeat card groups
1 through 11).
User's Manual for DISPER

SOURCE: Massachusetts Institute of Technology Report No. 218

The following describes the requirements of the 2-D vertically integrated dispersion model, DISPER. The model predicts contaminant concentration at the nodal points of a two dimensional finite element grid representing the solution field given the following information:

i) the geometry of the solution field in the form of a finite element grid, including the depth of each node.

ii) direct input, functional relations, or auxiliary program describing the circulation field over time, dispersion values and decay coefficients.

iii) location, duration, and strength of source and sink nodes, elements or sides.

iv) location, duration, and magnitude at prescribed concentration nodes (boundary conditions).

v) initial concentrations at each node (initial conditions).

The user may choose whatever units he wants to work with, as long as they are maintained in all the input. Units of mass (M), length (L), and time (T) are indicated in the input description.

The user must ascertain that the dimensioned arrays are sufficiently large. For this purpose and for transferring arrays to subroutines the following variables must be defined:

MAXNP Maximum number of nodes that can be handled
by program C1, C2, C3, F1, F2, P, XORD, YORD,
DEPTH, SYSM, SYSB, WINT, NEXT, U, H, V, COE,
P2
MAXEL Maximum number of elements that can be handled by program. ICON, AREA, A, B, ED, NELM, NLM.

MAXBS Maximum number of element sides with prescribed load, IB, QS.

MAXBN Maximum number of nodes with prescribed concentration, CNODE, NS.

MAXFE Maximum number of element with prescribed load, IPE, PE.

MAXPN Maximum number of nodes with prescribed load, IPN, PN.

MAXBW Maximum bandwidth of coefficient. The model will compute the necessary bandwidth for a given problem. See also card group 3. SYSM, SYSB.

MAXLB Maximum number of land boundaries. NLBN, ICONTU

MAXLBN Maximum number of nodes per land boundary. ICONTU

The arrays associated with each variable have been listed. In addition the following array should be dimensioned:

Q(2*MAXNP)

All arrays are transferred to subroutine as arguments and need only be dimensioned in the main program. Note, if the above maximum values exceed the values needed for a given problem no changes are necessary.

The following describes the specific input data requirements.

Card group 1: Title. One card (18A4)
Card group 2: Parameters and Options. One card (8110)

NUMEL  Number of elements (not to exceed MAXEL set in main program)
NUMNP  number of nodes (not to exceed MAXNP)
NBSIDE number of boundary sides with specified flux (not to exceed MAXBS)
NBNODE number of nodes with specified concentration (not to exceed MAXBN)
NFLXE  number of source/sink elements (not to exceed MAXFE)
NFLXN  number of source/sink nodes (not to exceed MAXFN)
NFLAG \{\begin{array}{l}
\text{-1 varying boundary conditions over time} \\
\text{0 constant boundary conditions over time}
\end{array}\}

Card group 3: Nodal Information. NUMNP cards (I5, 5X, 3F10.0)
M = 1, NUMNP
NEXT(M) external node number

The order in which these values are entered is important. The order must be such that the band width of the grid does not exceed the maximum specified value, MAXBW, in the main program. Internal node numbers are assigned to each node in the order in which they are read in. The band width is calculated as the maximum value of the difference between the highest and lowest internal node numbers for each element. For efficiency of storage, this value should be kept small.

XORD(M) x-coordinate of external node NEXT(M) (L)
YORD(M) y-coordinate of external node NEXT(M) (L)
DEPTH(M) depth at node NEXT(M) (L)
Card group 4: Element Data. NUMEL cards (4I10)

I = 1, NUMEL

N(I)  element number (in ascending order)
ICON(N,1) external node numbers of the element given
ICON(N,2) in sense of x toward y
ICON(N,3)

Card group 5: Land boundaries. One card (8I10).

NMLB  number of land boundaries
(NLAN(I), I = 1, NMLB) number of nodes in each boundary

For each boundary (I = 1, NMLB) (20I4)

ICONU(J,1) nodes of boundary I in successive order
when progressing such that the domain is
to the left at the boundary. (J = 1, NLEN(I) )

Card group 6: Prescribed loads and concentrations.

