Report No. 4

The WAM Model
cycle 4

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1. INTRODUCTION

The WAM-model is a third generation wave model which solves the wave transport equation explicitly without any presumptions on the shape of the wave spectrum. It represents the physics of the wave evolution in accordance with our knowledge today for the full set of degrees of freedom of a 2d wave spectrum.

The model runs for any given regional or global grid with a prescribed topographic dataset. The grid resolution can be arbitrary in space and time. The propagation can be done on a latitudinal - longitudinal or on a carthesian grid.The model outputs the significant wave height, mean wave direction and frequency, the swell wave height and mean direction, wind stress fields corrected by including the wave induced stress and the drag coefficient at each grid point at chosen output times, and also the 2d wave spectrum at chosen grid points and output times.

The model runs for deep and shallow water and includes depth and current refraction.

The integration can be interrupted and restarted at arbitrary times.

The source terms and the propagation are computed with different methods and time steps. The source term integration is done with an implicit integration scheme while the propagation scheme is a first order upwind flux scheme. The wind time step can be chosen arbitrarily.

Subgrid squares can be run in a nested mode.In a course grid run the spectra can be outputted at the boundaries of a subgrid . They can then be interpolated in space and time to the boundary points of the fine subgrid and the model can be rerun on the fine mesh grid.

The cpu time and memory usage depend on the region of interest and the grid resolution. For a global run 20 min cpu time is needed for a ten day forecast for a 3° by 3° lat - lon grid , 26 frequencies , 12 directions and 512 gridpoints in a block.

The model is documented in DOCTOR standard, i.e. each routine contains a header describing the purpose, method and interface of the routine and the externals used. All COMMON variables are documented in the main program and the program is block structured with headers describing the contents of each block or sub-block.

The model was developed at the Max-Planck-Institut für Meteorologie in Hamburg (Germany) by S. and K. Hasselmann with the aid of P. Janssen and G. Komen (KNMI, Netherlands), and L. Zambreski and H. Günther (GKSS, Germany, ECMWF, Reading, UK). It has been installed at about 35 institutions world wide and is used for research and also operational application. It is also being applied for interpreting and assimilating satellite wave data.

 The model is continually updated to incorporate the latest results of research. The further development

of the model is decided by the WAModel development group (chairman K. Hasselmann). The WAModel is available to the entire research and forecasting community.It is expected that results achieved with the model are made available in return to the wave modeling group.

So far four cycles of the model have been issued. The last cycle, cycle 4, is a technically enhanced version of cycle 3 carried out by H. Günther (ECMWF, Reading) and in addition includes new wind input physics developed by P. Janssen (1991). When a new cycle of the model is available members of the WAM-group are automatically informed.

2. MODEL DESCRIPTION

2.1 MODEL PHYSICS AND DYNAMICS

The WAM model describes the evolution of a two-dimensional ocean wave spectrum. In contrast to first and second generation models, the third generation model WAM introduces no ad hoc assumptions on the spectral shape. It computes the 2-d wave variance spectrum through integration of the transport equation :

$$\frac{dF}{dt} + \frac{\partial}{\partial\phi}(\dot{\phi}F) + \frac{\partial}{\partial\lambda}(\dot{\lambda}F) + \frac{\partial}{\partial\theta}(\dot{\theta}F) = S \qquad (2.1.1)$$

where:

F	represents the spectral density with respect to $(f, \theta, \phi, \lambda)$
f	denotes frequencies
θ	directions
ϕ	latitudes
λ	longitudes

$\dot{\phi}, \dot{\lambda}, \dot{\theta}$ are the rate of change of the position and propagation direction of a wave packet travelling along a great circle path.

The source function S is represented as a superposition of the wind input S_{in}, white capping dissipation S_{dis}, and nonlinear transfer S_{nl}

$$S = S_{in} + S_{dis} + S_{nl} \qquad (2.1.2)$$

The wind input term was adopted from Snyder et al. (1981) with a u_* scaling rather than U_5 (Komen et al.,1984). Wind input and dissipation terms of the present cycle 4 of the wave model are a further development based on Janssen´s quasi-linear theory of wind-wave generation (Janssen 1989, 1991).

The surface waves extract momentum from the air flow and therefore the stress in the surface layer depends both on the wind speed and the wave-induced stress τ_w. The growth rate of the waves then depends on the friction velocity u_*, and the roughness length z_0.

The wind input term is given by

$$S_{in} = \gamma \cdot F \qquad (2.1.3)$$

with F the two-dimensional spectrum and γ the growth rate of the waves. From Miles (1957) we know that for a logarithmic wind profile γ depends on only two parameters, normally

$$X = u_* \cos(\Theta - \phi)/C \quad \text{and} \quad \Omega = \frac{g\, z_0}{u_*^2} \qquad (2.1.4)$$

with u_* the friction velocity, Θ the direction in which the waves propagate, φ the wind directon, C the phase speed of the waves and z_0 the roughness length. Thus, through Ω the growth rate depends on the roughness, which on its turn depends on the sea state. The growth rate, normalised by angular frequency ω, is given as

$$\frac{\gamma}{\omega} = \varepsilon\beta x^2 \tag{2.1.5}$$

where

$$\beta = \frac{\beta_m}{\kappa^2}\mu\ln^4(\mu), \mu{<}1 \tag{2.1.6}$$

with k the von Karman constant, $\beta_m = 1.2$ a constant and μ is the dimensionless critical height $\mu = k \cdot z_c$ (with k the wave number and z_c the critical height defined by $U_0(z = z_c) = c$).

The stress τ of air flow over sea waves depends on the sea state and from a consideration of the momentum balance of air it is found that τ is given as

$$\tau = C_D U^2(L), \tag{2.1.7}$$

with drag coefficient

$$C_D = \{\kappa/(\ln(L/z_0))\}^2 \tag{2.1.8}$$

where

$$z_o = \frac{\alpha\tau}{g}/\sqrt{(1 - (\tau_w)/\tau)} \tag{2.1.9}$$

Here, L is the mean height above the waves and τ_w the wave-induced stress given by

$$\tau_w = \rho_w\int\omega\gamma(F \cdot \cos(\theta - \varphi)) \; df d\theta \tag{2.1.10}$$

In practice, the wave stress τ_w is pointed in the wind direction. The constant α is chosen in such a way that for old wind sea the usual Charnock relation for the drag over sea waves is found. This avoids double counting problems.

The dissipation source term is based on K. Hasselmanns (1974) white capping theory according to Komen et al., (1984).

In order to obtain a proper energy balance at high-frequencies the dissipation by white capping was extended by adding a k^2 term,thus

$$S_{dis} = (-\gamma_d) F \tag{2.1.11}$$

where

$$\gamma_d = \frac{1}{2}c_{dis}\langle\omega\rangle\,(\langle k\rangle^2 E)^2\,(\frac{k}{\langle k\rangle} + (\frac{k}{\langle k\rangle})^2)$$

(2.1.12)

Here $c_{dis} = 4.5$ is a constant, E is the total wave variance, k is the wave number and $\langle\omega\rangle$ and $\langle k\rangle$ are mean angular frequency and mean wave number.

$$\langle\omega\rangle = [E^{-1} \cdot \iint F(f, \theta) \cdot \omega^{-1}\,dfd\theta]^{-1}$$

(2.1.13)

$$\langle k\rangle = [E^{-1} \cdot \iint F(f, \theta) \cdot k^{-1/2}\,dfd\theta]^{-2}$$

(2.1.14)

$$E = \iint F(f, \theta)\,dfd\theta$$

(2.1.15)

The dependence of the proportionality factor on the square of the frequency is consistent with the white capping dissipation function derived by Hasselmann (1974)

The nonlinear source term is a parameterization of the exact nonlinear interactions as proposed by Hasselmann et al.(1981 and 1985) . The basic form of the exact nonlinear expression is retained. However the five-dimensional continuum of all resonant quadruplets is reduced to a two-dimensional continuum by considering only a pair of discrete interaction configurations.The theory on which the WAM model is based is described in more detail in WAMDIG (1988).

2.2 MODEL GRID STRUCTURE

Since the computation of the nonlinear source term is not vectorizable the grid points are placed into the innermost loop running from south to north in the form of 1d - array blocks . To account for waves propagating across the north or south boundaries of the block, the blocks overlap by two latitudes . Computation is done from the second southermost latitude to one before the last northermost latitude.
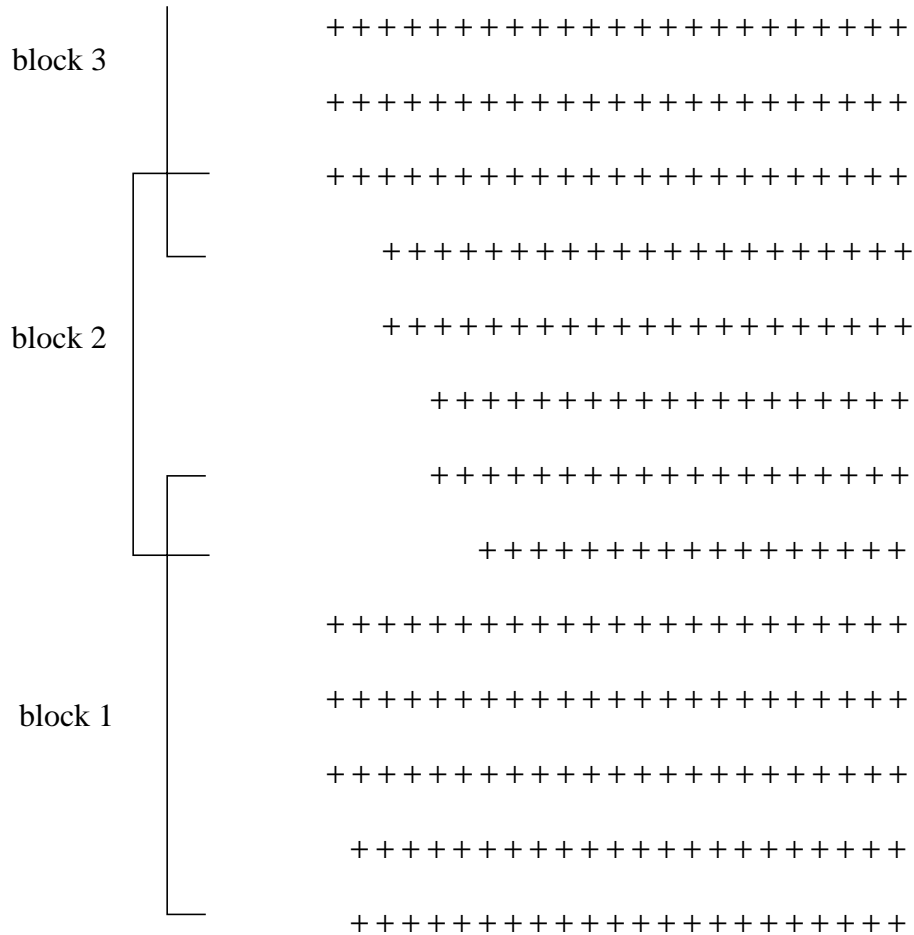
In contrast to former cycles of the model, gripoints are sea points only. Neighbouring gridpoints are marked as land or sea points for the propagation by two smaller arrays which are zero for the spectral value of land.

2.3 MODEL OUTPUT

The model computes 2d wave variance spectra at all grid points. These spectra can be saved for a restart at the end of a run. The user can choose specific grid points and dates during the integration to output 2d wave spectra. The spectrum is represented by a variable number of logarithmically spaced frequencies, extending from an arbitrarily chosen minimum frequency and by a varible number of equally spaced directions, starting from zero (North). Also mean wave height, direction and frequency and mean swell wave height and direction can be outputted at arbitrary gridpoints and integration times.

2.4 MODEL SYSTEM

The model system consists of three major program parts:

      1) pre-processing programs

      2) processing programs

      3) post-processing programs

The WAM model is designed to run as a module of a more general system or as a stand-alone program. It is set-up for a CRAY computer with a UNICOS operating system, but CDC CYBER 205 modifications are available as well. Front/End systems may be used for data storage and for postprocessing. However it is left to the user to modify the appropriate subroutines.

2.4.1   Pre-processing programs

Two pre-processing programs are provided:

      1) PREPROC

      2) PRESET

Program PREPROC

PREPROC generates all time independent information for the wave model.Starting from a regional or global topographic data set, the model grid is created in the form required for the model. The frequency and angular arrays are generated.If the current refraction option is activated, PREPROC expects a current data set and interpolates the data onto the model grid.

A number of model constants are precomputed and stored together with the model grid, frequency and angular information, and the currents in two output files.

If nested grids are generated, the information for the output, input and interpolation of boundary spectra are precomputed and stored in seperate files for the coarse and fine (sub) grid models.

Program PRESET

PRESET generates an initial wave field for a wave model cold start.

Controlled by the user input of PRESET, either the same initial JONSWAP spectrum is used at all sea points or the initial spectra are computed from the local initial winds according to fetch laws with a $\cos^2$ directional distribution.

The data are stored in the format of the model restart files.

2.4.2 Processing programs

Two processing programs are provided:

> 1) CHIEF
> 2) BOUINT

Program CHIEF

CHIEF is the shell program of the stand-alone version of the wave model calling the subroutine version of the wave model. All time dependent variables and user defined parameters are fixed, the wind fields are transformed into the model formats, and the transport equation is integrated over a chosen period.

The program uses the output files of PREPROC as set_up files and the files generated by PRESET or a former model run as initial values. A wind input file has to be provided by the user.

All additional information must be defined in the user input file.

The model can be integrated with independently chosen propagation,source term, wind input and wind output time steps. However, all time step ratios must be an integer or inverse integer.

A number of model options and parameters can be selected by the user in the program input. The following model options are inplemented:

> - carthesian or spherical propagation,
> - deep or shallow water,
> - without or with depth or with depth and current refraction,
> - nested grids
> - time interpolation of winds or no time interpolation,
> - model output at regular intervals or by list,
> - printer and/or file output of individually selected parameters.

All run time dependent files are fetched dynamically and follow a fixed file name convention. The user has control over directory names and paths through the model input.

The model results are saved in four files (if selected)

> 1) gridded output fields of

>> - significant wave height
>> - mean wave direction
>> - mean frequency (inverse of mean period)
>> - friction velocity
>> - wind direction

- wave peak frequency

- drag coefficient

- normalized wave stress

2) swell gridded output fields of

- swell wave height

- mean swell direction

- mean wind wave direction

- mean swell frequency

3) spectra at selected gridpoints (see PREPROC)

4) swell spectra at selected gridpoints (see PREPROC)

Program BOUINT

Program BOUINT interpolates the boundary output spectra from a coarse grid model run in time for the fine grid boundary input. This program has to be applied if nested grids are used.

2.4.3   Post-processing programs

Four post-processing programs are provided:

1) PGRID   Prints GRIDded output file

2) PSWGRID   Prints SWell GRIDded output file

3) PSPEC   Prints SPECtra output file

4) PSWSPEC   Prints SWell SPECtra output file

Each of the programs is set up for a model result file. Controlled by the user input the results are printed. Plot software is not included in the standard set of programs.

The files are dynamically fetched. The user may choose individual fields. If boundary spectra files are produced, both the course and fine grid file can be printed by program PSPEC.

3. WAM MODEL SYSTEM COMPONENTS.(PROGRAM HEADERS)

3.1 PROGRAM PREPROC

PURPOSE.

TO ARRANGE A GRID FOR THE WAM WAVE MODEL AND COMPUTE ALL FIXED
 MODEL PARAMETERS WHICH ARE STORED IN DIFFERENT COMMON BLOCKS.

METHOD.

A REPRESENTATIVE TOPOGRAPHIC DATA SET ON LAT-LONG
COORDINATES CONTAINING THE MODEL SQUARE BOX REGION IS READ
IN.THE MODEL REGION IS EXTRACTED AND INTERPOLATED ONTO A
GIVEN LAT-LONG GRID (SEE SUB TOPOAR).THE PROGRAM CHECKS
FOR A PERIODIC GRID. IF THE GRID IS NOT PERIODIC A
CLOSED BASIN IS ASSUMED.
THE PROGRAM DOES NOT DISTINGUISH BETWEEN DEEP AND
SHALLOW WATER.

BLOCK STRUCTURE :

GRID POINTS ARE COLLECTED INTO 1-DIMENSIONAL ARRAY BLOCKS
OF MAXIMAL NIBLO ELEMENTS, GRID POINTS
(ONLY SEAPOINTS) ARE COUNTED ALONG LINES OF LATITUDES
FROM WEST TO EAST WORKING FROM SOUTH TO NORTH.
BLOCKS OVERLAP OVER TWO LATITUDE LINES, TO COMPUTE NORTH-SOUTH
ADVECTION TERMS.

NESTED GRIDS:

THE GRID GENERATED CAN BE A
- COARSE GRID WHICH MEANS OUTPUT OF SPECTRA FOR A
  FOLLOW UP FINE GRID RUN.
- FINE GRID WHICH MEANS INPUT OF SPECTRA FROM AN
  EARLIER COARSE GRID RUN.
- COARSE AND FINE GRID

REFRACTION:

CONTROLLED BY THE REFRACTION OPTION A CURRENT FIELD IS READ,
INTERPOLATED TO THE MODEL GRID AND STORED IN THE GRID OUTPUT FILE.

PARAMETERS FOR ARRAY DIMENSIONS:

THE PRORAM CHECKS ALL DIMENSIONS INTERNALLY. ONLY THE BLOCK
LENGTH (NIBLO) IS USED FOR THE SET UP OF THE GRID, ALL THE OTHER
PARAMETERS HAVE TO BE CHOSEN LARGE ENOUGH. AT THE END OF THE

OUTPUT PROTOCOL A LIST IS PRINTED FOR THE OPTIMAL SETTINGS OF ALL DIMENSIONS. TO AVOID BANK CONFLICTS IT IS ADVISED TO USE A MULTIPLE OF 64 AS VALUE FOR NIBLO

INTERFACE.

PROGRAM *PREPROC*

IU01   LOGICAL UNIT FOR INPUT OF TOPOGRAPHIC DATA (SEE SUB TOPOAR).

IU02   LOGICAL UNIT FOR INPUT OF CURRENTS (SEE SUB READCUR).

IU03   LOGICAL UNIT FOR INPUT OF COARSE GRID
BOUNDARY ORGANISATION (COMMON CBOUND).
IF THIS IS A FINE GRID PREPROC. FORMATTED IF IFORM = 2
OTHERWISE UNFORMATTED.(SEE SUB MBOUNF).

IU05   LOGICAL UNIT FOR USER INPUT. (SEE SUB UIPREP).

IU06   LOGICAL UNIT FOR PRINTER OUTPUT UNIT

IU07   LOGICAL UNIT FOR OUTPUT OF GRID ORGANISATION
AND COMPUTED CONSTANTS. (UNFORMATTED, SEE SUB OUTCOM).

IU08   LOGICAL UNIT FOR OUTPUT OF COMMON UBUF.
(UNFORMATTED) (SEE SUB OUTUBUF).

IU09   LOGICAL UNIT FOR UNFORMATTED OUTPUT OF COARSE
GRID BOUNDARY ORGANISATION (COMMON CBOUND),
IF THIS IS A COARSE GRID PREPROC. (SEE SUB MBOUNC).

IU10   LOGICAl UNIT FOR UNFORMATTED OUTPUT OF FINE
GRID BOUNDARY ORGANISATION (COMMON CBOUND).
IF THIS IS A FINE GRID PREPROC. (SEE SUB MBOUNF).

IU17   SAME AS IU07 BUT FORMATTED.

IU18   SAME AS IU08 BUT FORMATTED.

IU19   SAME AS IU09 BUT FORMATTED.

IU20   SAME AS IU10 BUT FORMATTED.

ALL UNITS ARE DEFINED IN SECTION 1. OF THIS PROGRAM.

COMMON BLOCKS COUPLE, CURRENT, FREDIR, INDNL, GRIDPAR,MAP,

COUT, TABLE, AND SHALLOW ARE WRITTEN TO UNIT IU07 AND/OR IU17.

ALL ARRAYS DEPENDING ON FREQUENCY AND DIRECTION ARE WRITTEN FROM 1 TO THE USED NUMBER OF FREQUENCIES AND THE USED NUMBER OF DIRECTIONS.OTHER ARRAYS ARE WRITTEN ACCORDING TO THEIR DIMENSIONS.

EXTERNALS.

ABORT -   TERMINATES PROCESSING.

ADJUST-   CORRECTS LONGITUDE INPUT.

AKI-   COMPUTES WAVE NUMBER.

CHECK- CHECKS CONSISTENCY OF BLOCK OVERLAPS.

FINDB- FIND BLOCK NUMBER AND INDEX IN A BLOCK FOR EACH LAT -LON GRID POINT IN THE REGION

JAFU- DIRECTIONAL INDEX OF NON LINEAR INTERACTION

LOCINT- GRID INTERPOLATION

MBLOCK- PREPARES ONE BLOCK

MBOUNC- MAKE COARSE GRID BOUNDARY.

MBOUNF- MAKE FINE GRID BOUNDARY.

MBOXB- MAKE BOX FOR FINE GRID IN COARSE GRID.

MCOUT- PREPARES OUTPUT COMMON COUT

MFREDIR- COMPUTES FREQUENCY/DIRECTION COMMON FREDIR

MGRID- ARRANGES GRID FOR MODEL.

MINTF- MAKE INTERPOLATION TABLES FOR BOUNDARY INPUT.

MTABS- COMPUTES TABLES USED FOR SHALLOW WATER

MUBUF- COMPUTES COMMON UBUF.

NLWEIGT- COMPUTES NON LINEAR WEIGHTS IN COMMON INDNL

OUTCOM- OUTPUT OF COMPUTED COMMONS

OUTPP- OUTPUT OF GRID.

OUTUBUF- OUTPUT OF BLOCK COMMON UBUF

PACKI- PACKS AN INTEGER ARRAY.

PACKR- PACKS A REAL ARRAY.

READCUR- READ A CURRENT FIELD.

STRESS- STRESS TABLE.

TAUHF- HIGH FREQUENCY STRESS TABLE.

TOPOAR- PREPARE TOPOGRAPHY FOR GRID.

UIPREP- READS USER INPUT

WAMCUR- PREPARE CURRENT FIELD.

COMMON BLOCKS.

CPBOUN- USED FOR THE COURSE GRID ORGANIZATION OF THE BOUNDARY POINTS.

CINP- USER INPUT: SEA AREAS TO BE SET TO LAND, AND SPECIAL OUTPUT POINTS.

COUPL - PARAMETERS FOR COUPLING.

COUT- OUTPUT POINTS INDICES AND FLAGS.

CURGRD- INPUT CURRENT GRID SPECFICATIONS.

CURRENT- CURRENT FIELD.

FPBOUN- USED FOR THE FINE GRID ORGANIZATION OF THE

BOUNDARY POINTS.

FREDIR-	FREQUENCY AND DIRECTION GRID.
*GRIDPAR-	GENERAL GRID INFORMATION.
INDNL-	INDICES AND WEIGHTS USED IN THE COMPUTATION OF THE NONLINEAR TRANSFER RATE.
MAP-	LON/LAT INDEX OF EACH SEA POINT.
SHALLOW-	SHALLOW WATER TABLES.
TABLE-	TABLE FOR TOTAL STRESS AND HIGH FREQ. STRESS.
TESTO-	PRINTER OUTPUT UNIT AND TEST FLAGS.
UBUF-	GRID POINT DEPENDENT CONSTANTS

PARAMETERS.

PARAMETER-FOR ARRAY DIMENSIONS.

PARAMETER-FOR ARRAY DIMENSIONS FOR PREPROC ONLY.

PARAMETER-FOR ARRAY DIMENSIONS OF TOPOGRAPHIC DATA.

PARAMETER-FOR ARRAY DIMENSIONS FOR CURRENT INPUT.

3.2 PROGRAM PRESET

<u>PURPOSE.</u>

SPECTRAL INITIALIZATION OF INTEGRATION REGION

<u>INTERFACE.</u>

IU01	INTEGER	INPUT UNIT FOR UNBLOCKED WIND FILE.
		(SEE SUB READWND).
		IU01 HAS TO BE DEFINED IN SUB. READWND.
IU05	INTEGER	USER INPUT UNIT.
IU06	INTEGER	PRINTER OUTPUT.
IU07	INTEGER	INPUT UNIT PREPROC GRID OUTPUT.
IU12	INTEGER	OUTPUT UNIT BLOCKED SPECTRA.
IU14	INTEGER	OUTPUT UNIT SECOND LAT OF BLOCKS.
IU15	INTEGER	OUTPUT UNIT LAST WINDFIELDS.

<u>METHOD.</u>

JONSWAP PARAMETERS ARE DEFINED EITHER BY USER INPUT OR BY FETCH LAWS FROM THE LOCAL WIND. THE 2-D SPECTRA ARE COMPUTED FOR EACH POINT IN A BLOCK, ALL BLOCKS AND OVERLAPPING LATITUDES ARE SAVED.

IF FETCH LAWS ARE USED TO DEFINE JONSWAP PARAMETERS THE FIRST WINDFIELD IS GENERATED OTHERWISE THE WIND FIELD IS INITIALIZED WITH ZEROS. THE MAIN MODEL WILL RECONSTRUCT THE WIND ANYHOW.

THE FILE HANDLING OF THE RESTART FILES IS COMPUTER DEPENDENT. SUB GSFILE HAS TO BE MODIFIED, TO COPY THE UNIT ALIAS FILES (UNITS IU12,IU14, AND IU15) TO PERMANENT FILES.

NOTE: THE SUBROUTINE READWND HAS TO BE ADJUSTED TO THE AVAILABLE WINDFIELD FORMAT. AN EXAMPLE IS GIVEN ON FLOPPY 3 FOR AN UNFORMAT-TED WINDFILE .

<u>EXTERNALS.</u>

ABORT-	TERMINATES PROCESSING.
AIRSEA-	TOTAL STRESS IN SURFACE LAYER.
CREWFN-	CREATES A WIND FILE NAME.
GETWND-	GETS A WIND FIELD.
GSFILE-	GETS OR SAVES FILES (COMPUTER DEPENDENT).
IECF_LEN-	LENGTH OF A CHARACTER VARIABLE.
INCDATE-	UPDATES A DATE TIME GROUP.
LOCINT-	INTERPOLATES TO MODEL GRID.
MSTART-	GENERATES THE RESTART FILES.

NOTIM- CONTROLS WIND GENERATION (NO TIME INTERPOLATION).

OPENFIL- OPENS A FILE.

PEAK- COMPUTES JONSWAP PARAMETERS BY FETCH LAWS.

PREWIND- PREPARES WINDS.

*READWND- READS INPUT WINDFIELD

SAVREST- SAVES SPECTRAL ARRAYS AS INPUT INTO THE WAMODEL FOR A RESTART.

SPECTRA- COMPUTES SPECTRA FROM JONSWAP PARAMETERS.

SPLITBL- SAVES SECOND TO LAST LATITUDES.

SPR- DIRECTIONAL DISTRIBUTION.

READPRE- READS PREPROC OUTPUT.

TIMIN- CONTROLS WIND GENERATION (TIME INTERPOLATION).

WAMWND- CONVERTS INPUT WIND TO WAM WINDS.

COMMON BLOCKS.

COUPL- PARAMETERS FOR COUPLING.

COUT- INDICES AND FLAGS OF OUTPUT POINTS

CURRENT- CURRENT FIELD.

FREDIR- FREQUENCY AND DIRECTIONAL GRID.

GRIDPAR- GENERAL GRID INFORMATION.

INDNL- INDICES AND WEIGHTS USED IN THE COMPUTATION OF THE NONLINEAR TRANSFER RATE.

JONS- JONSWAP PARAMETERS.

MAP- LON/LAT INDEX OF EACH SEA POINT.

SHALLOW- SHALLOW WATER TABLES.

SPE1- ONE BLOCK OF SPECTRA.

STATUS- TIME STATUS OF INTEGRATION, WIND INPUT, OUTPUT OF RESULTS, AND MODEL OPTIONS.

TABLE- TABLE FOR TOTAL STRESS AND HIGH FREQ STRESS.

TESTO- PRINTER OUTPUT UNIT AND TEST FLAGS.

TEXT- FILE NAME INFORMATION.

UNITS- INPUT / OUTPUT UNITS.

WIND- VARIABLES USED FOR WIND COMPUTATIONS.

WNDGRD- INPUT WIND GRID SPECIFICATIONS.

PARAMETERS.

 *PARAMETER*FOR ARRAY DIMENSIONS.

*PARAMETER*FOR WIND INPUT ARRAY DIMENSIONS.

3.3 PROGRAM CHIEF

In this chapter the main program CHIEF and the four main subs WAVEMDL, INITMDL, PREWIND, and WAMODEL are explained.

3.3.1   Main CHIEF

PURPOSE.

THIS PROGRAM SUPERVISES THE EXECUTION OF THE WAMODEL.

INTERFACE.

IN ORDER TO EXECUTE, THE WAMODEL NEEDS FILES FROM ESSENTIALLY FIVE SOURCES.
1. THE UNFORMATTED FILES CREATED BY PREPROC
2. USER INPUT FILE
3. THE WIND INPUT FILE.
4. THE TIME INTERPOLATED BOUNDARY VALUES CREATED BY BOUINT.
       THESE FILES ARE DYNAMICALLY ASSIGNED.
5. THE START FILES:
THE RESTART FILES HAVE TO BE CREATED BY JOB PRESET, IF A COLD START HAS TO BE DONE. THESE FILES OR FILES FROM A PREVIOUS MODEL RUN ARE AUTOMATICALLY ASSIGNED. (SEE SUB GSFILE).
EXPLANATIONS FOR ALL FILES ARE GIVEN IN DETAIL IN SUB INITMDL.

METHOD.

THIS VERSION OF THE WAM MODEL HAS BEEN PRODUCED BY MERGING AND CORRECTLY INTERFACING WHAT USED TO BE THE STAND ALONE PROGRAMS:
           PREWIND AND THE WAM MODEL.
PREWIND REFORMATS WINDS INTO THE WAMODEL BLOCK STRUCTURE. STARTING WITH THE INITIAL SEA STATE FILES, THE WAMODEL CAN THEN INTEGRATE FORWARD IN TIME, DRIVEN BY THE REFORMATTED WINDS. THE SEA STATE AND RESULT FILES ARE SAVED IN REGULAR INTERVALS. THE SEA STATE FILES SERVE AS INITIAL CONDITION FOR A RESTART.
EACH CALL OF THE SUB WAVEMDL INTEGRATES FORWARD IN TIME BY ONE WIND INPUT TIME STEP OR ONE PROPAGATION TIME STEP, DEPENDING ON WHICH OF THE TWO IS LARGER.
THE FIRST CALL TO WAVEMDL IN ADDITION INITIALIZES THE MODEL RUN.

EXTERNALS.

WAVEMDL- SUPERVIZES THE OVERALL FLOW THROUGH THE MAIN
                MODULES: INITMDL, PREWIND AND WAMODEL.

COMMON BLOCKS.

STATUS- TIME STATUS OF INTEGRATION, WIND INPUT, OUTPUT
OF RESULTS, AND MODEL OPTIONS.

3.3.2   Subroutine WAVEMDL

PURPOSE

THIS SUB. SUPERVISES THE EXECUTION OF THE MAIN MODULES FOR MODEL
INITIALIZATION, WIND FIELD PROCESSING, MODEL EXECUTION.

INTERFACE.

CALL *WAVEMDL*

METHOD

THE FIRST CALL TO WAVEMDL INITIALIZES THE WAMODEL. THIS INCLUDES
READING INITIAL SEA STATE FROM DISK, READING COMMON VARIABLES FROM
PREPROC AND SETTING GENERAL PARAMETERS.
IN ALL CALLS TO WAVEMDL PREWIND AND WAMODEL ARE CALLED FOR ONE
WIND OR PROPAGATION TIME STEP DEPENDING ON WHICH OF THE TWO IS
LONGER.

EXTERNALS

INITMDL-- INITIALIZES THE WAMODEL,
PREWIND- REFORMATS WINDS FROM LAT-LON GRID TO MODEL
BLOCKED GRID STRUCTURE.
WAMODEL- INTEGRATES 2D WAVE SPECTRA IN SPACE AND TIME.

COMMON BLOCKS

TESTO - PRINTER OUTPUT UNIT AND TEST FLAGS

3.3.3   Subroutine INITMDL

PURPOSE.

 TO INITIALIZE THE WAM MODEL.

INTERFACE.

CALL *INITMDL (NADV)*
NADV NUMBER OF ADVECTION ITERATION STEP
PER CALL OF WAMODEL. OUTPUT PARAMETER.
---- INPUT/OUTPUT UNITS ---
THE NAMES ARE DEFINED IN SECTION 1. OF THIS PROGRAM, IF IT IS NOT

MENTIONED OTHERWISE.

IU01- INPUT UNIT FOR UNBLOCKED WIND FILE. (SEE SUB READWND).

IU02- INPUT UNIT FOR BOUNDARY VALUES FROM A PREVIOUS COARSE GRID IF THIS IS A FINE GRID RUN. THIS FILE IS DYNAMICALLY ASSIGNED FILEI = 'FBI' (OUTPUT OF BOUINT).

IU05- USER INPUT .

IU06- PRINT OUTPUT.

IU07- INPUT UNIT FOR PRECOMPUTED COMMON BLOCKS. (OUTPUT FROM PREPROC).

IU08- INPUT UNIT FOR COMMON UBUF. (OUTPUT OF PREPROC).

IU09- INPUT UNIT FOR COMMON CBOUND (OUTPUT OF PREPROC).

IU10- INPUT UNIT FOR COMMON FBOUND (OUTPUT OF PREPROC).

IU11- INPUT UNIT FOR SPECTRA AT ALL GRID POINTS. AFTER EACH PROPAGATION STEP THE FILES CONNECTED TO IU11 AND IU12 ARE INTERCHANGED.

IU12- OUTPUT UNIT FOR BLOCKS OF SPECTRA (SEE IU11).

IU13- INPUT UNIT FOR SPECTRA OF LAST LATITUDEIN A BLOCK. SPECTRA ARE SAVED FROM THE SECOND LATITUDE OF NEXT BLOCK AT PREVIOUS TIME STEP. AFTER EACH PROPAGATION STEP THE FILES CONNECTED TO IU13 AND IU14 ARE INTERCHANGED.

IU14- OUTPUT UNIT FOR SECOND LATITUDE IU13.

IU15- OUTPUT UNIT FOR LAST WINDFIELDS.

IU16- INPUT/OUTPUT UNIT FOR COMMON REFDOT.

IU17- INPUT UNIT FOR BLOCKED WINDS. THIS FILE IS DYNAMICALLY ASSIGNED IN SUB IMPLSCH. SEE SUB CREWFN TOO.

IU18- INPUT UNIT FOR BLOCKED WINDS. THIS FILE IS DYNAMICALLY ASSIGNED IN SUB IMPLSCH. SEE SUB CREWFN TOO.

IU19- OUTPUT UNIT FOR BOUNDARY VALUES IF THIS IS A FINE GRID RUN. THIS FILE IS DYNAMICALLY ASSIGNED FILEID = 'CBO'

IU20- OUTPUT UNIT FOR INTEGRATED PARAMETERS OF THE TOTAL SPECTRUM.(HS, THETAMEAN, FMEAN). THIS FILE IS DYNAMICALLY ASSIGNED FILEID = 'MAP'

IU21- OUTPUT UNIT FOR INTEGRATED PARAMETERS OF SWELL AND WIND WAVES. THIS FILE IS DYNAMICALLY ASSIGNED FILEID = 'SWE'

IU25- OUTPUT UNIT FOR SPECTRA AT CERTAIN GRID POINTS. THIS FILE IS DYNAMICALLY ASSIGNED FILEID = 'SPE'

IU26- OUTPUT UNIT FOR SWELL SPECTRA AT CERTAIN POINTS. THIS FILE IS DYNAMICALLY ASSIGNED FILEID = 'SWS'

IUSCR- SCRATCH UNITS FOR WIND PROCESSING.

IUVELO-OUTPUT UNIT FOR BLOCKED WIND FIELDS. THIS FILE IS
DYNAMICALLY ASSIGNED IN SUB NOTIM OR TIMIN.
SEE SUB CREWFN TOO.

THE RESTART FILES ARE DYNAMICALLY ASSIGNED AND COPIED TO THE UNITS
(IU12, IU14, IU15).

IF IT IS REQUESTED TO SAVE RESTART FILES THESE WILL BE COPIED IN
REGULAR INTERVALS FROM THE UNITS IU11 OR IU12, IU13 OR IU14, AND IU15
TO THE PERMANENT RESTART FILES. FOR DETAILS OF THE FILE NAMES SEE
SUB GSFILE.

THE PROGRAM USES OPEN TO ASSIGN FILES WHICH HAVE A FILEID(IU02,IU19,I-
U20,IU21,IU25,IU26). FOR DETAILS OF THE FILE NAME CONVENTION SEE SUB
OPENFIL.

SUB NOTIM OR TIMIN OPENS FILES AND ASSIGNS THEM TO UNIT IUVELO FOR
THE BLOCKED WINDS. THESE FILES ARE READ AND DELETED IN
SUB IMPLSCH (IU17 AND IU18). THE FILE NAMES ARE CREATED IN SUB CREWFN.

THE FILE HANDLING SUBS OPENFIL AND GSFILE ARE COMPUTER DEPENDENT
AND MAY BE ADOPTED BY THE USER.

IF A FRONT /END SYSTEM IS USED THE CODE BETWEEN 'CCMFA' AND 'CCMFE'
HAS TO BE COMMENTED OUT.

THE PROGRAM CLOSES AND DELETES ALL WORK FILES.

ALL PARAMETERS HAVE TO BE THE VALUES GIVEN AT THE END OF THE PRE-
PROC OUTPUT IN COLUMN 'REQUIRED'.

METHOD.

THIS ROUTINE INITIALIZES THE WAVEMODEL:
-        DEFINES THE UNITS FOR INPUT/OUTPUT,
-        READS THE USER INPUT FILE,
-        INITIALIZES SOME MODEL CONSTANTS,
-        RETRIEVES THE RECOVERY FILES FROM DISK
-        READS THE COMMON BLOCKS PRECOMPUTED BY PREPROC,
-        DOES SOME GENERAL BOOKKEEPING REGARDING DATES,
         INTEGRATION TIME STEPS AND OUTPUT TIME STEPS,
-        READS COMMON UBUF AND SPECTRA FOR A ONE BLOCK VERSION,
-        PRECOMPUTES AND WRITES TO IU16 REFRACTION TERMS,
-        OPENS THE FIRST OUTPUT FILES.

EXTERNALS.

ABORT-   TERMINATES PROCESSING.

GETREST-   GETS RESTART FILES.

GRADI-   COMPUTES DEPTH AND CURRENT GRADIENTS.

GSFILE- ROUTINE TO DYNAMICALLY FETCH OR DISPOSE FILES.

HEADBC- WRITE BOUNDARY OUTPUT FILE HEADER.

IECF_LEN- LENGTH OF A CHARACTER VARIABLE.

INCDATE- UPDATE DATE TIME GROUP.

OPENFIL- OPENS A FILE.

PROPDOT- PRECOMPUTES REFRACTION TERMS.

READBOU- READS PREPROC BOUNDARY FILES.

READPRE- READS PREPROC OUTPUT.

USERIN- READS USER INPUT.

COMMON BLOCKS.

CBOUND- COURSE GRID BOUNDARY OUTPUT.

COUPL- PARAMETERS FOR COUPLING.

COUT- OUTPUT POINTS, INDICES AND FLAGS.

CURRENT- CURRENT FIELD.

FBOUND- FINE GRID BOUNDARY INPUT ORGANISATION.

FREDIR- FREQUENCY AND DIRECTION GRID.

GRIDPAR- GENERAL GRID INFORMATION.

INDNL- INDICES AND WEIGHTS USED IN THE COMPUTATION
OF THE NONLINEAR TRANSFER RATE.

MAP- LON/LAT INDEX OF EACH SEA POINT.

OVER- INTERMEDIATE STORAGE OF LATITUDES.

REFDOT DEPTH AND CURRENT PART OF THETA DOT.

SHALLOW- SHALLOW WATER TABLES.

SPE1- ONE BLOCK OF SPECTRA.

SPE2- ONE BLOCK OF SPECTRA.

SPE3- ONE BLOCK OF SPECTRA.

STATUS- TIME STATUS OF INTEGRATION, WIND INPUT,
OUTPUT OF RESULTS, AND MODEL OPTIONS.

TABLE- TABLE FOR TOTAL STRESS AND HIGH FREQ STRESS.

TESTO- PRINTER OUTPUT UNIT AND TEST FLAGS.

TEXT- FILE NAME INFORMATION.

UNITS- INPUT / OUTPUT UNITS.

UBUF- GRID POINT DEPENDENT CONSTANTS

WIND- VARIABLES USED FOR WIND COMPUTATIONS.

PARAMETER.

PARAMETER - FOR ARRAY DIMENSIONS.

3.3.4 Subroutine PREWIND

<u>PURPOSE.</u>

EVALUATE WIND SPEED AND DIRECTION AT WAVE MODEL GRID POINTS.

<u>INTERFACE.</u>

CALL *PREWIND (NC, NR)*
  NC   FIRST DIMENSION OF INPUT WIND FIELD.
  NR   SECOND DIMENSION OF INPUT WIND FIELD.
UNIT *DESCRIPTION*
  IU01   INPUT WIND DATA (SUB READWND).
  IU06   PRINTER OUTPUT (SUB INITMDL).
  IUVELO   OUTPUT OF BLOCKED WIND FIELDS. (SUB CREWFN).
  IUSCR   SCRATCH UNITS FOR ALL BLOCKS
                   (INTERMEDIATE STORAGE,INPUT/OUTPUT) (SUB INITMDL).

<u>METHOD.</u>

INPUT WIND FIELDS WHICH CAN BE COMPONENTS OF
          USTAR, U10, USTRESS
ARE TRANSFORMED TO FRICTION VELOCITIES. THE INPUT FIELDS HAVE TO BE
ON A LAT /LONG GRID. SEE SUB READWND FOR FORMATS AND HEADER
INFORMATION, WHICH HAVE TO BE GIVEN TO THE PROGRAM.

A DOUBLE LINEAR INTERPOLATION IN SPACE IS PERFORMED ONTO THE MODEL
BLOCKED GRID POINTS.

IF THE WIND OUTPUT TIMESTEP IS LESS THAN THE INPUT TIMESTEP A LINEAR
INTERPOLATION IN TIME IS PERFORMED.

THERE ARE TWO POSSIBILITIES WITH RESPECT TO THE WIND OUTPUT FILES:

1. PROPAGATION TIMESTEP >= WIND INPUT STEP
   ONE OUTPUT FILE CONTAINS IDELPRO/IDELWO WINDFIELDS, I.E.
   INFORMATION FOR ONE PROPAGATION TIMESTEP.
   TIME FILE(I+1)= TIME FILE(I)+ IDELPRO

2. PROPAGATION TIMESTEP < INPUT WIND TIMESTEP
   ONE OUTPUT FILE CONTAINS IDELWI/IDELWO WINDFIELDS, I.E.
   INFORMATION FOR ONE WIND INPUT TIMESTEP.
   TIME FILE(I+1)= TIME FILE(I) + IDELWI

NOTE: THE SUBROUTINE READWND HAS TO BE ADJUSTED TO THE AVAILABLE
WINDFIELD FORMAT. AN EXAMPLE IS GIVEN ON FLOPPY 3 FOR AN UNFORMAT-
TED WINDFILE .