Only if NBSIDE > 0: Side Boundary Data. NBSIDE cards (2I10, F10.5)

I = 1  NBSIDE

IB(I,1)  external node numbers at end points of side
IB(I,2)  boundary I given so that area of interest is
to left of direction of advance

QS(I)  inward flux per unit length (ML^{-2}T^{-1})

Only if NE NODE > 0: Node Boundary Data. NE NODE cards (I10, F10.0)

I = 1, NE NODE

NB(I)  external node number at which concentration
is specified

CNODE(I) specified concentration at external node
NB(I)  (M/L^3)

Only if NFLXE > 0: Source/sink Elements. NFLXE cards (I10, F10.5).

I = 1, NFLXE

IP(E) source/sink external node number
PE(I) specified inflow per unit standard area
(ML^{-2}T^{-1})
Only if NFLXN > 0: Source/sink data. DMLEN cards (110, E10.4)

\[ I = 1, \text{NFLXN} \]

\[ \text{IPN(I)} \] source/sink external node number

\[ \text{PN(I)} \] specified inflow at external node IPN(I) (\( \text{MT}^{-1} \))

Card group 7: Integration Parameters and Options. One card (2F10.0 F15.0, 5, F10.5, 615)

- \[ \text{STRTIM} \] start time of integration
- \[ \text{ENDTIM} \] end time of integration
- \[ \text{DT} \] time increment
- \[ \text{MAXIT} \] maximum number of allowable iterations (should be 10 in most cases)
- \[ \text{TOL} \] tolerance for convergence (this is the normalized RMS error, .001 used in development work with satisfactory results)
- \[ \text{NOUT} \] hard copy output for every NOUT timesteps
- \[ \text{IRUN} \] run identifications number

\[
\begin{align*}
\text{IVEL} &= 1 \quad \text{constant uniform velocity field} \\
&= 2 \quad \text{uniform velocity field with sinusoidal component}
\end{align*}
\]

\[
\begin{align*}
\text{IDIS} &= 1 \quad \text{constant dispersion coefficient with uniform given value} \\
&= 2 \quad \text{variable dispersion coefficient determined in subroutine DISCO}
\end{align*}
\]

\[
\begin{align*}
\text{IHOT} &= 1 \quad \text{values of initial concentration to be read in} \\
&= 0 \quad \text{initial concentration set to zero}
\end{align*}
\]
Card group 8A
Only if IVEL ≠ 3 include data for initial values of the velocity, tidal amplitude and tidal velocity angular frequency.
One card (4F10.3)
V1, M1 velocity in x direction
V1, M2 velocity in y direction
Only if IVEL = 2
AMP tidal velocity amplitude
OMEG tidal velocity angular frequency

Card group 8B
Only if IDIS = 1: One card (3F10.3, E10.3)
EXX
EYY dispersion coefficients ($L^2T^{-1}$)
EYY
WDECY decay ($T^{-1}$)

Card group 8C
Only if IDIS = 2: One card (2F10.3, E10.3)
CON1 longitudinal dispersion constant ($L^2T^{-1}$)
CON2 lateral dispersion constant ($L^2T^{-1}$)
DECAY decay ($T^{-1}$)

Card group 8D
Only if INDF = 1: enter (M1N2/7) cards (7E11.4)
C1(I11), I11 - 1, XCHNF initial concentration vector, in internal numbering order (i.e., the same order in which the nodes are read in)
Card group 9: Termination Card (F10.0)

STRTIM = -1.

Instead of a termination card, which will stop the execution, input for a new variation of card group 7 may be inserted (repeat Card groups 7 through 7D).
CAFE DATA PREPARATION PROGRAMS

These programs were written to assist the user in preparing the input data for CAFE. Their use will not only reduce the setup time for a new grid, but will ensure greater accuracy in the results. This set of programs includes:

BOUNDELM - This program computes the boundary element data for CAFE (Card Group 2).

QBANG - Computes values of QBANG for all land boundary nodes (in Card Group 3).

NBAND - Computes internal node numbering for minimum band width.