EXTERNALS.

ABORT-   TERMINATES PROCESSING.

AIRSEA-   SURFACE LAYER STRESS.

CREWFN-   CREATES A WIND FILE NAME.

GETWND-   PROCESSES ONE WIND FIELD.

INCDATE-   INCREMENTS DATE TIME GROUP.

LOCINT-   INTERPOLATES IN SPACE.

*NOTIM-   STEERING SUB FOR INTERPOLATION IN SPACE ONLY.

READWND- READS AN INPUT WIND FIELD.

TIMIN-   STEERING SUB FOR INTERPOLATION IN SPACE AND TIME.

WAMWND- BLOCKS A WIND FIELD AND CONVERTS TO USTAR.

COMMON BLOCKS.

GRIDPAR-   GENERAL GRID INFORMATION.

STATUS-   TIME STATUS OF INTEGRATION, WIND INPUT, OUTPUT OF
               RESULTS, AND MODEL OPTIONS.

TESTO-   PRINTER OUTPUT UNIT AND TEST FLAGS.

UNITS-   INPUT / OUTPUT UNITS.

WIND-   VARIABLES USED FOR WIND COMPUTATIONS.

WNDGRD-   INPUT WIND GRID SPECIFICATIONS.

PARAMETERS.

PARAMETER-FOR ARRAY DIMENSIONS.

3.3.5 Subroutine WAMODEL

<u>PURPOSE.</u>

COMPUTATION OF THE 2-D FREQUENCY-DIRECTION WAVE SPECTRUM AT ALL GRID POINTS FOR A GIVEN INITIAL SPECTRAL AND FORCING SURFACE STRESS FIELD.

<u>INTERFACE.</u>

CALL *WAMODEL (NADV)*

       NADV   NUMBER OF CURRENT ADVECTION ITERATION.

<u>METHOD.</u>

GRID POINTS ARE LAT - LONG,VECTORIZATION IS ACHIEVED BY RUNNING THROUGH THE GRID POINTS IN AN INNER LOOP ORGANIZED AS 1-D ARRAY IN BLOCKS,-ALL COMPUTATIONS ARE CARRIED OUT FOR ONE BLOCK AT A TIME (SEE "BLOCK STRUCTURE" BELOW)

ALL COMPONENTS OF THE SPECTRUM ARE COMPUTED PROGNOSTICALLY FROM THE SPECTRAL TRANSPORT EQUATION UP TO A VARIABLE CUT-OFF FREQUENCY = MAX(4*FPM,2.5*FMEAN),WHERE FPM IS THE PIERSON MOSKOVITZ FREQUENCY AND FMEAN IS THE MEAN FREQUENCY, BEYOND THE PROGNOSTIC CUTOFF A DIAGNOSTIC F**-5 TAIL IS ATTACHED CONTINUOUSLY FOR EACH DIRECTION,

SOURCE FUNCTIONS ARE TAKEN FROM KOMEN ET AL(1984), JANSSEN (1991)

THE NONLINEAR TRANSFER IS PARAMETERIZED BY THE DISCRETE INTERACTION APPROXIMATION OF HASSELMANN ET AL (1985B)

THE SOURCE FUNCTION AND THE ADVECTION TERM ARE INTEGRATED ON TWO DIFFERENT TIME STEP LEVELS AND WITH DIFFERENT METHODS, THE ADVECTION TIME STEP IS A MULTIPLE OF THE SOURCE FUNCTION TIME STEP. THE SOURCE FUNCTIONS ARE INTEGRATED IMPLICITLY ACCORDING TO HASSELMANN AND HASSELMANN (1985A).THE RELEVANT FUNCTIONAL DERIVATIVES OF THE INDIVIDUAL SOURCE FUNCTIONS REQUIRED FOR THE SOLUTION OF THE IMPLICIT EQUATION ARE COMPUTED WITHIN THE SOURCE FUNCTION SUBS. THE TIME STEP IS TYPICALLY 20 MIN,THE ADVECTION IS INTEGRATED BY A FIRST ORDER UPWIND SCHEME,ALSO ACCORDING TO HASSELMANN AND HASSELMANN (1985A),

THE ADVECTIVE TIMESTEP IS DEPENDENT ON THE FREQUENCY AND SPATIAL GRID IN ACCORDANCE WITH CFL.WINDS ARE READ IN EVERY WIND TIME STEP. IF THE WIND TIME STEP IS GREATER THAN THE SOURCE TERM TIME STEP DELTWIND/DELTSOURCE STEPS ARE INTEGRATED WITH CONSTANT WINDS. WIND TIME STEP,PROPAGATION TIME STEP AND SOURCE TERM TIME STEP SHOULD HAVE INTEGER RATIOS. THEY ARE GIVEN IN SECONDS AT FULL

MINUTES.

ZERO ENERGY INFLUX IS ASSUMED AT COAST LINES. OPEN BOUNDARIES ARE INCORPORATED IN THE MODEL, IF IT RUNS FOR A NESTED GRID.

BLOCK STRUCTURE (SEE PREPROC FOR DETAILS):

SEA POINTS ARE COLLECTED INTO 1-DIMENSIONAL ARRAY BLOCKS OF MAXIMALLY NIBLO ELEMENTS.

SEA POINTS ARE COUNTED ALONG LINES OF LATITUDES FROM LEFT COAST TO RIGHT COAST WORKING FROM SOUTH TO NORTH. BLOCKS OVERLAP BY TWO LATITUDE LINES,TO COMPUTE NORTH -SOUTH ADVECTION TERMS, SEE ALSO COMMON GRIDPAR AND UBUF.

THE WIND FILES FOR THE BLOCKED WINDS CREATED BY PREWIND ARE READ AND DELETED IN SUB IMPLSCH (IU17 AND IU18). THE FILE NAMES ARE CREATED IN SUB CREWFN AND AN IMPLICIT OPEN IS USED.

THE FILE HANDLING SUBS OPENFIL, GSFILE AND CREWFN ARE COMPUTER DEPENDENT AND MAY BE ADOPTED BY THE USER.

THE PROGRAM CLOSES AND DELETES ALL WORK FILES.

ALL PARAMETERS HAVE TO BE THE VALUES GIVEN AT THE END OF THE PREPROC OUTPUT IN COLUMN 'REQUIRED'.

EXTERNALS.

ABORT-	TERMINATES PROCESSING.
AIRSEA-	SURFACE LAYER STRESS.
BOUINPT-	BOUNDARY VALUE INPUT.
CREWFN-	CREATES A WIND FILE NAME.
DOTDC-	READ COMMON REFDOT.
FEMEAN-	COMPUTATION OF MEAN FREQUENCY AT EACH GRID POINT.
FILLBL-	ADD LATITUDES TO A BLOCK.
GSFILE-	ROUTINE TO DYNAMICALLY FETCH OR DISPOSE FILES.
HEADBC-	WRITE BOUNDARY OUTPUT FILE HEADER.
IECF_LEN-	LENGTH OF A CHARACTER VARIABLE.
IMPLSCH-	IMPLICIT SCHEME FOR INTEGRATION OF SOURCE FUNCTIONS IN TIME AND INPUT OF WINDS.
INCDATE-	UPDATE DATE TIME GROUP.
INTPOL-	MAP SPECTRUM FROM SIGMA TO OMEGA SPACE.
INTSPEC-	SPACE INTERPOLATION OF BOUNDARY SPECTRA.
MAKEGRID-	MAKES GRIDDED FIELDS.
OPENFIL-	OPENS A FILE.
OUTBS-	CONTROLS OUTPUT FROM BLOCKS.

OUTBC- OUTPUT OF BOUNDARY VALUES.

OUTGRID- SAVE BLOCKED PARAMETERS INTO GRID ARRAYS.

OUTINT- OUTPUT OF INTEGRATED PARAMETERS.

OUTPP- WRITES GRIDDED FIELDS TO PRINTER.

OUTSPP- OUTPUT OF SPECTRA AT SELECTED POINTS.

PEAKFR- COMPUTES PEAK FREQUENCY.

PROPAG- PROPAGATION SCHEME.

PRSPP- PRINT A SPECTRUM.

PRSPPS- PRINT A SWELL SPECTRUM.

ROTSPEC ROTATE A SPECTRUM.

SAVREST- DISPOSE RESTART FILES.

SBOTTOM- COMPUTES BOTTOM DISSIPATION SOURCE TERM AND LINEAR CONTRIBUTION TO FUNCTIONAL MATRIX.

SDISSIP- COMPUTATION OF DISSIPATION SOURCE FUNCTION AND LINEAR CONTRIBUTION OF DISSIPATION TO FUNCTIONAL MATRIX IN IMPLICIT SCHEME.

SEMEAN- COMPUTATION OF TOTAL ENERGY AT EACH GRID POINT.

SEPWISW- COMPUTATION OF 2-DIMENSIONAL SWELL DISTRIBUTION,TOTAL SWELL ENERGY, MEAN SWELL DIRECTION, AND MEAN SWELL FREQUENCY AT EACH GRID POINT.

SINPUT- COMPUTATION OF INPUT SOURCE FUNCTION, AND LINEAR CONTRIBUTION OF INPUT SOURCE FUNCTION TO FUNCTIONAL MATRIX IN IMPLICIT SCHEME.

SNONLIN- COMPUTATION OF NONLINEAR TRANSFER RATE AND DIAGONAL LINEAR CONTRIBUTION OF NONLINEAR SOURCE FUNCTION TO FUNCTIONAL MATRIX.

SPLITBL- STORING OVERLAPPING LATITUDES OF BLOCKS.

STHQ- COMPUTATION OF MEAN WAVE DIRECTION AT EACH GRID POINT.

STRESSO- COMPUTATION OF WAVE STRESS.

STRSPEC- STRETCH A SPECTRUM.

COMMON BLOCKS.

CBOUND- COURSE GRID BOUNDARY OUTPUT.

COUPL- PARAMETERS FOR COUPLING.

COUT- OUTPUT POINTS INDICES AND FLAGS.

CURRENT- CURRENT FIELD.

FBOUND- FINE GRID BOUNDARY INPUT ORGANISATION.

FREDIR-   FREQUENCY AND DIRECTION GRID.

GRIDPAR-   GENERAL GRID INFORMATION.

INDNL-   INDICES AND WEIGHTS USED IN THE COMPUTATION

                OF THE NONLINEAR TRANSFER RATE.

INTPAR-   GRIDDED INTEGRATED PARAMETER TOTAL SPECTRUM.

INTSPAR-   GRIDDED INTEGRATED SWELL PARAMETERS.

MAP-   LON/LAT INDEX OF EACH SEA POINT.

MEANPA-   INTEGRATED PARAMETERS OF A BLOCK.

OVER-   INTERMEDIATE STORAGE OF LATITUDES.

REFDOT-   DEPTH AND CURRENT PART OF THETA DOT.

SHALLOW-   SHALLOW WATER TABLES.

SOURCE-   SOURCE FUNCTION AND TAIL FLAG.

SPE1-   ONE BLOCK OF SPECTRA.

SPE2-   ONE BLOCK OF SPECTRA.

SPE3-   ONE BLOCK OF SPECTRA.

STATUS-   TIME STATUS OF INTEGRATION, WIND INPUT,

                OUTPUT OF RESULTS, AND MODEL OPTIONS.

SWELL-   SEA AND SWELL PARAMETERS.

TABLE-   TABLE FOR TOTAL STRESS AND HIGH FREQ STRESS.

TESTO-   PRINTER OUTPUT UNIT AND TEST FLAGS.

TEXT-   FILE NAME INFORMATION.

UBUF-   GRID POINT DEPENDENT CONSTANTS

UNITS-   INPUT / OUTPUT UNITS.

WIND-   VARIABLES USED FOR WIND COMPUTATIONS.

PARAMETER.

PARAMETER-FOR ARRAY DIMENSIONS.

3.4 PROGRAM BOUINT

PURPOSE.

INTERPOLATION OF BOUNDARY SPECTRA OF THE COARSE GRID
WAVE MODEL OUTPUT IN TIME.

INTERFACE.

PROGRAM *BOUINT*

IU01	INTEGER	INPUT UNIT OF SPECTRA.
IU02	INTEGER	OUTPUT UNIT OF INTERPOLATED SPECTRA.
IU05	INTEGER	INPUT UNIT FOR USER INPUT.
IU06	INTEGER	PRINTER OUTPUT UNIT.

METHOD.

THE SPECTRA ARE READ FROM THE INPUT UNIT AND INTERPOLATED TO THE
OUTPUT TIMES SPECIFIED IN THE USER INPUT. IF THE FIRST DATE OF THE INPUT
SPECTRA IS LATER THAN THE FIRST OUTPUT DATE,THE FIRST INPUT SPECTRUM
IS KEPT FOR ALL DATES BEFORE THE FIRST INPUT DATE.
THE INTERPOLATION IS DONE IN FOUR STEPS..
- ROTATE SPECTRA ACCORDING TO MEAN OF MEAN ANGLES,
- TRANSFORM FREQUENCIES ACCORDING TO MEAN OF MEAN
    FREQUENCIES,
- ADJUST ENERGY ACCORDCING TO MEAN OF TOTAL ENERGY
- INTERPOLATE RESULTING SPECTRA.

INPUT AND OUTPUT DATA FILES ARE AUTOMATICALLY ASSIGNED. FILE NAMES
AND PATHS ARE DEFINED BY USER INPUT. SUB OPENFIL AND SFILE ARE USED.
THE USER MAY HAVE TO ADOPT THESE SUBS FOR HIS COMPUTER ENVIROMENT.
IF A FRONT/END SYSTEM IS USED CODE LINES COMMENTED BY 'CCEF' MUST
BE ACTIVATED AND CODE BETWEEN 'CCMFA' AND 'CCMFE' HAVE TO BE
COMMENTED OUT.

EXTERNALS.

ABORT-	TERMINATES PROCESSING.
DIFDATE-	COMPUTE TIME DIFFERENCE.
OPENFIL-	OPENS A FILE.
iecf_len-	LENGTH OF A CHARACTER VARIABLE.
INCDATE-	INCREMENTS A DATE.
INTSPEC-	INTERPOLATE A SPECTRUM.
ROTSPEC-	ROTATES SPECTRUM.
SFILE-	SAVES A FILE (FRONT/END COMPUTER ONLY).

STRSPEC-   TRANSFORM FREQUENCIES.

UIBOU-   READ USER INPUT.

PARAMETER.

PARAMETER-   FOR ARRAY DIMENSIONS OF BOUINT.

3.5 PROGRAM PGRID

PURPOSE.

POSTPROCESSING OF WAM MODEL INTEGRATED DATA.

INTERFACE.

PROGRAM *PGRID*

IU01　　　INPUT UNIT WAVE AND WIND FIELDS (WAMODEL IU20).

IU05　　　USER INPUT.

IU06　　　PRINTER OUTPUT.

EXTERNALS

ABORT-　　TERMINATES PROCESSING.

IECF_LEN-　LENGTH OF A CHARATER VARIABLE.

INCDATE-　INCREMENTS DATE-TIME-GROUP

*INGRID-　　READS WAVEMODEL OUTPUT FILE (MAP) (GRIDDED)

OPENFIL-　OPENS A FILE.

OUTPP-　　PRINTS A FIELD.

UIPGRID-　READS IN USER INPUT.

METHOD.

THIS PROGRAM TAKES THE WAM MODEL OUTPUTS AS INPUT AND PRINTS
FIELDS OF WAVE HEIGHTS, WAVE DIRECTION, FRICTION VELOCITY,
WINDSPEED U10, WIND DIRECTION, WAVE PEAK PERIOD, WAVE MEAN PERIOD,
NORMALIZED WAVE STRESS, AND/OR DRAG COEFFICIENT.
THE FILES ARE DYNAMICALLY ASSIGNED BY OPENFIL.

3.6 PROGRAM PSWGRID

PURPOSE.

POSTPROCESSING OF WAM MODEL INTEGRATED SWELL DATA.

INTERFACE.

PROGRAM *PSWGRID*

IU01	INPUT UNIT FOR INTEGRATED SWELL DATA.
IU05	USER INPUT.
IU06	PRINTER OUTPUT.

EXTERNALS.

ABORT-	TERMINATES PROCESSING.
iecf_len-	LENGTH OF A CHARACTER VARIABLE.
INCDATE-	INCREMENTS DATE-TIME-GROUP
INGRIDS-	READS WAVE MODEL SWELL OUTPUT FILE (GRIDDED).
OPENFIL-	OPENS A FILE.
OUTPP-	PRINTS A FIELD.
UIPGRID-	READS IN USER INPUT.

METHOD.

THIS PROGRAM TAKES THE WAM MODEL OUTPUTS AS INPUT.
IT PRINTS SWELL HEIGHTS,SWELL MEAN PERIODS AND/OR DIRECTIONS.
THE FILES ARE DYNAMICALLY ASSIGNED BY OPENFIL.

3.7 PROGRAM PSPEC

PURPOSE.

POSTPROCESSING OF WAM MODEL SPECTRA OUTPUT.

INTERFACE.

PROGRAM	GRID*
IU01	INPUT UNIT OF SPECTRA.
IU05	USER INPUT.
IU06	PRINTER OUTPUT.

EXTERNALS.

ABORT-	TERMINATES PROCESSING.
iecf_len-	LENGTH OF A CHARACTER VARIABLE.
INCDATE-	INCREMENTS DATE-TIME-GROUP
INSPP-	LEADS WAVE MODEL SPECTRA OUTPUT FILE.
OPENFIL-	OPENS A FILE.
PRSPP-	PRINTS A SPECTRUM.
UIPSPEC-	READS IN USER INPUT.

METHOD.

THIS PROGRAM TAKES THE WAM MODEL OUTPUTS AS INPUT AND
EXTRACTS SPECTRA AT SPECIFIED LOCATIONS AND TIMES.
THE FILES ARE DYNAMICALLY ASSIGNED BY OPENFIL.

3.8 PROGRAM PSWSPEC

PURPOSE.

POSTPROCESSING OF WAM MODEL SWELL SPECTRA OUTPUT.

INTERFACE.

PROGRAM *PSWGRID*

IU01   INPUT UNIT OF SWELL SPECTRA.

IU05   USER INPUT.

IU06   PRINTER OUTPUT.

EXTERNALS.

ABORT-   TERMINATES PROCESSING.

iecf_len-   LENGTH OF A CHARACTER VARIABLE.

INCDATE-   INCREMENTS DATE-TIME-GROUP

INSPPS-   READS WAVE MODEL SWELL SPECTRA OUTPUT FILE.

OPENFIL-   OPENS A FILE.

PRSPPS-   PRINTS A SWELL SPECTRUM.

UIPSPEC-   READS IN USER INPUT.

METHOD.

THIS PROGRAM TAKES THE WAM MODEL OUTPUT AS INPUT AND EXTRACTS SWELL SPECTRA AT SPECIFIED LOCATIONS AND TIMES. THE FILES ARE DYNAMICALLY ASSIGNED BY OPENFIL.

4. COMMUNICATION BETWEEN THE SUB SYSTEMS AND FILES

The program system uses 6 different types of files:

- input data which have to be provided by the user and to be assigned to fortran units in the jcl.

- set-up files which are generated by PREPROC and have to be assigned in the jcl to the programs.

- result files which are generated by CHIEF and used or generated by the postprocessing or by BOUINT. These files are dynamically assigned by the programs. The file name includes an identifier, date and time. Sub OPENFIL is used to form file names. The directory paths have to be given in the user input.

- restart files which are generated by PRESET and updated by CHIEF.These files are dynamically assigned by the programs. The file names are fixed in sub GSFILE, but directory paths have to be given in the user input.

- work files which are used by PRESET and CHIEF to store intermediate information. These files are dynamically assigned and deleted.

- printer output which is generated by each program.

Fortran read and write units inside the programs are integer variables following the convention IUxx, where xx is theunit number, e.g. xx = 01, xx = 11. The scratch units for the wind field processing (one unit for each model block) are stored in array IUSCR and the numbers are 39+IG, where IG is the block number. A further exception are the transfer units for the blocked wind fields IUVELO, IU17 and IU18 in main CHIEF. For details see below. All units are defined in the main programs and in sub INITMDL of main CHIEF.

4.1 PROGRAM PREPROC

4.1.1 Input data

a) User input (IU05, FORMATTED, sub UIPREP)

A user input defining options, grid, time steps, periods, etc. to control the program.

(see Section 5. for formats)

b)Topography file (IU01, FORMATTED, sub TOPOAR)

1. record: input grid description.

READ (IU01,'(8F10.5)') XDELA, XDELO, XLAS, XLAN, XLOW,XLOE

XDELA	-	latitude increment (deg),
XDELO	-	longitude increment (deg),
XLAS	-	most southern latitude (deg),
XLAN	-	most northern latitude (deg),
XLOW	-	most western (left) longitude (deg),
XLOE	-	most eastern (right) longitude (deg)

2. and following records: input topography data.

latend = NINT((XLAN-XLAS)/XDELA)

lonend = NINT((XLOE-XLOW)/XDELO)

DO 100 lat = 1, latend

READ (IU01,'((12(I5,A1)))')(IA1(lon,lat),AX(lon,lat),lon=1,lonend)

100 CONTINUE

IA1	-	depression or elevation in metres.
AX	-	D for depression , E for elevation.