QBCOMP - Allows user to specify system inflows in units of cubic meters per second. QBCOMP will convert these units into those required by CAFE (m² sec⁻¹).
BOUNDSEL

This program will determine the boundary element data required as input to CAFE. Inputs are: number of nodes, number of elements, element connectivity, and boundary data. The boundary element data are output in a form suitable for input to CAFE.

DIMENSIONING:

\[ \text{NMEL} = \text{number of elements} \]
\[ \text{NMNP} = \text{number of nodes} \]
\[ \#BND = \text{number of separate boundary strings, land and water} \]
\[ \text{MAX\#NODS} = \text{maximum number of nodes on any one boundary} \]
\[ \#BNDELM = \text{maximum number of boundary elements} \]
\[ \#OCEBNDS = \text{number of ocean boundaries} \]

Dimensions should be at least

\[ \text{NELM} \leq (\text{NMEL}) \]
\[ \text{ICON} \leq (\text{NMEL}, 3) \]
\[ \text{MEMEL} \leq (\text{NMNP}, 8) \]
\[ \text{NMEM} \leq (\text{NMNP}) \]
\[ \text{ICON8} \leq (\#BND, \text{MAX\#NODS}) \]
\[ \text{NMBN} \leq (\#BND) \]
\[ \text{BNDRY} \leq (\#BNDELM) \]
\[ \text{BNDELM} \leq (\#BNDELM) \]
\[ \text{BNDNO1} \leq (\#BNDELM) \]
\[ \text{BNDNO2} \leq (\#BNDELM) \]
\[ \text{NMBNO} \leq (\#OCEBNDS) \]

Input Data:

Card Group 1: NMEL, NMNP

End Card (715)
Card Group 2: Element Connectivity


Card Group 3: Boundary Data

Same as Card Groups 8, 9, 10 and 11 in CAFE User's Manual.
QBANG

This program will, upon input of the nodal and boundary information from CAFE, compute all values of QBANG and output correctly formatted CAFE node input data with values of NEXT, NBC, X, Y, DEPTH, and QBANG.

**Dimensioning:**

- NMNP - number of node points
- NMLB - number of land boundaries
- NMLBN - maximum number of nodes on any land boundary

**Inputs:**

**Card Group 1:** 1 Card NMNP (= of node points) (I10)

**Card Group 2:** NMNP Cards (2I5, 3F10.3)

(NEXT(I), NBC(NEXT(I)), X(NEXT(I)), Y(NEXT(I)), DEPTH(NEXT(I)),
I = 1, NMNP)

**Card Group 3:** Land Boundary Data (3I10) One Card

NMLB, (NMLBN(I), I = 1, NMLB)

**Card Group 4:** Segment Connectivity (2D4)

(INONL(I,J), J = 1, NMLBN(I))
NBAND

Upon entering of the number of nodes, the number of elements, the CAFE nodal data, and the element interconnectivity matrix, this program will reorder the nodes in such a way as to provide the lowest possible bandwidth for the element configuration.

Dimensioning:

Dimension Variables:

NMEL - number of elements

NMNP - number of node points

DIMENSION ICON1(NMEL), ICON2(NMEL), ICON3(NMEL), ICON(3*NSEL), MEMJT(6*NMP), JXEN(NMNP), JNT(NMNP), NENUT(NMNP), JOINT(NMNP), JP(NMNP), NEXT(NMNP), NBC(NMNP), X(NMNP), Y(NMNP), D(NMNP), D1(NMNP), D2(NMNP), D3(NMNP), D4(NMNP)

Input Data:

Card Group 1: NMNP, NMEL One Card (215)

Card Group 2: Nodal Information

Same as Card Group 3 in CAFE User's Manual

Card Group 3: Element Connectivity

Same as Card Group 4 in CAFE User's Manual

Program Output:

The program will output the nodal information in its reordered form, it will also output the bandwidth of the grid configuration.
In CAFE, specified inflows to the system are given in units of meters$^2$-sec$^{-1}$ (velocity x depth). QBCOMP will convert units of meters$^3$-sec$^{-1}$ (discharge) into the CAFE units. (Note: This program is used most easily in interactive WATFIV, but can be run in batch if desired.)

**Dimensioning:**

- **NMNP** - number of node points
- **NMLB** - number of land boundaries
- **NMLBN** - maximum number of nodes on any land boundary

**DIMENSION** NEXT(NMNP), X(NMNP), Y(NMNP), G(NMNP), IS(NMNP), JS(NMNP), ICONL(NMLB, NMLBN), NMLBN(NMLB)

**Input Data:**

**Card Group 1:** NMNP  
One Card (I5)

**Card Group 2:** Nodal Information  

**Card Group 3:** Land Boundary Data  

**Card Group 4:** NNODES  
One Card (I5)

NNODES is the number of nodes for which inflow computation is desired.

**Card Group 5:** Inflow Data  
NNODES Cards (I5, F20.2)

a) **Node** - external node number of node for which inflow computation is desired.

b) **Q** - specified inflow in meters$^3$-sec$^{-1}$.

8-20
Define File Statements - The define file statements in the main program (statement numbers 27, 28, and 32) must be modified to correspond to the direct-access files being read. (For an explanation of the define file statement, see "IBM System 360/370 FORTRAN IV Language, p. 72.) File 10 contains discharge information, File 11 contains heights, and File 12 has concentrations. The number of records, and the length of these records, should be specified as they were in the CAFE or DISPER run which generated the output to be plotted. If problems with reading the direct-access files are encountered, these statements are the first places to check.

Net Velocity Plots - When producing a net velocity plot (IVEL = 2), the "time information" card (Card Group 2c) should be coded:

\[ \text{NPLOTS} = 2 \]

\[ \text{NTIME}(1) = \text{NTIME} \text{ at which velocity averaging is to start} \]

\[ \text{NTIME}(2) = \text{NTIME} \text{ at which velocity averaging is to stop} \]

When plotting net velocities over one tidal cycle, care must be taken to ensure that NTIME(1) and NTIME(2) define exactly one tidal cycle. Since the magnitude of instantaneous velocities is generally much greater than the magnitude of the net velocities, and since the net velocities are generated by vector addition, omission of even a small part of a tidal cycle will lead to large errors in the plot.

Dimensioning - If dimensioning problems are encountered in one of the subroutines, check the dimension variable initialization in the block data subroutine.
This program will graphically display the outputs generated by CAFE and DISPER. It will:

Plot element geometry with optional element numbering.
Plot element grid boundaries.
Plot velocity vectors generated by CAFE.
Generate and plot net velocities.
Plot concentrations generated by DISPER.
Plot water surface elevations generated by DISPER.

The nodal coordinates may be any real value; the grid will be drawn properly located with respect to a pair of labeled x and y axes. The line thicknesses of the elements, grid boundaries, and velocity vectors are user-specified options. Inputs for velocity, water surface elevation, and concentration are taken from the direct access files generated by CAFE or DISPER.

NOTE: All references to the CAFE User's Manual refer to Wang's version.
Dimensioning

Dimension Variables:

NMNP - number of node points
NMEL - number of elements
NMLBN - number of land boundaries
NMLBN - number of nodes on any land boundary
NMUB - number of ocean boundaries
NMOBN - maximum number of nodes on any ocean boundary
NPLTS - number of plots in a time sequence (see card group 2)

Dimension Statement: (M/PROG)

DIMENSION NEXT(NMNP), NINT(NMNP), X(NMNP), Y(NMNP), NELM(NMEL),
ICON(NMEL, 3), XC(NMEL), YC(NMEL), NMLBN(NMLBN), ICONL(NMLBN, NMLBN),
NMOBN(NMOB), ICONO(NMOB, NMOBN), C(NMNP), ARRAY(NMNP), U(NMNP), V(NMNP),
H(NMNP), Q(NMNP*2), A(3), TITLE(14), XT(18), YT(18), NTIME(NPLOTS),
BS(10), D(NMNP)
Program Inputs