The grid is scanned from south to north and from west to east.

c) Current data file (IU02, FORMATTED, sub READCUR)

This file must be assigned if current refraction is requested.

1. record: input grid description.

READ (IU02, '(6F10.5,2I3)') UCLO, UCLH, UCLW, UCLE, DUCLO, DUCLA, KRCI, KCCI

UCLO	-	most southern latitude (deg),
UCLH	-	most northern latitude (deg),
UCLW	-	most western (left) longitude (deg),
UCLE	-	most eastern (right) longitude (deg)
DUCLA	-	latitude increment (deg),
DUCLO	-	longitude increment (deg),
KCCI	-	number of columns

KRCI   -   number of rows

2.and following records: eastern current component in m/s.

    DO 100 J=1,KRCI

           READ (IU02,'(8E9.3)') (UCUR(I,J),I=1,KCCI)

100 CONTINUE

following records: northern current component in m/s.

    DO 200 J=1,KRCI

           READ (IU02,'(8E9.3)') (VCUR(I,J),I=1,KCCI)

200 CONTINUE

    The grid is scanned from south to north and from west to east.

d) Coarse grid boundary file (IU03, UNFORMATTED or FORMATTED sub MBOUNF)

  This file must be assigned if the run generates a fine grid. The file was generated by the corresponding coarsegrid PREPROC.

  PREPROC set-up files for record structure.

  The FORMATTED read is used only if it is requested.

4.1.2   PREPROC set-up files

Controlled by the option IFORM PREPROC writes FORMATTED or UNFORMATTED or FORMAT-TED and UNFORMATTED files. The UNFORMATTED files are the files which will be used by the other programs. The FORMATTED files are not used in the model modules.

a) Grid and model constants

    (IU07, UNFORMATTED, sub OUTCOM)

    (IU17, FORMATTED, sub OUTCOM)

This file contains the grid (block) organisation, the frequency- angular grid, the depth array,
the current field and a number of precomputed model constants. Basically this is the information
stored in the common blocks, which are listed in the order in which they are written:

FREDIR   -   FREQUENCY AND DIRECTION GRID.

GRIDPAR   -   GENERAL GRID INFORMATION.

MAP   -   LON/LAT INDEX OF EACH SEA POINT.

INDNL   -   INDICES AND WEIGHTS USED IN THE

                         COMPUTATION OF THE NONLINEAR TRANSFER RATE.

COUPL   -   PARAMETERS FOR COUPLING.

TABLE   -   TABLE FOR TOTAL AND HIGH FREQUENCY STRESS.

COUT	-	OUTPUT POINTS INDICES AND FLAGS.
SHALLOW	-	SHALLOW WATER TABLES.
CURRENT	-	CURRENT FIELD.

Details may be found in the sub OUTCOM. Sub READPRE of mains CHIEF and PRESET is applied to read the UNFORMATTED file.

b)   Common UBUF

(IU08, UNFORMATTED, sub OUTUBUF)

(IU18, FORMATTED, sub OUTUBUF)

This file contains for each sea point the block number and grid point index of the four neighbouring points, which are stored in common UBUF. One record is written for each model block. Details may be found in the sub OUTUBUF. Sub INITMDL and WAMODEL of main CHIEF are applied to read the UNFORMATTED file.

c) Coarse boundary file

(IU09, UNFORMATTED, sub MBOUNC)

(IU19, FORMATTED, sub MBOUNC)

This file contains the block number, grid point index, latitude and longitude of all grid points of a nestboundary inside the grid. It is only generated if this is a coarsegrid PREPROC.Details may be found in the sub MBOUNC. Sub MBOUNF of PREPROC (see Section 4.1.1 d)) and sub READBOU of main CHIEF are applied to read the UNFORMATTED file.

d) Fine boundary file

(IU10, UNFORMATTED, sub MBOUNF)

(IU20, FORMATTED, sub MBOUNF)

This file contains the block number, grid point index, and interpolation tables for all grid points of the grid boundary, where spectra from a coarse grid run are used as boundary input. It is only generated if this is a fine grid PREPROC. Details may be found in the sub MBOUNF. Sub READBOU of main CHIEF is applied to read the UNFORMATTED file.

4.2 PROGRAM PRESET

4.2.1   Input data

a)User input (IU05, FORMATTED, main PRESET)

A user input defining options, time steps, periods, etc. to control the program. (see Section 5. for formats)

b)Wind input file (IU01, UNFORMATTED, sub READWND)

This file does not have to be assigned if a wind independent initialisation of the model is chosen. The user should look into sub READWND and change it to his formats. The included one may be used as a guid line to pass the correct information into the model.

1. record: input grid description.

READ (IU01) KCOL, KROW, RLATS, RLATN, RLONL, RLONR,ICOORD, IWPER

KCOL-	number of columns
KROW-	number of rows
RLATS-	most southern latitude (deg),
RLATN-	most northern latitude (deg),
RLONL-	most western (left) longitude (deg),
RLONR-	most eastern (right) longitude (deg)
ICOORD-	coordinate system code
IWPER-	periodic grid indicator

2. records: time of wind field

READ (IU01) IDTWIR IDTWIR - date and time of wind field

3. records: wind flag and u components

READ (IU01) ICODE, ((UWND(I,J),I=1,KCOL),J=1,KROW)

ICODE-	WIND FLAG (U∗ OR STRESS, OR U10)
UWND-	ARRAY OF U COMPONENTS.

4. records: wind flag and v components

READ (IU01) ICODE, ((VWND(I,J),I=1,KCOL),J=1,KROW)

ICODE-	WIND FLAG (U∗ OR STRESS, OR U10)
VWND-	ARRAY OF V COMPONENTS.

record 3 and 4 are repeated

The grid is scanned from south to north and from west to east.

4.2.2 PREPROC set-up files

a) Grid and model constants (IU07, UNFORMATTED, sub READPRE)

  Details may be found in the sub READPRE which is applied to read the unFORMATTED files.

  This file has been generated by PREPROC (see Section 4.1.2 a)

  Result files are not produced by this program.

4.2.3 Restart files

These files are generated by PRESET. The files are written to work files and sub GSFILE is used to copy the fortran unit alias files onto the permanent files. GSFILE is set-up for a CRAY UNICOS system, and the user may have to change it.

The user has control over the file directory in the user input file. The file name is fixed in sub GSFILE.

a)Blocks of spectra. (IU12, UNFORMATTED, sub MSTART)

  The permanent file name is BLSPANAL. This file contains the blocks of model spectra. BUFFEROUT
   is used to write the file. Details may be found in the sub MSTART where the file is written.

b)Second latitude of blocks. (IU14 UNFORMATTED, sub SPLITBL)

  The permanent file name is SLATANAL. This file is generated only in case of a multi block set-up.
   It contains the second latitude of all blocks but the first one. Details may be found in the sub SPLITBL
  where the file is written.

c)last blocked wind field. (IU15, UNFORMATTED, sub MSTART)

  The permanent file name is LAWIANAL. This file is initialized with zero by PRESET. Details may be
  found in the sub MSTART where the file is written.

4.2.4 Work files

Work files are used to generate the restart files. See Section 4.2.3 a), b) and c) for purpose and formats.

4.3 PROGRAM CHIEF

4.3.1   Input data

a) User input (IU05, FORMATTED, sub USERIN)
  A user input defining options, time steps, periods, etc.to control the program. (see Section 5. for
  formats)

b) Wind input file (IU01, UNFORMATTED, sub READWND)
  See Section 4.2.1 b)

c) Fine Boundary Input spectra (IU02 , UNFORMATTED, sub BOUINPT)
  Permanent file name is FBIyymmddhh000. This file is read by sub BOUINT, for a fine grid run. It has
  to be generated from the coarse grid data by mainBOUINT. The file contains the model spectra at each
  coarse grid boundary output point interpolated in time. This file has the same format as all spectral
  output files and can be printed by main PSPEC.

4.3.2   PREPROC set-up files

a) Grid and model constants (IU07, UNFORMATTED, sub READPRE)
  Details may be found in the sub READPRE which is applied to read the UNFORMATTED file.
  This file has been generated by PREPROC (see Section 4.2.1 a)

b) Common UBUF (IU08, UNFORMATTED, sub INITMDL, WAMODEL, PROPDOT)
  This file has been generated by PREPROC (see Section 4.2.1 b)

c) Coarse boundary file (IU09, UNFORMATTED, sub READBOU)
  This file has been generated by PREPROC (see Section 4.2.1 c). It is only used if this is a
  coarse grid run.

d) Fine boundary file (IU10, UNFORMATTED, sub READBOU)
  This file has been generated by PREPROC (see Section 4.2.1 d). It is only used if this is a fine grid run.

4.3.3   Result files

a) Coarse Boundary Output spectra (IU19 , UNFORMATTED, sub OUTBC)
  Permanent file name is CBOyymmddhh000. This file is written by sub OUTBC, in a coarse grid run.
  The file contains the model spectra at each coarse grid boundary output point. This file has the same
   format as all spectral output files and can be printed by main PSPEC.

b) Gridded output fields (IU20 , UNFORMATTED, sub OUTINT)
  Permanent file name is MAPyymmddhh000.This file is written by sub OUTINT. The file contains
   the gridded fields of sig. wave height, mean wave direction,mean frequency,friction velocity, wind

direction, peak frequency, drag coefficient, and normalized stress, if the parameter output is requested in the model user input file. This file can be printed by main PGRID.

c) Gridded swell output fields (IU21 , UNFORMATTED, sub OUTINT)
Permanent file name is SWEyymmddhh000. This file is written by sub OUTINT. The file contains the gridded fields of swell sig. wave heights, mean swell direction, mean sea direction and mean swell frequency, if the parameter output is requested in the model user input file. This file can be printed by main PSWGRID.

d) Spectral Output (IU25 , UNFORMATTED, sub OUTSPP)
Permanent file name is SPEyymmddhh000. This file is written by sub OUTSPP. The file contains the model spectra at output points selected in the user input of PREPROC,if the output is requested in the user input of main CHIEF. The spectral output file can be printed by main SPEC.

e) Swell Spectra Output (IU26 , UNFORMATTED, sub OUTSPP)
Permanent file name is SWSyymmddhh000. This file is written by sub OUTSPP. The file contains the model swell spectra at output points selected in the user input of PREPROC, if the output is requested in the user input of main CHIEF. The spectra output file can be printed by main PSWSPEC.

4.3.4   Restart files

These permanent files are generated by PRESET or up-dated by a model run. The files are copied by sub GSFILE to work files at the start of CHIEF. If requested in the user input the work files are copied back to the permanent files in regular time intervals. GSFILE is set-up for a CRAY UNICOS system, and the user may have to change it.The user has control of the file director in the user input file.The file name is fixed in sub GSFILE.

a) Blocks of spectra. (IU11, IU12, UNFORMATTED, sub INITMDL or WAMODEL).
The permanent file name is BLSPANAL.This file contains the blocks of model spectra. BUFFER is used to read or write the file.

b) Second latitude of blocks. (IU13, IU14 UNFORMATTED, sub SPLITBL)
The permanent file name is SLATANAL.This file is generated only in case of a multi block set-up. It contains the second latitude of all blocks except the first one.Details may be found in the sub SPLITBL where the file is written.

c) last blocked wind information. (IU15, UNFORMATTED, sub WAMODEL)
The permanent file name is LAWIANAL.

4.3.5   Work files

a) work files for restart files (IU11, IU12, IU13, IU14,IU15)
   Scratch file names are the fortran unit alias files.See 4.3.4 a), b) and c) for purpose and formats.
   Before each model propagation time step the units IU11 and IU13 are interchanged with IU12
   and IU14, respectively.

b) Scratch unit for wind processing (IU40, IU41,......)
   Scratch file names are the fortran unit alias files. These units are used to sort the blocked windfields,
   if the wind output timestep is less than the propagation timestep or if the winds are interpolated in time.
   The model needs one unit for each block. The units are defined in sub INITMDL. An implicit open is
   done in subs NOTIM or TIMIN and the alias files are deleted.

c) Blocked wind fields. (IUVELO, IU17, IU18 UNFORMATTED)
   Scratch files names are Wddhhmm To pass the blocked windfields from PREWIND to IMPLSCH files
   are opened. The file names are created by sub CREWFN and include the date. The files are deleted in
    SUB IMPLSCH to avoid accumulation.The units connected to these files are IUVELO in SUB
   NOTIM or TIMIN, where these files are written, and IU17 and IU18 in sub IMPLSCH, which
   reads the files.

4.4 PROGRAM BOUINT

4.4.1   Input data

a) User input (IU05, FORMATTED, sub USERIN)

   A user input defining options, time steps, periods, etc. to control the program. (see Section 5. for formats)

b) Coarse Boundary Output spectra (IU01 , UNFORMATTED, main BOUINT)

   Permanent file name is CBOyymmddhh000. This file was written by sub OUTBC of main CHIEF, see Section 4.3.3 a).

4.4.2   PREPROC set-up files are not used by this program

4.4.3   Result files

a) Fine Boundary Input spectra (IU02 , UNFORMATTED, main BOUINT)

   Permanent file name is FBIyymmddhh000. This file is written by main BOUINT, and used Chief sub BOUNIPT, if a fine grid run is done, see Section 4.3.1 c).

4.4.4   Restart files

Restart files are not used

4.4.5   Work files

Work files are not used

4.5 POST PROCESSING PROGRAMS PGRID, PSWGRID, PSPEC, PSWSPEC

Each of this programs is designed to read one of the model result files and print selected information.

4.5.1   PGRID (Print GRID)

a) User input (IU05, FORMATTED, sub UIPGRI)
   A user input defining printer time steps, paths, etc. to control the program. (see Section 5. for formats)

b) Gridded field output (IU01 , UNFORMATTED, sub INGRID)
   Permanent file name is MAPyymmddhh000. This file was written by sub OUTINT of main CHIEF, see Section 4.3.3 b).

4.5.2   PSWGRID (Print SWell GRID)

a) User input (IU05, FORMATTED, sub UISWG)
    A user input defining printer time steps, paths, etc. to control the program. (see Section 5. for formats)

b) Gridded field output (IU01 , UNFORMATTED, sub INGRIDS)
   Permanent file name is SWEyymmddhh000. This file was written by sub OUTINT of main CHIEF, see Section 4.3.3 c).

4.5.3   PSPEC (Print SPECtra)

a) User input (IU05, FORMATTED, sub UIPSPE)
   A user input defining printer time steps, paths, etc. to control the program. (see Section 5. for formats)

b) Gridded field output (IU01 , UNFORMATTED, sub INSPP)
   Permanent file name is SPEyymmddhh000. This file was written by sub OUTSPP of main CHIEF, see Section 4.3.3 d).
   or
   Permanent file name is CBOyymmddhh000. This file was written by sub OUTBC of main CHIEF, see Section 4.3.3 a).
   or
   Permanent file name is FBIyymmddhh000. This file was written by main BOUINT, see Section 4.3.3 a).

4.5.4   PSWSPEC (Print SWell SPECtra)

a) User input (IU05, FORMATTED, sub UIPSWS)

A user input defining printer time steps, paths, etc. to control the program. (see Section 5. for formats)

b) Swell spectra output (IU01 , UNFORMATTED, sub INGRID)

Permanent file name is SWSyymmddhh000. This file was written by sub OUTSPP of main CHIEF, see Section 4.3.3 e).

5. MODEL OPTIONS AND USER INPUT FILES

The user has a range of model options. Each main program has a user input file to allow the user to control the options. The lay-out of all input files follows the following rules:

-EVERY LINE STARTING WITH "C" IS A COMMENT LINE

-VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH "-"

(RIGHT-JUSTIFIED, BUT CHARACTER LEFT-JUSTIFIED)

Therefore all files are more or less self explaining. An example for each program is attached in the Appendix.

5.1 DEEP / SHALLOW WATER

Only propgram CHIEF distinguishes between deep and shallow water. If the variable ISHALLO in the CHIEF input file is 1 a deep water run is done. Any other value will result in a shallow water execution of the program.

5.2 PROPAGATION

Only program but CHIEF distinguishes between propagation on cartesian or spherical grid. If the variable ICASE in the CHIEF input file is 1 spherical propagation is done. Any other value will result in cartesian propagation. Because there is no difference in the grid set up all input values concerning the grid have to be given in degrees for both cases. This means the grid icrements in meter used for a cartesian propagation are the latitude,longitude increments in meter at the equator (meter = 40000000 / 360).

5.3 REFRACTION

This option only effects main PREPROC and CHIEF. There are three possibilities for the refraction option IREFRA:

- 0   the model runs without depth and without current refraction
- 1   the model runs with depth and without current refraction.
- 2   the model runs with depth and with current refraction.

If a deep water model is run (ISHALLO=1) the depth refraction is ignored, e.g. IREFRA=0 and IREFRA=1 will be the same. No extra computation are done in PREPROC for the depth refraction.

Therefore a current field has to be assigned to PREPROC and IREFRA=2, only if current refraction is used in CHIEF later on. The option in main CHIEF can be fixed independently of the setting in PREPROC, but if current refraction is selected, PREPROC must be run with current and refraction as well.

5.4 NESTED GRIDS

This option only effects main PREPROC and CHIEF.

Nested grids consist of a coarse grid model, the time interpolation program for the boundary spectra, BOUINT, and a fine grid model. The coarse grid model saves spectra at the boundary of a rectangular area every propagation time step. These spectra are interpolated in time by BOUINT. The fine grid model uses the interpolated spectra as input boundary values. A fine grid model can also be a coarse grid model as well. Therefore 'infinite' levels of nestings can be done. The following restrictions apply for the grid definition (grid points can be land or sea points.)

- the frequency and angular grid must be the same in both models.

- the fine grid must be rectangular and inside the coarse grid.

- all corner points of the fine grid must be coarse grid points.

- all coarse grid points in the nest area must be fine grid point

- all corner points of the fine grid must be coarse grid points.where grid points can be land or sea points.

No restriction applies for the time steps of the coarse and fine model. If a nested grid is set up by PRE-PROC, the nest can be switched off in CHIEF. The user has to choose different file directory (paths) for different levels of the nesting to prevent overwriting

5.5 OUTPUT OPTIONS

In Appendix A.3 the output parameters of main CHIEF are listed.

These parameters are printed, and/or written to file, or subpressed by selecting 'Y' or 'N' in the user input. There are two posibilities to define the output times:
>   - by a list of times. In this case all selected output parameters will be processed at these times,
>   if the time is the end time of a propagation step.
>   - by time increments for each group (see Appendix A.3) of output parameters.

The output increments must be multiples of the propagation step. The same holds for the postprocessing programs which work on the result files of the model.

5.6 FILE OPTIONS

As outlined in the previous chapter the model assigns result and restart files dynamically.

The user has to define the directory (PATH) name in the input files   Both restart and result files are kept in this directory.

The file name convention is computer dependent and explained in Section 7.2 .

Input values for USERID and RUNID are not required for CRAY UNICOS.

The model will generate a new result file every IDELRES time increments.The corresponding model time is coded in the file name. If IREST is 1, restart files will be copied at the same time. They will overwrite the former restart files.

In the input of the postprocessing programs the time included in the first result file name has to be specified.

5.7 TIMESTEPS

All model time steps must be specified as integer in seconds or hours.They have to be multiples of one minute. In the following K,L,M, and N are integer greater than zero.

The wind input time step IDELWI must be the time difference between two wind fields in the sequential input file. It can be a multiple of the difference to overread wind fields.

The wind output time step IDELWO is the time increment of the blocked winds produced by sub PREWIND. It has to be IDELWI = N*IDELWO. The winds are interpolated in time, if N is greater than 1.

The source function time step IDELT has to fullfill IDELWO = M*IDELT.IDELT should be not greater than 1200 s for deep water and not greater than 600 s for shallow water.

The propagation time step IDELPRO has to meet the cfl criterion. It has to be IDELPRO = L*IDELT and in addition IDELWO = K*IDELPRO or IDELPRO = K*IDELWO

All output time steps must be multiples of the propagation time step.

The time increment IDELRES to save result and restart files must be a multiple of the wind input step IDELWI.

6. PARAMETER FOR ARRAY DIMENSIONS

A full list of the parameters used is attached in the Appendix. Parameters for dimensions are grouped into:

- PARAMETER FOR ARRAY DIMENSIONS.
  This includes all dimension parameters which are common in PREPROC, PRESET
  AND CHIEF.Most of these parameters must be the same in all three programs (see below).

- PARAMETER FOR ARRAY DIMENSIONS FOR PREPROC ONLY.
  Used in PREPROC for nested grid processing.

- PARAMETER FOR ARRAY DIMENSIONS OF TOPOGRAPHIC DATA.
  used in PREPROC for input topographic data.

- PARAMETER FOR ARRAY DIMENSIONS FOR CURRENT INPUT.
  used in PREPROC for input current field.

- PARAMETER FOR WIND INPUT ARRAY DIMENSIONS.
  defined in subs WAVEMDL and PRESET for input wind fields.

- PARAMETER FOR ARRAY DIMENSIONS OF BOUINT.

The dimensions for the postprocessing programs are defined in the main programs.

Most of the required array size is known before the model is   installed for a particular grid. Same dimensions, eg the number of blocks are known after PREPROC has been executed.

For the first run of PREPROC the parameters have to be chosen large enough. The only critical dimension is NIBLO, the maximum block length, which is used to limit the blocks. At the end of the print output of PREPROC three numbers are given for each parameter:

- the value of the parameter in PREPROC, labled as DEFINED.

- the minimum value of the parameter, which is necessary to achieve a successful run of
  PREPROC, labled as USED.

- the value of the parameter required for the dimensions in PRESET and CHIEF, labled as
  REQUIRED.

To save memory and output file space it is recommended to rerun PREPROC with the parameters labled as USED.

7. COMPUTER DEPENDENT CODE

7.1 FORTRAN

The model is coded in ANSI FORTRAN standard X3.9-1978. But there are four exceptions:

- variable may have 7 or 8 characters.

- one function is in lower cases.

- BUFFER IN/OUT and UNIT is used in subs MSTART, INITMDL, and WAMODEL.
  Buffer can be replaced by UNFORMATTED read/write and UNIT functions can be deleted.

- Some subs use automatic arrays. The dimension has to be replaced by the appropiate value.

7.2 FILE HANDLING

The file handling is set up for a Cray UNICOS system.

For other computer systems the file names may have to follow completely different conventions and strategies. Therefore a run and user identifier is passed from the user input to the file handling routines, too.

Necessary modifications should be limited to subs OPENFIL, GSFILE and CREWFN, if the files are kept on the main frame computer. If front/end systems are used OPENFIL should be modified to fetch a result file, all calls of OPENFIL in INITMDL and WAMODEL should be commented.

To dispose files sub SFILE may have to be used in BOUINT and GSFILE has to be changed as well.

Draft versions of OPENFIL and GSFILE for Cyber_205 computer and of SFILE and GSFILE for front/ end systems are avaliable, but not tested.

Sub OPENFIL is used for result files. The full file names are:

PATH/FIDyymmddhhmm0

where Path is the complete directory name as defined in the user input, FID is the file identifier which is fixed inside the programs, and yymmddhhmm is the file time (the model time when the file is closed)

Sub GSFILE copies the restart files. In the UNICOS set up a call to the ISHELL is used to perform the copy operations.

8. CODE ORGANISATION

All programs of the wave model system are on the attached floppies. They are complete jobs set up for a CRAY unicos computer and should run after the included JCL has been modified to the local computer requirements. The user input is included in the jobs. The jobs are prepared to execute the test runs discussed in the next chapter. Input data and sample outputs for the runs are given.

A *DECK file for each main program is provided as well. These can be used as inputs for a source code utility eg. UPDATE. Because many subroutines are used in different programs, it is recommended to use one source code library for all the programs. To identify decks the following convention is used:

- The deck name of programs, subroutines and functions is the name of the fortran modul.

- COMDECKS of common blocks are called COMxxxx, where xxxx are the first four
        characters of the common block name

- COMDECKS of parameter statements are called PARxxxx, where xxxx are:
        ALL   PARAMETER FOR ARRAY DIMENSIONS.
        PREP   PARAMETER FOR ARRAY DIMENSIONS FOR PREPROC ONLY.
        TOPO   PARAMETER FOR ARRAY DIMENSIONS OF TOPOGRAPHIC DATA.
        CURR   PARAMETER FOR ARRAY DIMENSIONS FOR CURRENT INPUT.
        WIND   PARAMETER FOR WIND INPUT ARRAY DIMENSIONS.
        BOUI   PARAMETER FOR ARRAY DIMENSIONS PROG. BOUINT.
        CONS   PARAMETER FOR GLOBAL MODEL CONSTANTS.

- COMDECKS of common blocks and parameter description are called TXTxxxx,
        where xxxx are the first four characters of the common block name

8.1 FLOPPY 1: PROGRAMS AND INPUT DATA

Fortran programs including jcl and user input:

        PREPROC   .JOB   coarse grid swamp preproc
        PRESET   .JOB   coarse grid swamp preset
        CHIEF   .JOB   coarse grid wamodel for first day.
        BOUINT   .JOB   interpolation of boundary spectra.
        PGRID   .JOB   prints grids of integrated parameters.
        PSWGRID   .JOB   prints grids of integrated swell parameters.
        PSPEC   .JOB   prints spectra at selected grid points.
        PSWSPEC   .JOB   prints swell spectra at selected grid points.

8.2 FLOPPY 2: TESTCASE MODIFICATIONS AND OUTPUTS

Fortran subroutines for special set ups and computers:

CYBER205	.FOR	subroutines for cyber 205
FRONDEND	.FOR	sub gsfile for a front/end system
READWND	.FOR	sub to read UNFORMATTED winds.

Directory DATA: PREPROC input data for a test run

TOPOCAT	.DAT	topagraphic data of test run
CURRCAT	.DAT	current data of test run

Directory MODI:

PREPROC	.IN	user input of fine grid preproc.
PRESET	.IN	user input of fine grid preset.
CHIEF	.IN	user input of fine wamodel run
PARAMET	.PAR	parameter statement for fine grid

Outputs of test run

BOUINT	.OUT	output of prog BOUINT.

Directory COARSE:

PREPROC	.OUT	output of coarse grid PREPROC
PRESET	.OUT	output of coarse grid PRESET
CHIEF	.OU1	output of coarse grid CHIEF first day
CHIEF	.OU2	output of coarse grid CHIEF second day
PGRID	.OUT	output of coarse grid PGRID
PSWGRID	.OUT	output of coarse grid PSWGRID
PSPEC	.OUT	output of coarse grid PSPEC
PSWSPEC	.OUT	output of coarse grid PSWSPEC

Directory FINE:

PREPROC	.OUT	output of fine grid PREPROC
PRESET	.OUT	output of fine grid PRESET
CHIEF	.OUT	output of fine grid CHIEF
PGRID	.OUT	output of fine grid PGRID
PSWGRID	.OUT	output of fine grid PSWGRID
PSPEC	.OUT	output of fine grid PSPEC
PSWSPEC	.OUT	output of fine grid PSWSPEC

8.3 FLOPPY 3: SOURCE CODE UTILITY INPUT FILES.

PREPROC	.FOR	*deck file of preproc
PRESET	.FOR	*deck file of preset
CHIEF	.FOR	*deck file of chief
BOUINT	.FOR	*deck file of bouint
PGRID	.FOR	*deck file of pgrid
PSWGRID	.FOR	*deck file of pswgrid
PSPEC	.FOR	*deck file of pspec
PSWSPEC	.FOR	*deck file of pswspec
CYBER205	.FOR	*deck file of subroutines for cyber 205
FRONDEND	.FOR	*deck file of subroutines for front/end systems
READWND	.FOR	*deck file of subroutine to read unFORMATTED winds.

In addition to each *DECK file a file containing the extension 'frm' for input and 'jcl' for UNICOS jcl is given.The cyber 205 modifications have not been tested so far.

It is strongly recommended to run the model through update and make additional changes to the model via modsets, which can in return be made available to the WAM user comunity.

At the moment there are already modsets available for including variable ice boundaries and for choosing output dates depending on output points. This became necessary for assimilating ERS1 SAR data into the model. The modsets are available from the Max Planck Institut for Meteorology in Hamburg.

9. A TEST CASE

The following test run(s) are designed to test most of the model options. For the test the SWAMP grid has been selected. In addition to the standard SWAMP case 2 a bottom gradient, currents and a nested grid have been included.

All user input files shown in Appendix A1 correspond to the coarse grid set-up.

a. Before a program is run, please check the JCL and USER INPUT in the files JOB for your paths and userids. Create a file directory for the coarse and fine grid files. If you have a cyber_205 replace GSFILE and OPENFIL by the 205 versions, after you have checked these routines.

b. Transfer the preproc input data.

c. Run main PREPROC.JOB to generate the coarse grid.
   The result should be:
      an output as in COARSE/PREPROC.OUT
      3 files GRIDCATU, UBUFCATU and BOUCCATU

d. Run prog. PRESET.JOB to generate the coarse grid initial fields.
   The result should be:
      an output as in COARSE/PRESET.OUT
      3 files BLSPANAL, SLATANAL, LAWIANAL

e. Run prog. CHIEF.JOB to integrate the first 24 hours.
   The result should be:
      an output as in COARSE/CHIEF.OU1
      5 files MAP7809070600, SPE7809070600, SWE7809070600,
            SWS7809070600, CBO7809070600
   The three restart files BLSPANAL,SLATANAL, LAWIANAL are replaced.

f. Change the end date of the run (IDATEE) in the user input of CHIEF.JOB to 7809080600 and run the program to integrate the second 24 hours. The result should be:
      an output as in COARSE/CHIEF.OU2
      5 files MAP7809080600, SPE7809080600,SWE7809080600,
            SWS7809080600, CBO7809080600

g. Run the progs. PGRID.JOB , PSWGRID.JOB, PSPEC.JOB, and PSWSPEC.JOB to generate the printer outputs COARSE/xxxxx.OUT.

h. Run the prog. BOUINT.JOB to interpolate the boundary spectra in time. Compare the

printer output to BOUINT.OUT

i. Change and run PREPROC.JOB for the fine grid.

- change parameter statements as in MODI/PARAMET.PAR

- replace user input by MODI/PREPROC.IN

- activate in the jcl the assign for fort.3 and fort.10

- deactivate in the jcl the assign for fort.9

- change the paths for the output files from coarse to fine.

   The result should be:

       a printer output as in FINE/PREPROC.OUT

       3 files GRIDCATU, UBUFCATU, BOUFCATU.

j. Change and run PRESET.JOB for the fine grid.

- change parameter statements as in MODI/PARAME.PAR

- replace user input by MODI/PRESET.IN

- change the paths for the input files in the JCL from coarse to fine.

   The result should be:

       an output as in FINE/PRESET.OUT

       2 files BLSPANAL, LAWIANAL

       (SLATANAL is not generated, because this is a one block version.)

k. Change and run CHIEF.JOB for the fine grid for 2 days

- change parameter statements as in MODI/PARAME.PAR

- replace user input by MODI/CHIEF.IN

- change the paths for the input files in the JCL from coarse to fine.

- activate in the jcl the assign for fort.10

- deactivate in the jcl the assign for fort.9

   The result should be:

       an output as in FINE/CHIEF.OUT

       8 files MAP7809070600, SPE7809070600,

               SWE7809070600, SWS7809070600,

               MAP7809070600, SPE7809070600,

               SWE7809070600, SWS7809070600

  The restart files are not replaced.

l. Run the progs. PGRID.JOB , PSWGRID.JOB, PSPEC.JOB, and PSWSPEC.JOB to generate the printer outputs FINE/xxxxx.OUT.(please notice that same output parameters are not saved in the files, because they are not requested in the user input of the fine wamodel run)

- It is necessary to change the path in the job input files.

Have you got the same results? If so, then you can run the SWAMP cases. The results are attached in Appendix A3. The coarse grid model should be used.It is not necessary to rerun PREPROC for the following cases:

- without	current and depth	refraction	cartesian	deep	water
- without	current and depth	refraction	spherical	deep	water
- with	current	refraction	cartesian	deep	water
- with	current	refraction	spherical	deep	water
- with	depth	refraction	cartesian	shallow	water
- with	depth	refraction	spherical	shallow	water
- with	current and depth	refraction	cartesian	shallow	water
- with	current and depth	refraction	spherical	shallow	water

Create a new path for each case and change the paths in the user inputs. Run PRESET with IOPT=0 and the WAMODEL with IBOUNC = 0 , IBOUNF = 0. Specify the other options (ICASE, ISHALLO, IRE-FRA) in the CHIEF user input for the particular case and deactivate the assign in the JCL for boundary files. The lists in the Appendix are from the spectra output of main CHIEF. Therefore all other outputs can be deactivated in the user input file.

You have to run PRESET for each case or copy the start files in the different paths before you execute the model, because the model will look for them in the directory given in the user input. For the 180m, 120m, and 15m depth SWAMP you should use the same set up, but change the topography to the depth required and rerun PREPROC, eg with both nest options = 0.

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Appendix A   USER INPUT FILES

A.1 MAIN PREPROC

```
C
C         USER INPUT OF PREPROC.          CREATED 19/4/91
C         =======================
C         SET UP OF SWAMP CASE 2 GRID WITH CURRENT REFRACTION AND NEST.
C
C          USER INFORMATION IS BEING READ BY SUB. UIPREP
C          WITH THE PRESUMPTIONS THAT:
C          1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C          2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C             (RIGHT-JUSTIFIED)
C
C ------------------------------------------------------------------
C
C             **** HEADER OF MODEL RUN   ****

C      HEADER  CHARACTER*70  TEXT TO BE PRINTED
C
CHEADER
C--------+--------+--------+--------+--------+--------+--------+--------+
 SWAMP WAVE MODEL RUN                            PREPROC VERSION 4.0
C
C             **** FREQUENCY AND DIRECTION GRID ****
C
C     ML          INTEGER*5      NUMBER OF FREQUENCIES.
C     KL          INTEGER*5      NUMBER OF DIRECTIONS.
C     FR(1)       REAL*10        LOWEST FREQUENCY IN HERTZ.
C
C   ML    KL       FR(1)
C----- ----- ----------
    25    12  .04177248
C
C             **** OUTPUT GRID DEFINIONS ****
C
C     XDELLA      REAL           GRID INCREMENT FOR LATITUDE (DEGREE)
C     XDELLO      REAL           GRID INCREMENT FOR LONGITUDE (DEGREE)
C     AMOSOP      REAL           MOST SOUTHERN LATITUDE IN GRID MATRIX
C     AMONOP      REAL           MOST NORTHERN LATITUDE IN GRID MATRIX
C     AMOWEP      REAL           MOST WESTERN LONGITUDE IN GRID MATRIX
C     AMOEAP      REAL           MOST EASTERN LONGITUDE IN GRID MATRIX
C
C     XDELLA     XDELLO     AMOSOP     AMONOP     AMOWEP     AMOEAP
C---------- ---------- ---------- ---------- ---------- ----------
     0.500      0.500     -9.500     10.500      0.000     20.000
C
C             **** AREAS TO BE CHANGED IN GRID ****
C
```

```
C              SPECIFY A LIST WITH UP TO 80 AREAS.
C
C      XOUTS      REAL         SOUTHERN-MOST LATITUDE (DEGREE).
C      XOUTN      REAL         NORTHERN-MOST LATITUDE (DEGREE).
C      XOUTW      REAL         WESTERN-MOST LONGITUDE (DEGREE).
C      XOUTE      REAL         EASTERN-MOST LONGITUDE (DEGREE).
C      NOUTD      INTEGER      NEW DEPTH IN METRES (-999 IS LAND)


C
C      XOUTS      XOUTN      XOUTW      XOUTE      NOUTD
C---------- ---------- ---------- ---------- ----------
C
C   THE LIST HAS TO BE CLOSED BY  'END'
C
C END
C
C              **** OUTPUT LOCATIONS OF SPECTRA ****
C
C              SPECIFY A LIST WITH UP TO 100 SIDES.
C
C      OUTLAT     REAL         LATITUDE (DEGREE).
C      OUTLONG    REAL         LONGITUDE (DEGREE).
C
C     OUTLAT     OUTLONG
C---------- ----------
       -9.500     10.000
       -9.000     10.000
       -8.500     10.000
       -8.000     10.000
       -7.500     10.000
       -7.000     10.000
       -5.500     10.000
       -5.000     10.000
       -4.500     10.000
        0.000     10.000
        1.000     10.000
        2.000     10.000
        3.000     10.000
        4.000     10.000
        5.000     10.000
        6.000     10.000
       10.000     10.000
C
C   THE LIST HAS TO BE CLOSED BY  'END'
  END
C
C              **** MODEL OPTIONS ****
C
C      IFORM      INTEGER      = 1   UNFORMATTED WRITE ONLY.
C                              = 2   FORMATTED WRITE ONLY.
C                                    OTHERWISE BOTH OUTPUTS.
```

```
C       IREFRA    INTEGER    = 0   NO REFRACTION
C                            = 1   DEPTH REFRACTION
C                            = 2   CURRENT REFRACTION
C       ITEST     INTEGER    TEST OUTPUT LEVEL..
C                            > 0 FOR OUPUT UP TO SUBROUTINE LEVEL
C                            = 0   NO TEST OUTPUT
C       ITESTB    INTEGER    TEST OUTPUT LEVEL BLOCKS IF ITEST > 0.
C                            > 0 FOR BLOCK LEVEL TEST OUTPUT
C
C IFORM   IREFRA    ITEST   ITESTB
C------   ------   ------   ------
      1        2        0        4
C
C             **** NESTED GRIDS ****
C
C       IBOUNC    INTEGER    FLAG FOR THE COURSE GRID
C                            = 1 INFORMATION FOR A NESTED (FINE)
C                                GRID WILL BE GENERATED.
C       IBOUNF    INTEGER    FLAG FOR THE FINE GRID
C                            = 1   THIS IS A FINE GRID RUN, BOUNDARY
C                                  INFORMATION IS EXPECTED FROM A
C                                  PREVIOUS COARSE GRID RUN.
C       AMOSOC    REAL       SOUTHERN-MOST LONGITUDE OF NEST (DEGREE)
C       AMONOC    REAL       NORTHERN-MOST LONGITUDE OF NEST (DEGREE)
C       AMOWEC    REAL       WESTERN-MOST LATITUDE OF NEST (DEGREE)
C       AMOEAC    REAL       EASTERN-MOST LATITUDE OF NEST (DEGREE)
C                            (THESE NEST BOUNDARIES HAVE TO BE GIVEN
C                             IF IBOUNC = 1)
C
CIBOUNC IBOUNF    AMOSOC      AMONOC      AMOWEC      AMOEAC
C------ ------ ---------- ---------- ---------- ----------
      1      0      0.000       5.000       5.000      15.000
C
C -------------------------------------------------------------
C       END OF USER INPUT OF PREPROC
C -------------------------------------------------------------
```

A.2 MAIN PRESET

```
C
C         USER INPUT OF PRESET.          CREATED 19/4/91
C         =====================
C
C         USER INFORMATION IS BEING READ WITH THE PRESUMTIONS THAT:
C          1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C          2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C             (RIGHT-JUSTIFIED, BUT CHARACTER LEFT-JUSTIFIED)
C
C ---------------------------------------------------------------
C
C             **** HEADER OF MODEL RUN   ****
C
C     HEADER  CHARACTER*70  TEXT TO BE PRINTED
C
C HEADER
C---------+---------+---------+---------+---------+---------+---------+
 SWAMP WAVE MODEL RUN                             PRESET VERSION 4.0
C
C             **** OPTION FOR INITIAL SPECTRA   ****
C
C     IOPTI   = 0 WIND INDEPENDENT INITIAL VALUES.
C             = 1 WIND DEPENDENT INITIAL VALUES AND
C                 ENERGY EQUAL ZERO IF WINDSPEED IS ZERO
C             = 2 WIND DEPENDENT INITIAL VALUES AND
C                 ENERGY COMPUTED FROM GIVEN PARAMETERS IF
C                 WINDSPEED IS ZERO.
C     ITEST   = 0 NO TEST OUTPUT
C             > 0 FOR SUBROUTINE LEVEL
C     ITESTB  > 0 FOR BLOCK LEVEL TEST OUTPUT
C
C  IOPTI    ITEST    ITESTB
C-------   -------   ------
      1        0        4
C
C             **** PARAMETER OF INITIAL SPECTRUM   ****
C
C     ALPHA   = PHILLIPS' PARAMETER  (NOT USED IF IOPTI = 1)
C     FM      = PEAK FREQUENCY (HZ) AND/OR MAXIMUM FREQUENCY
C     GAMMA   = OVERSHOOT FACTOR
C     SIGMAA  = LEFT PEAK WIDTH
C     SIGMAB  = RIGHT PEAK WIDTH
C     THETAQ  = WAVE DIRECTION (DEG) (NOT USED IF IOPTI = 1)
C     FETCH   = FETCH IN METRES (IF ZERO THEN 0.5 OF THE
C               LATITUDE INCREMENT IS USED.)
C
C     ALPHA        FM        GAMMA      SIGMAA      SIGMAB      THETAQ
C---------- ---------- ---------- ---------- ---------- ----------
   0.01800    0.20000    3.00000    0.07000    0.09000    0.00000
C
```

```
C      FETCH
C----------
       30000.

C
C           **** FILE NAMES ****
C
C     UID      CHARACTER*3   USERID
C     RID      CHARACTER*3   RUN IDENTIFIER
C     PATH     CHARACTER*60  PATH NAME OF FILES
C
CUID  RID  PATH
C--- --- --------+---------+---------+---------+---------+---------+
 NAB  CAT  /tmp/nab/coarse
C
C           **** WIND INPUT PARAMETERS ****
C
C     IDATEA   INTERGER*10  START DATE OF RUN  (YYMMDDHHMM)
C     IDELWI   INTEGER*7    TIMESTEP ON INPUT WIND FILE (SECONDS)
C     U        CHARACTER*1  TIME UNIT  S SECONDS  OR  H HOURS
C
C    IDATEA    IDELWI U
C---------- ------- -
 7809060600    21600 S
C
C -----------------------------------------------------------------
C                END OF USER INPUT PROG. PRESET.C
C -----------------------------------------------------------------
```