Card Group 1: Options

a) IELM = 0 - no plot of element geometry
    1 - produces plot of element geometry
    2 - element geometry with numbered elements

b) IBOUND = 0 - no plot of land or ocean boundaries
    1 - plots land and ocean boundaries

c) IVEL = 0 - no plot of velocities
    1 - produces plot of velocity field generated by CAFE
    2 - produces plot of net velocity field (averaged from
        NTIME(1) to NTIME(2))

d) ICONC = 0 - no concentration plot
    1 - produces a plot of element concentrations generated by DISPER

e) IETA = 0 - no plot of water surface elevation
    1 - produces a plot of water surface elevation above MLW

f) IOUTPUT = 0 - no listing of input data
    1 - produces a listing of input data in the printed output
        data set

g) NCOPY = Enter the number of copies of each plot desired. If only one copy
        is desired, this may be left blank.

Card Group 2: Sequenced Plot Data: (Use Card Group 2 only if IVEL + ICONC
    + IETA > 0)

2a) Title (14A4) enter a title of up to 56 characters. The front should be
    padded with blanks as necessary to center the text in the 56 spaces.

2b) BS (10A4) this is another space for entering notes in the title block.
    This space is useful for recording the data set name(s) of the disk(s)
    being used.
2c) Time Information (2015)

NPLOTS, (NTIME(I), I = 1,NPLOTS)

Where each NTIME(I) is a fortran direct-access record number for which a plot
is desired, and NPLOTS is the number of these.

Card Group 3: Scale Parameters  One Card (4F10.2)

a) GSCALE - scale of plot (GSCALE units/inch of plot)

b) VSCALE - scale of velocity vectors

c) CFACT - concentrations to be plotted will be multiplied by this
   factor to aid in plot interpretation

d) TSC - scale factor for title block. This is useful when producing
   plots which will be reduced. TSC = 1.0 yields a title block
   4.0" x 1.6". TSC > 1.0 yields a proportionately large title
   block.

Card Group 4: Lineweights  One Card (4I5)

An explanation of allowable values for the line weight parameters can be
found in the Gould Plot Package Programming Manual, Sec. 2.4.

a) LW1 - element geometry

b) LW2 - land boundaries

c) LW3 - ocean boundaries

d) LW4 - velocity vector arrows

Card Group 5: NMEL, NMNP  One Card (2I5)

a) NMEL - number of elements

b) NMNP - number of node points

Card Group 6: Nodal Coordinates

This is the same as "Card Group 3" in the CAFE User's Manual.

Card Group 7: Element Data

This is the same as "Card Group 4" in the CAFE User's Manual.
Card Group 8: Land Boundary Data

Card Group 9: Segment Connectivity

Card Group 10: Ocean Boundary Data

Card Group 11: Segment Connectivity

Card Groups 8-11 are identical to Card Groups 7-10 in the CAFE Users's Manual. If IBOUND = 0, these cards may be omitted.
/*CATCRAF JR (1004,909,40.2.0), 'ANN CONWAY', CLASS=A*/
/*PASSWORD 001,MIDE*/
/*ROUTE PRINT TCF*/
/*EXEC FORTGCS,FLDT=*
/*FORT SYSIN DD 'DUMMY'
/*FORT SYSIN DD *'
/*INCLUDE GRAFORT
/*GD.SYSIN DD *'
0 1 0 1 0 0 1

1 91
5600  .5  1.  0.6
0  -1  2  0

/*INCLUDE MIDE6 1006965.1*/
/*INCLUDE ELEM6 1006965.1*/
/*INCLUDE GDDHOD 1006969.3*/
/*INCLUDE GDD1C1*/
/*GD.FT10001 DD DSH-IF.A0046809.HTCAN,*/
/*DISP=(OLD,KEEP)*/
/*GD.FT11F001 DD DSH-IF.A0046809.HTCAN,*/
/*DISP=(OLD,KEEP)*/
/*GD.FT12F001 DD DSH-IF.A0046809.DDNC1,*/
/*DISP=(OLD,KEEP)*/
/*GD.FT13F001 DD DUMMY*/
/*EXEC FLDT*/

B-29
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END OF VOLUME ENCOUNTERED.