A.3 MAIN CHIEF

```
C         USER INPUT OF CHIEF.              CREATED 19/4/91
C         ====================
C
C         USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C            1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C            2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C               (RIGHT-JUSTIFIED, BUT CHARACTER LEFT-JUSTIFIED)
C
C ----------------------------------------------------------------------
C
C         **** HEADER OF MODEL RUN   ****
C
C     HEADER  CHARACTER*70  TEXT TO BE PRINTED
C
CHEADER
C--------+--------+--------+--------+--------+--------+--------+
 SWAMP2 WAVE MODEL RUN                           MODEL VERSION 4.0
C
C            **** PERIOD OF MODEL RUN   ****
C
C     IDATEA   INTERGER*10   START DATE OF RUN   (YYMMDDHHMM)
C     IDATEE   INTERGER*10   END   DATE OF RUN   (YYMMDDHHMM)
C
C     IDATEA       IDATEE
C----------   ----------
 7809060600  7809070600
C
C            **** MODEL TIME STEPS ****
C
C     IDELPRO  INTERGER*7    PROPAGATION TIMESTEP
C     IDELT    INTERGER*7    SOURCE TIME STEP
C     IDELWO   INTERGER*7    OUTPUT WIND TIMESTEP
C     IDELWI   INTERGER*7    TIMESTEP ON INPUT WIND FILE
C     U        CHARACTER*1   TIME UNIT  S SECONDS  OR  H HOURS
C
C          ----------------------------------------------------------
C          DEMAND :   ALL RATIO'S ARE N OR 1/N AND N IS AN INTEGER
C          ----------------------------------------------------------
C
CIDELPRO U    IDELT U   IDELWO U   IDELWI U
C------- -   ------- -   ------- -   ------- -
    1200 S      400 S       12 H       24 H
C
C            **** OUTPUT TIME IN FIXED INTERVALS ****
C
C          ----------------------------------------------------------
C     DEMAND :   ALL OUTPUT TIMESTEPS MUST BE MULTIPLE OF IDELPRO.
C          ----------------------------------------------------------
C
C     IDELINT  INTERGER*7    INTEGRATED PARAMETER OF TOTAL SEA
```

```
C       IDELINS   INTERGER*7    INTEGRATED PARAMETER OF SWELL
C       IDELSPT   INTERGER*7    SPECTRA OF TOTAL SEA
C       IDELSPS   INTERGER*7    SPECTRA OF SWELL
C       IDELRES   INTERGER*7     OUTPUT FILES AND RESTART FILES ARE SAVED
C       U         CHARACTER*1   TIME UNIT  S SECONDS  OR  H HOURS
C
CIDELINT U  IDELINS U  IDELSPT U  IDELSPS U  IDELRES U
C------- -  ------- -  ------- -  ------- -  ------- -
      3 H        6 H        3 H        6 H       24 H
C
C            **** OUTPUT TIME AT SPECIFIED TIMES ****
C
C     -----------------------------------------------------------------
C     DEMAND :   ALL OUTPUT TIMES MUST BE AT THE END OF A PROPAGATION.
C     -----------------------------------------------------------------
C   SPECIFY A LIST WITH UP TO 100 DATES (YYMMDDHHMM) AND CLOSE THE
C   LIST BY 'END   '. IF THE LIST INCLUDES ANYTHING ELSE THAN 'END'
C   ALL OUTPUT TIME STEPS SPECIFIED ABOVE ARE IGNORED.
C
CYYMMDDHHMM   YYMMDDHHMM   YYMMDDHHMM
C----------   ----------   ----------
 7809060900   7809061200   7809061800
 7809070000   7809070600   7809071200
 7809071800   7809080000   7809080600
 END
C
C            **** SELECTION OF OUTPUT DATA ****
C
C     P   CHARACTER*1   PRINTER OUTPUT.
C        Y  DATA ARE PRINTED, OTHERWISE NO OUTPUT
C     F   CHARACTER*1   FILE OUTPUT.
C        Y  DATA ARE WRITTEN TO FILE, OTHERWISE NO OUTPUT
C
CP F                                     P F
C- -                                     - -
 N Y   SIGNIFICANT WAVE HEIGHT          N Y   MEAN WAVE DIRECTION
 N Y   WAVE MEAN FREQUENCY              N Y   FRICTION VELOCITYN Y
 N Y   WIND DIRECTION                   N Y   WAVE PEAK FREQUENCY
 N Y   DRAG COEFFICIENT                 N Y   NORMALISED WAVE STRESS
 N Y   SWELL WAVE HEIGHT                N Y   SWELL DIRECTION
 N Y   WIND WAVE DIRECTION              N Y   SWELL MEAN FREQUENCY
 N Y   SPECTRA OF TOTAL SEA             N Y   SWELL SPECTRA
C
C            **** MODEL OPTIONS  ****
C
C     ICASE    INTEGER*7   PROPAGATION OPTION..
C       1 SPHERICAL, OTHERWISE  CARTESIAN PROPAGATION
C     ISHALLO  INTEGER*7   SHALLOW WATER FLAG..
C       1 DEEP, OTHERWISE SHALLOW WATER MODEL
C     IREFRA   INTEGER*7  REFRACTION OPTION..
C       0 IF REFRACTION IS NOT USED
C       1 IF DEPTH REFRACTION IS USED
```

```
C          2 IF DEPTH AND CURRENT REFRACTION IS USED
C      ITEST   INTEGER*7  TEST OUTPUT LEVEL..
C          > 0 FOR OUPUT UPTO SUBROUTINE LEVEL
C          0 NO TEST OUTPUT
C      ITESTB  INTEGER*7  TEST OUTPUT LEVEL BLOCKS..
C          > 0 FOR BLOCK LEVEL TEST OUTPUT IF ITEST > 0
C      IREST   INTEGER*7  RESTART OPTION..
C          1 RESTART FILES ARE SAVED,
C          OTHERWISE FILES ARE NOT SAVED.
C
C  ICASE  ISHALLO   IREFRA    ITEST    ITESTB    IREST
C-------  -------   -------   -------   -------   -------
       1        0        2        0        1        1
C
C          **** BOUNDARY POINTS *****
C
C          IBOUNC = COURSE GRID OPTION
C          IBOUNF = FINE GRID OPTION
C
C          IBOUNC MUST BE: 1 FOR COURSE GRID OUTPUT
C                          OTHERWISE NO BOUNDARY POINTS
C          IBOUNF MUST BE: 1 FOR FINE GRID INPUT
C                          OTHERWISE NO BOUNDARY POINTS
C
C
C IBOUNC   IBOUNF
C-------  -------
       1        0
C
C          **** FILE NAMES ****
C
C          UID     = USERID            CHARACTER*3
C          RID     = RUN IDENTIFIER    CHARACTER*3
C          PATH    = PATH NAME OF FILES  CHARACTER*60
C
CUID  RID  PATH
C---  ---  ---------+---------+---------+---------+---------+---------+
 NAB  GLO  /tmp/nab/coarse
C
C -------------------------------------------------------------------
C             END OF USER INPUT PROG CHIEF.
C -------------------------------------------------------------------
```

A.4 MAIN BOUINT

```
C
C          USER INPUT OF BOUINT.           CREATED 19/4/91
C          =====================
C
C          USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C            1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C            2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C               (RIGHT-JUSTIFIED, BUT CHARACTER LEFT JUSTIFIED)
C
C -------------------------------------------------------------------
C
C          **** DATES AND TIME STEPS FOR OUTPUT  ****
C
C     IDATEA    INTEGER*10    START DATE OF OUTPUT    (YYMMDDHHMM)
C     IDATEE    INTEGER*10    END DATE OF OUTPUT      (YYMMDDHHMM)
C     IDELPRF   INTEGER*7     DATA OUTPUT TIME STEP   (SECOND)
C     U         CHARACTER*1   TIME UNIT  S SECONDS   OR  H HOURS
C
C     IDATEA        IDATEE   IDELPRF U
C---------- ---------- ------- -
  7809060610  7809080600      600 S
C
C          **** FILE NAMES AND FILE DATES ****
C
C     IDATES    INTEGER*10    DATE OF FIRST FILE NAME (YYMMDDHHMM)
C     IDELFI    INTEGER*7     FILE TIME STEP (SECONDS)
C     U         CHARACTER*1   TIME UNIT  S SECONDS   OR  H HOURS
C     USD       CHARACTER*3   USER ID
C     RDI       CHARACTER*3   RUN  ID (INPUT DATA)
C     FDI       CHARACTER*3   FILE ID (INPUT DATA)
C     PATHI     CHARACTER*60  PATH (INPUT DATA)
C     RDO       CHARACTER*3   RUN  ID (OUTPUT DATA)
C     FDO       CHARACTER*3   FILE ID (OUTPUT DATA)
C     PATHO     CHARACTER*60  PATH (OUTPUT DATA)
C
C     IDATES   IDELFI U  USD
C---------- ------ - ---
  7809070600     24 H  NAB
C
CRDI  FDI  PATHI
C--- --- --------+--------+--------+--------+--------+--------+
 CAT  CBO  /tmp/nab/coarse
C
CRDO  FDO  PATHO
C--- --- --------+--------+--------+--------+--------+--------+
 FAT  FBI  /tmp/nab/fine
C
C -----------------------------------
C END OF USER INPUT PROG. BOUINT.
C -----------------------------------
```

A.5 MAIN PGRID

```
C
C        USER INPUT OF PROGRAM PGRID (PRINT GRID)
C        ========================================
C
C          USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C            1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C            2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C               (RIGHT-JUSTIFIED, BUT CHARACTER LEFT JUSTIFIED)
C
C-----------------------------------------------------------------
C
C            **** OUTPUT TIME IN FIXED INTERVALS ****
C
C            IDATEA  = START DATE OF OUTPUT    (YYMMDDHHMM)
C            IDATEE  = END DATE OF OUTPUT      (YYMMDDHHMM)
C            IDELDO  = DATA OUTPUT TIME STEP   (SECOND)
C            U       = TIME UNIT: H = HOURS, S = SECONDS
C
C     IDATEA       IDATEE    IDELDO U
C---------- ---------- ------- -
 7809060900  7809080600       3 H
C
C            **** OUTPUT TIME AT SPECIFIED TIMES ****
C
C    SPECIFY A LIST WITH UP TO 100 DATES (YYMMDDHHMM) AND CLOSE THE
C LIST BY 'END '.  IF THE LIST INCLUDES ANYTHING ELSE THAN
C   'END'    ALL OUTPUT TIME STEPS SPECFIED ABOVE ARE IGNORED.
C
CYYMMDDHHMM  YYMMDDHHMM
C---------- ----------
 7809070600  7809080600
 END
C
C            **** FILE REQUESTS ****
C
C IDATEF  = DATE OF FIRST FILE NAME (YYMMDDHHMM)
C IDELFI  = FILE TIME STEP (SECONDS)
C U       = TIME UNIT: H = HOURS, S = SECONDS
C USD     = 3 CHARACTER USER ID
C RID     = 3 CHARACTER RUN  ID (FOR CYBER_205 ONLY)
C FID     = 3 CHARACTER FILE ID (NORMALLY MAP)
C PATH    = 60 CHARACTER PATH (WITHOUT FILE NAME)
C
C     IDATEF   IDELFI U  USD
C---------- ------- -  ---
 7809070600      24 H  NAB
C
CRID  FID  PATH
C--- --- ---------+---------+---------+---------+---------+---------+
 CAT  MAP  /tmp/nab/coarse
```

```
C
C            **** FIELDS TO BE PRINTED ****
C
C        NAME  = 50 CHARACTER PRINT HEADER (WILL BE EXTENDED BY DATE)
C        P     = T  (TRUE) IF PRINT IS REQUESTED  ELSE F (FALSE)
C
CNAME                                                         P
C--------+--------+--------+--------+--------+  -
 WAM WAVE HEIGHTS                                             T
 WAM WAVE DIRECTIONS                                          T
 10M WIND SPEED                                               T
 FRICTION VELOCITY                                            T
 WIND DIRECTION                                               T
 MEAN PERIOD                                                  T
 PEAK PERIOD                                                  T
 DRAG COEFFICIENT                                             T
 NORMALISED WAVE STRESS                                       T
C
 END
C
C -------------------------------------------------------------------
C         END OF USER INPUT PROGRAM PGRID.
C -------------------------------------------------------------------
```

A.6 MAIN PSWGRID

```
C
C         INPUT OF PROGRAM PSWGRID (PRINT SWELL GRID)
C         ===========================================
C
C         USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C          1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C          2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C             (RIGHT-JUSTIFIED, BUT CHARACTER LEFT JUSTIFIED)
C
C ----------------------------------------------------------------------
C
C              **** OUTPUT TIME IN FIXED INTERVALS ****
C
C              IDATEA   = START DATE OF OUTPUT    (YYMMDDHHMM)
C              IDATEE   = END DATE OF OUTPUT      (YYMMDDHHMM)
C              IDELDO   = DATA OUTPUT TIME STEP   (SECOND)
C              U        = TIME UNIT: H = HOURS, S = SECONDS
C
C     IDATEA      IDATEE    IDELDO U
C---------- ---------- ------- -
 7809060900  7809080600    10800 S
C
C              **** OUTPUT TIME AT SPECIFIED TIMES ****
C
C  SPECIFY A LIST WITH UP TO 100 DATES (YYMMDDHHMM) AND CLOSE THE
C  LIST BY 'END       '. IF THE LIST INCLUDES ANYTHING ELSE
C  THAN 'END' ALL OUTPUT TIME STEPS SPECFIED ABOVE ARE IGNORED.
C
CYYMMDDHHMM
C----------
 7809080600
 END
C
C              **** FILE REQUESTS ****
C
C              IDATEF   = DATE OF FIRST FILE NAME (YYMMDDHHMM)
C              IDELFI   = FILE TIME STEP (SECONDS)
C              U        = TIME UNIT: H = HOURS, S = SECONDS
C              USD      = 3 CHARACTER USER ID
C              RID      = 3 CHARACTER RUN  ID  (FOR CYBER_205 ONLY)
C              FID      = 3 CHARACTER FILE ID  (NORMALLY SWE)
C              PATH     = 60 CHARACTER PATH  (WITHOUT FILE NAME)
C
C     IDATEF  IDELFI U  USD
C---------- ------ -  ---
 7809070600     24 H  NAB
C
CRID  FID  PATH
C--- --- ---------+---------+---------+---------+---------+---------+
 CAT  SWE  /tmp/nab/coarse
```

```
C
C                **** FIELDS TO BE PRINTED ****
C
C        NAME     = 50 CHARACTER PRINT HEADER (WILL BE EXTENDED BY DATE)
C        P        = T (TRUE) IF PRINT IS REQUESTED  ELSE F (FALSE)
C
CNAME                                                  P
C--------+--------+--------+--------+--------+  -
 SWELL WAVE HEIGHTS                                   T
 MEAN SWELL DIRECTIONS                                T
 MEAN SEA DIRECTIONS                                  T
 MEAN SWELL PERIODS                                   T
C
 END
C
C ----------------------------------------------------------------
C        END OF USER INPUT PROGRAM PSWGRID.
C ----------------------------------------------------------------
```

A.7 MAIN PSPEC

```
C
C         INPUT OF PROGRAM PSPEC (PRINT SPECTRA)
C         ======================================
C
C          USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C            1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C            2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C               (RIGHT-JUSTIFIED, BUT CHARACTER LEFT JUSTIFIED)
C
C-------------------------------------------------------------------
C
C               **** OUTPUT TIME IN FIXED INTERVALS ****
C
C               IDATEA   = START DATE OF OUTPUT    (YYMMDDHHMM)
C               IDATEE   = END DATE OF OUTPUT      (YYMMDDHHMM)
C               IDELDO   = DATA OUTPUT TIME STEP   (SECOND)
C               U        = TIME UNIT: H = HOURS, S = SECONDS
C
C     IDATEA       IDATEE     IDELDO U
C----------   ----------   ------- -
 7809060900   7809080600     10800 S
C
C               **** OUTPUT TIME AT SPECIFIED TIMES ****
C
C   SPECIFY A LIST WITH UP TO 100 DATES (YYMMDDHHMM) AND CLOSE THE
C   LIST BY 'END        '. IF THE LIST INCLUDES ANYTHING ELSE THAN
C   'END' ALL OUTPUT TIME STEPS SPECFIED ABOVE ARE IGNORED.
C
CYYMMDDHHMM
C----------
 7809080600
C
 END
C
C               **** FILE REQUESTS ****
C
C               IDATEF  = DATE OF FIRST FILE NAME (YYMMDDHHMM)
C               IDELFI  = FILE TIME STEP (SECONDS)
C               U       = TIME UNIT: H = HOURS, S = SECONDS
C               USD     = 3 CHARACTER USER ID
C               RID     = 3 CHARACTER RUN  ID (FOR CYBER_205 ONLY)
C               FID     = 3 CHARACTER FILE ID (NORMALLY SPE, CBO, OR FBI)
C               PATH    = 60 CHARACTER PATH (WITHOUT FILE NAME)
C
C     IDATEF    IDELFI U  USD
C----------   ------- -   ---
 7809070600        24 H  NAB
C
CRID  FID  PATH
C---  ---  ---------+---------+---------+---------+---------+---------+
```

```
 CAT   SPE   /tmp/nab/coarse
C
C               **** OUTPUT SIDES ****
C
C               XLONG   = LONGITUDE IN DEGREE
C               XLAT    = LATITUDE IN DEGREE
C               NAME    = SIDE NAME (UP TO 20 CHARACTER)
C
C               ------------------------------------------------------------
C               THE PROGRAM DIMENSIONS ALLOW UP TO 26 SIDES
C               SPECTRA ARE NOT SORTED AS TIME SERIES.
C               ------------------------------------------------------------
C
C     XLONG        XLAT    NAME
C--------   --------   ---------+---------+
    10.000    -9.500   FETCH  0.5 DEG
    10.000    -9.000   FETCH  1.0 DEG
    10.000    -8.500   FETCH  1.5 DEG
    10.000    -8.000   FETCH  2.0 DEG
    10.000    -7.500   FETCH  2.5 DEG
    10.000    -7.000   FETCH  3.0 DEG
    10.000    -5.500   FETCH  4.5 DEG
    10.000    -5.000   FETCH  5.0 DEG
    10.000    -4.500   FETCH  5.5 DEG
    10.000     0.000   FETCH  10. DEG
    10.000     1.000   FETCH  11. DEG
    10.000     2.000   FETCH  12. DEG
    10.000     3.000   FETCH  13. DEG
    10.000     4.000   FETCH  14. DEG
    10.000     5.000   FETCH  15. DEG
    10.000     6.000   FETCH  16. DEG
    10.000    10.000   FETCH  20. DEG
C
C               THE INPUT LIST HAS TO BE CLOSED BY AN END LINE
C
     0.000     0.000   END
C
C ----------------------------------------------------------------------
C               END OF USER INPUT PROGRAM PSPEC.
C ----------------------------------------------------------------------
```

A.8 MAIN PSWSPEC

```
C
C         INPUT OF PROGRAM PSWSPEC (PRINT SWELL SPECTRA)
C         ==============================================
C
C          USER INFORMATION IS BEING READ WITH THE PRESUMPTIONS THAT:
C            1. EVERY LINE STARTING WITH 'C' IS A COMMENT LINE
C            2. VALUES ARE PUT IN BELOW POSITIONS INDICATED WITH '-'
C               (RIGHT-JUSTIFIED, BUT CHARACTER LEFT JUSTIFIED)
C
C -------------------------------------------------------------------
C
C             **** OUTPUT TIME IN FIXED INTERVALS ****
C
C             IDATEA  = START DATE OF OUTPUT    (YYMMDDHHMM)
C             IDATEE  = END DATE OF OUTPUT      (YYMMDDHHMM)
C             IDELDO  = DATA OUTPUT TIME STEP   (SECOND)
C             U       = TIME UNIT: H = HOURS, S = SECONDS
C
C     IDATEA        IDATEE    IDELDO U
C---------- ---------- ------- -
 7809060900  7809080600    10800 S
C
C             **** OUTPUT TIME AT SPECIFIED TIMES ****
C
C   SPECIFY A LIST WITH UP TO 100 DATES (YYMMDDHHMM) AND CLOSE THE
C   LIST BY 'END   ' IF THE LIST INCLUDES ANYTHING ELSE THAN 'END'
C   ALL OUTPUT TIME STEPS SPECFIED ABOVE ARE IGNORED.
C
CYYMMDDHHMM
C----------
 7809080600
C
 END
C
C             **** FILE REQUESTS ****
C
C             IDATEF  = DATE OF FIRST FILE NAME (YYMMDDHHMM)
C             IDELFI  = FILE TIME STEP (SECONDS)
C             U       = TIME UNIT: H = HOURS, S = SECONDS
C             USD     = 3 CHARACTER USER ID
C             RID     = 3 CHARACTER RUN  ID (FOR CYBER_205 ONLY)
C             FID     = 3 CHARACTER FILE ID (NORMALLY WSS)
C             PATH    = 60 CHARACTER PATH (WITHOUT FILE NAME)
C
C     IDATEF   IDELFI U  USD
C---------- ------- -   ---
 7809070600      24 H  NAB
C
CRID  FID  PATH
C--- --- ---------+---------+---------+---------+---------+---------+
```

```
 CAT  SWS  /tmp/nab/coarse
C
C                **** OUTPUT SIDES ****
C
C                XLONG   = LONGITUDE IN DEGREE
C                XLAT    = LATITUDE IN DEGREE
C                NAME    = SIDE NAME (UP TO 20 CHARACTER)
C
C                ------------------------------------------------------
C                THE PROGRAM DIMENSIONS ALLOW UP TO 26 SIDES
C                SPECTRA ARE NOT SORTED AS TIME SERIES.
C                ------------------------------------------------------
C
C   XLONG        XLAT   NAME
C--------   --------   ---------+---------+
   10.000      3.000   FETCH  13. DEG
   10.000     10.000   FETCH  20. DEG
C
C                THE INPUT LIST HAS TO BE CLOSED BY AN END LINE
C
    0.000      0.000   END
C
C ----------------------------------------------------------------------
C                END OF USER INPUT PROGRAM PSWSPEC.
C ----------------------------------------------------------------------
```

Appendix B   PARAMETER STATEMENTS

B.1 PARAMETER FOR ARRAY DIMENSIONS

VARIABLE.	TYPE.	PURPOSE.
NANG	INTEGER	NUMBER OF ANGLES.
NFRE	INTEGER	NUMBER OF FREQUENCIES.
NGX	INTEGER	NUMBER OF LONGITUDES IN GRID.
NGY	INTEGER	NUMBER OF LATITUDES IN GRID.
NBLO	INTEGER	NUMBER OF BLOCKS.
NIBLO	INTEGER	NUMBER OF POINTS IN BLOCK.
NOVER	INTEGER	MAXIMUM NUMBER POINTS IN FIRST LATITUDE OF BLOCKS.
MOUTP	INTEGER	MAXIMUM NUMBER OF OUTPUT POINTS.
MOUTT	INTEGER	MAXIMUM NUMBER OF OUTPUT TIMES.
NMAXC	INTEGER	NUMBER OF BOUNDARY OUTPUT POINTS IF THIS IS A COARSE GRID; ELSE = 1.
NMAXF	INTEGER	NUMBER OF BOUNDARY POINTS, IF THIS IS A FINE GRID RUN; ELSE = 1.
NBINP	INTEGER	NUMBER OF BOUNDARY INPUT POINTS FROM A PREVIOUS COARSE GRID RUN, IF THIS IS A FINE GRID RUN; ELSE = 1.
NIBL1	INTEGER	= NIBLO IF MULTI BLOCK VERSION. = 1 IF ONE BLOCK VERSION.
NIBLD	INTEGER	= NIBLO IF DEPTH OR CURRENT REFRACTION. = 1 ELSE.
NBLD	INTEGER	= NIBLO IF DEPTH OR CURRENT REFRACTION. = 1 ELSE.
NIBLC	INTEGER	= NIBLO IF CURRENT REFRACTION. = 1 ELSE.
NBLC	INTEGER	= NIBO IF CURRENT REFRACTION. = 1 ELSE.

B.2 PARAMETER FOR ARRAY DIMENSIONS FOR PREPROC ONLY

VARIABLE.	TYPE.	PURPOSE.
NBMAX	INTEGER	MAXIMUM NUMBER OF BOUNDARY POINTS.

B.3 PARAMETER FOR ARRAY DIMENSIONS OF TOPOGRAPHIC DATA

VARIABLE.	TYPE.	PURPOSE.
JLONI	INTEGER	NUMBER OF LONGITUDES IN TOPAGRAPHIC GRID.
JLATI	INTEGER	NUMBER OF LATITUDES IN TOPAGRAPHIC GRID.
IOUTA	INTEGER	NUNBER OF AREAS TO BE SUPPRESSED.

B.4 PARAMETER FOR ARRAY DIMENSIONS FOR CURRENT INPUT

VARIABLE.	TYPE.	PURPOSE.
NCC	INTEGER	NUMBER OF LONGITUDES IN CURRENT GRID.
NRC	INTEGER	NUMBER OF LATITUDES IN CURRENT GRID.

B.5 PARAMETER FOR WIND INPUT ARRAY DIMENSIONS

VARIABLE.	TYPE.	PURPOSE.
NC	INTEGER	COLUMNES IN WIND INPUT GRID (DIMENSION)
NR	INTEGER	ROWS IN WIND INPUT GRID (DIMENSION).

B.6 PARAMETER FOR ARRAY DIMENSIONS PROG. BOUINT

VARIABLE.	TYPE.	PURPOSE.
NANG	INTEGER	NUMBER OF DIRECTIONS.
NFRE	INTEGER	NUMBER OF FREQUENCIES.
MBMAX	INTEGER	NUMBER OF SPECTRA PER INPUT DATE.

B.7 PARAMETER PROGS. PGRID and PSWGRID

VARIABLE.	TYPE.	PURPOSE.
ID1	INTEGER	FIRST DIMENSION OF GRID ARRAY.
ID2	INTEGER	SECOND DIMENSION OF GRID ARRAY.
IDS	INTEGER	DIMENSION OF PARAMETER ARRAY.
IDO	INTEGER	DIMENSION OF OUTPUT TIME ARRAY.

B.8 PARAMETER PROGS. PSPEC and PSWSPEC

VARIABLE.	TYPE.	PURPOSE.
IDD	INTEGER	DIMENSION OF DIRECTION ARRAYS.
IDF	INTEGER	DIMENSION OF FREQUENCY ARRAYS.
IDS	INTEGER	DIMENSION OF SIDE ARRAYS.
IDO	INTEGER	DIMENSION OF OUTPUT TIME ARRAY.

B.9 PARAMETER OF GLOBAL CONSTANTS

VARIABLE.	TYPE.	PURPOSE.
G	REAL	ACCELLERATION OF GRAVITY.
PI	REAL	PI.
CIRC	REAL	EARTH CIRCUMFERENCE (METRES).
RAD	REAL	PI / 180.
DEG	REAL	180. / PI.
ZPI	REAL	2. * PI.
R	REAL	EARTH RADIUS (METRES).

Appendix C RESULTS OF TEST RUNS

C.1 SWAMP CASE 2

WAM-model results SWAMP CASE 2. (without current and depth refraction).

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900
                          U10   = 18.45 m/s
cartesian propagation IDELPRO   = 1200s
                          IDELT   = 1200s (deep water)
                          IDELT   = 600s (shallow water)
constant water depth.
cpu times CRAY-YMP8: deep water 84.6s, shallow water 189.4s
Duration: 48 hours

	deep water			180 m			120 m			15 m	
F(d)	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*
0.5	3.89	.1362	0.96	3.88	.1355	0.93	3.88	.1355	0.93	3.16	.1551	0.99
1.0	4.74	.1206	0.90	4.73	.1203	0.90	4.72	.1204	0.90	3.43	.1414	0.92
1.5	5.26	.1120	0.87	5.26	.1121	0.88	5.25	.1123	0.88	3.52	.1357	0.89
2.0	5.67	.1067	0.87	5.66	.1066	0.87	5.64	.1069	0.87	3.53	.1328	0.87
2.5	5.99	.1028	0.87	5.98	.1028	0.88	5.96	.1032	0.88	3.55	.1313	0.87
3.0	6.26	.0998	0.88	6.25	.0998	0.87	6.22	.1003	0.87	3.57	.1303	0.87
4.5	6.85	.0937	0.87	6.84	.0937	0.87	6.78	.0945	0.87	3.61	.1287	0.87
5.0	7.00	.0922	0.87	6.99	.0923	0.87	6.92	.0931	0.87	3.62	.1284	0.87
5.5	7.13	.0909	0.87	7.12	.0910	0.87	7.04	.0919	0.87	3.62	.1282	0.87
10.	7.94	.0838	0.86	7.91	.0841	0.86	7.74	.0855	0.86	3.64	.1276	0.87
11.	8.07	.0829	0.86	8.03	.0833	0.86	7.84	.0847	0.86	3.64	.1276	0.87
12.	8.18	.0821	0.86	8.13	.0825	0.86	7.93	.0840	0.86	3.64	.1275	0.87
13.	8.27	.0814	0.86	8.22	.0818	0.86	8.01	.0834	0.86	3.64	.1275	0.87
14.	8.35	.0808	0.86	8.29	.0813	0.86	8.08	.0829	0.86	3.64	.1275	0.87
15.	8.41	.0803	0.86	8.35	.0809	0.86	8.13	.0825	0.86	3.64	.1275	0.87
16.	8.46	.0799	0.86	8.40	.0805	0.86	8.17	.0821	0.86	3.64	.1275	0.87
20.	8.54	.0793	0.86	8.47	.0799	0.86	8.25	.0815	0.86	3.64	.1275	0.87

Fetch: 20 degrees

T(h)	deep water			180 m			120 m			15 m		
	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*
3	3.13	.1695	1.02	3.19	.1666	1.05	3.19	.1666	1.05	3.03	.1705	1.06
6	4.64	.1321	0.95	4.57	.1294	0.92	4.57	.1294	0.92	3.68	.1380	0.90
12	5.86	.1050	0.87	5.81	.1053	0.87	5.81	.1054	0.87	3.57	.1303	0.87
18	6.73	.0952	0.87	6.70	.0954	0.87	6.69	.0957	0.87	3.62	.1284	0.87
24	7.33	.0893	0.87	7.30	.0896	0.87	7.25	.0901	0.87	3.63	.1278	0.87
30	7.77	.0854	0.86	7.73	.0857	0.86	7.65	.0864	0.86	3.64	.1276	0.87
36	8.10	.0827	0.86	8.05	.0831	0.86	7.92	.0841	0.86	3.64	.1276	0.87
42	8.36	.0807	0.86	8.30	.0812	0.86	8.12	.0825	0.86	3.64	.1275	0.87
48	8.54	.0793	0.86	8.47	.0799	0.86	8.25	.0815	0.86	3.64	.1275	0.87

WAM-model results SWAMP CASE 2. (without current and depth refraction).

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900

                             U10   = 18.45 m/s

spherical propagation   IDELPRO   = 1200s

                             IDELT   = 1200s (deep water)

                             IDELT   = 600s (shallow water)

constant water depth.

cpu times CRAY-YMP8: deep water 86.4s, shallow water 196.3s

Duration: 48 hours

	deep water			180 m			120 m			15 m	
F(d)	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*
0.5	3.89	.1363	0.96	3.88	.1355	0.93	3.88	.1355	0.93	3.16	.1551	0.99
1.0	4.74	.1206	0.90	4.72	.1203	0.90	4.72	.1204	0.90	3.43	.1415	0.92
1.5	5.26	.1120	0.87	5.26	.1121	0.88	5.25	.1123	0.88	3.52	.1357	0.89
2.0	5.66	.1067	0.87	5.66	.1067	0.87	5.64	.1070	0.87	3.53	.1328	0.87
2.5	5.98	.1029	0.87	5.98	.1028	0.87	5.95	.1032	0.87	3.55	.1313	0.87
3.0	6.25	.0999	0.87	6.25	.0998	0.88	6.21	.1003	0.88	3.57	.1304	0.87
4.5	6.84	.0937	0.87	6.84	.0938	0.87	6.78	.0945	0.87	3.61	.1288	0.87
5.0	7.00	.0923	0.87	6.99	.0923	0.87	6.91	.0931	0.87	3.62	.1285	0.87
5.5	7.13	.0910	0.87	7.12	.0911	0.87	7.04	.0919	0.87	3.62	.1283	0.87
10.	7.94	.0838	0.86	7.91	.0842	0.86	7.74	.0855	0.86	3.64	.1276	0.87
11.	8.07	.0829	0.86	8.03	.0833	0.86	7.84	.0847	0.86	3.64	.1276	0.87
12.	8.18	.0821	0.86	8.13	.0825	0.86	7.93	.0840	0.86	3.64	.1275	0.87
13.	8.28	.0813	0.86	8.23	.0818	0.86	8.01	.0834	0.86	3.64	.1275	0.87
14.	8.36	.0807	0.86	8.30	.0813	0.86	8.08	.0828	0.86	3.64	.1275	0.87
15.	8.42	.0803	0.86	8.36	.0808	0.86	8.13	.0824	0.86	3.64	.1275	0.87
16.	8.47	.0799	0.86	8.40	.0805	0.86	8.18	.0821	0.86	3.64	.1275	0.87
20.	8.56	.0792	0.86	8.49	.0799	0.86	8.26	.0814	0.86	3.64	.1275	0.87

Fetch: 20 degrees

	deep water			180 m			120 m			15 m	
T(h)	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*	Hs	Fmean	U*
3	3.13	.1695	1.02	3.19	.1666	1.05	3.19	.1666	1.05	3.03	.1705	1.06
6	4.64	.1321	0.95	4.57	.1293	0.92	4.57	.1294	0.92	3.68	.1380	0.90
12	5.87	.1050	0.87	5.82	.1053	0.87	5.81	.1054	0.87	3.57	.1303	0.87
18	6.74	.0951	0.87	6.71	.0954	0.87	6.69	.0957	0.87	3.62	.1284	0.87
24	7.34	.0893	0.87	7.30	.0895	0.87	7.26	.0900	0.87	3.63	.1278	0.87
30	7.77	.0853	0.86	7.74	.0857	0.86	7.65	.0864	0.86	3.64	.1276	0.87
36	8.11	.0826	0.86	8.06	.0830	0.86	7.93	.0840	0.86	3.64	.1275	0.87
42	8.37	.0807	0.86	8.32	.0812	0.86	8.13	.0824	0.86	3.64	.1275	0.87
48	8.56	.0792	0.86	8.49	.0799	0.86	8.26	.0814	0.86	3.64	.1275	0.87

C.2 WAM-MODEL RESULTS SWAMP TEST WITH DEPTH REFRACTION

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900

U10   = 18.45 m/s

IDELPRO   = 1200s

IDELT   = 600s

Topographic data with bottom slope.

CPU times CRAY-YMP8: cartesian 195.2s, spherical 196.3s

Duration: 48 hours

	cartesian				spherical		
F(d)| Hs	Theta	Fmean	U*		Hs	Theta	Fmean	U*
0.5	3.88	360.	.1355	0.93	3.88	0.	.1355	0.93
1.0	4.72	360.	.1206	0.90	4.72	360.	.1206	0.90
1.5	5.25	360.	.1126	0.89	5.25	360.	.1126	0.89
2.0	5.63	360.	.1072	0.88	5.63	360.	.1072	0.88
2.5	5.93	359.	.1035	0.87	5.93	360.	.1036	0.87
3.0	6.18	359.	.1007	0.88	6.18	359.	.1008	0.87
4.5	6.72	359.	.0951	0.87	6.72	359.	.0952	0.87
5.0	6.85	358.	.0938	0.87	6.84	358.	.0939	0.87
5.5	6.96	358.	.0927	0.87	6.96	358.	.0928	0.87
10.	7.59	357.	.0868	0.87	7.58	357.	.0868	0.87
11.	7.66	356.	.0861	0.87	7.66	356.	.0861	0.87
12.	7.74	356.	.0855	0.87	7.74	356.	.0855	0.87
13.	7.80	356.	.0850	0.87	7.81	356.	.0849	0.87
14.	7.86	356.	.0845	0.87	7.87	356.	.0845	0.87
15.	7.91	356.	.0841	0.87	7.92	356.	.0841	0.87
16.	7.95	356.	.0838	0.87	7.95	356.	.0838	0.87
20.	8.02	355.	.0832	0.87	8.03	355.	.0832	0.87

Fetch: 13 degrees

	cartesian				spherical		
T(h)| Hs	Theta	Fmean	U*		Hs	Theta	Fmean	U*
3	3.19	0.	.1666	1.05	3.19	0.	.1666	1.05
6	4.57	360.	.1294	0.92	4.57	360.	.1294	0.92
12	5.80	360.	.1055	0.87	5.80	360.	.1055	0.87
18	6.66	360.	.0960	0.87	6.67	360.	.0960	0.87
24	7.19	359.	.0906	0.87	7.19	359.	.0906	0.87
30	7.53	358.	.0874	0.86	7.53	358.	.0874	0.86
36	7.71	357.	.0858	0.87	7.71	357.	.0858	0.87
42	7.78	356.	.0851	0.87	7.78	356.	.0851	0.87
48	7.80	356.	.0850	0.87	7.81	356.	.0849	0.87

C.3 WAM-MODEL RESULTS SWAMP TEST WITH CURRENT REFRACTION

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900

U10	= 18.45 m/s
IDELPRO	= 1200s
IDELT	= 1200s

Deep water runs.

CPU times CRAY-YMP8: cartesian 115.4s, spherical 117.8s

Duration: 48 hours

	cartesian				spherical			
F(d)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
0.5	3.84	1.	.1342	0.91	3.84	1.	.1343	0.91
1.0	4.76	1.	.1199	0.90	4.75	1.	.1199	0.90
1.5	5.29	1.	.1114	0.87	5.29	1.	.1114	0.87
2.0	5.71	1.	.1062	0.87	5.71	1.	.1062	0.87
2.5	6.04	1.	.1023	0.87	6.04	1.	.1023	0.87
3.0	6.34	4.	.0994	0.87	6.34	4.	.0995	0.87
4.5	6.76	1.	.0932	0.87	6.76	1.	.0932	0.87
5.0	6.94	2.	.0917	0.87	6.93	2.	.0917	0.87
5.5	7.09	2.	.0904	0.87	7.09	2.	.0904	0.87
10.	7.90	1.	.0833	0.87	7.90	1.	.0833	0.87
11.	8.02	0.	.0823	0.86	8.02	0.	.0823	0.86
12.	8.13	359.	.0813	0.86	8.13	359.	.0813	0.86
13.	8.33	356.	.0797	0.85	8.33	356.	.0796	0.85
14.	8.08	1.	.0826	0.87	8.09	0.	.0826	0.87
15.	8.22	359.	.0818	0.87	8.23	359.	.0817	0.87
16.	8.32	359.	.0811	0.87	8.32	358.	.0810	0.87
20.	8.47	357.	.0798	0.87	8.48	357.	.0798	0.87

Fetch: 13 degrees

	cartesian				spherical			
T(h)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
3	3.14	359.	.1620	1.04	3.14	359.	.1620	1.04
6	4.59	358.	.1285	1.00	4.59	358.	.1285	1.00
12	5.88	357.	.1019	0.87	5.88	357.	.1019	0.87
18	6.80	357.	.0924	0.87	6.80	357.	.0924	0.87
24	7.44	356.	.0866	0.86	7.44	356.	.0866	0.86
30	7.88	356.	.0829	0.86	7.88	356.	.0829	0.86
36	8.14	355.	.0808	0.86	8.15	355.	.0808	0.86
42	8.28	356.	.0799	0.85	8.28	355.	.0799	0.85
48	8.33	356.	.0797	0.85	8.33	356.	.0796	0.85

C.4 WAM-MODEL RESULTS SWAMP TEST WITH CURRENT REFRACTION

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900

U10 = 18.45 m/s

IDELPRO = 1200s

IDELT = 600s

Constant water depth of 15m

CPU times CRAY-YMP8: cartesian 231.6s, spherical 218.9s

Duration: 48 hours

	cartesian				spherical		
F(d)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
0.5	3.16	0.	.1551	0.99	3.16	0.	.1551	0.99
1.0	3.43	0.	.1414	0.92	3.43	0.	.1415	0.92
1.5	3.52	0.	.1357	0.89	3.52	0.	.1357	0.89
2.0	3.53	0.	.1327	0.87	3.53	0.	.1328	0.87
2.5	3.55	0.	.1313	0.87	3.55	0.	.1313	0.87
3.0	3.56	360.	.1309	0.88	3.56	360.	.1310	0.88
4.5	3.62	0.	.1252	0.88	3.61	0.	.1252	0.88
5.0	3.62	0.	.1249	0.87	3.62	0.	.1249	0.87
5.5	3.63	0.	.1246	0.87	3.63	0.	.1247	0.87
10.	3.64	360.	.1237	0.87	3.64	360.	.1237	0.87
11.	3.65	360.	.1236	0.87	3.65	360.	.1236	0.87
12.	3.65	360.	.1235	0.87	3.65	360.	.1235	0.87
13.	3.64	360.	.1237	0.88	3.64	360.	.1237	0.88
14.	3.63	360.	.1282	0.88	3.63	360.	.1282	0.88
15.	3.64	360.	.1277	0.88	3.64	360.	.1277	0.88
16.	3.64	360.	.1276	0.87	3.64	360.	.1276	0.87
20.	3.64	360.	.1275	0.87	3.64	360.	.1275	0.87

Fetch: 13 degrees

	cartesian				spherical		
T(h)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
3	3.04	359.	.1624	1.07	3.04	359.	.1624	1.07
6	3.70	358.	.1321	0.94	3.70	358.	.1321	0.94
12	3.57	360.	.1259	0.88	3.57	360.	.1259	0.88
18	3.62	360.	.1243	0.88	3.62	360.	.1243	0.88
24	3.64	360.	.1238	0.88	3.64	360.	.1238	0.88
30	3.64	360.	.1237	0.88	3.64	360.	.1237	0.88
36	3.64	360.	.1237	0.88	3.64	360.	.1237	0.88
42	3.64	360.	.1237	0.88	3.64	360.	.1237	0.88
48	3.64	360.	.1237	0.88	3.64	360.	.1237	0.88

WAM-MODEL RESULTS SWAMP TEST WITH CURRENT AND DEPTH REFRACTION.

Initial spectra: 0.00 0.2000 0.0180 3.0000 0.0700 0.0900

                       U10   = 18.45 m/s

                       IDELPRO   = 1200s

                       IDELT   = 600s

Topographic data with bottom slope.

CPU times CRAY-YMP8: cartesian 214.5s, spherical 217.0s

Duration: 48 hours

	cartesian				spherical		
F(d)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
0.5	3.85	0.	.1351	0.91	3.85	0.	.1351	0.91
1.0	4.72	0.	.1204	0.90	4.72	0.	.1204	0.90
1.5	5.25	0.	.1123	0.88	5.25	0.	.1123	0.88
2.0	5.65	0.	.1070	0.88	5.64	0.	.1070	0.87
2.5	5.96	0.	.1033	0.87	5.96	0.	.1033	0.88
3.0	6.23	3.	.1007	0.87	6.22	3.	.1007	0.87
4.5	6.62	360.	.0944	0.87	6.62	360.	.0945	0.88
5.0	6.76	360.	.0931	0.87	6.76	360.	.0931	0.87
5.5	6.88	360.	.0919	0.87	6.88	360.	.0920	0.87
10.	7.49	356.	.0855	0.87	7.48	356.	.0855	0.87
11.	7.56	355.	.0846	0.87	7.56	355.	.0845	0.87
12.	7.63	354.	.0837	0.87	7.63	354.	.0836	0.87
13.	7.77	349.	.0816	0.87	7.77	349.	.0816	0.87
14.	7.56	355.	.0868	0.89	7.57	355.	.0868	0.89
15.	7.72	355.	.0858	0.88	7.72	355.	.0858	0.88
16.	7.81	355.	.0851	0.88	7.82	355.	.0850	0.88
20.	7.97	354.	.0835	0.87	7.99	354.	.0834	0.88

Fetch: 13 degrees

	cartesian				spherical		
T(h)	Hs	Theta	Fmean	U*	Hs	Theta	Fmean	U*
3	3.19	359.	.1585	1.06	3.19	359.	.1585	1.06
6	4.52	357.	.1250	0.94	4.52	357.	.1250	0.94
12	5.81	357.	.1022	0.87	5.81	357.	.1022	0.87
18	6.70	356.	.0931	0.87	6.70	356.	.0931	0.87
24	7.23	355.	.0877	0.86	7.23	355.	.0877	0.86
30	7.55	353.	.0844	0.86	7.55	353.	.0844	0.86
36	7.70	351.	.0826	0.86	7.71	351.	.0826	0.86
42	7.75	350.	.0819	0.86	7.76	350.	.0819	0.86
48	7.77	349.	.0816	0.87	7.77	349.	.0816	0.87

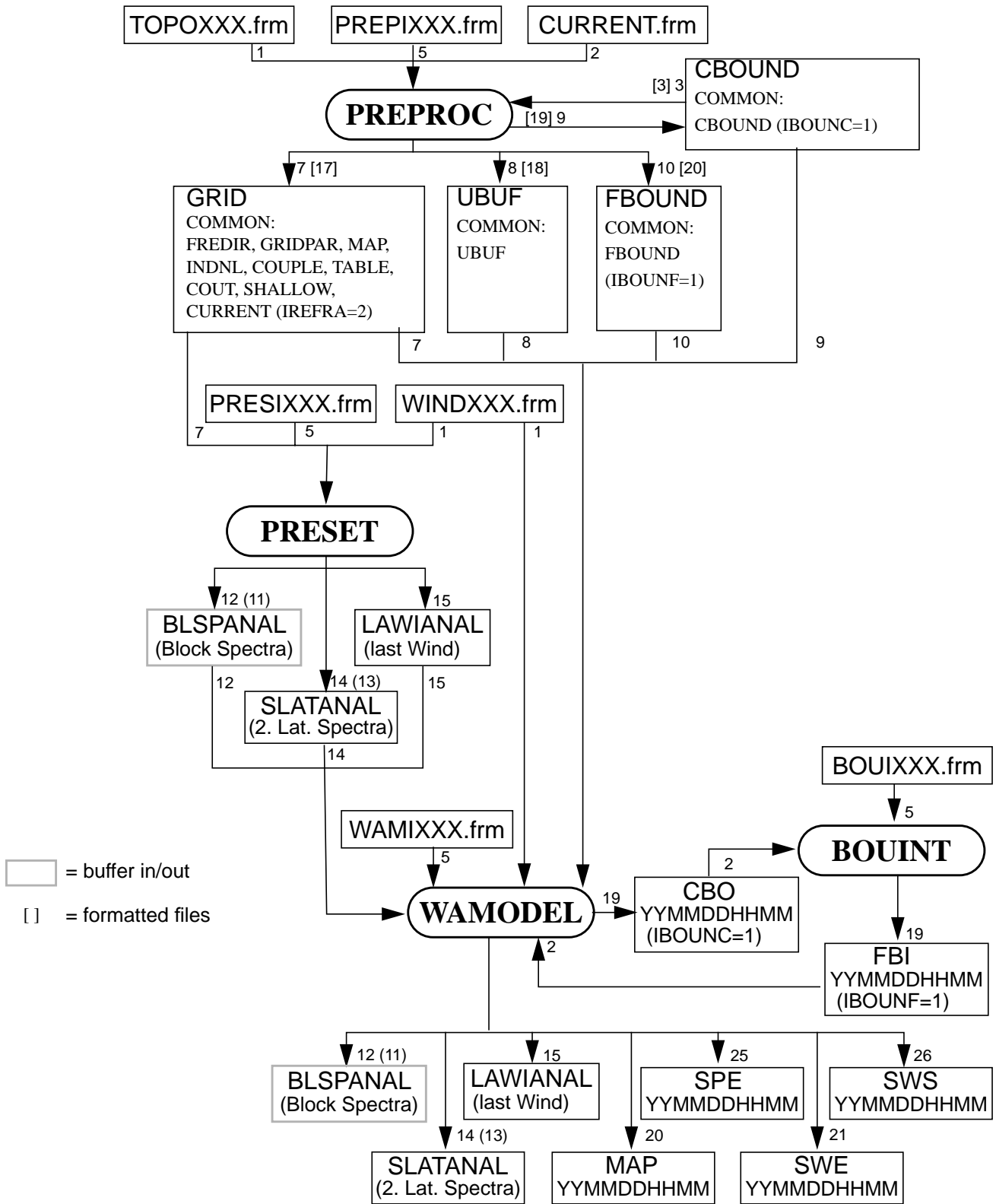# Appendix D   WAM MODEL FLOW GRAPHS
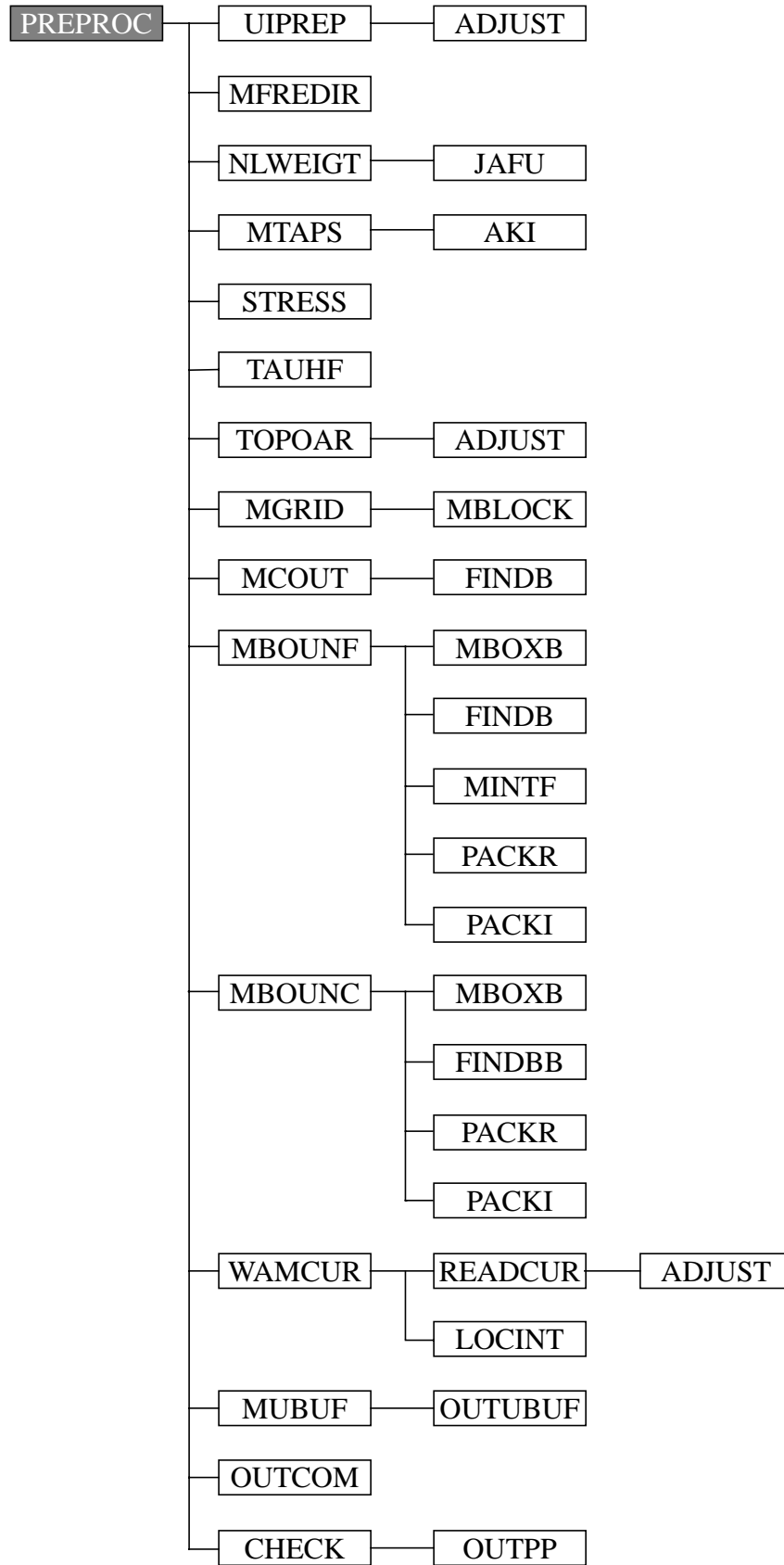

Figure 1   Communication between subsystems

Figure 2   Main-PREPROC subroutines cycle_4.

Note: Calls of subroutine ABORT are not shown. ABORT is called by CHECK, LOCINT,MBLOCK, MBOUNF, MBOXB, TOPOAR AND UIPREP.
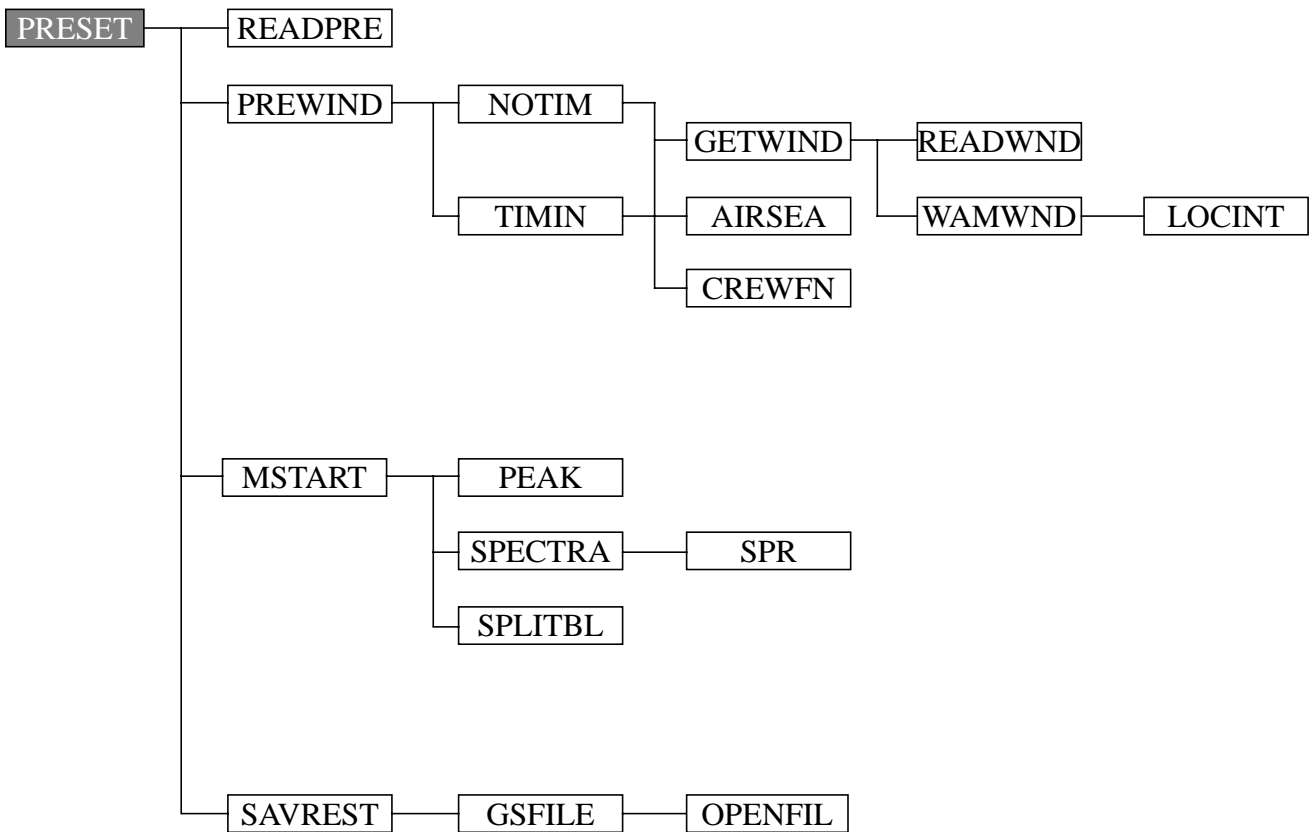
```
PRESET ──┬── READPRE

         ├── PREWIND ──┬── NOTIM ──────┬── GETWIND ──── READWND
         │             │               │
         │             └── TIMIN ──────┼── AIRSEA ──── WAMWND ──── LOCINT
         │                             │
         │                             └── CREWFN

         ├── MSTART ──┬── PEAK
         │            │
         │            ├── SPECTRA ──── SPR
         │            │
         │            └── SPLITBL

         └── SAVREST ──── GSFILE ──── OPENFIL
```

Figure 3   Main-PRESET subroutines cycle_4.

Note: Calls of subroutines INCDATE and ABORT are not shown. INCDATE is called by PREWIND. ABORT is called by PRESET, MSTART and GSFILE..
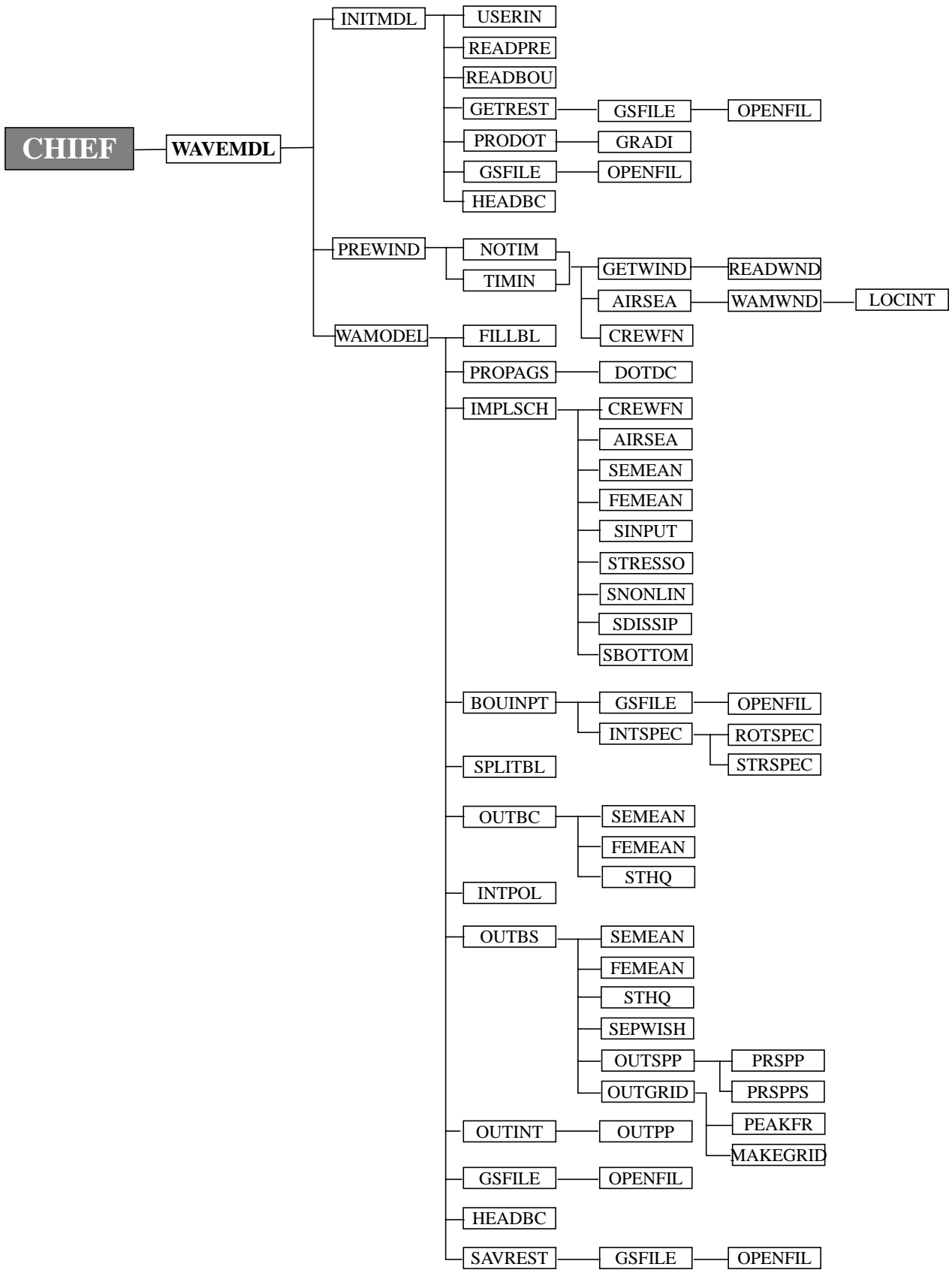
Figure 4   Main-CHIEF subroutines cycle_4.
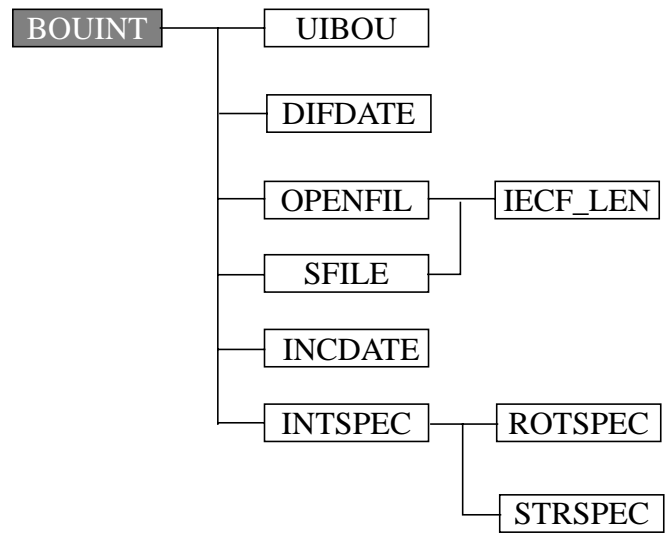
Figure 5   Main-BOUINT subroutines cycle_4.

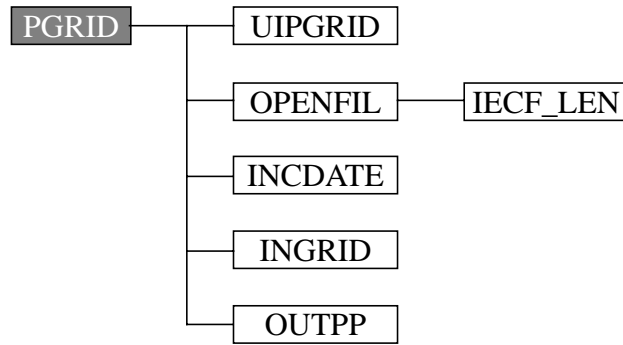Note: Calls of subroutine ABORT are not shown. ABORT is called by BOUINT, UIBOU and GSFILE.

Figure 6   Main-PGRID subroutines cycle_4.

Note: Calls of subroutine ABORT are not shown. ABORT is called by INGRID and UIPGRID.
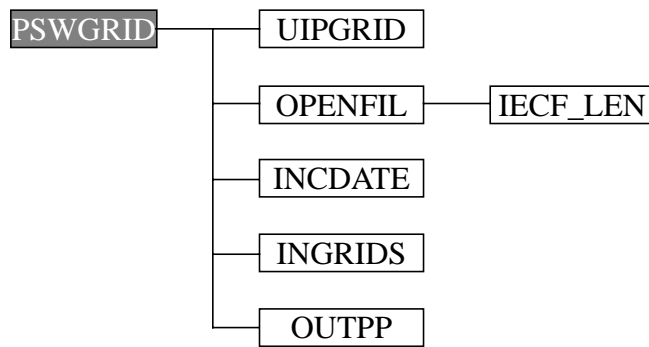

Figure 7   Main-PSWGRID subroutines cycle_4.

Note: Calls of subroutine ABORT are not shown. ABORT is called by INGRIDS and UIPGRID.
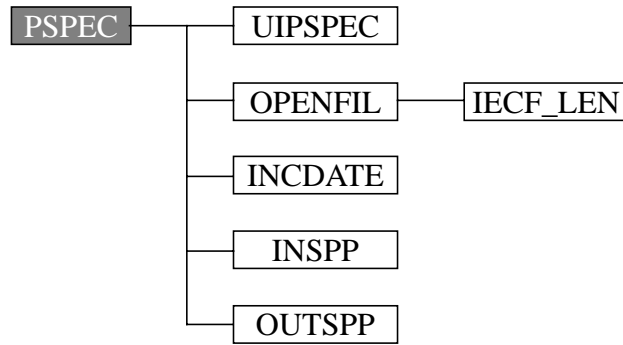
Figure 8   Main-PSPEC subroutines cycle_4.

Note: Calls of subroutine ABORT are not shown. ABORT is called by INSPP and UIPSPEC.
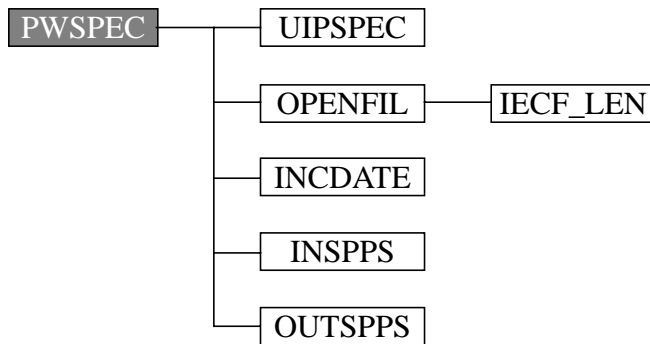

Figure 9   Main-PWSPEC subroutines cycle_4.

Note: Calls of subroutine ABORT are not shown. ABORT is called by INSPPS and OUTSPPS.